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ALL INDIA NETWORK PROJECT ON TOBACCO

Annual Report

2023-24

भाकृअनुप – केन्द्रीय तम्बाकू अनुसंधान संस्थान
ICAR - CENTRAL TOBACCO RESEARCH INSTITUTE
(ICAR-NATIONAL INSTITUTE FOR RESEARCH ON COMMERCIAL AGRICULTURE)
(An ISO 9001 : 2015 Certified Institute)
RAJAHMUNDRY - 533 105, ANDHRA PRADESH, INDIA

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Annual Report 2023-24

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I. INTRODUCTION

Tobacco is an important low volume- high value commercial crop, grown in an area of 0.425 M ha (0.30% of net cultivated area) and contributes about Rs. 45,000 crores to the national exchequer through foreign exchange earnings and excise revenue. India produces presently about 772 million kg of tobacco (FAO stat, 2024). Different tobacco types such as Flue Cured Virginia (FCV), Burley, Oriental, *Bidi, Natu/ Pikka, Chewing* and *Rustica* are grown under diverse agro-climatic conditions. To address the location specific needs of different tobacco types, the All India Coordinated Project on Tobacco was established by Indian Council of Agricultural Research during 1970-71 with the headquarters of the Coordinating unit at Anand (Gujarat). The headquarters was subsequently shifted to ICAR-CTRI, Rajahmundry, Andhra Pradesh on 16-08-1998. Further, the AICRP on Tobacco was renamed as All India Network Research Project on Tobacco and kept under the administrative control of the Director, ICAR-CTRI, Rajahmundry. A total of numbers of 14 centres (3 Main centres, 7 sub-centres and 4 voluntary centres) are functioning at present.

The three main network centres of AINPT are located at Rajahmundry, Shivamogga and Anand; the seven sub-centres at Nipani, Nandyal, Berhampur, Araul, Dinhata, Guntur and Hunsur. The four voluntary centres of AINPT are functioning at Ladol, Jeelugumilli, Kandukur and Vedasandur. The centres at Rajahmundry, Guntur, Hunsur and Dinhata are functioning under the administrative control of ICAR-Central Tobacco Research Institute (ICAR-CTRI), Rajahmundry. Anand, Shivamogga, Nipani, Nandyal, Berhampur and Araul centres are under the administrative control of respective Universities, *viz*., Anand Agricultural University, Anand; University of Horticulture and Agricultural Sciences, Shivamogga; University of Agricultural Sciences, Dharwad; Acharya NG Ranga Agricultural University, Guntur; Odisha University of Agriculture and Technology, Bhubaneswar and Chandra Sekhar Azad University of Agriculture and Technology, Kanpur, respectively (Table 1). The existing Scientific, Technical, Administrative and Supporting staff strength was 16, 21, 03 and 01, respectively. AINPT Co-ordination Unit at Rajahmundry co-ordinates activities of all the centres and monitors the research programmes through four Project Investigators located at ICAR-CTRI, Rajahmundry. It also co-ordinates resource activities of different centres and also with ICAR on all the administrative, financial and issues related to the coordinating centres and ensure implementation of all the mandated programmes as per the guidelines of ICAR.

Mandate

Tobacco improvement through co-ordinated multi-disciplinary and multi-location research on different tobacco types (FCV, *Bidi, Natu, Chewing* and *Hookah* etc.) grown in their respective niche areas in the country.

Research Programmes

1. Evolving location specific superior varieties/hybrids of different tobaccos.
2. Breeding tobacco varieties tolerant for biotic and abiotic stresses.
3. Evaluation and development of best-bet site specific agro-techniques for enhancing the production efficiency and produce quality.

4. Development of location specific and cost-effective IPM modules for effective management of pest and diseases and to minimise the pesticide residues in tobacco.
5. Screening and identification of genotypes having traits of commercial importance and non-conventional uses.
6. Comparative evaluation of tobacco and non-tobacco based cropping systems that are remunerative and sustainable.

Table 1: Mandated tobacco research at different centres is given below

S. No.	Name of the Unit and location	Year of start	Type of tobacco
A.	**Main Centres**		
1.	ICAR-CTRI, Rajahmundry (Andhra Pradesh)	1970-71	FCV & Burley
2.	Zonal Agricultural Horticultural Research Station, Shivamogga, KSNUAHS, Naveli (Karnataka)	1970-71	FCV
3.	*Bidi* Tobacco Research Station TRS, Anand, AAU (Gujarat)	1970-71	Bidi, Chewing & *Rustica*
B.	**Sub-Centres**		
4.	ICAR-CTRI-RS, Dinhata (West Bengal)	1970-71	*Jati* & *Motihari* (*Rustica*)
5.	ICAR-CTRI-RS, Hunsur (Karnataka)	1970-71	FCV
6.	ICAR-CTRI-RS, Guntur (Andhra Pradesh)	1970-71	FCV, *Natu* & Burley
7.	Regional Agricultural Research Station, Nandyal, ANGRAU (Andhra Pradesh)	1970-71	*Bidi*, *Natu* & Burley
8.	Agricultural Research Station, Nipani, UAS, Dharward (Karnataka)	1970-71	Bidi
9.	All India Network Project on Tobacco, Nutri-Crops Research Station, Berhampur, OUAT (Odisha)	1987-88	*Pikka*
10.	Tobacco Research Station, Araul, CSAUAT, Kanpur Nagar district (Uttar Pradesh)	1987-88	*Rustica*
C.	**Voluntary centres**		
11.	Agricultural Research Station, Ladol, SDAU, Dantiwada (Gujarat)	2001	Rustica
12.	ICAR-CTRI-RS, Kandukur (Andhra Pradesh)	2001	FCV
13.	ICAR-CTRI-RS, Jeelugumilli (Andhra Pradesh)	2001	FCV& Irrigated Natu
14.	ICAR-CTRI-RS, Vedasandur (Tamil Nadu)	2001	Chewing, Cheroot, Cigar filler & Cigar Wrapper

The technical programme for all the AINPT centres is finalized during the Annual Group Meetings or Biennial Workshops and implemented by the different centres. The XXVI Tobacco Workshop of All India Network Project on Tobacco was held on 21st September, 2023 in virtual mode at ICAR-CTRI, Rajahmundry. Dr. T. R. Sharma, DDG (CS) was the Chief Guest and Dr. D. K. Yadava, ADG (Seed) as the Guest of Honour. During the Workshop, experimental results of 2022-23 were reviewed and also future technical programme was finalized. In the plenary session seven technologies were released to the farming community.

Centre-wise approved experiments in different disciplines during 2023-24 are given below. A total of 113 experiments including 83 Plant breeding, 20 Agronomy, 1 Soil Science & Agricultural Chemicals, 4 Entomology, 5 Plant Pathology were conducted.

Table 2: Centre-wise approved experiments in different disciplines

Centre	PB	AG	SS & AC	EN	PP	NE	Total
Rajahmundry	1	2	1	-	-	-	4
Jeelugumilli	3	1	-	-	-	-	4
Kandukur	1	1	-	-	-	-	2
Guntur	1	-	-	-	-	-	1
Hunsur	4	1	-	-	-	-	5
Shivamogga	11	4	-	4	-	-	19
Anand	12	2	-	-	5	-	19
Nandyal	14	2	-	-	-	-	16
Nipani	12	3	-	-	-	-	15
Berhampur	9	2	-	-	-	-	11
Araul	6	2	-	-	-	-	8
Dinhata	3	-	-	-	-	-	3
Ladol	5	-	-	-	-	-	5
Vedasandur	1	-	-	-	-	-	1
Total	**83**	**20**	**1**	**4**	**5**	-	**113**

PB: Plant Breeding
AG: Agronomy
SS & AC: Soil Science & Agricultural Chemistry
EN: Entomology
PP: Plant Pathology
NE: Nematology

II. METEOROLOGICAL DATA

RAJAHMUNDRY

An amount of 946.08 mm of rainfall was received during 2023-24 in 47 rainy days (Table R). The mean maximum temperature varied from 29.15°C to 39.30°C, whereas, the minimum temperature ranged from 19.03°C to 25.45°C. The relative humidity in the early hours varied from 88.26% to 91.03% whereas relative humidity in the mid hours varied from 53.90% to 87.58%. The maximum Evaporation was observed in the month of April i.e. 4.91 mm. Maximum rainfall is seen during the Pre Nursery and Transplanting stages.

Table R: Meteorological data at Rajahmundry centre (2023-24)

Month	Temperature(°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Evaporation (mm)
	Max.	Min.	7.25 Hrs	14.25 hrs			
2023							
Apr.	37.88	23.89	88.50	60.27	62.60	1	4.91
May	37.53	25.10	90.84	64.71	84.80	7	4.34
Jun.	39.30	25.45	86.40	53.90	25.08	2	4.72
Jul.	32.64	23.67	90.77	87.58	260.10	14	3.03
Aug.	33.57	21.93	89.16	73.97	126.20	9	3.89
Sep.	33.28	22.43	91.03	73.53	86.50	8	2.65
Oct.	35.17	24.05	89.16	55.00	1.40	1	3.40
Nov.	32.38	21.73	90.23	60.03	77.40	3	2.74
Dec.	29.15	20.36	87.87	69.68	222.00	2	2.07
2024							
Jan.	31.58	19.03	88.26	58.87	0.00	0	2.34
Feb.	35.12	19.39	89.52	61.38	0.00	0	3.47
Mar.	35.83	21.94	90.94	58.45	0.00	0	3.56
Total					**946.08**	**47**	

Table R-1: Rainfall received and rainy days during tobacco growth phases-2023-24

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	August to September	190.30	13
2	Nursery	September to November	99.80	7
3	Transplanting	November to December	223.40	3
4	Growth	January to February	0.00	0
5	Harvesting	February to April	0.00	0
		Total	**513.50**	**23**

JEELUGUMILLI

An amount of 887.77mm of rainfall was received during 2023-24 in 66 rainy days (Table J). The mean maximum temperature varied from 28.64°C to 37.68°C, whereas, the minimum temperature ranged from 18.43°C to 26.11°C. The relative humidity in the early hours varied from 83.43% to 94.12% whereas relative humidity in the mid hours varied from 46.50% to 72.35%. The maximum Evaporation was observed in the month of June *i.e.* 6.28 mm. The highest Sunshine hours were observed during the months of May and October. Maximum rainfall is seen during the Pre Nursery and Growth stages.

Table J: Meteorological data at Jeelugumilli centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	36.75	24.32	88.37	46.50	34.60	02	7.64	4.90
May	35.99	24.15	87.93	53.45	44.30	05	7.10	4.67
Jun.	37.68	26.11	83.43	47.20	46.60	08	6.22	6.28
Jul.	29.96	23.26	90.06	72.35	300.47	20	2.38	1.87
Aug.	31.58	24.76	89.51	66.19	96.80	10	4.26	2.72
Sep.	31.54	24.67	92.33	70.26	81.80	11	2.83	2.39
Oct.	33.23	23.62	88.70	55.74	28.80	02	7.10	3.91
Nov.	30.95	21.84	90.03	61.70	23.20	05	4.90	3.00
Dec.	28.64	18.43	92.61	65.22	224.20	03	4.63	2.75
2024								
Jan.	29.65	19.37	94.12	53.67	0.00	0	3.89	2.68
Feb.	31.79	20.20	93.31	52.82	0.00	0	5.51	3.77
Mar.	33.96	22.58	92.03	54.00	0.00	0	3.45	5.02
Total					**887.77**	**66**		

Table J-1: Rainfall received and rainy days during tobacco growth phases-2023-24

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	01.04.2023 to 24.08.2023	389.90	37
2	Nursery	25.08.2023 to 29.10.2023	143.40	20
3	Transplanting	30.10.2023 to 20.11.2023	22.20	04
4	Growth	21.11.2023 to 24.01.2024	225.20	04
5	Harvesting	25.01.2024 to 10.04.2024	0.00	0
		Total	**780.70**	**65.0**

KANDUKUR

An amount of 1697.3 mm of rainfall was received during 2023-24 in 29 rainy days (Table K). Mean maximum temperature varied from 37.7°C to 24.2°C, whereas, the minimum temperature ranged from 28°C to 38°C. The relative humidity in the early hours varied from 87% to 91% whereas relative humidity in the mid hours varied from 87% to 91%. The highest Sunshine hours were observed during the month of May (9.2 hrs).

Table K: Meteorological data at Kandukur centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)
	Max.	Min.	7.25 hrs	14.25 hrs			
2023							
Apr.	35	28	87	69	138	2	8.6
May	36	31	90	67	38	2	9.2
Jun.	38	33	90	69	51	3	9.0
Jul.	32	29	89	65	94	4	8.5
Aug.	34	30	91	65	25	3	8.3
Sep.	34	29	87	64	207	6	6.3
Oct.	35	29	87	64	0	0	6.5
Nov.	29	26	90	64	35	7	6.4
Dec.	28	24	89	66	177	2	5.9
2024							
Jan.	30	25	90	65	0	0	6.8
Feb.	33	26	89	65	0	0	6.4
Mar.	34	28	89	64	0	0	6.3
Total					**764**	**29**	

Table K-1: Rainfall received and rainy days during tobacco growth phases-2023-24

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery		528	20
2	Nursery	3.10.2023 to 10.10.2023	-	-
3	Transplanting	25.12.2023 to 30.12.2023	-	-
4	Growth	02.02.2024 to 04.04.2024	-	-
5	Harvesting	17.02.2024 to 19.04.20.24	-	-
		Total	**528**	**20**

GUNTUR

An amount of 1032.5 mm of rainfall was received during 2023-24 in 51 rainy days as against average rainfall of 990 mm (Table G). The mean maximum temperature varied from 43.7°C to 29.7°C, whereas, the mean minimum temperature ranged from 19.8°C to 31.6°C. The relative humidity in the early hours varied from 57.9% to 88.2% whereas relative humidity in the mid hours varied from 36.5% to 70.4%. The highest Sunshine hours were observed during the month of June (8.5 hrs). The maximum Evaporation was observed in the month of June *i.e.* 8.5 mm. Maximum Rainfall was received during the Pre-Nursery, Nursery and Transplanting stages.

Table G: Meteorological data at Guntur centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	37.6	26.6	57.9	51.2	6.0	2	7.0	6.0
May	43.7	24.9	60.4	53.4	103.0	4	8.0	7.5
Jun.	39.6	22.0	62.0	52.8	113.4	10	6.0	8.5
Jul.	36.2	26.3	62.0	53.3	254.0	13	6.0	7.0
Aug.	35.2	27.7	64.7	53.0	106.6	5	7.5	6.0
Sep.	33.5	25.8	81.5	64.9	210.8	11	7.2	5.4
Oct.	34.7	31.6	72.0	60.0	21.0	2	7.5	4.5
Nov.	36.6	23.3	80.9	66.9	37.0	2	6.3	3.5
Dec.	29.7	20.2	88.8	70.4	180.7	2	7.5	7.0
2024								
Jan.	31.5	19.8	87.4	59.9	---	---	6.1	5.0
Feb.	33.9	22.2	88.2	46.4	---	---	7.5	5.7
Mar.	36.2	24.2	82.8	36.5	---	---	8.2	6.0
Total					**1032.5**	**51**		

Table G-1: Rainfall received and rainy days during tobacco growth phases-2023-24

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	01/04/2023 To 31/07/2023	476.4	29
2	Nursery	22/08/2023 To 31/10/2023	338.4	18
3	Transplanting	08/11/2023 To 15/12/2023	217.7	4
4	Growth	15/01/2024 To 20/03/2024	-	-
5	Harvesting	27/03/2024 To 30/04/2024	-	-
		Total	**1032.5**	**51**

HUNSUR

An amount of 855.8 mm of rainfall was received during 2023-24 in 51 rainy days (Table H). Mean maximum temperature varied from 27.9°C to 36.1°C, whereas, the minimum temperature ranged from 4.9°C to 12.8°C. The relative humidity in the early hours varied from 90% to 93% whereas relative humidity in the mid hours varied from 66.1% to 77.5%. The highest Sunshine hours were observed during the months of February (8.1 hrs) and March (8.1 hrs). The maximum Evaporation was observed in the month of April *i.e.* 5.9 mm. During the different crop growth stages 436.1 mm rainfall was received in 36 rainy days. Higher amount of rainfall received during the Nursery and Growth phase.

Table H: Meteorological data at Hunsur centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	36.1	12.8	91.2	68.7	17.2	2	7.3	5.9
May	35.4	9.7	91.2	66.1	166.5	7	6.4	5.0
Jun.	30.0	9.9	91.0	73.1	68.6	6	5.0	4.3
Jul.	28.3	8.6	91.0	70.6	79.2	11	4.0	3.1
Aug.	29.9	9.6	91.0	69.9	25.7	4	4.8	4.5
Sep.	27.9	8.3	91.0	77.5	110.8	7	4.5	3.1
Oct.	30.8	7.4	91.0	75.1	247.6	8	5.1	4.8
Nov.	31.5	6.2	91.0	73.7	134.2	5	4.9	5.1
Dec.	30.2	4.9	90.5	73.7	0	0	6.5	5.3
2024								
Jan.	32.5	8.9	91.0	72.7	6.0	1	7.6	5.3
Feb.	33	9.5	92	73.0	0	0	8.1	5.3
Mar.	32	9.5	93	74.0	0	0	8.1	5.3
Total					**855.8**	**51**		

Table H-1: Rainfall received and rainy days during different FCV tobacco growth phase (2023-24)

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	February to March 15th	0	0
2	Nursery	March 15th to May 15th	188	7
3	Transplanting	May 15th to June 1ST week	17.7	3
4	Growth	June 1st week to July 30th	145.8	17
5	Harvesting	Aug 1st to Sept 15th	84.6	9
		Total	**436.1**	**36**

Pests and diseases: Incidence of wilt was noticed in all the tobacco growing areas of KLS due to alternate wetting and drying of moisture conditions/situations in the field during crop establishment stage and crop growth.

SHIVAMOGGA

Total rainfall of 629.0 mm was received during the year 2023-24 in 52 rainy days. A maximum temperature of 36.1^{0}C was recorded during April and minimum temperature of 17.1^{0}C was recorded during February. The relative humidity in the early hours varied from 75.1% to 91.8% whereas relative humidity in the mid hours varied from 33.8% to 85.1%. The maximum Evaporation was observed in the month of February *i.e.* 7.21 mm. The highest Sunshine hours were observed during the month of February (7.21 hrs). Maximum Rainfall was received during the Nursery and Growth stages.

Table S: Meteorological data at Shivamogga centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	36.1	20.7	76.4	33.8	54	4	9.3	7.6
May	34.8	22.7	78.6	47.1	87.6	5	9.3	6.2
Jun.	31.4	22.5	83.4	66.9	57.6	7	4.0	4.6
Jul.	27.3	21.8	90.7	85.1	238.2	21	1.4	3.4
Aug.	30.0	21.5	91.8	73.0	40.0	5	6.2	4.7
Sep.	29.6	21.3	90.9	78.9	45.2	5	4.7	4.5
Oct.	32.2	20.6	88	62	3.2	0	6.7	6.8
Nov.	31.0	20.1	88	67	103.2	5	6.3	4.5
Dec.	30.8	17.7	86.2	61.2	0.0	0	7.4	4.5
2024								
Jan.	31.4	17.4	84.3	49.7	0.0	0	9.57	4.20
Feb.	34.6	17.1	77.8	29.5	0.0	0	9.84	7.21
Mar.	36.1	20.2	75.1	28.9	0.0	0	8.59	5.94
Total					**629.0**	**52**		

Table S-1: Rainfall received and rainy days during different FCV tobacco growth phases (2023-24)

Tobacco growth stages	Period	Rainfall (mm)	Rainy days
Pre nursery	24-03-2023 to 27-04-2023	22	02
Nursery	28-04-2023 to 29-06-2023	170	13
Transplanting	30-06-2023 to 10-07-2023	65	07
Growth	01-07-2023 to 23-08-2023	248	24
Harvesting	24-08-2023 to 27-10-2023	75	07
Total	**Total**	582	53

Pest and diseases: Rainfall received during the cropping period (July to October) was326.6mm as against 734.2 mm normal rainfall. Rainfall received was 44.5% which was 55.5% lower, with 31actual number of rainy days as against 49.7 normal rainy days. This lower rainfall and dry spell was highly congenial for incidence of Aphids. Further problem of pollen production and seed set was also observed due to sever heat and moisture stress.

ANAND

The rainfall received during the year 2023-24 was 978.6 mm in 43 rainy days (Table A) which was more than the normal rainfall (862 mm) of the middle Gujarat Agro-Climatic Zone. Mean maximum temperature varied from 27.4°C to 38.80°C, whereas, the minimum temperature ranged from 13.56°C to 27.20°C. The relative humidity in the early hours varied from 66.67% to 92.35% whereas relative humidity in the mid hours varied from 30.40% to 75.42%. The highest Sunshine hours were observed during the month of May (10.84 hrs). The maximum Evaporation was observed in the month of May *i.e.* 9.04 mm.The rainfall received during the pre-nursery stage was useful for land preparation. During transplanting, 65.4 mm rainfall within 5 rainy days was received which helped in transplanting of tobacco seedlings. Temperature during growth phase was normal and the rainfall of 180 mm received.

Table A: Meteorological data at Anand centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	37.29	23.32	66.67	30.40	0.00	0	9.83	7.99
May	38.80	25.94	71.68	35.90	14.00	1	10.84	9.04
Jun.	36.04	27.20	81.03	56.00	194.50	7	6.96	6.94
Jul.	32.63	26.50	92.35	75.42	501.70	17	3.21	3.53
Aug.	32.09	26.19	86.05	65.45	15.20	2	3.19	3.91
Sep.	32.85	25.88	89.03	67.30	216.60	13	5.38	3.97
Oct.	35.17	22.27	84.45	39.45	0.00	0	9.61	4.03
Nov.	32.33	18.49	80.77	40.67	10.60	1	8.50	3.25
Dec.	28.16	16.97	86.03	52.38	12.80	1	7.53	2.69
2024								
Jan.	27.40	13.56	87.61	46.48	0.00	0	8.24	2.84
Feb.	30.40	16.20	75.95	37.19	0.00	0	9.60	4.37
Mar.	34.88	18.49	70.48	24.80	13.20	1	10.12	6.11
Total	--	--	--	--	**978.6**	**43**	--	--

Table A-1: Meteorological data during different *bidi* tobacco growth phases (2023-24)

Crop stage	Period	Rainfall (mm)	Rainy days
Pre-nursery	4thJune to 1st July (28)*	14.0	1
Nursery	2nd July to 19th Aug. (49)*	194.5	7
Transplanting	20th Aug. to 16th Sept. (28)*	511.5	18
Growth	17th Sept to 31st Dec. (106)*	65.4	5
Harvesting	1st Jan. to 1st April (91)*	180.0	11
Total	**365**	13.2	1
		978.6	**43**

** Figures in parentheses indicate number of days*

ARAUL

An amount of 879.93 mm of rainfall was received during 2023-24 in 55 rainy days (Table Ar). The mean maximum temperature varied from 15.30°C to 38.79C, whereas, the minimum temperature ranged from 12.30°C to 41.50°C. The relative humidity in the early hours varied from 38.30% to 95.48% whereas relative humidity in the mid hours varied from 15.3% to 70.21%. The highest Sunshine hours were observed during the month of May (8.95 hrs). The maximum Evaporation was observed in the month of June *i.e.* 7.98 mm. Among the different crop growth stages Pre Nursery stage received maximum amount of Rainfall.

Table Ar: Meteorological data at Araul centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	33.25	18.10	38.30	15.30	32.11	02	8.01	3.66
May	41.50	27.30	76.22	44.30	23.23	04	8.95	4.35
Jun.	40.80	23.48	66.28	40.14	80.03	04	6.65	7.98
Jul.	40.65	21.95	90.60	70.21	438.95	17	8.16	7.35
Aug.	30.25	21.10	90.20	65.77	150.68	09	8.17	2.19
Sep.	33.40	20.15	80.10	60.48	48.65	07	3.33	3.25
Oct.	30.13	12.61	79.65	40.13	25.45	04	5.88	3.98
Nov.	22.60	9.95	73.50	32.12	0.00	0	4.34	4.05
Dec.	16.33	5.50	91.10	60.67	0.00	0	3.94	3.03
2024								
Jan.	12.30	3.25	95.48	72.72	26.25	04	2.15	1.11
Feb.	21.60	16.18	80.22	50.10	18.03	02	7.10	3.14
Mar.	24.80	19.35	68.13	28.38	36.55	02	6.75	3.78
Total					**879.93**	**55**		

Table Ar-1: Rainfall during different *rustica* tobacco growth phases (2023-24)

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery	April, 2023 to August, 2023	728.70	36
Nursery	September, 2023 to October, 2023	74.10	11
Transplanting	November, 2023	0	0
Growth	December, 2023 to February, 2024	44.28	06
Harvesting	March, 2024	36.55	02
	Total	**883.63**	**55**

LADOL

During month of December, January and February minimum temperature was recorded from 13.1 ^{0}C to 16.2 ^{0}C and maximum temperature was from 27.7 ^{0}C to 31.5 ^{0}C which was favorable for crop growth, cured leaf yield and quality parameters. The relative humidity in the early hours varied from 49.2% to 88.9% whereas relative humidity in the mid hours varied from 21.4% to 74.6%. Among the different crop growth stages Pre Nursery stage received maximum amount of Rainfall

Table L: Meteorological data at Ladol centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days
	Max.	Min.	7.25 hrs	14.25 hrs		
2023						
Apr.	38.0	24.0	49.2	22.1	9.0	1
May	39.8	26.9	62.1	30.2	42.0	2
Jun.	36.5	27.1	78.0	57.5	165.5	8
Jul.	34.0	26.4	88.9	74.6	456.0	15
Aug.	33.4	27.9	85.7	69.7	21.0	2
Sep.	34.8	26.5	82.2	63.2	295.0	6
Oct.	35.2	21.1	66.2	36.3		
Nov.	32.5	18.0	63.0	34.9	39.0	1
Dec.	29.0	15.0	70.1	41.3		
2024						
Jan.	27.7	13.1	67.8	38.8		
Feb.	31.5	16.2	56.9	28.2		
Mar.	36.2	18.6	46.6	21.4	9.0	1
Total					1036.5	36

Table L-1: Rainfall received and rainy days during tobacco growth phases-2023-24

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery	01/05/2023 to 31/09/2023	979.5	33
Nursery	01/10/2023 to 05/11/2023	-	-
Transplanting	06/11/2023 to 20/11/2023	-	-
Growth	21/11/2023 to 05/04/2024	48.0	2
Harvesting	06/04/2024 to 30/04/2024	-	-
	Total	**1027.5**	**35**

DINHATA

An amount of 2728.1 mm of rainfall was received during 2023-24 in 88 rainy days (Table D). The mean maximum temperature varied from 28.1°C to 35.4°C, whereas, the minimum temperature ranged from 10.3°C to 26.3°C. The relative humidity in the early hours varied from 59.2% to 97.8% whereas relative humidity in the mid hours varied from 46.4% to 91.5%. The highest Sunshine hours were observed during the month of May (8.95 hrs). The maximum Evaporation was observed in the month of November *i.e.* 8.62 mm. Among the different crop growth stages Pre-Nursery and Nursery stages received maximum amount of Rainfall.

Table D: Meteorological data at Dinhata centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days	Sun Shine (hrs)
	Max.	Min.	7.25 hrs	14.25 hrs			
2023							
Apr.	35.4	23.6	91.5	85.4	38.0	4	6.2
May	34.0	24.5	84.8	73.5	286	8	6.3
Jun.	32.0	30.1	88.0	83.7	720.5	18	1.8
Jul.	31.7	25.7	91.6	87.5	565.6	15	3.16
Aug.	31.6	26.3	90.6	89.4	436.0	16	1.95
Sep.	31.8	25.6	91.5	88.0	478.0	14	3.82
Oct.	30.6	22.8	90.8	91.5	191.0	9	4.68
Nov.	31.18	18.4	87.3	80.1	0	0	8.62
Dec.	29.2	13.9	93.2	78.1	0	0	5.4
2024							
Jan.	28.1	10.3	97.8	74.2	0.0	0	4.54
Feb.	30.5	14.8	59.2	46.4	2.0	1	5.3
Mar.	30.6	19.9	70.6	74.5	11	3	6.5
Total					2728.1	88	

Table D-1: Rainfall received during different growth phases (2023-24)

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	(15.08.2023) to (14.09.2023)	457.0	15
2	Nursery	(15.09.2023) to (15.11.2023)	430.0	16
3	Transplanting	(16.11.2023) to (15.12.2023)	0	0
4	Growth	(16.12.2023) to (19.02.2024)	0	0
5	Harvesting	(20.02.2024) to (20.03.2024)	13	4
		Total	900	35

NIPANI

Month wise rainfall and rainy days received during the year 2023 are presented in Table-1. The total rainfall of 722.8 mm was received during the year 2023 and was spread over 61 rainy days. The rainfall received in the months of April (11.8 mm) and May (56.4 mm) helped for land preparation during *Kharif*. Heavy and continues rains were received in the month of July (328.4 mm) in 26 rainy days, affected nursery. Due to this heavy rain, resowing of certain entries seeds was taken place. Further, incessant rains received in the month of September (160.0 mm) this helped the early planted tobacco for healthy growth.

Table N: Meteorological data at Nipani centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days
	Max.	Min.	7.25 hrs	14.25 hrs		
2023						
Apr.	36.7	15.7	62.2	37.7	11.8	1
May	36.4	17.9	71.4	46.6	56.4	3
Jun.	34.1	19.1	77.0	62.5	30.2	3
Jul.	26.5	17.6	90.9	89.8	328.4	26
Aug.	28.9	16.8	86.2	76.6	74.4	7
Sep.	29.4	17.0	88.3	77.8	160.6	15
Oct.	32.8	15.6	78.6	51.6	11.6	2
Nov.	32.8	13.6	75.4	50.5	40.8	2
Dec.	31.2	10.3	76.6	53.3	2.8	1
2024						
Jan.	32.4	9.6	72.6	43.9	5.8	1
Feb.	35.5	10.5	61.3	35.6	-	-
Mar.	37.5	13.4	56.0	32.8	-	-
Total					**722.8**	**61**

Table N-1: Rainfall received and rainy days during tobacco growth phases-2023-24

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery	1st April to 24th June	69.6	4
Nursery	25th June to 10th August	384.2	34
Transplanting	11th August to 15th September	157.0	10
Growth	16th September to 15th December	106.2	12
Harvesting	16th December to 27th January	5.8	1
	Total	**722.8**	**61**

Rainfall received and number of rainy days in various tobacco growth stages during the year 2023-24 at Agricultural Research Station, Nipani is presented in Table-2. Total rainfall of 722.8 mm was received during different growth stages of tobacco. The total rainfall of 722.8mm was received during various growth stages of tobacco as against 769.7mm average rainfall (average of last 83 years). The total rainfall

received during the year was 6.5% lesser than average rainfall. The rainfall received during pre-nursery stage was 69.6mm spread over 4 rainy days helped for land preparation both for nursery and main field. The well distributed rainfall during nursery stage (384.2mm) spread over 34 rainy days produced good number of transplantable tobacco seedlings both in research station and farmers field. The rainfall received during transplanting period (157.0mm in 10 rainy days) was more than the average rainfall. Further, the rainfall of 106.2mm in 12 rainy days was 84.4% was lower than average rainfall during growth stage. Incidence of damping off disease in nursery and TMV, leaf curl and aphids in growth stages in main field was severely observed. There was no rainfall during harvesting stage which helped for easy harvesting and powdering of the tobacco in the main field.

Pest and diseases

The total rainfall received during the year was 6.5% lesser than average rainfall. The plant stand and crop condition was not satisfactory and unfavourable for the crop of late planted tobacco leading to low quality produce. As a consequence of this tobacco plant growth was drastically affected with high incidence of aphids, leaf curl and TMV and very low incidence of brown leaf spot and frog eye leaf spot were noticed in late planted tobacco.

NANDYAL

An amount of 534.9 mm of rainfall was received during 2023-24 in 38 rainy days (Table Ny). The mean maximum temperature varied from 31.4°C to 39.8°C, whereas, the minimum temperature ranged from 19.8°C to 27.2°C. The relative humidity in the early hours varied from 61.4% to 88.1% whereas relative humidity in the mid hours varied from 22.3% to 62.0%. The highest Sunshine hours were observed during the months of April and February (9.2 hrs). The maximum Evaporation was observed in the month of April *i.e.* 9.7 mm. Among the different crop growth stages Nursery stage received maximum amount of Rainfall.

Table Ny: Meteorological data at Nandyal centre (2023-24)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2023								
Apr.	39.8	24.7	61.4	26.8	0.6	0.0	9.2	9.7
May	39.6	27.0	66.5	36.9	68.0	3.0	8.5	9.1
Jun.	37.6	27.2	70.6	38.7	34.7	6.0	6.7	7.5
Jul.	33.5	24.9	81.0	62.0	219.8	15	2.2	3.2
Aug.	35.1	25.6	75.3	46.3	41.9	5.0	5.6	5.1
Sep.	33.1	24.8	83.8	57.8	167.3	9.0	4.7	4.3
Oct.	34.8	24.0	75.9	42.7	0.0	0.0	7.7	5.5
Nov.	33.0	23.6	83.3	55.1	0.6	0.0	6.3	4.6
Dec.	31.4	19.8	86.7	51.5	2.0	0.0	5.9	2.4
2024								
Jan.	32.3	21.3	88.1	52.0	0.0	0.0	6.8	4.1
Feb.	36.1	20.4	84.1	40.8	0.0	0.0	9.2	6.4
Mar.	39.5	23.7	74.0	22.3	0.0	0.0	8.3	8.9
Total					**534.9**	**38**		

Table Ny-1: Rainfall received during different *bidi* tobacco growth phases (2023-24)

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery	31.03.23 to 20.06.23	10.2	11.0
Nursery	22.07.23 to 22.09.23	323.3	17.0
Transplanting	22.09.23 to 04.11.23	50.1	3.0
Growth	01.12.23 to 15.02.24	2.0	0.0
Harvesting	28.02.24 to 20.03.24	0.0	0.0
	Total	**385.6**	**28.0**

BERHAMPUR

Total rainfall of 849.2 mm (Table B) was received during the year 2023-24 which was 427 mm less than the normal rainfall (1276.2 mm). Number of rainy days (51) was also less as compared to normal (64.2). Maximum rainfall (241.0 mm) was received during the month of July followed by September (170 mm) and June (113.7 mm). Higher rainfall than normal was received inthe month of April, July, 2023 and January 2024 and less rainfall in rest nine months of the year. More rainy days were observed in April, 2023 and March 2024 and equal and less rainy days in rest ten months of the year. About 61.78 percent rainfall received in the months June, July and September. Rainfall and rainy days received during different growth stages of tobacco in 2023-24 were presented in Table B. The maximum and minimum temperature could not be recorded due to non- functioning of weather station.

Table B: Meteorological data at Berhampur centre (2023-24)

Month	Rainfall (mm)	Rainy days
2023		
Apr.	63(36.6)	4(2.8)
May	40.5(65.4)	4(4.1)
Jun.	113.7(168.3)	7(8.8)
Jul.	241(220.8)	12(11.8)
Aug.	82(246.8)	8(12.5)
Sep.	170(216.3)	8(10.6)
Oct.	11(177.7)	1(6.9)
Nov.	3(71.1)	0(2.1)
Dec.	71(7.1)	3(0.5)
2024		
Jan.	27(9.4)	1(0.7)
Feb.	1(24.1)	0(1.5)
Mar.	26(32.6)	3(1.9)
Total	849.2(1276.2)	51.0(64.2)

Source: Odisha Rain fall monitoring system (rainfall.nic.in/PubRainChartDtl.asp)
*Figures in parenthesis are normal rainfall and rainy days of Ganjam district,
Source: IMD, Pune)

Table B-1: Rainfall received during different *pikka* tobacco growth phases (2023-24)

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery	(1.4.22) to (31.07.22)	458.2	27
Nursery	(01.8.22) to (15.9.22)	152.0	12
Transplanting	(16.9.22) to (31.10.22)	111.0	5
Growth	(1.11.22) to (31.1.23)	101.0	4
Harvesting	(1.2.23) to (31.3.23)	27.0	3
	Total	**849.2**	**51**

VEDASANDUR

An amount of 1309.8 mm of rainfall was received during 2023-24 in 63 rainy days (Table V). The maximum Rainfall was seen in the month of October. Among the different crop growth stages maximum amount of rainfall received during Nursery.

Table V: Meteorological data at Vedasandur centre (2023-24)

Month	Rainfall (mm)	Rainy days
2023		
Apr.	116	4
May	81.4	4
Jun.	156.4	6
Jul.	25.4	4
Aug.	152	7
Sep.	115	5
Oct.	280.5	10
Nov.	224	9
Dec.	118	9
2024		
Jan.	7.8	1
Feb.	19.6	2
Mar.	13.7	2
Total	**1309.8**	**63**

Table V-1: Rainfall received during different chewing tobacco growth phases (2023-24)

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery			
Nursery	15.08.2023 to 15.12.2023	584.33	29
Transplanting	01.10.2023 to 15.11.2023	180.5	10
Growth	15.11.2023 to 31.12.2023	71.43	5
Harvesting	01.02.2024 to 15.03.2024	0.00	0
	Total	**836.26**	**44**

III. AREA, PRODUCTION AND PRODUCTIVITY

RAJAHMUNDRY

Table R: Year-wise area, production and productivity of FCV Tobacco Andhra Pradesh.

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
2001-02	87754	120000	1368
2002-03	93209	128000	1370
2003-04	109373	148000	1353
2004-05	113334	153000	1350
2005-06	117242	145000	1240
2006-07	126889	172000	1355
2007-08	126700	165000	1305
2008-09	140875	204000	1448
2009-10	150233	208000	1382
2010-11	139240	173000	1244
2011-12	112792	163000	1445
2012-13	120105	177000	1470
2013-14	123615	214000	1731
2014-15	108737	190000	1748
2015-16	70122	118000	1686
2016-17	61821	105000	1719
2017-18	70317	133000	1892
2018-19	76950	124000	1613
2019-20	79294	128650	1622
2020-21	65142	112740	1731
2021-22	66265	120980	1826
2022-23	85756	181020	2111
2023-24	99312		

Source: *Tobacco Board, Guntur*

SHIVAMOGGA/ HUNSUR

Table S: Area, production and productivity of FCV Tobacco in Karnataka

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
2003-04	69158	73690	1066
2004-05	69700	90350	1296
2005-06	73980	82910	1121
2006-07	78162	96980	1241
2007-08	85755	87650	1022
2008-09	90427	114000	1261
2009-10	106600	115670	1085
2010-11	118989	127850	1074
2011-12	104393	104290	999
2012-13	93974	93860	999
2013-14	97770	102020	1043
2014-15	85934	103400	1203
2015-16	75837	71950	949
2016-17	76089	98720	1297
2017-18	81083	106890	1318
2018-19	83696	85080	1017
2019-20	80369	106180	1321
2020-21	73609	88420	1201
2021-22	71877	68.14	948
2022-23	66000	60.00	909
2023-24	63404	88.85	1401

Source: Tobacco Board. APF63, Ramanathapura

ANAND

Table A: Year-wise area, production and productivity of tobacco in Gujarat

Year	Area(ha)	Production(tonnes)	Productivity(kg/ha)
2010-11	147900	280500	1897
2011-12	158000	278400	1762
2012-13	123800	212400	1716
2013-14	137000	240000	1752
2014-15	166000	236000	1422
2015-16	198000	326000	1646
2016-17	167000	375000	2246
2017-18	145000	274000	1889
2018-19	179500	378000	2106
2019-20	162400	345900	2130
2020-21	170400	396200	2325
2021-22	191600	452900	2363
2022-23	190100	432500	2275
2023-24	1894	4215	2225

Source: www.dag.gujarat.gov.in

ARAUL

Table Ar: Year-wise area, production and productivity of *Rustica* tobacco in Uttar Pradesh

Year	Area (ha)	Production (tonnes)	Productivity(kg./ha)
2013-14	22455	24857	1107
2014-15	29115	32958	1132
2015-16	27650	32488	1175
2016-17	27352	32269	1180
2017-18	23112	28614	1238
2018-19	26352	36814	1397
2019-20	28550	39594	1387
2020-21	25155	30335	1206
2021-22	22817	27962	1225
2022-23	24332	35590	1380
2023-24	Data Not Available		

Source: *Statistical Department, Directorate of Agriculture, U.P*

LADOL

Table L: Year-wise area, production and productivity of *Rustica* tobacco in Gujarat

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
2008-09	49200	70100	1425
2009-10	62800	101500	1616
2010-11	88000	176000	2000
2011-12	95400	160900	1687
2012-13	57800	98000	1696
2013-14	98000	165000	1684
2014-15	126000	186000	1476
2015-16	146500	218000	1488
2016-17	132000	210000	1591
2017-18	104000	200000	1923
2018-19	116300	242600	2086
2019-20	114200	240100	2102
2020-21	124700	279700	2243
2021-22	137700	339470	2465
2022-23	138400	327700	2368
2023-24* (3rd Advance Estimate)	1350	3132	2320

DINHATA

Table D: Area, production and productivity of *Motihari* and *Jati* tobacco in West Bengal

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
2010-11	13375	17388	1300
2011-12	16840	23576	1400
2012-13	16840	23576	1400
2013-14	18000	27000	1500
2014-15	18000	25200	1400
2015-16	18500	27750	1500
2016-17	18500	27750	1500
2017-18	18500	27750	1500
2018-19	18500	27750	1500
2019-20	15151	20457	1350
2020-21	15400	20697	1400
2021-22	12505	19732	1470

Source: *Evaluation wing, Directorate of Agriculture, Govt. Of West Bengal, 2021*

NIPANI

Bidi tobacco is mainly grown in Nipani, Chikodi, Hukkeri, Gokak and Raibag talukas of Belagavi district. At present, it occupies an area of 6489 hectares with the production of about 9485 tonnes and productivity of 1546 kg/ha. The *bidi* tobacco produce of this area is known for its quality throughout the country

Table N: Area and productivity trends of tobacco in a decade in Karnataka

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
2003-04	21997	8379	381
2004-05	22000	18700	850
2005-06	21598	16771	776
2006-07	19826	7931	400
2007-08	25203	13162	522
2008-09	22104	13704	620
2009-10	20284	13793	680
2010-11	19680	12398	630
2011-12	18200	12922	710
2012-13	17680	11810	668
2013-14	11392	14240	1250
2014-15	15107	19770	1308
2015-16	13422	17449	1300
2016-17	10889	17422	1599
2017-18	11358	13750	1210
2018-19	11675	14250	1221
2019-20	7109	7484	1095
2020-21	7185	8026	1142
2021-22	6500	9815	1510
2022-23	6118	6654	1088
2023-24	6489	9458	1546

Source: *Department of Agriculture, Government of Karnataka*

NANDYAL

Table Ny: Area, Production and Productivity of *bidi* tobacco grown in Andhra Pradesh

Year	Area(ha)	Production (tonnes)	Productivity (kg/ha)	Market price (Rs/kg)
2007-08	5621	9747	1734	30-45
2008-09	9593	13411	1398	50-65
2009-10	15744	30228	1920	25-50
2010-11	12000	21156	1763	25-35
2011-12	8777	14482	1650	45-55
2012-13	6705	10403	1600	35-45
2013-14	7000	12509	1700	65-85
2014-15	7500	11608	1540	60-80
2015-16	9800	9776	967	60-80
2016-17	10250	15375	1500	75-85
2017-18	9250	11088	1200	75-85
2018-19	10500	16275	1550	70-80
2019-20	11250	18844	1750	70-80
2020-21	2500	4520	1700	
2021-22	3400	5120	1650	
2022-23	3424	5659	1623	
2023-24	58980			

BERHAMPUR

Table B: Tobacco area, production and productivity of Odisha 1987-88 to 2019-20

Year	Area(ha)	Production(tonnes)	Productivity(kg/ha)
1987-88	14000	5000	357
1988-89	14000	6000	429
1989-90	15000	9000	600
1990-91	15000	9000	600
1991-92	15000	11000	733
1992-93	13000	10000	769
1993-94	10000	6000	600
1994-95	10000	6000	600
1995-96	9000	7000	778
1996-97	9000	5000	556
1997-98	9000	4000	444
1998-99	8000	4000	500
1999-00	7000	5000	714
2000-01	3000	2000	667
2001-02	6000	4000	667
2002-03	4000	3000	750
2003-04	5310	3490	657
2004-05	4760	3250	683
2005-06	3720	2710	728
2006-07	4130	3020	731
2007-08	3790	2790	736
2008-09	4030	3000	744
2009-10	3300	2480	752
2010-11	2160	1860	861
2011-12	1820	1520	835
2012-13	2030	1150	567
2013-14	1690	1010	598
2014-15	1590	950	597
2015-16	1600	950	594
2016-17	600	360	600
2017-18	310	180	581
2018-19	190	110	579

Source: *Dept. of Agriculture & Food Production, Bhubaneswar, Odisha (*un published)*

VEDASANDUR

Table V: Area and Production of Tobacco in Tamil Nadu for the past 10 years

Year	Area (ha)	Production (tonnes)	Average Productivity (kg/ha)
2010-11	17000	43300	2547
2011-12	16000	40000	2500
2012-13	15000	37500	2500
2013-14	12000	28000	2333
2014-15	11000	27500	2500
2015-16	11000	27500	2500
2016-17	11000	27500	2500
2017-18	11000	27500	2500
2018-19	11000	27500	2500
2019-20	10000	25000	2500
2020-21	10000	24500	2450
2021-22	10000	25000	2500
2022-23	13000	25000	2500
2023-24	13000	25000	2400

IV. RECOMMENDATIONS TO FARMING COMMUNITY

SHIVAMOGGA

Crop Production

- Inter-cropping of groundnut in alternate rows of FCV tobacco results in increased tobacco cured leaf yield, provides additional intercrop yield and monetary advantage over the sole crop of FCV tobacco

ARAUL

- The higher tobacco equivalent yield recorded in Chickpea (3190 kg/ha) followed by Vegetable pea (2242 kg/ha). Economics of the treatment revealed that highest monitory return of Rs. 78045 was recorded by Vegetable pea with benefit cost ratio of 1.81.

SHIVAMOGGA

Crop Protection

- Management of Tobacco leaf curl vector, Whitefly, *Bemisia tabaci* (*Hemiptera*: *Aleyrodidae*) by using different modules indicated that IPM module proved to be effective in minimizing the whitefly damage, reducing the tobacco leaf curl virus disease by sustained the natural enemies and making it economically beneficial.

V. STATUS AND SCOPE FOR FARM MECHANIZATION

HUNSUR

- There is scope for evaluating power weeder/mini mechanically operated intercultural implements for weeding and intercultural purpose in the field crop situations. As the labor is costly and not available there is also need for formulating and designing small portable bale making machine for to save labor and time.

SHIVAMOGGA

- At present tractor drawn ridgers are being used for making ridges and furrows for planting in heavy rainfall areas. All other operations are being carried out manually by labourers. However, if suitable tractor drawn implements/machines are developed, there is an ample scope for mechanising weedicide application, fertilizer application and plant protection operations in the long run

NIPANI

- Tobacco is grown on small area of 2 to 5 acres by farmers. Hence, there is no scope for mechanisation. But some farmers are cultivating tobacco under drip irrigation system.

VI. SALIENT RESEARCH FINDINGS

RAJAHMUNDRY

Crop Improvement

- Among the twelve entries (IET-100 to IET-111) evaluated with checks, IET-101, IET-103 and IET-109 has recorded significantly superior green leaf yield, cured leaf yield, bright leaf yield and grade index over the better control CTRI Sulakshana and proposed for promoting to AVT-I.
- The entries IET-101, IET-102, IET-111, CTRI Sulakshana and CTRI Sreshta have recorded TMV resistant reaction under Artificial Condition.

JEELUGUMILLI

Crop Improvement

- Among the 12 entries (IET-100 to IET-111) evaluated in IVT along with four control varieties *viz.*, Kanchan, LT Kanchan, CH-1 and CTRI Naveena, none of the 12 tested entries recorded higher leaf yields than CTRI Naveena which recorded 3088 kg/ha cured leaf and 1885 grade index value.
- In AVT-II, based on the pooled analysis of data of two years (2022-24), the entry, FCRH-13 recorded non- significant higher cured leaf yields (2188 kg/ha) than controls. The grade Index in the entry FCRH-13 found to be significantly superior to the best control, Kanchan. Due to non-significant cured leaf yield, the entry, FCRH-13 is not recommended for further evaluation.
- In the IVT trial, conducted with 4 entries (IET118 to IET 121) along with two control varieties viz., Kommugudem and Rangapuram, the entry IET-119 recorded significantly higher (16%) cured leaf yield (2028 kg/ha) than better control, Kommugudem. The entry IET-119 may be promoted for evaluation under ensuing AVT trial.

GUNTUR

Crop Improvement

- In the Initial Varietal Trial, none of the 12 tested entries recorded significantly higher leaf yields than controls. However, three entries *viz.*, IET-100, IET-101 and IET-103 have performed better with significant high green leaf, cured leaf, bright leaf yields and also grade index over other test entries and two checks, namely, Siri and Kanchan.
- Incidence of tobacco leaf curl was observed to be moderate and ranged from 0.33 to 1.66% in all the entries evaluated under IVT trials conducted, while the incidence of caterpillar, aphid and TMV was nil.

KANDUKUR

Crop Improvement

- Among the 12 entries (IET-100 to IET-111) evaluated in IVT along with four control varieties viz., Siri, Kanchan, CTRI Sulakshana and CTRI Sreshta, none of the tested entries were found significantly superior over the checks with respect to green leaf, cured leaf, bright leaf and grade index.

HUNSUR

Crop Improvement

- In the IVT trial, three entries IET-107, IET-109 & IET-110 were found promising under KLS conditions. Entries IET-109 & IET-110 recorded significantly higher cured leaf yield, bright leaf yield and TGE over all the three checks, while IET-107 was found superior to checks Kanchan and FCH 222 and proposed for promoting to AVT-I.
- In AHT II, hybrid entry FCHH 2 recorded significantly higher Cured leaf yield, bright leaf yield and TGE over check CH 3 in the second year of the trial as well as in pooled analysis of two years.
- The promising entry FCH-2 is going to be proposed for identification during the Group Meeting

SHIVAMOGGA

Crop Improvement

- In Initial Variety/ Hybrid (IVT / IHT) Trials on FCV tobacco the entries IET-102 (1265 kg ha-1), IET-103(1304 kg ha-1), IET-104(1351 kg ha-1), and IET-109 (1140 kg ha-1) recorded 32%, 35%, 40% and 19% respectively, higher CLY over the best check CH-3 and proposed for promoting to AVT-I.
- Initial Variety Trials (IVT-Repeat) on FCV tobacco, five entries (FCR – 71, FCR – 72, FCR – 73, FCR – 74 and FCJ-42) were evaluated. The entry FCR – 72 has recorded 37% higher cured leaf yield (1408 kg/ha) and FCR – 73 has recorded 55% higher cured leaf yield (1591 kg/ha) over the best check Sahyadri and proposed for promoting to AVT-I.
- In the Station Trial-II on FCV tobacco, five entries were evaluated along with the three checks, where two entries viz., TB-100 xTB-102 (sel-5) recorded 42% higher CLY (1634 kg/ha) and NLST-2 x FCH-221 (sel-1) recorded 38% higher CLY (1590 kg/ha) over the best check Sahyadri.
- In another Station Trail, out of ten entries evaluated, two entries viz., FCS23-1 and FCS23-2 has recorded significantly higher GLY, CLY and TGE over the checks. FCS23-1 recorded 36% higher CLY 1887 kg/ha) and FCS23-2 recorded 29% higher CLY (1787 kg/ha) over the best check Sahyadri.
- All the three entries, FCS-4, FCH – 1 and FCH-2 performed better in the bulk trial.

Crop Production

- Application of 100% RDF + Ghanajeevamrutha @ 2 t/ha + Jeevamrutha @ 500 liters/ha (three application to soil) + KNO3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP) performed significantly superior over other treatments with respect to growth and yield (CLY: 989 kg ha-1) of FCV tobacco.
- The results of the feasibility of crop intensification through relay-intercropping in FCV tobacco didn't not show significant variation among the treatments as radish, amaranthus, fenugreek, palak and marigold were sown or planted during last intercultural operation to FCV tobacco.
- Application of hydrogel at different rates and time significantly influenced growth and yield of FCV tobacco. Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day recorded significantly higher green leaf yield (10073 kg ha-1) and cured leaf yield (1215 kg/ha).
- FCV tobacco grown with groundnut as intercrop has recorded significantly higher number of leaves harvested per plant (21.8), green leaf yield (12993 kg/ ha), cured leaf yield (1642 kg/ha), tobacco equivalent yield (1948 kg/ha), land equivalent ratio (1.71), area time equivalent ratio (1.53), monetary advantage index (Rs. 1,41,097/ha) and benefit cost ratio (2.60).

Crop Protection

- Among the different modules evaluated, Integrated Module comprising of Integration of castor as a trap crop, collection and destruction of *S. litura* egg mass, use of pheromone trap & bird perches and need based foliar spray of insecticides could protect FCV tobacco from *S. litura.*
- Among the different modules evaluated against Tobacco Leaf Curl disease, module-1 (IPM module) found to be superior with 71.64 per cent reduction in Tobacco Leaf Curl disease over control, followed by module-2 (Chemical module 65.31 %) with higher C:B ratio of 1:2.3 and 1:2.1, respectively.
- Among the 16 cultivars evaluated against tobacco leaf curl virus which is transmitted by whitefly (*Bemisia tabaci*) five cultivars *viz.*, Aurea, Sahyadri, Kanchana, FCS-4, Thrupthi shown resistant and remaining cultivars were moderately resistant and VA-770 was moderately susceptible.
- The aphid population was very high during the experimental period due to high temperature and humidity.
- Natural enemies like *Nesidocoris* sp. and *Ischiodon* sp. were recorded more on aphid infested plants.

NIPANI

Crop Improvement

- IVT: The test IET 114 (2168 kg/ha), IET 113 (2151 kg/ha) and IET 115 (1854 kg/ha) recorded significantly superior leaf yield over the best check Bhavyashree (1530 kg/ha) and NBD 209 (1420 kg/ha) and proposed for promoting to AVT-I during 2024-25.
- AVT-I: Test entry ABD 239 (1543 kg/ha) registered numerically higher leaf yield compared to popular check A-119 (921 kg/ha) and local check Bhavyashree (1500 kg/ha). None of the entries were superior over the best check.

- AVT-II: Test entry NyBD 68 (1693 kg/ha) registered higher leaf yield followed by ABD 228 (1652 kg/ha) and NyBD 69 (1554 kg/ha) over the best check NBD-209 (1398 kg/ha) and popular check A-119 (1112 kg/ha). Pooled analysis over two years revealed that none of the test entries were superior to the best check NBD 209 (1528 kg/ha).
- LSD: The promising entry NBD 316 has recorded higher leaf yield of 1891 kg/ha over the best check NBD 209 (1265 kg/ha). The promising entry NBD 316 is being proposed for identification during the Group Meeting.
- SVT-R: Due to the severe leaf curl, the trial has been vitiated. The same trial will be repeated during 2024-25 as SVT (R).
- PVT: The test entry NBD 407 (2491 kg/ha) recorded significant superiority for the leaf yield over the best check NBD 209 (1231 kg/ha). The best test entries NBD 381, NBD 387, NBD 388, NBD 390, NBD 393, NBD 398, NBD 406 and NBD 407 will be evaluated in Station Varietal Trial (SVT) along with checks during 2024-25.
- PVT (S): Five entries viz., NBD-S-26 (2781 kg/ha), NBD-S-21 (2443 kg/ha), NBD-S-27 (2421 kg/ha), NBD-S-24 (2413 kg/ha) and NBD-S-20 (2152 kg/ha) recorded significant superiority and two test entries viz., NBD-S-22 (1920 kg/ha), NBD-S-3 (1855), recorded numerically superiority for the leaf yield over the best seed check A-145 (1779 kg/ha). The entry NBD-S-2 (706.65 kg/ha) recorded significantly superior seed yield over best check A 119 (435.99 kg/ha). The nine best test entries NBD-S-3, NBD-S-20, NBD-S-21, NBD-S-22, NBD-S-24, NBD-S-26, NBD-S-25, NBD-S-1 and NBD-S-27 will be evaluated in Station Varietal Trial-Seeds (SVT-S) along with checks during 2024-25.
- PHT: Total 25 test hybrids recorded significant superiority for the leaf yield over the best check NBD 209 (1231 kg/ha). The test hybrid, NBTH 1068 (MS A-119 X ABD 228) recorded highest leaf yield (4534 Kg/ha) followed by NBTH 1067 (3645 Kg/ha), NBTH 1073 (3267 Kg/ha) and NBTH 1070 (3112 Kg/ha). All these 25 test hybrids will be evaluated in SHT during 2024-25.
- New crosses: A total of 45 new inter varietal crosses and 26 MS based crosses were generated for leaf yield, quality and disease and pest resistance.
- F1's: Out of 45 F1s, the cross combinations ABD 229 x NBD 209 (3360 Kg/ha), ABD 228 x A-119 (3133 Kg/ha), A-119 x ABD 228 (2983 Kg/ha), ABD 228 x Vedaganga-1 (2560 Kg/ha), ABD 228 x NBD 209 (2133 Kg/ha), ABD 226 x A-119 (2027 Kg/ha), NBD 209 x ABD 226 (2027 Kg/ha) and NBD 316 x ABD 226 (1257 Kg/ha) were found to be potential heterotic cross combinations and will be advanced to F2 generation during 2024-25.
- F2 Populations: Total 33 plants were selected from five populations and finally 12 plants selected based on yield performance will be advanced to next generation (F3).
- F3 Progenies: Sixteen superior progenies out of six crosses were selected and finalised based on visual and yield performance and will be advanced to next generation (F4).
- F4 Lines: Forty-three F4 lines evaluated in an un-replicated yield trial. The F4 lines were evaluated for yield and yield attributes and superior twenty six lines were selected and will be tested in F5 during 2024-25.

- A/B Lines: Eight A/B lines and seven released varieties were multiplied and maintained.
- Germplasms: A total of 244 germplasms were planted and maintained.

Crop Production

- One interculture followed by two hand weedings gave significantly higher leaf yield of tobacco (778 kg/ha) compared to weedy check (133 kg/ha), pre emergent application of weedicides Penadmethalin, Chlomazone & Chlorimeron Ethyl; Pre-planting of Butachlor; Post emergent application of Quizalofop Ethyl, Propaquizofop Ethyl & Fenoxapop-p-ethyl and Pre and Post Emergent application of Metribuzine.
- There is no significant impact of mulches and cropping system on tobacco leaf yield. There was no interaction effect of mulches and cropping systems on growth, yield and yield parameters of bidi Tobacco.
- Raising of Sunhemp as green manure before tobacco planting followed by neem cake application at 30 DAP + hand removal of Orobanche produced maximum leaf yield of 1341 kg/ha as compared to fallow tobacco + Non removal of Orobanche (889 kg/ha).

NANDYAL

Crop Improvement

- The *natu* tobacco entry NyNT 65 (2062 kg /ha) has contributed to IVT *natu* trials under AINPT during 2023-24
- IVT on *bidi* tobacco: IET 112 (1746 kg/ha) has recorded on par cured leaf yield with improvement of 6.3 % when compared to the best check Nandyal Pogaku 2 (1641 kg/ha).
- IVT on *natu* tobacco: IET 118 (1668 kg/ha) has recorded significantly higher cured leaf yield with improvement of 14.8 % and IET 120 (1533 kg/ha) recorded on par cured leaf yield at 5.5 % when compared to the best check WAF (1452 kg/ha) and proposed for advancing to AVT-I
- AVT –I on *bidi* tobacco: ABD 239 (1641 kg/ha) has recorded significantly higher cured leaf yield with improvement of 18.5 % when compared to the best check Nandyal Pogaku 2 (1384 kg/ha)
- OFT on *bidi* tobacco: Hybrids NyBTH 152 (2540 kg/ha), NyBTH 155 (2338 kg/ha) & NyBTH 157 (2223 kg/ha) has recorded higher cured leaf yield of 23. 0 %, 13.0 % & 8.0 % respectively when compared to the best check Nandyal Pogaku 2 (2066 kg/ha)
- OHT I on *bidi* tobacco: Hybrids NyBTH 212 (1177 kg/ha) & NyBTH 211 (1151 kg/ha) was recorded on par cured leaf yield when compared to the best check Nandyal Pogaku 2 (1142 kg/ha)
- OHT II on *bidi* tobacco: On pooled basis, the hybrids NyBTH 206 (1862 kg/ha) NyBTH 204(1836 kg/ha), NyBTH 207 (1763 kg/ha) & NyBTH 205 (1757 kg/ha) has recorded significantly higher cured leaf yield of 10.2 % to 16.8 % respectively than the best check Nandyal Pogaku 1 (1594 kg/ha).

- ♦ OVT II on *bidi* tobacco: Based on pooled performance, the entries NyBD 92 (2026 kg/ha) and NyBD 91 (1897 kg/ha) has recorded significantly higher cured leaf yield of 20.8 % & 13.1 % respectively than the best check Nandyal Pogaku 2 (1677 kg/ha).
- ♦ OVT II on *natu* tobacco: The entries NyNT 98 (1503 kg/ha) & NyNT 96 (1493 kg/ha) has recorded on par cured leaf yield with improvement of 11.4 % & 10.7 % than the best check Bhairavi (1348 kg/ha)

Crop Production

- ♦ The soils of major bidi tobacco growing areas of Kurnool district were found to be alkaline, non saline in nature, low in organic carbon, low in available Nitrogen, high in available Phosphorous and Potassium. Hence, apply 1/4th of phosphorous and potassium less than the recommended dose. Most of the soil samples were low in Iron content and to correct the iron deficiency, apply Iron sulphate @ 50kg/ha as soil application. Most of the soil samples were above the critical level of Zinc, Manganese & Copper.
- ♦ Among the five locations assessed, Gargyapuram recorded more yield comparatively other villages and which is more or less equal to Pudicherla and Kethavarm.
- ♦ Sequence cropping of kharif sorghum followed by tobacco along with Neem cake application at 30 DAT and post-emergence application of Imazathapyr 1 ml/lit at 70 and 100 DAT on *Orobanche* spikes recorded lowest percent of *Orobanche* infestation and higher cured leaf yield (2324 kg/ha), net returns (Rs.130514/ha) and B:C ratio (2.2) which is significantly on par with Green manuring of black sesame- tobacco, Neem cake application at 30 DAT and Hand removal of *Orobanche* compared to Fallow- Tobacco + Non removal of *Orobanche*.

ANAND

Crop improvement

- In *Bidi* tobacco, none of the entry showed their superiority over better check for cured leaf yield in IVT.
- ABD 244 and ABD 228 showed maximum cured leaves yield in AVT-I and AVT-II, respectively.
- In *Rustica* tobacco Line IET 116 showed significant superiority for cured leaf yield over better check in IVT and proposed for promoting to AVT-I.
- None of the entry showed significant superiority for cured leaf yield over better checks in AVT-I and AVT-II

Crop Production

- In a Trail, Evaluation of different Fertilizer doses on Bidi Tobacco, *Bidi* tobacco variety GABTH 2 was found superior over GT 7 with the highest leaf width, plant height and leaf yield. Application of 180-100-100 kg NPK/ha recorded significantly higher leaf length and yield.

Crop Protection

- Resistance has not found to develop in *Pythium aphanidermatum* to Metalaxyl MZ and Azoxystrobin.
- In a study on impact on organic amendments on Root-knot, Variety ABT 10 gave 2373 kg/ha yield and 0.00 root-knot index (RKI) as compared to A 119 which gave 1427 kg/ha with 3.87 RKI. Maximum cured leaf yield was found in the treatment of poultry manure (2144 kg/ha) followed by farmyard manure (2039 kg/ha) and vermicompost (1972 kg/ha). The lowest root-knot index was recorded from the treatment with poultry manure (1.48 RKI) which was followed by farmyard manure (1.53 RKI).
- Prediction model on Frog Eye Spot disease was found to be true to the tune of 70 % and 78.94 % in nursery and field, respectively.
- The minimum per cent disease index (PDI) was recorded in the treatment of Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0549 per cent (6.67 PDI) followed by Azoxystrobin 11% + Tebuconazole 18.3% @ 0.04395 per cent (9.90 PDI) and Zineb 68% + Hexaconazole 4% @ 0.18 per cent (12.30 PDI).
- The cured leaf yield was maximum (2372 kg/ha) in Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0329 treatment followed by Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0329 (2466 kg/ha), Pyreclostrabin + Metiram (2442 kg/ha), Carbendazim (2378 kg/ha) and Propiconazole (2353 kg/ha)

ARAUL

Crop Improvement

- IVT: The entry IET-116 and IET-117 showed significant superiority for cured leaf yield over the best check variety Azad Kanchan and may be approved for AVT-I to be conducting during *rabi* 2024-25.
- In AVT-I, line ArR-105 showed significant superiority over check Azad Kanchan for cured leaf yield with yield improvement of 18.32% respectively.
- On the basis of combined statistical analysis over two season (*Rabi* 2022-23, 2023-24), none of the entries tested found neither significantly nor numerically superior over the check Azad Kanchan and SK-417 in AVT-II.
- Combined statistical analysis of the data collected over three seasons (rabi 2021-22, 2022-23& 2023-24) was done for identifying most promising lines in PYT-II. Entry ArR-116 showed significant superiority over check Azad Kanchan with yield improvement of 17.13% and nominated for IVT conducted during Rabi-2024-25.
- In OFT on Hookah Tobacco, two entries viz., ArR-91 and ArR-69 with three checks Azad Kanchan, SK-417 and ArR-27 (Nath) were evaluated. The entry ArR-69 recorded higher cured leaf yield when compared with best check ArR-27 (Nath) with yield improvement of 17.91%.

Crop Production

- The higher tobacco equivalent yield recorded in Chickpea (3190 kg/ha) followed by Vegetable pea (2242 kg/ha). Economics of the treatment revealed that highest monitory return of Rs. 78045 was recorded by Vegetable pea with benefit cost ratio of 1.81 and it will go as remunerated recommendation to farming community.

- The higher tobacco equivalent yield recorded by Wheat (2901 kg/ha) followed by Mustard (1717 kg/ha). Economics of the treatment revealed that highest monitory return of Rs. 63150 was recorded by Wheat with benefit cost ratio of 1.34.

DINHATA

Crop Improvement

- IVT (RUSTICA TOBACCO): Out of two entries tested, the entry IET-116 recorded significantly superior cured leaf yield (2591 kg/ha) than better control Dharla and proposed for promoting to AVT-I.
- AVT-1 (RUSTICA TOBACCO): Out of two entries assessed, entry AR-184 recorded significantly superior cured leaf yield (2170 kg/ha) than best control DD-437.
- IVT (CHEWING TOBACCO): Out of two entries evaluated none of the entry recorded significantly superior yields. However, highest cured leaf yield was recorded in IET 122 (1509 kg/ha)

LADOL

Crop Improvement

- Three state trials comprising one each of IET (ST-1), PYT (ST-2) and LSVT involving 31 genotypes including three checks were evaluated during 2023-24. On the basis of overall performance 4 genotypes *viz.*, LR 22-2, LR 22-5, LR 23-10 and LR 23-7 were found promising and gave significant higher cured leaf yield.
- The station has conducted two co-ordinated trials *viz.*, IVT and AVT-I. Total 11 genotypes including three checks were evaluated for cured leaf yield and agronomic characters. On the basis of overall performance, none of the entries were found promising and gave significant higher cured leaf yield.

BERHAMPUR

Crop Improvement

- Initial Varietal Trial: Two test entries, BPT 7 (2246 kg/ha) and NF 4-27-3 (2240 kg/ha) produced significantly higher cured leaf yield than check variety Gajapati with yield advantage of 21.5 and 21.2 % respectively.
- In Evaluation of germplasm lines during 2023, 11 genotypes recorded short, topped plant height (< 70 cm), 18 genotypes more number of leaves/plant (>20): 7 genotypes Leaf length of >60 cm, 4 genotypes Leaf width 30 cm, 17 genotypes Cured leaf yield of >2500kg/ha.
- Yield Evaluation Trail: Six genotypes (KFC, NG 61, Natu Paracheru, NG 64, Narasraopeta and Ongole) during 2023 produced significantly higher cured leaf yield in tobacco than best check variety Gajapati. Pooled results over three years showed that only four genotypes NG 61, WAF, II 1873 and Bhairavi produced significantly higher cured leaf yield (1616, 1524, 1504 and 1474 kg/ha respectively than check variety Gajapati (1178 kg/ha).

- Evaluation for drought: Four genotypes (Natu Special, Bhairavi, Line 61 and Talamariaku) exhibited significantly higher cured leaf yield in tobacco than best check variety JP Local during 2023. Pooled results over two years showed that only one genotype *Natu* Special (1410 kg/ha) produced significantly higher cured leaf yield than check variety JP Local (1092 kg/ha).
- Exploratory trial on *rustica* tobacco: During 2023, *Rustica* varieties GCT 3 (3231 kg/ha) produced higher cured leaf yield followed by DCT 5 (2772 kg/ha), DCT 4 (2612 kg/ha) and GCT 2 (2527 kg/ha), than check variety GC 1(2131 kg/ha). Two years pooled data revealed that variety GCT3 produced maximum cured leaf yield of 2328 kg/ha followed by DCT 5 (2228 kg/ha), DCT 4 (2063 kg/ha) and GCT 2 (2038 kg/ha) than check variety GC 1 (1671 kg/ha).
- Exploratory trial on *jati* tobacco: Jati varieties Manasi (2749 kg/ha) followed by Chama (2709 kg/ha) and Podali (2347 kg/ha) produced higher cured leaf yield than check variety DJ 1(1956 kg/ha) with yield advantage of 40.5, 38.5 and 20.0 percent respectively.
- Multi location Trial on *pikka* tobacco: Three test entries, BPT 7 (1912 kg/ha), BPT 50 (1658 kg/ha) and NF 4-27-3 (1756 kg/ha) produced significantly higher cured leaf yield than check variety JP Local 1456 kg/ha) with yield advantage of 31.3, 13.9 and 20.6% respectively.
- Morphological characterisation of *pikka* tobacco entries: Among the 22 genotypes characterized for 23 characters, no variability was observed for intermodal length, leaf stalk, capsule length and capsule width, and low variability for topped plant height, plant width, leaf length, days to flowering and flower colour. All other fourteen morphological characters exhibited medium to high phenotypic variability
- Genotypes Kommipadu Vithanum, Natu Special, Talamariaku, Natu Noonepalli, JP Local, NG 61, NG 64, II 1068, Gajapati and Kavali expressed maximum morphological diversity for twelve characters out of 23 characters and seemed to be more divergent in nature
- Two years study showed that 1st September is the optimum transplanting time for *pikka* tobacco genotype BPT 7 which is producing higher cured leaf yield (2337 kg/ha) than 16th September and 16th August yielding 2203 and 1819 kg/ha respectively.
- Two years study showed that $N:P_2O_5:K_2O$ @ 80:40:40kg /ha is the optimum fertilizer dose for *pikka* tobacco genotype BPT 7 producing higher cured leaf yield (2206 kg/ha).

VEDASANDUR

Crop Improvement

- IVT: IET-122 and IET-123 recorded numerically higher cured leaf yield than the check varieties.

VII. IMPORTANT EVENTS

HUNSUR

- One day workshop to the registered FCV tobacco growers and technical staff on good agriculture practices was organized by board and CTRI on 16.05.2023 at chilkunda
- Training programme on FCV Tobacco production technology for Technical staff of M/S. Polisetty Somasundaram , Guntur was organized at ICAR CTRI RS Hunsur from 21.08.2023 to 25.08.2023 for about 9 members
- Marigold saplings were distributed to farmers through tobacco board as an Ecofriendly IPM Package for management of leaf eating caterpillars and tobacco budworms
- Corrective measures were advocated to the farmers for the control of heavy incidence of stem borers' infection in the nursery /tray/field crops during the crop season.
- Enrichment of coco peat with bio fertilizers for effective diseases and nematode management

SHIVAMOGGA

- Quinquennial Review team visited AINP (Tobacco), KSNUAHS, Shivamogga on 25th May 2023
- Monitoring team visited AINP (Tobacco), KSNUAHS, Shivamogga on 08th& 09th of September 2023.

ANAND

- Scientists of the project attended 20th meeting of AGRESCO, AAU, Anand.
- Scientists of the project attended XXVI Workshop meeting of AINPT on Tobacco during 21st September 2023
- Scientist of the project attended national and international level symposia

ARAUL

- Attended XXVI Workshop of All India Network Project on Tobacco (AINPT) held on 21st September 2023 at ICAR-CTRI, Rajahmundry (A.P).

LADOL

- Dr. D. R. Chaudhari, Assistant Professor attended 20th AGRESCO Sub-committee Meeting of Crop Improvement, Plant Physiology and Bio-Technology on March 6-7, 2024 at SDAU, S.K. Nagar.

NIPANI

- Dr. P. S. Matiwade visited the Rait Sampark Kendra, Nipani to know the distribution of seeds for Kharif sowing on 3rd July, 2023.
- Dr. P. S. Matiwade and Dr. Chandrakant Soregaon visited the farmer's field who brought the small scale sewing machine at Ammalzari village Tal: Nipani on 11th July, 2023.

- Dr. Ravi Hunje, Special Officer (Seeds) and Dr. T. R. Shashidhar, Seed Production Officer, University of Agricultural Sciences, Dharwad visited the research station and seen all the related documents and seed production plots sown on 19th July, 2023.
- Dr. P. S. Matiwade, Dr. Chandrakant Soregaon, Dr. B. Arunkumar and Dr. Geeta Dandin participated in review meeting of *BIDI*, Rustica and Natu tobaccos coming under AINP(T) centers on 20th July, 2023.
- Dr. P. S. Matiwade as per the order of Tahashildar, Nipani as a nodal officer, visited the flood affected areas of Akkol, Mamdapur and Galataga villages of Nipani taluka on 24th July, 2023.
- Dr. P.S. Matiwade, Dr. Chandrakant Soregaon, Dr. B. Arunkumar and Dr. Geeta Dandin participated in review meeting of QRT (2016-2022) of *BIDI* Tobacco on 26th July, 2023.
- Dr.P.S.Matiwade as a nodal officer, visited the flood affected areas Akkol, Mamdapur and Galataga villages of Nipani taluka on 28th July, 2023.
- Dr. P.S. Matiwade participated in the Rabi Agronomist's Meet at UAS, Dharwad, and presented the research results of *BIDI* tobacco agronomy and discussed about technical programme 2023-24. Chaired the one session of the technical meet at STU, UAS, Dharwad from 1st to 2nd August, 2023.
- Dr. P.S. Matiwade participated as a chief guest in the one day workshop on 'Organic Farming – a need of the day' organized by G.I.Bagewadi College, Nipani on 10th August, 2023.
- Dr. P.S. Matiwade participated as a Chairman of the Committee constituted for auction sale of animals at ARS, Kalloli on 17th August, 2023.
- Dr. P.S. Matiwade and Dr. Chandrakant Soregaon participated in two days NARP meeting and discussed about Rabi Technical Programme at RARS, Vijaypur from 24th to 26th August, 2023.
- Dr. P.S. Matiwade and Dr. C.D. Soregaon distributed the invitation cards of 'Krishimela-2023' for MLA, MP, MLC etc., at Athani, Kagwad and Examba on 4th September, 2023.
- Dr. P.S. Matiwade visited the villages of Belagavi district for surveying of drought affected areas from 15th to 16th September, 2023.
- Dr. P.S. Matiwade, Dr. C.D. Soregaon and Dr. Geeta Dandin participated in XXVI Annual Workshop of Tobacco (on line) held at CTRI, Rajahmundary (AP) on 21st September, 2023.
- Dr. P.S. Matiwade visited the drought affected farmers field of Belagavi district along with Central team at Belagavi and surrounding villages on 6th October, 2023.
- Dr. P.S. Matiwade participated in the meeting related to 'Mera Mitti and Mera Desh and World Mental Health Day' organized at Talluka Panchayat, Nipani on 10th October, 2023.
- Dr. P.S. Matiwade attended the "World Soil Day" at Bennihaalli village on 5th December, 2023.
- Dr. P.S. Matiwade and Dr. C.D. Soregaon participated in Platinum Jubilee celebration of CTRI and International Seminar on Tobacco at CTRI, Rajahmundary from 12th to 17th December, 2023.

- Dr. P.S. Matiwade participated in "3rd National Seminar on Spectroscopy and Chromatography at Devachand College, Arjunnagar Tq: Kagal (M.H.) on 6th January, 2024.
- Dr. N.K. Hegade, H'able. Vice-Chancellor, University of Horticulture Sciences, Bagalkot, Dr. P.L. Patil, H'able. Vice-Chancellor, University of Agricultural Sciences, Dharwad and Dr. C.R. Patil, Professor and Head, Microbiology, UAS, Dharwad visited the research station to know the activities on 12th January, 2024.
- Dr. B.D. Biradar, Director of Research, Dr. Suma Mugali, Professor of GPB and Mr. Piddannavar, Office Superintendent, UAS, Dharwad inspected the research station activities on 5th February, 2024.
- Dr. P.S. Matiwade participated in online meeting to review the Organic Farming at various research stations chaired by Director of Research, UAS, Dharwad on 8th February, 2024.
- Dr. P.S. Matiwade participated in the function of distribution of Diploma (Agri.) certificates. Function was graced by Vice-Chancellors of UAS, Dharwad and Bengaluru at KFC, UAS, Dharwad on 29th February, 2024.
- Dr. P.S. Patiwade visited the demonstration plots of Bengalgram and wheat at Benadi and Khadaklat villages on 4th March, 2024.
- Dr. Sanjay B. Patil and Dr. P.S. Patiwade participated IN Krishi Ustav-2024 organised by Rotary Club of Belagavi Central, Belagavi from 8th to 10th March, 2024.
- Dr. P.S. Patiwade participated Annual Agronomists Meet (Kharif) at STU, UAS, Dharwad from 20th to 24th March, 2024.
- Dr. P.S. Patiwade attended the work of Evaluation of the applications received for 2023-24 Krishi Pandit Awards at Khanapur, Belagavi, Soudatti, Bailhongal, Gokak, Chikodi and Nippani talukas of Belagavi district from 27th to 28th March, 2024.

NANDYAL

- From 15.05.23 to 19.05.23 participating in SLTP 2023 Meetings at Lam, Guntur presented work done report of AINPT, Breeding for the year 2022-23 and Tentative Technical Programme for 2023-24.
- On 17.06.23 attended National Bee Board and Honey Mission Training programme inaugural session.
- Participated and conducted of Sri Alluri Sita Rama Raju Jayanthi celebrations at RARS, Nandyal on 04.07.2023
- On 4.07.23 participated in Bureau of Indian Standards on tobacco and tobacco products meeting by virtual mode
- On 08.07.23 participated in Dr. Y. S. R. Rythu Dinothsavam meeting at RARS, Nandyal.
- On 19.7.23 ABD 132 variety release proposal presented in SVRC and it is released for commercial cultivation in A.P.
- Participated in review meeting on achievements and proposed technical programme for the year 2023-24 through virtual mode by the Director, CTRI, Rajahmundry on 20.07.2023.

- Participated in QRT meeting for the period 2016-2022 through virtual mode by the Director, CTRI, Rajahmundry on 26.07.2023.
- On 02.08.23 participated in Sri Raghava charyulu birth celebrations
- Participated and conducted of Parthenium Awareness Week from 16-22nd, August, 2023 at RARS, Nandyal.
- Participated in Sri Tanguturi Prakasam Panthulu Jayanthi celebrations at RARS, Nandyal on 23.08.2023.
- Distribution committee chairman for Walkathon" in the mark of International Year of Millets 2023 on 28th December, 2023
- On 28.03.24 attended BIS, New Delhi virtual meeting.
- UHOD (Agronomy) visited RARS Nandyal and monitored the Tobacco and chickpea (Agronomy) experiments on 18.01.2024.
- Participated in Trupuraneni Ramaswamy Chowdary Jayanthi celebrations at RARS, Nandyal on 18.01.2024
- Attended the monitoring of AINP on Tobacco at RARS, Nandyal by the ICAR-CTRI, Rajahmundry Monitoring team on 02.02.2024.
- Conducted and participated in observance of Vardhanti of Uyyalawada Narasimha Reddy on 22.02.2024 at RARS, Nandyal.
- On 01.03.3.24 -04.03.24 participated and presented AINPT Agronomy work done report for the year 2023-24 and Tentative Technical Programme of work for 2023-24.
- From 12.03.24 to 15.03.24 participated in Pre-ZREAC meeting and presented AINPT Agronomy work done report for the year 2023-24 and Tentative Technical Programme of work for 2024-24.
- Participated in Dr. B.R. Ambedkar Jayanthi celebrations on 14.04.2024 at RARS, Nandyal.

BERHAMPUR

- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated and presented research achievement 2022-23 and technical programme 2023-24 of AINP on Tobacco at Zonal Research and Extension Advisory Council (ZREAC) meeting at OUAT, Bhubaneswar held on 25 & 26.04.2023.
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/c participated and presented research achievement 2022-23 and technical programme 2023-24 of AINP on Tobacco at Pre SLREC (State Level Research and Extension Council) virtual meeting held from.9.5.23
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated in SLREC meeting held at OUAT, Bhubaneswar on 23.5.23 to 25.5.23.
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated in OUAT Breeders conclave on 7.2.24 at OUAT, Bhubaneswar

VIII. STATUS OF GERMPLASM MAINTAINTED & SEED PRODUCED

Centre	Tobacco Type	Number of Germplasm
CTRI & its Research Stations	All types	3386
Shivamogga	FCV	113
Anand	*Bidi*	202
	Rustica	255
Araul	*Rustica*	310
Ladol	*Rustica*	295
Nipani	*Bidi*	244
Nandyal	*Bidi*	215
	Natu	103
Berhampur	*Pikka*	112

SEED PRODUCED AT DIFFERENT CENTRES

ANAND

S. No.	Variety	Area occupied (%)	Seedlings (No)			Truthfully Labelled Seed (kg)			Breeder Seed Produced (kg)	
			Produced	Sold	Amount Realised (Rs)	Produced	Sold	Amount Realised (Rs)		
Bidi Tobacco										
1	A 2	0.45	-	-		181.5	34.75	41700	0.175	
2	A 119	46.15	110000	100000	30000	4022.5	3563.5	4276200	0.500	
3	A 145	3.35	-	-		476	259	310800	0.180	
4	GT 4	2.33	-	-		664.75	180.25	216300	0.400	
5	GT 5	6.07	20000	20000	6000	475	469	562800	.125	
6	GT 7	14.71	120000	120000	36000	1140.25	1135.75	1362900	0.800	
7	GT 9	0.00	-	-		0	0	0	-	
8	ABT 10	0.07	-	-		34.75	5.75	6900	0.130	
9	GABT 11	0.67	-	-		118	52	62400	0.280	
10	MRGTH 1	0.04	50000	50000	18000	6.64	3.25	78000	MRGTH 1	0.200
									Male	0.050
									Female	0.050
11	GABTH 2	0.09	50000	50000	18000	7.20	7.20	172800	GABTH 2	0.140
									Male	0.060
									Female	0.050
	Total					**7126.59**	**5710.45**	**7090800**	**3.14**	
Rustica Tobacco										
13	GC 1	9.37	10000	10000	3000	1456	723.25	1084875	0.800	
14	GCT 2	0.94	-	-		173	72.25	108375	0.3000.100	
15	GCT 3	15.74	15000	15000	4500	2301	1215.25	1822875	0.7001.200	
	Total					**3930**	**2010.75**	**3016125**		
	Grand Total					**11056.59**	**7721.2**	**10106925**		

NIPANI

S. No.	Variety	Area occupied (%)	Truthfully Labelled Seed (kg)		
			Produced	Sold	Amount Realised (Rs)
BIDI tobacco					
1.	A-119	12.5	1.5	1.5	1200
2.	NBD 209	41.6	5	5.0	4000
3.	Bhagyashree	6.25	0.75	-	-
4.	Bhavyashree	6.25	0.75	-	-
5.	Vedaganga-1	4.16	0.5	-	-
6.	A-2	4.16	0.5	-	-
7.	NBD 316	25.0	3	3	2400
8.	Total		12	12	7600

Note: S. No. 3,4,5,6 seeds are produced and used for the experiment and farmers demo purpose.

LADOL

Crop	*Rustica* Tobacco		
Variety	GCT 3	DCT 4	Total
Production	1275.0	1050.0	2325.0

IX. VARIETY RELEASE PROPSALS

HUNSUR

* FCH-2

NIPANI

* NBD-316

PRIVATE FIRM

* FCRH-7
* FCRH-11

X. EXTENTION ACTIVITIES

SHIVAMOGGA

A. On-farm trials

- Use of areca husk @10t/ha on the FCV tobacco ridge at the time of planting for moisture conservation
- FCS 4 a high yielding FCV tobacco variety

B. Demonstrations

- Dr. T. M. Soumya, Dr. Shashikala S. Kolakar and Dr. Prashantha. C, conducted method demonstration on use of areca husk for moisture conservation in Bilaguli, Mulehosalli and Shiradanahalli of Arakalagudu taluk, Hasan district on 08.06.2023.
- Dr. T. M. Soumya, Dr. Shashikala S. Kolakar and Dr. Prashantha. C, conducted method demonstration on use of areca husk for moisture conservation in Thorenur, Shirangala, Chikkanayakana Hosalli, Hebbale and Nallur of Kushalnagar taluk, Kodagu district on 09.06.2023.
- Dr. Prashantha C., conducted method demonstration on use of areca husk for moisture conservation in Shriradanahlli, Mulehisalli and Beluguli of Arakalgudu taluk, Hassan district on 08.08.2023.
- Dr. Shashikala S. Kolakar and Dr. Prashantha C., conducted large scale demonstration of FCS-4 variety in Shrirangala and Thorenur of Kushalnagar taluk, Kodagu district on 29.08.2023 & 30.08.2023

C. Field visits

- Dr. Shashikala S. Kolakar visited fields of Nagaraja and Ramachandrappa at Jeenalli village of Nyamati taluk, Davangere district, Panchaksharappa, Shekharappa, Ramachandrappa, Gajendrappa, Puttappa and Kuchirappaat Kattige village of Honnalitaluk, Davanageredistrict on 23.06.2023for FCS-4 farm trial.
- Dr. T. M. Soumya and Dr. Prashantha C. visited fields of Ramachadrappa s/o Sannamallappa, Doddaramappa s/o Marigoudappa, Chadrappa s/o Siddalippaat Jeenalli village of Nyamati taluk, Davanagere district, Puttappa s/o Basappa, Panchaksharappa, Vasanth s/o Melappa, Thukya s/o Krishna Naik at Kattige village, Honnali taluk, Davanagere district on 04.08.2023 to address Black shank & leaf curl virus problem in FCV tobacco and their management.
- Dr. Prashantha C., visited fields of Shivamurthy K.P., Chandrashekar in Arasukallahalli, Shekarappa in Hosapura ofHunasur taluk, Mysuru district on 07.08.2023 to address pest & disease problem in FCV tobacco and their management.
- Dr. Prashantha C. visited fields of Jnananandain Shriradanahlli, Suresh in Mulehosalli, Doddegowda in Beluguli of Arakalgudu taluk, Hassan district on 08.08.2023 to address pest & disease problem in FCV Tobacco and their management.
- Dr. Shashikala S. Kolakar and Dr. Prashantha C. visited fields of Sheshappa in Shrirangala, Umesh in Thorenur, Mahesh Hebbale in Chikkanayakana Hosalli, Nagesh in Shrirangala, Doddegowda in Biluguli, Suresh in Thorenur and Manjegowda in Gangur of Arakalgudu taluk, Hassan district on 29.08.2023 & 30.08.2023 for FCS-4 farm trial.

- Dr. Shashikala S. Kolakar visited tobacco fields (farm trial) of Ramachandrappa and Prabhugowda at Jeenahalli and Basavanagowda at Kattige of Nyamathi taluk, Davangere district on 09.09.2023
- Dr. T.M. Soumya, Dr. Shashikala S. Kolakar and Dr. Prashantha C., visited Ramanathpura auction market and visited farmers fields at Ramanathpura, Gangur, Ragimaruru and Mallapura villages of Arakalgudu taluk, Hassan district on 08.01.2024.
- Dr. T.M. Soumya visited villages near Honnali on 10-02-2024.
- Dr. Prashantha C, visited inflorescence caterpillar infested Arecanut plantation of Yashawanth in Anupinakatte village, Shivamogga districton 13.02.2023.
- Dr. Prashantha C. visited FCV tobacco nursery of Jnanananda in Shriradanahlli of Kushalnagar taluk, Kodagu district, Doddegowda in Beluguli, Girish and Devaraj in RagimarurArakalgudu taluk, Hassan district on 28.03.2024.

D. Training programs

- Dr. T. M. Soumya, Dr. Shashikala S Kolakar and Dr. Prashantha. C., conducted training on use of areca husk for moisture conservation at Bilaguli, Arakalagudu taluk, Hasan district on 08.06.2023 (30 farmers).
- Dr. T. M. Soumya, Dr. Shashikala S Kolakar and Dr. Prashantha. C, conducted training on use of areca husk for moisture conservation at Shirangala, Kushalnagar taluk, Kodagu district on 09.06.2023 (18 farmers).
- Dr. T. M. Soumya and Dr. Prashantha C. organized training programme on nutrient and pest management in FCV tobacco at Jeenahalli, Nyamati taluk, Davanagere district on 04.08.2023 (20 farmers).
- Dr. Prashantha C. conducted training on pest and diseases of tobacco and their management at Mulehosalli, Arakalgudu taluk, Hassan district on 08.08.2023 (25 farmers).
- Dr. T. M. Soumya and Dr. Prashantha C. organized training programme on nursery management in FCV tobacco at ZAHRS, Navile, Shivamogga 09.08.2023 (16 farmers).
- Dr. T. M. Soumya, Dr. Shashikala S Kolakar and Dr. Prashantha C. conducted training programme on Tobacco production technologies: Cultivation, Grading and Marketing of FCV tobacco at Ramanthpura, Arakalagud taluk, Hassan district on 08.01.2024 (30 farmers).
- Dr. Prashantha C. organized training programme on pre-monsoon preparation for agriculture and pest and disease-free nursery preparation at Shiradanahalli, Arakalagud taluk, Hassan district on 28.03.2024 (20 farmers).

E. Guest Lectures

- Dr. T. M. Soumya delivered lecture on Tobacco curing and grading for IV B.Sc. (Agri.) ELP students on 08.04.2023
- Dr. T. M. Soumya delivered lecture on Tobacco curing and grading for IV B.Sc. (Agri.) ELP students on 18.04.2023.
- Dr.T. M. Soumya served as resource person for bimonthly meeting of Department of Agriculture, Shivamogga on 28.06.2023 on the topic Contingent crop planning.
- Dr. T. M. Soumya delivered lecture on Paddy production practices in the DAESI programme at ICAR-KVK, Shivamogga on 08.07.2023.

- Dr. T. M. Soumya delivered lecture on Organic manures and liquid manures in the technology week programme at ICAR-KVK, Shivamogga on 18.07.2023.
- Dr. T. M. Soumya delivered lecture on Tobacco, its cultivation, curing and marketing for II Year B.Sc Agri. (Hons.) students of Iruvakki campus on their exposure visit on 06.09.2023
- Dr. T. M. Soumya worked as resource person for the training on scientific sheep and goat farming on topic fodder crop production technology on 06.11.2023.
- Dr. T.M. Soumya served as resource person in National capacity building programme on Natural Farming: Present status and future prospects organised by IDP NAHEP, KSNUAHS, Shivamogga from 19.12.2023 to 23.12.2023.
- Dr. T.M. Soumya served as resource person in IDP (Institutional Development Plan) sponsored five days national capacity building programme on "Natural farming: Present status and future prospects" held from 19.12.2023 to 23.12.2023 at KSNUAHS, Shivamogga and delivered a lecture on Green Manuring and Mulching: A basic component of natural farming 23.12.2023.
- Dr. T.M. Soumya served as resource person in bimonthly meeting of KSDA and presented on effect of climate change on 16.02.2024.

Other Events

- Dr. Cesar Gemeno, Professor of Entomology from University of Lieida, Spain, visited AINPT experimental plots at ZAHRS, Navile, Shivamogga on 29th December 2023

HUNSUR

- On farm trials with promising line FCH 248 and Kanchan were successfully conducted at twelve villages of KLS region
- Twelve village level training programmes on Nursery management, Field crop management , Varieties, mineral nutrition, Diseases and pests, PHPM, Plant position grading, FFT, ZBNF etc., were conducted across all the platforms of KLS

ANAND

- Examined more than 50 diseased samples of bidi and rustica tobacco and advised the farmers during 2023-24.
- Scientists of the project visited 5 FLD's of bidi tobacco hybrid allotted at different villages.
- Organized two Farmer's training programme on scientific cultivation of tobacco.

LADOL

- Scientist-Farmers direct talks aimed under 'Mera Gauv Mera Gaurav' programme have been initiated in Mandali, Rampur (Kot), Hirpura, Pundhra and Madhi villages and FLDs of rustica tobacco varieties GCT 3, DCT 4 and GCT 5 have been allotted to 25 farmers in these villages.
- During season, provide information about 1000-1200 farmers regarding agricultural practices in *rustica* tobacco and seed production techniques.

DINHATA

- Conducted tobacco field day on 15/02/2024 at Okrabari village.
- Conducted awareness programme on Improved production technology of tobacco on 14/08/2024
- Visited farmers field at Okrabari (13/02/2024) and performance of Torsha variety was demonstrated to farmers.
- Visited Jamadarbas (29/11/2023) village and awareness created among farmers about CTRI released tobacco varieties, cultivation technology, etc.
- Attended farmers fair at Kutchlibari, Cooch Behar and delivered a lecture on tobacco in the training farmers programme on 16/01/2024)

NIPANI

- Dr. P. S. Matiwade, Dr. Chandrakant Soregaon and Dr.B.Arunkumar visited tobacco nursery in farmer's field at Karajaga Tal: Hukkeri and Bhojwadi Tal: Nipani on 16th and 18th July, 2023.
- Dr. P. S. Matiwade, Dr. C. D. Soregaon and Dr. Geeta Dandin visited farmers tobacco field intercropped with Soybean under drip irrigation and also supplied the bidi tobacco seedlings (NBD-316 and NBD-209) for farm trial in the farmer field at Nidasosiwadi village of Hukkeri taluka on 16th October, 2023.
- Dr. P. S. Matiwade, Dr. C. D. Soregaon and Dr. Geeta Dandin visited farmer's tobacco field at Kodani village of Nippani taluka on 9th November, 2023.
- Dr. P. S. Matiwade and Dr. C. D. Soregaon visited the farm trial on NBD-316 and problematic fields of tobacco in Karajaga and Hargapur villages under Hukkeri taluk on 19th December, 2023
- Dr. P. S. Matiwade visited to tobacco farm trial on NBD 316 and NBD 209 at Bhojwadi village Tq: Nippani on 7th January, 2024.

NANDYAL

A. Transfer of technology

- During 2023-24, T & V meeting was conducted on 28.01.2023, 23.02.2023, 25.03.2023, 25.04.2023, 25.05.2023, 28.06.2023, 15.07.2023, 10.08.2023, 27.09.2023, 28.10.2023, 16.12.2023, 30.01.2024, 20.02.2024 and 23.03.24 to discuss about prevailing pests and diseases in tobacco crop along with production recommendations.

B. On-farm trials

- Conducted on farm trials on bidi tobacco hybrids NyBTH 152, NyBTH 155, NyBTH 157, NyBTH 170 & NyBTH 171 at Kadumuru, Uppaladadhiya Pudicherla & Diguvapadu villages of Midthuru, Nandikotkur and Orvakal mandals

C. Field visits

- On 22.8.23 attended diagnostic visit at Orvakal mandal of Hussainapuram, Pudicherla and Kethavaram villages.

D. Training programmes

- On 22.08.23 conducted training programme on popularization of Nandyal pogaku 1, Nandyal pogaku 2 and visited OFTs at Kadumuru, Uppaladadhiya Pudicherla & Diguvapadu villages of Midthuru, Nandikotkur and Orvakal mandals
- On 04.11.23 conducted training programme on seed production and package of practices in bidi tobacco crop.
- On 25.11.23 conducted training programme on popularization of bidi tobacco variety Nandyal Pogaku 2 and its production recommendations.

E. Publication of Technical bulletin /information material

- Sheshu Madhav, J.N.Patel ,P.Pulli Bai ,P.S.Matiwade, C.Chandrasekhara Rao, B.Krishna Kumari & S.Flora.2023. Indian bidi tobacco.
- P.Pulli Bai, K.Sathish Babu, K.Sarala & M. Sheshu Madhav.2023. bidi tobacco variety Nandyal Pogaku 2

F. Popular articles

- K. Sathish Babu, P.Pulli Bai, K. Arun Kumar, N.C. Venkateswarlu and C. Chandra sekhara Rao. bidi pogaku pantanu ashinche chidapidalu, tegulla yajamanyyam.Eruvaka. January, 2023. Pg.no.19-20.
- K. Sathish Babu, P.Pulli Bai, M. Jyostna kiranmai, M. Jayalakshmi, R.Narasimhulu, N.C. Venkateswarlu and C. Chandra sekhara Rao. bidi, cigerratte natu pogaku adhika digibadaki yajamanyya paddhathulu.Rythuvani. February. 2023. Page no.43-44.
- P.Pulli Bai, K.sathish Babu, K.prabhakar, S.Jaffar basha, N.C. Venkateswarlu, K. Sarala, M.Seshu Madhav. Takkuva hanikaraka bidi pogaku rakamu Nandyal Pogaku 2 lakshanalu , Rythuvani, February, 2024, PP.34.
- Babu, K.S, Bai.P.P, Prabhakar, K, Jayalakshmi, Mand Venkateswarlu N.C. Nutrient Deficiency Symptoms and Correction Measures in Tobacco. Vigyan Varta an International E-Magazine for Science Enthusiasts. December, 2023.Vol. (4):12, E-ISSN: 2582-9467.

VEDASANDUR

- A Farmers' Day was organized on 14-2-2024 Farmers Day was conducted at ICAR-CTRI RS Vedasandur
- Tobacco and Ashwagandha field day was conducted on 21-3-24 at ICAR-CTRI Research Station, Vedasandur

XI. INFRASTRUCTURE DEVELOPMENT AND ANY OTHER DEVELOPMENTAL ACTIVITIES

SHIVAMOGGA

- Renovated AINPT Chief Scientist and staff room
- Fencing for experimental plots and nursery
- Installed motor pump set for irrigation facility

ANAND

- One new bore-well for irrigation facility
- Old farm building renovation done.
- New Seed threshing machine occupy.

DINHATA

- Construction of brick wall and iron grill in the office building

VEDASANDUR

- Nursery shed was constructed

XII. ALTERNATIVE CROPPING SYSTEMS

HUNSUR

- Crops like ginger and maize are extensively cultivated in the tobacco growing areas of KLS. Of late Chia is also being grown as second crop after kharif tobacco in the tobacco based cropping system due to high price realization and easy cultivation of this crop

SHIVAMOGGA

- Among the commercial crops chilli is prevailing in the area. However, much of the tobacco area is being now under maize crop. Among the different alternative cropping systems tried from the station paired row of hybrid cotton + chilli + French bean (3 rows) recorded highest net returns followed by hybrid cotton + chilli + groundnut (3 rows). No single crop cultivation can equate the income generated by tobacco

ANAND

- Castor and cotton have been recommended as alternate crops to tobacco. It is followed to some extent depending on market value of the crops.
- Tobacco – Pearl millet (summer) crop sequence for bidi tobacco growing area of middle Gujarat Agro climatic zone found economical and widely followed in irrigated areas

NANDYAL

- Studies on alternative cropping systems to tobacco during 2012-13 revealed that maize- Chickpea sequence has recorded significantly higher tobacco equivalent yields (3.401kg/ha) and higher net returns (Rs 1,00,833/- per ha). In the year 2013-14, maize-sunflower has recorded significantly higher tobacco equivalent yields (3,429 kg/ha) and higher net returns (Rs 69,813/- per ha). Therefore, these cropping systems can serve as alternative to tobacco.

ARAUL

- Summer Maize-Cauliflower - *Hookah* Tobacco.
- Spring Moongbean - Maize-Tobacco

LADOL

- Castor and cotton have been recommended as alternate crops to tobacco. It is followed to some extent depending on market value of the crops.
- Tobacco – Pulses / (*Kharif*) crop sequence for *rustica* tobacco growing area of north Gujarat Agro climatic zone found economical.

BERHAMPUR

- Farmers grow maize, finger millet, groundnut, cotton, Arhar and vegetables in *kharif* and black gram, green gram, horse gram and sesamum during rabi under residual moisture condition.

XIII. PUBLICATIONS/ SYMPOSIA/ WORKSHOP/ SEMINARS

SHIVAMOGGA

A. Publications

- Vaishnavi, H.N., Soumya, T.M., Kumar, O., Dhananjaya, B.C. and Rajashekharappa, K., 2023, Feasibility of crop intensification through intercropping of legumes in FCV tobacco. *J. Pharma Innovn.*, **12** (6):5181-5185
- Soumya, T.M., Siddharth, H., Vignesh, Manjunath, M.P. and Akarsh, S.V., 2023, Mulching: A diversified and multipurpose input in agriculture. *Environ. Conserv. J.*, **24** (3): 283–295
- Soumya, T.M., Shashikala, S.K., Prashantha, C. and Siddagangamma, K.R., 2023, Effect of humic substances on germination and growth of FCV Tobacco seedlings in Karnataka light soil. *Biol. Forum*,**15**(10): 1174-1177
- Sanga Thejaswini, Hanumanthaswamy, B.C., Sharanabasappa, S.D., Soumya, T.M., Mallikarjuna, H.B. and Kalleshwaraswamy, C.M., 2023, Ovicidal action of different insecticides against *Spodoptera frugiperda* (JE Smith) under laboratory and field conditions. *Pestic. Res. J.*,**35**(2): 201-206
- Timmanna, H., Prashantha, C.,Shashank, P.R., Nigam, V.D. and Birla, N. 2023, Occurrence and Spread of Invasive Thrips, *Thripsparvispinus* (Karny) in North India., *Indian Journal of Entomology*,**85**(1): 160-163 .

B. Abstracts

- Soumya, T.M., Shashikala, S.K., Prashantha, C. and Sharath M. N., 2023 Suitability of different legumes as intercrops in skip rows of FCV Tobacco, Abstracts of voluntary papers, ICFTCA -2023, at ICAR-CTRI, Rajahmundry from14thto 16th December, 2023, Pp. 65.
- Shashikala, S.K., Soumya, T.M. and Prashantha, C., 2023, Assessment of genetic variability for morphological characters of FCV tobacco (*Nicotiana tabacum*) germplasm accessions., Abstracts of voluntary papers, ICFTCA -2023, at ICAR-CTRI, Rajahmundry from14thto 16th December, 2023, Pp. 05.
- Prashantha, C., Soumya, T.M., Shashikala, S.K. and Sreedhar U., 2023, Evaluation of different management modules against Tobacco Whitefly, *Bemisia tabaci* in FCV Tobacco grown under Karnataka Light Soil Region, Abstracts of voluntary papers, ICFTCA -2023, at ICAR-CTRI, Rajahmundry from 14thto 16th December, 2023, Pp. 63.

C. Symposia / Workshop /Annual meetings / Technical meeting:

- Dr. T. M. Soumya, Dr. Shashikala S Kolakar, Dr. Prashantha C. participated in AINP(T) review meeting through virtual mode and presented results and achievements of 2022-23 and Technical programme for 2023-24 organised by ICAR-CTRI, Rajahmundry on 2nd May, 2023.
- Dr. T.M. Soumya, Dr. Shashikala S. Kolakar and Dr. Prashantha C. attended QRT-preview meeting at KSNUAHS, Shivamogga on 18th May 2023.
- Dr. T.M. Soumya, Dr. Shashikala S. Kolakar and Dr.Prashatha, C. attended QRT-meeting at KSNUAHS, Shivamogga on 25th May 2023.
- Dr. Prashantha C. attended National conference on Cocoa organized by SNUAHS, Shivamogga at JNNCE Auditorium, Shivamogga on 3rd June 2023.
- Dr. T. M. Soumya, Dr. Shashikala S. Kolakar and Dr. Prashantha C. participated in XXVI Tobacco Workshop of AINPT organised by ICAR-CTRI, Rajahmundry, on 21st September, 2023.
- Dr. T. M. Soumya, Dr. Shashikala S Kolakar and Dr. Prashantha C. participated in International Conference Frontiers in Tobacco and Commercial Agriculture towards Preparedness for Future Farming (ICFTCA 2023) at ICAR-CTRI, Rajahmundry from14thto 16th December, 2023.
- Dr. Prashantha C., participated in IDP sponsored 5 days National capacity building programme on Natural Farming: Present status and future prospects at KSNUAHS, Shivamogga from 19th to 23rd December, 2023.
- Dr. T. M. Soumya organized the IDP (Institutional Development Plan) sponsored five days national capacity building programme on "Natural farming: Present status and future prospects" as a course Co-Director held from 19.12.2023 to 23.12.2023 at KSNUAHS, Shivamogga
- Dr. Shashikala S Kolakar, participated in winter school on "Genomics and Innovative Breeding Approaches for economically Important and Futuristic Traits in vegetable Crops" organized at Division of Vegetable Science, ICAR-Indian Agricultural Research Institute, New Delhi-110012 from 6th to 26th March, 2024.
- Dr. Prashantha C., participated in 10 days High-end workshop programme on Capacity building in taxonomy of Indian Scarabaeidae: Diversity and life strategies of white grubs under DST- Science and Engineering Board (SERB), GOI, New Delhi at NAE on Insect Taxonomy lab, Department of Entomology, UAS, Bengaluru from 12th to 21st March 2024
- Dr. PrashanthaC., attended Annual Technical Meeting of Entomology at Mudigere on 23rd to 25th January 2024.
- Dr.Shashikala S Kolakar,attended Annual technical meeting of Plant Science at Shivamogga on 20th to 22ndFebruary 2024.
- Dr. T. M. Soumya,attended Annual technical meeting of Agronomy at Brahmavara on 29th February to 2nd March 2024.

ANAND

A. Publications

Research Papers:

National level

- Patel, P. D. and Rojasara, Y. M. (2022). Molecular variability of *Pythium aphanidermatum* causing damping-off of *BIDI* tobacco using RAPD technique. The Pharma Innovation Journal, 11(9): 1488-1492.
- Gediya, K. M., Jalpa P. Panchal and Patel, J. N. (2023). Effect of different organic manures and bio NPK in conjunction with inorganic fertilizers on growth, yield, quality and economics of *rustica* tobacco varieties under middle Gujarat conditions. Tobacco Research49 (1): 38-43.
- Jalpa P. Panchal, Gediya, K. M. and Patel, J. N. (2023).Response of vegetable intercrops on the performance of chewing tobacco (*Nicotiana rustica* L.) based intercropping system. Agricultural Research Journal 60(2): 177-181.
- Rojasara, Y. M., Bhatt, N. A. and Patel, J. N. (2023). Effects of antagonistic crop for management of root-knot nematode in *BIDI* tobacco nursery. Tobacco Research, 49 (1): 18-22.
- Desai, S. G., Rojasara, Y. M., Dabhi, M. V. and Suthar, Y. M. (2023). Bioefficacy of fungicides against damping-off disease in *BIDI* tobacco nursery condition. The Pharma Innovation Journal, 12(12): 1458-1460

International level

- Gediya, K. M., Jalpa P. Panchal and Patel, J. N. (2022). Influence of Nitrogen and Topping Levels on Yield and Quality of *BIDI* Tobacco Hybrid Varieties. Ecology Environment & Conservation, 28(4): 1798-1802.
- Sakure, A. A., Sushil Kumar, Delvadia, D. R., Rojasara, Y. M., Mistry, J. G. and Patel, D. A. (2023). Analysis of F2 population identified SSR marker linked with Meloidogyne resistance and leaf thickness in *Nicotiana tabacum*. Iranian Journal of Science, https://doi.org/10.1007/s40995-023-01560-1

B. Seminar/Symposium/Workshops

- Rojasara, Y. M., Bhatt, N. A. and Patel, J. N. (2022). Effects of bio fumigation for management of root-knot nematodes in *BIDI* tobacco nursery. An extended summary presented in National Conference on "Phytopathology for Sustainable Disease Management and Food Security" held at RARS, Tirupati, AP, India during 31st October to 2nd November, 2022.
- Rojasara, Y. M., Bhatt, N. A. and Patel, J. N. (2023). Efficacy of ready mix fungicides for the management of damping-off disease in *bidi* tobacco nursery. An extended summary presented in Annual Conference & National Symposium on "Plant Health Management: A Way Forward for Food Safety, Security and Sustainability held at AAU, Anand, Gujarat during 10th to 12th May, 2023.

- Rojasara, Y. M. Jalpa Panchal, Bhatt, N. A. and Patel, J. N. (2023). First report of *Orobanche aegyptiaca* Pers. parasitism on *rustica* tobacco seedlings in nursery and Parthenium weed in Anand district of Gujarat. An extended summary presented in National Symposium of Indian Phytopathological Society on "Plant Health Management: Current Trends and Novel Mitigation Strategies" held at ICAR-Central Tuber Crops Research Institute, Sreekariyam, Thiruvananthapuram, Kerala, India during 11th to 12th September, 2023.
- Jalpa Panchal, Gediya, K. M., Bhatt, N. A. and Patel, J. N. (2023). Effect of transplanting date and variety on growth, yield and quality of *rustica* tobacco. A poster presented in International Conference on "Frontiers in Tobacco and Commercial Agriculture Towards Preparedness for Future Farming" held at Adikavi Nannaya University, Rajahmundry during 14th to 16th December, 2023.
- Rojasara, Y. M., Bhatt, N. A. and Patel, J. N. (2023). Impact of rotation with resistant variety for the management of root-knot nematode in *BIDI* tobacco field. An extended summary presented in International Conference of Indian Society of Tobacco Science on "Frontiers in Tobacco and Commercial Agriculture Towards Preparedness for Future Farming" held at Adikavi Nannaya University, Rajahmundry, Andhra Pradesh, during 14th to 16th December, 2023

DINHATA

A. Publications

- **Mandi, S.**, Reddy, DD., Dam, SK., Barman, JKR., **Saha, N.D.**, and **Saha, P.** (2023). Effect of nitrogen, phosphorus and potassium on yield potential of motihari tobacco. *Tobacco Research* 49(1): 15-17.
- **Dam S. K.** and U. Sreedhar (2023). Bio-efficacy of new fungicide fenamidone +mancozeb against damping off disease in FCV tobacco nurseries. *Tobacco Research*. 49(1):11-14. (NAAS 3.33)

B. Participation in Symposia/ Seminars/ Workshops/ Conferences etc.,

- Dr. Partha Saha, Dr. Namita Das Saha, Dr. SK Dam Attended International Conference on Frontiers in Tobacco and Commercial Agriculture towards Preparedness for Future Farming" (ICFTCA-2023) during 14-16 December, 2023at ICAR-Central Tobacco Research Institute (ICAR-NIRCA), Rajahmundry.
- Dr Partha Saha attended 10th Indian Horticulture Congress 6-9 November, 2023 at Assam Agricultural University, Guwahati
- Dr Partha Saha attended ISVS Golden Jubilee National Seminar 24-26 Feb, 2024, Ayodhya, UP
- Dr Namita Das Saha attended five days training received on 'Design Thinking in Agricultural Research and Education (Online Mode)" from 09-13 October 2023
- Dr Namita Das Saha In an International Conference on Advanced Agricultural Technologies for Self Reliant Farmers and Developed India, held on 11th February, 2024 at East Champaran, Bihar (presented in virtual mode) sponsored by IRRI, ISARC.

NIPANI

A. Publications

- B.P. Maruthi Prasad, B. R. Patil, D. Geeta AND P.S. Matiwade., 2023, Principal Component Analysis (PCA) and hierachial clustering in tobacco (*Nicotiana tabacum L.*) for yield and yield attributing traits, Electronic Journal of Plant Breeding, **24**(2):737-746. (**NASS-5.2**)

B. Abstracts

- Matiwade P.S., Soregaon C.D., Arunkumar, B., Dandin, G., Sajjanar, G.M., Jahagirdar S.A., Tippannavar, P.S., Sarala, K. and M. Sheshu Madhav, NBD 209: A promising *BIDI* Tobacco Variety for Northern transition Zone of Karnataka, International Conference on "Frontiers in Tobacco and commercial Agriculture towards preparedness for Future Farming held at Aadikavi Nannaya University, Rajahmundry jointly organized by ISTS and ICAR-CTRI (ICAR-NICRA). PP-1, 14-16th December, 2023.
- Matiwade P. S., Arunkumar, B., Soregaon C. D., Dandin, G., Sajjanar, G.M., Jahagirdar S.A., Tippannavar, P.S., Sarala, K. and M. Sheshu Madhav, Response of *BIDI* Tobacco to levels of Sulphur under rainfed conditions, International Conference on "Frontiers in Tobacco and commercial Agriculture towards preparedness for Future Farming held at Aadikavi Nannaya University, Rajahmundry jointly organized by ISTS and ICAR-CTRI (ICAR-NICRA). PP-55, 14-16th December, 2023.
- Matiwade P. S., Arunkumar, B., Soregan C. D., Dandin, G., Sajjanar, G.M., Jahagirdar S.A., Tippannavar, P.S., Sarala, K. and M. Sheshu Madhav, Response of *BIDI* Tobacco to various sources of Potassium under rainfed conditions, International Conference on "Frontiers in Tobacco and commercial Agriculture towards preparedness for Future Farming held at Aadikavi Nannaya University, Rajahmundry jointly organized by ISTS and ICAR-CTRI (ICAR-NICRA). PP-56, 14-16th December, 2023.

NANDYAL

A. Publications

- K. Sathish Babu, P.Pulli Bai, K .Prabhakar, S. Rama Devi, S. Jaffar Basha, M.Jayalakshmi, K.Kasturi Krishna, K.Sarala and N.C.Venkateswarlu. 2023. Effect of different management practices on control of broomrape in *BIDI* tobacco (*Nicotiana tabacum* L.). *METSZET JOURNAL.* ISSN No: 2061-2710, volume (8):11, 463-472.

B. Trainings attended

- On 10.02.2023 participated in National webinar on "Women Empowerment through Entrepreneurship "organized by ANGRAU, POSHAN, INCUBATION, Tirupati.

- Participated in demonstration cum distribution of agricultural implements and farm tool kits under SC subplan-2022-23 at cherkucherla (V), Midthur (M), Nandyal dist. Organized by NAARM, Hyderabad on 27.06.2023.
- On 4.07.23 participated in Bureau of Indian Standards on tobacco and tobacco products FAD 4 meeting by virtual mode.
- Participated in National webinar on Hybrid Artificial Intelligence models in Agriculture organized by S.V. Agricultural college, Tirupati on 08.08.2023.
- July 11-Augt 31st, 2023 attended agMOOCs online training programme on "Agricultural Statistics in Practice".
- From July 11-Sept 15th, 2023 attended agMOOCs online training programme on "Integrated Pest Management" (IPM).
- Participated in National webinar on Role of post harvest technology and machinery in ensuring food security by ANGRAU-POSHAN INCUBATOR, Tirupati on 17.08.2023
- Participated in District Agricultural Advisory Board (DAAB) meeting at District Collector Office, Nandyal on 18.08.2023.
- Participated in ANGRAU Diamond Jubilee webinar series I .Role of post harvest Technologies and Machienary in Ensuring Food security organized by RARS, Anakapalli on 25.08.2023.
- Participated in National webinar on Application of artificial intelligence and machine learning in Agricultural engineering: unleashing the potential for global food security by ANGRAU-IDP organized by Dr. N.T.R college of Agricultural engineering, Bapatla on 4-5 september-2023.
- Participated in 5 days National webinar series on the eve of Diamond jubilee celebrations of ANGRAU organized by ANGRAU POSHAN INCUBATOR, Tirupati from 19-23rd September on ANGRAU-Agri innovations and entrepreneurship development cell.
- Participated in National webinar on Role of Nano technology in plant diseases management on 21 September, 2023 organized by IDP-S.V. Agricultural college, Tirupati.
- Participated in 21 days training programme on Green revolution training cum workshop programme from 24 September to October 14, 2023 organized by Hindustan Agriculture welfare society, U.P., India.
- Participated in National webinar on Know-How AGRITOURISM on 25 September, 2023 on the eve of Diamond jubilee celebrations of ANGRAU organized by High Altitude & Tribal zone, RARS, Chintapalli.
- Participated in Manage-TNAU collaborative online 5 days training programme on Natural Farming for sustainable Agriculture from 09-13, October, 2023
- Participated in 21 days training programme on Green revolution training cum workshop programme from 24 September to October 14, 2023 organized by Hindustan Agriculture welfare society, U.P., India.
- On 21.11.23 participated in 23rd meeting of FAD 4, BIS by virtual mode.
- Participated in 14 days training programme on "Organic production in India-current status and preparing for future" from November 29th to 12th December, 2023 at the Institute of Organic Farming, UAS, Dharwad.
- Participated in International Conference on Frontiers in Tobacco and commercial Agriculture towards preparedness for future farming to be held from 14th to 16th December, 2023 at Adikavi Nannayya University, Rajahmundry.

- Participated in International Agriculture conference on Natural & Organic Farming: In context to Bharatiya Agriculture through virtual mode organized by Gujarat Natural Farming Science University Meerut from 24th-26th December, 2023.
- Participated in training programme to progressive farmers of Kurnool district on production technologies of important oil seed crops at salkapuram (V), Kallur mandal on soil test based fertilizer application in oil seed crops on 06.01.2024.
- Attended as expert to ICC as per RBK channel to deliver the talk on Rabi pantallo samagra neeti yajamanyam and Vesavi lo chesukovalsina polam panulu at RBK channel Gannavarm on 20.02.2024.

C. Workshops

- On September 21st 2023 participated in XXVI Workshop of All India Network Project on Tobacco will be held at ICAR- CTRI, Rajahmundry on 21st September, 2023

D. Conferences

- On 5th – 6th June, 2023 participated in Annual Post Graduate Students National Conference on Frontiers in Agricultural Research- Challenges and Opportunities for Food and Nutritional Security is organized by S.V. Agricultural College, Tirupati.
- On 14-16th December 2023 participated in International Conference on Frontiers in Tobacco and Commercial Agriculture towards preparedness for Future Farming is organized by ICAR-CTRI, Rajahmundry
- Abstract submitted entitled "Genetic Diversity and Association Studies for Drought Tolerance in BIDI Tobacco (Nicotiana tabacum L.)".Annual Post Graduate Students' National Conference (APGSNC – 2024) 'NACAFF – 'Next Gen- Agriculture – Cross Disciplinary Approaches for Augmenting Farm Productivity and Farmers' Prosperity'

E. Abstracts

- P. Pulli Bai, V. Jayalakshmi, M. Reddi Sekhar, K. Sarala, K. Gangadhara, K. Prabhakara Rao and Shaik Nafeez Umar. 2023. Classification of R genes for plant pathogen interaction and their approach in Breeding. Annual Post Graduate Students National Conference on Frontiers in Agricultural Research- Challenges and Opportunities for Food and Nutritional Security on 5th – 6th June, 2023 at S.V. Agricultural College, Tirupati, pg. 20-21.
- P. Pulli Bai, V. Jayalakshmi, M. Reddi Sekhar, K. Sarala, K. Gangadhara, K. Prabhakara Rao and Shaik Nafeez Umar. 2023. Speed Breeding and its Implications in Crop Improvement. Annual Post Graduate Students National Conference on Frontiers in Agricultural Research- Challenges and Opportunities for Food and Nutritional Security on 5th – 6th June, 2023 at S.V. Agricultural College, Tirupati, pg. 54-55.
- P.Pulli Bai*, K. Sathish Babu, S. Jaffar Basha, S. Rama Devi, K. Prabhakar, K. Sarala and N.C. Venkateshwarlu. 2023. Evaluation of newly developed genotypes for potential source of tobacco seed oil (TSO) and yield attributing traits in *bidi* tobacco (*Nicotiana tabacum* L.). International Conference on Frontiers in Tobacco and Commercial Agriculture Towards preparedness for Future Farming held from 14th to 16th December, 2023 at Rajahmundry. pg.2.

- K Sathish Babu *, P Pulli Bai, K Prabhakar, S Rama Devi, S Jaffar Basha, S Kasturi Krishna, K. Sarala and N.C. Venkateswarlu. Enhancing the productivity of *bidi* tobacco based cropping systems. International Conference on Frontiers in Tobacco and commercial Agriculture towards preparedness for future farming held from 14th to 16th December, 2023 at Rajahmundry.
- K. Sathish Babu, G. Krishna Reddy, B. Sahadeva Reddy, T.N.V.K.V. Prasad, M. Raveendra Reddy and P. Lavanya Kumara. Importance of fortified organic manures in Agriculture. Frontiers in Agricultural Research-challenges and opportunities for food and nutrional security held from 5-6 June, 2023.

BERHAMPUR

A. Research papers

International level

- Prusti, A.M. (2023). Morphological characterization in *pikka* tobacco. In International conference " Frontiers in Tobacco and Commercial Agriculture towards preparedness for future farming, 14-16, December,2023 at CTRI Rajahmundry pg 6

B. Symposium/ Workshop/ Seminars attended

- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated in XXVI Tobacco Workshop of AINPT at CTRI Rajahmundry on 21.9.23
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated in International Conference on "Frontiers in Tobacco and Commercial Agriculture towards preparedness for future Farming" and poster presentation at CTRI Rajahmundry from 14 – 16. 12.23.
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated in Agri -Edu fair at OUAT, BBSR from 21 – 22. 12.23
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated in 24th Odisha Bigyan 'O' Paribesh Congress National Conference on Environmental Challenges Role of Science and Technology18-19th December 2023, at Berhampur University
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/C participated and successfully completed the "Online Refresher Course on Millets (Shree Anna) - Model Crops for Sustainable Farming, Value Addition, Entrepreneurship Development and Nutritional Security (RCSA2023)'' jointly organized by Society for Millets Research and ICAR-Indian Institute of Millets Research, Hyderabad held during 7th – 27th September 2023.
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) I/c participated and successfully completed the 21 Days On line mode Summer School on "Emerging Challenges and Opportunities in Biotic and Abiotic Stress Management" (ECOBASM-2023)

VEDASANDUR

- Lakshminarayana R., T.G.K. Murthy, K.N. Subramanya, R.V.S. Rao, K. Palanichamy, A.V.S.R. Swamy, K. Nagarajan, M. Kumaresan, T.S.N. Reddy, K. Sarala, P. Manivel, K. Prabhakara Rao and M. Sheshu Madhav. 2023. "YASINI" - A new high yielding black shank disease resistant chewing tobacco variety for Tamil Nadu. Tobacco Research 49(1): 29-37.
- Sonia P., K. Shravankumar, K. Giribau, S. Ramaraja, S. Bhaskar Naik, K. Prabhagara Rao, K. Sarala and P. Manivel. 2023. Genotyping of chewing tobacco variety BSR-1 using SSR markers. In International Conference on "Frontiers in Tobacco and Commercial Agriculture Towards Preparedness for Future Farming" 14-16 December, 2023, Adikavi Nannaya University, Rajahmundry, Organized by Indian Society of Tobacco Science and ICAR-Central Tobacco Research Institute (ICAR-NRICA), Rajahmundry-533105, Andra Pradesh. P. 50.
- M. Kumaresan, D. Damodar Reddy, P. Manivel, S. Kasthuri Krishna, M. Seshu Madhav, J. Poorna Bindu, M. Venkatesan and V. Annadurai. 2023. Economic viability of various crops and cropping system for higher farm returns under Vedasandur condition. Abstract in International Conference on "Frontiers in Tobacco and Commercial Agriculture Towards Preparedness for Future Farming" 14-16 December, 2023, Adikavi Nannaya University, Rajahmundry, Organized by Indian Society of Tobacco Science and ICAR-Central Tobacco Research Institute (ICAR-NRICA), Rajahmundry-533105, Andra Pradesh. P. 71.
- Venkatesan M. and P. Manivel. 2023. Evaluation of bio control agents against root-knot nematode, Meloidogyne incognita under laboratory condition. In International Conference on "Frontiers in Tobacco and Commercial Agriculture Towards Preparedness for Future Farming" 14-16 December, 2023, Adikavi Nannaya University, Rajahmundry, Organized by Indian Society of Tobacco Science and ICAR-Central Tobacco Research Institute (ICAR-NRICA), Rajahmundry-533105, Andra Pradesh. P. 85.
- Kumaresan M., P. Manivel, M. Sheshu Madav, S. Kasthuri Krishna and V. Annadurai. 2023. Biotic stress in ashwagandha (Withania somnifera Dunal L.) through weeds on the growth and root yield. In International Conference on "Frontiers in Tobacco and Commercial Agriculture Towards Preparedness for Future Farming" 14-16 December, 2023, Adikavi Nannaya University, Rajahmundry, Organized by Indian Society of Tobacco Science and ICAR-Central Tobacco Research Institute (ICAR-NRICA), Rajahmundry-533105, Andhra Pradesh. P. 124.
- M. Sheshu Madhav, K. Sarala, C. Nanda, J.N. Patel, D.R. Chaudhari, Partha Saha, P. Manivel. 2023. Success Stories of AINPT, Technical Bulletin No: 03/2023, ICAR-Central Tobacco Research Institute, Rajahmundry, pp. 17.

XIV. STAFF POSITION

CENTRE – WISE DETAILS OF SANCTIONED POSTS FROM 2018-19

Name of the Centre	Scientific	Technical	Administrative	Supporting	Total
Anand	5	6	1	1	13
Shivamogga	3	5	1	-	9
Nipani	2	3	1	-	6
Nandyal	2	3	-	-	5
Araul	2	2	-	-	4
Berhampur	2	2	-	-	4
Total	**16**	**21**	**3**	**1**	**41**

Staff in position (as on 31-07-2024)

S. No.	Centre	Cadre	Name of Sanctioned Post	Name of the Person working
1.	Shivamogga	Scientific	Scientist (Plant Breeding)	Dr. Shashikala S. Kolakar
2.	Shivamogga	Scientific	Scientist (Agronomy)	Dr. T M Soumya
3.	Shivamogga	Scientific	Scientist (Ento./Pathology)	Dr. Prashantha C
4.	Shivamogga	Technical	Field Assistant	Rajappa K
5.	Shivamogga	Technical	Curer	Nagaraja
6.	Shivamogga	Administrative	Assistant	Akshay Patil
7.	Nipani	Scientific	Principal Scientist (Plant Breeding)	Dr. S. B. Patil
8.	Nipani	Scientific	Scientist (Agronomy)	Dr. Shivamurthy D.
9.	Nipani	Technical	Research Assistant	Dr. Geeta Dandin
10.	Nipani	Technical	Field Assistant	Mr. I. S. Koshti
11.	Nandyal	Scientific	Scientist (Plant Breeding)	P. Pulli Bai
12.	Nandyal	Scientific	Scientist (Agronomy)	K. Sathish Babu
13.	Araul	Scientific	Scientist (Agronomy)	Dr. K. C. Arya
14.	Araul	Technical	Technical Assistant	Dr. N. B. Singh
15.	Araul	Technical	Agriculture Assistant	Sri. Vivek Kumar Singh
16.	Anand	Scientific	Scientist (Plant Breeding)	Dr. Jyotindra N Patel
17.	Anand	Scientific	Scientist (Nematology)	Dr. Y. M. Rojasara
18.	Anand	Technical	Senior Research Assistant	Miss. Jalpa P Panchal
19.	Anand	Technical	Senior Research Assistant	Vekariya K J
20.	Anand	Technical	Lab. Technician	Mrs. Hiral Upadhyay
21.	Anand	Technical	Curer	R. K. Rathava
22.	Anand	Administrative	Junior Clerk	Viralkumar U. Makwana

XV. BUDGET

Revised Estimates for the year 2023-24: AINPT (ICAR Share)

Head	Amount (Rs. in Lakhs)
Grant in aid Salaries	278.00
Grant in aid Capital	0.00
Grant in aid General	100.00
Total	**378.00**

Budget details at SAU centres

(Rs. in Lakhs) ICAR Share: 75%

S. No.	PARTICULARS	Opening Balance	Allocation	Expenditure
SHIVAMOGGA				
1	Salary of Research Staff & Est.	00	65.00	61.12
2	Travelling allowance	00	1.3	1.16
3	Recurring contingencies	00	15.0	13.32
Total		**00**	**81.30**	**75.61**
ANAND				
1	Salary of Research Staff & Est.	0.00	77.64	108.33
2	Travelling allowance	0.00	1.00	0.71
3	Recurring contingencies	0.00	15.50	15.50
Total		**0.00**	**94.14**	**124.54**
ARAUL				
1	Salary of Research Staff & Est.	00	42.36	35.63
2	Travelling allowance	00	0.50	0.42
3	Recurring contingencies	00	4.50	4.50
Total		**00**	**47.36**	**40.55**
NIPANI				
1	Salary of Research Staff & Est.	00	67.00	63.09
2	Travelling allowance	00	2.00	1.44
3	Recurring contingencies	00	12.00	10.20
Total		**00**	**81.00**	**74.73**
NANDYAL				
1	Salary of Research Staff & Est.	00	26.00	19.87
2	Travelling allowance	00	1.00	0.29
3	Recurring contingencies	00	9.50	9.49
Total		**00**	**36.50**	**29.65**
BERHAMPUR				
1	Salary of Research Staff & Est.	8.33	0.00	0.00
2	Travelling allowance	0.59	0.50	0.14
3	Recurring contingencies	2.84	5.00	5.00
Total		**11.76**	**5.50**	**5.14**

XVI. CO-ORDINATION UNIT, RAJAHMUNDRY

The XXVI Tobacco Workshop of All India Network Project on Tobacco was held on 21st September, 2023 in virtual mode at ICAR-CTRI, Rajahmundry. Dr. T. R. Sharma, DDG (CS) was Chief Guest and Dr. D. K. Yadava, ADG (Seed) was the Guest of Honour. Scientists from various AINPT centers and other delegates from all over India participated in the Workshop. The experimental results of 2022-23 were reviewed and also formulated the future technical programme.

- A total number of 24 lines were evaluated in IVT/IHT, 28 in AVT/AHT, 12 in Bulk/ On-farm trials.
- One publication AINPT Annual Report 2022-23 was released by Dr. D. K. Yadava, ADG (Seed)
- Prepared and submitted budget proposals (Budget Estimates/ Revised Estimates), for the year 2023-24 and statement on allocation of funds to SAU centres. Also prepared the output-outcome outlay (Annual Plans) of the AINPT and submitted to ICAR
- Fund allocation was made to all the SAU centres on regular intervals as per the remittances by the Council
- Revised EFC Memo for 2021-26 was prepared and submitted to the Council.
- Compiled and submitted the quarterly information for output-outcome framework
- Collected IVT proposals of different tobacco types, constituted the Technical Programme for Initial Varietal Trials and Initial Hybrid Trials of FCV and Non-FCV tobacco types, IVT/IHT seed supplied to all the concerned centres
- Compiled seed production details of the different centres
- Created different Google sheets for collection and maintenance of information from all the AINPT centres for ready reference
- Varieties released through AINPT are updated from time to time in the Varietal Information System of ICAR Krishi Portal
- Compiled the list of publications of all the centres of AINPT along with citations
- Website for AINPT (https://aicrp.icar.gov.in/tobacco/) is being updated regularly depicting all the activities of AINPT
- Technologies developed by AINPT are uploaded from time to time in the Technology Repository of ICAR Krishi Portal

- Virtual meetings with all the AINPT centres along with Principal Investigator, Crop Improvement were conducted in virtual mode for discussing issues *viz.*, Outcome/Output targets and Achievements, Budget, NEH proposals, SCSP Proposals etc., during the year

- A meeting was conducted with all the SAU centres to discuss the Budget transactions of AINPT with Nodal Officer, FAO and SAO in Virtual Mode on 3rd June, 2024

- Collected IVT proposals of different tobacco types and arranged vrtual meetings with the committee for consideration of IVT/IHT proposals, constituted the Technical Programme for Initial Varietal/ Hybrid trials of FCV and Non-FCV tobacco types as suggested by the IVT Committee and approved by the Competent Authority

- Seed of IVT/IHT entries collected from respective centres and supplied to all the different centres

- Virtual Meetings conducted with all the AINPT centres with Director and Principal Investigators *viz.*, Crop Improvement, Crop Production, Crop Chemistry and Soil Science and Crop Protection on 02nd July, 2024 at ICAR-CTRI, Rajahmundry in virtual mode to discuss the ongoing projects and to formulate the Technical Programme for the year 2024-25

- Compiled the Annual Report of 2023-24

- Compiled the proceedings of XXVI Tobacco Workshop of AINPT

- Received and forwarded the notification proposals of three tobacco cultivars viz., FCJ-11 (CTRI Naveena), FCR-15 (CTRI Sreshta) and YB-22 (Vijetha) to CVRC.

Project No.: AINPT 01

Research project title	Project on Development of Mobile Application for Non-FCV tobacco
Objectives	▪ To Develop an Android based mobile application for Non FCV tobacco grown in India for effective instant technology transfer
Investigators	H. Ravisankar, M. Sheshu Madhav, B. Krishna Kumari, T. Anuhya Jayaprada
Year of start	2021-22
Year of completion	2022-23
Location	Co-Unit, Rajahmundry

RESULTS

India is a boutique of different tobacco types used for various end uses. Nearly 15 tobacco types are cultivated across the different agro-ecological situations of the country. Tobacco is a quality conscious commercial crop known for its notable contribution to the economy in terms of excise revenue (Rs. 33,000 crores), Export earnings (~ Rs 12,000 crores), and employment (45.7 Million people). Access to Scientific knowledge and good agricultural practices is very much essential for quality tobacco production to fetch higher prices there by farmers' income. Mobile Apps can help farmers in many ways, including (i) Optimizing crop operations, improve productivity, and reduce waste, (ii) Weather forecasting (iii) Indirectly increase GDP usage (iv)Crop monitoring and product quality. Other benefits of Mobile Apps for agriculture include increasing efficiency, improving sustainability, alerting against impediments, better decision-making, and reducing costs.

Tobacco types are basically categorized into two broad groups (i) Flue-cured Virginia (ii) Non-Flue-cured Virginia. Mobile App was developed for FCV tobacco by the ICAR- Central Tobacco Research Institute. All India Network Project on Tobacco developed an Android Based Static Mobile App for Non-FCV tobaccos using Java and XML languages on Good Agricultural Practices (GAPs) for global accessing of the information through smart phones by tobacco farmers and stake holders. It is an icon based user-friendly menu driven application for easy and instant accessing of the complete information on Non-FCV tobaccos. This App provides complete information about types of Non-FCV tobacco, package of practices and research infrastructure available at each place. Good Agriculture Practices (GAP) module provides information about soils and climate, nursery management, field crop management and post-harvest management related to 11 non- FCV tobacco types. The app contains different templates for effective content management. Testing and debugging completed. Hosted in Google Play Store with URL https://play.google.com/store/apps/details?id=com.nonfcv.myapplication. More than 150 users accessed the information and in the years to come it will become an unique source of Non-FCV tobacco information for easy understanding and accessing of each attributes with a single click. The Mobile App is obtained copyright certificate with the Registration Number: SW-17633/2023. This quick and instant accessing assists the tobacco farmers in raising their crop in a more scientific way for achieving higher yields. It also helps the Institute in transferring the latest technology in no time and improves the Institute visibility at the national level.

XVII. ANNUAL PROGRESS REPORT (2023-24)

CROP IMPROVEMENT

CROP IMPROVEMENT

A. VFC TOBACCO

COORDINATED EVALUATION OF FCV TOBACCO GENOTYPES

IVT ON VFC TOBACCO

VFJBRC/ VFKBRC/ VFHBRC/ VFSBRC 2:

INITIAL VARIETAL TRIAL ON FCV TOBACCO

Objectives: To evaluate the FCV tobacco entries for yield and quality at Six centres *viz.,* Rajahmundry, Guntur, Jeelugumilli, Kandukur, Hunsur and Shivamogga along with respective checks.

Year of start : 2023-24

Year of Completion :2023-24

FCV tobacco Centres and Investigators

Centres	:	Investigators
Rajahmundry	:	K. Prabhakara Rao and K. Sarala
Jeelugumilli	:	K. Sarala and K. Prabhakara Rao
Guntur	:	K. Sarala, P. Venkateswarlu and M. V. Jaya Krishna
Kandukur	:	Gangadhara K
Hunsur	:	Nanda C
Shivamogga	:	Shashikala S Kolakar, T.M. Soumya, Prashantha C.

Design : RBD
Total treatments : 12 + checks as given below
Replications : Three

Entries: 12 (Twelve)

IET-100	IET-103	IET-106	IET-109
IET-101	IET-104	IET-107	IET-110
IET-102	IET-105	IET-108	IET-111

Checks at different Centres:

Rajahmundry	:	1. Siri	2. CTRI Sulakshana	3. CTRI Sreshta	4. Kanchan
Jeelugumilli	:	1. Kanchan	2. LT-Kanchan	3.CTRI Naveena	
Kandukur	:	1.Siri	2. CTRI Sulakshana	3. CTRI Sreshta	4. Kanchan
Guntur	:	1.Siri	2. CTRI Sulakshana	3. CTRI Sreshta	4. Kanchan
Hunsur	:	1. Kanchan	2. FCH-222	3. CH 3	
Shivamogga	:	1. Thrupthi	2. Kanchan	3. Sahyadri	

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Rajahmundry	2.8 x 6.3 m	0.7 x 0.7m
Jeelugumilli	2.0 x 12.0 m	1.0 x 0.6 m
Guntur	2.8 x 4.0 m	0.7 x 0.7m
Kandukur	2.6 x 5.85 m	0.65 x 0.65 m
Hunsur	2.0 × 6.6m	1.0 × 0.55 m
Shivamogga	3.6 x 6.0 m	0.9 x 0.6 m

RESULTS

In the Initial varietal trial (IVT), twelve entries were evaluated for their yield potential against respective checks at different centres. Observations recorded leaf yield, natural/ artificial incidence of pest and diseases. Cured leaf quality parameters (Nicotine, Reducing sugars and chlorine) were estimated.Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha.Data on yield and other characteristics at different centres are presented in Tables 1 to 15 IVTVFC TOBACCO. The results are discussed here under centre-wise.

RAJAHMUNDRY

Yield: Among the Entries evaluated, three entries IET-101 (11009 kg/ha, 1843 kg/ha, 1258 kg/ha & 1311 kg/ha), IET-103 (10998 kg/ha, 1858 kg/ha, 1263 kg/ha & 1322 kg/ha) and IET-109 (11002 kg/ha, 1841 kg/ha, 1253 kg/ha & 1313 kg/ha) recorded significantly superior green, cured& bright leaf yields and grade index, respectively over the better control CTRI Sulakshana. The three entries showed a percentage increase of 13-14% over the better control CTRI Sulakshana.

Disease /Pest incidence: Under artificial screening for TMV the test entries IET-101, IET-102, IET-111 and the controls CTRI Sulakshana and CTRI Sreshta recorded TMV resistant reaction and others are susceptible. Under the natural conditions the disease incidence of leaf curl in the test entries are comparable to controls.

Salient Findings/Achievements:

- Among the twelve entries assessed, IET-101, IET-103 and IET-109 has recorded significantly superior green, cured& bright leaf yields and grade index over the better control CTRI Sulakshana.
- IET-101, IET-102, IET-111 along with controls CTRI Sulakshana and CTRI Sreshta has recorded TMV resistant reaction.

Conclusion: Based on the results, the entries IET-101, IET-103 and IET-109 are proposed to promote for testing under AVT-I in the ensuing season.

JEELUGUMILLI

Yield: The differences among the entries tested for all the three characters *viz.*, green leaf, cured leaf and grade index found to be significant. However, none of the tested entries recorded higher leaf yields than CTRI Naveena which recorded 18361 kg/ha green leaf, 3088 kg/ha cured leaf and 1885 grade index value. The green leaf yield among the entries ranged from 9611kg/ha (IET-100) to17208 kg/ha (IET-107), cured leaf from 1654 kg/ha (IET-100) to 2871 kg/ha (IET-109) and grade index values from 914 (IET-100) to 1825 (IET-107).

Morphological characterization: In general, the entries tested recorded higher plant height than controls. Number of leaves ranged from 23-32, leaf length values of 9th, 10th and 11th leaves ranged from 54-82 cm and width from 20-46 cm in various entries. CTRI Naveena recorded higher length (~82 cm) and width (up to 46) values for 9th, 10th and 11th leaves.

Disease /Pest incidence: Incidence of pests (caterpillar & aphids) and diseases (Black Shank, CMV/TMV& leaf curl) observed under natural condition among the entries and controls. Kanchan recorded relatively higher incidence of leaf curl. Black shank was not recorded in IET-110 and CH-3, TMV/CMV in IET-102.

Salient Findings/Achievements

- Among the 12 entries (IET100 to IET 111) evaluated along with four control varieties *viz.*, Kanchan, LT Kanchan, CH-1 and CTRI Naveena, the differences for all the three characters viz., green leaf, cured leaf and grade index found to be significant
- None of the 12 tested entries under IVT recorded higher leaf yields than CTRI Naveena which recorded 3088 kg/ha cured leaf and 1885 grade index value

Conclusion: As none of the entry is significantly superior, none of the entry was promoted to AVT trials.

GUNTUR

Yield: Maximum green leaf (19642 kg/ha), cured leaf (2934 kg/ha), bright leaf (1726 kg/ha) and grade index (2348 kg/ha) were recorded in IET-100 followed by IET-101 (19196, 2883, 1684 & 2279 Kg/ha), IET-103 (19077, 2816, 1613 & 2181 kg/ha) and IET-109 (18640, 2571, 1473 & 2163 Kg/ha). These four entries were significantly superior over two checks *i.e.,* Siri and Kanchan. However, these were at par with the remaining two checks, namely, CTRI Sulakshana and CTRI Sreshta. The remaining eight entries were inferior to above mentioned entries and checks. There was an increase of 11.48, 33.60, 52.74 and 55.70% in respect of green leaf, cured leaf, bright leaf and grade index, respectively due to IET-100 entry over the standard check, Siri.

Disease /Pest incidence: Pest and disease incidence under natural conditions was recorded and was below ETL in all the entries including checks. Only leaf curl incidence was recorded and ranged from 0.33 to 1.66% (Table VFGBR-1.2).

Salient Findings/Achievements:

- Four entries *viz.*, IET-100, IET-101, IET-103 and IET-109 have performed better with significant high green leaf, cured leaf, bright leaf yields and also grade index over two checks *i.e.*, Siri and Kanchan
- Incidence of tobacco leaf curl was observed to be moderate and ranged from 0.33 to 1.66% in all the entries evaluated under IVT trials conducted, while the incidence of caterpillar, aphid and TMV was nil.

Conclusion: As none of the entry is significantly superior to better checks, none of the entry was promoted to AVT trials.

KANDUKUR

Yield: None of the tested entries were found significantly superior over the checks with respect to green leaf, cured leaf, bright leaf and grade index.

Morphological characterization: Among the test entries, IET 106 recorded higher plant height followed by IET 100 and IET 110 and Kanchan recorded lowest plant height.

Disease /Pest incidence: No major disease incidence was noticed in the trial.

Conclusion: None of the tested entries were found significantly superior over the checks with respect to green leaf, cured leaf, bright leaf and grade index

HUNSUR

Yield: Three entries *viz.*, IET-107, IET-109 and IET-110 were found to be significantly superior in terms of all the yield parameters. Entries IET-109 and IET-110 recorded significantly higher cured and bright leaf yield as well as TGE overall the three checks while, entry IET-107 recorded significantly higher green leaf yield (16000 kg/ha), cured leaf yield (2127 kg/ha) and TGE (1607) over the checks Kanchan and FCH-222. Percent improvement in cured leaf ranged from 20% (IET-107) to 32% (IET-110 & IET-109) over check Kanchan, 17% over check CH-3.

Morphological characterization: Morphological characters like plant height, number of leaves, inter-nodal length, leaf length and width of 5^{th}, 7^{th} and 9^{th} leaf were recorded. Plant height ranged 55 to 82.2cm, number of leaves ranged from 17 to 22, Inter-nodal length ranged from 3.0to 4.2cm.

Disease /Pest incidence: Incidence of disease and pests are low

Salient Findings/Achievements:

- Entries IET-110 & IET-109 recorded significantly higher cured leaf yield, bright leaf yield and TGE overall the three checks
- Entry IET-107 was found superior to checks Kanchan and FCH 222 in terms of cured leaf yield and TGE

Conclusion: Three promising entries IET-107, IET-110 & IET-109 were promoted for further evaluation under AVT

SHIVAMOGGA

Yield: Entries *viz.*, IET-102, IET-103, IET-104, IET-109 recorded numerically higher green leaf yield over all the four checks, while IET-100, IET-102, IET-103, IET-104, IET-105, IET-106, IET-109, IET-110 recorded numerically higher cured leaf yield over the all the four checks. However, entries *viz.*, IET-102 (9503, 1265 kg/ha), IET-103(9640, 1304 kg/ha), IET-104 (9844, 1351 kg/ha) and IET-109(9494, 1140 kg/ha) recorded significant higher GLY and CLY over all the checks. Further, an increase of CLY over the best check (CH-3) was 32% (IET-102), 35% (IET-103), 40 % (IET-104), and 19% (IET-109) respectively.

Morphological characterization: Among the twelve entries plant height ranged from 89 (IET-102) to 117 (IET-109)cm and number of leaves ranged from 13 (IET-103) to 19 (IET-107).

Disease /Pest incidence: Among the twelve entries evaluated, the minimum score of Black Shank (2) was recorded on the entries IET-103, IET-105 and IET-108,while TMV score of 2 was observed on IET-103, IET-104, IET-105 and IET-107. Minimum number of 0.1 of *Spodoptera litura* was observed on IET-101, IET-104 and IET-107 and IET-111, while the whitefly population was minimum on IET-108.

Salient Findings/Achievements:

- Among the twelve entries with checks, IET-102, IET-103, IET-104, IET-109 has recorded higher GLY, CLY and TGE over the checks.
- IET-102 (1265 kg/ha), IET-103 (1304 kg/ha), IET-104 (1351 kg/ha), IET-109 (1140 kg/ha) recorded 32%, 35%, 40% and 19% respectively, higher CLY over the best check CH-3

Conclusion: IET-102, IET-103, IET-104, IET-109 has recorded higher GLY, CLY and TGE over the checks hence, these entries may be promoted to Advanced Varietal Trial.

Recommendation for AVT-I: Based on the result of FCV centres and discussions held during the Interaction meeting with AINPT centres on 2nd July, 2024, the following decisions were taken in respect of entries to be promoted to AVT-Iat different centres

S.NO.	PROJECT	ENTRIES Approved/ REMARKS	CENTRE FOR TAKING ACTION
1.	AVT-I ON FCV TOBACCO KARNATAKA	Entries approved: IET-107, IET-109 and IET-110 along with checks as per the IVT 2023-24	Hunsur centre
2.		Entries approved: FCR-72, FCR-73, IET-102, IET-103, IET-104, IET-107 and IET-109 along with checks as per the IVT 2023-24 for KLS region	Shivamogga centre
3.		Karnataka centers must raise all the IVT entries seedlings from 2025-26 onwards. Considering the results from AP Centres, After the finalization of the AVT may be conducted as approved	Hunsur Centre Shivamogga Centre
4.	AVT-I ON FCV TOBACCO ANDHRA PRADESH	Entries approved: FCR-71, FCR-72, FCR-73, IET-101, IET-102, IET-103, IET-104, IET-107, IET-109 & IET-110along with checks as per the IVT 2023-24	Rajahmundry, Jeelugumilli, Gunturand Kandukur centres

Table 1 IVT VFC TOBACCO: Green leaf yield (kg/ha) in IVT at different centres (2023-24)

Entries	Rajahmundry	Jeelugumilli	Guntur	Kandukur	Hunsur	Shivamogga
IET-100	10027	9611	19642	9252	9881	7733
IET-101	11009 (13.1)*	15097	19196	9776	9540	7294
IET-102	9989	14181	18750	10089	9652	9503*
IET-103	10998 (12.6)*	14236	19077	9276	9783	9640*
IET-104	8733	11806	18601	10036	11609	9844*
IET-105	8422	16069	17857	10676	10106	7699
IET-106	8687	11722	17708	10927	13235	7582
IET-107	9172	17208	17321	10430	16000*	5977
IET-108	9638	14222	17886	10194	13619	7319
IET-109	11002 (13)*	17111	18640	11184	15265*	9494*
IET-110	9711	14139	16636	10096	14811*	8060
IET-111	9687	13903	18545	10842	14008	6050
Kanchan (C)	9174	13722	18154	11245	10606	5425
LT-Kanchan (C)	-	14389	-	-	-	-
CH-1 (C)	-	13583	-	-	-	-
CTRI Naveena (C)	-	18361	-	-	-	-
Siri (C)	9594	-	17619	12361	-	-
CTRI Sulakshana (C)	9737	-	18988	13616	-	-
CTRI Shresta (C)	9611	-	18363	12765	-	-
FCH 222 (C)	-	-	-	-	11997	-
CH 3 (C)	-	-	-	-	14447	7801
Thrupthi (C)	-	-	-	-	-	5710
Sahyadri (C)	-	-	-	-	-	7795
G. Mean	9700	14335	-	10798	-	-
S. Em±	443	699	492	326	769	552
C.D. at 5%	1260	2018	1422	929	2228	1595
C.V. (%)	7.91	8.44%	7.66	6.0.4	10.83	12

**Significant at 5%*

Table 2 IVT VFC TOBACCO: Cured Leaf yield (kg/ha) in IVT at different centres (2023-24)

Entries	Rajahmundry	Jeelugumilli	Guntur	Kandukur	Hunsur	Shivamogga
IET-100	1671	1654	2934	1275	1474	1018
IET-101	1843 (13.6)*	2485	2883	1363	1485	816
IET-102	1645	2357	2580	1463	1386	1265*
IET-103	1858 (14.5)*	2351	2816	1378	1189	1304*
IET-104	1477	2065	2553	1456	1894	1351*
IET-105	1404	2693	2392	1569	1074	1062
IET-106	1464	2035	2476	1440	2036	1016
IET-107	1529	2867	2446	1521	2127* (20 K)	853
IET-108	1606	2400	2395	1521	2101*	899
IET-109	1841 (13.4)*	2871	2571	1512	2347*# (32 K, 17C)	1140*
IET-110	1617	2415	2345	1480	2338*# (32 K, 17C)	959
IET-111	1615	2372	2485	1563	2097	711
Kanchan (C)	1529	2361	2083	1627	1773	870
LT-Kanchan (C)	-	2486	-	-	-	-
CH 1 (C)	-	2333	-		-	-
CTRI Naveena (C)	-	3088	-	-	-	-
Siri (C)	1602	-	2196	1851	-	-
CTRI Sulakshana (C)	1623	-	2633	2070	-	-
CTRI Shresta (C)	1602	-	2616	1678	-	-
FCH 222 (C)	-	-	-	-	1675	-
CH 3 (C)	-	-	-	-	2006	961
Thrupthi (C)	-	-	-	-	-	938
Sahyadri (C)	-	-	-	-	-	-
G. Mean	1620	2427	-	1548	-	-
S. Em±	75	132	140	59	113	52
C.D. at 5%	214	380	405	168	326	150
C.V. (%)	8.05	9. 41	9.63	7.59	10.83	9.28

**Significant at 5%*

Table 3 IVT VFC TOBACCO: Bright Leaf yield (kg/ha) in IVT at different centres (2023-24)

Entries	Rajahmundry	Guntur	Kandukur	Hunsur
IET-100	1136	**1726**	522	1119
IET-101	1258 (14)*	1684	593	816
IET-102	1119	1345	529	1028
IET-103	1263 (14.5)*	1613	482	848
IET-104	1004	1345	516	1379
IET-105	954	1264	511	616
IET-106	996	1205	561	1530
IET-107	903	1175	530	1497(18K)
IET-108	982	1166	845	1492
IET-109	1253 (13.5)*	1473	666	1775*# (40 K, 28C)
IET-110	1083	1110	714	1881*# (48 K, 34C)
IET-111	1056	1494	816	1508
Siri (C)	1066	1130	1064	-
CTRI Sulakshana (C)	1104	1577	1174	-
CTRI Shresta (C)	1089	1497	883	-
Kanchan (C)	977	1113	867	1265
LT-Kanchan (C)	-	-	-	-
CTRI Naveena (C)	-	-	-	-
FCH 222 (C)	-	-	-	1157
CH 3 (C)	-	-	-	1399
Thrupthi (C)	-	-	-	-
Sahyadri (C)	-	-	-	-
G. Mean	1078	-	705	-
S. Em±	52	78	34	104
C.D. at 5%	147	227	98	301
C.V. (%)	8.31	9.97	9.78	13.98

**Significant at 5%*

Table 4 IVT VFC TOBACCO: Grade index/ TGE (kg/ha) in IVT at different centres (2023-24)

Entries	Rajahmundry	Jeelugumilli	Guntur	Kandukur	Hunsur	Shivamogga
IET-100	1186	914	2348	714	1210	814
IET-101	1311 (13.8)*	1276	2279	788	963	654
IET-102	1168	1485	2023	790	1046	1014*
IET-103	1322 (14.8)*	1395	2181	734	871	1044*
IET-104	1049	1378	1994	774	1416	1080*
IET-105	997	1501	1943	792	713	853
IET-106	1040	1219	1883	782	1565	814
IET-107	1085	1825	1839	799	1607*(24K)	684
IET-108	1140	1410	1726	932	1564	723
IET-109	1313 (14.0)*	1639	2163	843	1769*# (36 K, 32C)	915*
IET-110	1148	1596	1642	901	1841*# (41 K, 37C)	768
IET-111	1146	1467	1949	996	1584*	573
Siri (C)	1137	-	1508	1197	-	-
CTRI Sulakshana (C)	1152	-	2113	1369	-	-
CTRI Shresta (C)	1137	-	2041	1098	-	-
Kanchan (C)	1052	1628	1583	1028	1300	699
LT-Kanchan (C)	-	1529	-	-	-	-
CH 1 (C)	-	1469	-	-	-	-
CTRI Naveena (C)	-	1885	-	-	-	-
FCH 222 (C)	-	-	-	-	1243	-
CH 3 (C)	-	-	-	-	1343	770
Thrupthi (C)	-	-	-	-	-	-
Sahyadri (C)	-	-	-	-	-	753
G. Mean	1149	1476	-	909	-	-
S. Em±	55	93	135	31	93	23
C.D. at 5%	157	268	392	87	270	69
C.V. (%)	8.29	10.87	12.07	6.74	12.08	5.42

**Significant at 5%*

Table 5 IVT VFC TOBACCO: Morphological characters of the entries of IVT at Jeelugumilli (2023-24)

S. No.	Entry name	Plant height (cm)	No. of leaves	Inter-nodal length (cm)	9th leaf length (cm)	9th leaf width (cm)	10th leaf length (cm)	10th leaf width (cm)	11th leaf length (cm)	11th leaf width (cm)
1	IET-100	160	31	9	62	30	62	26	68	34
2	IET-101	160	30	9	60	22	54	20	65	28
3	IET-102	155	31	10	60	26	58	22	60	24
4	IET-103	170	30	7	63	31	60	30	68	36
5	IET-104	150	23	9	74	35	74	33	70	34
6	IET-105	165	27	10	61	32	60	30	60	24
7	IET-106	150	24	9	64	28	70	32	72	33
8	IET-107	150	30	7	64	28	62	27	56	23
9	IET-108	190	30	7	63	34	67	36	69	37
10	IET-109	170	32	7	62	28	64	35	60	26
11	IET-110	140	26	6	59	26	64	35	70	38
12	IET-111	160	28	9	60	24	64	25	69	32
13	Kanchan (C)	110	26	5	68	33	64	27	70	40
14	LT Kanchan (C)	130	29	8	76	35	78	30	70	34
15	CH 1 (C)	120	30	5	72	34	80	45	79	38
16	CTRI Naveena (C)	140	30	8	80	46	82	40	80	38

Table 6 IVT VFC TOBACCO: Morphological characters of the entries of IVT at Kandukur (2023-24)

Entries	Plant height (cm)	Leaf length (cm)	Width (cm)	No. of leaves	Inter nodal length (cm)
IET-100	139	39.3	20.5	23	4.0
IET-101	132	39.5	19	23	3.9
IET-102	117	42.3	22	24	3.6
IET-103	124	42.5	21.1	26	3.9
IET-104	125	48.1	24.7	22	4.3
IET-105	133	43.5	23.1	24	3.9
IET-106	143	47.4	22.6	25	4.0
IET-107	111	49.3	24.3	25	3.6
IET-108	115	43.1	18.9	22	3.6
IET-109	121	45	21.9	25	3.8
IET-110	102	42.1	20.1	21	3.5
IET-111	122	44.8	22.4	25	3.6
Kanchan (C)	129	42.6	20.8	25	3.9
Siri (C)	132	44.0	22.9	26	4.0
CTRI Sulakshana (C)	104	41.0	19.7	23	3.7
CTRI Shresta (C)	101	39.5	17.5	22	3.4

Table 7 IVT VFC TOBACCO: Morphological characters of the entries of IVT at Hunsur (2023-24)

S. No.	Entry name	Plant height (cm)	No. of leaves	Inter-nodal length (cm)	5th leaf length (cm)	5th leaf width (cm)	7th leaf length (cm)	7th leaf width (cm)	9th leaf length (cm)	9th leaf width (cm)
1	IET-100	44.6	14	3.19	42.78	26.4	45.48	22.86	45.92	21.52
2	IET-101	82.2	19.40	4.24	49.86	28.02	50.32	28.18	61.2	34.5
3	IET-102	57.6	18.80	3.06	45.48	29.48	52.86	29.9	51.86	26
4	IET-103	70.2	18.60	3.77	49.92	31.4	50.52	32.04	54.42	29.98
5	IET-104	56.6	18.60	3.04	45.44	27.76	50.08	28.48	51.72	27.54
6	IET-105	71.4	17.40	4.10	49.78	27.64	56.88	34.8	56.46	31.96
7	IET-106	64.2	18.80	3.41	51.78	32.3	54.1	30.92	57.38	35.58
8	IET-107	70.2	21.00	3.34	51.12	29.36	49.56	31.18	59.3	27.9
9	IET-108	72.6	20.00	3.63	48.34	29.76	55.96	30.12	54.34	26.44
10	IET-109	64.4	20.20	3.19	44.86	26.9	52.84	30.86	51.04	27.62
11	IET-110	71.2	19.00	3.75	50.32	29.72	53.54	31.88	56.36	29.76
12	IET-111	54.8	18.00	3.04	40.14	23.36	43.54	23.88	45.76	21.48
13	Kanchan (C)	71.6	18.60	3.85	53.18	25	55.54	28.68	55.52	29.06
14	FCH 222 (C)	73.8	18.60	3.97	54.206	31.5	57.14	28.76	57.38	27.6
15	CH-3(C)	55.6	17.40	3.20	50.2	32.02	54.94	38.54	56.66	28.78
	SE	2.195	0.270	0.110	1.003	0.702	0.980	0.902	1.042	0.946
Range	Minimum	54.800	17.400	3.040	40.140	23.360	43.540	23.880	45.760	21.480
	Maximum	82.200	21.000	4.240	54.206	32.300	57.140	38.540	61.200	35.580

Table 8 IVT VFC TOBACCO: Morphological characters of the entries of IVT at Shivamogga (2023-24)

Entries	Plant height (cm)	Leaf length (cm)	Width (cm)	No. of leaves	Inter nodal length (cm)
IET-100	99.4	47	21	17	4.2
IET-101	101.0	48	21	16	4.8
IET-102	88.7	44	20	14	4.1
IET-103	93.7	42	19	13	4.0
IET-104	96.7	50	22	16	4.6
IET-105	112.2	51	23	17	4.6
IET-106	102.9	49	21	18	4.0
IET-107	96.0	45	20	19	3.2
IET-108	109.0	52	22	18	3.5
IET-109	116.8	49	21	18	4.2
IET-110	94.2	44	19	18	4.1
IET-111	94.8	42	17	15	4.3
Kanchan (C)	92	48	19	18	4.1
Thrupthi (C)	97.3	45	19	14	4.8
Sahyadri (C)	102	46	15	17	4.8
CH-3(C)	85.6	45	19	16	3.9

Table 9 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Rajahmundry (2023-24)

Entries	Natural Condition (Mean No. of plants infected / plot (40 plants)				Artificial Inoculation with
	Caterpillar	Aphids	Leaf Curl	Black Shank	TMV/ CMV
IET-100	Nil	Nil	2	Nil	S
IET-101	Nil	Nil	3	Nil	R
IET-102	Nil	Nil	2	Nil	R
IET-103	Nil	Nil	2	Nil	S
IET-104	Nil	Nil	1	Nil	S
IET-105	Nil	Nil	3	Nil	S
IET-106	Nil	Nil	3	Nil	S
IET-107	Nil	Nil	3	Nil	S
IET-108	Nil	Nil	2	Nil	S
IET-109	Nil	Nil	3	Nil	S
IET-110	Nil	Nil	2	Nil	S
IET-111	Nil	Nil	1	Nil	R
Siri (C)	Nil	Nil	1	Nil	S
CTRI Sulakshana (C)	Nil	Nil	2	Nil	R
CTRI Shresta (C)	Nil	Nil	3	Nil	R
Kanchan (C)	Nil	Nil	2	Nil	S

** R: Resistance; S: Susceptible*

Table 10 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Jeelugumilli (2023-24)

Entries	Natural Condition (Mean No. of plants infected / plot (40 plants)			
	Caterpillar	Leaf Curl	Black Shank	TMV/ CMV
IET-100	-	4	-	2
IET-101	-	4	-	2
IET-102	-	5	-	3
IET-103	2	4	-	-
IET-104	2	4	-	1
IET-105	-	3	-	-
IET-106	2	3	-	1
IET-107	-	2	-	-
IET-108	3	2	-	2
IET-109	-	3	-	-
IET-110	-	2	1	1
IET-111	-	4	-	-
Kanchan (C)	-	5	-	-
LT Kanchan (C)	-	4	-	2
CH 1 (C)	2	4	1	-
CTRI Naveena (C)	2	3	-	-

** R: Resistance; S: Susceptible*

Table 11 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Guntur (2023-24)

Entries	Natural Condition (Mean No. of plants infected / plot (40 plants)				
	Caterpillar	Aphids	Leaf Curl	Black Shank	TMV/ CMV
IET-100	Nil	Nil	0.33	Nil	Nil
IET-101	Nil	Nil	1.66	Nil	Nil
IET-102	Nil	Nil	1.33	Nil	Nil
IET-103	Nil	Nil	0.33	Nil	Nil
IET-104	Nil	Nil	1.66	Nil	Nil
IET-105	Nil	Nil	1.33	Nil	Nil
IET-106	Nil	Nil	1.66	Nil	Nil
IET-107	Nil	Nil	0.33	Nil	Nil
IET-108	Nil	Nil	1.66	Nil	Nil
IET-109	Nil	Nil	0.66	Nil	Nil
IET-110	Nil	Nil	1.00	Nil	Nil
IET-111	Nil	Nil	1.66	Nil	Nil
Siri (C)	Nil	Nil	1.33	Nil	Nil
CTRI Sulakshana (C)	Nil	Nil	0.66	Nil	Nil
CTRI Shresta (C)	Nil	Nil	0.33	Nil	Nil
Kanchan (C)	Nil	Nil	1.00	Nil	Nil

** R: Resistance; S: Susceptible*

Table 12 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Hunsur (2023-24)

Entries	Black shank	Leaf Curl	TMV	CMV	RKI
IET-100	2	4	-	-	2.33
IET-101	6	3	-	-	3.67
IET-102	8	7	-	1	2.00
IET-103	3	4	-	-	1.30
IET-104	-	1	1	3	1.67
IET-105	3	3	-	-	2.33
IET-106	-	5	-	-	1.33
IET-107	-	2	-	4	1.33
IET-108	-	4	-	2	1.33
IET-109	-	7	-	2	2.00
IET-110	-	5	-	3	3.00
IET-111	-		-	-	2.33
Kanchan (C)	2	4	-	3	2.33
FCH 222 (C)	-	5	-	6	1.00
CH 3 (C)	2	4	-	4	1.67

Table 13 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Shivamogga (2023-24)

Entries	TMV	Black Shank	*Spodopteralitura*	White fly
IET-100	4	4	0.3	3.0
IET-101	3	4	0.1	2.9
IET-102	4	4	0.2	2.2
IET-103	4	2	0.2	2.1
IET-104	2	3	0.1	3.1
IET-105	2	2	0.3	2.9
IET-106	3	3	0.4	1.8
IET-107	2	3	0.1	1.7
IET-108	3	2	0.2	1.6
IET-109	4	4	0.3	3.0
IET-110	4	4	0.4	3.1
IET-111	4	4	0.1	3.2
Kanchan (C)	4	4	0.2	3.1
Thrupthi (C)	3	4	0.3	3.4
Sahyadri (C)	2	2	0.1	2.9
CH3	3	4	0.4	3.3

Table 14 IVT VFC TOBACCO: Quality parameters of IVT entries at Kandukur (2023-24)

Entries	Nicotine (%)	Reducing Sugars (%)
IET-100	1.6	10.2
IET-101	1.6	8.6
IET-102	2.4	11.4
IET-103	1.7	12.6
IET-104	1.8	10.0
IET-105	1.9	9.6
IET-106	1.8	11.7
IET-107	1.4	10.6
IET-108	1.4	11.5
IET-109	1.5	10.9
IET-110	1.2	14.6
IET-111	1.3	10.2
Kanchan (C)	1.7	10.5
Siri (C)	1.6	10.5
CTRI Sulakshana (C)	2.0	10.7
CTRI Shresta (C)	1.2	14.3

Table 15 IVT VFC TOBACCO: Quality parameters of the entries of IVT at Hunsur (2023-24)

Entries	Nicotine		R. Sugars		Chlorides	
	X	L	X	L	X	L
IET-100	0.79	1.22	15.89	12.05	1.84	2.33
IET-101	1.02	0.78	16.93	17.24	2.42	1.65
IET-102	1.71	1.74	16.57	18.87	2.25	1.86
IET-103	1.19	1.63	15.01	11.75	2.49	2.33
IET-104	1.34	1.29	17.93	16.72	1.44	1.57
IET-105	0.99	1.22	18.02	8.79	2.41	2.14
IET-106	0.80	0.78	18.18	16.12	1.68	1.66
IET-107	0.92	0.72	15.95	18.17	2.57	1.16
IET-108	0.68	0.68	16.85	18.68	1.91	1.44
IET-109	1.21	1.24	15.43	15.30	2.42	2.30
IET-110	0.96	1.17	13.94	16.34	2.26	1.53
IET-111	0.65	0.88	17.95	17.87	2.42	2.33
Kanchan (C)	0.67	0.85	21.50	17.89	1.88	1.55
FCH 222 (C)	0.78	0.62	18.98	20.36	2.16	1.74
CH-3 (C)	0.71	0.93	18.54	18.52	1.75	1.76

JEELUGUMILLI

Project No.: VFJBRC 3.2

Research project title	**Advanced Hybrid Trial-II on FCV tobacco**
Objectives	▪ To assess further the yield performance of different identified lines under AHT-II ▪ To record the pest and disease incidence in identified FCV lines under AHT-II ▪ To analyze the chemical components (chemistry) of above identified lines
Investigators	K. Sarala & K. Prabhakara Rao
Year of start	2023-24
Year of completion	2023-24
Location	ICAR-CTRI Research Station, Jeelugumilli

Treatments	:	4 (1+3)	Spacing	:	1.0 x 0.6 m
Replications	:	Six	Plot size	:	2.0 x 12.0 m
Design	:	R B D			

RESULTS

Yield: One entry, FCRH-13 was tested in RBD along with three checks following standard cultural practices (Table 1 VFRJBRC 3.2). Significant differences are observed among the entries for cured leaf and grade index. Entries, FCRH-13 recorded higher green leaf (13653 kg/ha), cured leaf yields (2418 kg/ha) and grade index values (1655) than controls. The grade Index in the entry FCRH-13 found to be significantly superior to the best control, CH-1.

Morphological characterization: The tested entries viz., FCRH-13, Kanchan, LT-Kanchan and CH-1 showed differences for plant height, number of leaves, inter-nodal length and leaf size (Table 2 VFJBRC 3.1).

Disease /Pest incidence: Mean incidence of major pests and diseases observed across replications under natural conditions is given at Table 3 VFRJBRC 3.2. Caterpillar and aphid incidence was not recorded in the trial. Black shank recorded in CH-1. Higher leaf curl infected plants observed in Kanchan followed by LT Kanchan. Least curl observed in CH-1 followed by FCRH-13. Black shank and TMV/CMV was not recorded in FCRH-13 and CH-1. Kanchan and LT Kanchan recorded one each of Black shank and TMV/CMV.

Chemical quality: The chemical quality parameters viz., nicotine and reducing sugars of tested entries in both 'X' and 'L' positions are given at Table 4. FCRH-13 and CH-1 recorded slightly higher nicotine values. FCRH-13 recorded higher reducing sugars. (Table 4 VFRJBRC 3.2). Chlorides of are slightly reduced in FCRH-3 than other lines.

Pooled Analysis: In the pooled analysis of data of two years (2022-24), significant differences are observed among the entries for all the three characters viz., green leaf, cured leaf and grade index (Table 5). The entry, FCRH-13 recorded higher green leaf (12653 kg/ha), cured leaf yields (2188 kg/ha) and grade index values (1514) than controls. The grade Index in the entry FCRH-13 found to be significantly superior to the best control, Kanchan. Based on the pooled data, due to non-significant cured leaf yield, the entry, FCRH-13 is **not recommended** for further evaluation.

Salient findings/Achievements

- During 2023-24, the lone entry (FCRH-13) tested recorded higher green leaf (13653 kg/ha), cured leaf yields (2418 kg/ha) and grade index values (1655) than controls. The grade Index in the entry FCRH-13 found to be significantly superior to the best control, CH-1.
- In the pooled analysis of data of two years (2022-24), the entry, FCRH-13 recorded higher green leaf (12653 kg/ha), cured leaf yields (2188 kg/ha) and grade index values (1514) than controls. The grade Index in the entry FCRH-13 found to be significantly superior to the best control, Kanchan.

Conclusion: Based on the pooled data, due to non-significant cured leaf yield, the entry, FCRH-13 is not recommended for further evaluation.

Table 1 VFJBRC 3.2: Yield characters of AHT-II entries during 2023-24

Entries	Yield (kg/ha)		
	Green leaf	Cured leaf	Grade Index
FCRH-13	13653	2418	1655*
Kanchan (C)	12250	2160	1342
LT Kanchan (C)	11042	1950	1256
CH-1 (C)	11667	2040	1363
Grand mean	12153	2142	1404
S.Em. ±	539	88	59
C.D. at 5%	1624	265	179
C.V. %	10.86	10.04	10.37

Table 2 VFJBRC 3.1: Morphological characters of the entries of AHT-II at Jeelugumilli (2023-24)

Entries	Plant Height (cm)	No. of Leaves	Inter-nodal Length (cm)	9th Leaf (cm)		10th Leaf (cm)		11th Leaf (cm)	
				Length	Width	Length	Width	Length	Width
FCRH-13	140	27	3	53	24	63	30	64	38
Kanchan (C)	120	25	4	62	30	65	28	70	34
LT Kanchan (C)	120	29	4	64	28	68	26	64	24
CH-1 (C)	130	27	5	68	22	69	30	70	26

Table 3 VFJBRC 3.1: Pest and disease incidence in AHT-II entries (2023-24)

Entries	Mean No. of plants infected/plot (40 plants)*				
	Caterpillar	Leaf Curl	Black Shank	TMV/ CMV	Aphids
FCRH-13	-	4	-	-	-
Kanchan (C)	-	9	1	1	-
LT Kanchan (C)	-	6	1	1	-
CH-1 (C)	-	3	-	-	-

Table 4 VFJBRC 3.1: Chemical quality parameters of entries in AHT-II (2023-24)

Entries	Nicotine (%)		Reducing Sugars (%)		Chlorides(%)	
	'X' position	'L' position	'X' position	'L' position	'X' position	'L' position
FCRH-13	3.12	4.13	11.11	8.66	1.13	1.28
Kanchan (C)	2.45	3.33	8.57	6.86	1.26	1.45
LT Kanchan (C)	3.02	3.20	7.19	6.05	1.63	1.57
CH-1 (C)	3.80	4.35	7.89	8.34	1.41	1.58

Table 5 VFJBR 3.2: Performance of advanced lines in AHT-II (2023-24) Pooled data (yield in kg/ha)

Treatments	Green Leaf	Cured Leaf	Grade Index
FCRH-13	12653	2188	1514*
Kanchan (C)	11950	2057	1353
LT-Kanchan (C)	10788	1863	1243
CH-1(C)	10823	1890	1304
G. Mean	11553	1999	1354
S.Em. ±	26.48	49.86	38.92
C.D. at 5%	943	144	112
C.V. %	9.79	8.64	9.96
Seasons			
2022-23	10953	1856	1304
2023-24	12152	2142	1403
S.Em. ±	389	71.23	63.25
C.D. at 5%	NS	224	NS
C.V. %	16.5	17.45	22.89
Seasons X treatments			
S.Em. ±	462	70.51	55.04
C.D. at 5%	NS	NS	159

*Significantly superior than better control, Kanchan

HUNSUR

Project No.: VFHBRC 2 (Repeat)

Research project title	**Initial Varietal Trial on FCV tobacco (R)**
Objectives	▪ To evaluate advanced breeding lines for their suitability to KLS based on yield and quality
Investigators	Nanda C
Year of start	2023-24
Year of completion	2023-24
Location	ICAR-CTRI Research Station, Hunsur

Treatments : 8 (5+3) Spacing : 1.0 x 0.55 m
Replications : Five Plot size : 2.0 x 6.6 m
Design : RBD

RESULTS

In the Initial varietal trial (Repeat), five entries *viz.*, FCR-71, FCR-72, FCR-73, FCR-74 and FCJ-42 were evaluated for their yield potential. Morphological characters like plant height, number of leaves, intermodal length, leaf length and width of 5th, 7th and 9th leaf were recorded. Observations on the natural incidence of pest and diseases were recorded. Cured leaf quality parameters (Nicotine, Reducing sugars and chlorine) were estimated. Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha (Table 1 VFHBRC 2R). Results indicated that none of the entries were superior to any of the checks.

Salient findings/Achievements:

- None of the entries were found superior to checks
- Higher incidence of black shank was observed among the tested lines
- The leaf quality parameters viz., Nicotine and Reducing sugars were well within the prescribed limits in all the entries tested

Conclusion: None of the five tested entries were promoted to AVT-I

Table 1 VFHBRC 2R: Yield characters in kg/ha of the entries of IVT (R) (2023-24)

Entries	Green leaf	Cured leaf	Bright leaf	TGE
FCR-71	7998	1170	710	777
FCR-72	7664	1073	573	697
FCR-73	7938	1304	762	897
FCR-74	11163	1477	1107	1119
FCJ-42	11265	1486	951	1294
Kanchan (C)	16248	2240	1329	1543
FCH 222 (C)	16957	2170	1198	1434
CH-3 (C)	12532	1579	1031	1151
S.Em ±	746	134	93	99
C.D. at 5%	2262	406	282	300
C.V. (%)	11.26	14.85	16.78	15.38

Table 2 VFHBRC 2R: Morphological characters of the entries of IVT (R) (2023-24)

Entries	Plant Height (cm)	No. of Leaves	Inter-nodal Length (cm)	5th Leaf (cm)		7th Leaf (cm)		9th Leaf (cm)	
				Length	Width	Length	Width	Length	Width
FCR-71	63.2	18.00	3.51	52.4	30.34	53.9	34.04	53.56	32.18
FCR-72	69.4	18.80	3.69	50.96	29.46	57.2	30.8	56.84	31.46
FCR-73	68.6	19.20	3.57	50.68	35.12	51.44	34.66	52.94	37.2
FCR-74	62.6	18.80	3.33	53.08	27.28	52.5	28.6	51.34	27.44
FCJ-42	66.8	19.20	3.48	56.52	34.48	58.76	33.54	55.7	33.26
Kanchan (C)	61	18.40	3.32	50.98	27.96	58.60	30.14	58.86	27.16
FCH 222 (C)	68.8	19.00	3.62	55.70	31.30	57.50	31.58	57.8	34.10
CH-3 (C)	69.6	19.00	3.66	49.54	29.9	55.28	32.56	61.48	34.38
SE	1.222	0.146	0.050	0.881	0.997	0.991	0.739	1.190	1.218
Minimum	61.00	18.00	3.32	49.54	27.28	51.44	28.60	51.34	27.16
Maximum	69.60	19.20	3.69	56.52	35.12	58.76	34.66	61.48	37.20

Table 4 VFHBRC 2R: Chemical quality parameters (%) of the entries of IVT (R) (2023-24)

Entries	Nicotine		R. Sugars		Chlorides	
	X	L	X	L	X	L
FCR-71	1.12	0.73	13.34	15.94	1.73	2.15
FCR-72	1.24	1.41	12.56	8.95	2.41	1.54
FCR-73	1.04	1.43	13.85	13.13	1.15	1.47
FCR-74	1.29	0.65	13.81	19.72	1.40	1.30
FCJ-42	0.89	1.59	18.08	13.39	2.11	1.19
Kanchan (C)	0.95	1.79	14.51	11.48	1.24	1.66
FCH 222 (C)	0.80	1.61	16.04	11.10	1.29	1.46
CH 3 (C)	0.97	1.14	12.34	15.59	1.33	1.08

Table 5 VFHBRC 2R: Incidence of pest and diseases in the entries of IVT (R) during 2023-24

Entries	Disease data				
	CMV	TMV	Black shank	LC	RKI
FCR-71	-	-	20	2	1.33
FCR-72	-	4	8	4	2.00
FCR-73	-	-	18	1	1.33
FCR-74	-	-	16	-	1.33
FCJ-42	-	-	12	2	3.67
Kanchan (C)	-	-	-	1	2.00
FCH 222 (C)	-	-	-	2	2.00
CH 3 (C)	-	-	5	2	2.33

Project No.: VFHBRC 3.2

Research project title	**Advanced Hybrid Trial-II on FCV tobacco**
Objectives	▪ To evaluate two hybrid entries for yield and quality in KLS against checks Kanchan, FCH 222 and CH-3.
Investigators	Nanda C
Year of start	2023-24
Year of completion	2023-24
Location	ICAR-CTRI Research Station, Hunsur

Treatments	:	5 (2+3)	Spacing	:	1.0 x 0.55 m
Replications	:	Five	Plot size	:	2.0 x 6.6 m
Design	:	RBD			

RESULTS

In Advanced Hybrid Trial-II, two hybrids, FCRH-13 and FCHH2 were evaluated against checks (Kanchan, FCH 222 and CH-3) in a RBD trial with five replications. Morphological characters like plant height, number of leaves, intermodal length, leaf length and width of 5th, 7th and 9th leaf were recorded. Observations on the natural incidence of pest and diseases were recorded. Cured leaf quality parameters (Nicotine, Reducing sugars and Chlorine) were estimated. Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha.

Data analysis indicated that the hybrid entry FCHH-2 recorded significantly higher green leaf yield (17514 kg/ha), cured leaf yield (2433 kg/ha) and TGE (1718) over the better hybrid check CH-3 with 21% improvement in cured leaf over the checks. Pooled analysis of the data for the two years (2022-236 & 2023-24) also indicated that hybrid entry FCHH-2 was significantly better than all the checks in terms of all the four yield parameters (Table 1 VFHBRC 3.2). It has recorded 20 to 23% improvement in yield over the hybrid check CH-3.

Salient findings/Achievements

- Hybrid entry FCHH 2 recorded significantly higher Cured leaf yield, bright leaf yield and TGE over check CH 3 in the second year of the trial
- Pooled analysis of two years data also revealed the superiority of FCHH 2 over the checks
- Leaf quality parameters such as Nicotine and Reducing sugars were well within the prescribed limits in all the entries tested.

Conclusion: Based on the pooled analysis, the hybrid entry FCHH-2 is recommended for further evaluation

Table 1 VFHBRC 3.2: Yield characters in kg/ha of the entries of AHT-II (2023-24)

Entries	Green leaf	Cured leaf	Bright leaf	TGE
FCRH-13	16145	2202	1431	1553
FCHH-2	17514* (25 F, 27C)	2433* (21 F&C)	1468	1718* (30 F, 20C)
Kanchan (C)	13685	1965	1205	1366
FCH 222 (C)	14027	2015	1103	1320
CH-3 (C)	13774	2015	1286	1435
S.Em ±	823	97	100	60
C.D. at 5%	2468	290	NS	180
C.V. (%)	12.25	10.14	17.16	9.06

Table 2 VFHBRC 3.2: Morphological characters of the entries of AHT-II (2023-24)

Entries	Plant Height (cm)	No. of Leaves	Inter-nodal Length (cm)	5th Leaf (cm)		7th Leaf (cm)		9th Leaf (cm)	
				Length	Width	Length	Width	Length	Width
FCRH-13	55	17.4	3.16	46.98	26.66	56.08	27.44	57.26	26.72
FCHH-2	57	17.8	3.20	55.04	34.24	62.62	34.42	63.22	35.08
Kanchan (C)	72.8	20.4	3.57	57.4	27.24	59.92	25.42	62.44	26.66
FCH 222 (C)	58.4	17.8	3.28	53.48	31.24	54.8	32.02	58.65	34.08
CH-3 (C)	60.28	18.36	3.28	51.56	29.85	56.78	29.26	57.25	31.12

Table 3 VFHBRC 3.2: Pooled data (yield in kg/ha) on performance of advanced lines in AHT-II (2023-24)

Treatments	Green Leaf	Cured Leaf	Grade Index	TGE
FCRH-13	14349	1900	1284	1383
FCHH-2	16010* (21 K, 23C)	2170* (16 K, 20C)	1528* (22 K, 23C)	1633* (24 K, 23C)
Kanchan (C)	13194	1867	1250	1313
FCH 222 (C)	12852	1805	1143	1265
CH-3(C)	12943	1806	1237	1330
S.Em. ±	579	74	66	52
C.D. at 5%	1604	204	182	145
C.V. %	13.19	12.21	16.16	11.91
Seasons				
2021-22	12711	1689	1278	1290
2022-23	15029	2130	1299	1478
S.Em. ±	505	68	62	52
C.D. at 5%	1646	221	NS	168
Seasons X Treatments				
S.Em. ±	818	104	93	74
C.D. at 5%	NS	NS	NS	NS

* Significant at 5%,

Figures in parenthesis indicate percent improvement over check CH-3 and Kanchan

Table 4 VFHBRC 3.2: Incidence of pest and diseases in the entries of AHT-II during 2023-24

Entries	Disease data				
	CMV	TMV	Black shank	LC	RKI
FCRH-13	-	-	-	2	1.00
FCHH 2	-	-	-	2	2.33
Kanchan (C)	1	-	6	2	1.33
FCH 222 (C)	-	2	-	-	3.00

Table 5 VFHBRC 3.2: Chemical quality parameters (%) of the entries of AHT-II during 2023-24

Entries	Nicotine		R. Sugars		Chlorides	
	X	L	X	L	X	L
FCRH-13	1.00	1.39	13.23	14.36	1.64	1.37
FCHH-2	0.87	1.60	12.54	11.97	1.95	1.43
Kanchan (C)	1.05	1.43	11.14	11.07	1.30	1.85
FCH 222 (C)	0.94	1.13	16.29	10.72	1.74	1.85
CH 3 (C)	0.84	1.75	13.97	10.34	1.87	1.50

Project No: OFT

Research project title	On Farm Trial on FCV tobacco
Investigators	Nanda C
Year of start	2023-24
Year of completion	2023-24
Location	ICAR-CTRI Research Station, Hunsur

On farm trials with promising line FCH-2(FCH 248) and Kanchan were successfully conducted at twelve villages. The line recorded an average of 26% improvement in cured leaf yield over the popular check Kanchan.

Table OFT: On farm testing of FCH-2 in KLS

S. No.	Village	Farmer	Cured leaf yield		% increase over Kanchan
			FCH-2 (FCH 248)	Kanchan	
1.	Mantikoppalu	Sri. Devraju S/o Hucchegowda TBGRNo. 3/337/051	800	700	14
2.	Somanahalli	Sri. Chethan Kumar S/o Dharmaraju TBGRNo. 3/349/066	1000	800	25

S. No.	Village	Farmer	Cured leaf yield		% increase over Kanchan
			FCH-2 (FCH 248)	Kanchan	
3.	Jadaganakoppalu	Sri. Devraja S/o Chikkagowdru TBGRNo. 3/321/065	800	640	20
4.	Harave, Periyapatna (No irrigation)	Sri. Puttaraja S/o Rajegowda TBGRNo.04	800	550	31
5.	Harave, Periyapatna	Sri. Nagegowda S/o Dasegowda TBGRNo.04	1000	800	25
6.	HLG Koppalu, Ramanathpura (No rains)	Sri Dharma S/o Ningegowda TBGRNo.7/027/403	800	600	25
7.	Agarnahalli	Sri Siddaramegowda S/o Siddegowda TBGRNo.64/312/049	1200	950	26
8.	Agarnahalli	Sri Raju S/o Annaiah TBGRNo.64/312/069	900	800	14
9.	Rangaiahna koppalu	Smt.Lakshmamma W/o. Krishnegowda TBGRNo.3/381/002	1000	800	20
10.	Habbanakuppe	H.L. Raghu Kumar S/o. lt H.R.Lingaraju TBGRNo.61/102/026	800	550	31
11.	Harave, Periyapatna	Nayankumar H.R. S/o Ravi TBGRNo.4/087/011	900	700	22
12.	Guruvaiahna koppalu	Smt.Leelamma W/o. Appajigowda TBGRNo. 5/010/019	1000	850	15
Mean			917	728	26

SHIVAMOGGA

Project No.: VFSBRC 2 (Repeat)

Research project title	**Initial Varietal Trial on FCV tobacco (R)**
Objectives	▪ To identify high yielding good quality FCV tobacco varieties for zone 7 ▪ To assess the yield performance of different lines
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2023-24
Year of completion	2023-24
Location	ZAHRS, Shivamogga

Treatments : 8 (5+3) Spacing : 1.0 x 0.55 m
Replications : Five Plot size : 2.0 x 6.6 m
Design : RBD

RESULTS

Five entries *viz.*, FCR-71, FCR-72, FCR-73, FCR- 74 and FCJ-42 were evaluated with three checks *viz.*, Thrupthi, Kanchan and Sahyadri for the green leaf yield (GLY), cured leaf yield (CLY) and top grade equivalent (TGE) in a replicated trial. Results indicated that FCR-72 and FCR-73 recorded significantly higher GLY, CLY and TGE over the checks. It was observed that FCR-72 has recorded 37% higher cured leaf yield (1408 kg/ha) and FCR-73 has recorded 55% higher cured leaf yield (1591 kg/ha) over the best check Sahyadri and they have recorded green leaf yield of 9037kg/ha and 10024 kg/ha respectively.

Salient Findings/Achievements:

- Among the five entries with checks, FCR- 72 and FCR- 73 have recorded higher GLY, CLY and TGE over the checks
- FCR-72 recorded 37% higher CLY over the best check Sahyadri
- FCR-73 recorded 55% higher CLY over the best check Sahyadri

Conclusion: The entries FCR-72 and FCR-73 were proposed for advancing to AVT-I

Table 1 VFSBRC 2R: Yield characters in kg/ha of the entries of IVT (R) (2023-24)

Entries	Green leaf	Cured leaf	TGE
FCR-71	5426	837	669
FCR-72	9037*	1408*(37%)	1266*
FCR-73	10024*	1591*(55%)	1272*
FCR-74	5768	817	653
FCJ-42	3677	571	456
Thrupthi (C)	5351	804	643
Kanchan (C)	4368	627	439
Sahyadri (C)	6623	1022	817
S.Em ±	466	73	31
C.D. at 5%	1413	222	94
C.V. (%)	12.84	13.24	7.68

Table 2VFSBRC 2R: Incidence of pest and diseases in the entries of IVT (R) during 2023-24

Entries	*Spodoptera litura*	Whitefly	Black shank	TMV
FCR-71	0.2	4.9	4	4
FCR-72	0.3	5.3	4	3
FCR-73	0.1	5.4	4	4
FCR-74	0.4	3.2	3	4
FCJ-42	0.2	3.1	3	3
Thrupthi (C)	0.2	2.9	3	3
Kanchan (C)	0.1	3.3	2	2
Sahyadri (C)	0.3	2.8	2	3

*Figures in parenthesis indicate percent increase over check

Project No.: VFSBRC 4.1

Research project title	Station Varietal Trial-I on FCV tobacco
Objectives	▪ To identify high yielding good quality FCV tobacco varieties for zone 7
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2023-24
Year of completion	2023-24
Location	AINP(T), ZAHRS, Navile, Shivamogga

Treatments : 13 (10+3) Spacing : 90 x 60 cm
Replications : Three Plot size : 3.6 x 6 m
Design : RBD
Fertilizers : 40:30:80 kg N:P:K /ha
DOS: 05-05-2023 DOP: 05-07-2023

RESULTS

Ten entries were evaluated for the green leaf yield (GLY), cured leaf yield (CLY) and top grade equivalent (TGE) in a replicated trial along with the three checks *viz.*, Thrupthi, Kanchan and Sahyadri. Among the ten entries *viz.*, FCS23-1, FCS23-2, FCS23-3, FCS23-4, FCS23-5, FCS23-6, FCS23-7, FCS23-8, FCS23-9 and FCS23-10 with three checks (Thrupthi, Kanchan and Sahyadri) tested, two entries *viz.*, FCS23-1 and FCS23-2 has recorded significantly higher GLY, CLY and TGE over the checks. FCS23-1 recorded 36% higher CLY (1887 kg/ha) and FCS23-2 recorded 29% higher CLY (1787 kg/ha) over the best check Sahyadri. They recorded GLY of 15183 kg/ha and 15128 kg/ha, respectively and TGE of 1506 and 1430, respectively.

Salient findings/Achievements

- Among the ten entries with checks, FCS23-1andFCS23-2has recorded higher GLY, CLY and TGE over the checks.
- FCS23-1 recorded 36% higher CLY over the best check Sahyadri
- FCS23-2 recorded 29% higher CLY over the best check Sahyadri

Conclusion: The entries FCS23-1and FCS23-2 were found to be superior

Table 1 VFSBR 4.1: Evaluation of entries for GLY, CLY and TGE in station trial

Entries	GLY	CLY	TGE
	kg/ha		
FCS23-1	15183*	1887*(36%)	1506*
FCS23-2	15128*	1787*(29%)	1430*
FCS23-3	7079	933	747
FCS23-4	6329	778	626
FCS23-5	11352	1378	1103
FCS23-6	8976	1181	945
FCS23-7	5284	635	508
FCS23-8	6869	845	676
FCS23-9	6526	911	728
FCS23-10	6586	799	639
Thrupthi (C)	9189	1158	930
Kanchan (C)	11478	1330	1194
Sahyadri (C)	12437	1381	1243
S.Em. ±	912	127.29	104
C.D. at 5%	2663	371.54	306
C.V. (%)	16.78	19.11	19.00

*Figures in the parenthesis are increase over Thrupthi

Table 2 VFSBRC 4.1: Incidence of pest and diseases in station trial during 2023-24

Entries	*Spodoptera litura*	Whitefly	Black shank	TMV
FCS23-1	0.2	2.1	2	1
FCS23-2	0.4	4.1	3	2
FCS23-3	0.3	4.2	1	2
FCS23-4	0.2	2.0	2	3
FCS23-5	0.1	1.9	3	1
FCS23-6	0.3	5.3	1	3
FCS23-7	0.1	1.8	3	2
FCS23-8	0.2	2.3	2	1
FCS23-9	0.4	2.1	1	3
FCS23-10	0.2	2.4	1	2
Thrupthi (C)	0.2	3.1	2	1
Kanchan (C)	0.1	2.9	1	2
Sahyadri (C)	0.3	2.2	2	1

*Figures in parenthesis indicate percent increase over check

Project No.: VFSBRC 4.2

Research project title	Station Varietal Trial-II on FCV tobacco
Objectives	▪ To identify high yielding good quality FCV tobacco varieties for zone 7
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2021-22
Year of completion	2023-24
Location	AINP(T), ZAHRS, Navile, Shivamogga

Treatments	:	8 (5+3)	Spacing	:	90 x 60 cm
Replications	:	Three	Plot size	:	3.6 x 6 m
Design	:	RCBD			
Fertilizers	:	40:30:80 kg N:P:K /ha			
DOS: 05-05-2023			DOP: 04-07-2023		

RESULTS

Five entries were evaluated for the green leaf yield (GLY), cured leaf yield (CLY) and top grade equivalent (TGE) in a replicated trial along with the three checks *viz.*, Thrupthi, Kanchan and Sahyadri. Among the five entries *viz.*, TB-70 x TB-102 (sel-2), TB-100 x TB-102 (sel-5),Tobios-6 x Sahyadri (sel-8), Tobios -5 x Kanchan (sel-1), NLST-2 x FCH-221 (sel-1) with three checks (Thrupthi, Kanchan and Sahyadri) tested, two entries *viz.*, TB-100 x TB-102 (sel-5) and NLST-2 x FCH-221 (sel-1) has recorded significantly higher GLY, CLY and TGE over the checks. TB-100 x TB-102 (sel-5) recorded 42% higher CLY (1634 kg/ha) and NLST-2 x FCH-221 (sel-1) recorded 38% higher CLY (1590 kg/ha) over the best check Sahyadri. They recorded GLY of 11860 kg/ha and 10569 kg/ha, respectively and TGE of 1470 and 1266, respectively.

Salient findings/Achievements

- Among the five entries with checks, TB-100xTB-102 (sel-5) and NLST-2 x FCH-221 (sel-1) has recorded higher GLY, CLY and TGE over the checks.
- TB-100xTB-102 (sel-5) recorded 42% higher CLY over the best check Sahyadri
- NLST-2 x FCH-221 (sel-1) recorded 38% higher CLY over the best check Sahyadri

Conclusion: The entries, TB-100 x TB-102 (sel-5) and NLST-2 x FCH-221 (sel-1) were promoted for testing under IVT during 204-25

Table 1 VFSBR 4.2: Evaluation of entries for GLY, CLY and TGE in station trial

Entries	GLY	CLY	TGE
	kg/ha		
TB- 70 xTB-102 (sel-2)	5947	875	701
TB-100 xTB-102 (sel-5)	11860*	1634* (42%)	1470*
Tobios-6 x Sahyadri (sel-8)	7206	988	791
Tobios -5 x Kanchan(sel-1)	5708	772	620
NLST-2 x FCH-221 (sel-1)	10569*	1590* (38%)	1266*
Thrupthi (C)	7688	1019	821
Kanchan (C)	6861	975	780
Sahyadri (C)	8007	1149	923
S.Em. ±	797	120	96
C.D. at 5%	2416	363	291
C.V. (%)	17	18.36	18

*Figures in the parenthesis are increase over Thrupthi

Table 2 VFSBRC 4.2: Incidence of pest and diseases in station trial during 2023-24

Entries	*Spodoptera litura*	Whitefly	Black shank	TMV
TB- 70 xTB-102 (sel-2)	0.7	6.3	4	3
TB-100 xTB-102 (sel-5)	0.6	5.6	4	4
Tobios-6 x Sahyadri (sel-8)	0.2	5.3	4	4
Tobios -5 x Kanchan(sel-1)	0.3	3.2	2	3
NLST-2 x FCH-221 (sel-1)	0.1	3.1	3	2
Thrupthi (C)	0.2	2.9	3	2
Kanchan (C)	0.4	2.8	2	3
Sahyadri (C)	0.2	3.2	3	2

*Figures in parenthesis indicate percent increase over check

Project No.: BULK TRIAL (BT)

Research project title	Bulk Trial on FCV tobacco
Objectives	▪ To know the performance of the entry in a larger area
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2022-23
Year of completion	2022-23
Location	AINP(T), ZAHRS, Navile, Shivamogga

Treatments : 6 (3+3) Spacing : 90 x 60 cm
Plot size : 500 m^2 Fertilizers : 40:30:80 kg N:P:K/ha

DOS: 05-05-2022 DOP: 04-07-2022

RESULTS

Three entries, FCS-4, FCH–1 and FCH-2 were evaluated for their yield performance in larger area and all the three entries have recorded higher GLY (8557kg/ha, 7770 kg/ha and 9949 kg/ha, respectively), CLY (1225 kg/ha, 1024 kg/ha and 1426 kg/ha, respectively) and TGE (978, 823 and 1140, respectively) over three checks Sahyadri, Kanchan and Thrupthi.

Salient findings/Achievements

- All the three entries, FCS-4, FCH-1 and FCH-2 performed better in the bulk trial

Table 1 BT: Evaluation of entries for GLY, CLY and TGE in Bulk trial (2023-24)

Entries	GLY	CLY	TGE
	kg/ha		
FCS-4	8557	1225	978
FCH – 1	7770	1024	823
FCH – 2	9949	1426	1140
Thrupthi (C)	6273	906	730
Kanchan (C)	5700	822	660
Sahyadri (C)	6750	956	770

*Figures in the parenthesis are increase over Thrupthi

Table 2 BT: Incidence of pest and diseases in Bulk trial (2023-24)

Entries	*Spodoptera litura*	Whitefly	Black shank	TMV
FCS-4	0.2	2.0	1	2
FCH – 1	0.3	1.9	2	1
FCH – 2	0.2	2.1	1	3
Thrupthi (C)	0.4	1.8	2	2
Kanchan (C)	0.3	2.0	1	1
Sahyadri (C)	0.4	2.1	3	2

*Figures in parenthesis indicate percent increase over check

Project No.: VFSBR 5

Research project title	Evaluation and characterization of FCV tobacco germplasm
Objectives	▪ To know the yield contributing characters of the entries
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2022-23
Year of completion	2023-24
Location	AINP(T), ZAHRS, Navile, Shivamogga

Treatments : 28 Plot size : 3.6 × 6.0 m
Design : RCBD Date of sowing : 30-04-2022
Replications : Two Fertilizer dose : 40:30:80 N:P:K (kg/ha)
DOS: 15-05-2023 DOP: 20-07-2023

S. No	Genotypes	S.No	Genotypes
1	VA-770	15	YELLOW SPECIAL-A
2	V-373[SER]	16	EC-554926
3	NC-2326	17	EC-554930
4	Q-46	18	COKER-176
5	RHOMAS-7	19	NC-37-NF
6	SPEIGHT-G-103	20	NC-729
7	NC-940	21	Delcrest-66
8	REAMS-744	22	A-23
9	RG-17	23	Olior-10
10	SPEIGHT-G-152	24	VA-115
11	SPEIGHT-G-172	25	VA-4219
12	SPEIGHT-G-178	26	Thrupthi
13	SPEIGHT-NF-3	27	Kanchan
14	VA-119	28	Sahyadri

RESULTS

The experiment was vitiated due to sever moisture and heat stress.

Project No.: VFSBR 6

Research project title	Back cross breeding programme: Conversion of Thrupthi, Sahyadri, Tobios-6, Bhavya & FCH-222 into male sterile lines
Objectives	▪ To convert and maintain male sterile lines
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2015
Year of completion	2023
Location	AINP(T), ZAHRS, Navile, Shivamogga

Date of sowing : 26-05-2023 Date of planting : 12-07-2023

RESULTS

Lines were maintained but could not successfully carry out the crossing programme and further maintenance could not be taken up as there is no seed available for further continuation.

Table VFSBR 6: Male sterile lines maintained

MS1 TOBIOS -6	TOBIOS -6
MS1 FCH 222	FCH 222
MS1 BHAVYA	BHAVYA
MS1 SAHYADRI	SAHYADRI
MS TOBIOS -6	TOBIOS -6
MS2 FCH 222	FCH 222

MS2 BHAVYA	BHAVYA
MS2 SAHYADRI	SAHYADRI
MS2 TOBIOS -6	TOBIOS -6
MS THRUPTI	THRUPTI

Project No.: VFSBR 7

Research project title	New crosses & early generation studies
Objectives	▪ Development of resistant lines for black shank and TMV and for other agronomic traits.
Investigators	Shashikala S Kolakar, T.M.Soumya &Prashantha C
Year of start	2022
Year of completion	Long term
Location	AINP(T), ZAHRS, Navile, Shivamogga

RESULTS

Three F_3 populations were successfully maintained.

The crosses are in F_3 generation

1. Sahyadri x FCR 68
2. Sahyadri x CTRI Sulakshana
3. Sahyadri x VT1158

Project No.: VFSBR 8

Research project title	Development of high yielding and quality hybrids in FCV tobacco using male sterility system
Objectives	▪ Use of converted male sterile lines for development of hybrids for zone 7 (KLS region)
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2021
Year of completion	2023
Location	AINP(T), ZAHRS, Navile, Shivamogga

Treatments	: 07	Spacing	: 90 x 60 cm
Design	: RCBD	Plot size	: 3.6 × 6.0 m
Replications	: Three	Date of sowing	: 24-05-2023
Date of planting	: 10-07-2023	Fertilizer dose	: 40:30:80 N:P:K (kg/ha)

RESULTS

Twenty one entries were evaluated in the replicated trial against three checks CH-3, Thrupthi, Kanchan and Sahyadri none of the entries were superior to the best check CH-3.

Salient findings/Achievements

- None of the entries performed superior to check

Table VFSBR 8: Evaluation of male sterility based entries for GLY, CLY and TGE

Genotype	F_1 Generation			Pests		diseases	
	GLY	CLY	TGE	*S. litura*	Whitefly	Black shank	TMV
	kg/ha						
MS1 FCH222xFCJ-11	2443	337	236	0.4	3.1	1	1
MS1 FCH222 x NLCR-7	1828	302	211	0.5	3.4	2	1
MS1 Bhavyax FCJ-38	2635	404	283	0.3	2.9	1	2
MS1 Bhavya x FCJ-11	2567	462	324	0.2	2.8	2	2
MS1 Bhavya x NLCR-7	2811	441	309	0.4	3.3	2	1
MS1 Tobios-6 x FCJ-38	4457	735	515	0.1	3.4	3	1
MS1 Tobios-6 x FCJ-11	3523	519	363	0.2	3.3	1	2
MS1 Tobios-6 x NLCR-7	5068	583	585	0.3	4.1	1	1
MS2 Bhavya x FCJ-38	5975	827	579	0.4	3.9	1	2
MS2 Bhavya x FCJ-11	6720	1039	727	0.2	3.2	2	2
MS2 Bhavy x NLCR-11	4136	647	453	0.1	3.1	1	1
MS2 Sahyadri x FCJ-38	4404	790	553	0.3	3.0	1	1
MS2 Sahyadri X FCJ-11	6870	1021	715	0.5	2.9	1	1
MS2 Sahyadri X NLCR-7	4865	802	562	0.2	3.0	2	2
MS2 Tobios-6 x FCJ-38	4954	686	480	0.4	2.9	1	1
MS2 Tobios-6 x FCJ-11	5332	722	505	0.3	1.9	2	2
MS2 Tobios-6x NLCR 11	4514	675	473	0.2	2.1	1	1
MS1 Sahyadri x FCS-4	2905	534	374	0.3	2.9	1	2
MS2 FCH-222 x FCS-4	3292	555	389	0.2	2.8	2	2
MS2 Sahyadri x FCS-4	6012	801	561	0.4	3.3	2	1
MS2 Tobios-6 x FCS-4	5586	803	562	0.1	3.4	3	1
CH-3(C)	7230	1043	730	0.1	2.4	2	2
Thrupthi (C)	6240	939	657	0.4	3.1	1	2
Kanchan (C)	6540	822	556	0.3	3.4	1	1
Sahyadri (C)	7020	874	612	0.2	3.3	1	1
S.Em. ±	447	72	50				
C.D. at 5%	1304	210	147				
C.V. (%)	13	14.38	14				

Project No.: VFSBR 10

Research project title	Breeding for high seed yield and oil yield in both FCV and *chewing* tobacco
Objectives	▪ To identify high yielding FCV tobacco varieties with respect to seed and oil yield for zone 7 (KLS region)
Investigators	Shashikala S Kolakar, T.M. Soumya, Prashantha C.
Year of start	2021
Year of completion	2023
Location	AINP(T), ZAHRS, Navile, Shivamogga

Treatments	: 13	Spacing	: 90 x 60 cm
Design	: RCBD	Plot size	: 3.6 × 6.0 m
Replications	: Two	Date of sowing	: 05-05-2023
Date of planting	: 04-07-2023	Fertilizer dose	: 40:30:80 N:P:K (kg/ha)

RESULTS

Among the ten entries tested against three checks, VA-770 recorded significantly higher Green leaf yield (9952kg/ha), Cured leaf yield (1381kg/ha) and Top grade equivalent (1105) over the checks.

Salient findings/Achievements

- VA-770 performed superior to check

Table 1 VFSBR 10: Evaluation of FCV tobacco entries for yield

S. No.	Genotypes	GLY (kg/ha)	CLY (kg/ha)	TGE (kg/ha)
1	TANTA-1	3395	465	372
2	VA-309	7788	1118	894
3	VA-770	9952*	1381*	1105*
4	NC-11271	7189	1162	929
5	PULAWASAKA-13	5141	718	648
6	SPEIGHT-G-58	6060	931	745
7	VA-76	8199	1145	916
8	YELLOW SPECIAL-A	4996	711	568
9	NC-567	4021	560	448
10	HE-2	7259	1025	820
11	Thrupthi (C)	5137	703	562
12	Kanchan (C)	5477	762	615
13	Sahyadri (C)	7113	1020	815
S.Em. ±		676	90	71
C.D. at 5%		1974	263	207
C.V. (%)		19	17.46	17

Table 2 VFSBR 10: Pest and disease incidence

S. No.	Genotypes	*S. litura*	Whitefly	Black shank	TMV
1	TANTA-1	1.28	2.46	4	2
2	VA-309	1.00	2.67	3	2
3	VA-770	0.88	2.52	2	2
4	NC-11271	0.92	2.18	2	2
5	PULAWASAKA-13	0.92	2.01	3	2
6	SPEIGHT-G-58	0.72	2.12	2	2
7	VA-76	0.72	2.87	2	2
8	YELLOW SPECIAL-A	0.76	2.10	1	1
9	NC-567	0.80	1.78	2	2
10	HE-2	0.84	1.81	2	2
11	Thrupthi (C)	0.72	1.85	2	1
12	Kanchan (C)	0.90	1.76	3	1
13	Sahyadri (C)	0.76	1.96	2	1

Project No.: VFSBR 11

Research project title	Conversion of FCH-1, FCH-2 and FCS-4 in male sterile lines

RESULTS

The experiment was not taken up due to non availability of the male sterile lines

Germplasm maintenance	113 FCV germplasm lines are maintained at the AINPT, Shivamogga.

RESULTS

The experiment was vitiated due to sever moisture and heat stress.

B. *BIDI* TOBACCO

COORDINATED EVALUATION OF *BIDI* TOBACCO GENOTYPES

IVT ON *BIDI* TOBACCO

BDABRC/ BDNBRC/ BDNyBRC 2:INITIAL VARIETAL TRIAL ON *BIDI* TOBACCO

Objectives: To evaluate the *Bidi* tobacco entries for yield and quality at three centres *viz.*, Anand, Nipani and Nandyal along with respective check varieties.

Year of start : 2023-24

Year of Completion :2023-24

Bidi tobacco Centres and Investigators

Centres	:	Investigators
Anand	:	J. N. Patel & D.R. Delvadiya
Nipani	:	C. D. Soregaon & S.B. Patil
Nandyal	:	P. Pulli Bai & K. Satish Babu

Design : RBD
Total treatments : 04 + checks as given above
Replications : Four (04)

Entries: 04 (Four)

1. IET-112
2. IET-113
3. IET-114
4. IET-115

Checks at different Centres

Anand	1. A 119	2. GT 7	3. GABT-11	4. GABTH-2
Nipani	1. A 119	2. Bhavyashree	3. NBD 209	
Nandyal	1. A 119	2. Nandyal Pogaku-1	3.Nandyal Pogaku-2	

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Anand	3.6 × 7.5 m	0.90 m x 0.75 m
Nipani	4.0× 7.5 m	1m x 0.75 m
Nandyal	6.75 × 2.25 m	0.75 x 0.75 m

RESULTS

In the Initial varietal trial (IVT), four entries were evaluated for their yield potential against respective checks at different centres. Observations recorded leaf yield, natural/ artificial incidence of pest and diseases. Cured leaf quality parameters (Nicotine, Reducing sugars and chlorine) were estimated.Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha.Data on yield and other characteristics at different centres are presented in Table 1 to 6 IVT *Bidi* Tobacco. The results are presented centre-wise.

ANAND

Yield: None of the line showed significantly superior for cured leaf yield over better check.

Morphological characterization: All the morphological characters i.e. no. of leaves per plant, plant height, leaf length, leaf width, leaf thickness, days to flowering and days to maturity were comparable with check variety.

Disease /Pest incidence: TMV and leaf curl incidences were found 23 to 32 % and 10-30 % for all the test entries, respectively.

Salient Findings/Achievements

- None of the line showed significantly superior for cured leaf yield over better check.
- None of the lines under testing was free from leaf curl and tobacco mosaic virus diseases.

Conclusion: None of the line showed significantly superior for cured leaf yield over better check. So, it could not be promoted to AVT.

NIPANI

Yield: Test entries IET 114 (2168 Kg/ha), IET 113 (2151 Kg/ha) and IET 115 (1854 Kg/ha) recorded significantly superior leaf yield over the best check Bhavyashree (1530 Kg/ha) and NBD 209 (1420 Kg/ha).

Morphological characterization: The entry IET 114 has recorded highest plant height (138.08 cm), number of leaves (21), leaf length (55.05 cm) and leaf width (23.59 cm) compared to all other test entries and checks.

Disease /Pest incidence: Among seven entries evaluated under natural conditions for major diseases of tobacco, all the entries have shown the moderately resistant reaction to leaf curl except IET 114 which showed highly resistant reaction to tobacco leaf curl. All the seven entries showed highly resistant reaction for TMV. Whereas, foliar disease like frog eye spot was not observed in any of the entry while brown leaf spot showed resistant to highly resistant reaction.

Salient Findings/Achievements

- IET 114 (2168 Kg/ha), IET 113 (2151 Kg/ha) and IET 115 (1854 Kg/ha) recorded significantly superior leaf yield over the best check Bhavyashree (1530 kg/ha) and NBD 209 (1420 Kg/ha).

Conclusion: These entries were advanced for testing under AVT-I along with checks in during 2024-25.

NANDYAL

Yield: The entry, IET 112 (1746 kg/ha) has recorded on par cured leaf yield with improvement of 6.3 % when compared to the best check Nandyal Pogaku-2 (1641 kg/ha).

Morphological characterization: The tested entries has recorded on an average plant height (79.7cm), Days to 50 % flowering (121), leaf length (42.2 cm), leaf width (16.8 cm), SPAD (60.71) & leaf thickness (14.6 mg/m^2).

Disease /Pest incidence: Under field conditions leaf curl, TMV & frog eye, *Cercospora*leaf spots were observed but below ETL and in all the tested entries severe incidence of sucking pests like mealy bug and aphids was noticed during maturity stage due to terminal moisture stress.

Salient Findings/Achievements

- IET 112 (1746 kg/ha) has recorded on par cured leaf yield with improvement of 6.3 % when compared to the best check Nandyal Pogaku-2 (1641 kg/ha).

Conclusion: None of the entries was found significant for cured leaf yield and these entries will not be promoted to the AVT-I during 2024-25.

Recommendation for promoting to AVT-I: Based on the result of *bidi* centres and discussions held during the Interaction meeting with AINPT centres on 2nd July, 2024, three *bidi* entries viz., IET-113, IET-114, IET-115 were promoted along with respective checks for conducting AVT-I at all *Bidi* centres

Table 1 IVT *BIDI* TOBACCO: Cured Leaf yield and morphological characters of IVT entries at different centres (2023-24)

Entries	Yield (kg/ha)			No. of leaves/plant			SPAD
	Anand	Nipani	Nandyal	Anand	Nipani	Nandyal	Nandyal
IET-112	2858	1774	1746	23	18	15	64.3
IET-113	1756	2151*	1546	22	18	15	64.4
IET-114	2787	2168*	1531	24	21	15	67.2
IET-115	2429	1854*	1592	25	20	15	44.2
A 119 (C)	1648	1403	1094	20	18	15	63.0
GT 7 (C)	2195	-		24	-		
GABT-11 (C)	3666	-		27	-		
GABTH-2 (C)	2796	-		26	-		
Bhavyasree (C)		1530			17		
NBD-209 (C)		1420			20		
Nandyal Pogaku-1 (C)		-	1622		-	15	61.7
Nandyal Pogaku-2 (C)		-	1641		-	15	60.2
G. Mean		1757.08	1537		18.90	15	60.71
S. Em+	171.5	100.22	71.17	0.78	0.62		
C.D. at 5%	504.3	292.52	213.1	2.30	1.82		
C.V. (%)	13.62	12.75	9.2	6.60	7.38		

**Significant at 5 %*

Table 2 IVT *BIDI* TOBACCO: Morphological characters of IVT entries at different centres (2023-24)

Entries	Plant Height (cm)			Leaf Length (cm)			Leaf Width (cm)		
	A	N	Ny	A	N	Ny	A	N	Ny
IET-112	100.4	108.88	83.3	60.4	50.36	43.8	26.7	20.27	17.6
IET-113	105.7	100.40	73.6	59.7	52.05	40.3	23.5	22.18	15.9
IET-114	101.7	138.08	79.1	56.8	55.05	42.0	24.8	23.59	17.3
IET-115	116.3	122.96	79.1	56.8	53.18	43.8	25.3	22.42	16.9
A 119 (C)	84.3	122.36	66.4	56.0	50.04	40.9	22.9	20.58	16.2
GT 7 (C)	90.9	-		56.0	-		21.4	-	
GABT-11 (C)	88.4	-		64.3	-		28.4	-	
GABTH-2 (C)	87.1	-		58.7	-		23.4	-	
Bhavyasree(C)		123.16			50.57			20.34	
NBD-209 (C)		134.84			53.64			22.50	
Nandyal Pogaku-1 (C)		-	89.7		-	42.2		-	16.5
Nandyal Pogaku-2 (C)		-	86.7		-	42.1		-	17.3
G. Mean		121.53	79.7		52.13	42.2		21.70	16.8
S. Em+	4.88	4.82		1.40	1.38		1.39	0.86	
C.D. at 5%	14.37	14.07		4.11	4.02		4.08	2.51	
C.V. (%)	10.10	8.87		4.77	5.91		11.32	8.87	

Table 3 IVT *BIDI* TOBACCO: Morphological characters of IVT entries at different centres (2023-24)

Entries	Days to flower			Days to 50% flowering			Inter-nodal length (cm)			Days to Maturity			Leaf thickness (mm)			Spangle score		
	A	N	Ny	A	N	Ny	A	N	Ny	A	N	Ny	A	N	Ny	A	N	Ny
IET-112	76	-	-	-	-	124	-	4.44	-	180	-	-	9.24	-	15.7	8.2	-	3
IET-113	65	-	-	-	-	123	-	4.62	-	177	-	-	11.29	-	14.1	7.7	-	4
IET-114	70	-	-	-	-	124	-	5.18	-	177	-	-	11.85	-	19.1	7.6	-	4
IET-115	75	-	-	-	-	118	-	5.09	-	182	-	-	12.03	-	16.4	7.8	-	4
A 119 (C)	62	-	-	-	-	112	-	4.82	-	165	-	-	12.99	-	12.4	9.1	-	6
GT 7 (C)	68	-	-	-	-		-	-	-	174	-	-	10.96	-		8.1	-	
GABT-11 (C)	88	-	-	-	-		-	-	-	184	-	-	11.41	-		9.0	-	
GABTH-2 (C)	79	-	-	-	-		-	-	-	180	-	-	11.34	-		9.2	-	
Bhavyasree (C)		-	-	-	-		-	5.42	-	-	-	-	-	-			-	
NBD-209 (C)		-	-	-	-		-	4.10	-	-	-	-	-	-			-	
Nandyal Pogaku-1 (C)		-	-	-	-	114	-	-	-	-	-	-	-	-	11.2		-	5
Nandyal Pogaku-2 (C)		-	-	-	-	134	-	-	-	-	-	-	-	-	13.3		-	4
G. Mean		-	-	-	-	121	-	5.09	-	-	-	-	-	-	14.6		-	4
S. Em+	2.12	-	-	-	-		-	0.15	-	1.96	-	-	-	-			-	
C.D. at 5%	6.25	-	-	-	-		-	0.43	-	5.78	-	-	-	-			-	
C.V. (%)	5.82	-	-	-	-		-	6.48	-	2.22	-	-	-	-			-	

A: Anand; N: Nipani; Ny: Nandyal

Table 4 IVT *BIDI* TOBACCO: Incidence of pest and diseases in the entries of IVT at Anand (2023-24)

Entries	TMV (%)	Leaf Curl (%)			
		LCA	LCB	LCC	LCD
IET-112	32.5	Yes	-	-	-
IET-113	23.8	-	-	-	Yes
IET-114	28.8	-	-	Yes	-
IET-115	28.8	-	Yes		-
A 119 (C)	7.50	-	-	Yes	-
GT 7 (C)	25.0	-	-	-	Yes
GABT-11 (C)	63.8	Yes	-	-	-
GABTH-2 (C)	42.5	-	-	Yes	-

Where, LCA = Low, **LCB** = 10%, **LCC** = 10-20%, **LCD** = 20-30%

Table 5 IVT *BIDI* TOBACCO: Incidence of pest and diseases in the entries of IVT at Nipani (2023-24)

Entries	Aphid (0-5 scale)	TMV (%)	Leaf Curl (%)
			LCA
IET-112	4	5.30	20.29
IET-113	5	3.89	24.81
IET-114	4	3.45	9.93
IET-115	5	5.83	14.83
A 119 (C)	5	5.52	25.50
Bhavyasree(C)	4	5.63	17.32
NBD-209 (C)	4	3.18	14.30

Score: 0=0, 1=1-50, 2=51-250, 3=251-500, 4=501-1000, 5=>1000

Table 6 IVT *BIDI* TOBACCO: Quality parameters of the entries of IVT at Anand (2023-24)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
IET-112	6.05	5.5	1.242
IET-113	5.57	5.8	0.887
IET-114	6.26	5.25	1.136
IET-115	5.26	5.45	1.171
A 119 (C)	6.57	5.8	0.887
GT 7 (C)	6.78	5.4	0.817
GABT-11 (C)	6.27	5.75	0.603
GABTH-2 (C)	5.57	5.12	0.887

COORDINATED EVALUATION OF *BIDI* TOBACCO GENOTYPES

BDABRC/ BDNBRC/ BDNyBRC 1.1: ADVANCED VARIETAL TRIAL ON *BIDI* TOBACCO (AVT-I)

Objectives: To evaluate the *Bidi* tobacco entries for yield and quality at three centres *viz.,* Anand, Nipani and Nandyal along with respective checks in AVT-I.

Year of start : 2023-24

Year of Completion : 2023-24

***Bidi* tobacco Centres and Investigators**

Centres	:	Investigators
Anand	:	J. N. Patel & D.R. Delvadiya
Nipani	:	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Nandyal	:	P. Pulli Bai & K. Satish Babu

Design : RBD
Total treatments : 02 + checks as given above
Replications : Four (04)

Entries: 02 (Two)

1. ABD 239
2. ABD 244

Checks at different Centres

Anand	1. A 119	2. GT 7	3. GABT-11	4. GABTH-2
Nipani	1. A 119	2. Bhavyashree	3. NBD 209	
Nandyal	1. A 119	2. Nandyal Pogaku-1	3.Nandyal Pogaku-2	

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Anand	3.6 × 7.5 m	0.90 m x 0.75 m
Nipani	4.0 × 7.5 m	1 m x 0.75 m
Nandyal	6.75 × 3.0 m	0.75 x 0.75 m

RESULTS

ANAND

The results revealed significant yield differences among the lines tested. None of the line showed significantly superior for cured leaf yield over better check. Line ABD 244 showed maximum cured leaves yield but non-significant. None of the lines under testing was free from leaf curl and tobacco mosaic virus (except MR GTH 1) diseases.

Salient findings/Achievements:

- Line ABD 244 showed maximum cured leaves yield but non-significant.

NIPANI

Test entry ABD 239 (1543 kg/ha) registered numerically higher leaf yield compared to popular check A-119 (921 kg/ha) and local check Bhavyashree (1500 kg/ha) but it was lower compared to the Best check NBD-209 (1580 kg/ha). Test entry ABD 239 has shown highest number of leaves per plant (21), higher leaf length (45.24 cm) and leaf width (17.93 cm) compared to other entries and checks. The best check NBD 209 recorded highest plant height (126.70) compared to all other entries.

Salient findings/Achievements

- Test entry ABD 239 (1543 kg/ha) registered numerically higher leaf yield compared to popular check A-119 (921 kg/ha) and local check Bhavyashree (1500 kg/ha).
- None of the entries were superior over the best check.

NANDYAL

The entry ABD 239 (1641 kg/ha) has recorded significantly higher cured leaf yield with improvement of 18.5 % when compared to the best check Nandyal Pogaku 2 (1384 kg/ha) and on an average SPAD (65.92) recorded (Table BDNY BRC 1.1). The entry ABD 239 along with checks will be evaluated under AVT II on *bidi* tobacco during 2024-25.

Salient findings /Achievements

- ABD 239 (1641 kg/ha) has recorded significantly higher cured leaf yield with improvement of 18.5% when compared to the best check Nandyal Pogaku-2 (1384 kg/ha)

Recommendation: All the entries evaluated under AVT-I will be assessed in AVT-II at all centres

Table 1 BDABRC/BDNBRC/ BDNyBRC1.1: Yield characters of AVT-I entries during 2023-24

Entries	Yield (kg/ha)			No. of leaves/ Plant		SPAD
	ANAND	NIPANI	NANDYAL	ANAND	NIPANI	NANDYAL
ABD 239	2938	1543	1641 *	23	21	68.5
ABD 241	3380	-	-	27		
ABD 244	3494	1126	1308	25	20	58.2
A 119 (C)	1881	921	1013	20	14	75.5
GT 7 (C)	2114	-	-	24	-	-
MRGTH-1 (C)	1910	-	-	23	-	-
GABT-11 (C)	3199	-	-	27	-	-
Bhavyasree (C)	-	1500	-	-	16	-
NBD-209 (C)	-	1580	-	-	20	-
Nandyal Pogaku-1 (C)	-	-	1113	-	-	62.2
Nandyal Pogaku-2 (C)	-	-	1384	-	-	65.2
G. Mean	-	1333.96	1292		18.68	65.92
S. Em+	164.2	102.14	46.1	0.83	1.25	-
C.D. at 5%	506.1	314.74	139.5	2.54	3.86	-
C.V. (%)	10.53	15.31	8.5	5.91	13.40	-

Significant at 5%

Table 2 AVT-I *BIDI* TOBACCO: Morphological characters of AVT-I entries at different centres (2023-24)

Entries	Plant Height (cm)			Leaf Length (cm)			Leaf Width (cm)		
	A	N	Ny	A	N	Ny	A	N	Ny
ABD 239	86.9	105.15	85.5	60.6	45.24	49.8	26.1	17.93	20.5
ABD 241	90.5			60.3			24.6		
ABD 244	102.5	79.38	75.5	60.7	39.58	41.3	25.9	15.85	18.4
A 119 (C)	93.9	82.50	79.2	57.4	42.50	34.7	24.3	16.72	13.1
GT 7 (C)	94.4			56.7			20.7		
MRGTH-1 (C)	85.1			58.0			25.0		
GABT-11 (C)	80.4			58.6			26.5		
Bhavyasree (C)		105.84			42.64			16.26	
NBD-209 (C)		126.70			40.20			15.27	
Nandyal Pogaku-1 (C)			82.2			38.5			15.8
Nandyal Pogaku-2 (C)			86.2			44.0			18.7
G. Mean		100.11	81.7		52.54	41.7		20.51	17.3
S. Em+	4.43	6.20		1.55	2.50		1.54	1.19	
C.D. at 5%	NS	19.10		NS	7.7		NS	3.66	
C.V. (%)	8.47	12.38		4.57	9.51		10.8	11.58	

Table 3 AVT-I *BIDI* TOBACCO: Morphological characters of AVT-I entries at different centres (2023-24)

Entries	Inter-nodal length	Spangle score	Days to 50% flowering	Days to flower	Days to maturity	Leaf thickness (mg/cm²)	
	NIPANI	NANDYAL	NANDYAL	ANAND	ANAND	ANAND	NANDYAL
ABD 239	3.08	2.4	140	77	172	12.15	16.4
ABD 241				86	169	11.83	
ABD 244	2.97	2.6	145	77	179	11.94	13.8
A 119 (C)	3.55	4.6	120	57	164	14.07	12.4
GT 7 (C)				63	165	11.03	
MRGTH-1 (C)				64	163	13.51	
GABT-11 (C)				93	179	10.95	
Bhavyasree (C)	4.09						
NBD-209 (C)	2.95						
Nandyal Pogaku-1 (C)		3.6	125				13.2
Nandyal Pogaku-2 (C)		3.4	143				13.3
G. Mean	4.42	3.32	135				13.8
S. Em+	0.33			1.57	2.86		
C.D. at 5%	1.03			4.83	8.82		
C.V. (%)	15.08			3.67	2.91		

Table 3 AVT-I *BIDI* TOBACCO: Disease incidence and chemical quality (%) parameters at Anand (2023-24)

Entries	TMV (%)	Leaf curl (%)			Nicotine	Reducing Sugars	Chlorides
		LCB	LCC	LCD			
ABD 239	45.00	Yes	-	-	5.36	4.80	0.781
ABD 241	51.67	-	Yes	-	4.25	4.96	0.639
ABD 244	50.00	-	Yes	-	5.46	5.50	0.710
A 119 (C)	19.17	-	Yes	-	5.57	5.05	0.781
GT -7 (C)	47.50	-	-	Yes	4.85	4.82	0.680
MRGTH- 1(C)	0.00	-	-	Yes	4.55	4.15	0958
GABT- 11 (C)	65.83	-	Yes	-	5.05	4.47	0.675

Where, LCB = 10%, LCC = 10-20%, LCD = 20-30%

Table 4 AVT-I *BIDI* TOBACCO: Incidence of pest at Nipani (2023-24)

Entries	Aphid (0-5 scale)
ABD 239	5
ABD 241	5
ABD 244	5
A 119 (C)	5
Bhavyasree (C)	5
NBD-209 (C)	4

Score: 0=0, 1=1-50, 2=51-250, 3=251-500, 4=501-1000, 5=>1000

ANAND

Project No.: BDABRC 1.2

Research project title	Advanced Varietal Trial-II on *bidi* tobacco
Objectives	▪ To evaluate the *bidi* tobacco entries for yield and quality in AVT-II.
Investigators	J.N. Patel & D. R. Delvadiya
Year of start	2023-24
Year of completion	2023-24
Location	BTRS, AAU, Anand

Treatments	:	8 (4+4)	Spacing	:	90 x 75 cm
Replications	:	Three	Plot size	:	3.6 x 7.5 m
Design	:	RBD			

RESULTS

The results revealed significant yield differences among the lines tested. None of the line showed significantly superior for cured leaf yield over better check. Line ABD 228 showed maximum cured leaves yield but non-significant. None of the lines under testing was free from leaf curl and tobacco mosaic virus (except MR GTH 1) diseases.

Conclusion: None of the lines under testing were advanced to further evaluation.

Table 1 BDABRC 1. 2: Yield and morphological characters during 2023-24

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height	Leaf		Leaf thick-ness (mg/ cm²)	Days to flower	Days to maturity
			----- cm -----	length	width			
ABD 226	3308	27	97.4	59.9	26.3	11.68	75	175
ABD 228	**3631**	28	86.7	59.4	25.8	11.75	89	186
ABD 229	2767	28	89.1	56.1	21.6	10.78	87	181
NyBD 69	3063	27	100.1	61.7	26.7	9.07	86	182
A 119	1703	20	97.7	57.8	24.3	12.85	62	168
GT -7 (C)	2552	24	89.0	57.4	21.4	11.98	68	170
MRGTH- 1(C)	2135	23	91.8	59.9	25.5	13.42	59	165
GABT- 11 (C)	3086	28	82.9	62.1	28.0	9.99	86	189
S.Em ±	192.5	0.59	2.54	1.22	1.09	-	3.08	2.40
C.D. at 5%	583.9	1.79	7.70	3.69	3.31	-	9.35	7.29
C.V. (%)	12.0	3.97	4.79	3.55	7.57	-	6.98	2.35

Table 2 BDABRC 1.2: Disease incidence and chemical quality (%) parameters (2023-24)

Entries	TMV (%)	Leaf curl (%)			Nicotine	Reducing Sugars	Chlorides
		LCB	LCC	LCD			
ABD 226	40.83	-	Yes	-	5.36	5.2	0.71
ABD 228	80.00	-	Yes	-	5.26	5.05	0.735
ABD 229	45.83	-	Yes	-	4.65	4.35	0.56
NyBD 69	67.50	Yes	-	-	4.05	4.15	0.675
A 119	20.00	-	Yes	-	5.26	5.5	0.639
GT -7 (C)	35.00	-	Yes	-	4.85	4.25	0.675
MRGTH- 1(C)	00	-	-	Yes	4.48	4.15	0.568
GABT- 11 (C)	79.17	Yes	-	-	5.05	4.85	0.532

Where, LCB = 10%, LCC = 10-20%, LCD = 20-30%

Table 3 BDABRC 1.2: Pooled analysis of *bidi* tobacco genotypes performance in AVT (2022-23 & 2023-24)

Treatment	Year		POOLED mean	% Increase over Checks		
	2022-23	2023-24		GABT11	GT 7	MRGTH 1
ABD 226	3831	3308	3570	-	26.8	25.2
ABD 228	4875	3631	**4253***	14.9	51.0	49.2
ABD 229	4212	2767	3490	-	23.9	22.4
NyBD 69	3348	3063	3206	-	13.8	12.5
A 119 (C)	2343	1703	2023	-	-	-
GT 7 (C)	3079	2552	2816	-	-	-
MRGTH 1 (C)	3567	2135	2851	-	-	-
GABT 11 (C)	4314	3086	3700	-	-	-
S.Em.±	124.3	192.5	390.4	-	-	-

Treatment	Year		POOLED mean	% Increase over Checks		
	2022-23	2023-24		GABT11	GT 7	MRGTH 1
C.D. at 5 %	377.0	583.9	**435.6**	-	-	-
C.V. %	5.8	12.0	10.7	-	-	-
Y	-	-		-	-	-
S.Em.±	-	-	195.2	-	-	-
C.D. at 5 %	-	-	652.8	-	-	-
YXT	-	-		-	-	-
S.Em.±	-	-	286.0	-	-	-
C.D. at 5 %	-	-	828.4	-	-	-

Project No.: On Farm Trial (OFT)

Research project title	On Farm Trial
Objectives	▪ To evaluate the performance of promising entry of *bidi* tobacco for yield and quality
Investigators	J.N. Patel & D. R. Delvadiya
Year of start	2023-24
Year of completion	2023-24
Location	BTRS, AAU, Anand

Treatments : 3 (1+2)
Spacing : 90 x 75 cm
Plot size : 18.0 x 15 m

RESULTS

ABD 228 showed maximum cured leaf yield (9%) over better check GABTH 2 and (40%) over check GT-7.

Table 1 BDABRC 1. 2: Yield and morphological characters during 2023-24

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height	Leaf		Leaf thick-ness (mg/ cm²)	Days to flower	Days to maturity
			----- cm -----	length	width			
ABD 228	3675	26	88.0	60.1	26.4	11.40	90	188
GT -7 (C)	2623	24	86.6	61.7	23.3	10.96	70	171
GABTH- 2 (C)	3373	25	90.4	62.2	28.1	11.34	77	178

Table 2 BDABRC 1.2: Chemical quality (%) parameters (2023-24)

Entries	Nicotine	Reducing Sugars	Chlorides
ABD 228	5.76	5.72	0.835
GT -7 (C)	5.08	4.12	0.775
GABTH- 2 (C)	5.97	4.72	0.807

Project No.: BDABR 22

Research project title	Search for materials resistant to root-knot disease (Joint study by Plant Breeding and Plant Pathology Sections)
Objectives	▪ To evaluate the promising *bidi* tobacco entries against root-knot
Investigators	J.N. Patel, D. R. Delvadiya & Y. M. Rojasara
Year of start	1968-69
Year of completion	Long term
Location	BTRS, AAU, Anand

RESULTS

Out of 72 genotypes screened including check varieties, two genotypes including check were found free from root-knot index in root-knot sick field and selected for further screening in the next year.

Salient Findings/Achievements

- Two genotypes including check were found free from root-knot index in root-knot sick field

Project No.: BDABR 23

Research project title	Screening of advanced breeding materials /introductions for leaf curl and *Cercospora* leaf spot diseases under field conditions (Joint study by Plant Pathology and Plant Breeding sections)
Objectives	▪ To evaluate the promising *bidi* tobacco entries against leaf curl and *cercospora* leaf spot
Investigators	J.N. Patel, D. R. Delvadiya & Y. M. Rojasara
Year of start	1970-71
Year of completion	Long term
Location	BTRS, AAU, Anand

RESULTS

During the year 2023-24, one hundred seventeen entries of advanced breeding materials /crosses of *bidi* tobacco and thirty-seven entries of *rustica* tobacco including respective check were examined for leaf curl and *Cercospora* leaf spot diseases. Observations revealed that none of the entries were found free from leaf curl infection of *bidi* and *rustica* tobacco entries. During the year very low incidence of frog-eye leaf spot disease was noticed.

Salient Findings/Achievements

- None of the entries were found free from leaf curl infection field, respectively

Project No.: BDABR 31

Research project title	Breeding for resistance to tobacco mosaic in *bidi* tobacco (Joint study by Plant Pathology and Plant Breeding sections)
Objectives	▪ To evaluate the promising *bidi* tobacco entries against mosaic spot
Investigators	J.N. Patel, D. R. Delvadiya & Y. M. Rojasara
Year of start	1981-82
Year of completion	Continues project
Location	BTRS, AAU, Anand

RESULTS

During the year under report, total 37 (including twenty-five mosaic resistant cultures) entries of *bidi* tobacco grown in different generations were artificially inoculated with tobacco mosaic virus and evaluated for resistance to mosaic. Out of these, 37 entries including segregation materials showed resistance to the disease and these materials are maintained by plant breeding section for further breeding advancement work

Salient Findings/Achievements

- Total 37 entries including segregation materials showed resistance to Mosaic

NIPANI

Project No.: BDNBRC 1.2

Research project title	Advanced Varietal Trial-II on *bidi* tobacco
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka under AVT-II
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

Treatments	:	9 (5+4)	Spacing	:	100 x 75 cm
Replications	:	Three	Plot size	:	4 × 7.5 m
Design	:	RBD			

RESULTS

The Advanced Varietal Trial-II (AVT-II) trial consisted of five entries and four checks which were evaluated. Test entry NyBD 68 (1693 kg/ha) registered higher leaf yield followed by ABD 228 (1652 Kg/ha) and NyBD 69 (1554 kg/ha) numerically over the best check NBD-209 (1398 kg/ha) and significantly over the popular check A-119 (1112 kg/ha). All the test entries registered numerically superior leaf yield over all the four checks. Test enrty ABD 229 has shown highest plant height (155.93 cm) and number of leaves per plant (17). Higher leaf length (50.09 cm) and leaf width (19.99 cm) were observed in the test entry NyBD 68 compared to other entries and checks (Table 1BDNBRC 1.2).

Pooled analysis over three years revealed that the test entry ABD 228 (1512 kg/ha) was numerically superior to the best check NBD 209 (1484 Kg/ha).

Salient Findings/Achievements

- Test entry NyBD 68 (1693 kg/ha) registered higher leaf yield followed by ABD 228 (1652 Kg/ha) and NyBD 69 (1554 kg/ha) over the best check NBD-209 (1398 kg/ha) and popular check A-119 (1112 kg/ha).
- Pooled analysis over two years revealed that none of the test entries were superior to the best check NBD 209 (1528 Kg/ha).
- Pooled analysis over three years revealed that the test entry ABD 228 (1512 kg/ha) was numerically superior to the best check NBD 209 (1484 Kg/ha).

Conclusion: None of the entry was advanced to further evaluation.

Table 1 BDNBRC 1.2: Cured leaf yield and morphological characters in AVT-II (2023-24)

Entries	Leaf yield (kg/ha)	Plant Height (cm)	Leaves / Plant	Inter nodal length (cm)	Leaf length (cm)	Leaf width (cm)
ABD-226	1378	154.60	16	5.49	43.48	16.05
ABD-228	1652	105.47	16	4.39	46.19	15.76
ABD 229	1455	155.93	17	5.89	41.69	16.12
NyBD-68	1693	134.07	13	5.87	50.09	19.99
NyBD-69	1554	121.67	12	6.15	48.09	17.48
Vedaganga-1 (C)	1331	140.67	13	5.91	41.76	15.48
A-119 (C)	1112	121.53	13	5.23	44.57	14.71
Bhavyashree (C)	1228	128.93	16	6.00	46.28	16.08
NBD-209 (C)	1398	134.33	14	5.52	51.15	15.71
Mean	1422.18	133.02	14.49	5.60	45.92	16.37
S.Em ±	108.51	12.64	1.48	0.51	3.48	1.46
C.D.at 5%	325.32	37.90	4.43	1.53	10.44	4.38
C.V%	13.22	16.46	17.66	15.79	13.33	15.46

** Significantly superior to control NBD 209*

Table 2 BDNBRC 1.2: Pooled data of IVT 2021-22, AVT-I 2022-23 and AVT-II 2023-24

Entries	Leaf Yield (kg/ha)			
	IVT (2021-22)	AVT–I (2022-23)	AVT–II (2023-24)	Mean
ABD-226	864	1385	1378	1209
ABD-228	1322	1563	1652	1512
ABD 229	1106	1720	1455	1427
NyBD-68	844	1684	1693	1407
NyBD-69	922	1262	1554	1246
Vedaganga-1 (C)	1294	960	1331	1195
A-119 (C)	1422	1090	1112	1208
Bhavyashree (C)	1400	1181	1228	1270
NBD-209 (C)	1680	1375	1398	1484
Mean	1206.30	1357.80	1422.18	1328.70
S.Em ±	96.00	90.68	108.51	152.54
C.D.at 5%	287.81	271.86	325.32	457.31
C.V%	13.78	11.57	13.22	19.88

Table 4 AVT-I *BIDI* TOBACCO: Incidence of pest at Nipani (2023-24)

Entries	Aphid (0-5 scale)
ABD-226	5
ABD-228	5
ABD 229	5
NyBD-68	5
NyBD-69	5
Vedaganga-1 (C)	5
A-119 (C)	5
Bhavyashree (C)	5
NBD-209 (C)	5

Score: 0=0, 1=1-50, 2=51-250, 3=251-500, 4=501-1000, 5=>1000

Project No.: LARGE SCALE DEMONSTRATION (LSD)

Research project title	Large scale demonstration on *bidi* tobacco
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

Treatments : 2 (1+1) Plot size : 46 × 40 m

RESULTS

The entry NBD 316 was evaluated with the best check NBD 209 in plot size of 46 m x 40 m (2438 plants) to confirm its leaf yield superiority. The promising entry NBD 316 has recorded highest leaf yield of 1891 kg/ha over the best check NBD 209 (1265 kg/ha).

Salient findings/Achievements

- The promising entry NBD 316 has recorded higher leaf yield of 1891 kg/ha over the best check NBD 209 (1265 kg/ha).

Conclusion: The promising entry NBD 316 in LSD will be proposed for release.

Table 1 LSD: Cured leaf yield and morphological characters (2023-24)

Entries	Yield (kg/ha)	Plant height (cm)	Leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD 316	1891	174.00	16	7.93	62.59	26.60
NBD-209 (C)	1265	131.95	15	6.14	52.09	18.00

Project No.: BDNBR 4.1

Research project title	Station Varietal Trial-I on *bidi* tobacco
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka under SVT-I
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

Treatments : 13 (9+4) Plot size : 4 × 7.5 m
Replications : Three Design : RBD

RESULTS

The Station Varietal Trial-I (SVT-I) consisted of nine test entries and four checks which were evaluated in RBD with three replications and spacing of 4 m x 7.5 m (Gross and Net plot). Due to the **severe leaf curl,** the trial has been vitiated. The trial was scored by pathologist and results were mentioned below.

Thirteen entries along with checks have been included in the trial. Entries have recorded the moderately susceptible to highly susceptible reaction to leaf curl disease except NBD 360 which showed moderately resistant reaction whereas all the entries showed highly resistant reaction to TMV. Frog eye leaf spot disease showed highly resistant to resistant reaction and brown leaf spot recorded highly resistant to moderately resistant reaction (Table 1 BDNBR 4.1).

Salient findings/Achievements

- The same trial will be repeated during 2024-25 as SVT-I (R)

Table 1 BDNBR 4.1: Evaluation of Station Varietal Trial- SVT against diseases under natural conditions

Entries	Leaf curl %	Reaction	TMV %	Reaction	Frog eye spot (0-5)	Reaction	Brown spot (0-5)	Reaction
NBD 360	13.26	MR	0.00	HR	1	R	0	HR
NBD 361	52.95	MS	2.56	HR	0	HR	1	R
NBD 365	64.95	MS	2.76	HR	0	HR	2	MR
NBD 368	68.30	MS	3.51	HR	1	R	1	R
NBD 373	79.25	HS	6.67	HR	1	R	1	R
NBD 374	86.42	HS	3.65	HR	0	HR	1	R
NBD 375	75.29	HS	1.59	HR	0	HR	1	R
NBD 376	77.74	HS	2.56	HR	1	R	1	R
NBD 380	60.07	MS	4.56	HR	0	HR	1	R
Vedaganga-1 (C)	53.61	MS	2.95	HR	1	R	2	MR
A-119 (C)	59.42	MS	2.40	HR	0	HR	2	MR
Bhavyashree (C)	55.21	MS	4.52	HR	0	HR	1	R
NBD-209 (C)	56.81	MS	2.20	HR	1	R	1	R

Project No.: BDNBR 4.3

Research project title	Station Hybrid Trial-I on *bidi* tobacco
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

RESULTS

Total twelve superior test hybrids over checks during 2022-23 were developed using 14 parents for conducting SHT-I during 2024-25.

Salient findings/Achievements

- All the test hybrids will be evaluated in SHT-I(R) Station Hybrid Trial-I R during 2024-25.

Project No.: BDNBR 4.5

Research project title	Preliminary Varietal Trial on *bidi* tobacco
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

Treatments	:	33 (29+4)	Plot size	:	2 × 7.5 m
Replications	:	Two	Design	:	R B D

RESULTS

The Preliminary Varietal Trial consisted of 29 test entries and four checks which were evaluated in RBD with tow replications and spacing of 2 m x 7.5 m (Gross and Net plot). Among the test entries NBD 407 (2491 kg/ha) recorded significant superiority for the leaf yield over the best check NBD 209 (1231 kg/ha). However, seven test entries viz., NBD 387 (1337 Kg/ha), NBD 398 (1283), NBD 393 (1278 Kg/ha), NBD 406 (1245 Kg/ha), NBD 390 (1240 Kg/ha), NBD 381 (1100 Kg/ha) and NBD 388 (1034 Kg/ha) recorded significant superiority for the leaf yield over the popular check A 119 (897Kg/ha). (Table-7)

Salient findings/Achievements

- The test entry NBD 407 (2491 kg/ha) recorded significant superiority for the leaf yield over the best check NBD 209 (1231 kg/ha).

- The best test entries NBD 381, NBD 387, NBD 388, NBD 390, NBD 393, NBD 398, NBD 406 and NBD 407 will be evaluated in Station Varietal Trial (SVT) along with checks during 2024-25.

Table 1 BDNBR 4.5: Cured leaf yield and morphological characters in PVT during 2023-24

Entries	Leaf yield (kg/ha)	Plant Height (cm)	No. of Leaves / Plant	Inter nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD 381	1100	108.40	13	4.80	49.34	17.80
NBD 382	499	101.00	13	5.00	36.00	12.50
NBD 383	844	117.50	13	5.00	36.50	12.50
NBD 384	966	130.80	12	6.08	46.82	17.38
NBD 385	442	102.00	11	5.50	45.50	15.50
NBD 386	895	127.70	14	5.52	38.86	13.88
NBD 387	1337	119.40	12	5.96	47.50	16.10
NBD 388	1034	134.20	15	4.34	44.68	15.18
NBD 389	707	129.20	13	5.84	43.62	15.00
NBD 390	1240	137.30	16	6.28	49.82	17.74
NBD 391	714	123.20	10	6.28	46.66	16.94
NBD 392	494	105.00	11	5.00	46.50	17.00
NBD 393	1278	109.20	10	5.78	51.08	17.92
NBD 394	923	86.00	9	4.46	38.90	13.24
NBD 395	770	105.40	10	4.74	42.56	15.16
NBD 396	791	108.80	9	5.06	38.38	13.46
NBD 397	547	105.50	9	4.66	38.36	13.50
NBD 398	1283	92.80	9	4.64	44.20	15.76
NBD 399	648	110.30	12	4.80	44.06	14.90
NBD 400	919	121.00	9	5.12	48.08	17.96
NBD 401	862	102.70	9	4.56	47.92	17.76
NBD 402	542	87.10	7	4.20	41.00	12.54
NBD 403	809	122.20	10	5.66	45.68	13.42
NBD 404	564	94.30	9	4.76	41.76	14.88
NBD 405	556	100.00	13	4.50	43.00	15.50
NBD 406	1245	100.70	10	5.36	50.50	18.72
NBD 407	2491	108.60	12	5.40	50.58	19.76
NBD 408	548	99.50	14	5.50	45.50	12.50
NBD 409	643	97.60	7	5.08	43.28	14.80
Vedaganga-1 (C)	1006	129.80	10	5.86	45.72	15.96
A-119 (C)	897	114.50	10	5.46	46.20	14.92
Bhavyashree (C)	1037	113.40	11	6.32	47.56	16.60
NBD-209 (C)	1231	119.50	11	6.10	52.76	19.44
Mean	904.90	110.83	10.94	5.15	44.13	15.47
S.Em ±	44.22	8.76	1.46	0.47	0.94	0.49
C.D. at 5%	127.38	25.23	4.22	1.37	2.71	1.41
C.V%	6.91	11.18	18.93	13.02	3.02	4.47

** Significant at 5%*

Observations on the aphid population were made on five plants from each plot following the method of Sreedhar *et. al.*, 1993.

The indices (0-5) were standardized by counting the number of aphids on three leaves per plant (Top, Middle and Bottom) which formed a particular index (0-5). The results showed that, all the entries recorded highest scale of 5 for aphids.

Table 2 BDNBR 4.5: Incidence of insect pests under PVT during 2023-24

S. No.	Entries	Aphids (0 to 5 Scale)
1	NBD 381	5
2	NBD 382	5
3	NBD 383	4
4	NBD 384	3
5	NBD 385	4
6	NBD 386	3
7	NBD 387	4
8	NBD 388	3
9	NBD 389	3
10	NBD 390	3
11	NBD 391	5
12	NBD 392	5
13	NBD 393	4
14	NBD 394	5
15	NBD 395	5
16	NBD 396	5
17	NBD 397	5
18	NBD 398	5
19	NBD 399	5
20	NBD 400	5
21	NBD 401	5
22	NBD 402	5
23	NBD 403	5
24	NBD 404	4
25	NBD 405	3
26	NBD 406	3
27	NBD 407	4
28	NBD 408	5
29	NBD 409	3
30	Vedaganga-1 (C)	4
31	A-119 (C)	5
32	Bhavyashree (C)	3
33	NBD-209 (C)	4

Score: 0=0, 1=1-50, 2=51-250, 3=251-500, 4=501-1000, 5=>1000

Project No.: BDNBR 4.5

Research project title	**Preliminary Varietal Trial - Seeds on *bidi* tobacco**
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

Treatments	:	33 (28+5)	Plot size	:	2 × 7.5 m
Replications	:	Two	Design	:	R B D

RESULTS

The Preliminary Varietal Trial -Seeds consisted of 28 test entries and five checks which were evaluated in RBD with two replications and spacing of 2 m x 7.5 m (Gross and Net plot). Among the 28 test entries, five entries *viz.,* NBD-S-26 (2781 kg/ha), NBD-S-21 (2443 kg/ha), NBD-S-27 (2421 kg/ha), NBD-S-24 (2413 kg/ha) and NBD-S-20 (2152 kg/ha) recorded significant superiority and two test entries *viz.,* NBD-S-22 (1920 kg/ha), NBD-S-3 (1855), recorded numerically superior for the leaf yield over the best seed check A-145 (1779 kg/ha) (Table 8). The entry NBD-S-2 (706.65 kg/ha) recorded significantly superior seed yield over best check A 119 (435.99 kg/ha) while the entries viz., NBD-S-3 (508.92 kg/ha), NBD-S-20 (500.43 kg/ha) NBD-S-25 (449.77 kg/ha) and NBD-S-1 (446.21 kg/ha) were numerically better seed yielders.

Salient findings/Achievements:

- Five entries *viz.,* NBD-S-26 (2781 kg/ha), NBD-S-21 (2443 kg/ha), NBD-S-27 (2421 kg/ha), NBD-S-24 (2413 kg/ha) and NBD-S-20 (2152 kg/ha) recorded significant superiority and two test entries *viz.,* NBD-S-22 (1920 kg/ha), NBD-S-3 (1855), recorded numerically superiority for the leaf yield over the best seed check A-145 (1779 kg/ha).
- The entry NBD-S-2 (706.65 kg/ha) recorded significantly superior seed yield over best check A 119 (435.99 kg/ha).
- The nine best test entries NBD-S-3, NBD-S-20, NBD-S-21, NBD-S-22, NBD-S-24, NBD-S-26, NBD-S-25, NBD-S-1 and NBD-S-27 will be evaluated in Station Varietal Trial-Seeds (SVT-S) along with checks during 2024-25.

Table 1 BDNBR 4.5: Preliminary Varietal Trial –Seeds

Entries	Pedigree	Seed yield (kg/ha)	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Int. length (cm)	Leaf length (cm)	Leaf width (cm)
NBD-S-1	A-119 x ArBD-7	446.21	1015	111.90	10	5.16	43.74	15.00
NBD-S-2	"	706.65	1120	119.40	11	5.38	48.38	18.70
NBD-S-3	"	508.92	1853	143.50	11	7.20	53.70	19.38
NBD-S-4	"	411.12	1451	108.50	10	5.52	47.54	18.40
NBD-S-5	ABD119 x ABD 69	405.32	1710	140.30	13	6.08	52.86	20.00
NBD-S-6	"	293.33	1303	134.60	12	5.64	47.50	17.46
NBD-S-7	"	263.75	1407	120.60	10	5.20	41.42	14.20
NBD-S-8	"	284.44	1237	127.50	13	5.50	42.90	15.16
NBD-S-9	"	299.21	1406	129.20	11	5.62	41.18	14.40
NBD-S-10	"	294.66	973	110.40	14	4.34	35.70	13.54
NBD-S-11	"	268.44	690	101.80	15	3.90	36.52	13.10
NBD-S-12	"	318.66	500	101.70	15	4.52	38.30	13.68
NBD-S-13	"	341.77	710	107.10	14	4.52	37.78	14.14
NBD-S-14	"	309.77	724	99.00	13	4.20	40.24	14.48
NBD-S-15	"	362.21	580	105.40	15	4.18	41.04	14.88
NBD-S-16	"	340.44	632	100.80	13	3.94	38.56	16.14
NBD-S-17	"	395.12	941	111.20	13	4.68	43.42	14.36
NBD-S-18	"	235.11	987	99.40	13	3.82	41.00	14.44
NBD-S-19	"	222.22	895	110.20	14	5.04	41.80	15.06
NBD-S-20	"	500.43	2152	122.00	13	6.04	48.10	18.60
NBD-S-21	Bhagyashree x ArBD-7	379.99	2443	129.90	17	6.58	49.22	17.64
NBD-S-22	"	277.33	1920	121.60	15	5.10	54.36	18.54
NBD-S-23	"	234.22	507	114.20	12	5.56	48.64	16.18
NBD-S-24	"	300.88	2413	104.83	11	4.37	49.33	15.50
NBD-S-25	"	449.77	716	114.50	12	4.84	50.22	17.12
NBD-S-26	"	418.21	2781	120.20	14	5.44	46.80	14.22
NBD-S-27	NBD 259 x TI-525	411.99	2421	126.67	11	5.10	39.67	14.10
NBD-S-28	"	291.10	1579	131.70	12	5.04	46.34	14.58
A-145		334.21	1779	121.40	13	5.46	45.64	16.70
Vedaganga-1		321.77	1704	140.30	13	6.44	51.96	19.20
A-119		435.99	1410	126.30	13	4.50	49.08	18.00
Bhavyashree		344.44	1253	118.50	13	5.48	47.14	16.94
NBD-209		420.92	1341	110.80	21	4.98	46.26	16.34
Mean		356.47	1350.08	115.76	12.75	5.09	44.63	15.94
S.Em ±		29.57	119.48	7.12	1.00	0.49	4.53	1.52
C.D. at 5%		85.18	344.17	20.50	2.89	1.42	13.05	4.37
C.V%		11.73	12.52	8.69	11.13	13.70	14.35	13.45

Project No.: BDNBR 4.6

Research project title	**Preliminary Hybrid Trial on *bidi* tobacco**
Objectives	▪ Identification of superior *bidi* tobacco entries for Karnataka
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Nipani

Treatments : 41(37+4) Plot size : 2 × 7.5 m
Replications : Two Design : R B D

RESULTS

The Preliminary Hybrid Trial (PHT) consisted of 37 test hybrids and four checks and nineteen parents were evaluated. Total 25 test hybrids recorded significant superiority for the leaf yield over the best check NBD 209 (1231 kg/ha). The test hybrid, NBTH 1068 (MS A-119 X ABD 228) recorded highest leaf yield (4534 Kg/ha) followed by NBTH 1067 (3645 Kg/ha), NBTH 1073 (3267 Kg/ha) and NBTH 1070 (3112 Kg/ha). (Table 1 BDNBR 4.6)

Salient findings/Achievements

- Total 25 test hybrids recorded significant superiority for the leaf yield over the best check NBD 209 (1231 kg/ha).
- All these 25 test hybrids will be evaluated in SHT during 2024-25.

Table 1 BDNBR 4.6: Cured leaf yield and morphological characters in PHT during 2023-24

Entries	Pedigree	Leaf yield (kg/ha)	Plant height (cm)	No. of Leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH 1067	MS A-119 X ABD 226	3645	92.86	10	3.60	42.61	13.63
NBTH 1068	MS A-119 X ABD 228	4534	75.19	9	1.87	37.14	11.76
NBTH 1069	MS A-119 X ABD 229	2001	82.69	7	4.17	38.44	12.96
NBTH 1070	MS A-119 X NyBD 68	3112	98.79	12	4.43	44.10	15.60
NBTH 1071	MS NBD 209 X ABD 226	2001	80.19	10	2.87	33.74	12.76
NBTH 1072	MS NBD 209 X ABD 228	2401	100.19	9	4.87	40.74	13.16

Entries	Pedigree	Leaf yield (kg/ha)	Plant height (cm)	No. of Leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH 1073	MS NBD 209 X NyBD 68	3267	107.69	12	5.52	45.09	17.86
NBTH 1074	MS NBD 209 X S-20	2867	101.44	12	4.97	50.24	19.96
NBTH 1075	MS NPN 22 X A-119	2045	129.79	15	5.39	49.14	19.44
NBTH 1076	MS NPN 22 X ABD 95	2705	102.99	11	4.87	49.90	20.44
NBTH 1077	MS NPN 22 X ABD 226	2376	122.79	22	5.72	54.36	21.65
NBTH 1078	MS NPN 22 X ABD 228	2126	94.79	21	3.56	56.48	22.53
NBTH 1079	MS NPN 22 X ABD 229	2105	127.19	18	5.72	46.64	18.17
NBTH 1080	MS NPN 22 X NyBD 68	1622	120.79	16	5.08	48.48	18.45
NBTH 1081	MS NPN 22 X NyBD 69	2215	140.99	21	5.52	50.08	19.05
NBTH 1082	MS NPN 22 X S-20	1892	115.79	17	6.32	50.24	18.77
NBTH 1083	MS Bhagyashree X ABD 101	1465	132.79	16	5.76	46.44	18.25
NBTH 1084	MS Bhagyashree X ABD 228	1474	96.39	23	3.24	51.80	19.53
NBTH 1085	MS Bhagyashree X NyBD 68	719	100.39	12	4.80	44.48	16.17
NBTH 1086	MS Bhagyashree X NyBD 69	1271	121.79	20	4.32	39.52	14.45
NBTH 1087	MS Bhagyashree X A-428	1030	91.39	14	4.24	41.76	17.21
NBTH 1088	MS Vedaganga X NPN 22	941	110.33	14	4.81	35.49	12.14
NBTH 1089	MS A-2 X ABD 95	948	100.93	12	4.41	43.29	14.70
NBTH 1090	MS A-2 X ABD 226	870	100.33	14	4.25	35.21	12.22
NBTH 1091	MS A-2 X NyBD 68	1314	105.33	15	4.91	37.12	14.10
NBTH 1092	MS A-2 X NyBD 69	819	102.33	13	3.77	34.77	12.18
NBTH 1093	MS PL-5 X ABD 95	1344	101.33	13	5.33	36.89	13.42
NBTH 1094	MS PL- 5 X ABD 226	2114	100.33	12	5.17	42.45	14.50
NBTH 1095	MS PL-5 X ABD 228	2181	94.08	15	4.57	40.60	14.00
NBTH 1096	MS PL- 5 X NyBD 68	1048	107.33	11	4.61	31.01	11.34
NBTH 1097	MS PL-5 X NyBD 69	834	100.53	13	4.69	29.89	11.70
NBTH 1098	MS GT-5 X ABD 95	2674	94.73	14	5.08	36.30	14.14
NBTH 1099	MS GT-5 X ABD 101	1608	109.53	11	5.08	39.34	15.78
NBTH 1100	MS GT-5 X ABD 226	861	87.33	11	4.88	36.26	14.54
NBTH 1101	MS GT-5 X ABD 229	1386	94.33	11	4.40	44.58	19.34

Entries	Pedigree	Leaf yield (kg/ha)	Plant height (cm)	No. of Leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH 1102	MS GT-5 X NyBD 68	2108	124.13	15	4.88	48.34	21.10
NBTH 1103	MS GT-5 X NyBD 69	2370	74.73	12	3.56	38.62	16.74
ABD 95 (GRPM 111)		1608	114.73	16	5.04	44.66	18.02
ABD 101 (GRPM 115)		1274	121.13	15	4.56	43.18	16.10
ABD 226 (AVT-II -1)		1074	91.73	11	4.48	33.50	13.34
ABD 228 (AVT-II -2)		1874	74.73	20	2.36	43.62	15.66
ABD 229 (AVT-II -3)		1532	100.73	14	3.84	33.78	13.22
NyBD 68 (AVT-II -4)		1074	101.73	16	5.20	33.74	14.10
NyBD 69 (AVT-II -5)		1336	96.97	13	4.68	38.31	13.67
S-20 (GRPM 11)		945	98.77	12	5.28	37.59	13.59
A-119		1227	88.80	10	4.32	42.80	16.40
NPN 22		818	104.97	10	4.76	46.23	16.71
A-428 (GRPM 206)		692	90.77	11	4.64	44.39	15.35
MS A-2		729	113.97	12	4.68	35.19	12.59
MS A 119		625	94.97	11	4.60	44.67	15.47
MS NBD 209		1105	123.97	12	6.28	39.99	14.79
MS NPN 22		652	111.97	11	5.04	42.67	14.83
MS Bhagyashree		598	132.97	12	5.80	38.99	13.43
MS Vedaganga		339	104.97	12	4.84	39.07	12.67
MS PL- 5		558	116.17	12	5.68	36.63	13.03
MS GT-5		873	101.57	15	4.56	34.83	12.63
Mean		1593.65	104.16	13.49	4.68	41.54	15.50
S.Em ±		118.92	5.36	1.22	0.45	3.39	1.55
C.D. at 5%		256.91	11.59	2.65	0.96	7.33	3.35
C.V%		6.63	4.16	7.33	7.88	6.75	8.43
Checks							
Vedaganga-1 (C)		1044.85	122.31	14.56	4.38	32.58	11.69
A-119 (C)		977.31	88.60	10.42	4.07	39.15	13.69
Bhavyashree (C)		1181.95	103.50	15.48	4.40	41.48	13.92
NBD-209 (C)		1239.08	117.95	15.70	4.94	45.91	15.81

Project No.: BDNBR 5

Research project title	GENERATION OF BREEDING MATERIAL
Objectives	▪ Breeding for higher yield and quality coupled with disease resistance
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	-
Location	ARS, Nipani

Project No.: BDNBR 5.1

Research project title	Generation of New Crosses

RESULTS

A total of 45 new inter varietal crosses and 26 MS based crosses were generated for leaf yield, quality and disease and pest resistance.

Salient findings/Achievements

The new cross combinations will be evaluated for their yield and agronomic characters during 2024-25.

Table 1 BDNBR 5.1: List of inter varietal crosses generated during 2023-24

Objective: High & quality leaf yield coupled with disease & pest resistance

S. No.	Crosses
1.	A-119 x NBD 343
2.	A-119 x NBD 344
3.	A-119 x NBD 356
4.	A-119 x ABD 252
5.	NBD 209 x NBD 343
6.	NBD 209 x NBD 344
7.	NBD 209 x NBD 356
8.	NBD 209 x ABD 252
9.	NPN 22 x NBD 343
10.	NPN 22 x NBD 344
11.	NPN 22 x NBD 356
12.	NPN 22 x ABD 252
13.	NBD 316 x NBD 343
14.	NBD 316 x NBD 344
15.	NBD 316 x NBD 356
16.	NBD 316 x ABD 252
17.	A- 2 x NBD 343
18.	A-2 x NBD 344
19.	A- 2 x NBD 356
20.	A- 2 x ABD 252
21.	Bhagyashree x NBD 344
22.	Bhagyashree x A-428
23.	Vedaganga x A-428
24.	A-119 x A-428
25.	NBD 209 x A-428
26.	NPN 22 x A 428
27.	NBD 316 x A-428
28.	A-2 x A-428
29.	GT-5 x A-428

S. No.	Crosses
30.	NBD 209 x Vin-5
31.	NBD 209 x ArR 104
32.	NBD 209 x ArR 105
33.	NBD 316 x Vin-5
34.	NBD 316 x ArR 104
35.	NBD 316 x ArR 105
36.	NBD 316 x ArBD 39
37.	NBD 316 x Natu Bhairavi
38.	NBD 316 x Ornamental Tobacco
39.	NPN 22 x ArBD 39
40.	NPN 22 x Natu Bhairavi
41.	ArR 104 x NBD 316
42.	ArR 105 x NBD 316
43.	ArBD 39 x NBD 316
44.	Vin-5 x NBD 316
45.	A-428 x NBD 316

Table 2 BDNBR 5.1: List of new MS based crosses generated during 2022-23

Objective: The crosses were made with an objective of achieving good quality and more leaf yield coupled with resistance to pest and diseases.

S.No.	Entry code	Crosses
1.	NBTH 1104	MS A-119 x NBD 343
2.	NBTH 1105	MS A-119 x NBD 344
3.	NBTH 1106	MS A-119 x NBD 356
4.	NBTH 1107	MS A-119 x ABD 252
5.	NBTH 1108	MS NBD 209 x NBD 343
6.	NBTH 1109	MS NBD 209 x NBD 344
7.	NBTH 1110	MS NBD 209 x NBD 356
8.	NBTH 1111	MS NBD 209 x ABD 252
9.	NBTH 1112	MS NPN 22 x NBD 343
10.	NBTH 1113	MS NPN 22 x NBD 344
11.	NBTH 1114	MS NPN 22 x NBD 356
12.	NBTH 1115	MS NPN 22 x ABD 252
13.	NBTH 1116	MS Bhagyashree x NBD 344
14.	NBTH 1117	MS Bhagyashree x NBD 356
15.	NBTH 1118	MS Bhagyashree x ABD 252
16.	NBTH 1119	MS Vedaganga x ABD 252
17.	NBTH 1120	MS A-2 x NBD 343
18.	NBTH 1121	MS A-2 x NBD 344
19.	NBTH 1122	MS A-2 x ABD 252
20.	NBTH 1123	MS PL-5 x NBD 343
21.	NBTH 1124	MS PL-5 x NBD 344
22.	NBTH 1125	MS PL-5 x NBD 356
23.	NBTH 1126	MS PL-5 x ABD 252
24.	NBTH 1127	MS GT-5 x NBD 343
25.	NBTH 1128	MS GT-5 x NBD 356
26.	NBTH 1129	MS GT-5 x NBD 252

Project No.: BDNBR 5.2

Research project title	Generation of breeding material (F_1 evaluation)

Evaluation of F_1s

A total 45 F1s evaluated along with four checks *viz.,* Vedaganga-1, A-119, Bhavyashree and NBD-209. Out of 45 F1s, the cross combinations ABD 229 x NBD 209 (3360 Kg/ha), ABD 228 x A-119 (3133 Kg/ha), A-119 x ABD 228 (2983 Kg/ha), ABD 228 x Vedaganga-1 (2560 Kg/ha), ABD 228 x NBD 209 (2133 Kg/ha), ABD 226 x A-119 (2027 Kg/ha), NBD 209 x ABD 226 (2027 Kg/ha) and NBD 316 x ABD 226 (1257 Kg/ha) were found to be potential heterotic cross combinations and will be advanced to F2 generation during 2024-25. (Table-12)

Salient findings/Achievements

- The potential heterotic cross combinations selected based on yield performance will be advanced to next generation (F2).

Table 1 BDNBR 5.2: Early Generation material in F_1 evaluation (2023-24)

Objective: High leaf yield and good quality

S. No.	Entries
1.	ABD 226 X A-119
2.	ABD 226 X NBD 209
3.	ABD 226 X NBD 316
4.	ABD 226 X Vedaganga-1
5.	ABD 228 X A-119
6.	ABD 228 X NBD 209
7.	ABD 228 XVedaganga-1
8.	ABD 229 X A 119
9.	ABD 229 X NBD 209
10.	ABD 229 X NBD 316
11.	ABD 229 X Vedaganga-1
12.	ABD 229 X NPN 22
13.	NyBD 68 X A-119
14.	NyBD 68 X NBD 209
15.	NyBD 68 X NBD 316
16.	NyBD 68 X Vedaganga-1
17.	NyBD 68 X NPN 22
18.	NyBD 69 X A 119
19.	NyBD 69 X NBD 209
20.	NyBD 69 X NBD 316
21.	NyBD 69 X Vedaganga-1
22.	NyBD 69 X NPN 22

Objective: High & quality leaf yield coupled with disease & pest resistance

S. No.	Entries
23.	Vedaganga-1X ABD 226
24.	Vedaganga-1 X ABD 228
25.	Vedaganga-1X ABD 229
26.	Vedaganga-1 X NyBD 68
27.	Vedaganga-1 X NyBD 69
28.	A-119 X ABD 226
29.	A-119 X ABD 228
30.	A-119 X ABD 229
31.	A-119 X NyBD 68
32.	A-119 X NyBD 69
33.	NPN-22 X ABD 226
34.	NPN 22 X ABD 228
35.	NPN 22 X ABD 229
36.	NPN 22 X NyBD 69
37.	NBD 209 X ABD 226
38.	NBD 209 X ABD 228
39.	NBD 209 X ABD 229
40.	NBD 209 X NyBD 68
41.	NBD 209 X NyBD 69
42.	NBD 316 X ABD 226
43.	NBD 316 X ABD 229
44.	NBD 316 X NyBD 68
45.	NBD 316 X NyBD 69
46.	Vedaganga-1
47.	A-119
48.	Bhavyashree
49.	NBD-209

Table 2 BDNBR 5.2: Selected F_1s for advancement of F_2

S. No	F_1	Leaf yield potential (kg/ha)
1.	ABD 226 X A-119	2027
2.	ABD 228 X A-119	3133
3.	ABD 228 X NBD 209	2133
4.	ABD 228 XVedaganga-1	2560
5.	ABD 229 X NBD 209	3360
6.	A-119 X ABD 228	2983
7.	NBD 209 X ABD 226	2027
8.	NBD 316 X ABD 226	1257

Project No.: BDNBR 5.2

Research project title	Generation of breeding material (F_2 evaluation)

Evaluation of F_2s

A total five F_2 population namely, NBD 209 x ABD 101, NBD 209 x ABD 95, NBD 316 x ABD 95, NBD 316 x NBD 111 and NBD x S 20 evaluated. Total 33 plants were selected from five populations and finally 12 plants selected based on yield performance will be advanced to next generation (F_3) which are given in the following table.

Salient findings/Achievements

- A total of twelve plants were selected based on the visual observation and yield performance will be advanced to F_3 generation.

Table 1 BDNBR 5.3: Data on F_2s plants selected for advancement of F_3 generation

Entries	Plants population maintained	Initial selection	Final selection
NBD 209 X ABD 101	180	2	1
NBD 209 X ABD 95	310	5	2
NBD 316 X ABD 95	470	12	6
NBD 316 X NBD 111	280	6	2
NBD 316 X S 20	500	8	1
	Total	**33**	**12**

Table 2 BDNBR 5.3: List of F_3 population 2023-24

S. No.	Entry code	Pedigree
1	2022-1-4-4	NBD 209 x ABD 101
2	2022-2-15-6	NBD 209 x ABD 95
3	2022-2-15-10	NBD 209 x ABD 95
4	2022-3-5-8	NBD 316 x ABD 95
5	2022-3-6-4	NBD 316 x ABD 95
6	2022-3-24-2	NBD 316 x ABD 95
7	2022-3-35-7	NBD 316 x ABD 95
8	2022-3-35-9	NBD 316 x ABD 95
9	2022-3-43-3	NBD 316 x ABD 95
10	2022-4-15-3	NBD 316 x NBD 111
11	2022-4-18-9	NBD 316 x NBD 111
12	2022-5-4-10	NBD 316 x S-20

Project No.: BDNBR 5.3

Research project title	Generation of breeding material (F_3 evaluation)

Evaluation of F_3s

Seventy four F_3 families of the nine crosses A-119 x NBD 276, A-119 x NBD 277, NBD 209 x NBD 277, Vedaganga-1 x NBD 277, A-2 x NBD 277, PL-5 x NBD 277, Bhavyashree x NBD 277, NBD 209 x NBD 276 and Bhagyashree x NBD 277 were evaluated for leaf yield and its attributes. A total of 16 plants out of six crosses selected and finalised based on visual and yield performance will be advanced to next generation (F_4) which are given in the following table.

Salient findings/Achievements:

- Sixteen superior progenies selected from F_3 families of above mentioned pedigrees will be advanced to next generation (F_4).

Table 1 BDNBR 5.4: Data on selected F_3's for advancement to F_4 generation

Entries	Plants population maintained	Initial selection	Final selection
A-119 x NBD 276	540	10	4
A-119 x NBD 277	170	2	1
NBD 209 x NBD 277	400	6	4
Vedaganga-1 x NBD 277	620	12	3
A-2 x NBD 277	360	10	2
Bhagyashree x NBD 277	200	7	2
	Total	**47**	**16**

Table 2 BDNBR 5.4: List of F_4 population

S. No.	Entry Code	Pedigree
1	2021-1-1/2-4/3-9	A-119 x NBD 276
2	2021-1-1/6-3/6-4	A-119 x NBD 276
3	2021-1-1/6-3/7-6	A-119 x NBD 276
4	2021-1-1/6-3/8-8	A-119 x NBD 276
5	2021-2-1/4-8/5-7	A-119 x NBD 277
6	2021-3-1/3-6/2-1	NBD 209 x NBD 277
7	2021-3-1/3-6/3-5	NBD 209 x NBD 277
8	2021-3-1/3-6/3-9	NBD 209 x NBD 277
9	2021-3-2/9-4/4-6	NBD 209 x NBD 277
10	2021-4-1/8-2/3-8	Vedaganga-1 x NBD 277
11	2021-4-1/2-6/1-4	Vedaganga-1 x NBD 277
12	2021-4-1/2-6/2-10	Vedaganga-1 x NBD 277
13	2021-5-2/2-3/10-8	A-2 x NBD 277
14	2021-5-2/6-2/22-7	A-2 x NBD 277
15	2021-12-2/5-9/2-5	Bhagyashree x NBD 277
16	2021-12-2/5-9/2-9	Bhagyashree x NBD 277

Project No.: BDNBR 5.5

Research project title	Generation of breeding material (F_4 evaluation)

Evaluation of F_4s

Forty-three F_4 lines evaluated in an unreplicated yield trial. The F_4 lines were evaluated for yield and yield attributes and superior lines were selected and will be tested in F_5 during 2024-25.

Salient findings/Achievements

- Twenty-six entries forwarded to F_5 from F_4 generation

Table 1 BDNBR 5.4: F_4 lines forwarded to F_5

S. No.	Entry code	Pedigree
1.	2020-21-6-1/7-6-1	Bhavyashree x NBD 316
2.	2020-21-6-2/8-1-4	Bhavyashree x NBD 316
3.	2020-21-6-2/8-1-8	Bhavyashree x NBD 316
4.	2020-21-6-2/8-1-10	Bhavyashree x NBD 316
5.	2020-21-6-2/8-3-1	Bhavyashree x NBD 316
6.	2020-21-6-2/8-3-5	Bhavyashree x NBD 316
7.	2020-21-6-2/8-7-5	Bhavyashree x NBD 316
8.	2020-21-6-2/8-8-1	Bhavyashree x NBD 316
9.	2020-21-14-1/10-1-8	Bhavyashree x NBD 316
10.	2020-21-16-1/11-9-1	Bhavyashree x NBD 316
11.	2020-21-16-1/11-12-2	Bhavyashree x NBD 316
12.	2020-21-21-1/14-7-9	Bhavyashree x NBD 316
13.	2020-21-21-1/14-11-1	Bhavyashree x NBD 316
14.	2020-21-27-1/18-1-4	Bhavyashree x NBD 316
15.	2020-21-27-1/18-3-2	Bhavyashree x NBD 316
16.	2020-21-12-2/22-5-9	Bhavyashree x ABD 174
17.	2020-21-12-2/22-6-6	Bhavyashree x ABD 174
18.	2020-21-12-2/22-10-1	Bhavyashree x ABD 174
19.	2020-21-14-1/23-1-10	Bhavyashree x ABD 174
20.	2020-21-14-1/23-3-3	Bhavyashree x ABD 174
21.	2020-21-14-1/23-4-2	Bhavyashree x ABD 174
22.	2020-21-14-1/23-6-7	Bhavyashree x ABD 174
23.	2020-21-14-1/23-7-8	Bhavyashree x ABD 174
24.	2020-21-14-1/23-10-8	Bhavyashree x ABD 174
25.	2020-21-14-1/23-10-9	Bhavyashree x ABD 174
26.	2020-21-14-3/24-3-6	Bhavyashree x ABD 174

Project No.: BDNBR 1

Research project title	Collection, evaluation and maintenance of germplasm lines in *bidi* tobacco
Objectives	▪ To maintain *bidi* germplasm and to utilize in the Breeding programme
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2015-16
Year of completion	Long term
Location	ARS, Nipani

RESULTS

A total of 251 germplasm lines were planted and maintained.

Table 1 BDNBR 1: List of Germplasms to be maintained during 2023-24 Set-I

Entry code	Entries	Entry code	Entries
1	Keliu-20	144	ArBD-8
2	Anand-23	145	ArBD-9
3	Anand-119	146	ArBD-32
4	Anand-2	147	ArBD-33
5	GT-4	153	G. M. Koyali
6	Kukumarthi	154	Line {34-30 X $(A-119)^2$} 103-6-1-40-22-34-26-35-22-25-2
7	103-9-101	155	Line 543-41-12-14 (RPK type)
8	783-51	156	Line-1-1
9	114-4 (RPK type)	157	Pilliu-37
10	Peschtere 28	158	Line-169-119 (Upper leaves long internode)
11	S-20	159	Black Spangle Parent (B.S.P)
12	S-12	160	Necrotic Crinkle Dwarf(N.C.D)
13	S-112	161	Line 93-103-93 (88- 47 X Sokh)
14	Akol	162	Line 114-16 (Female parent of GT-4)
15	Gundsurti	163	Line 181-83-1 (S-20 X K-20)
16	Kodani	164	Line 134-2-2 {K-20 X Sokh} X K-20
17	V-54	165	Line 543-37-38-24 (A-119 X Olor)
18	Dumbara	166	Line 121-13-27-29 (108-15 X Olar)
19	Smyrna	173	C-11

Entry code	Entries	Entry code	Entries
20	Sanand local	174	KL
21	Subhelav selection	175	Oriental
22	Red Russion	176	Xanthi
23	Bankete A-1	177	Samsan
24	V-58	178	Trabizonal
25	Keliu-49	179	Viswanath
26	Pilliu-19	180	Sender Patti Special
27	BL 4-2	181	Bhagyalakshmi
28	103-9-101-28-31 (A-2 X Olor)	182	HDBRG-LP-2
35	GT-9	183	F_7-127
36	TI-421	184	Margadhan
37	TI-525	185	Bhagya
38	KDH-959	186	320-2-30-28-18-I
39	Abirami	187	Jati Patti
40	Jayalaksmi	188	320-2-30-28-20-12
41	575-28-110	189	16-12-21-106-4-26
42	GT-5	190	DWFC
43	GT-7	191	Thangam
53	K-20-Plule leaves	192	320-2-80-25-84-10-I
54	RPK-1-2	193	Jati
56	22-10-1 (11-47-Sokha)	194	Kunkumarthi
57	35 - 19 - 39 - 24	195	GT-5
58	169-19-16 (88-47-Sokha)	196	Vairam
59	SB -154	197	F-7-124
60	169-19-6 (88-47-Sokha)	206	A-428
61	A-1-11-65	212	ArBD-39
62	169-2 (N & L)		Vin-5
63	Jhakhari Rampur		Ornamental Tobacco
64	AKBT-03-02		Natu Bhairavi
65	ABT-10		ArR -104
66	Bhavyashree		ArR-105
141	ArBD-4		N-b-r
142	ArBD-5		Gajapathi
143	ArBD-7		

Set-II

Entry code	Entries	Entry code	Entries
44	NBD-119	199	NPN-64
45	NBD-239-2	200	NPN-65
46	NBD-257	201	NPN-66
47	NBD-259	202	NPN-73
48	NBD-260	203	NPN-75
49	NBD-239-4	204	NPN-81
50	NBD-209	205	NPN-30
51	NBD-122	207	NBD-289
52	NBD-261	208	NBD-290
55	NBD - 48 – 1	214	NBD-309
67	NBD-43	215	NBD-312
68	NBD-53	216	NBD-314
69	NBD-57-1	217	NBD-300
70	NBD-71	219	NBD-302
71	NBD-80-1	220	NBD-297
72	NBD-80-2	221	NBD-315
73	NBD-85	222	NBD-316
74	NBD-95	223	NBD-317
75	NBD-111	224	NBD-318
76	NBD-115	225	NBD-319
77	NBD-136	226	NBD-307
78	NBD-154	227	NBD-308
79	NBD-155	228	NBD-310
80	NBD-159	229	NBD-311
81	NBD-164	230	NBD-313
82	NBD-236	234	NBD-320
83	NBD-271	238	NBD-324
84	NBD-276	239	NBD-325
85	NBD-277	240	NBD-326
198	NPN-63	241	NBD 237

Set-III

Entry code	Entries	Entry code	Entries
29	ABD-7	117	ABD-103
30	ABD-15	118	ABD-104
31	ABD-119	119	ABD-107
32	ABD-24	120	ABD-109
33	ABD-30	121	ABD-110
34	ABD-36	122	ABD-111
86	ABD-43	123	ABD-112
87	ABD-46	124	ABD-113
88	ABD-50	125	ABD-115

Entry code	Entries	Entry code	Entries
89	ABD-51	126	ABD-116
90	ABD-52	127	ABD-117
91	ABD-54	128	ABD-118
92	ABD-60	129	ABD-120
93	ABD-61	130	ABD-121
94	ABD-62	131	ABD-123
95	ABD-67	132	ABD-124
96	ABD-68	133	ABD-125
97	ABD-69	134	ABD-127
98	ABD-70	135	ABD-128
99	ABD-71	136	ABD-130
100	ABD-72	137	ABD-131
101	ABD-73	138	ABD-132
102	ABD-77	139	ABD-146
103	ABD-78	140	ABD-152
104	ABD-79	167	ABD-10
105	ABD-84	168	ABD-65
106	ABD-87	169	ABD-66
107	ABD-90	170	ABD-67
108	ABD-91	171	ABD-101 (GABT-11)
109	ABD-92	172	ABD-118
110	ABD-94	210	ABD-138
111	ABD-95	211	ABD-151
112	ABD-96	231	ABD-145
113	ABD-99	232	ABD-163
114	ABD-100	243	ABD 164
115	ABD-101	244	ABD 173
116	ABD-102		

Set-IV

Entry code	Entries
148	NyBD-3
149	NyBD-4
150	NyBD-5
151	NyBD-56
152	NyBD-59
209	NyBD-55

Out of 244 germplasms, 68 were evaluated for yield and other parameters. Total 32 entries are of good leaf yielding varieties will be used in crossing programme.

Entry code	Entries	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Int. length (cm)	Leaf length (cm)	Leaf width (cm)
Set-I							
2	Anand-23	1733	111.00	12	4.87	45.93	17.40
3	Anand-119	1733	145.00	18	7.40	51.90	22.50
11	S-20	1156	133.33	16	6.47	57.20	25.93
26	Pilliu-19	1307	128.00	18	7.00	50.67	19.00
27	BL-42	1570	137.00	10	6.00	60.07	22.73
28	103-9-101-28-31(A-Olor)	1371	138.00	18	3.67	55.33	24.93
29	GT-5	1367	141.00	18	3.60	53.40	21.87
31	TI-525	1280	131.67	19	3.80	56.00	25.53
33	Abirami	1600	100.67	16	3.27	57.00	25.87
48	AKBT-03-02	1867	150.00	20	4.00	61.50	27.10
49	ABT-10	2267	154.67	19	6.33	63.93	29.40
51	ArBD-4	2000	134.00	16	8.00	56.80	27.20
53	ArBD-7	2533	129.33	16	7.00	58.87	27.87
54	ArBD-8	2171	135.00	13	9.80	60.40	28.60
56	ArBD-32	2167	140.33	17	8.67	58.53	27.00
57	ArBD-33	2133	137.00	13	7.27	59.47	28.47
71	Line-121-13-27-29(108-15 x Olar)	1644	151.67	16	8.20	67.47	27.53
72	C-11	2667	54.40	14	5.93	72.93	31.93
73	KL	3133	77.60	18	3.60	68.13	32.13
77	Trabizonal	1600	126.33	16	3.13	59.80	24.80
93	Kumkumarthi						
94	GT-5	3733	52.60	17	7.20	71.20	39.10
97	A-428	2067	117.00	17	7.93	52.93	21.07
Set-II							
3	NBD 257	1707	118.33	18	5.87	50.73	19.20
5	NBD 260	876	117.33	16	6.27	62.80	28.60
20	NBD 115	3633	171.67	20	8.73	62.00	25.53
22	NBD 154	2433	134.00	20	7.53	58.73	22.47
28	NBD 276	3352	146.00	13	7.93	65.07	26.80
30	NPN 63	2252	133.33	13	9.00	58.93	29.93
35	NPN 75	1067	148.33	13	7.73	53.60	21.93
38	NBD 289	1467	150.00	16	7.33	50.00	19.67
40	NBD 309	1467	123.67	14	5.33	51.47	18.80
41	NBD 312	1422	131.67	16	6.33	54.93	22.27
43	NBD 300	1200	130.00	12	6.13	57.93	27.87
44	NBD 302	1787	122.67	15	5.00	59.93	27.13
45	NBD 297	2800	126.00	15	6.87	52.27	22.27

Entry code	Entries	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Int. length (cm)	Leaf length (cm)	Leaf width (cm)
46	NBD 315	1570	143.33	16	6.13	51.40	21.13
47	NBD 316	2080	144.33	15	6.93	57.20	26.07
48	NBD 317	1659	147.33	11	7.47	52.40	21.00
55	NBD 313	2356	171.67	17	7.33	99.80	26.40
Set-III							
6	ABD 36	2637	151.33	16	9.47	71.60	30.87
7	ABD 43	1748	137.67	14	7.60	62.80	28.00
9	ABD 50	2567	135.33	16	4.20	59.27	22.93
13	ABD 60	2193	164.33	20	7.40	52.93	22.33
16	ABD 67	2000	121.67	18	8.67	57.67	26.13
17	ABD 68	2552	144.00	20	7.27	60.00	23.60
18	ABD 69	1733	145.33	16	7.80	59.80	27.07
20	ABD 71	2400	130.00	13	6.73	52.93	21.20
21	ABD 72	1573	95.00	12	5.07	54.07	21.07
30	ABD 92	2933	156.67	18	7.40	68.20	29.87
32	ABD 95	1973	145.00	17	7.60	60.67	27.53
39	ABD 104	2027	153.33	18	7.07	55.93	22.53
40	ABD 107	1840	147.00	18	8.60	56.60	25.33
43	ABD 111	1973	134.00	17	8.40	62.53	29.33
48	ABD 117	747	124.33	14	6.33	54.00	23.00
54	ABD 125	2067	146.33	15	8.33	61.60	25.53
55	ABD 127	3307	137.33	16	8.47	68.67	30.27
56	ABD 128	1900	139.33	18	7.53	63.93	31.67
61	ABD 152	1943	122.00	17	8.13	61.27	29.87
63	ABD 65	1067	132.50	14	8.00	63.70	33.60
64	ABD 66	2533	161.33	17	9.00	65.80	32.13
66	ABD 101 (GABT-11)	2210	159.67	17	8.20	57.40	26.00
67	ABD 118	2044	161.67	17	8.20	62.67	30.13
69	ABD 151	1967	150.33	14	8.13	58.00	26.00
70	ABD 145	2781	175.00	20	8.67	55.33	22.73
72	ABD 164	987	136.67	14	8.00	61.00	29.67
73	ABD 173	2233	134.00	15	8.00	56.07	27.13

Project No.: BDNBR

Research project title	Maintenance of A/B lines and released varieties
Objectives	▪ To maintain A lines & released varieties
Investigators	C. D. Soregaon, S.B. Patil, P.S. Matiwade & Geeta Dandin
Year of start	2023-24
Year of completion	-
Location	ARS, Nipani

Table BDNBR: List A and B lines maintained

S. No.	Entry Name	S. No.	Entry Name
1	MS A-119 X A-119	1	A-119
2	MS NBD-209 X NBD 209	2	NBD-209
3	MS Bhavyashree X Bhavyashree	3	Bhavyashree
4	MS Bhagyashree X Bhagyashree	4	Bhagyashree
5	MS Vedagandga X Vedaganga	5	Vedaganga
6	MS A-2 X A-2	6	A-2
7	MS PL-5 X PL-5	7	PL-5
8	MS GT-5 X GT-5	8	GT-5

NANDYAL

Project No.: OFT

Research project title	On Farm Trial on *bidi* tobacco
Objectives	▪ To evaluate the performance of promising *bidi* tobacco entries under Nandyal conditions in on-farm trial
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments : 9 (5+4) Plot size : 1000 m^2
Design : Non-replicated

RESULTS

In on-farm trial (2023-24) on *bidi* tobacco, 5 hybrids along with four checks were evaluated. The hybrids NyBTH-152(2540 kg/ha), NyBTH-155(2338 kg/ha) & NyBTH-157(2223 kg/ha) has recorded higher cured leaf yield with improvement of 23. 0 %, 13.0 % & 8.0 % respectively when compared to the best check Nandyal Pogaku-2 (2066 kg/ha) (Table 1 OFT).The hybrids NyBTH-152 & NyBTH-157 (Based on all trials data these two hybrid entries has recorded 15-20% yield advantage over recently released variety Nandyal Pogaku-2 and having high nicotine > 7% with low carbon monoxide content.) will be evaluated under OFT during 2024-25.

According to the results of the chemical quality analysis, it has been found that the hybrids NyBTH-152, NyBTH-157, and NyBTH-170 have recorded higher nicotine content of 7.26%, 7.15%, and 7.01%, respectively, compared to the hybrid check GABTH 2 (5.89%). Additionally, all the hybrids showed reducing sugar levels within the acceptable range while their chlorides were outside the acceptable range (Table 3 OFT).

Salient Findings/Achievements

- Hybrids NyBTH-152(2540 kg/ha), NyBTH-155(2338 kg/ha) & NyBTH-157(2223 kg/ha) has recorded higher cured leaf yield of 23%, 13% & 8% respectively when compared to the best check Nandyal Pogaku-2 (2066 kg/ha)

Table 1 OFT: Morphological characters & (2023-24)

Entries	Days to 50% flowering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score
NyBTH 152	118	77.5	51.5	25.2	5
NyBTH 155	120	80.2	50.7	21.5	5
NyBTH 157	117	84.1	49.6	18.7	5
NyBTH 170	122	78.5	44.6	17.7	4
NyBTH 171	122	88.1	42.5	16.9	5
A119 (C)	114	73.2	36.5	12.3	6
Nandyal pogaku-1(C)	113	85.2	47.7	21.1	5
Nandyal pogaku-2(C)	132	95.1	50.4	22.3	4
GABTH-2 (C)	140	72.4	40.6	15.6	2
GM	122	81.58	46.0	19.0	4.5

Table 2 OFT: Physiological characters & cured leaf yield (2023-24)

Entries	Leaf thickness (mg/cm^2)	SPAD	Cured leaf yield (kg/ha	% IOC (NP-2)
NyBTH 152	17.3	58.0	2540	23.0
NyBTH 155	15.6	57.1	2338	13.0
NyBTH 157	14.2	63.6	2223	8.0
NyBTH 170	14.4	68.2	1746	
NyBTH 171	14.3	54.5	1853	
A119 (C)	11.2	50.4	1436	
Nandyal pogaku-1(C)	16.8	87.2	1817	
Nandyal pogaku-2(C)	16.0	61.2	2066	
GABTH-2 (C)	14.1	50.4	1842	
GM	14.9	61.2	1985	

Table 3 OFT: Data on chemical analysis (2023-24)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
NyBTH 152	7.26	2.83	3.53
NyBTH 155	6.11	3.16	4.19
NyBTH 157	7.15	2.85	3.50
NyBTH 170	7.01	2.75	3.81
NyBTH 171	6.02	3.65	2.43
A119 (C)	5.09	3.33	3.34
Nandyal pogaku-1(C)	6.28	3.03	3.69
Nandyal pogaku-2(C)	5.88	3.01	5.10
GABTH-2 (C)	5.89	3.25	3.60

BDNyBR 4: HYBRIDIZATION AND SELECTION TO EVOLVE SUPERIOR *BIDI* TOBACCO VARIETIES/HYBRIDS

Project No.: BDNyBR 4.1

Research project title	**Observational Varietal Trial-I on *bidi* tobacco**
Objectives	▪ To evolve high yielding and better quality *bidi* tobacco hybrids with good aroma. ▪ To develop *bidi* tobacco hybrids with lower levels of smoke toxicants *viz.,* tar, Carbon monoxide (CO), polyphenol and smoke nicotine.
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments	:	5 (2+3)	Spacing	:	75 x 75 cm
Replications	:	Three	Plot size	:	6.75 × 2.25 m
Design	:	RBD	Fertilizer	:	NPK 110:70:50 kg/ha

RESULTS

In observational varietal trial- I (2023-24) on *bidi* tobacco, 2 entries along with three checks were evaluated in five replications. None of the entries were found significantly superior than the check Nandyal Pogaku-2. (Table BDNyBR 4.1)

Salient Findings/Achievements

- None of the entries were found significantly superior than the check Nandyal Pogaku-2.

Table 1 BDNyBR 4.1: Morphological characters & yield in OVT-I (2023-24)

Entries	Days to 50% flowe-ring	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thick-ness (mg/cm²)	Spangle score	Cured leaf yield (kg/ha)	% IOC (NP-1)
NyBD 95	127	79.9	46.8	18.1	5	52.2	20.2	1634
NyBD 96	129	78.5	46.7	18.4	5	55.6	16.9	1562
A119 (C)	117	74.3	37.8	14.8	6	61.9	14.1	1333
Nandyal Pogaku-1 (C)	114	80.1	45.6	17.8	5	50.2	17.3	1490
Nandyal Pogaku-2 (C)	134	84.6	45.3	19.0	4	50.8	18.3	1554
GM	124	79.5	44.4	17.6	5	54.1	17.4	1515
S.Em ±								58.1
C.D. at 5%								181.3
C.V%								9.0

Project No.: BDNyBR 4.2

Research project title	Observational varietal trial-II on *bidi* tobacco
Objectives	▪ To evolve high yielding and better quality *bidi* tobacco hybrids with good aroma. ▪ To develop *bidi* tobacco hybrids with lower levels of smoke toxicants *viz.,* tar, Carbon monoxide (CO), polyphenol and smoke nicotine.
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments	:	10 (7+3)	Spacing	:	75 x 75 cm
Replications	:	Three	Plot size	:	6.75 × 2.25 m
Design	:	R B D	Fertilizer	:	NPK 110:70:50 kg/ha

RESULTS

In observational varietal trial-II (2023-24) on *bidi* tobacco, 7entries along with three checks were evaluated. The entry NyBD 92 (2006 kg/ha) has recorded significantly higher cured leaf yield with improvement of 19.6% when compared to the best check Nandyal Pogaku-2 (1677 kg/ha).

According to the results of the chemical quality analysis, it has been found that the varieties NyBD 88, NyBD 92, and NyBD 90 have recorded higher nicotine content of 7.42%, 6.97%, and 6.80%, respectively & cured leaf yield, compared to the best check A119 (7.26%). Additionally, all the varieties showed reducing sugar levels within the acceptable range while their chlorides were outside the acceptable range (Table BDNyBR 4.2 OVT II).

Pooled cured leaf yield performance of observational varietal Trial II on bidi tobacco during (2022-23 and 2023-24), seven entries along with three checks were evaluated. The entries NyBD 92 (2026 kg/ha) and NyBD 91 (1897 kg/ha) has recorded significantly higher cured leaf yield with improvement of 20.8 % & 13.1 % respectively than the best check Nandyal Pogaku 2 (1677 kg/ha). (Table BDNY BR 3.4a). The entries NyBD 92 & NyBD 91 will be proposed for IVT during 2024-25.

Salient Findings/Achievements

- The entry NyBD 92 (2006 kg/ha) has recorded significantly higher cured leaf yield of 19.6 % than the best check Nandyal Pogaku 2 (1677 kg/ha).
- Based on pooled performance of the entries NyBD 92 (2026 kg/ha) and NyBD 91 (1897 kg/ha) has recorded significantly higher cured leaf yield of 20.8% & 13.1% respectively than the best check Nandyal Pogaku-2 (1677 kg/ha).

Table 1 BDNyBR 4.2: Morphological characters in OVT-II (2023-24)

Entries	Days to 50% flowe-ring	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	SPAD	Leaf thick-ness (mg/cm²)
NyBD 88	124	83	40.8	15.4	5	61.2	15.0
NyBD 89	128	84	39.0	14.4	5	57.2	13.8
NyBD 90	125	76	43.0	15.4	5	65.3	13.7
NyBD 91	125	83	42.4	15.7	4	60.3	18.2
NyBD 92	121	81	40.8	15.7	4	79.1	16.7
NyBD 93	123	76	40.9	13.4	4	54.6	13.4
NyBD 94	125	82	40.4	15.7	4	65.8	13.8
A119 (C)	116	73	38.8	14.8	6	73.2	10.8
Nandyal Pogaku-1 (C)	119	88	36.3	13.0	5	66.2	12.6
Nandyal Pogaku-2 (C)	132	89	42.8	15.7	4	62.7	13.4
GM	**124**	**82**	**40.5**	**14.9**	**5**	**64.56**	**14.1**

Table 2 BDNyBR 4.2: Yield chemical quality parameters in OVT-II (2023-24)

Entries	Cured leaf yield(kg/ha)	% IOC (NP-1)	Nicotine %	Reducing sugars %	Chlorides %
NyBD 88	1734		7.42	2.82	4.06
NyBD 89	1813		5.29	5.01	3.78
NyBD 90	1756		6.80	2.80	3.79
NyBD 91	1899		5.72	2.54	2.92
NyBD 92	2006*	19.6	6.97	2.78	3.14
NyBD 93	1665		6.40	2.48	3.38
NyBD 94	1508		5.65	2.82	2.88
A119 (C)	1646		7.26	2.60	4.47
Nandyal Pogaku-1 (C)	1500		4.13	3.21	3.44
Nandyal Pogaku-2 (C)	1677		5.28	2.93	4.89
GM	1720.3				
S.Em ±	87.2				
C.D. at 5%	261.0				
C.V%	11.0				

Table 2 BDNyBR 4.2: Pooled data on cured leaf yield in OVT-II (2022-24)

Entries	Cured leaf yield (kg/ha)		Mean Cured leaf yield (kg/ha)	% Increase over check
	2022-23	2023-24		
NyBD 88	1962	1734	1848	10.1
NyBD 89	1888	1813	1851	10.3
NyBD 90	1912	1756	1834	
NyBD 91	1896	1899	1897*	13.1
NyBD 92	2047	2006	2026*	20.8
NyBD 93	1930	1665	1797	
NyBD 94	1850	1508	1679	
A119 (C)	1704	1646	1675	
Nandyal Pogaku-1 (C)	1810	1500	1655	
Nandyal Pogaku-2 (C)	1677	1677	1677	
GM	1868	1720	1794	
	Years	Entries	Years × Entries	
S.Em ±	55.6	87.2	71.3	
C.D. at 5%	155.6	261	213.9	
C. V. (%)	5.1	11	7.7	

Project No.: BDNyBR 4.3

Research project title	Station Hybrid Trial-I on *bidi* tobacco
Objectives	▪ To evolve high yielding and better quality *bidi* tobacco hybrids with good aroma. ▪ To develop *bidi* tobacco hybrids with lower levels of smoke toxicants *viz.*, tar, Carbon monoxide (CO), polyphenol and smoke nicotine.
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments	:	13 (9+4)	Spacing	:	75 x 75 cm
Replications	:	Three	Plot size	:	6.75 × 2.25 m
Design	:	RBD	Fertilizer	:	NPK 110:70:50 kg/ha

RESULTS

In observational hybrid trial-I (2023-24) on *bidi* tobacco, 9 hybrids along with four checks were evaluated. There is no significant difference among the tested hybrids in cured leaf yield were observed. The hybrids NyBTH 212 (1177 kg/ha) &NyBTH 211(1151 kg/ha) was recorded on par cured leaf yield when compared to the best check Nandyal Pogaku 2 (1142 kg/ha).(Table BDNY BR3.1).

Salient Findings/Achievements

- Hybrids NyBTH 212 (1177 kg/ha) & NyBTH 211 (1151 kg/ha) was recorded on par cured leaf yield when compared to the best check Nandyal Pogaku-2 (1142 kg/ha)

Table 1 BDNyBR 4.3: Morphological characters & yield in SHT-I (2023-24)

Entries	Days to 50% flowe-ring	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	SPAD	Leaf thickness (mg/cm²)	Cured leaf yield (kg/ha)
NyBTH 208	119	80.7	45.6	15.5	4	65.2	15.8	1099
NyBTH 209	120	83.7	45.3	14.2	4	71.9	13.2	1106
NyBTH 210	121	86.3	44.7	14.7	4	71.6	13.7	1049
NyBTH 211	120	83.1	46.0	15.5	5	78.8	15.4	1151
NyBTH 212	121	75.8	43.9	15.6	5	68.5	14.4	1177
NyBTH 213	122	86.0	44.5	14.0	4	81.5	15.0	1049
NyBTH 214	121	83.7	45.4	13.9	5	66.3	14.3	1066
NyBTH 215	119	85.6	45.9	16.2	4	70.4	17.2	1048
NyBTH 216	122	78.7	46.3	16.3	5	50.7	17.4	1090
A119 (C)	115	70.2	38.6	12.7	6	76.1	12.8	1038
Nandyal Pogaku-1 (C)	120	80.3	46.0	16.1	5	56.3	13.2	1112
Nandyal Pogaku-2 (C)	137	87.2	49.1	18.2	4	79.4	15.4	1142
GABTH-2 (C)	119	73.8	43.7	15.0	3	71.5	13.6	1029
GM	121	81.2	45.0	15.2	4	69.86	14.7	1089
S.Em ±								43.2
C.D.@5%								NS
C.V%								10.0

Project No.: BDNyBR 4.4

Research project title	Station Hybrid Trial-II on *bidi* tobacco
Objectives	▪ To evolve high yielding and better quality *bidi* tobacco hybrids with good aroma. ▪ To develop *bidi* tobacco hybrids with lower levels of smoke toxicants *viz.,* tar, Carbon monoxide (CO), polyphenol and smoke nicotine.
Investigators	P. Pulli Bai&K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments	:	10 (6+4)	Spacing	:	75 x 75 cm
Replications	:	Three	Plot size	:	6.75 × 2.25 m
Design	:	RBD			

RESULTS

In observational hybrid trial-II (2023-24) on bidi tobacco, 6 hybrids along with four checks were evaluated. There is no significant difference among the tested hybrids in cured leaf yield were observed. The hybrid NyBTH 206 (1560 kg/ha) has recorded on par cured leaf yield when compared to the best check Nandyal Pogaku-2 (1552 kg/ha)(Table 1 BDNyBR 4.4).

According to the results of the chemical quality analysis, it has been found that the hybrids NyBTH 202, NyBTH 206, and NyBTH 204 have recorded higher nicotine content of 6.91%, 6.27 %, and 5.89 %, respectively & cured leaf yield, compared to the hybrid check GABTH 2 (6.21%). Additionally, all the hybrids showed reducing sugar levels within the acceptable range while their chlorides were outside the acceptable range (Table 2 BDNyBR 4.4).

Pooled cured leaf yield performance of observational hybrid Trial II on bidi tobacco during (2022-23 and 2023-24), six hybrids along with four checks were evaluated. The hybrids NyBTH 206 (1862 kg/ha) NyBTH 204(1836 kg/ha), NyBTH 207 (1763 kg/ha) & NyBTH 205 (1757 kg/ha) has recorded significantly cured leaf yield with improvement of 10.2 % to 16.8 % respectively than the best check Nandyal Pogaku 1 (1594 kg/ha). (Table 3 BDNyBR 4.4).The above hybrids may be contributed to AINPT, IHT during 2024-25.

Salient Findings/Achievements

- During 2023-24 hybrid NyBTH 206 (1560 kg/ha) has recorded on par cured leaf yield when compared to the best check Nandyal Pogaku 2 (1552 kg/ha)
- Pooled cured leaf yield of hybrids NyBTH 206 (1862 kg/ha) NyBTH 204(1836 kg/ha), NyBTH 207 (1763 kg/ha) & NyBTH 205 (1757 kg/ha) has recorded significantly higher cured leaf yield of 10.2 % to 16.8 % respectively than the best check Nandyal Pogaku-1 (1594 kg/ha).

Table 1 BDNyBR 4.4: Morphological characters & in SHT-II (2022-23)

Entries	Days to 50% flowe-ring	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	SPAD	Leaf thickness (mg/cm²)
NyBTH 202	123	77.9	50.0	19.6	4	61.7	23.5
NyBTH 203	120	76.2	49.6	18.7	4	60.5	19.2
NyBTH 204	124	81.2	47.9	16.9	4	58.7	18.7
NyBTH 205	129	78.8	44.9	16.8	5	60.8	20.0
NyBTH 206	128	74.6	47.9	17.9	5	62.5	19.4
NyBTH 207	130	73.8	43.4	15.0	6	66.6	17.4
A119 (C)	112	78.9	37.7	14.2	6	82.5	15.5
Nandyal Pogaku-1 (C)	117	78.2	46.2	18.2	6	53.8	16.3
Nandyal Pogaku-2 (C)	136	80.8	47.2	17.9	4	66.5	18.2
GABTH-2 (C)	122	74.6	42.1	17.5	2	62.5	13.8
GM	124	77.5	45.6	17.3	5	63.61	18.2
S.Em ±							
C.D.@5%							
C.V%							

Table 2 BDNyBR 4.4: Yield chemical quality parameters in OHT-II (2023-24)

Entries	Cured leaf yield (kg/ha)	Nicotine %	Reducing sugars %	Chlorides %
NyBTH 202	1375.20	6.91	2.65	3.47
NyBTH 203	1345.64	3.70	2.90	3.92
NyBTH 204	1454.82	5.89	2.88	3.25
NyBTH 205	1503.19	4.40	3.37	3.71
NyBTH 206	1560.15	6.27	3.40	3.94
NyBTH 207	1388.31	2.96	2.55	4.14
A119 (C)	1372.60	4.17	3.42	4.29
Nandyal Pogaku-1 (C)	1508.18	6.29	3.28	3.77
Nandyal Pogaku-2 (C)	1552.18	5.65	2.84	5.01
GABTH-2 (C)	1290.83	6.21	2.62	3.71
GM	1435.11			
S.Em ±	55.8			
C.D.@5%	156.0			
C.V%	7.0			

Table 3 BDNyBR 4.2: Pooled data on cured leaf yield in OHT-II (2022-24)

Entries	Cured leaf yield (kg/ha)		Mean Cured leaf yield (kg/ha)	% Increase over check
	2022-23	2023-24		
NyBTH 202	1988	1375	1682	
NyBTH 203	1896	1346	1621	
NyBTH 204	2264	1408	1836*	15.1
NyBTH 205	2080	1433	1757*	10.2
NyBTH 206	2255	1469	1862*	16.8
NyBTH 207	2137	1388	1763*	10.6
A119 (C)	1478	1373	1425	
Nandyal Pogaku-1 (C)	1642	1547	1594	
Nandyal Pogaku-2 (C)	1563	1563	1563	
GABTH-2 (C)	1392	1291	1342	
GM	1859	1419	1639	
	Years	Entries	Years × Entries	
S.Em ±	66.2	55.8	42.8	
C.D. at 5%	200.0	156.0	128.4	
C. V. (%)	6.0	7.0	8.0	

BDNyBR 5: STUDY AND GENERATION OF BREEDING MATERIAL

Project No.: BDNyBR 5.1

Research project title	New crosses made (Hybridization and study of segregating generations in *bidi* tobacco)
Objectives	▪ To evolve high yielding and better quality *bidi* tobacco hybrids with good aroma. ▪ To develop *bidi* tobacco hybrids with lower levels of smoke toxicants *viz.*, tar, Carbon monoxide (CO), polyphenol and smoke nicotine. ▪ Early drought tolerant, higher cured leaf yield with high nicotine content
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	Long term
Location	AINPT, RARS, Nandyal

DOS: 28-07-2023 DOT: 21-09-2023

RESULTS

The following crosses were made

1. For development of *bidi* tobacco hybrids

S.No.	Cross combination	Objective
1	GABT 11 X ABD 239	Drought tolerant higher cured leaf yield with high nicotine content
2	GABT 11 X ABD 244	Drought tolerant higher cured leaf yield with high nicotine content
3	NBD 260 X ABD 239	Higher cured leaf yield with high nicotine content
4	NBD 260 X ABD 244	Higher cured leaf yield with high nicotine content

2. Maintenance of CMS and parental lines for hybrid seed multiplication

CMS A119 X A119, CMS GT4 X GT4, CMS GT5 X GT5 & CMS GT7 X GT7 and seed multiplication of parental lines for evaluation of station hybrid trials.

Project No.: BDNyBR 5.2

Research project title	Study of F_1 generation

DOS: 01-08-2023 DOT: 29-09-2023

RESULTS

In F_1 generation 9 crosses were evaluated during 2023-24 and these will be forwarded under F_2 generation during 2024-25.

Table BDNyBR 5.2: Study of F_1 generation

S. No	Crosses	Objective
1	ABD 132 X NBD 276	Drought tolerant, higher cured leaf yield
2	ABD 132 X ABD146	Drought tolerant, higher cured leaf yield
3	ABD 132 X NBD 289	Drought tolerant, higher cured leaf yield
4	NyBD 56 X NBD 276	Early drought tolerant, higher cured leaf yield with high nicotine content
5	NyBD 56 X ABD 146	Early drought tolerant, higher cured leaf yield with high nicotine content
6	NyBD 56 X NBD 289	Early drought tolerant, higher cured leaf yield with high nicotine content
7	NP 1 X NBD 276	Early drought tolerant, higher cured leaf yield with high nicotine content
8	NP 1 X ABD 146	Early drought tolerant, higher cured leaf yield with high nicotine content
9	NP 1 X NBD 289	Early drought tolerant, higher cured leaf yield with high nicotine content

Project No.: BDNyBR 5.3

Research project title	Study of segregating generations in *bidi* tobacco

DOS: 01-08-2023 DOT: 01-10-2023

RESULTS

During *Kharif* 2023-24, 6 *bidi* tobacco crosses were evaluated under F_2 generation, 40 superior single plants were selected and these will be further evaluated under F_3 generation during 2024-25

Table BDNyBR 5.3: Evaluation of F_2 generation

S.No	Crosses	Objective	SPAD	No. of SPs	RWC (%)
1	GT7 X ABD211	Drought tolerant higher cured leaf yield with good leaf quality	69.7	6	82.8
2	GT7 X NyBD56		50.5	8	77.8
3	GT4 X NyBD56		51.9	6	79.6
4	GT4 XABD211		55.6	9	73.6
5	A119XABD211		64.2	6	77.1
6	A119 XNyBD56		54.3	5	85.0
	Total			**40**	

Project No.: BDNyBR 5.4

Research project title	Evaluation of F_3 generation

DOS: 03-08-2023 DOT: 29-09-2023

RESULTS

During *Kharif* 2023-24, 6 *bidi* tobacco crosses were evaluated under F_3 generation, 30 superior single plants were selected and these will be further evaluated under F_4 generation during 2024-25.

Table BDNyBR 5.4: Evaluation of F_3 generation

S.No	Crosses	Objective	SPAD	RWC (%)	No. of plant progenies studied	No. of SPs
1	GT4XABD196	Drought tolerant higher cured leaf yield with less smoke toxicants	73.7	81.1	4	3
2	GT4X NyBD 62		61.5	71.4	3	2
3	GT7X ABD 196		65.2	77.1	10	4
4	GT7X NyBD 62		62.9	76.9	5	5
5	A119XABD 196		59.7	77.3	4	4
6	A119XNyBD 62		61.2	81.3	4	3
	Total				**30**	**21**

Project No.: BDNyBR 5.5

Research project title	Evaluation of F_4 generation

DOS: 04-08-2023 DOT: 30-09-2023

RESULTS

During *kharif* 2023-24, 6 F_4 *bidi* crosses were evaluated from 68 single progenies 19 superior single plants were selected and promoted to F_5 generation during 2024-25.

Table BDNyBR 5.5: Evaluation of F_4 generation

S.No	Crosses	Objective	SPAD	RWC (%)	No. of plant progenies studied	No. of SPs
1	GT4 X NBD316	Drought tolerant higher cured leaf yield with good leaf quality	74.5	78.4	6	3
2	GT4 X ABD189		75.8	84.5	5	4
3	GT7 X NBD316		69.2	71.4	6	3
4	GT7 X ABD189		61.7	70.3	4	3
5	A119 X NBD316		59.5	77.6	3	3
6	A119 X ABD189		55.5	71.8	2	3
	Total				**26**	**19**

Project No.: BDNyBR 5.6

Research project title	Evaluation of F_5 generation
Objectives	Drought tolerant high yielding with good leaf quality

DOS: 04-08-2023 DOT: 30-09-2023

RESULTS

During *Kharif* 2023-24, 6 F_5 bidi crosses were evaluated from 19 single plant progenies 22 superior single plants were selected and promoted to F_6 generation during 24-25.

Table BDNyBR 5.6: Evaluation of F_5 generation

S.No.	Crosses	SPAD	RWC (%)	No. of plant progenies studied	No. of SPs
1	GT4 X ABD174	57.9	80.0	4	3
2	GT4 X ABD 166	58.5	67.6	3	3
3	GT7 X ABD 174	54.7	69.2	2	4
4	GT7X ABD 166	58.4	70.0	3	2
5	A119 X ABD 174	50.8	84.4	4	6
6	A119 X ABD 166	55.2	76.9	3	4
	Total			**19**	**22**

Project No.: BDNyBR 5.7

Research project title	Evaluation of F_6 generation
Objective	Drought tolerant, high yielding with good leaf quality

DOS: 08-08-2023 DOT: 01-10-2023

RESULTS

In F_6 generation from 60 plant progenies of 18crosses, 50single plant selections were made and these bulks will be evaluated under OVT I during 2024-25.

Salient findings /Achievements

- Four fresh crosses were made for higher cured leaf yield and high nicotine content these will be evaluated under F_1 generation during 2024-25.
- From F_1 to F_6 generations out of 51 crosses 135 plant progenies studied in these 152 single plant progenies were selected for further evaluation during 2024-25.

Table BDNyBR 5.7: Evaluation of F_6 generation

S. No.	Cross combination	SPAD	RWC (%)	No. of plant progenies studied	No. of uniform bulks selected
1.	GT4XABD145	52.9	91.7	2	3
2.	GT4XABD163	58.9	75.0	4	4
3.	GT4XABD167	55.2	81.3	6	3
4.	A119XABD145	57.5	62.2	4	1
5.	A119XABD163	62.8	72.1	3	1
6.	A119XABD167	60.4	67.6	2	1
7.	GT7 X ABD132	58.7	81.4	5	1
8.	GT7 X NBD289	66.7	88.9	4	3
9.	GT7 X NBD260	61.5	85.2	3	3
10.	GT7 X ABD119	64.5	76.3	2	3
11.	GT4 X ABD132	63.4	78.6	4	5
12.	GT4 X NBD289	61.4	75.6	3	2
13.	GT4 X NBD260	68.5	68.6	2	2
14.	GT4 X ABD119	48.9	79.1	4	4
15.	A119 X ABD132	54.5	76.1	3	5
16.	A119 X NBD289	47.5	76.1	2	4
17.	A119 X NBD260	53.9	84.1	4	2
18.	A119 X ABD119	60.8	90.9	3	3
	Total			**60**	**50**

Project No.: BDNyBR 1

Research project title	Collection, evaluation and maintenance of *bidi* tobacco germplasm
Objectives	▪ To maintain and study *bidi* germplasm lines for utilization in future breeding programmes. ▪ To evaluate and isolate superior *bidi* Tobacco lines for direct release. ▪ To collect local land races, varieties and lines by under taking expeditions in *bidi* Tobacco growing areas of the tract.
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

DOS: 11-08-2023 DOT: 26-09-2023

RESULTS

Two hundred and sixteen *bidi* tobacco germplasm lines were maintained. During *kharif* 2023-24, 4 new germplasm lines from Anand and Nipani centre (IET 112-IET 115) & 2 advanced lines (NyBD 95 & 96) received from Nandyal centre.50 *bidi* tobacco germplasm lines were evaluated during 2023-24. Data ranges pertaining to various characters are:

Plant height (cm): 79-85 (ABD 117 ArBD 4,7 &8) – 120-125 (ABD 67,69, 103 &109), leaf length (cm):42-45 (ABD 72,99,100,113& 123) – 54-58 (ABD 84,106,111,125 & 130),leaf width (cm): 10-12(ABD 69, 92,104 & 123) to 16-18 (ABD 70,91,100,120 & 130),SPAD : 48-55 (ABD 43, 84,90,110 & ArBD 39) to 72-80(ABD 51,52,102,110 & 113),Relative Water Content %(RWC):62-72(ABD 43,75,84 & ArBD 7) to 85-90(ABD 51,52,102 & 111),Leaf thickness (mg/cm^2):10-11 (NBD 276,ABD 60,70,99 & ArBD 4) to 20-23 (ABD 51,75,103,109 & 111) & Spangle score :3(ABD 226,228 & 229) to 6 (A119,ArBD 32,33),root length (cm): < 20(ABD 138,ABD 152,NyBD 73,74 & 75)- > 20 cm (ABD 115, ABD 122 & ABD 124) & cured leaf yield per plant (g):209 (ABD104,ArBD 7& ArBD 4)- 800 (ABD 61,69,100,113 & ABD 128) .

Fifty *bidi* tobacco germplasm lines were analyzed for chemical quality, the line NyBD 79 (8.24) has recorded highest nicotine % & other lines NyBD 59, 63, 75,93,ABD 54,ABD 68,GT4 & GT 5 have > 7% nicotine content. All the germplasm lines are having reducing sugars within the acceptable range while their chlorides were outside the acceptable range (Table 2 BDNyBR 1).

Salient findings /Achievements

- Fifty*bidi* tobacco germplasm lines were evaluated during 2023-24
- The line NYBD 79 (8.24) has recorded highest nicotine % & other lines NyBD 59,63, 75,93,ABD 54,ABD 68,GT4 & GT 5 have > 7% nicotine content.

Table 1 BDNyBR 1: Characters of *Bidi* tobacco germplasm lines span a wide range.

S. No.	Characters	Range	
		Mini	Max
1	Plant height (cm)	79-85	120-125
2	Leaf length (cm)	42-45	54-58
3	Leaf width (cm)	10-12	16-18
4	SPAD	48-55	72-80
5	RWC %	62-72	85-90
6	Leaf thickness((mg/cm^2))	10-11	20-23
7	Spangle score	3	6
8	Root length (cm)	20	35
9	Cured leaf yield /plant(g)	209	800

Table 2 BDNyBR 1: Chemical quality parameters of *Bidi* tobacco Germplasm lines during 2023-24

S. No	Sample No	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
1.	NYBD 79	8.24	1.84	2.85
2.	NYBD 93	7.62	1.89	2.60
3.	NYBD 59	7.50	2.57	4.14
4.	ABD 54	7.46	2.08	2.97
5.	GT 4	7.43	1.98	2.69
6.	ABD 68	7.42	2.49	3.31
7.	NYBD 75	7.41	2.17	2.18
8.	GT 5	7.27	2.22	3.38
9.	NYBD 63	7.20	2.39	3.15
10.	NYBD 78	6.98	1.88	3.80
11.	NYBD 92	6.94	1.70	4.04
12.	NYBD 56	6.92	2.48	3.36
13.	NYBD 85	6.90	1.57	2.89
14.	A119	6.87	1.84	3.43
15.	NYBD 86	6.81	2.17	2.75
16.	NYBD 67	6.56	2.16	2.69
17.	NYBD 72	6.48	1.99	3.05
18.	NYBD 90	6.42	1.78	3.30
19.	ABD 131	6.40	2.22	2.81
20.	NYBD 60	6.35	1.70	3.26
21.	NYBD 88	6.26	2.13	3.68
22.	NYBD 70	6.20	2.08	3.42
23.	NYBD 62	6.12	2.16	3.28
24.	NYBD 91	6.12	2.03	3.42

S. No	Sample No	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
25.	NYBD 68	6.08	2.27	3.84
26.	NYBD 73	5.98	1.59	3.28
27.	ABD 78	5.95	2.02	3.18
28.	NYBD 77	5.88	2.09	2.49
29.	NYBD 71	5.86	2.12	2.48
30.	ABD 119	5.67	1.96	2.96
31.	NYBD 61	5.61	2.06	3.91
32.	NYBD 94	5.61	3.00	2.85
33.	NYBD 76	5.52	2.51	3.09
34.	Nandyal pogaku 1	5.49	1.78	4.56
35.	NYBD 66	5.43	2.66	3.09
36.	NYBD 81	5.38	2.56	2.80
37.	NYBD 80	5.37	2.53	3.16
38.	GT 7	5.36	1.97	3.82
39.	ABD 146	5.28	2.26	3.11
40.	ABD 118	5.25	2.76	3.36
41.	NYBD 87	5.24	3.50	3.07
42.	NYBD 89	5.08	3.34	2.88
43.	ABD 129	4.32	2.06	3.70
44.	ABD 152	4.23	2.34	3.06
45.	NYBD 69	4.05	3.30	3.89
46.	NYBD 84	3.88	3.07	3.53
47.	NYBD 74	3.82	2.94	3.66
48.	NYBD 82	3.74	4.36	3.09
49.	ABD 128	3.73	7.22	2.13
50.	NYBD 83	3.69	3.17	3.75

C. *NATU / PIKKA* TOBACCO

COORDINATED EVALUATION OF *NATU/ PIKKA* TOBACCO GENOTYPES

IVT ON *NATU/PIKKA* TOBACCO

NTJBRC/ NTNyBRC/ NTBBRC 2: INITIAL VARIETAL TRIAL ON *NATU* TOBACCO

Objectives: To evaluate the *Natu* tobacco entries for yield and quality at three centres *viz.*, Jeelugumilli, Nandyal and Berhampur along with respective checks under IVT.

Year of start : 2023-24
Year of Completion : 2023-24

Natu tobacco Centres and Investigators

Centres	:	Investigators
Jeelugumilli	:	K. Sarala and K. Prabhakara Rao
Nandyal	:	P. Pulli Bai and K. Sathish Babu
Berhampur	:	Arjun Mohan Prusti

Design : RBD
Total treatments : 4 + checks as given above
Replications : Five (Four replications Berhampur)

Entries: 4 (Four)

1. IET-118
2. IET-119
3. IET-120
4. IET-121

Checks at different Centres

Jeelugumilli	1. Kommagudem	2. Rangapuram
Nandyal	1. Bhairavi	2. WAF
Berhampur	1. Gajapati	2. JP Local

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Jeelugumilli	2.0 X 12.0 m	1.0 x 0.6 m
Nandyal	6.75 x 1.5 m	0.7 x 0.7 m
Berhampur	3.75 x 5 m	0.75 x 0.50 m

RESULTS

In the Initial varietal trial (IVT), four entries were evaluated for their yield potential against respective checks at different centres. Observations recorded leaf yield, natural/ artificial incidence of pest and diseases.Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha.Data on yield characteristics at different centres are presented in Tables 1 to 3IVT *NATU* Tobacco. The results are discussed centre-wise.

JEELUGUMILLI

The differences among the entries tested for cured leaf found to be significant. The entry IET-119 recorded significantly higher (16%) cured leaf yield (2028 kg/ha) than better control, Kommugudem.

Salient Findings/Achievements (In 2-3 bullets):

- A trial conducted with 4 entries (IET-118 to IET-121) along with two control varieties *viz.*, Kommugudem and Rangapuram, the differences among the entries tested for cured leaf found to be significant.
- The entry IET-119 recorded significantly higher (16%) cured leaf yield (2028 kg/ha) than better control, Kommugudem.

Conclusion: The entry IET-119 may be promoted for evaluation under ensuing AVT trial.

NANDYAL

The entry IET 118 (1668 kg/ha) has recorded significantly higher cured leaf yield with improvement of 14.8 % and IET 120 (1533 kg/ha) recorded on par cured leaf yield at 5.5 % when compared to the best check WAF (1452 kg/ha) and on an average SPAD (61.5) recorded.

Morphological characterization: The tested entries has recorded on an average plant height (73.0 cm), Days to 50 % flowering (123) , leaf length (42.1 cm) , leaf width (14.0 cm), SPAD (61.5) & leaf thickness (15.0 mg/m^2).

Disease /Pest incidence: Under field conditions leaf curl, TMV & frog eye, *Cercospora* leaf spots were observed but below ETL and in all the tested entries severe incidence of sucking pests like mealy bug and aphids was noticed during maturity stage due to terminal moisture stress.

Salient Findings/Achievements

- IET-118 (1668 kg/ha) has recorded significantly higher cured leaf yield with improvement of 14.8 % and IET-120 (1533 kg/ha) recorded on par cured leaf yield at 5.5 % when compared to the best check WAF (1452 kg/ha)

Conclusion: The entries IET-118 and IET-120 will be promoted to AVT I along with checks will be evaluated during 2024-25.

BERHAMPUR

There was significant difference among test entries for cured leaf yield. Entry IET 119 recorded highest cured leaf yield (2246 kg/ha) followed by IET 121 (2240 kg/ha) and IET 120 (1953 kg/ha) producing 21.5, 21.2 and 5.7 percent more yield advantage over best check entry Gajapati (1848 kg/ha) respectively.

Morphological characterization: In general test entries exhibited significant difference from check entries for different morphological characters. Among Test entries, IET-118 found to be the shortest plant (50.8 cm) which was significantly lower than check variety Gajapati (92.1 cm). Entry IET-121 expressed significantly more number of leaves (21.6) and IET-119 exhibited longer leaf (59.3cm) than best check variety Gajapati (19.1 and 52.1 cm respectively). Entries IET-119 and IET-121 expressed significantly higher leaf breadth (26.8, 26.1cm) than check variety JP Local (23.3 cm).

Salient Findings/Achievements

- Entries IET-119 and IET-121 recorded significantly higher cured leaf yield (2246 and 2240 kg/ha respectively) than better check variety Gajapati (1848 kg/ha) with an yield advantage of 21.5 and 21.2 percent respectively

Conclusion: Entries IET-119 and IET-121 exhibiting significantly higher cured leaf yield may be promoted to AVT I trial during 2024-25

Recommendation: Based on the result of *natu/pikka* centres and discussions held during the Interaction meeting with AINPT centres on 2nd July, 2024, IET-118, IET-119 & IET-121 are recommended for evaluation under AVT-I at all *natu/pikka* centers.

Table 1 IVT *NATU* TOBACCO: Cured Leaf yield (kg/ha) of IVT entries at different centres (2023-24)

Entries	Yield (kg/ha)		
	Jeelugumilli	Nandyal	Berhampur
IET-118	1087	1668*	1642
IET-119	2028*	1524	2246*
IET-120	919	1533	1953
IET-121	1419	1497	2240*
Kommagudem (C)	1743		
Rangapuram (C)	1396		
Bhairavi (C)	-	1451	
WAF (C)	-	1452	
Gajapati (C)	-		1848
JP Local (C)	-		1681
G. Mean	1432	1521	1935
S. Em±	65	45.2	87.0
C.D. at 5%	191	137.6	262.1
C.V. (%)	9.10	6.5	9.0

**Significant at 5 %*

Table 2 IVT *NATU* TOBACCO: Morphological characters of IVT entries atdifferent centres (2023-24)

Entries	Plant Height (cm)		Leaf length (cm)		Leaf Breadth (cm)	
	Ny	B	Ny	B	Ny	B
IET-118	75	50.8	45.6	54.6	14.1	23.8
IET-119	68	94.9	41.2	59.3*	14.0	26.8*
IET-120	70	102.9	41.4	52.1	14.0	24.0
IET-121	75	139.0	37.5	55.3	13.6	26.1*
Kommagudem (C)	-	-				
Rangapuram (C)	-	-				
Bhairavi (C)	77	-	43.6		13.2	
WAF (C)	71	-	43.6		15.1	
Gajapati (C)	-	92.1		52.1		22.2
JP Local (C)	-	133.1		51.7		23.3
G. Mean	73	102.1	42.1	54.2	14.0	24.3
S. Em±	-	3.2		1.7		0.8
C.D. at 5%	-	9.5		5.1		2.4
C.V. (%)	-	6.2		6.3		6.6

Ny= Nandyal; B= Berhampur

Table 3 IVT *NATU* TOBACCO: Morphological characters of IVT entries at Nandyal centre (2023-24)

Entries	Days to flower	Plant Stand	Leaf Thickness	SPAD
IET-118	116	18	16.5	58.2
IET-119	127	18	15.0	58.5
IET-120	126	18	12.9	68.5
IET-121	126	18	11.9	60.2
Bhairavi (C)	125	18	16.6	64.2
WAF (C)	118	18	17.1	59.5
G. Mean	123	18	15.0	61.5

NANDYAL

Project No.: NTNyBR 4.1

Research project title	Observational Varietal Trial-I on *natu* tobacco
Objectives	▪ To evolve high yielding and better quality *natu* tobacco hybrids with good aroma ▪ To develop good nicotine content drought tolerant varieties
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments	:	4 (2+2)	Spacing	:	70 x 70 cm
Design	:	RBD	Plot size	:	6.75 × 2.25 m

RESULTS

In observational varietal trial- I (2023-24) on *natu* tobacco, 2 entries along with two checks were evaluated in seven replications. There is no significant difference were observed among the tested entries in cured leaf yield than the best check WAF (Table NTNyBR 4.1).

Salient findings /Achievements

- None of the entries were found significantly superior than the check WAF.

Table NTNyBR 4.1: Observational Varietal Trial –I on *natu* tobacco (2023-24)

Entries	Days to 50% flowering	Pl.ht (cm)	Leaf length (cm)	Leaf width (cm)	SPAD	Leaf thickness (mg/cm^2)	Cured leaf yield (kg/ha)
NyNT 103	123	59.3	44.2	15.5	62.5	14.7	1551
NyNT 104	126	62.1	41.9	15.3	66.9	12.9	1514
Bhairavi (C)	125	62.5	45.0	15.7	63.6	14.2	1458
WAF (C)	123	70.6	47.5	15.2	46.8	16.2	1474
GM	**124**	**63.6**	**44.6**	**15.4**	**59.9**	**14.5**	**1499**
S.Em ±							42.3
C.D. at 5%							NS
C. V. (%)							7.4

Project No.: NTNyBR 4.2

Research project title	Observational Varietal Trial-II on *natu* tobacco
Objectives	▪ To evolve high yielding and better quality *natu* tobacco hybrids with good aroma ▪ To develop good nicotine content drought tolerant varieties
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

Treatments	:	10 (9+1)	Spacing	:	70 x 70 cm
Design	:	RBD	Plot size	:	6.75 × 2.25 m

RESULTS

In observational varietal trial-II (2023-24) on *natu* tobacco, 9 entries along with one check were evaluated. The entries NyNT 94 (1805 kg/ha) & NyNT 98 (1804 kg/ha) has recorded significantly higher cured leaf yield with improvement of 16.3 % when compared to the best check Bhairavi (1551 kg/ha) (Table 1 NTNyBR 4.2).According to the results of the chemical quality analysis, it has been found that the varieties NyNT 97, NyNT 94(with higher cured leaf yield), and NyNT 99 have recorded higher nicotine content of 2.38 %, 2.36 %, and 2.26 %, respectively & cured leaf yield, compared to the best check Bhairavi (2.53 %). Additionally, all the varieties showed reducing sugar levels within the acceptable range while their chlorides were outside the acceptable range (Table 2 NTNyBR 4.2).

Pooled cured leaf yield performance of observational varietal Trial II on *natu* tobacco during (2022-23 and 2023-24), nine entries along with one check were evaluated. The entries NyNT 98 (1503 kg/ha) & NyNT 96 (1493 kg/ha) has recorded on par cured leaf yield with improvement of 11.4 % & 10.7 % than the best check Bhairavi (1348 kg/ha).

Salient findings /Achievements

- The entries NyNT 98 (1503 kg/ha) & NyNT 96 (1493 kg/ha) has recorded on par cured leaf yield with improvement of 11.4 % & 10.7 % than the best check Bhairavi (1348 kg/ha).

Table 1NTNyBR 4.2: Morphological and yield data of Observational Varietal Trial –II (2023-24)

Entries	Days to 50% flowering	Pl.ht (cm)	Leaf length (cm)	Leaf width (cm)	SPAD	Leaf thickness (mg/cm^2)	Cured leaf yield (kg/ha)	% IOC
NyNT 94	124	66.9	45.1	15.4	55.6	13.1	1805*	16.3
NyNT 95	125	74.0	43.3	15.1	82.5	13.6	1337	
NyNT 96	126	75.7	40.6	15.0	63.5	14.2	1741	
NyNT 97	129	69.4	40.7	14.5	71.5	11.5	1502	
NyNT 98	128	64.8	42.7	15.1	57.5	11.4	1804*	16.3
NyNT 99	124	75.4	47.1	15.8	59.3	11.6	1579	
NyNT 100	126	75.1	43.5	16.1	54.2	14.1	1422	
NyNT 101	127	73.4	44.4	14.9	65.4	14.5	1544	
NyNT 102	128	73.3	42.4	15.0	58.2	12.1	1518	
Bhairavi (C)	129	75.6	42.6	14.9	65.4	11.3	1551	
GM	127	72.4	43.2	15.2	63.31	12.7	1580	
S.Em ±							78.6	
C.D. at 5%							235.0	
C. V. (%)							8.6	

Table 2 NTNyBR 4.2: Chemical Quality parameters in Observational Varietal Trial –II (2023-24)

Entries	Nicotine %	Reducing sugars %	Chlorides %
NyNT 94	2.36	4.58	4.62
NyNT 95	2.08	3.51	5.48
NyNT 96	1.54	3.49	5.15
NyNT 97	2.38	3.30	5.08
NyNT 98	1.70	3.24	4.69
NyNT 99	2.26	3.68	4.01
NyNT 100	2.20	2.92	4.25
NyNT 101	2.21	3.17	4.10
NyNT 102	1.56	3.03	4.07
Bhairavi (C)	2.53	4.28	3.73

Table 3 NTNyBR 4.2: Data on pooled yield of Observational Varietal Trial -II on during (2022-23 and 2023-24)

Entries	Cured leaf yield kg/ha		Mean	% Increase over best check
	2022-23	2023-24		
NyNT 94	1127	1805	1466	
NyNT 95	1065	1337	1201	
NyNT 96	1244	1741	1493	10.7
NyNT 97	1411	1502	1456	
NyNT 98	1203	1804	1503	11.4
NyNT 99	1055	1579	1317	
NyNT 100	1114	1422	1268	
NyNT 101	1262	1544	1403	
NyNT 102	1220	1518	1369	
Bhairavi (C)	1145	1551	1348	
Grand Mean	1185	1580	1382	
	Years	Entries	Years x Entries	
S.Em ±	57.74	78.6	57.7	
C.D. at 5%	172.8	235.0	166.1	
C. V. (%)	8.4	8.6	7.8	

NTNyBR 5: STUDY AND GENERATION OF BREEDING MATERIAL IN *NATU* TOBACCO

Project No.: NTNyBR 5.1

Research project title	New crosses made (Hybridization and study of segregating generations in *natu* tobacco)
Objectives	▪ To evolve high yielding and better quality ***natu*** tobacco hybrids with good aroma.
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	Long term
Location	AINPT, RARS, Nandyal

DOS: 28-7-2023 DOT: 21-09-2023

RESULTS

During 2023-24, the following new crosses were made

2 new crosses were made for improvement of *natu* tobacco varieties. These 2 crosses will be evaluated in F_1 generation during 2024-25

1. For development of *natu* tobacco varieties

Cross combination	Objective
Natu Special X ArBD 32	Higher cured leaf yield with good quality
Natu Special X Natu noonepalli	

Project No.: NTNyBR 5.2

Research project title	Study of F_1 generation

DOS: 09-08-2023 DOT: 04-10-2023

RESULTS

During 2026-24, 3 *natu* tobacco crosses evaluated under F_1 generation and these will be evaluated under F_2 generation during 2024-25

Evaluation of F_1 generation

Cross combination	Objective
Bhairavi X NyNT 94	High yielding, drought tolerant with good quality
Bhairavi X Line 372	
Bhairavi X NyNT 91	

Project No.: NTNyBR 5.3

Research project title	Evaluation of F_2 generation

DOS: 09-08-2023 DOT: 04-10-2023

RESULTS

During *Kharif* 2023-24, 2 *natu* tobacco crosses were evaluated under F_2 generation, 20 superior single plants were selected and these will be evaluated under F_3 generation during 2024-25.

Evaluation of F_2 generation

S.No.	Cross	Objective	SPAD	RWC (%)	No. of SPs
1	Bhairavi X Line 361	Drought tolerant higher cure leaf yield	49.8	84.2	14
2	Bhairavi X NG 50		46.9	85.2	6
	Total				**20**

Project No.: NTNyBR 5.4

Research project title	Evaluation of F_3 generation

DOS: 09-08-2023 DOT: 04-10-2023

RESULTS

During *kharif* 2023-24, 2 crosses were evaluated under F_3 generation, from 20 progenies 12 superior single plants were selected and these will be evaluated under F_4 generation during 2024-25.

Evaluation of F_3 generation

S. No.	Cross combination	Objective	SPAD	RWC (%)	No. of plant progenies studied	No. of SPs
1	Bhairavi X Peddavittanam	Drought tolerant higher cure leaf yield	47.8	81.3	10	8
2	Bhairavi X Natunoonepalli		55.5	79.1	10	4
	Total				**20**	**12**

Project No.: NTNyBR 5.5

Research project title	Evaluation of F_4 generation

DOS: 09-08-2023 DOT: 04-10-2023

RESULTS

During *Kharif* 2023-24, 2 F_4 *natu* tobacco crosses were evaluated from 8 single progenies 7 superior single plants were selected and promoted to F_5 generation during 2024-25.

Evaluation of F_4 generation

S. No.	Cross combination	Objective	SPAD	RWC (%)	No. of plant progenies studied	No. of SPs
1	Bhairavi X Kavali	High yielding drought tolerant with good quality	48.5	75.0	5	5
2	Bhairavi X Natuparchur		45.1	72.1	3	2
	Total				**8**	**7**

Project No.: NTNyBR 5.6

Research project title	Evaluation of F_5 generation

DOS: 09-08-2023 DOT: 04-10-2023

RESULTS

In F_5 generation from 9 progenies of 2 crosses, 7 single plant selections were made and promoted to F_6 generation during2024-25.

Evaluation of F_5 generation

S.No.	Cross combination	Objective	SPAD	RWC (%)	No. of plant progenies studied	No. of SPs
1	Bhairavi x WAF	Drought tolerant high yielding varieties	45.9	82.4	5	5
2	Bhairavi x Natu Special		52.5	83.7	4	2
	Total				**9**	**7**

Project No.: NTNyBR 5.7

Research project title	Evaluation of F_6 generation

DOS: 09-08-2023 DOT: 04-10-2023

RESULTS

During *kharif* 2023-24, 2 *natu* F_6s were evaluated 11 single progenies were studied out of this 6 superior uniform bulks were made, these will be evaluated under OVT-I during 2024-25.

Evaluation of F_6 generation

S.No.	Cross combination	Objective	SPAD	RWC (%)	No. of plant progenies studied	No. of Uniform bulks selected
1	Bhairavi x KFC	Drought tolerant high yielding varieties	45.5	71.1	5	4
2	Bhairavi x Talmariaku		58.8	81.6	6	2
	Total				11	6

Salient findings /Achievements

- Two fresh crosses were made for higher cured leaf yield with good nicotine content these will be evaluated under F_1 generation during 2024-25.
- From F_1 to F_6 generations out of 13 crosses 48 plant progenies studied in these 52 single plant progenies were selected for further evaluation during 2024-25.

Project No.: NTNyBR 1

Research project title	Collection, evaluation and maintenance of *natu* tobacco germplasm
Objectives	▪ To maintain and study *natu* germplasm linesfor utilization in future breeding programmes. ▪ To evaluate and isolate superior *natu*tobacco lines for direct release. ▪ To collect local land races, varieties and lines by under taking expeditions in *natu*tobacco growing areas of the tract.
Investigators	P. Pulli Bai & K. Sathish Babu
Year of start	2023-24
Year of completion	2023-24
Location	AINPT, RARS, Nandyal

DOS: 11-08-2023 DOT: 04-10-2023

RESULTS

One hundred and four *natu* tobacco germplasm lines were maintained. During 2023-24, 2 new lines NyNT 103 & NyNT 104 is included and 30 germplasm lines were evaluated. Data ranges pertaining to natu germplasm lines are:

Plant height (cm)1-76 (Natu parachuru, Dharanikota & Yelamanchali) to 85-89 (II 1870, Sattenapalli, Natu special), leaf length (cm):35-42 (Natu parachuru, Mutant & Yelamanchali) to 50-57 (Kavali, WAF, Natu special & Tokaaakufarm),leaf width (cm): 9.8-14 (Tokaaaku farm, Nellore & Pyruvittanam) to 14-15.6 (Singarayakonda, Yelamanchali & Chilakaluripeta), SPAD : 39-43 (Chilakaluripeta, Bommidala & Oriental) to 60-82 (Dharanikota, II 1870 & NyNT 64),Relative Water Content % (RWC): 71-73 (Natu special, Bommidala & Jakirampur) to 85-89 (Solunki, II 1870 & Addanki), Leaf thickness (mg/cm^2): 10.3-12 (Bommidala, Oriental & Natu inkollu) to 14-16.7 (Natu parachuru, Dharanikota & NyNT 64), root length (cm): < 25 (NG 60, NGP 89, II 1068 & II 1875) -> 25 cm (NGP 92, Line 364, 372, Kavali & Natu noonepalli) & cured leaf yield per plant (g): 110 (Peddavittanam) - 750 (II 1872, Kommipadu vittanam & Dharanikota).

Thirty *natu* tobacco germplasm lines were analyzed for chemical quality, the lines II 1870, *Natu* special, Pencil leaf, II 1872, Rathna (Nandigama),has recorded > 3.0% nicotine content. All the germplasm lines are having reducing sugars within the acceptable range, except II 1870 the chlorides were outside the acceptable range in all the lines (Table 2 NTNyBR 1)

Salient findings /Achievements

- Thirty germplasm lines were evaluated during 2023-24
- The lines II 1870, Natu special, Pencil leaf, II 1872, Rathna (Nandigama), has recorded > 3.0% nicotine content

Table 1 BDNyBR 1: Characters of *Natu* tobacco germplasm lines span a wide range.

S. No.	Characters	Range	
		Mini	Max
1	Plant height (cm)	71-76	85-89
2	Leaf length (cm)	35-42	50-57
3	Leaf width (cm)	9.8-14	14-15.6
4	SPAD	39-43	60-82
5	RWC (%)	71-73	85-89
6	Leaf thickness(mg/cm^2)	10.3-12	14-16.7
7	Root length (cm)	20	35
8	Cured leaf yield /plant(g)	110	750

Table 2 BDNyBR 1: Chemical quality parameters of *Natu* tobacco Germplasm lines during 2023-24

S. No	Sample No	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
1.	II 1870	3.57	1.42	1.85
2.	Natu special	3.43	1.53	2.41
3.	Pencil leaf	3.11	1.69	3.31
4.	II 1872	3.10	1.66	3.39
5.	Rathna(Nandigama)	3.04	2.53	4.15
6.	Addanki	2.62	2.07	2.35
7.	WAF	2.14	2.32	3.27
8.	Peddavithamon	2.07	1.76	3.25
9.	Natunoonepalli	1.99	2.10	2.42
10.	Oriental tobacco	1.80	1.86	3.41
11.	Dharanikota	1.77	2.23	3.18
12.	Mutant	1.74	2.46	4.17
13.	Kavali	1.72	1.79	2.98
14.	NYNT64	1.70	2.00	3.40
15.	NYNT65	1.67	2.96	3.10
16.	Yelimanchali	1.61	2.07	3.87
17.	Kommipaddu vithanam	1.51	2.00	3.48
18.	Sattenapalli	1.47	2.24	3.73
19.	Bommidala	1.45	2.06	4.18
20.	5B-154	1.40	1.98	2.77
21.	Solunki	1.36	1.51	2.86
22.	Nellore	1.34	2.71	3.46
23.	Jakirampur	1.29	1.99	3.33
24.	Singaray Konda	1.15	1.88	3.81
25.	Natu parachure	0.96	1.73	3.80
26.	Pryuvithanam	0.93	2.47	2.91
27.	Talamariaaku	0.81	2.27	2.46
28.	Chilakaluripeta	0.80	2.87	4.76
29.	Inkollu	0.80	2.42	2.98
30.	DWFC	0.60	2.38	3.52

BERHAMPUR

Project No.: PBBR 2

Research project title	**Collection, evaluation and maintenance of tobacco germplasm**
Objectives	▪ To collect, evaluate and maintain tobacco germplasm for future use.
Investigators	A. M. Prusti
Year of start	1987
Year of completion	Continuing
Location	AINP on Tobacco, CPR, Berhampur

Treatments : 143 (139+4) Spacing : 75 x 50 cm
Design : Non Replicated Plot size : Each entry in one row of 5.0 m length
Fertilizer dose : $N:P_2O_5:K_2O$: 80:40:40 kg/ha

RESULTS

One hundred twelve genotypes and fifty advanced cultures were maintained for future breeding programme. During kharif 2023,eightynine germplasm lines, fifty advanced cultures and four checks were evaluated for topped plant height, leaf number, leaf length, leaf width and cured leaf yield and given in Table 1 PBBR 2. Genotypes exhibited wide variation for all biometrical characters.Topped plant height, , number of leaves, leaf length, leaf width and cured leaf yield ranged from 53.4 cm (HV 98-21) to 132.6 cm (AC 42), 11 (1026-IT, AC 26) to 22 (AC 37), 27 cm (PVM 7) to 64.4cm (AC 13) , 12.0 cm (NATU ELURA) to 31 cm (AC 13) and 670 kg/ha(NATU ANKAPALLI) to 2969 kg/ha (PVM 4) respectively.

Salient findings/Achievements

- Short topped plant height(< 70 cm): (11 genotypes): (HV 98-21, AC 26, VR 2, 1026-IT, PATHARAPALLI, DG 4, MUSTABADA VITHENUM, NATU ELURA, 45-90 and AC 45)
- More number of leaves/plant (>20): (18 genotypes): (NATU PATHAVERUM, TOKA –AKU (FARM), GADI KURCHIVITHENUM, NATU LINGAYA PALAM), SEL. 36-3, RAYALA DHARANIKOTA, AC 8, AC 22, AC 30, AC39, AC 49, 1076 X 409-IT, NF 4-20-2, 1027 IT, AC 16. AC42, AC 43and AC 37
- Leaf length (>60 cm): (7 genotypes): (AC 13, AC 31, NyNT 65, NATU MEDARAMETLA, NF 4-20-2, AC 6 and AC 4)
- Leaf width (>30 cm): (4 genotypes): (AC 13, AC 16, AC 31 and AC 19)
- Cured leaf yield (>2500kg/ha): (17 genotypes): AC 5, AC 9, PVM 14, AC 3, 1076 X 409-IT, DONE VITHENUM, NF 4-20-2, AC 42, AC 4, AC 37, AC 13, TOKA –AKU (NERSERAOPETA), AC 31, PRAVAT (NATU), AC 10, AC 16 and PVM 4

Table 1 PBBR 2: Data on morphological characters of tobacco germplasm (2023)

Genotypes	Topped plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
BADA KHEMUNDI LOCAL	80.0	13.8	45.6	20.8	1219
HV 98-14	80.8	14.0	49.6	21.5	1973
GNT 6 LOCAL	96.0	16.0	49.2	20.6	1253
9 -- 14	93.0	18.4	47.4	21.8	1421
1872	92.0	15.2	51.8	21.4	2053
1076 X 409-IT	98.0	19.6	52.2	23.4	2581
TOKA –AKU (FARM)	96.0	19.2	49.4	25.6	2317
GADI KURCHIVITHENUM	100.6	19.2	47.6	21.6	1363
NATU PATHAVERUM	98.0	19.0	51.8	23.6	2419
MUSTABADA VITHENUM	69.0	13.2	50.0	18.0	2075
DR 1	87.6	16.4	51.2	23.1	1808
NATU SINGRIAKONDA	77.6	13.2	49.4	25.0	1896
ANKREDDY PALAM	74.0	14.0	53.0	23.3	1728
DONE VITHENUM	104.0	18.4	54.2	25.8	2587
MUTANT (TOKAKU)	110.0	17.6	55.0	20.8	1571
NATU LINGAYA PALAM)	104.0	19.2	49.2	25.2	2328
JP 1	108.2	16.8	47.6	24.6	1611
RAYALA (JUNALGODA)	100.8	17.3	45.8	17.0	1525
RAYALA (ANKREDDY PALAM)	82.4	15.6	40.4	16.4	1280
JML 33-90	99.0	17.2	46.6	18.8	1355
BIHAR (SATHREN PALLI)	98.6	18.4	48.6	22.3	1179
NATU	107.4	18.6	53.0	23.4	1533
RANIPETA	76.0	14.0	51.8	23.6	1701
PATIBITHENUM	125.0	16.0	52.6	26.2	1157
TOKA -AKU (CHILACALURIPET)	97.2	18.8	53.4	24.8	1461
TOKA –AKU (NERSERPETA)	107.0	18.4	51.6	26.4	2804
NATU KAVELI	86.3	15.0	53.3	26.3	1549
NATU (CHEBROLA)	87.0	17.0	49.0	23.0	2427
NATU (NELLORE)	76.0	14.4	48.4	19.8	1267
51-90	111.0	17.2	50.6	27.6	2216
PRAVAT (NATU)	86.3	16.0	43.8	22.8	2863
SEL. 36-3	95.0	19.2	42.4	24.2	2277
HV 98-18	71.7	12.7	49.0	20.7	1141
KORAPUT LOCAL	110.0	16.4	54.4	22.6	1635

Genotypes	Topped plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
1027 IT	90.0	21.2	47.8	22.8	1693
PTB 6	108.0	16.8	50.4	23.1	784
1026 - IT	65.0	11.0	42.5	22.5	1451
GNT 6 X 58-90	85.0	16.0	41.0	16.0	1168
DG 4	66.7	12.0	45.2	17.3	720
1062 – IT	108.3	14.3	44.3	19.0	1240
NATU ELURA	70.0	12.0	34.0	12.0	925
NATU METURMETA	99.0	14.8	49.8	24.0	1867
1023- IT	86.0	14.0	46.6	24.8	1891
NATU NONPALLI	75.0	14.0	40.0	15.0	981
MARAGADAM	83.0	14.0	52.8	21.6	1352
J - 2	97.5	13.0	47.5	21.0	1240
INUKUKU	75.0	16.0	39.5	18.8	1651
M. TOKAKU	112.0	16.0	44.0	26.8	1435
1072 – IT	95.0	16.0	40.0	22.0	1885
NATU ANKREDDY PALAM	87.5	15.0	49.0	23.0	1491
PATHARAPALLI	66.1	12.8	48.4	23.7	1552
NATU MADIRA	71.0	13.2	55.6	24.6	2061
45 – 90	70.0	14.0	46.0	19.0	1152
HV 98 – 21	53.4	11.4	44.2	17.3	1237
409 – IT	115.0	18.0	49.0	24.0	1464
RAYALA (FARM)	77.5	14.1	47.3	19.7	1245
PTB 5	100.0	16.0	40.0	17.0	1285
RAYALA DHARANIKOTA	124.6	19.2	54.8	22.8	1672
HV 98-2	107.5	18.0	50.5	24.3	1296
MARAGADAM	80.0	15.0	55.4	27.0	1472
PTB 11	106.7	17.3	43.7	18.3	1843
1076 – IT	98.0	16.8	46.4	21.8	1827
VR 2	63.8	14.2	56.4	27.8	2069
33-90	75.3	13.4	44.3	18.9	2213
58-90	76.0	13.6	54.8	26.2	2059
BHAGYALAKSHMI	88.0	17.6	47.4	23.6	2120
BOTCHAVITHANUM (ALLANKI)	100.0	16.4	53.8	24.4	1576
KVT – GANAPAVARAM (SATTENAPALLI)	87.0	15.2	56.8	27.4	2357
MANASI	100.6	15.2	52.8	22.8	2056
NATU ADDANKI	105.0	16.8	55.2	24.7	2021
NATU ANKAPALLI	100.4	17.2	50.0	19.4	339
NATU BURUGUPUDI	107.6	15.2	51.2	22.4	1485
NATU MEDARAMETLA	102.0	17.6	60.2	28.6	1589
NATU SPECIAL	102.6	15.4	48.2	25.4	1840

Genotypes	Topped plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
NATU YELAMANCHALI	101.6	16.8	153.6	24.9	1533
NATU VITHANUM-ONGOLE	114.4	16.2	49.4	20.3	1387
RAYALA NARSARPETA	93.0	15.2	50.0	23.0	1741
PVM 2	111.6	17.8	51.8	22.9	1840
PVM 3	82.0	16.8	50.8	22.4	1984
PVM 4	97.0	15.0	54.6	25.3	2969
PVM 6	106.6	14.4	48.8	22.2	1032
PVM 7	98.3	15.0	27.0	17.7	1309
G 88	70.4	11.6	47.2	23.2	1467
G 89	90.0	18.0	55.0	26.0	1043
BPT 3	96.0	15.6	44.4	22.4	1211
BPT 4	98.0	17.4	46.6	17.4	1773
PVM 14	101.6	17.6	53.4	25.6	2568
NF 4-20-2	111.0	19.8	60.2	25.8	2681
Ny 65	67.0	13.4	61.6	24.6	2120
AC 1	117.0	18.4	56.4	25.1	963
AC 2	107.8	16.8	55.2	28.4	1960
AC 3	133.0	17.6	59.4	26.2	2570
AC 4	126.0	18.4	60.0	25.6	2693
AC 5	128.0	18.2	55.8	25.3	2515
AC 6	128.0	17.4	60.2	26.5	2141
AC 7	96.0	16.0	52.6	22.8	1728
AC 8	106.0	19.2	59.8	20.6	1837
AC 9	120.0	18.8	57.6	25.6	2531
AC 10	98.0	14.8	46.0	20.0	2884
AC 11	89.0	12.8	53.8	24.0	1717
AC 12	80.0	11.3	55.0	27.0	1933
AC 13	104.8	14.2	64.4	31.0	2794
AC 14	91.6	14.2	52.8	21.5	2459
AC 15	97.0	16.0	53.0	23.2	2347
AC 16	124.0	21.2	57.6	31.0	2949
AC 17	107.0	17.2	51.4	22.8	1656
AC 18	97.0	16.2	53.0	25.0	2429
AC 19	88.0	14.2	59.0	30.5	2424
AC 20	93.8	12.8	50.8	24.8	1720
AC 21	93.3	14.0	39.7	16.3	2253
A C 22	114.0	19.2	55.8	22.4	1296
AC 23	94.4	15.8	54.2	23.4	2269
AC 24	96.5	13.2	45.2	19.1	803
AC 25	102.4	16.4	52.4	23.2	1515
AC 26	61.7	11.0	45.3	19.7	1237
AC 27	110.0	17.0	53.0	26.2	1656

Genotypes	Topped plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
AC 28	100.0	18.4	55.6	27.7	1304
AC 29	86.0	15.2	46.4	23.8	1253
AC 30	108.0	19.2	53.0	21.6	1520
AC 31	107.0	17.6	63.4	30.6	2855
AC 32	110.0	16.4	52.4	22.0	1843
AC 33	104.0	16.8	56.2	24.0	1557
AC 34	81.0	14.4	54.4	26.2	2331
AC 35	77.0	14.2	45.2	20.2	1917
AC 36	102.0	14.6	47.8	20.5	1387
AC 37	130.0	22.0	57.6	27.0	2701
AC 38	111.0	14.2	52.8	27.0	2141
AC 39	121.0	19.2	54.0	25.4	2048
AC 40	76.0	15.6	56.8	25.9	2355
AC 41	91.0	16.4	52.2	25.4	1864
AC 42	132.6	21.2	57.4	27.2	2683
AC 43	111.0	21.4	52.2	23.8	1336
AC 44	97.0	16.6	52.8	25.2	2003
AC 45	70.0	13.0	48.5	22.0	768
AC 46	72.5	14.0	39.5	15.0	861
AC 47	87.5	17.5	45.8	20.3	760
AC 48	105.0	17.0	53.0	28.0	680
AC 49	97.0	19.2	50.0	20.7	1163
AC 50	88.0	16.4	48.6	22.6	1739
BPT 7 (C)	70.4	13.0	45.8	18.2	1383
BPT 50 (C)	77.6	14.0	41.3	17.6	1001
Gajapati (C)	63.5	11.3	47.2	19.9	1391
JP Local (C)	86.6	16.0	47.5	19.3	1396

Project No.: PBBR 4

Research project title	**Hybridization and generation advancement for improvement of *pikka* tobacco**
Objectives	▪ To evolve high yielding and better quality *pikka* tobacco lines
Investigators	A. M. Prusti
Year of start	2023
Year of completion	2023
Location	AINP on Tobacco, CPR, Berhampur

RESULTS

During 2023 F_1 generation of the following crosses were grown and harvested in bulk separately.

Crosses	Objective
Gajapati x Bhairavi	Drought and high cured leaf yield
JP local x Bhairavi	
Gajapati x *Natu* Noonepalli	

During 2023, F_2 generation of the following crosses were grown and superior plants were selected.

S. No.	Crosses	Objective
1	Bhairavi X Line 361	Drought and high cured leaf yield Total 64 selections were made based on visual observation and will be advanced to F_3 generation in 2024-25.
	Bhairavi x Peda Vitanam	
2	Bhairavi x NG 50	
3	Bhairavi x Natu Noonepalli	
	Bhairavi x NyNT 94	

Crosses	Objective
Gajapati x Bhairavi	Drought and high cured leaf yield
JP local x Bhairavi	

Project No.: PBBR 8

Research project title	**Yield Evaluation Trial (YET) on *pikka* tobacco**
Objectives	▪ To evaluate promising genotypes in Yield Evaluation Trial (YET) for selection of superior genotypes for further testing in Replicated Yield Trial (RYT)
Investigators	A. M. Prusti
Year of start	2021-22
Year of completion	2023-24
Location	AINP on Tobacco, CPR, Berhampur

Design	:	RBD	Replications	:	Two
Treatments	:	22 (20 +2)	Spacing	:	75 x 50 cm
Plot size	:	5 x 3 m	Fertilizer dose	:	$N:P_2O_5:K_2O$: 80:40:40 kg/ha

RESULTS

Twenty *pikka* tobacco genotypes along with two check varieties, Gajapati and JP Local were evaluated during 2023 in RCBD with two replications for cured leaf yield and ancillary characters such as topped plant height (cm), no. of leaves / plant, leaf length (cm) and leaf width (cm). Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes tested in YET 2023 is given in Table 1 PBBR 8.

Significant differences were observed among test entries for cured leaf yield, topped plant height, number of leaves per plant, leaf length and leaf width. Topped plant height ranged from 45.4 cm (NG 64) to 103.3 cm (JP Local), the average being 71.5 cm. Since leaf is the economic part of tobacco crop, number of leaves/plant, leaf length and leaf width have significant positive correlation with cured leaf yield. Number of leaves per plant ranged from 10.4 (NG 61) to 19.8 (II 1873) with an average of 15.0. Leaf length is another economically important character which has significant contribution to cured leaf yield. Leaf length ranged from 43.5 cm (II 1068) to 63.4 cm (Kavali) with a mean value of 54.0cm. Only one genotype (Kavali) was found significantly superior in leaf length over check variety Gajapati (54.6 cm). Leaf width of test entries ranged from 12.8cm (Kommipadu vittanam) to 27.5 cm (Chebrolu) with an average value of 18.3 cm. Two genotypes (Natu Special and Chebrolu) exhibited significantly higher leaf width than check variety JP Local (20.9 cm). Cured leaf yield of the test entries ranged from 1122 kg/ha (Kavali) to 1621 kg/ha (KFC) with a mean value of 1443 kg/ha. Six genotypes such as KFC, NG 61, Natu Paracheru, NG 64, Narasraopeta and Ongole recorded significantly higher cured leaf yield 1621, 1600, 1584, 1561, 1557 and 1551kg/ha respectively than check variety Gajapati (1262 kg/ha). These six genotypes showed yield advantage of 22.9 % (Ongole) to 28.4% (KFC) over the check variety Gajapati.

Three years pooled analysis of variance (**Table 2 PBBR 8)** revealed that there was significant difference among genotypes, years and genotype X year interaction components for cured leaf yield in tobacco. Four genotypes NG 61, WAF, II 1873 and Bhairavi produced significantly higher cured leaf yield (1616, 1524, 1504 and 1474 kg/ha, respectively than check variety Gajapati (1178 kg/ha).These four genotypes showed yield advantage of 25.2 % (Bhairavi) to 37.1 % (NG 61) over the check variety Gajapati.

Conclusion: In YET, twelve genotypes (Bhairavi, Kommipaduvittanam, II 1068, II 1873, KFC, Line 61, Natu Noonepalli, Natu Special, NG 61, NGP 89, Ongole and WAF) during 2021 and six genotypes (Bhairavi, II 1873, NG 61, NG 64, Peda vittanam, Potti vittanam) in 2022 and six genotypes (KFC, NG 61, Natu Paracheru, NG 64, Narasraopeta and Ongole)in 2023 expressed significantly superiority over best check variety Gajapati in 2021, JP Local in 2022 and Gajapati in 2023, for cured leaf yield in tobacco. Since there was significant difference among genotypes, years and genotype X year interaction components for cured leaf yield in tobacco only four genotypes NG 61, WAF, II 1873 and Bhairavi produced significantly higher cured leaf yield (1616, 1524, 1504 and 1474 kg/ha respectively pooled over years than check variety Guajarati (1178 kg/ha).These four genotypes showed yield advantage of 25.2 % (Bhairavi) to 37.1 % (NG 61) over the check variety Gajapati.

Salient Findings/Achievements

- During 2023, Six genotypes (KFC, NG 61, Natu Paracheru, NG 64, Narasraopeta and Ongole) produced significantly higher cured leaf yield in tobacco than best check variety Gajapati

- Pooled results over three years showed that only four genotypes NG 61, WAF, II 1873 and Bhairavi produced significantly higher cured leaf yield (1616, 1524, 1504 and 1474 kg/ha respectively than check variety Gajapati (1178 kg/ha).These four genotypes showed yield advantage of 25.2% (Bhairavi) to 37.1 % (NG 61) over the check variety Gajapati.

Table 1 PBBR 8: Data on morphological characters of *pikka* tobacco genotypes in BET 2023 *kharif* season

Treatments	Topped plant height (cm)	No. of leaves / plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)				% IOC
					2021	2022	2023	Pooled	
Bhairavi	51.4	13.8	50.5	15.8	1339*	1558*	1527	1474*	25.2
Chebrolu	102.5	18.1	45.9	27.5*	1139	1099	1476	1238	
Kommipaduvittanam	85.5	15.6	56.3	12.8	1386*	1432	1439	1419	
II 1068	51.1	14.2	43.5	19.7	1424*	1076	1363	1288	
II 1873	88.3	19.8	54.7	15.6	1404*	1597*	1512	1504*	27.7
KFC	58.3	16.0	54.8	18.9	1413*	973	1621*	1336	
Line 61	59.2	17.4	53.9	18.2	1254*	1290	1491	1345	
Narasaraopeta	74.4	16.3	47.7	17.1	1189	1225	1557*	1324	
Natu Noonepalli	72.4	13.3	53.5	14.3	1331*	1109	1281	1240	
NatuParacheru	47.3	10.5	50.7	16.0	976	1304	1584*	1288	
Natu Special	81.9	14.8	56.2	25.3*	1366*	1261	1246	1291	
NG 61	45.9	10.4	58.0	18.1	1376*	1871*	1600*	1616*	37.1
NG 64	45.4	12.2	54.3	19.1	1154	1652*	1561*	1455	
NGP 89	56.8	13.5	58.2	17.6	1464*	1374	1529	1456	
Ongole	72.0	13.6	51.3	20.1	1256*	1322	1551*	1376	
Peda Vittanam	93.6	14.5	53.5	15.8	938	1404	1355	1232	
Potti Vittanam	73.9	15.3	55.7	15.0	968	1574*	1465	1335	
Talmariaku	86.6	15.6	58.9	17.0	1007	1326	1485	1272	
Kavali	84.0	17.6	63.4*	16.2	587	1293	1122	1001	
WAF	55.3	13.1	59.6	23.0	1332*	1717*	1522	1524*	29.3
Gajapati	84.7	16.7	54.6	18.4	1097	1053	1262	1178	
J P Local	103.3	18.9	54.2	20.9	997	1175	1199	1083	
Mean	71.5	15.0	54.0	18.3	1200	1349	1443	1331	
S.Em ±	6.6	1.4	2.5	1.4	53.1	89.31	92.8	99.9	
C.D. at 5%	19.3	4.1	7.5	4.3	156.1	262.61	273.0	282.4	
C. V. (%)	13.0	13.1	6.7	11.2	6.3	9.4	9.1		

Table 2 PBBR 8: Pooled Analysis of Variance for cured leaf yield in tobacco

Source	Df	SS	MSS
Replication within Year	3	230384.30	76794.77
Year (Y)	2	1322786.92	661393.5**
Genotypes (G)	21	2635554.46	125502.6*
G*Y	42	2517019.74	59929.04**
Pooled error	63	815317.20	12941.54
Total	131		

Project No.: PBBR 10

Research project title	Evaluation of drought tolerant genotypes
Objectives	▪ To evaluate genotypes for drought tolerance and selection of drought tolerant genotypes for use in hybridization programme
Investigators	A. M. Prusti
Year of start	2022-23
Year of completion	2024-25
Location	AINP on Tobacco, CPR, Berhampur

Design	:	RBD	Replications	:	Two
Treatments	:	22 (20 +2)	Spacing	:	75 x 50 cm
Plot size	:	5 x 3 m	Fertilizer dose	:	N:P_2O_5:K_2O: 80:40:40 kg/ha

RESULTS

In order to assess drought tolerant genotypes, twenty *pikka* tobacco genotypes along with two check varieties, Gajapati and JP Local were evaluated during 2023 in RBD with two replications for cured leaf yield and ancillary characters such as topped plant height (cm), no. of leaves / plant, leaf length (cm) and leaf width (cm) . Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes tested in evaluation of drought tolerant genotypes 2023 is given in Table 1 PBBR 10.

Significant differences were observed among test entries for cured leaf yield, topped plant height, number of leaves per plant, leaf length and leaf width. Topped plant height ranged from 41.4 cm (*Natu* Paracheru) to 104.0 cm (JP Local), the average being 69.2 cm. Since leaf is the economic part of tobacco crop, number of leaves/plant, leaf length and leaf width breadth have significant positive correlation with cured leaf yield. Number of leaves per plant ranged from 11.1 (*Natu* Paracheru) to 19.5 (II 1873) with an average of 15.3. Leaf length ranged from 37.8 cm (Chebrolu) to 56.9 cm (Potti Vitanam) with a mean value of 50.7 cm. Leaf width of test entries ranged from 12.3 cm (Kommipadu Vitanam) to 25.4 cm (Ongole) with an average value of 18.6 cm. Two genotypes Chebrolu(24.7 cm) and Ongole (25.4 cm) exhibited significantly higher leaf width than check variety Gajapati (18.7 cm). Cured

leaf yield of the test entries ranged from 799 kg/ha (Peda Vitanam) to 1532 kg/ha (*Natu* Special) with a mean value of 1190 kg/ha. Four genotypes namely, Natu Special (1532 kg/ha), Bhairavi (1433 kg/ha), Line 61(1373 kg/ha), and Talamiraaku (1372 kg/ha) recorded significantly higher cured leaf yield than check variety JP Local (1190 kg/ha). These four genotypes expressed yield advantage of 15.3 % (Talamiraaku) to 28.7% (*Natu* Special) over the best check variety JP Local.

Two years pooled analysis of variance (Table 2 PBBR 10) revealed that there was significant difference among genotypes, years and genotype X year interaction components for cured leaf yield in tobacco. Only one genotype *Natu* Special (1410 kg/ha) produced significantly higher cured leaf yield than check variety JP Local (1092 kg/ha) with yield advantage of 29.1% under drought condition.

The Chemical quality parameters *viz.* Nicotine, Reducing Sugar and Chloride of test entries are presented in Table 3 PBBR 10. It was revealed that the nicotine content of test entries varies from 0.59 (NG 64) to 2.17 (Line 61). Test entry *Natu* Paracheru recorded lowest reducing sugar and chloride content of 0.82 and 0.33% respectively. Genotypes Line 61 and Narasraopeta exhibited maximum reducing sugar (5.81%) and chloride content (0.87%) respectively. However, there was no significant difference among test entries with respect to Nicotine and Chloride content. The Chemical quality parameters are in acceptable limit.

Salient findings/Achievements

- During 2023,four genotypes (*Natu* Special, Bhairavi, Line 61 and Talamari aku)exhibited significantly higher cured leaf yield in tobacco than best check variety JP Local.
- Pooled results over two years showed that only one genotype Natu Special (1410 kg/ha) produced significantly higher cured leaf yield than check variety JP Local (1092 kg/ha). These genotypes showed yield advantage of 29.1 over the check variety JP Local.

Conclusion: Since there was very high significant difference among years and genotype X year interaction components for cured leaf yield in tobacco, this trial may be conducted for another one year *i.e.* in 2024 for meaningful conclusion.

Table 1 PBBR 10: Cured leaf yield and ancillary characters of *pikka* tobacco genotypes during 2023

Genotypes	Topped plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)			Increase over best check (%)
					2022	2023	Mean	
Bhairavi	71.6	15.9	48.9	17.3	1136	1433*	1284	
Chebrolu	89.7	16.5	37.8	24.7*	953	1301	1127	
Kommipadu Vitanam	84.0	18.5	55.3	12.3	848	1195	1021	
II 1068	50.4	13.9	51.9	18.6	1326*	1313	1320	
II 1873	78.3	19.5	50.0	17.0	617	875	746	
Kavali	76.4	17.9	56.0	16.5	1336*	1271	1303	
KFC	52.3	13.3	50.3	15.3	910	1068	989	
Line 61	76.9	16.7	47.2	19.1	1201*	1373*	1287	
Narasraopeta	84.2	15.5	49.7	19.9	997	1103	1050	
Natu Noonepalli	67.4	16.0	48.0	17.9	1066	1051	1059	
Natu Paracheru	41.4	11.1	46.7	17.8	1127	1223	1175	
Natu Special	86.2	16.7	49.1	21.5	1288*	1532*	1410*	29.1
NG 61	46.7	12.7	54.2	19.5	1212*	1050	1131	
NG 64	74.2	15.4	56.0	18.0	1070	894	982	
NGP 89	47.3	11.3	54.8	19.9	727	1278	1002	
Ongole	85.9	16.0	53.6	25.4*	594	1161	877	
PedaVitanam	59.3	13.8	43.8	18.2	925	799	862	
Potti Vitanam	69.0	15.0	56.9	17.6	1161	1330	1246	
Talamariaku	84.7	18.6	53.8	20.6	963	1372*	1167	
WAF	46.1	11.7	49.2	17.9	1043	1252	1148	
Gajapati (C)	47.9	12.2	51.6	18.7	936	1143	1039	
JP Local (C)	104.0	19.5	50.0	17.1	1005	1179	1092	
Mean	69.2	15.3	50.7	18.6	1020	1190	1105	
S.Em ±	6.0	1.4	2.7	1.3	57.8	57.4	103.8	
C.D. at 5%	17.6	4.2	7.9	3.8	170.0	168.8	296.1	
C. V. (%)	12.2	13.2	7.5	9.8	8.0	6.8		

Table 2 PBBR 10: Pooled Analysis of Variance for cured leaf yield in tobacco

Source	df	SS	MSS
Replication within Year	2	65902.73	32951.36
Year (Y)	1	640227.682	640227.7**
Genotypes (G)	21	2283264.36	108726.9*
G*Y	21	904534.818	43073.09**
Pooled error	42	278721.27	6636.221
Total	87		

NB * and ** significant at 5% and 1% levels respectively

Table 3 PBBR 10: Chemical quality parameters of *pikka* tobacco genotypes during 2023

Entries	Nicotine (%)	Reducing Sugar (%)	Chloride (%)
Bhairavi	0.84	0.99	0.52
Chebrolu	1.64	1.31	0.56
KommipaduVitanam	0.97	0.97	0.48
II 1068	1.85	1.26	0.74
II 1873	1.12	1.05	0.42
Kavali	1.37	1.15	0.67
KFC	1.29	0.91	0.81
Line 61	2.17	1.91	0.64
Narasraopeta	2.00	1.31	0.87
Natu Noonepalli	1.75	1.09	0.54
Natu Paracheru	1.55	0.82	0.33
Natu Special	1.32	1.09	0.51
NG 61	0.93	5.81	0.77
NG 64	0.59	0.86	0.47
NGP 89	1.08	1.23	0.52
Ongole	1.79	1.32	0.51
Peda Vitanam	1.21	1.25	0.67
Potti Vitanam	1.72	1.03	0.50
Talamariaku	1.57	1.45	0.63
WAF	0.92	1.11	0.53
Gajapati (C)	1.53	1.29	0.58
JP Local (C)	0.95	4.58	0.46
Mean	1.37	1.53	0.58
S.Em ±	0.3	0.8	0.1
C.D. at 5%	NS	2.3	NS
C. V. (%)	35.3	72.8	29.4

Project No.: PBBR 11 (A)

Research project title	**Exploratory trail on *rustica* tobacco**
Objectives	▪ To evaluate promising released genotypes of *rustica* tobacco under Odisha condition and identify suitability for general cultivation
Investigators	A. M. Prusti
Year of start	2022-23
Year of completion	2024-25
Location	AINP on Tobacco, CPR, Berhampur

Design : Unreplicated
Treatments : 5 (4 +1) Spacing : 60 x 50 cm
Plot size : 6 x 5 m Fertilizer dose : N:P_2O_5:K_2O: 80:40:40 kg/ha

RESULTS

Four promising released *rustica* tobacco genotypes (GCT 2, GCT 3, DCT 4 and DCT 5) along with one check variety GC 1 were evaluated during 2023. It was found from Table 1 PBBR 11(A) that all test entries produced higher cured leaf yield than check variety GC 1 (2131 kg/ha). Maximum cured leaf yield was reported by GCT 3 (3231 kg/ha) followed by DCT 5 (2772 kg/ha), DCT 4 (2612 kg/ha) and GCT 2 (2527 kg/ha), with yield advantage of 51.6, 30.1,22.6 and 18.9 percent higher cured leaf yield than check variety GC 1(2131 kg/ha) respectively. Two years pooled data revealed that variety GCT3 produced maximum cured leaf yield of 2328 kg/ha followed by DCT 5(2228 kg/ha), DCT 4 (2063kg/ha) and GCT 2 (2038 kg/ha) than check variety GC 1 (1671 kg/ha) with yield superiority of 39.3, 33.3, 23.4 and 21.9 percent respectively. Chemical quality parameters of *rustica* tobacco varieties are presented in Table 2 PBBR 11(A). It was found that variety DCT 5 expressed maximum Nicotine (3.68%) and reducing sugar (1.44%) and lowest chloride content (0.41%).

Salient findings/Achievements

- During 2023, *Rustica* varieties GCT 3 (3231 kg/ha) produced higher cured leaf yield followed by DCT 5 (2772 kg/ha), DCT 4 (2612 kg/ha) and GCT 2 (2527 kg/ha), than check variety GC 1(2131 kg/ha) with yield advantage of 51.6, 30.1, 22.6 and 18.9 % respectively.
- Two years pooled data revealed that variety GCT3 produced maximum cured leaf yield of 2328 kg/ha followed by DCT 5 (2228 kg/ha), DCT 4 (2063 kg/ha) and GCT 2 (2038 kg/ha) than check variety GC 1 (1671 kg/ha) with yield superiority of 39.3, 33.3, 23.4 and 21.9 percent respectively.

Conclusion: Since the ranking and yield performance of these varieties vary over years, these entries may be further tested third year in 2024 for confirmation.

Table 1 PBBR 11(A): Cured leaf yield of *rustica* tobacco varieties during 2023

Varieties	Cured leaf yield (Kg/ha)					
	2022-23	% IOC	2023-24	% IOC	Mean	% IOC
GCT 2	1548	27.9	2527	18.6	2038	21.9
GCT3	1424	17.7	3231	51.6	2328	39.3
DCT 4	1513	25	2612	22.6	2063	23.4
DCT 5	1684	39.2	2772	30.1	2228	33.3
GC 1 (C)	1210		2131		1671	

Table 2 PBBR 11(A): Chemical quality parameters of *rustica* tobacco varieties (2023)

Variety	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
GCT 2	0.79	0.44	0.54
GCT3	1.78	0.86	0.54
DCT 4	1.94	0.95	0.54
DCT 5	3.68	1.44	0.41
GC 1 (C)	0.90	0.55	0.74

Project No.: PBBR 11(B)

Research project title	Exploratory trail on *Jati* tobacco
Objectives	▪ To evaluate promising released genotypes of *Jati* tobacco under Odisha condition and identify suitability for general cultivation
Investigators	A. M. Prusti
Year of start	2023-24
Year of completion	2024-25
Location	AINP on Tobacco, CPR, Berhampur

Design : Unreplicated
Treatments : 4 (3 +1) Spacing : 75 x 50 cm
Plot size : 9 x 5 m Fertilizer dose : N:P_2O_5:K_2O: 80:40:40 kg/ha

RESULTS

Three promising released *jati* tobacco genotypes (Podali, Manasi and Chama) along with one check variety DJ 1 were evaluated during 2023. It was found from Table 1 PBBR 11(B) that all test entries produced higher cured leaf yield than check variety DJ 1 (2131 kg/ha). Maximum cured leaf yield was reported by Manasi (2749 kg/ha) followed by Chama (2709 kg/ha) and Podali (2347 kg/ha), with yield advantage of 40.5, 38.5 and 20.0 percent respectively higher cured leaf yield than check variety DJ 1(1956 kg/ha). Chemical quality parameters of *jati* tobacco varieties are presented in Table 2 PBBR 11(B). It was found that variety Podali expressed maximum Nicotine (6.32%) and reducing sugar (1.86%) and Manasi with lowest chloride content (0.90%).

Salient findings/Achievements

- During 2023, *Jati* varietiesManasi (2749 kg/ha) followed by Chama (2709 kg/ha) and Podali (2347 kg/ha) produced higher cured leaf yield than check variety DJ 1 (1956 kg/ha) with yield advantage of 40.5, 38.5 and 20.0 percent respectively

Conclusion: In exploratory trial on *jati* tobacco 2023, three varieties Manasi (2749 kg/ha) followed by Chama (2709 kg/ha) and Podali (2347 kg/ha) produced higher cured leaf yield than check variety DJ 1(1956 kg/ha) with yield advantage of 40.5, 38.5 and 20.0 percent respectively. Since this is the first year of testing these varieties may be further tested another two years in 2024 and 2025 for confirmation.

Table 1 PBBR 11: Cured leaf yield of *jati* tobacco varieties during 2023

Varieties	Cured leaf yield (kg/ha)	Increase over best check (%)
Podali	2347	20.0
Manasi	2749	40.5
Chama	2709	38.5
DJ 1(C)	1956	

Table 2 PBBR 11(A): Chemical quality parameters of *jati* tobacco varieties (2023)

Variety	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
Podali	6.32	1.86	1.02
Manasi	4.89	1.42	0.90
Chama	4.43	1.24	0.93
DJ 1(C)	4.55	1.10	0.97

Project No.: PBBR 12

Research project title	Multi location trial in *pikka* tobacco
Objectives	▪ To evaluate promising genotypes in different locations for Yield and yield attributing characters and identifies suitability for general cultivation
Investigators	A. M. Prusti and M.R. Mohanty
Year of start	2022-23
Year of completion	2024-25
Location	AINP on Tobacco, CPR, Berhampur

Design	:	RBD	Replications	:	Four
Treatments	:	6 (4 +2)	Spacing	:	75 x 50 cm
Plot size	:	5 x 3.75 m	Fertilizer dose	:	N:P_2O_5:K_2O: 80:40:40 kg/ha

RESULTS

Four promising pikka tobacco genotypes (BPT 7, BPT 50, NF 4-27-3 and NF 4-20-2) along with two check varieties, Gajapati and JP Local were evaluated at three locations namely CPR, Berhampur, RRTTS Semiliguda and RRTTSS Jeypore during 2023 in RBD with four replications for cured leaf yield and ancillary characters such as topped plant height (cm), no. of leaves / plant, leaf length (cm) and leaf width (cm) . Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes tested in MLT 2023are given in Table 1 PBBR 12. Test entry NF 4-27-3 exhibited maximum leaf number (22.2), Both entries BPT 50 (21.1) and NF 4-27-3 (22.2) produced significantly higher number of leaves per plant than check variety JP Local (18.0). Maximum leaf length (59.3 cm) was shown by BPT 7. All test entries except NF 4-20-2 were at par with check variety JP local so far leaf length was concerned. Test entry BPT 7 recorded significantly higher leaf width (27.9 cm) than check variety Gajapati (24.9 cm) at Berhampur. Test entries BPT 50 was found significantly superior in cured leaf yield than better check variety at Berhampur, Semiliguda and Jeypore location. Test entries BPT 50 was found significantly superior in cured leaf yield than better check variety at Jeypore research station whereas genotype NF 4-27-3 was found significantly superior in cured leaf yield than better check variety at Berhampur and Semiliguda research station .Pooled analysis over locations showed that test entries BPT 7 (1912 kg/ha), BPT 50 (1658 kg/ha) and NF 4-27-3 (1756 kg/ha) produced significantly higher cured leaf yield than check variety JP Local 1456 kg/ha). Chemical quality parameters of MLT entries are presented in Table 2 PBBR 12. It wasfound that the quality parameters of the test entries are comparable with Check varieties and are in acceptable limit.

Salient findings/Achievements

- During 2022, three test entries, BPT 7 (1436 kg/ha), BPT 50 (1406 kg/ha) and NF 4-27-3 (1415 kg/ha) produced significantly higher cured leaf yield than check variety JP Local 1175 kg/ha) with yield advantage of 22.2, 19.7 and 20.4% respectively.
- During 2023, Three test entries, BPT 7 (1912 kg/ha), BPT 50 (1658 kg/ha) and NF 4-27-3 (1756 kg/ha) produced significantly higher cured leaf yield than check variety JP Local 1456 kg/ha) with yield advantage of 31.3, 13.9 and 20.6% respectively.

Conclusion: In Multi Location Trail 2023, Three test entries, BPT 7 (1912 kg/ha), BPT 50 (1658 kg/ha) and NF 4-27-3 (1756 kg/ha) produced significantly higher cured leaf yield than check variety JP Local 1456 kg/ha) with yield advantage of 31.3, 13.9 and 20.6% respectively. Since this is the second year of evaluation, these entries may be further tested third year in 2024 for confirmation.

Table 1 PBBR 12: Data on ancillary characters of *pikka* tobacco genotypes (2023)

Genotypes	Topped plant height (cm)	Number of leaves/ plant	Leaf length (cm)	Leaf breadth (cm)
BPT 7	96	19.3	59.3	27.9*
BPT 50	123	21.1*	55.5	25.9
NF 4-27-3	138	22.2*	55.9	25.7
NF 4-20-2	90	18.9	50.3	25
Gajapati	93	17.3	53.9	24.9
JP Local	146	18.0	54.1	21.9
Mean	114.2	19.4	54.8	25.2
S.Em ±	6.2	0.6	1.8	1.0
C.D. at 5%	18.8	1.9	5.4	2.9
C. V. (%)	10.9	6.5	6.5	7.6

Table 2 PBBR 12: Data on Cured leaf yield of *pikka* tobacco genotypes at multi-locations during 2023

Genotypes	Cured Leaf Yield (kg/ha)				% IOC
	Berhampur	Semiliguda	Jeypore	Mean	
BPT 7	2390*	2098*	1248*	1912*	31.3
BPT 50	2000	1758	1216*	1658*	13.9
NF 4-27-3	2212*	1941*	1115	1756*	20.6
NF 4-20-2	1884	1656	892	1477	
Gajapati	1854	1628	835	1439	
JP Local	1796	1576	995	1456	
Mean	2023	1776	1050	1616	
S.Em ±	84.4	85.9	53.9	44.0	
C.D. at 5%	254.3	258.9	162.5	125.2	
C. V. (%)	8.3	9.7	10.3		

Table 3 PBBR 12: Chemical quality parameters of *pikka* tobacco genotypes at multi-locations during 2023

Genotypes	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
BPT 7	1.64	2.74	0.69
BPT 50	1.02	4.51	0.60
NF 4-27-3	0.88	5.03	0.69
NF 4-20-2	1.50	3.37	0.71
Gajapati	1.55	3.04	0.74
JP Local	0.74	5.74	0.61
Mean	1.22	4.07	0.67
S.Em ±	0.24	2.74	0.05
C.D. at 5%	NS	4.51**	0.15
C. V. (%)	39.03	5.03	14.38

Project No.: PBBR 13

Research project title	Morphological characterization in *pikka* tobacco
Objectives	▪ To study the diversity pattern among twenty genotypes collected from AINPT Nandyal and to identify genotypically divergent parents for hybridization programme
Investigators	A. M. Prusti
Year of start	2021-22
Year of completion	2023-24
Location	AINP on Tobacco, CPR, Berhampur

Design	:	RBD	Replications	:	Three
Treatments	:	22 (20 +2)	Spacing	:	75 x 50 cm
Plot size	:	5 x 1.5 m	Fertilizer dose	:	N:P_2O_5:K_2O: 80:40:40 kg/ha

RESULTS

Twenty *pikka* tobacco genotypes along with two check varieties, Gajapati and JP Local were evaluated in RBD with three replications for 23 characters and 58 states. No variability was observed for internodal length, leaf stalk, capsule length and capsule width, and low variability for topped plant height, plant width, leaf length, days to flowering and flower colour. All other fourteen characters exhibited medium to high phenotypic variability. Genotypes (Kommipadu Vithanum and Natu Special), (Kommipadu Vithanum and Talamari aku), (Natu Noonepalli and JP Local), (NG 61 and NG 64), (NG 64 and JP Local), (II 1068 and Gajapati) and (NG 64 and Kavali) expressed maximum morphological diversity for twelve characters out of 23 characters and seemed to be more divergent in nature.

Salient findings/Achievements

- Genotypes (KommipaduVithanum and Natu Special), (KommipaduVithanum and Talamari aku), (Natu Noonepalli and JP Local), (NG 61 and NG 64), (NG 64 and JP Local), (II 1068 and Gajapati) and (NG 64 and Kavali) expressed maximum morphological diversity for twelve characters out of twenty three characters and seemed to be more divergent in nature.

Table 1 PBBR 13: Characterisation *in pikka* tobacco during 2022

Parameter	Range		
Plant Habit	1.Erect (2): (II 1068, NGP 89)	2.Semi erect (7): (Natu Noonepalli, NG 64)	3.Open (13): (KFC, Chebroli)
Topped plant height (cm)	1.Short (Upto 100 cm) (20) : (Ongole, NG 64)	2.Medium (100 to 160 cm) (2): (II 1068, Kommipadu Vithanam)	3.Tall (>160 cm)- Nil
Internodal Length	1.Short (< 4cm): nil	2.Medium (5-7 cm): nil	3.Long (>8 cm)(22): All
Plant Width (cm)	1.Low(<40 cm) (1): (Kawali)	2.Medium (40 -70 cm) :21(Bhairavi, Gajapati)	3.High (>70cm): Nil
Stem colour	1.Light green (11) : (Chebroli, Kawali)	2.Green (5) : (NG 64, Line 61)	3.Dark green (6): (WAF, JP L)
Leaf colour	1. Light green (7): (Line 61, NatuSpl.)	2.Green (7): (NGP 89, Natu Noonepalli)	3.Dark green (7): KFC, JPL)
Gumminess	1.Low (10):(PottiVithanam, JP Local)	2.Medium (8) : (ii 1873, KFC, WAF)	3.High (4): (Ongole, Gajapati)
Stalk	All (22) are sessile		
Leaf shape	1.Oblong (12) : (Natu special, II 1873)	2.Lanceolate (4): (Chebroli, Talmariaku)	3.Ovate (6): (Kawali, NG 61)
Leaf base	1.Acute (13): (KFC, Line 61)	2.Rounded (9): (II 1068, II 1873)	
Leaf surface	1.Smooth (12): (NGP 89, II 1068)	2.Puckered (10): (Natu Noonepalli, KFC)	
Leaf margin	1.Wavy (8): Gajapati, Potti Vithanam)	2.Straight (14) : (Narasaraopeta,, Line 61)	
Leaf tip	1.Acute (17) : (Natu Special, NG 64)	2.Rounded (5): (NG 61, JP Local)	
Venation	1.Prominent (11):(KFC, Ongole)	2.Medium (11): (NatuNoonepalli, II 1873)	
Midrib	1.Thick (11):(PottiVithanam, NG 61)	2.Medium (11): (NG 64, Line 61)	
Leaf length (cm)	1.Low (<25 cm) (1) : (Kawali)	2.Medium (25-35 cm): Nil	3.High (>35 cm) (21) : (II 1068, Ongole)
Leaf width(cm)	1.Low (<10 cm) (3): (Chebroli, Line 61)	2.Medium (10-25 cm)(19): (II 1873, II 1068)	High (>25 cm): Nil
Days to flowering	1.Early (<130days) (2): (Kawali, Gajapati)	2.Late (>130 days) (20): (Bhairavi , II 1068)	
Inflorescence	1.Compact (11): (Kommipadu vithanam, II 1068)	2.Open (7) : (KFC, Natu Noonepalli)	3.Branched (4): (Natu Special, NG 61)
Flower colour	1.Pink (21): (Chebroli, Bhairavi)	2.White (1) : (WAF)	
Capsule shape	1.Conical (18): (NatuSpecial,II 1873)	2.Ovaoid (4): (Narasaraopeta, WAF)	
Capsule length (cm)	1.Low (<1.5cm): Nil	2.Medium (1.5-2.0 cm) 22 (All)	3.High (>2.0 cm): Nil
Capsule width (cm)	1.Low (< 1 cm):Nil	2.Medium (1.0-1.5 cm) 22 (All)	3.High (1.5 cm):Nil

D. *RUSTICA* TOBACCO

COORDINATED EVALUATION OF *RUSTICA* TOBACCO GENOTYPES

IVT ON *RUSTICA* TOBACCO

RUABRC/RUArBRC/RULdBRC 2/RUDBRC: INITIAL VARIETAL TRIAL ON *RUSTICA* TOBACCO

Objectives: To evaluate the *rustica* tobacco entries for yield and quality at four centres *viz.*, Anand, Araul, Dinhata and Ladol along with respective check varieties under IVT

Year of start : 2023-24

Year of Completion :2023-24

***Rustica* tobacco Centres and Investigators**

Centres	:	Investigators
Anand	:	J. N. Patel & D.R. Delvadiya
Araul	:	A.K. Srivastava, K.C. Arya &N.B. Singh
Dinhata	:	Partha Saha, Namita Das Saha & S.K. Dam
Ladol	:	D.R. Chaudhari

Design : RBD
Total treatments : 02 + checks as given above
Replications : Five

Entries: 02 (Two)

1. IET-116
2. IET-117

Checks at different Centres

Anand	1. GC 1	2. GCT 2	3. GCT 3
Araul	1. Azad Kanchan	2. SK 417	
Dinhata	1. DD 437	2. Dharla	
Ladol	1. GCT 3	2. DCT 4	3. GCT 5

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Anand	2.40 m x 4.00 m	60 cm x 60 cm
Araul	2.7x4.5 m	45x45 cm
Dinhata	3.6 x 2.7 m	60 x 45 cm
Ladol	2.40 m x 4.50 m	60 cm x 45 cm

RESULTS

In the Initial varietal trial (IVT), two entries were evaluated for their yield potential against respective checks at different centres. Observations recorded leaf yield, natural/ artificial incidence of pest and diseases. Cured leaf quality parameters (Nicotine, reducing sugars and chlorine) were estimated. Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha. Data on yield and other characteristics at different centres are presented in Tables 1 to 7 IVT *Rustica* tobacco. The results are presented centre-wise.

ANAND

Yield: Significant differences were observed among test entries for cured leaf yield. Entry IET-116 (3179 kg/ha) found significantly superior over all check.

Morphological characterization: All the morphological characters *i.e.* no. of leaves per plant, plant height, leaf length, leaf width, leaf thickness, days to flowering and days to maturity were comparable with check variety.

Disease /Pest incidence: TMV and leaf curl incidences were found 53 % and 20% for test entries IET-116, respectively.

Salient Findings/Achievements

- Entry IET 116 showed significant superiority for cured leaf yield over all check.
- None of the entries were found free from tobacco mosaic and leaf curl disease.

Conclusion: The test entry IET-116 may be evaluated under AVT-I during 2024-25.

ARAUL

Yield: Significant differences were observed among test entries for cured leaf yield. Test entries IET-116 (4125 kg/ha) and IET-117 (3990 kg/ha) found significantly superior over best check Azad Kanchan (3335 kg/ha).Low TMV incidences were observed for test entries IET-116 (26.70%) as well as for leaf curl percent.

Salient Findings/Achievements:

- Test entries IET-116 & IET-117 were found superior in respect of cured leaf yield.

Conclusion: Lines tested IET-116 & IET-117 may be promoted for AVT-I to be conducted during Rabi-2024-25.

DINHATA

Significant variations were observed between the entries for cured leaf yield. The highest cured leaf yield (2590.96 kg//ha) was observed for the entry IET-116 which was 38.16% higher than the Check Dharla (1875.31 kg/ha).

Morphological characterization: Significant variations were observed for different morphological traits. The highest plant height (38.00 cm) was observed for the entry IET-116 followed by IET-117 (36.00 cm). The entry IET had the highest leaf breadth (26.89).

Disease /Pest incidence: No significant disease and pest were observed in test entries. The incidence of hollow stalk was highest (1.2%) in check DD-437 whereas it was only 0.5% in IET-116.

Salient Findings/Achievements:

- Test entry IET-116 was found to be superior in respect of cured leaf yield, first grade leaf.
- The performance of test entry IET-117 was not found superior over the check.

Conclusion: Lines tested IET-116 can be promoted for AVT-I to be conducted during Rabi-2024-25.

LADOL

Yield: None of the entry showed significant superiority for cured leaf yield over best check GCT 5 (4692 kg/ha). However, entry IET 117 showed numerical maximum cured leaf yield (4929 kg/ha) against best check GCT 5.

Morphological characterization: Significant differences for plant height and no. of leaves per plant, leaf length and leaf width were found for the entries tested in IVT.

Salient Findings/Achievements

- None of the entry showed significant superiority for cured leaf yield over best check GCT 5 (4692 kg/ha). Hence, none of the entry promoted in AVT I trial.

Conclusion: None of the entry promoted for AVT I trial

Recommendation for AVT-I: Based on the result of *rustica* centres and discussions held during the Interaction meeting with AINPT centres on 2nd July 2024, IET-116 & IET-117 are recommended for evaluation under AVT-I at all *rustica* centers.

Table 1 IVT *RUSTICA* TOBACCO: Yield data of IVT *rustica* entries at different centres (2023-24)

Entries	Cured leaf yield at different centres (kg/ha)			
	Anand	Araul	Dinhata	Ladol
IET-116	3179*	4125*	2590.96*	4804
IET-117	1547	3990*	1656.59	4929
GC 1 (C)	2328	-	-	-
GCT 2 (C)	2288	-	-	-
GCT 3 (C)	2179	-	-	4303
DCT 4 (C)	-	-	-	4471
GCT 5 (C)	-	-	-	4692
Azad Kanchan (C)	-	3335	-	-
SK-417 (C)	-	3210	-	-
DD 437 (C)	-	-	1779.84	-
Dharla (C)	-	-	1875.31	-
Grand Mean	-	3665	1975.67	4640
S.Em ±	181.2	149.65	142.52	123.00
C.D. at 5%	543.3	481.22	215.23	369.00
C.V. (%)	17.59	10.13	4.58	5.93

Table 2 IVT *RUSTICA* TOBACCO: Morphological characters of IVT entries of *rustica* tobacco at different centres (2023-24)

Entries	No. of leaves/ plant				Plant height (cm)				Leaf length (cm)				Leaf Breadth (cm)			
	A	Ar	D	L	A	Ar	D	L	A	Ar	D	L	A	Ar	D	L
IET-116	15	19	11.44	12	55.8	63.75	58.00	59.7	35.2	29.70	25.21	39.4	35.2	29.70	26.89	38.0
IET-117	12	16	8.22	12	49.9	60.10	57.00	54.3	35.3	28.35	26.66	43.5	35.3	28.35	27.93	43.2
GC 1 (C)	14				43.7				43.2				43.2			
GCT 2 (C)	14				52.6				34.9				34.9			
GCT 3 (C)	14			12	51.6			65.1	34.2			36.5	34.2			33.9
DCT 4 (C)				13				58.1				37.9				34.4
GCT 5 (C)				12				46.2				40.2				41.2
Azad Kanchan (C)		15				57.30				26.20				26.20		
SK-417 (C)		12				54.10				25.30				25.30		
DD 437 (C)			8.44				56.67				23.55				26.06	
Dharla (C)			7.44				53.33				24.29				23.24	
GM			8.89								1.02					
S.Em ±	0.57	0.66	1.21	0.36	2.42	1.44	1.25	1.58	1.33	1.75	NS	0.76	1.33	1.75	1.47	0.59
C.D. at 5%	NS	1.44	0.75	1.07	7.27	4.07	2.41	4.73	3.99	4.96	3.58	2.29	3.99	4.96	2.14	1.78
C.V. (%)	9.27	5.21	6.45	6.59	10.7	4.15	5.68	6.22	8.13	10.22		4.33	8.13	10.22	4.63	3.49

A: Anand Ar: Araul D: Dinhata L: Ladol

Table 3 IVT *RUSTICA* TOBACCO: Data on morphological characters in IVT *rustica* entries at different centres (2023-24)

Entries	Leaf thickness		Days to flower		Days to maturity		Inter-nodal length		Plant stand		
	Anand	Araul	Anand	Araul	Anand	Araul	Araul	Dinhata	Anand	Araul	Ladol
IET-116	8.33	14.88	52	58	128	122	5.97	3.63	39.4	54	40
IET-117	7.56	13.10	53	55	125	120	5.85	4.11	39.0	50	39
GC 1 (C)	16.42	-	47	-	117	-	-	-	39.0	-	-
GCT 2 (C)	15.85	-	61	-	132	-	-	-	38.8	-	-
GCT 3 (C)	10.61	-	52	-	127	-	-	-	38.6	-	39
DCT 4 (C)	-	-	-	-	-	-	-	-	-	-	39
GCT 5 (C)	-	-	-	-	-	-	-	-	-	-	40
Azad Kanchan (C)	-	12.80	-	52	-	118	5.90	-	-	50	-
SK-417 (C)	-	11.65	-	50	-	116	6.16	-	-	48	-
DD 437 (C)	-	-	-	-	-		-	4.44	-	-	-
Dharla (C)	-	-	-	-	-		-	5.11	-	-	-
S.Em ±	-	-	2.17	1.23	0.74	0.88	0.65	0.45	0.44	0.52	0.42
C.D. at 5%	-	-	6.51	3.45	2.21	2.16	NS	NS	NS	NS	NS
C.V. (%)	-	-	9.13	4.12	1.31	1.13	0.66	1.52	2.59	2.21	2.40

Table 4 IVT *RUSTICA* TOBACCO: Incidence of disease and first grade leaf yields and quality leaf outturn at Dinhata Centre (2023-24)

Treatments	TMV(%)	First grade leaf (kg/ha)	Quality leaf(%)
IET-116	0.5	1666.67	64.33
IET-117	0.1	929.02	56.1
DD-437 (C)	0.9	1097.12	61.64
Dharla (C)	0.8	953.09	50.8
S.Em ±	-	87.52	-
C.D. at 5%	-	185.52	-
C.V. (%)	-	7.52	-

Table 5 IVT *RUSTICA* TOBACCO: Disease incidence and quality parameters in IVT *rustica* entries at Anand Centre (2023-24)

Entries	TMV (%)	Leaf curl (%)				Nicotine (%)	R. Sugars (%)	Chlorides (%)
		LCA	LCB	LCC	LCD			
IET-116	53	-	-	Yes	-	4.35	3.64	1.065
IET-117	47	Yes	-	-	-	4.55	4.56	1.101
GC -1 (C)	30	-	-	-	Yes	4.65	4.05	0.852
GCT -2 (C)	47	-	Yes	-	-	4.25	3.85	0.887
GCT- 3 (C)	42	-	Yes	-	-	5.97	4.85	0.710

Where, **LCA**= Low, **LCB**= 10%, **LCC**= 10-20%, **LCD**= 20-30%

Table 6 IVT *RUSTICA* TOBACCO: Disease incidence in IVT *rustica* entries at Araul Centre (2023-24)

Entries	TMV(%)	Leaf curl (%)	
		LCA	LCC
IET-116	26.70	Yes	Yes
IET-117	29.10	-	-
Azad Kanchan (C)	26.85	Yes	-
SK-417 (C)	27.30	-	-

Where, **LCA**= Low, **LCC**= 10-20%,

Table 7 IVT *RUSTICA* TOBACCO: Data on chemical and disease incidence in IVT *rustica* entries at Ladol Centre (2023-24)

Entries	Chemical parameters (%)			Disease (%)	
	Nicotine	Reducing Sugars	Chlorides	LCV	LMV
IET-116	5.82	1.74	2.07	1.01	0.51
IET-117	4.65	3.56	2.14	0.51	0.00
GCT-3 (C)	6.81	2.95	2.00	0.00	0.51
DCT-4 (C)	7.58	2.63	2.28	1.03	0.00
GCT-5 (C)	6.06	2.34	2.97	0.00	0.00

COORDINATED EVALUATION OF RUSTICA TOBACCO GENOTYPES

RUABRC/ RUArBRC / RUDBRC/RULdBRC 1.1: ADVANCED VARIETAL TRIAL ON *RUSTICA* TOBACCO (AVT-I)

Objectives: To evaluate the *Rustica* tobacco entries for yield and quality at four centres *viz.*, Anand, Araul, Dinhata and Ladol along with respective checks under AVT-I.

Year of start : 2023-24

Year of Completion : 2023-24

Rustica tobacco Centres and Investigators

Centres	:	Investigators
Anand	:	J. N. Patel & D.R. Delvadiya
Araul	:	A.K. Srivasatava K.C. Arya & N.B. Singh
Dinhata	:	Partha Saha, Namita Das Saha & S.K. Dam
Ladol	:	D.R. Chaudhari

Design : RBD
Total treatments : 03 + checks as given above
Replications : Five

Entries: 03 (Three)

1. AR-182
2. AR-184
3. ArR-105

Checks at different Centres

Anand	1. GC 1	2. GCT 2	3. GCT 3
Araul	1. Azad Kanchan	2. SK 417	
Dinhata	1. DD 437	2. Dharla	
Ladol	1. GCT 3	2. DCT 4	3. GCT 5

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Anand	2.40 m x 6.00 m	60 cm x 60 cm
Araul	2.7x4.5 m	45x45 cm
Dinhata	3.6 x 2.7 m	60 x 45 cm
Ladol	2.40 m x 4.50 m	60 cm x 45 cm

RESULTS

In the Advanced varietal trial (AVT), three entries were evaluated for their yield potential against respective checks at different centres. Observations recorded leaf yield, natural/ artificial incidence of pest and diseases. Cured leaf quality parameters (Nicotine, Reducing sugars and chlorine) were estimated. Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha. Yield data and morphological characters at different centres are presented in Table 1 to 6 AVT-I*Rustica* tobacco. The results are presented centre-wise.

ANAND

The results revealed significant yield differences among the genotypes tested. None of the genotype showed significant higher yield than best check GCT 3.None of the entries was free from tobacco mosaic and leaf curl disease.

ARAUL

Significant difference were observed among test entries for cured leaf yield. Entry ArR-105 (4250 kg/ha) found significantly superior over check Azad Kanchan (3465 kg/ha) for cured leaf yield with yield improvement of 18%.

Salient Findings/Achievements

- Line ArR-105 showed significant superiority over check Azad Kanchan for cured leaf yield with yield improvement of 18% respectively.

DINHATA

Salient Findings/Achievements

- Test entry AR-184was found best in respect of cured leaf yield
- The first grade leaf was highest in Check Dharla with highest quality outturn
- The highest Nicotine was found in check Dharla (8%)

LADOL

In AVT-I trial, yield difference was found significant among all the entries tested. None of the entry showed significant superiority for cured leaf yield over best check GCT 5 (4648 kg/ha).

Salient findings/Achievements

- None of the entry showed significant superiority for cured leaf yield over best check GCT 5 (4648 kg/ha).

Recommendation: The trail to be repeated as AVT-II during 2024-25

Table 1 AVT-I *RUSTICA* TOBACCO: Yield data of AVT-I *rustica* entries at different centres (2023-24)

Entries	Cured leaf yield at different centres (kg/ha)			
	Anand	Araul	Dinhata	Ladol
AR-182	2505	3390	2051.65	4430
AR-184	2802	3795	2169.55	4112
ArR-105	2213	4250 (18)	1536.42	4596
GC 1 (C)	2406			
GCT 2 (C)	2397			
GCT 3 (C)	3078			4332
DCT 4 (C)				4528
GCT 5 (C)				4648
Azad Kanchan (C)		3465		
SK-417 (C)		3220		
DD 437 (C)			1970.99	
Dharla (C)			1694.03	
Grand Mean			1884.52	4441
S.Em ±	181.9	155.15	155.58	150
C.D. at 5%	536.7	562.35	125.84	442
C.V. (%)	15.8	11.27	11.78	6.04

Figuresin parenthesis is percent increase over best control

Table 2 AVT-I *RUSTICA* TOBACCO: Morphological characters of AVT-I entries of *rustica* tobacco at different centres (2023-24)

Entries	Plant height (cm)				No. of leaves/ plant				Leaf length (cm)				Leaf Breadth (cm)			
	A	Ar	D	L	A	Ar	D	L	A	Ar	D	L	A	Ar	D	L
AR-182	63.5	58.15	55.22	59.3	16	17	11.44	12	43.1	39.20	28.17	35.6	32.2	27.70	28.34	32.6
AR-184	54.8	59.90	53.44	53.5	15	19	8.22	11	45.7	40.10	23.94	37.0	32.9	29.15	26.88	35.0
ArR-105	46.4	60.95	58.00	47.5	14	19	7.89	11	45.1	41.15	27.98	37.4	35.0	29.75	29.43	39.9
GC 1 (C)	47.9	-	-	-	14	-	-	-	44.4	-	-		34.8	-	-	
GCT 2 (C)	54.4	-	-	-	14	-	-	-	45.5	-	-		36.2	-	-	
GCT 3 (C)	50.2	-	-	66.3	15	-	-	12	48.2	-	-	35.6	34.9	-	-	33.5
DCT 4 (C)	-	-	-	60.4	-	-	-	13	-	-	-	38.2	-	-	-	34.1
GCT 5 (C)	-	-	-	45.2	-	-	-	12	-	-	-	39.4	-	-	-	39.3
Azad Kanchan (C)	-	56.48	-	-	-	16	-	-	-	38.10	-	-	-	25.20	-	-
SK-417 (C)	-	53.90	-	-	-	14	-	-	-	35.85	-	-	-	22.15	-	-
DD 437 (C)	-	-	61.11	-	-		8.44	-	-	-	26.91	-	-	-	26.16	-
Dharla (C)	-	-	67.22	-	-		7.44	-	-	-	26.27	-	-	-	26.16	-
GM	-	-		-	-	0.78	8.68	-	-	-		-	-	-	-	-
S.Em ±	1.32	1.62	4.52	1.39	0.52	2.10	2.45	0.33	1.25	-	2.42	0.76	1.07	-	1.69	0.75
C.D. at 5%	3.90	4.37	8.42	4.11	NS	6.20	1.75	0.96	NS	-	3.12	2.24	NS	-	1.31	2.21
C.V. (%)	5.6	4.19	8.25	5.64	7.94		7.85	6.17	6.18	-	9.4	4.57	7.0	-	6.45	4.69

A: Anand Ar: Araul D: Dinhata L: Ladol

Table 3 AVT-I *RUSTICA* TOBACCO: Data on morphological characters in AVT-I*rustica* entries at different centres (2023-24)

Entries	Leaf thickness		Inter-nodal length	Plant stand	Days to flower	Days to maturity
	Anand	Araul	Dinhata	Ladol	Anand	Anand
AR-182	7.45	11.78	3.63	48	64	121
AR-184	10.18	11.95	4.11	49	55	125
ArR-105	11.29	12.87	4.39	48	46	115
GC 1 (C)	14.05	-	-	-	48	119
GCT 2 (C)	12.20	-	-	-	54	131
GCT 3 (C)	13.07	-	-	48	50	127
DCT 4 (C)	-	-	-	49	1.32	-
GCT 5 (C)	-	-	-	48	3.90	-
Azad Kanchan (C)	-	11.00	-	-	5.59	-
SK-417 (C)	-	10.93	-	-	-	-
S.Em ±	-	-	-	0.58	-	0.34
C.D. at 5%	-	-	-	NS	-	1.00
C.V. (%)	-	-	-	2.69	-	0.62

Table 4AVT-I*RUSTICA* TOBACCO: Disease incidence and quality parameters in AVT-I*rustica* entries at Anand Centre (2023-24)

Entries	TMV (%)	Leaf curl (%)		Nicotine (%)	R. Sugars (%)	Chlorides (%)
		LCC	LCD			
AR-182	49.0	Yes	-	4.96	3.64	1.136
AR-184	55.0	Yes	-	4.85	3.68	1.171
ArR-105	37.0	Yes	-	4.55	4.05	1.065
GC -1 (C)	24.0	-	Yes	5.57	4.85	1.101
GCT -2 (C)	39.0	-	Yes	4.05	3.85	1.181
GCT- 3 (C)	27.0	Yes	-	4.25	4.05	0.816

Where, LCC = 10-20%, LCD = 20-30%

Table 5AVT-I*RUSTICA* TOBACCO: First grade leaf yields and quality leaf outturn and Chemical quality parameters at Dinhata Centre (2023-24)

Treatments	First grade leaf (kg/ha)	Quality leaf (%)	Nicotine (%)	R. Sugars (%)	Chlorides (%)
AR-182	882.71	43.02	6.45	0.65	3.28
AR-184	866.87	39.96	7.12	0.49	3.65
ArR-105	808.02	52.60	3.28	0.90	4.12
DD-437 (C)	827.78	41.99	6.96	0.49	3.42
Dharla (C)	891.36	52.62	7.94	1.10	2.38
S.Em ±	21.36	-	-	-	-
C.D. at 5%	30.45	-	-	-	-
C.V. (%)	12.52	-	-	-	-

Table 6 AVT-I*RUSTICA* TOBACCO: Data on chemical and disease incidence in AVT-I *rustica* entries at Ladol Centre (2023-24)

Entries	Chemical parameters (%)			Disease (%)	
	Nicotine	Reducing Sugars	Chlorides	LCV	LMV
AR-182	5.25	2.20	1.71	1.26	0.42
AR-184	6.73	2.28	2.01	0.41	0.00
ArR-105	6.21	3.14	2.18	0.42	0.42
GCT-3 (C)	7.14	2.24	2.67	0.84	0.42
DCT-4 (C)	5.92	2.51	1.69	0.81	0.41
GCT-5 (C)	5.34	1.82	2.23	0.42	0.42

ANAND

Project No.: RUABRC 1.2

Research project title	**Advance Varietal Trial-II on *rustica* tobacco**
Objectives	▪ To evaluate the performance of promising *Rustica* tobacco entries under Gujarat conditions in AVT-II
Investigators	J.N. Patel & D. R. Delvadiya
Year of start	2023-24
Year of completion	2023-24
Location	BTRS, AAU, Anand

Treatments : 7 (4+3) Spacing : 60 x 60 cm
Replications : Four Plot size : 2.4 x 6.0 m
Design : R B D

RESULTS

Among the four entries tested (LR-96, LR-97, ArR-96 and ArR-98)along with checks(GC 1, GCT 2, GCT 3), the results revealed non-significant yield differences among the genotypes tested. None of the genotypes showed significantly superior for cured leaf yield over better check. None of the entries was free from tobacco mosaic and leaf curl disease.

Conclusion: None of the entry is promoted for pre-release evaluation.

Table 1 RUABRC 1. 2: Yield and morphological characters during 2023-24

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height	Leaf			Days to flower	Days to maturity
				length	width	Thickness		
			----- cm -----					
LR-96	1749	14	37.5	42.6	31.3	7.86	54	130
LR-97	2005	14	41.4	41.6	29.2	12.99	52	130
ArR-96	2309	15	48.7	42.7	30.6	13.69	49	117
ArR-98	2335	15	57.2	44.1	32.3	9.81	55	124
GC 1(C)	2462	14	42.0	44.2	36.1	15.62	47	116
GCT 2 (C)	2231	15	60.6	43.9	32.0	10.42	57	131
GCT 3 (C)	2348	13	54.2	44.1	31.1	12.32	48	126
S.Em ±	163.0	0.68	2.03	1.25	1.38	-	1.74	0.62
C.D. at 5%	NS	NS	6.04	NS	NS	-	5.18	1.85
C.V. (%)	14.8	9.49	8.34	5.78	8.72	-	6.76	1.0

Table 2 RUABRC 1.2: Disease incidence and chemical quality parameters during 2023-24

Entries	TMV (%)	Leaf curl (%)			Nicotine(%)	Reducing Sugars(%)	Chlorides(%)
		LCC	LCD	LCX			
LR-96	38.75	-	Yes	-	4.16	4.15	0.887
LR-97	26.25	Yes	-	-	5.66	4.85	1.001
ArR-96	43.75	-	-	Yes	5.05	4.15	1.029
ArR-98	48.75	-	Yes	-	4.04	3.68	0.994
GC 1(C)	23.75	-	Yes	-	4.15	4.05	0.958
GCT 2 (C)	53.75	Yes	-	-	4.55	4.25	0.994
GCT 3 (C)	37.50	-	Yes	-	3.85	3.90	1.171

Where, LCC = 10-20%, LCD = 20-30%, LCX = highly affected/Severe

Table 3 RUABRC 1.2: Pooled analysis of *bidi* tobacco genotypes performance in AVT (2022-23 & 2023-24)

Treatment	Year		POOLED mean	% Increase over Checks		
	2022-23	2023-24		GCT 3	GCT 2	GC 1
LR 96	1964	1749	1856	-	-	-
LR 97	2981	2005	2493	-	-	-
Ar R 96	3210	2309	2760	4.5	8.2	11.9
Ar R 98	2470	2335	2403	-	-	-
GC 1 (c)	2472	2462	2467	-	-	-
GCT 2 (c)	2870	2231	2550	-	-	-
GCT 3 (c)	2934	2348	2641	-	-	-
S.Em.±	184.8	163.0	190.15	-	-	-
C.D. at 5 %	549.1	NS	NS	-	-	-
C.V. %	13.7	14.8	14.21	-	-	-
Y	-	-	-	-	-	-
S.Em.±	-	-	101.6	-	-	-
C.D. at 5 %	-	-	351.7	-	-	-
YXT	-	-	-	-	-	-
S.Em.±	-	-	174.2	-	-	-
C.D. at 5 %	-	-	500.1	-	-	-

Project No.: ON FARM TRIAL (OFT)

Research project title	On farm trial
Objectives	▪ To evaluate the performance of promising *Rustica* tobacco entries under Gujarat conditions under OFT
Investigators	J.N. Patel & D. R. Delvadiya
Year of start	2023-24
Year of completion	2023-24
Location	BTRS, AAU, Anand

Treatments : 3 (1+2) Spacing : 60 x 60 cm
Design : R B D Plot size : 6 x 18 m

RESULTS

ArR 83 genotype tested under OFT did not showed superiority for cured leaf yield over better check GCT 3.

Table 1 OFT: Yield and morphological characters during 2023-24

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Days ToFlower	Days ToMaturity
ArR 83	2029	15.8	46.8	45.7	38.2	52.2	131
GC 1(C)	1783	17.8	40.8	43.1	36.9	44.2	120
GCT 3 (C)	2226	16.0	51.2	46.8	33.0	57.4	128

Table 2 OFT: Chemical quality parameters during 2023-24

Entries	Nicotine(%)	Reducing Sugar(%)	Chlorides(%)
ArR 83	5.57	4.85	1.065
GC 1(c)	4.65	4.53	1.181
GCT 3 (c)	5.05	4.85	1.029

Speed Breeding in *Rustica* tobacco 2021 to 2024

New cross made2021	F_1	F_2	F_3	F_4	F_5
GC 1 X GCT 5	winter	summer	winter	summer	winter
LR 94 X GCT 5	2022	2023	2023	2024	2024
	No selection	No selection	30 IPS	30 IPS Grow in Nursery	
	2 progeny	2 progeny	16 lines	Date: 14/2/24	

Table: F_3generation advancement in Speed Breeding in Field 2024

S. No.	Cross Progeny pedigree	No. of plant Selection from F_3 generation
1	F_3 (LR 94X GCT 5)-5	1
2	F_3 (LR 94X GCT 5)-43	2
3	F_3 (LR 94X GCT 5)-70	5
	Cross 1	**8**
4	F_3 (GC 1X GCT 5)-1	3
5	F_3 (GC 1X GCT 5)-29	4
6	F_3 (GC 1X GCT 5)-38	1
7	F_3 (GC 1X GCT 5)-42	2
8	F_3 (GC 1X GCT 5)-44	1
9	F_3 (GC 1X GCT 5)-51	1
10	F_3 (GC 1X GCT 5)-68	1
11	F_3 (GC 1X GCT 5)-80	1
12	F_3 (GC 1X GCT 5)-91	1
13	F_3 (GC 1X GCT 5)-92	3
14	F_3 (GC 1X GCT 5)-96	3
15	F_3 (GC 1X GCT 5)-98	1
16	F_3 (GC 1X GCT 5)-81	-
	Cross 2	**22**
	Total lines sown in field on 14/02/24 in Nursery F_4	30

NB: From summer **F_4** nursery 2024, F_4 generation advancement will be raised in summer season 2024

ARAUL

Project No.: RUArBRC 1.2

Research project title	**Advanced Varietal Trial-II on *rustica* tobacco**
Objectives	▪ To identify promising entries superior to the check in respect of yield and leaf quality suitable for the state for possible release of variety under AVT-II
Investigators	K.C. Arya &N.B. Singh
Year of start	2023-24
Year of completion	2023-24
Location	Tobacco Research Station, Araul

Treatments	:	4 (2+2)	Spacing	:	45 x 45 cm
Replications	:	Five	Plot size	:	2.7 x 4.5 m
Design	:	R B D			

RESULTS

Two entries *viz*. ArR-96 and LR-98 with two Checks Azad Kanchan & SK-417 were evaluated in randomized block design with six replications in AVT-II.On the basis of combined statistical analysis over two season (*Rabi* 2022-23, 2023-24), none of the entries tested found neither significantly nor numerically superior over the checks, Azad Kanchan and SK-417.

Salient findings/Achievements

- None of the entries tested found neither significantly nor numerically superior over the check. Azad Kanchan and SK-417.

Table 1 RUArBRC 1.2: Pooled data on cured leaf yield and percent increase over checks in AVT II during *rabi* 2023-24

Treatment	Cured leaf yield (kg/ha)		
	2021-22	2022-23	Mean
ArR-96	3145	2865	3005
LR-98	2990	3010	3000
Azad Kanchan (C)	2993	3450	3222
SK-417 (LC)	2660	3165	2913
Mean	2947	3123	3035
S. Em. ±	138.05	128.60	140.10
C.D. at 5%	310.24	408.11	416.22
C.V. (%)	8.97	10.06	10.26
Season			
S. Em. ±			133.42
C.D. at 5%			NS
Season x Treatments			
S. Em. ±			132.43
C.D. at 5%			NS

** Significant at 5%*

Project No.: RUArBR 5

Research project title	**Preliminary Yield Evaluation Trial-I on *rustica* tobacco**
Objectives	▪ To identify the high yielding advanced breeding line with good quality leaf for their inclusion in co-ordinated trial under PYET -I
Investigators	K.C. Arya &N.B. Singh
Year of start	2023-24
Year of completion	2023-24
Location	Tobacco Research Station, Araul

Treatments	:	10 (8+2)	Spacing	:	45 x 45 cm
Replications	:	Three	Plot size	:	2.7 x 4.5 m
Design	:	R B D			

RESULTS

Ten entries were evaluated including two checks *viz*. Azad Kanchan and SK-417 in randomized block design with three replications. The result revealed that entry, ArR-129 (4210 kg/ha) followed by entry ArR-131 (3820 kg/ha) found significantly superior over check Azad Kanchan (3350 kg/ha) for cured leaf yield.

Salient findings/achievements

- Entry ArR-129 followed by entry ArR-131 found significantly superior over check Azad Kanchan (3350 kg/ha) for cured leaf yield with yield improvement of 25.67% and 14.03% respectively.

Table 1 RUArBR 5: Performance of *Hookah* tobacco lines in PYET-I during *rabi* 2023-24

Treatment	Days to Maturity	Av. Curable leaves/ plant	Plant Height (cm)	Leaf (cm)		Yield (kg/ha)
				Length	Width	
ArR-127	119	10	61.10	30.10	24.22	2630
ArR-128	116	14	63.33	28.22	20.18	2210
ArR-129	118	15	61.28	36.35	24.18	4210
ArR-130	116	12	56.30	24.33	20.10	2775
ArR-131	118	13	60.98	32.22	24.65	3820
ArR-132	114	12	56.71	29.13	22.13	2335
ArR-133	114	10	60.22	24.50	20.10	2050
ArR-134	122	10	65.10	27.88	21.10	2995
Azad Kanchan (C)	117	14	56.38	27.10	22.22	3350
SK-417 (C)	119	13	56.15	29.15	24.35	2930
S. Em. ±						135.35
C.D. at 5%						410.42
C.V. (%)						10.95

Project No.: RUArBR 5A

Research project title	**Preliminary Yield Evaluation Trial-II on *rustica* tobacco**
Objectives	▪ To identify the high yielding advanced breeding line with good quality leaf for their inclusion in co-ordinated trial under PYET-II
Investigators	K.C. Arya &N.B. Singh
Year of start	2021-22
Year of completion	2023-24
Location	Tobacco Research Station, Araul

Treatments : 10 (8+2) Spacing : 45 x 45 cm
Replications : Three Plot size : 2.7 x 4.5 m
Design : R B D

RESULTS

Ten entries were evaluated with two check viz. Azad Kanchan and SK-417 were evaluated in randomized block designed with three replications. Combined statistical analysis of the data collected over three seasons (*rabi* 2021-22, 2022-23& 2023-24) was done for identifying most promising lines. Results indicated significant differences among the entries for cured leaf yield. On the pooled basis, entry ArR-116 (3828 kg/ha) showed significant superiority over check Azad Kanchan (3268 kg/ha) with yield improvement of 17.13%.

Salient research /achievements

- On the pooled basis, entry ArR-116 showed significant superiority over check Azad Kanchan with yield improvement of 17.13% and nominated for IVT conducted during *Rabi* 2024-25.

Table 1 RUArBR 5A: Pooled results of *rustica* tobacco in PYET II during *rabi* 2021-22 to 2023-24

Treatment	Cured leaf yield (kg/ha)				% increase over Azad Kanchan
	2021-22	2022-23	2023-24	Mean	
ArR-111	3815*	3770*	3435	3673	
ArR-112	3020	2810	2875	2902	
ArR-113	1644	2030	1585	1753	
ArR-114	2260	2475	2310	2348	
ArR-115	2225	2310	2550	2362	
ArR-116	3610*	3665*	4210*	3828*	17.13
ArR-117	2160	2020	2265	2148	
ArR-118	2625	2135	2210	2323	
Azad Kanchan (C)	3020	3310	3475	3268	
SK-417 (LC)	2995	3115	3225	3112	
Mean	2737	2764	2814	2772	
S. Em. ±	191.06	178.10	190.13	186.11	
C.D. at 5%	574.03	504.12	498.33	512.38	
C.V. (%)	14.81	12.62	13.79	12.68	
	SEASONS				
S. Em. ±			166.37	166.37	
C.D. at 5%			478.07	478.07	
	SEASONS × TREATMENTS				
C.D. at 5%			481.13	481.13	

** Significant at 5%*

Project No.: OFT

Research project title	On Farm Trail on *rustica* tobacco
Objectives	▪ To identify the high yielding advanced breeding line with good quality leaf for release under OFT
Investigators	K.C. Arya & N.B. Singh
Year of start	2021-22
Year of completion	2023-24
Location	Tobacco Research Station, Araul

Treatments : 5 (2+3)

RESULTS

Advanced breeding lines ArR-69 and ArR-91 of hookah tobacco was evaluated along with checks Azad Kanchan, SK-417 and ArR-27 for cured leaf yield and quality in OFT trial. The entry, ArR-69 (4290 kg/ha) recorded higher cured leaf yield when compared with best check ArR-27 (Nath) (3640 kg/ha) with yield improvement of 17.91%.

Table 1 OFT: Yield potential and Morphological traits of OFT (2023-24)

Entries	Yield (kg/ha)	No. of leaves/ Plant	Plant Height (cm)	Days to maturity (Days)	Leaf (cm)		% increase over ArR-27
					Length	Width	
ArR-91	3310	12	58.35	118	36.35	26.22	
ArR-69	4290	16	64.30	124	43.15	33.23	17.91
Azad Kanchan (C)	3330	13	56.48	117	30.35	24.45	
SK-417 (C)	2710	13	53.40	116	26.30	24.48	
ArR-27 (C)	3640	15	61.33	121	35.68	30.42	

LADOL

Project No.: RULdBRC 1.1

Research project title	Advanced Varietal Trial-I on *rustica* tobacco
Objectives	▪ To evaluation and identify of high yielding advanced breeding lines superior to the local check varieties with respect to yield, quality and disease reactions under AVT-I ▪ To carry out detailed studies with the promising entries for possible release of variety.
Investigators	D. R. Chaudhari
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Ladol

Treatments : 4 (2+2) Spacing : 60 x 45 cm
Replications : Five Plot size : 2.4 x 4.5 m
Design : RBD

Conclusion: Trail will be conducted as AVT-II during 2024-25.

Project No.: RULdBRS 1

Research project title	Initial Evaluation Trial on *rustica* tobacco
Objectives	▪ To identify the high yielding advanced breeding line with good quality leaf for their inclusion in co-ordinated trial under IET
Investigators	D. R. Chaudhari
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Ladol

Treatments : 12 (9+3) Spacing : 60 x 45 cm
Replications : Three Plot size : 2.4 x 4.5 m
Design : R B D

RESULTS

In IET (ST-1) trial, twelve entries were evaluated in which entry LR 22-2 and LR 22-5 were found significantly superior and gave 12.98 and 11.11 per cent higher cured leaf yield than best check GCT 5 (4616 kg/ha).

Salient findings/Achievements

- Entries LR 22-2 and LR 22-5 were found significantly superior and gave 12.98 and 11.11 per cent higher cured leaf yield than best check GCT 5 (4616 kg/ha).

Table 1 RULdBRS 1: Data on yield (kg/ha), morphological characters & Disease incidence (2023-24)

Entries	Yield kg/ha	Plant Stand	Plant height (cm)	Leaf		No. of leaves/ plant	Disease	
				Length (cm)	Width (cm)		LCV (%)	LMV (%)
LR 21-7	4496	38	60.7	40.5	39.5	11	0.00	0.00
LR 21-8	4400	39	62.2	41.6	40.6	11	0.00	0.00
LR 22-1	4700	40	52.4	38.4	38.2	12	0.83	0.83
LR 22-7	4731	40	58.4	39.0	38.8	11	0.84	0.84
LR 22-2	5215 (12.98)	40	59.8	39.4	37.5	12	0.00	0.84
LR 22.5	5129 (11.11)	40	55.2	38.6	37.9	13	0.00	0.84
LR 22-4	4358	39	54.9	37.6	39.1	10	0.00	1.72
LR 22-8	4349	39	60.7	39.9	38.5	10	0.00	0.00
LR 22-9	4375	38	56.7	38.7	41.8	10	0.00	0.88
GCT-3 (C)		38	63.9	36.3	34.8	12	0.87	0.87
DCT-4 (C)		39	57.4	38.1	35.7	12	0.85	0.00
GCT-5 (C)		39	47.9	42.2	42.0	12	0.00	0.00
GM								
S. Em. ±		0.47	2.19	0.96	0.74	0.43		
C.D. at 5%		NS	6.41	2.80	2.16	1.27		
C.V. (%)		2.09	6.59	4.22	3.29	6.65		

Figures in parenthesis are percent increase over better control ** Significant at 5%*

Table 2 RULdBRS 1: Data on quality parameters in 2023-24

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
LR 21-7	4.84	2.47	1.50
LR 21-8	7.54	2.32	1.87
LR 22-1	8.05	2.19	2.24
LR 22-7	6.42	3.17	1.81
LR 22-2	9.88	2.43	2.58
LR 22.5	4.89	2.52	1.55
LR 22-4	7.61	289	2.31
LR 22-8	8.79	2.04	2.44
LR 22-9	8.20	2.56	2.25
GCT-3 (C)	6.47	2.28	2.17
DCT-4 (C)	6.46	1.66	2.14
GCT-5 (C)	6.38	1.94	1.88

Project No.: RULdBRS 2

Research project title	**Preliminary Yield Trial-I on *rustica* tobacco**
Objectives	▪ To identify the high yielding advanced breeding line with good quality leaf for their inclusion in co-ordinated trial under PYT-I
Investigators	D. R. Chaudhari
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Ladol

Treatments	:	13 (10+3)	Spacing	:	60 x 45 cm
Replications	:	Three	Plot size	:	2.4 x 4.5 m
Design	:	R B D			

RESULTS

In PYT (ST-2) trial, Out of thirteen entries, two entries were found significantly superior and gave better performance than best check GCT 5. Entry LR 23-10 and LR 23-7 were gave 13.69 and 12.52 per cent respectively higher cured leaf yield than best check GCT 5 (4529 kg/ha).

Salient findings/Achievements

- Entries LR 23-10 and LR 23-7 were gave 13.69 and 12.52 per cent respectively higher cured leaf yield than best check GCT 5 (4529 kg/ha).

Table 1 RULdBRS 2: Data on yield (kg/ha), morphological characters & Disease incidence (2023-24)

Entries	Yield kg/ha	Plant Stand	Plant height (cm)	Leaf		No. of leaves/ plant	Disease	
				Length (cm)	Width (cm)		LCV (%)	LMV (%)
LR 23-1	4477	39	52.8	40.7	40.6	11	0.00	0.00
LR 23-2	4375	38	53.2	38.6	42.0	10	0.00	1.77
LR 23-3	4884	40	49.7	40.7	35.4	11	0.83	0.00
LR 23-4	4812	39	63.8	38.9	41.2	12	1.72	0.86
LR 23-5	4956	39	68.7	39.3	39.3	12	0.85	0.85
LR 23-6	4220	39	54.2	37.7	42.4	9	0.00	0.00
LR 23-7	5096 (12.52)	39	69.2	41.7	38.2	14	0.00	0.00
LR 23-8	4735	38	53.7	35.6	40.0	12	0.00	0.87
LR 23-9	4989	39	49.7	39.0	44.4	10	0.00	0.00
LR 23-10	5149 (13.69)	39	54.4	43.0	44.6	12	0.00	0.00
GCT-3 (C)	4220	38	65.7	36.4	34.6	12	1.75	0.00
DCT-4 (C)	4392	39	61.7	37.2	35.3	13	0.85	0.85
GCT-5 (C)	4529	38	47.6	40.2	40.1	12	0.00	0.87
GM	4679							
S. Em. ±	181	0.60	2.09	1.10	1.13	0.45		
C.D. at 5%	529	NS	6.10	3.21	3.28	1.31		
C.V. (%)	6.70	2.68	6.32	4.87	4.89	6.74		

Figures in parenthesis are percent increase over better control ** Significant at 5%*

Table 2 RULdBRS 2: Data on quality parameters in 2023-24

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
LR 23-1	6.82	2.36	1.78
LR 23-2	6.87	2.27	1.27
LR 23-3	6.78	1.82	1.85
LR 23-4	6.88	1.51	1.57
LR 23-5	6.37	2.09	1.75
LR 23-6	7.06	1.89	1.74
LR 23-7	7.15	1.69	1.64
LR 23-8	6.31	3.00	1.11
LR 23-9	6.56	2.25	1.50
LR 23-10	5.94	2.00	1.50
GCT-3 (C)	6.59	1.72	2.26
DCT-4 (C)	6.95	1.87	1.84
GCT-5 (C)	6.01	1.53	1.23

Project No.: RULdBRS 3

Research project title	**Large Scale Evaluation Trial on *rustica* tobacco**
Objectives	▪ To evaluation and identify of high yielding advanced breeding lines superior to the local check varieties with respect to yield, quality and disease reactions. ▪ To carry out detailed studies with the promising entries for possible release of variety.
Investigators	D. R. Chaudhari
Year of start	2023-24
Year of completion	2023-24
Location	ARS, Ladol

Treatments	:	6 (3+3)	Spacing	:	60 x 45 cm
Replications	:	Three	Plot size	:	2.4 x 4.5 m
Design	:	R B D			

RESULTS

In LSVT trial, six entries were included in which significant differences among all the entries were noticed for cured leaf yield. None of the entry showed significant superiority for cured leaf yield over best check GCT 5 (4524 kg/ha). However, entry LR 101 showed numerical maximum cured leaf yield (4726 kg/ha) against best check GCT 5.

Salient findings/Achievements:

- None of the entry showed significant superiority for cured leaf yield over best check GCT 5 (4524 kg/ha). Entry LR 101 showed numerical maximum cured leaf yield (4726 kg/ha) against best check GCT 5.

Table 1 RULdBRS 2: Data on yield (kg/ha), morphological characters & Disease incidence (2023-24)

Entries	Yield kg/ha	Plant Stand	Plant height (cm)	Leaf		No. of leaves/ plant	Disease	
				Length (cm)	Width (cm)		LCV (%)	LMV (%)
LR 98	4360	39	55.1	39.7	37.4	11	0.64	0.00
LR 100	4007	37	54.0	37.3	37.2	10	2.03	1.35
LR 101	4726	39	53.7	39.8	39.6	12	0.65	0.00
GCT-3 (C)	4122	37	60.4	34.4	32.8	12	1.34	0.00
DCT-4 (C)	4333	38	54.2	36.5	33.1	12	1.31	0.00
GCT-5 (C)	4524	38	44.5	40.8	39.7	12	1.32	0.66
GM	4345							
S. Em. ±	133	0.55	1.79	0.69	0.81	0.38		
C.D. at 5%	401	NS	5.39	2.07	2.45	1.14		
C.V. (%)	6.12	2.89	6.66	3.60	4.44	6.62		

Table 2 RULdBRS 3: Data on quality parameters in 2023-24

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
LR 98	7.35	1.74	1.74
LR 100	7.57	3.26	2.04
LR 101	6.15	3.11	2.29
GCT-3 (C)	6.09	2.69	2.12
DCT-4 (C)	6.19	1.74	1.76
GCT-5 (C)	5.97	1.71	1.27

E. *CHEWING* TOBACCO

COORDINATED EVALUATION OF *CHEWING* TOBACCO GENOTYPES

IVT ON CHEWING TOBACCO

CHABRC/ CHDBRC/ CHVBRC 2: INITIAL VARIETAL TRIAL ON CHEWINGTOBACCO

Objectives: To evaluate the ChewingTobacco entries for yield and quality at three centres *viz.,* Anand, Dinhata and Vedasandur along with respective checks.

Year of start:2023-24
Year of Completion:2023-24

Chewing tobacco Centres and Investigators

Centres	:	Investigators
Anand	:	Vitiated (Due to Late sowing and unseasonal rainfall)
Dinhata	:	Partha Saha, Namita das Saha, S.K. Dam
Vedasandur	:	P. Manivel, M. Kumaresn, R. Rajendran K. Raja

Design : RBD
Total treatments : 2 + checks as given above
Replications : 5

Entries: 2 (Two)

1. IET-122
2. IET-123

Checks at different Centres:

Anand	:	1. GT 6	2. GT 8	3.A 145
Dinhata	:	1. Chama	2. Podali	3. Manasi
Vedasandur	:	1. Meenakshi (CR)	2. Bhagyalakshmi	3. Abirami

Plot size and spacing at the respective centres

Centre	Plot size	Spacing
Anand	18 m^2	75 cm x 60 cm
Dinhata	5.4 x 3.6 m	90 x 90 cm
Vedasandur	22.5 m2	75 x 75 cm

RESULTS

In the Initial varietal trial (IVT), two entries were evaluated for their yield potential against respective checks at different centres. Observations recorded leaf yield, natural/ artificial incidence of pest and diseases. Cured leaf quality parameters (Nicotine, Reducing sugars and chlorine) were estimated. Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha. Data on yield characteristics at different centres are presented in Tables 1 to 3 IVT Chewing Tobacco. The results are discussed centre-wise.

ANAND

Trial is vitiated (Due to Late sowing and unseasonal rainfall)

DINHATA

Yield: Significant variations were observed between the entries. The highest cured leaf yield (1508.91 kg//ha) was observed for the entry IET-122 followed by IET 123 (1457.47 kg/ha). The first grade leaf was found maximum in check Manasi (676.69 kg/ha).

Morphological characterization: Significant variations were observed for different morphological characters. The highest plant height (56.44 cm) was observed for the check Podali. The number of leaves per plant was maximum in Manasi (11.67) whereas the entry IET-122 had 9.78 and IET-123 had 9.33 number of leaves. The maximum leaf length and leaf width was observed for IET-122 (46.00 cm & 30.66 cm).

Disease /Pest incidence: The highest incidence of LCV was observed in check Manasi (4.9%) whereas highest incidence of TMV was observed in check Podali (7.0%). The entries IET 122 and IET 123 had TMV incidence of 3.5% and 2.1%, respectively.

Salient findings/Achievements

- The highest cured leaf yield (1508.91 kg//ha) was obtained in IET 122
- The first grade leaf was found maximum in check Manasi (676.69 kg/ha).
- The incidence of LCV and TMV was less in both IET 122 and IET-123

Conclusion: Lines tested IET-122 and IET-123 can be promoted for AVT-I to be conducted during 2024-25.

VEDASANDUR

Yield: The highest yields of 3408 kg/ha (IET-123) followed by 3350 kg/ha (IET-122) were recorded by test entries as compare to the check varieties Meenatchi (3202 kg/ha), Bhagyalakshmi (3267 kg/ha), Abirami (3195 kg/ha).

Morphological characterization: Maximum leaf length of 55.77 cm in check variety Meenakshi whereas the test entries IET 123 and IET 122 had 55.3 and 52.53 cm. respectively which was non-significant.

Disease /Pest incidence: For leaf curl both test entries and checks showed similar reactions (scores 2.0 to 2.1). For TMV test entries showed lower scones than the check varieties.

Salient findings/Achievements

- IET-122 and IET-123 had significantly higher total and first grade cured leaves than the check varieties.
- For morphological traits also test entries had comparable values to check varieties
- Diseases incidences were low as compared to checks

Conclusion: Based on the merits, IET-122 and IET-123 can be promoted to AVT-I.

Recommendation: IVT 2023-24 on chewing tobacco (IET-122 and IET-123) may be repeated for 2024-25

Table 1 IVT CHEWING TOBACCO: Cured Leaf yield (kg/ha) of IVT entries at different centres (2023-24)

Entries	Yield (kg/ha)	
	Dinhata	Vedasandur
IET-122	1509	3350
IET-123	1457	3408
Chama (C)	1012	
Podali (C)	1320	
Manasi (C)	1355	
Meenakshi (CR) (C)		3202
Bhagyalakshmi (C)		3267
Abirami (C)		3195
G. Mean	1331	3284
S. Em±	128	98
C.D. at 5%	210	290
C.V. (%)	5.47	7.28

*Significant at 5%

Table 2 IVT CHEWINGTOBACCO: Incidence of diseases in the entries of IVT at Dinhata &Vedasandur (2023-24)

Entries	Leaf curl		TMV	
	Dinhata	Vedasandur	Dinhata	Vedasandur
IET-122	3.5	2.0	2	1
IET-123	2.1	2.0	1	1
Chama (C)	2.1	-	6	-
Podali (C)	2.8	-	7	-
Manasi (C)	4.9	-	3	-
Meenakshi (CR) (C)	-	2.0	-	2
Bhagyalakshmi (C)	-	2.1	-	1.5
Abirami (C)	-	2.1	-	1.5

Table 3 IVT *CHEWING* TOBACCO: Morphological characters of IVT entries at different centres (2023-24)

Entries	Plant Height (cm)	Leaf length (cm)		Leaf Breadth (cm)		Inter-nodal Length (cm)		Plant Stand	Days to flower	Days to Maturity
	Dinhata	Dinhata	Vedasandur	Dinhata	Vedasandur	Dinhata	Vedasandur	Vedasandur	Vedasandur	Vedasandur
IET-122	54.33	46.00	52.53	30.96	38.33	4.22	7.95	37.83	59	120.33
IET-123	41.44	37.19	55.3	26.74	36.77	3.96	6.52	39.00	58.17	120.67
GT 6 (C)										
GT 8 (C)										
A 145 (C)										
Chama (C)	53.67	37.85		24.15		4.28				
Podali (C)	56.44	39.33		19.74		5.61				
Manasi (C)	54.56	39.48		26.33		4.83				
Meenakshi (CR) (C)			55.77		38.37		7.6	38.00	65	125.17
Bhagyalakshmi (C)			54.27		33.93		6.95	38.00	62.5	125.33
Abirami (C)			55.37		35.73		7.03	38.17	63	123.33
G. Mean	52.08	39.97	54.65	25.58	36.63	4.58	7.21		61.53	122.97
S. Em±	8.36	4.52	1.24	8.41	2.05	1.52	0.38		0.81	0.68
C.D. at 5%	3.12	7.45	5.61	12.14	13.49	0.69	14.20		5.52	2.30
C.V. (%)	6.78	6.87	3.66	6.45	6.03	4.52	1.13		2.40	2.0

♠♠♠♠♠♠

CROP PRODUCTION

CROP PRODUCTION

A. VFC TOBACCO

RAJAHMUNDRY

Project No.: VFRAGC/VFJAGC/ VFKAGC 1

Research Project Title:	**Effect of humic acid as bio-stimulants for healthy tobacco seedling production**
Objectives of the Project	• To study the effect of humic acid as biostimulants on healthy seedling production • To study the effect of humic acid on soil fertility
Investigators	S. Kasturi Krishna, T. Kiran Kumar, S.V. Krishna Reddy, M .Anuradha
Year of Start	2023-24
Year of Completion	2024-25
Location of the project:	CTRI, Rajahmundry, CTRIRS Jeelugumilli, CTRI RS Kandukur
Experimental details	Treatments: 6 Replications: 03 Design: RBD Varieties: Kanchan, Siri, CTRI Sreshta Observations: No. of seedlings, dry wt. of seedlings, Root volume, Root dry weight, Transplantable seedlings

Treatment details

T1:	Control (RDF)
T2:	Soil application of HS @ 1.25 kg/ha
T3:	Soil application of HS @ 1.25 kg/ha + Foliar spray of HS @ 0.05% at 30 DAS
T4:	Soil application of HS @ 1.25 kg/ha + Foliar spray of HS @ 0.05% at 45 DAS
T5:	Soil application of HS @ 1.25 kg/ha + Foliar spray of HS @ 0.05% at 10 days after resetting in poly trays

RESULTS

As the organic matter is reducing due to the present cultivation practices, external application of organic sources is the need of the hour. Hence humic substances were initiated in nursery. Experiments were conducted to study the effect of humic acid as bio-stimulants for healthy seedling production at ICAR-CTRI Rajahmundry, CTRI RS Kandukur CTRI RS Jeelugumilli includes soil and foliar application of humic acid at different nursery growing stages along with control in RBD replicated 4 times. Humic acid was applied to the soil in respective treatments and seed was sown @ 0.5 g per square meter. All the operations were carried as per package of practices. Foliar application was done as scheduled in different treatments and observations were recorded. Method and rate of application of humic substances to FCV tobacco seedlings showed non-significant effect on root volume, dry weight of seedlings and no. of transplantable seedlings at all the places (Table 1-3 VFRAGC/VFJAGC/ VFKAGC 1).Though application of humic acid showed non-significant effect on transplantable seedlings when compared to recommended practice but foliar application at 35 & 45 days after sowing impacted root dry weight and stem dry weight at Rajahmundry. Root dry weight at Rajahmundry and CTRI RS Jeelugumilli was higher might be due to sandy nature of soil type. No. of transplantable seedlings are also higher at Rajahmundry and Jeelugumilli than at Kandukur.

Salient findings/Achievements

- Application of humic acid showed non-significant effect on transplantable seedlings when compared to recommended practice
- Foliar application at 35 & 45 days after sowing impacted root dry weight and stem dry weight of seedlings.

Table 1 VFRAGC/VFJAGC/ VFKAGC 1: Effect of humic substance on no. of transplantable seedlings & other biometric observation in nursery at Kandukur

Treatment	No. of seedlings /m²	Fresh Weight of 10 seedlings (g)	Dry weight of 10 seedlings (g)	Root volume/10 seedlings (ml)
Control (RDF)	431	34.0	3.94	2.1
Soil application of HS @ 1.25 kg/ha	446	33.0	3.81	2.0
Soil application of HS @ 1.25 kg/ha + Foliar spray of HS @ 0.05% at 30 DAS	440	35.0	4.09	2.3
Soil application of HS @ 1.25 kg/ha + Foliar spray of HS @ 0.05% at 45 DAS	444	35.0	3.91	2.2
Soil application of HS @ 1.25 kg/ha + Foliar spray of HS @ 0.05% at 10 days after resetting in poly trays	484	34.0	4.08	2.8
Foliar spray of humic substances @ 0.05% at 30 and 45 DAS	439	34.0	3.87	2.1
L.S.D (0.05)	NS	NS	NS	NS

Table 2 VFRAGC/VFJAGC/ VFKAGC 1: Effect of humic substances on no. of transplantable seedlings & other biometric observations in nursery at Rajahmundry

Treatments	No of transplantable seedlings /m2	Stem dry weight of 10 seedlings(g)	Root dry weight of 10 seedlings(g)	Root volume/10 seedlings(ml)
Soil application of HS @ 1.25 kg/ha	468	3.68	0.79	3.5
Soil application of HS @ 1.25 kg/ha + Foliar spray @ 0.05% at 30DAS	465	4.41	0.81	3.5
Soil application of HS @ 1.25 kg/ha + Foliar spray @ 0.05% at 30 DAS and 45 DAS	468	5.64	1.22	3.9
Soil application of HS @ 1.25 kg/ha + Foliar spray @ 0.05% 10 days after resetting in poly trays	468	4.89	0.84	3.6
Control (RDF)	495	4.52	1.10	3.8
L.S.D (0.05)	NS	NS	NS	NS

Table 3 VFRAGC/VFJAGC/ VFKAGC 1: Effect of humic substances on no. of transplantable seedlings and other biometric observations in nursery at Jeelugumilli

Treatments	No. of trans-plantable seedlings/m²	Fresh weight of 10 seedlings(g)	Dry weight of 10 seedlings(g)	Root volume/10 seedlings (ml)
Soil application of HS @ 1.25 kg/ha	518	3.48	0.68	3.4
Soil application of HS @ 1.25 kg/ha + Foliar spray @ 0.05% at 30 DAS	501	4.21	0.71	3.6
Soil application of HS @ 1.25 kg/ha + Foliar spray @ 0.05% at 30 DAS and 45 DAS	512	4.87	0.92	4.1
Soil application of HS @ 1.25 kg/ha + Foliar spray @ 0.05% 10 days after resetting in poly trays	526	4.31	0.74	4.1
Control (RDF)	543	4.62	1.03	4.3
L.S.D (0.05)	NS	NS	NS	NS

SHIVAMOGGA

Project No.: VFSAG 73

Research project title	**Effect of integration of natural farming inputs on the performance of FCV tobacco**
Objectives	▪ To study the performance of FCV tobacco with the incorporation of natural farming components
Investigators	T. M. Soumya, Shashikala S Kolakar & Prashantha C.
Year of start	2023-2024
Year of completion	2024-2025
Location	AINP (T), ZAHRS, Navile, Shivamogga

Experimental details

Design	:	RCBD
Replications	:	Three
Treatments	:	Ten
Gross plot size	:	7.2 m x 4.2 m (30.24 m^2)
Net plot size	:	5.4 m x 3.0 m(16.20 m^2)
Variety	:	KST-28 (Sahyadri)
Duration	:	02 years
Season	:	*Kharif*
Date of transplanting	:	30.06.2023
Number of pickings	:	07
First picking	:	23.08.2023
Final picking	:	06.10.2023

Treatments: 10

	Treatments
T_1	RDF (40: 30:80 $NP_2O_5K_2O$ kg/ha)* + FYM @ 12.5 t/ha
T_2	Farmers practice : Fertilizers + Ghanajeevamrutha @ 1 t/ha+ Jeevamrutha @ 500 lt/ha (One application to soil)
T_3	100% RDF + Ghana jeevamrutha @ 1 t/ha+ Jeevamrutha @ 500 lt/ha to soil (Three applications)
T_4	100% RDF + Ghana jeevamrutha @ 1 t/ha+ Jeevamrutha @ 500 lt/ha to soil (Three applications) +KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)
T_5	75% RDF + Ghana jeevamrutha @ 1 t/ha+ Jeevamrutha @ 500 l/t ha to soil (Three applications)
T_6	75% RDF + Ghana jeevamrutha @ 1 t/ha+ Jeevamrutha @ 500 t/ha to soil (Three applications)+ KNO_3@ 2% (2 sprays 45-50 DAP & 55-60 DAP)
T_7	100 % RDF + Ghana jeevamrutha @ 2 t/ha+ Jeevamrutha @ 500 t/ha to soil (Three applications)
T_8	100% RDF + Ghana jeevamrutha @ 2 t/ha+ Jeevamrutha @ 500 t/ha to soil (Three applications) +KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)
T_9	75% RDF + Ghana jeevamrutha @ 2 t/ha+ Jeevamrutha @ 500 t/ha to soil (Three applications)
T_{10}	75% RDF + Ghana jeevamrutha @ 2 t/ha+ Jeevamrutha @ 500 t/ha to soil (Three applications)+KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)

RESULTS

Results of the experiment on integration of natural farming inputs in FCV tobacco indicated that the natural farming inputs significantly influenced the crop growth and yield. Significantly higher plant height was recorded with application of 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP) at 30 DAP, 45 DAP and at final picking (45.5 cm, 81.1 cm and 141.1 cm, respectively). Significantly higher leaf area was recorded in application of 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2%(2 sprays 45-50 DAP & 55-60 DAP) at 30 and 45 DAP and of leaves at X and L position (403.9, 524.0, 805.4 and 710.3 cm^2 $leaf^{-1}$, respectively).

The same treatment registered significantly higher green leaf yield (8326 kg ha^{-1}), cured leaf yield (989 kg ha^{-1}) and top grade equivalent (743 kg ha^{-1}) of FCV tobacco. The microbial loads *viz.*, actinomycetes, fungi and bacteria were significantly higher with the application of Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil). The chemical quality constitutes such as nicotine, reducing sugars and chloride were within the acceptable standards and there was no significant difference among the treatments for both X and L position leaves.

Conclusion: Application of 100% RDF + Ghanajeevamrutha @ 2 t ha-1 + Jeevamrutha @ 500 liters ha-1 (Three application to soil) + KNO3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP) performed significantly superior over other treatments

Table 1 VFSAG 73: Growth parameters of FCV tobacco as influenced by integration of natural farming inputs at different growth stages during 2023-24

Treatment	Plant height (cm)			No. of leaves/ plant		Number of leaves harvested per plant
	30 DAP	45 DAP	Final picking	30 DAP	45 DAP	
T_1: RDF (40:30:80 N:P_2O_5:K_2O kg ha-1) + FYM @ 12.5 t ha^{-1}	33.4	59.6	124.2	10.7	11.6	15.6
T_2: Farmers' practice: Fertilizers + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (One application to soil)	38.4	62.7	125.6	10.9	11.8	16.5
T_3: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	40.4	64.5	129.8	11.1	12.1	19.0
T_4: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	42.9	68.2	140.6	11.5	12.7	19.4
T_5: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	39.2	63.2	129.9	11.0	11.3	13.8
T_6: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	30.6	52.5	123.8	9.9	10.3	14.5
T_7: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	41.0	58.7	135.6	11.2	11.8	18.6
T_8: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	45.5	81.1	141.1	12.7	13.2	21.3
T_9: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	42.8	65.3	138.1	11.3	11.9	18.8
T_{10}: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	32.4	59.3	124.9	10.5	10.8	15.9
S. Em±	2.95	3.40	4.41	0.45	0.43	0.95
C.D. at 5%	8.77	10.09	13.11	1.35	1.28	2.84

Table 2 VFSAG 73: Leaf area (cm^2 /leaf) of FCV tobacco as influenced by integration of natural farming inputs at different growth stages during 2023-24

Treatment	30 DAP	45 DAP	Leaf at X position	Leaf at L position
T_1: RDF (40:30:80 N:P_2O_5:K_2O kg ha-1) + FYM @ 12.5 t ha^{-1}	286.8	383.7	676.9	576.9
T_2: Farmers practice: Fertilizers + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (One application to soil)	298.4	393.5	716.9	639.3
T_3: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	328.6	478.8	736.2	641.9
T_4: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	396.6	516.8	790.1	696.8
T_5: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	317.5	432.0	725.9	634.9
T_6: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	233.1	472.4	709.4	552.3
T_7: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	333.9	494.5	759.3	656.0
T_8: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	403.9	524.0	805.4	710.3
T_9: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	349.8	505.6	772.0	682.5
T_{10}: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	254.0	313.9	627.0	546.9
S. Em±	32.35	26.17	14.66	14.11
C.D. at 5%	96.11	77.76	43.56	41.92

Table 3 VFSAG 73: Leaf yield of FCV tobacco as influenced by integration of natural farming inputs during 2023-24

Treatment	Green leaf yield (kg/ha)	Cured leaf yield(kg/ha)	TGE (kg/ha)
T_1: RDF (40:30:80 N:P_2O_5:K_2O kg ha-1) + FYM @ 12.5 t ha^{-1}	5822	772	537
T_2: Farmers practice: Fertilizers + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (One application to soil)	6428	842	605
T_3: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil)	6589	863	612
T_4: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-6 DAP)	7927	958	686
T_5: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	6541	859	627
T_6: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	4184	734	474
T_7: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil)	7155	907	644
T_8: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	8326	989	743
T_9: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	7488	914	659
T_{10}: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	4618	693	505
S. Em±	725.5	29.81	28.46
C.D. at 5%	2155.7	88.58	84.57

Table 4 VFSAG 73: Total microbial load in Jeevamrutha and Ghanajeevamrutha on the day of application

Sl. No.	Natural Farming ingredients	Actinomycetes CFU x 10^2 ml^{-1}	Fungi CFU x 10^4 ml^{-1}	Bacteria CFU x 10^6 ml^{-1}
1	Jeevamrutha	2.6	16.2	293.4
2	Ghanajeevamrutha	1.5	28.5	218.5

Table 5 VFSAG 73: Microbial load in soil as influenced by integration of natural farming inputsafter harvest of the crop

Treatment	Actinomycetes CFUx10^2 ml^{-1}	Fungi CFUx10^4 ml^{-1}	Bacteria CFUx10^6 ml^{-1}
T_1: RDF (40:30:80 N:P_2O_5:K_2O kg ha-1) + FYM @ 12.5 t ha^{-1}	1.2	13.6	183.9
T_2: Farmers practice: Fertilizers + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (One application to soil)	2.6	18.3	319.4
T_3: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil)	2.6	19.5	334.5
T_4: 100% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-6 DAP)	2.5	18.5	328.4
T_5: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	2.5	19.8	329.4
T_6: 75% RDF + Ghanajeevamrutha @ 1 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	2.4	19.8	337.6
T_7: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil)	3.3	24.2	361.1
T_8: 100% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	3.5	24.7	392.1
T_9: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application to soil)	2.6	21.3	396.0
T_{10}: 75% RDF + Ghanajeevamrutha @ 2 t ha^{-1} + Jeevamrutha @ 500 liters ha^{-1} (Three application tosoil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	2.8	22.6	354.1
S. Em±	0.16	1.53	22.74
C.D. at 5%	0.48	4.56	67.58

Table 6 VFSAG 73: Chemical quality constituents of FCV tobacco leaves as influenced by integration of natural farming inputs during 2023-24

Treatment	X position leaf (%)			L position leaf (%)		
	Nicotine	R. Sugar	Chloride	Nicotine	R. Sugar	Chloride
T_1: RDF (40:30:80 N:P_2O_5:K_2O kg ha-1) + FYM @ 12.5 t ha^{-1}	0.95	20.09	0.81	1.00	18.13	0.94
T_2: **Farmers practice:** Fertilizers + Ghanajeevamrutha @ 1 t/ha + Jeevamrutha @ 500 l/ha (One application to soil)	1.13	19.52	0.83	1.17	18.92	0.73
T_3: 100% RDF + Ghanajeevamrutha @ 1 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil)	1.06	20.08	0.74	1.12	19.27	0.82
T_4: 100% RDF + Ghanajeevamrutha @ 1 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	0.95	19.87	0.72	0.98	19.64	0.74
T_5: 75% RDF + Ghanajeevamrutha @ 1 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil)	0.79	19.83	0.84	0.84	20.68	0.69
T_6: 75% RDF + Ghanajeevamrutha @ 1 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	1.31	16.68	0.88	1.08	18.67	0.70
T_7: 100% RDF + Ghanajeevamrutha @ 2 t/ha + Jeevamrutha @ 500 l/ha (Three applications to soil)	0.95	17.40	0.73	1.21	16.64	0.69
T_8: 100% RDF + Ghanajeevamrutha @ 2 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	1.05	18.28	0.77	0.93	18.45	0.69
T_9: 75% RDF + Ghanajeevamrutha @ 2 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil)	1.22	18.52	0.76	1.17	20.29	0.73
T_{10}: 75% RDF + Ghanajeevamrutha @ 2 t/ha + Jeevamrutha @ 500 l/ha (Three application to soil) + KNO_3 @ 2% (2 sprays 45-50 DAP & 55-60 DAP)	1.13	19.50	0.94	1.10	18.21	0.78
S. Em±	0.10	1.34	0.12	0.11	0.78	0.09
C.D. at 5%	NS	NS	NS	NS	NS	NS

Project No.: VFSAG 74

Research project title	**Feasibility of crop intensification through relay-intercropping in FCV tobacco**
Objectives	▪ To study the feasibility of different vegetables as relay inter-crops and their influence on growth and yield of FCV tobacco ▪ To know the economic viability of relay inter-cropping in FCV tobacco under rainfed condition of KLS region
Investigators	T. M. Soumya, Shashikala S Kolakar & Prashantha C.
Year of start	2023-2024
Year of completion	2024-2025
Location	AINP (T), ZAHRS, Navile, Shivamogga

Experimental details

Design	:	RCBD	
Replications	:	3	
Treatments	:	8	
Gross plot size	:	7.2 m × 4.2 m	
Variety	:	KST-28 (Sahyadri)	
Duration	:	02 years	
Season	:	*Kharif*	
Date of transplanting of tobacco	:	30-06-2023	
Date of sowing of relay crop	:	28-08-2023 {45 days after planting of FCV Tobacco (After completion of last inter-cultivation)}	
Date of harvest FCV tobacco Radish Amaranthus Fenugreek Palak Marigold	:	**First harvest** 23.08.2023 07.10.2023 25.09.2023 - - -	**Final harvest** 13.10.2023 18.10.2023 18.10.2023 - 18.10.2023 20.10.2023
Number of pickings	:	FCV Tobacco	08
		Amaranthus	02
		Radish	02
		Palak and Marigold	01

Crops and their information:

Crop	Spacing	Duration (Days)	FYM (t/ha)	Fertilizer N:P_2O_5:K_2O (kg/ha)
FCV tobacco	90 cm × 60 cm	120	12.5	40:30:80
Radish	30 cm×12 cm	50-65	25	50:100:50
Amaranthus	Broadcasting	40-50	25	100:50:50
Fenugreek	Broadcasting	20-30	12.5	100:50:0
Palak	Broadcasting	42-50	25	150:100:100
Marigold	60 cm x 60 cm	120-130	20	125:60:60

Biometric Observations

Biometric observations were recorded at 30 DAP, 45 DAP, first picking and at final picking. The observations on plant height (cm), number of leaves per plant, number of leaves harvested per plant in FCV tobacco were averaged from randomly identified 5 plants in net plot. Leaf area (cm^2) was calculated using leaf length, breadth and factor (Suggs *et al.*, 1960). Weight of green leaf and cured leaf at each picking was recorded from net plot. The quality parameters *viz.*, nicotine (%), reducing sugar (%) and chlorides (%) were recorded after harvest of leaves. The yield of relay crops was recorded as and when they attained physiological maturity.

Treatments: 08

T_1	:	FCV tobacco - Radish (Skip row)
T_2	:	FCV tobacco - Amaranthus (Skip row)
T_3	:	FCV tobacco - Fenugreek (Skip row)
T_4	:	FCV tobacco - Palak (Skip row)
T_5	:	FCV tobacco - Marigold (Skip row)
T_6	:	FCV tobacco - Radish (On the ridge)
T_7	:	FCV tobacco - Marigold (On the ridge)
T_8	:	FCV tobacco (Sole)

Note: Sole crop of these intercrops tried in the experiment were sown separately in the adjacent plot and were not included in the treatment combination.

RESULTS

Relay intercropping allows two crops to be obtained from the same land in a single year. By sowing the second crop into the first one before the first crop is harvested, the second crop gets a head start on its growing season, enabling it to reach maturity by the end of the season, with this background the experiment on feasibility of crop intensification through relay-intercropping in FCV tobacco was studied.

The results of the experiment on feasibility of crop intensification through relay-intercropping in FCV tobacco did not show significant variation among the treatments. Growth and yield of FCV tobacco was non-significant when it was relay intercropped with Radish, Amaranthus, Fenugreek, Palak and Marigold because one week before the last picking of FCV tobacco the relay intercrops were sown or planted in the field. Hence, significant variations among the treatments were not observed in FCV tobacco-based relay intercropping system. Higher green leaf yield (7270 kg/ha) and cured leaf yield (997 kg/ha) was recorded in sole FCV tobacco compared to other treatment.

The chemical quality constitutes such as nicotine, reducing sugars and chloride were within the acceptable standards and there was no significant difference among the different treatments both in X and L position leaves.

Conclusion: Relay intercropping in FCV tobacco didn't show any significant variation in tobacco yield. While additional yield of intercrops was obtained.

Table 1 VFSAG 74: Effect of relay-intercropping on plant height (cm) and number of leaves per plant of FCV tobacco at different growth stages

Treatment	Plant height (cm) of FCV tobacco			Number of leaves/plant	
	30 DAP	45 DAP	Final picking	30 DAP	45 DAP
T_1: FCV Tobacco–Radish (Skip row)	28.4	51.1	124.5	11.4	14.2
T_2: FCV Tobacco–Amaranthus (Skip row)	34.9	60.3	124.4	12.3	14.0
T_3: FCV Tobacco–Fenugreek (Skip row)	34.2	57.3	118.9	12.3	12.8
T_4: FCV Tobacco–Palak (Skip row)	36.0	58.0	115.9	13.0	14.9
T_5: FCV Tobacco–Marigold (Skip row)	32.7	64.3	112.5	12.3	14.5
T_6: FCV Tobacco–Radish (On the ridge)	29.7	57.8	113.0	11.6	14.4
T_7: FCV Tobacco–Marigold (On the ridge)	31.9	60.2	110.7	12.3	12.1
T_8: FCV Tobacco (Sole)	30.9	49.9	124.8	12.8	13.3
S. Em±	3.8	5.7	4.7	0.7	0.6
C.D. at 5%	NS	NS	NS	NS	NS

Table 2 VFSAG 74: Effect of relay-intercropping on leaf area and number of leaves harvested per plant at different growth stages of FCV tobacco

Treatment	Average leaf area (cm^2 $leaf^{-1}$)				Number of leaves harvested $plant^{-1}$
	30 DAP	45 DAP	X Position	L position	
T_1: FCV Tobacco–Radish (Skip row)	410.3	670.8	874.0	710.4	13.2
T_2: FCV Tobacco–Amaranthus (Skip row)	480.6	656.1	887.3	690.6	13.3
T_3: FCV Tobacco–Fenugreek (Skip row)	488.5	559.9	847.5	653.0	12.5
T_4: FCV Tobacco–Palak (Skip row)	534.8	737.1	889.3	713.5	10.8
T_5: FCV Tobacco–Marigold (Skip row)	432.7	646.6	821.3	632.3	13.4
T_6: FCV Tobacco–Radish (On the ridge)	413.6	668.4	804.8	620.2	13.7
T_7: FCV Tobacco–Marigold (On the ridge)	449.1	530.0	817.3	622.6	15.9
T_8: FCV Tobacco (Sole)	484.0	607.5	879.0	700.3	14.3
S. Em±	36.6	61.8	22.2	24.8	1.7
C.D. at 5%	NS	NS	NS	NS	NS

Table 3 VFSAG 74: Effect of relay-intercropping on yield of FCV tobacco, intercrop yield and tobacco equivalent yield

Treatment	Green leaf yield (kg/ha)	Cured leaf yield (kg/ha)	TGE (kg/ha)	Intercrop yield (kg/ha)
T_1: FCV Tobacco–Radish (Skip row)	6998	959	669	3294
T_2: FCV Tobacco–Amaranthus (Skip row)	7052	994	716	1136
T_3: FCV Tobacco–Fenugreek (Skip row)	6796	959	682	0
T_4: FCV Tobacco–Palak (Skip row)	6507	987	707	303
T_5: FCV Tobacco–Marigold (Skip row)	6863	967	710	629
T_6: FCV Tobacco–Radish (On the ridge)	6535	981	721	377
T_7: FCV Tobacco–Marigold (On the ridge)	7065	947	626	395
T_8: FCV Tobacco (Sole)	7270	997	733	0
S. Em±	790	39	41	557
C.D. at 5%	NS	NS	NS	1689

* Top grade equivalent

Table 4 VFSAG 74: Effect of relay-intercropping on chemical quality constituents of FCV tobacco leaves

Treatment	X position leaf (%)			L position leaf (%)		
	Nicotine	R. Sugars	Chloride	Nicotine	R. Sugars	Chloride
T_1: FCV Tobacco–Radish (Skip row)	1.06	17.03	0.70	1.11	16.70	0.72
T_2: FCV Tobacco–Amaranthus (Skip row)	1.04	18.15	0.75	1.18	17.90	0.79
T_3: FCV Tobacco–Fenugreek (Skip row)	0.97	17.18	0.75	1.20	18.71	0.85
T_4: FCV Tobacco–Palak (Skip row)	1.00	15.64	0.77	1.02	15.89	0.89
T_5: FCV Tobacco–Marigold (Skip row)	1.18	16.13	0.76	1.14	16.23	0.76
T_6: FCV Tobacco–Radish (On the ridge)	1.21	16.32	0.80	1.11	12.95	0.77
T_7: FCV Tobacco–Marigold (On the ridge)	1.05	13.83	0.88	1.14	16.80	0.90
T_8: FCV Tobacco (Sole)	0.93	15.95	0.79	1.00	16.72	0.75
S. Em±	0.11	1.33	0.10	0.08	1.31	0.09
C.D. at 5%	NS	NS	NS	NS	NS	NS

B. *BIDI* TOBACCO

ANAND

Project No.: BDAAG 166 (Modified)

Research project title	Evaluation of different fertilizer doses on growth, yield and quality of *bidi* tobacco grown in middle Gujarat
Objectives	▪ To study the effect of different fertilizer doses on growth and cured leaf yield of *bidi* tobacco varieties ▪ To study the effect of different fertilizer doses on leaf quality and nutrient uptake pattern of *bidi* tobacco varieties
Investigators	Jalpa Panchal & N. J. Jadav
Year of start	2023-24 **(Modified)**
Year of completion	2025-26
Location	BTRS, AAU, Anand

Introduction: Potassium is essential for healthy normal growth of tobacco plants and is known as an element of quality in terms of leaf color, texture and combustibility. Leaf produced with high K is smooth and thin with improved fire holding capacity, compared to the one produced under low potassium supply. Maintaining an adequate P concentration in the soil solution is necessary for improved yield and quality of tobacco. In general, soils used for tobacco production in middle Gujarat are low to medium in available phosphorus. Phosphorus deficiency results in stunted growth, poor leaf expansion and unusually dark-green leaves. Research work was not explored on P and K requirement for *bidi* tobacco in middle Gujarat conditions. Hence, this study will be under taken to evaluate different fertilizer doses on growth, yield and quality of *bidi* tobacco grown in middle Gujarat.

Design	:	RBD	**Spacing**	:	90 × 75 cm
Replication	:	Three	**Fertilizer kg/ha**	:	RDF (200 kg/ha)
Crop	:	*Bidi* Tobacco	**Plot size**	:	4.5 × 6.0 m

Note: Nitrogen was applied in four equal splits; 1st as basal and remaining three splits each at 30 days interval after transplanting. Whereas, phosphorus was applied at the time of transplanting and potassium was applied in two equal splits 1st at the time of transplanting and 2nd at 30 DATP.

Treatments: 2 x 5 =10 combinations

A) Variety (V)	(B) Fertilizer dose (F) (kg/ha)
V_1 = GT 7	F_1 = 180-00-00 NPK
V_2 = GABTH 2	F_2 = 180-50-00 NPK
	F_3 = 180-00-50 NPK
	F_4 = 180-50-50 NPK
	F_5 = 180-100-100 NPK

Observations:

1. Plant height (cm) at Harvest
2. Leaf length (cm) at harvest
3. Leaf width (cm) at harvest
4. Cured leaf yield (kg/ha)
5. Dry weight per unit leaf area (mg/cm^2) at harvest
6. Quality parameters (Nicotine, Reducing sugar and Chloride contents)
7. Initial and final soil status (EC, pH, OC and available P and K)
8. Nutrient uptake (N, P_2O_5 and K_2O)

RESULTS

Experimental results depicted in Table 1 BDAAG 166 revealed that cured leaf yield and yield attributes were significantly affected due to varieties. Among varieties, GABTH 2 was found superior over GT 7 with the highest leaf length, width, plant height and dry weight per unit leaf area resulted in the highest cured leaf yield. With regards to fertilizers, tobacco yield attributes and cured leaf yield were not influenced significantly due to fertilizers. However, application of 180-50-50 kg NPK/ha gave numerically maximum cured leaf yield. Interaction effect between variety and fertilizer was found non-significant for yield attributes and cured leaf yield.

A perusal of data presented in Table 2 BDAAG 166 indicated that nicotine and reducing sugar contents were significantly influenced due to varieties and fertilizers. The highest nicotine and reducing sugar contents were noticed in variety GABTH 2 as compared to GT 7. Treatment F_1 (180-00-00 NPK) gave higher nicotine content and it was statistically at par with treatment F_2(180-50-00 NPK). Reducing sugar was not influenced significantly due to different fertilizer doses. Chloride content was not affected significantly due to varieties and fertilizers. Interaction effect between variety and fertilizer was found non-significant for nicotine, reducing sugar and chloride content.

Experimental results depicted in Table 3 BDAAG 166 revealed that soil pH, EC, organic carbon, available phosphorus and available potash were not influenced significantly due to varieties. Among fertilizers, application of 180-100-100 NPK/ha recorded significantly higher available phosphorus and potash. Soil pH, EC and soil organic carbon were not affected significantly due to fertilizers. Interaction effect between varieties and fertilizers found non-significant for all soil parameters.

Experimental results summarized in Table 4 BDAAG 166 revealed that phosphorus and potash contents and their uptake by bidi tobacco were significantly affected due to both varieties and fertilizers except, potash content. The highest phosphorus content as well as nitrogen, phosphorus and potash uptakes by bidi tobacco were found in variety GABTH 2. However, application of 180-100-100 NPK/ha recorded higher phosphorus and potash contents and their uptake by bidi tobacco. It was at on par with treatment of 180-50-50 NPK for phosphorus content and uptake as well as it was on par with treatments of 180-50-50 and 180-00-50 NPK for potash content and uptake. Interaction effect between varieties and fertilizers did not show their significant effect on nutrients content and their uptake.

Salient findings/ Achievements

- *Bidi* tobacco variety GABTH 2 was found superior over GT 7 with the highest leaf length, width, plant height and dry weight per unit leaf area resulted in the highest cured leaf yield.
- None of the fertilizer dose showed significant effect on *bidi* tobacco yield attributes and cured leaf yield. However, application of 180-50-50 kg NPK/ha gave numerically maximum cured leaf yield.

Table 1 BDAAG 166: Response of date of transplanting and variety on yield and morphological characters of *bidi* tobacco (2023-24)

Treatment	Yield (kg/ha)	Leaf length	Leaf width	Plant height	Dry weight per leaf area (mg/cm²)
		(cm)			
A. Variety (V)					
V_1 = GT 7	2654	46.35	17.25	87.44	10.93
V_2 = GABTH 2	3436	49.24	19.35	95.08	11.39
S. Em±	78	0.86	0.56	1.34	0.15
C.D. at 5%	233	2.56	1.65	3.98	0.45
B. Fertilizer dose (F) (kg/ha)					
F_1 = 180-00-00 NPK	2983	48.72	18.70	89.20	11.35
F_2 = 180-50-00 NPK	2790	45.45	16.48	87.47	11.24
F_3 = 180-00-50 NPK	2987	46.75	17.67	92.87	11.12
F_4 = 180-50-50 NPK	3239	49.84	20.33	93.47	11.04
F_5 = 180-100-100 NPK	3223	48.22	18.32	93.30	11.05
S. Em±	124	1.36	0.88	2.12	0.24
C.D. at 5%	NS	NS	NS	NS	NS
Int. V x F	NS	NS	NS	NS	NS
C.V. (%)	10.0	7.0	11.8	5.7	5.3

Table 2 BDAAG 166: Response of date of transplanting and variety on quality parameters of *bidi* tobacco (2023-24)

Treatment	Quality parameters (%)		
	Nicotine	Reducing Sugar	Chloride
A. Variety (V)			
V_1 = GT 7	4.40	3.73	0.98
V_2 = GABTH 2	4.69	4.14	1.03
S. Em±	0.04	0.03	0.02
C.D. at 5%	0.12	0.08	NS
B. Fertilizer dose (F) (kg/ha)			
F_1 = 180-00-00 NPK	4.76	3.94	1.02
F_2 = 180-50-00 NPK	4.62	3.85	0.98
F_3 = 180-00-50 NPK	4.44	3.98	1.04
F_4 = 180-50-50 NPK	4.50	3.97	0.94
F_5 = 180-100-100 NPK	4.41	3.95	1.05
S. Em±	0.07	0.04	0.03
C.D. at 5%	0.20	NS	NS
Int. V x F	NS	NS	NS
C.V. (%)	3.5	2.7	6.3

Table 3 BDAAG 166: Effect of varieties and fertilizers on pH, EC, organic carbon and soil available nutrient contents of *bidi* tobacco (2023-24)

Treatments	pH	EC (ds/m)	Organic Carbon (%)	Available Phosphorus content (kg/ha)	Available Potash content (kg/ha)
INITIAL VALUE	7.83	0.18	0.33	24.17	216.32
Varieties (V)					
V_1: GT 7	8.11	0.20	0.37	28.75	222.40
V_2: GABTH 2	8.05	0.21	0.38	30.12	226.80
S. Em±	0.02	0.004	0.005	0.48	2.16
C.D. at 5%	NS	NS	NS	NS	NS
Fertilizer (F)					
F_1: 180-00-00 NPK	8.04	0.22	0.36	23.92	216.00
F_2: 180-50-00 NPK	8.11	0.20	0.38	29.33	216.33
F_3: 180-00-50 NPK	8.04	0.21	0.39	25.39	224.67
F_4: 180-50-50 NPK	8.16	0.20	0.37	31.84	229.00
F_5: 180-100-100 NPK	8.06	0.21	0.38	36.70	237.00
S. Em±	0.03	0.01	0.01	0.76	3.41
C.D. at 5%	NS	NS	NS	2.27	10.15
V x F Int.	NS	NS	NS	NS	NS
C.V. (%)	1.1	7.3	4.8	6.4	3.7

Table 4 BDAAG 166: Effect of varieties and fertilizers on nutrients content and leaf uptake by *bidi* tobacco (2023-24)

Treatments	Nitrogen content (%)	Phosphorus content (%)	Potash content (%)	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potash uptake (%)
Varieties (V)						
V_1: GT 7	2.15	0.22	0.29	57.11	5.93	7.68
V_2: GABTH 2	2.19	0.23	0.30	75.36	7.94	10.33
S. Em±	0.02	0.002	0.005	2.07	0.18	0.30
C.D. at 5%	NS	0.01	NS	6.15	0.53	0.88
Fertilizer (F)						
F_1: 180-00-00 NPK	2.19	0.21	0.28	65.86	6.35	8.24
F_2: 180-50-00 NPK	2.15	0.23	0.27	60.24	6.30	7.55
F_3: 180-00-50 NPK	2.14	0.21	0.31	64.04	6.44	9.43
F_4: 180-50-50 NPK	2.20	0.24	0.30	71.34	7.68	9.56
F_5: 180-100-100 NPK	2.16	0.25	0.32	69.70	7.91	10.26
S. Em±	0.04	0.003	0.01	3.27	0.28	0.47
C.D. at 5%	NS	0.01	0.02	NS	0.84	1.40
V x F Int.	NS	NS	NS	NS	NS	NS
C.V. (%)	4.2	3.4	6.0	12.1	10.0	12.8

NIPANI

Project No.: BDNAG 56

Research project title	**Evaluation of pre and post emergence herbicide molecules against weeds in tobacco ecosystem**
Objectives	▪ To evaluate the herbicide molecules against monocot and dicot weeds and in turn impact on tobacco yield and quality
Investigators	P. S. Matiwade, B. Arun Kumar & Geeta Dandin
Year of start	2019-20
Year of completion	2023-24
Location	ARS, Nipani

Note: As per the review meeting held on 2nd July, 2024. The herbicide trial conducted at ICAR, Rajahmundry may be replicated under Network mode at all *Bidi* centres (the experiment is formulated for implementation during 2024-25 crop season at Anand, Nandyal and Nipani)

Treatment details

S. No.	Name of the weedicide	Type	Time of application
1	Pendimethalin 30 EC @3.25 lit/ha	Pre-emergent	5 days before planting
2	Pendimethalin 38.7 CS @1.5 lit/ha	Pre-emergent	5 days before planting
3	Clomazone 50 EC @ 0.5 lit/ha	Pre-emergent	5 days before planting
4	Chlorimeron Ethyl 25 WP @ 4 g/ha	Pre-emergent	5 days before planting
5	Butachlor 5% @ 0.5 lit/ha	Pre-planting	8-10 days before planting
6	Quizalofop ethyl 5EC @ 0.5 lit/ha	Post-emergent	20-25 days after planting/Any time after planting
7	Propaquizofop Ethyl 10 EC	Post-emergent	20-25 days after planting /Any time after planting
8	Fenoxapop-p-ethyl 9 EC 0.5 lit/ha	Post-emergent	20-25 days after planting /Any time after planting
9	Metribuzine @ 0.75 g/ha	Pre and post emergent	5 days before planting and 20-25 days after planting /Any time after planting
10	One inter cultivation followed by 2 HW	-	-
11	Weedy check	-	-

Design : RBD
Replications : Three
Plot size : 10 × 5 m

RESULTS

Though the tobacco leaf yields are very low due to non-control of monocot weeds such as *Cynoden dactylon* (Hariyali), there was significant variation observed between the treatments. The significantly higher leaf yield of tobacco (778 kg/ha) was recorded in the treatment where tobacco crop once inter-cultivated followed by two hand weedings, as compared to weedy check (133 kg/ha) and other pre and post emergent weedicides. This may be due to lesser weed weight. The nest higher yield of bidi tobacco was recorded in the treatments where the crop was sprayed with pre-emergent weedicide Pendimethalin 38.7 CS @1.5 lit/ha and post emergent weedicide Quizalofop ethyl 5EC @ 0.5 lit/ha (507 kg/ha). The growth and yield parameters were also followed the same trend.

Salient findings/Achievements

- The significantly higher leaf yield of tobacco (778 kg/ha) was recorded in the treatment where tobacco crop once inter cultivated followed by two hand weedings.

Table 1 BDNAG 56: Yield and morphological characters of *bidi* tobacco as influenced by different weedicides

Treatments	Leaf yield kg/ha	Plant height (cm)	No. of. Leaves/ plant	Leaf Length (cm)	Leaf Width (cm)	Weed weight (kg/ha)
Pendimethalin 30 EC @ 3.25 lit/ha	358	112.87	13	39.73	14.81	128
Pendimethalin 38.7 CS @ 1.5 lit/ha	507	135.00	14	44.55	17.02	51
Clomazone 50 EC @ 0.5 lit/ha	372	129.27	15	45.15	16.81	66
Chlorimeron Ethyl 25 WP @ 4 g/ha	461	129.93	13	41.99	15.83	79
Butachlor 5% @ 0.5 lit/ha	433	134.47	15	47.93	19.01	58
Quizalofop ethyl 5EC @ 0.5 lit/ha	507	141.87	14	47.73	18.87	84
Propaquizofop Ethyl 10 EC	333	122.67	14	43.83	16.21	73
Fenoxapop-p-ethyl 9 EC 0.5 lit/ha	491	133.53	14	45.88	17.59	77
Metribuzine @ 0.75 g/ha	443	131.73	14	48.48	19.08	47
One inter cultivation followed by 2 HW	778	131.80	15	49.89	19.77	39
Weedy check	133	125.33	13	47.29	17.92	61
Mean	437.71	129.86	14.00	45.68	17.54	69.43
S. Em±	49.61	6.24	1.06	1.38	0.94	7.22
C.D. at 5%	146.35	NS	NS	4.06	2.76	21.30
C.V. (%)	19.63	8.32	13.10	5.21	9.23	18.01

Project No.: BDNAG 57

Research project title	**Doubling of farmer's income by tobacco based cropping system under mulches**
Objectives	▪ To study the tobacco cropping system under mulches to double the farmer's income
Investigators	P. S. Matiwade, B. Arun Kumar & Geeta Dandin
Year of start	2021-22
Year of completion	2024-25
Location	ARS, Nipani

Treatment details

S. No.	Treatments	Details
1	Main factor (Mulches)	1. Black plastic mulch
		2. Trash mulch
		3. Crop residue mulch
		4. Soil mulch
2	Sub factor (Tobacco based cropping systems)	1. Tomato-Tobacco-Summer groundnut
		2. Groundnut-Tobacco-Soybean
		3. Soybean-Tobacco-Maize
		4. Sunhemp-Tobacco-Sugarcane (Relay crop)
		5. Soybean-Tobacco-Sugarcane (Relay crop)
		6.Tobacco alone
		7. Banana alone
		8. Turmeric alone

Design : Factorial RBD
Replications : Six
Plot size : 10 × 5 m

RESULTS

The results on leaf yields of main tobacco are only given here. There is no significant impact of mulches and cropping system on tobacco leaf yield.

Effect of mulches: The maximum tobacco leaf yield of 1185 kg/ha was recorded when tobacco was planted on black plastic mulch as compared to trash mulch (997 kg/ha), crop residue mulch (891 kg/ha) and soil mulch (842 kg/ha). Further, significant impacts on various mulches were seen only on plant weight and leaf length.

Effect of crops/ cropping systems: Under various tobacco based sequence cropping systems, tobacco planted in Tomato-Tobacco-Summer groundnut sequence cropping system produced maximum leaf yield of 1041 kg/ha followed by tobacco planted in Groundnut-Tobacco-Soybean (1035 kg/ha), Soybean-Tobacco-Maize (1036 kg/ha), Soybean-Tobacco-Maize (1036 kg/ha), Sunhemp-Tobacco-Sugercane (Relay crop) (965 kg/ha), Soybean-Tobacco-Sugarcane (Relay crop) (907 kg/ha) and Tobacco alone (889 kg/ha). There is no significant impact on growth and yield parameters.

Interaction effect of mulches and crops/ cropping system: There was no interaction effect of mulches and cropping systems on growth, yield and yield parameters of *Bidi* Tobacco.

Salient findings/Achievements

- There was no significant impact of mulches, crops/ cropping systems and their interaction on tobacco leaf yield.

Table 1 BDNAG 57: Yield and morphological characters of *bidi* tobacco influenced by different treatments

Treatments	Leaf yield kg/ha	Plant height (cm)	No. of. Leaves/ plant	Leaf Length (cm)	Leaf Width (cm)
Mulches (M)					
M1- Black plastic mulch	1185	118.10	16.40	56.75	21.47
M2- Trash mulch	997	109.40	16.40	52.57	19.45
M3- Crop residue mulch	891	107.50	16.10	53.08	19.38
M4- Soil mulch	842	104.00	16.00	51.69	19.38
S.Em±	86.96	2.33	0.41	1.07	0.68
C.D. at 5%	NS	7.26	NS	3.34	NS
Cropping System (S)					
S1-Tomato-Tobacco-Summer groundnut	1041	108.30	17.20	53.42	19.51
S2- Groundnut-Tobacco-Soybean	1035	108.00	15.90	53.42	19.71
S3- Soybean-Tobacco-Maize	1036	112.00	16.00	54.83	20.71
S4-Sunhemp-Tobacco-Sugarcane (Relay crop)	965	111.20	16.00	54.09	20.19
S5- Soybean-Tobacco-Sugarcane (Relay crop)	907	110.40	15.90	52.69	19.74
S6-Tobacco alone	889	108.80	16.4	52.71	19.67
S.Em±	45.84	1.56	0.37	0.63	0.36
C.D. at 5%	NS	NS	NS	NS	NS
Interaction (MxS)	NS				

Project No.: BDNAG 58

Research project title	Integrated management of *Orobanche* in *bidi* tobacco
Objectives	▪ To find out the effect of integrated management practices on *Orobanche* infestation and growth ▪ To study the effect of integrated management practice of *Orobanche* on tobacco yield and quality
Investigators	P. S. Matiwade, B. Arun Kumar & Geeta Dandin
Year of start	2021-22
Year of completion	2025-26
Location	ARS, Nipani

Treatment details: 10 (Ten)

S. No.	Name of the Treatment
1	Fallow-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*
2	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Neem oil on *Orobanche* spikes
3	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Pongamia oil on *Orobanche* spikes
4	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Paraquat on *Orobanche* spikes
5	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Imazethapyr on *Orobanche* spikes
6	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Glyphosate on *Orobanche* spikes
7	Green manuring of Black sesamum-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*
8	Green manuring of Sunnhemp-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*
9	Fallow-tobacco + Hand removal of *Orobanche*
10	Fallow-tobacco + Non removal of *Orobanche*

Design : RBD
Replications : Three
Plot size : 10 × 5 m

RESULTS

There was a significant impact on the *bidi* tobacco leaf yield due to various treatment combinations. The treatment where Sunhemp was green manured before planting tobacco applied with neem cake at 30 DAP followed by hand removal of *Orobanche* produced maximum leaf yield of 1341 kg/ha as compared to fallow tobacco + Non removal of *Orobanche* (889 kg/ha). This may be due to lesser number of *Orobanche* spikes and their weight. However, it was on par with the treatment where tobacco was planted on fallow land applied with neem cake @ 30 DAP (1169 kg/ha), post emergent application of neem oil (1212 kg/ha), pongamia oil (1252 kg/ha) to *Orobanche* spikes. But it was significantly higher than the treatment where tobacco was planted on fallow land applied with neem cake @ 30 DAP followed by post emergent application of Paraquat (1086 kg/ha), Imazethapyr (1111kg/a), Glyphosate (1044 kg/ha) to *Orobanche* spikes, green manuring of Black sesamum-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche* (1121 kg/ha) and allow-tobacco + Hand removal of *Orobanche* (1050 kg/ha). Similar trend was followed in growth and yield parameters of *bidi* tobacco.

Salient findings/Achievements

- The treatment where Sunhemp was green manured before planting tobacco applied with neem cake at 30 DAP followed by hand removal of *Orobanche* produced maximum leaf yield of 1341 kg/ha as compared to fallow tobacco + non removal of *Orobanche* (889 kg/ha).

Table 1 BDNAG 58: Yield and yield components of *bidi* tobacco as influenced by different treatments to control *Orobanche*

S. No.	Treatments	Tobacco leaf yield (kg/ha)	No. of *Orobanche* spikes /ha	*Orobanche* weight (kg/ha)	Plant height (cm)	No. of. leaves/plant	Leaf length (cm)	Leaf width (cm)
1	Fallow-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	1169	21629	44	189.30	17	60.17	26.85
2	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Neem oil on *Orobanche* spikes	1212	21185	57	175.07	17	59.81	27.16
3	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Pongamia oil on *Orobanche* spikes	1252	23111	58	173.33	16	58.69	27.20
4	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Paraquat on *Orobanche* spikes	1086	18741	51	182.00	17	60.23	28.17
5	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Imazethapyr on *Orobanche* spikes	1111	18666	55	184.73	17	62.75	29.53
6	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Glyphosate on *Orobanche* spikes	1044	14074	51	169.27	16	55.41	24.97
7	Green manuring of Black sesamum-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	1121	26296	63	182.33	17	57.05	25.44
8	Green manuring of Sunnhemp-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	1341	14296	23	181.87	17	56.70	26.73
9	Fallow-tobacco + Hand removal of *Orobanche*	1050	14296	99	153.93	16	54.47	24.57
10	Fallow-tobacco + Non removal of *Orobanche*	889	17481	40	169.93	17	53.24	22.74
	Mean	**1127.47**	**18977.50**	**54.17**	**176.18**	**16.77**	**57.85**	**26.34**
	S.Em±	**63.02**	**1459.65**	**4.21**	**8.19**	**0.93**	**1.74**	**0.87**
	C.D. at 5%	**187.23**	**4336.84**	**12.50**	**NS**	**NS**	**5.16**	**2.58**
	C.V. (%)	**9.68**	**13.32**	**13.46**	**8.05**	**9.62**	**5.20**	**5.72**

NANDYAL

Project No.: BDNyAG 20

Research project title	**Study on identification of soil fertility status of *bidi* tobacco growing areas of Nandyal and Kurnool districts**
Objectives	▪ To identify the soil fertility status of *bidi* tobacco fields ▪ Identification of deficit plant nutrients that limiting the *bidi* tobacco yield & quality ▪ To increase the overall *bidi* tobacco yield & quality in Kurnool district
Investigators	K. Satish Babu, P. Pullibai & Y.S. Satish Kumar
Year of start	2023-24
Year of completion	2026-27
Location	RARS, Nandyal

RESULTS

During 2023-24 conducted soil survey and collected soil samples in major bidi tobacco growing areas of Kurnool district. The results are given below

- ✓ All the soil samples were alkaline and non saline in nature.
- ✓ All the soil samples were low organic carbon in nature (O.C % <0.50 is low)
- ✓ All the samples were low in available Nitrogen.
- ✓ The soil is high in available Phosphorous and hence, apply 1/4th Phosphorous less than the recommended dose of Phosphatic fertilizers.
- ✓ All the samples were high in available Potassium and hence apply 1/4th Potassium less than the recommended dose of Potassic fertilizers.
- ✓ Most of the soil samples were low in Iron content (5.0 ppm is the critical level). To correct the iron deficiency, apply Iron sulphate @ 50kg/ha as soil application.
- ✓ Most of the soil samples were above the critical level of Zinc, Manganese & Copper.
- ✓ Gargyapuram recorded more yields comparatively other villages and which is more or less equal to Pudicherla and Kethavarm.

Salient findings/Achievements

- During 2023-24, conducted soil survey and collected soil samples in five locations of major *bidi* tobacco growing areas of Kurnool district and results revealed that Gargyapuram recorded more yields comparatively other villages and which is more or less equal to Pudicherla and Kethavarm.

Conclusion: During 2023-24, conducted soil survey and collection of soil samples in major *bidi* tobacco growing areas of Kurnool district and results revealed that all the soil samples were alkaline, non saline in nature, low in organic carbon content, available nitrogen and high in available phosphorous and potassium. Gargyapuram recorded more yields comparatively other villages and which is more or less equal to Pudicherla and Kethavarm.

Table 1 BDNyAG 20: Physico chemical properties of soils of *bidi* tobacco growing areas of Kurnool district during 2023-24

Location	pH	E.C (d s/m)	N (Kg/ha)	P_2O_5 (Kg/ha)	K_2O (Kg/ha)
Orvakal	8.65	0.07	200	101.4	637
Pudicherla	8.47	0.06	178	40.1	531
Kethavaram	8.48	0.07	152	59.9	644
Gargyerapuram	8.09	0.06	205	68.0	501
Diguvapadu	8.23	0.05	178	65.0	556

Table 2 BDNyAG 20: Micro nutrient status of soils of bidi tobacco growing areas of Kurnool district during 2023-24

Location	Iron (ppm)	Zinc (ppm)	Manganese (ppm)	Copper (ppm)
Orvakal	3.94	0.78	10.38	6.18
Pudicherla	4.01	0.79	10.29	6.21
Kethavaram	4.10	0.78	10.14	6.39
Gargyerapuram	4.11	0.81	10.63	6.32
Diguvapadu	4.08	0.73	10.12	6.51

Table 3 BDNyAG 20: Location wise yields of bidi tobacco growing areas of Kurnool district during 2023-24

Location	Yields (kg/ha)
Orvakal	1500
Pudicherla	2010
Kethavaram	2000
Gargyerapuram	2500
Diguvapadu	1750

Project No.: BDNyAG 21

Research project title	Integrated Management of broomrape (*Orobanche spp*) in *bidi* tobacco
Objectives	▪ To study the effect of integrated management practices on control of *Orobanche.* ▪ To study the effect of different *Orobanche* management methods on cured leaf yield and quality of *bidi* tobacco. ▪ To study the effect of different *Orobanche* management methods on net returns.
Investigators	K. Satish Babu, P. Pullibai & Y.S. Satish Kumar
Year of start	2023-24
Year of completion	2026-27
Location	RARS, Nandyal

RESULTS

During *kharif* cultivation of sorghum which is sequence cropping with tobacco along with Neem cake application at 30 DAT and post-emergence application of Imazathapyr 1 ml/lit at 70 and 100 DAT on *Orobanche* spikes observed lowest number of *Orobanche* spikes per plant and higher plant height (68.8 cm), leaf length (47.4 cm), leaf width (22.2 cm),Dry weight/unit leaf area (10.8) and yield parameters like green leaf yield (11687 kg/ha) cured leaf yield (2324 kg/ha), net returns (Rs.130514/ha) and B:C ratio (2.2) which is significantly on par with Green manuring of black sesame- Tobacco, Neem cake application at 30 DAT and Hand removal of *Orobanche.* Higher percent of *Orobanche* infestation, lower growth and yield parameters were observed in Fallow- Tobacco + Non removal of *Orobanche*. The leaf chemical parameters *viz*., nicotine, reducing sugars and chlorides did not differ significantly due to integrated management measures of *bidi* tobacco. The leaf chemical parameters were in permissible limits with nicotine ranging from 3.61 to 4.71 % whereas reducing sugars was from 2.42 to 2.87 % and chlorides from 1.06 to 1.98%.

Salient findings/Achievements

- Significantly higher growth, yield parameters, net returns and benefit cost ratio and lower number of *Orobanche* spikes per plant recorded with cultivation of sorghum which is sequence cropping with tobacco along with Neem cake application at 30 DAT and post-emergence application of Imazathapyr 1 ml/lit at 70 and 100 DAT compared with fallow –tobacco and non removal of *Orobanche.*

Conclusion: During *kharif* cultivation of sorghum which is sequence cropping with tobacco along with Neem cake application at 30 DAT and post-emergence application of Imazathapyr 1 ml/lit at 70 and 100 DAT on *Orobanche* spikes observed lowest number of *Orobanche* spikes per plant and recorded higher growth, yield parameters, high net returns and benefit cost ratio compared with fallow –tobacco and non removal of *Orobanche.*

Table 1 BDNyAG 21: *Orobanche* infestation as influenced by integrated management of broomrape in *bidi* tobacco during 2023-24

Treatments	Fresh weight (kg/plot)	Dry weight (kg/plot)	No. of spikes/plant
T1: Fallow –tobacco + neem cake application at 30 DAT+ Hand removal of *Orobanche*	1.93	0.55	7.3
T2: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of neem oil on *Orobanche* spikes	1.86	0.53	10.6
T3: Fallow –tobacco + Neem cake application at 30 DAT+ Post emergence application of pongamia oil on Orobanche spikes	1.85	0.67	10.3
T4: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	1.19	0.38	9.7
T5:Green manuring of black sesame – tobacco + Neem cake application at 30 DAT + hand removal of Orobanche	2.48	0.89	6.8
T6:Green manuring of sunhemp – tobacco + Neem cake application at 30 DAT+ hand removal of *Orobanche*	2.81	0.96	7.1
T7:Sorghum-tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	2.03	0.83	6.5
T8:Fallow –tobacco + Hand removal of *Orobanche*	2.30	0.84	9.3
T9: Fallow –tobacco + Non removal of *Orobanche*	2.54	1.19	12.0

Table 2 BDNyAG 21: Growth parameters as influenced by Integrated Management practices of broomrape in bidi tobacco during 2023-24

Treatments	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Dry Wt. /unit Leaf area (mg/cm^2)
T1: Fallow –tobacco + neem cake application at 30 DAT+ Hand removal of *Orobanche*	65.2	43.4	19.2	9.2
T2: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of neem oil on *Orobanche* spikes	55.6	31.2	15.6	8.2
T3: Fallow –tobacco + Neem cake application at 30 DAT+ Post emergence application of pongamia oil on *Orobanche* spikes	56.6	36.6	16.4	8.4
T4: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	59.6	39.8	17.9	8.6
T5:Green manuring of black sesame – tobacco + Neem cake application at 30 DAT + hand removal of *Orobanche*	67.6	46.8	21.6	10.4
T6:Green manuring of sunhemp – tobacco + Neem cake application at 30 DAT+ hand removal of *Orobanche*	67.2	45.2	20.4	9.9
T7:Sorghum-tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	68.8	47.4	22.2	10.8
T8:Fallow –tobacco + Hand removal of *Orobanche*	62.1	40.4	18.6	8.9
T9: Fallow –tobacco + Non removal of *Orobanche*	34.6	19.4	12.4	5.8
S.Em±	1.8	0.6	1.4	0.8
C.D. at 5%	4.5	1.9	3.9	2.1
C.V. (%)	9.2	8.8	9.6	8.4

Table 3 BDNyAG 21: Yield parameters as influenced by Integrated Management of broomrape in *bidi* tobacco

Treatments	Green leaf Yield (kg/ha)	Cured Leaf Yield (kg/ha)
T1: Fallow –tobacco + neem cake application at 30 DAT+ Hand removal of *Orobanche*	10547	2175
T2: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of neem oil on *Orobanche* spikes	8926	1747
T3: Fallow –tobacco + Neem cake application at 30 DAT+ Post emergence application of pongamia oil on *Orobanche* spikes	9326	1819
T4: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	9846	1890
T5:Green manuring of black sesame – tobacco + Neem cake application at 30 DAT + hand removal of *Orobanche*	11346	2211
T6:Green manuring of sunhemp – tobacco + Neem cake application at 30 DAT+ hand removal of *Orobanche*	11047	2104
T7:Sorghum-tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	11687	2324
T8:Fallow –tobacco + Hand removal of Orobanche	10053	1944
T9: Fallow –tobacco + Non removal of *Orobanche*	5705	1230
S.Em±	280.5	45.6
C.D. at 5%	645.6	129.2
C.V. (%)	11.8	10.6

Table 4 BDNyAG 21: Economics as influenced by integrated management of broomrape in bidi tobacco during 2023-24

Treatments	Cured leaf yield (kg/ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
T1: Fallow –tobacco + neem cake application at 30 DAT+ Hand removal of *Orobanche*	2175	166003	74763	1.8
T2: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of neem oil on *Orobanche* spikes	1747	172778	81538	1.9
T3: Fallow –tobacco + Neem cake application at 30 DAT+ Post emergence application of pongamia oil on *Orobanche* spikes	1819	184636	93011	2.0
T4: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	1890	179554	88029	2.0
T5:Green manuring of black sesame – tobacco + Neem cake application at 30 DAT + hand removal of *Orobanche*	2211	210044	122044	2.4
T6:Green manuring of sunhemp – tobacco + Neem cake application at 30 DAT+ hand removal of *Orobanche*	2104	199881	108881	2.2
T7:Sorghum-tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	2324	218514	130514	2.5
T8:Fallow –tobacco + Hand removal of Orobanche	1944	206656	120656	2.4
T9: Fallow –tobacco + Non removal of *Orobanche*	1230	116879	45354	1.6

Table 5 BDNyAG 21: Leaf chemical quality as influenced by Integrated Management of broomrape in *bidi* tobacco during 2023-24

Treatments	Nicotine (%)	R. Sugars (%)	Chlorides (%)
T1: Fallow –tobacco + neem cake application at 30 DAT+ Hand removal of *Orobanche*	4.38	2.53	1.23
T2: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of neem oil on *Orobanche* spikes	3.97	2.59	1.55
T3: Fallow –tobacco + Neem cake application at 30 DAT+ Post emergence application of pongamia oil on *Orobanche* spikes	3.72	2.61	1.66
T4: Fallow –tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	4.02	2.87	1.56
T5:Green manuring of black sesame – tobacco + Neem cake application at 30 DAT + hand removal of *Orobanche*	4.21	2.59	1.67
T6:Green manuring of sunhemp – tobacco + Neem cake application at 30 DAT+ hand removal of *Orobanche*	4.38	2.53	1.78
T7:Sorghum-tobacco + Neem cake application at 30 DAT + Post emergence application of Imazathapyr on *Orobanche* spikes	4.71	2.86	1.98
T8:Fallow –tobacco + Hand removal of Orobanche	4.36	2.91	1.68
T9: Fallow –tobacco + Non removal of *Orobanche*	3.61	2.42	1.06
S.Em±	0.05	0.07	0.08
C.D. at 5%	NS	NS	NS
C.V. (%)	7.8	5.8	8.9

C. *RUSTICA TOBACCO*

ANAND

Project No.: RUAAG 23

Research project title	**Evaluation of different fertilizer doses on growth, yield and quality of *rustica* tobacco grown in middle Gujarat**
Objectives	▪ To study the effect of different fertilizer doses on growth and cured leaf yield of rustica tobacco varieties ▪ To study the effect of different fertilizer doses on leaf quality and nutrient uptake pattern of rustica tobacco varieties
Investigators	Jalpa Panchal & N. J. Jadav
Year of start	2023-24
Year of completion	2025-26
Location	BTRS, AAU, Anand

Introduction: Potassium is essential for healthy normal growth of tobacco plants and is known as an element of quality in terms of leaf color, texture and combustibility. Leaf produced with high K is smooth and thin with improved fire holding capacity, compared to the one produced under low potassium supply. Maintaining an adequate P concentration in the soil solution is necessary for improved yield and quality of tobacco. In general, soils used for tobacco production in middle Gujarat are low to medium in available phosphorus. Phosphorus deficiency results in stunted growth, poor leaf expansion and unusually dark-green leaves. Research work was not explored on P and K requirement for *rustica* tobacco in middle Gujarat conditions. Hence, this study will be under taken to evaluate different fertilizer doses on growth, yield and quality of *rustica* tobacco grown in middle Gujarat.

Design	:	RBD(Factorial)	**Spacing**	:	60 × 45 cm
Replication	:	Three	**Fertilizer kg/ha**	:	As per treatment
Crop	:	*Rustica* Tobacco	**Plot size**	:	3.6 × 5.4 m

NOTE: Nitrogen was applied in four equal splits; 1st as basal and remaining three splits each at 30 days interval after transplanting. Whereas, phosphorus was applied at the time of transplanting and potassium was applied in two equal splits 1st at the time of transplanting and 2nd at 30 DATP.

Treatments: 2 x 5 =10 combinations

A) Variety (V)	(B) Fertilizer dose (F) (kg/ha)
V1 = GC 1	F_1 = 200-00-00 NPK
V2 = GCT 3	F_2 = 200-50-00 NPK
	F_3 = 200-00-50 NPK
	F_4 = 200-50-50 NPK
	F_5 = 200-100-100 NPK

Observations:

1. Plant height (cm) at Harvest
2. Leaf length (cm) at harvest
3. Leaf width (cm) at harvest
4. Cured leaf yield (kg/ha)
5. Dry weight per unit leaf area (mg/cm^2) at harvest
6. Quality parameters (Nicotine, Reducing sugar and Chloride contents)
7. Initial and final soil status (EC, pH, OC and available P and K)
8. Nutrient uptake (N, P_2O_5 and K_2O)

RESULTS

Data predicted in Table 1 RUAAG 23 revealed that varieties influenced significantly on leaf length, leaf width, plant height and cured leaf yield. Among varieties, GCT 3 was found superior over GC 1 with the highest leaf length and plant height resulted in the highest cured leaf yield. With regards to fertilizers, tobacco yield attributes and cured leaf yield were not influenced significantly due to fertilizers. However, application of 200-100-100 kg NPK/ha gave numerically maximum cured leaf yield. Interaction effect between variety and fertilizer was found non-significant for yield attributes and cured leaf yield.

The data presented in Table 2 RUAAG 23 revealed that all the quality parameters *i.e.* nicotine, reducing sugar and chloride contents were not influenced significantly due to varieties. With regard to fertilizers, nicotine content was affected significantly wherein, treatment F_1 (200-00-00 NPK) recorded higher nicotine content over treatment F_2 (200-50-00 NPK). With respect to interaction effect between variety and fertilizer, they failed to exert their significant effect on quality parameters.

Experimental results depicted in Table 3 RUAAG 23 revealed that soil pH, EC, organic carbon and available phosphorus and potash contents were not influenced significantly due to varieties. Among fertilizers, application of 200-100-100 NPK/ha recorded significantly the highest available phosphorus and potash. Soil pH, EC and organic carbon were not affected significantly due to fertilizers. Interaction effect between varieties and fertilizers found non-significant for soil parameters.

Experimental results summarized in Table 4 RUAAG 23 revealed that nitrogen and potash contents were not influenced significantly due to varieties. However, variety GCT 3 gave significantly the highest phosphorus content and its uptake as well as nitrogen and potassium uptakes. Besides, application of 200-100-100 kg NPK/ha recorded significantly higher phosphorus content closely followed by treatments F_2 and F_4. Application of 200-100-100 kg NPK/ha gave significantly higher potash content and its uptake by *rustica* tobacco. It was at par with treatments F_3 and F_4. Interaction effect between varieties and fertilizers found non-significant on phosphorus and potash contents as well as uptakes.

Salient findings/ Achievements

- *Rustica* tobacco variety GCT 3 was found superior over GC 1 with the highest leaf length and plant height resulted in the highest cured leaf yield.

- None of the fertilizer dose showed significant effect on *bidi* tobacco yield attributes and cured leaf yield. However, application of 180-50-50 kg NPK/ha gave numerically maximum cured leaf yield.

Table 1 RUAAG 23: Effect of varieties and fertilizers on cured leaf yield and yield attributes of *rustica* tobacco (2023-24)

Treatments	Cured leaf yield (kg/ha)	Leaf length (cm)	Leaf width (cm)	Plant height (cm)	Dry weight/ unit leaf area (mg/cm²)
Varieties (V)					
V_1: GC 1	2522	31.04	27.36	41.97	12.89
V_2: GCT 3	2796	34.99	22.26	51.17	12.02
S.Em±	72	0.67	0.75	1.01	0.34
C.D. at 5%	214	1.98	2.23	3.00	NS
Fertilizers (F)					
F_1: 200-00-00 NPK	2615	33.89	26.10	47.16	13.26
F_2: 200-50-00 NPK	2589	30.37	21.93	42.33	12.22
F_3: 200-00-50 NPK	2639	32.21	23.60	46.93	12.02
F_4: 200-50-50 NPK	2673	33.58	25.90	49.47	11.31
F_5: 200-100-100 NPK	2779	35.02	26.52	46.95	13.47
S.Em±	114	1.06	1.19	1.60	0.54
C.D. at 5%	NS	NS	NS	NS	NS
V x F Int.	NS	NS	NS	NS	NS
C.V. (%)	10.5	7.8	11.7	8.4	10.6

Table 2 RUAAG 23: Effect of varieties and fertilizers on quality parameters of *rustica* tobacco (2023-24)

Treatments	Nicotine (%)	Reducing sugar (%)	Chloride (%)
Varieties (V)			
V_1: GC 1	5.78	5.30	1.07
V_2: GCT 3	5.79	5.39	1.10
S.Em±	0.07	0.08	0.02
C.D. at 5%	NS	NS	NS
Fertilizers (F)			
F_1: 200-00-00 NPK	6.05	5.64	1.06
F_2: 200-50-00 NPK	5.56	5.48	1.01
F_3: 200-00-50 NPK	5.74	5.15	1.11
F_4: 200-50-50 NPK	5.76	5.20	1.10
F_5: 200-100-100 NPK	5.83	5.24	1.13
S.Em±	0.10	0.13	0.03
C.D. at 5%	0.31	NS	NS
V x F Int.	NS	NS	NS
C.V. (%)	4.4	5.8	7.0

Table 3 RUAAG 23: Effect of varieties and fertilizers on pH, EC, organic carbon and soil available nutrients of *rustica* tobacco (2023-24)

Treatments	pH	EC (ds/m)	Organic Carbon (%)	Available Phosphorus content (kg/ha)	Available Potash content (kg/ha)
INITIAL VALUE	7.61	0.19	0.37	29.35	171.74
Varieties (V)					
V_1: GC 1	7.98	0.24	0.46	33.55	187.20
V_2: GCT 3	7.96	0.23	0.47	34.45	188.47
S.Em±	0.03	0.004	0.01	0.41	1.31
C.D. at 5%	NS	NS	NS	NS	NS
Fertilizers (F)					
F_1: 200-00-00 NPK	7.99	0.23	0.48	28.66	170.17
F_2: 200-50-00 NPK	8.00	0.23	0.48	34.50	169.67
F_3: 200-00-50 NPK	7.93	0.24	0.46	28.90	189.67
F_4: 200-50-50 NPK	8.00	0.23	0.46	35.34	190.00
F_5: 200-100-100 NPK	7.95	0.22	0.45	42.12	219.67
S.Em±	0.04	0.01	0.01	0.65	2.08
C.D. at 5%	NS	NS	NS	1.94	6.17
V x F Int.	NS	NS	NS	NS	NS
C.V. (%)	1.3	7.0	5.7	4.7	2.7

Table 4 RUAAG 23: Effect of varieties leaf and fertilizers on nitrogen, phosphorus and potash and their uptake by *rustica* tobacco (2023-24)

Treatments	Nitrogen content (%)	Phosphorus content (%)	Potash content (%)	Nitrogen uptake (kg/ha)	Phosphorus uptake (kg/ha)	Potash uptake (%)
Varieties (V)						
V_1: GC 1	2.15	0.25	0.21	54.15	6.34	5.33
V_2: GCT 3	2.19	0.27	0.22	61.29	7.51	6.16
S.Em±	0.02	0.003	0.003	1.60	0.20	0.15
C.D. at 5%	NS	0.01	NS	4.76	0.59	0.45
Fertilizers (F)						
F_1: 200-00-00 NPK	2.21	0.25	0.20	57.73	6.48	5.18
F_2: 200-50-00 NPK	2.20	0.27	0.21	57.03	7.02	5.50
F_3: 200-00-50 NPK	2.14	0.25	0.22	56.39	6.62	5.87
F_4: 200-50-50 NPK	2.13	0.26	0.22	57.08	6.86	5.82
F_5: 200-100-100 NPK	2.17	0.28	0.23	60.37	7.65	6.35
S.Em±	0.02	0.005	0.005	2.53	0.31	0.24
C.D. at 5%	NS	0.02	0.01	NS	NS	0.72
V x F Int.	NS	NS	NS	NS	NS	NS
C.V. (%)	2.7	4.9	5.4	10.8	11.0	10.3

ARAUL

Project No.: RUArAG 31-A

Research project title	**Studies on economical viability of tobacco / non tobacco crop of *rabi* season**
Objectives	▪ Find out the best cost benefit ratio among different *Rabi* crops with comparison to *rustica* tobacco variety ArR-27 (Nath)
Investigators	K.C. Araya
Year of start	2023-24
Year of completion	2024-25
Location	Tobacco Research Station, Araul

Design : R B D Spacing : As per crop
Replications : Four Plot size : 5 x 4 m^2

Treatments: 04

T_1-Tobacco (ArR-27 Nath)	T_3-Barley
T_2-Wheat	T_4- Mustard

RESULTS

In order to work out economics of tobacco/ non-tobacco crops of season *Rabi*, an experiment was conducted during 2023-24 at Tobacco Research Station, Araul, Kanpur, U.P. The soil of experiment site was Sandy loam. The experiments consist of four treatments. The analysis indicated that, tobacco equivalent yield were significantly affected under various treatments. The higher tobacco equivalent yield recorded under the **Treatment-2** (Wheat) i.e. 2901 kg/ha followed by **Treatment-4** [Mustard] *i.e.* 1717 kg/ha. Economics of the treatment revealed that highest monitory return of Rs. 63150.00 was recorded by Treatment-2 with benefit cost ratio of 1.34.

Salient findings/achievements

- The higher tobacco equivalent yield recorded with Wheat i.e. 2901 kg/ha followed by Mustard i.e. 1717 kg/ha. Economics of the treatment revealed that highest monitory return of Rs. 63150.00 was recorded by Treatment-2 with benefit cost ratio of 1.34.

Table 1 RuArAG-31-A: Data on tobacco equivalent yield and morphological characters with non-tobacco crops of *Rabi* season (2023-24)

Treatments	Tobacco/ Non-tobacco yield (kg/ha)	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	No. Curable leaves
T_1-Tobacco (ArR-27)	1830	64.65	4220	37.91	17
T_2-Wheat	5250	-	-	-	-
T_3-Barley	2950	-	-	-	-
T_4- Mustard	1450	-	-	-	-

Table 2 RuArAG-31-A: Data on Cost Economics of different crops as influenced by treatments

Treatments	Tobacco equivalent yield (kg/ha)	Gross return (Rs./ha)	Cost of cultivation (Rs./ha)	Net return (Rs./ha)	B.C. Ratio
T_1-Tobacco (ArR-27)	1830	69540	44500	25040	0.56
T_2-Wheat	2901	110250	47100	63150	1.34
T_3-Barley	1120	67850	38700	29150	0.75
T_4- Mustard	1717	65250	30100	35150	1.16

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CROP CHEMISTRY AND SOIL SCIENCE

CROP CHEMISTRY AND SOIL SCIENCE

Project No.: VFRCHC 1

Research project title	Leaf quality evaluation of different tobaccos
Objectives	▪ Analysis of chemical quality parameters of tobacco leaf samples related to different experiments.
Investigators	L.K. Prasad
Year of start	1999-2000
Year of completion	Long term
Location	ICAR-CTRI, Rajahmundry

RESULTS

A total no. of **754 (FCV and Non-FCV)** tobacco leaf samples received from different AINPT centres were processed and analysed for chemical quality parameters viz., nicotine, reducing sugars and chlorides.

A. FCV TOBACCO

A total of **321** FCV tobacco leaf samples received from different centres and were analysed for chemical quality parameters. The centre wise results are presented below:

1. **CTRI RS Hunsur:** FCV tobacco leaf samples (63) pertaining to AINPT Trial, IVT-R, IVT and AVT-II experiments were analysed. The leaf nicotine content varied from 0.65 to 1.71 % in 'X' position and 0.62 to 1.79 % in 'L' position, while reducing sugars varied from 11.14 to 21.50 % in 'X' position and 8.79 to 20.36 % in 'L' position and the chlorides ranged from 1.15 to 2.57 % in 'X' position and 1.08 to 2.33 % in 'L' position.
2. **CTRI RS Kandukur:** FCV tobacco leaf samples (64) pertaining to IVT were analysed. The nicotine content varied from 0.95 to 2.56 %, while the reducing sugars varied from 7.39 to 16.90 % and the chloride content varied from 1.42 to 3.93 %.
3. **CTRI RS Jeelugumilli:**FCV tobacco leaf samples (8) pertaining to AHT-2 were analysed. The leaf nicotine varied from 2.45 to 3.80 % in 'X' position and 3.20 to 4.35 % in 'L' position, while reducing sugars varied from 7.19 to 11.11 % in 'X' position and 6.05 to 8.34 % in 'L' position. Chlorides ranged from 1.13 to 1.63 % in 'X' position and 1.28 to 1.58 % in 'L' position.
4. **CTRI Shivamogga:** FCV tobacco leaf samples (186) pertaining to Agronomy Experiment was analysed. The leaf nicotine varied from 0.50 to 1.61 %, while reducing sugars varied from 3.94 to 24.87 % and the chlorides ranged from 0.36 to 1.36 %.

B. NON-FCV TOBACCO

A total No. of **433** leaf samples of non-FCV tobacco were analysed for quality parameters. The centre wise results are presented below:

1. **Nandyal:** *Bidi* tobacco leaf samples (27) pertaining to "Response of bidi tobacco to different drought mitigation measures" and 173 bidi tobacco samples pertaining to

breeding experiments of RARS, Nandyal conducted during the year 2023-24 were analysed. The leaf nicotine varied from 0.60 to 8.24 %, while the reducing sugars varied from 1.11 to 7.22 %. The chloride content varied from 1.64 to 5.48 %.

2. **Nipani:** *Bidi* tobacco leaf samples (42) pertaining to AVT-II, LSD, Weedicide Trial from ARS, Nipani collected during the year 2023-24 were analysed. The leaf nicotine content varied from 0.99 to 3.92 % in 'X' position and 1.01 to 3.81 % in 'L' position, while the reducing sugars varied from 3.08 to 7.88 % in 'X' position and 3.08 to 7.35 % in 'L' position. The chloride content varied from 0.54 to 2.38 % in 'X' position and 0.50 to 2.31% in 'L' position.

3. **Ladol:** A total number of 42 *rustica* tobacco leaf samples pertaining to the projects IVT, AVT-1, IET (ST-1), PYT (ST-2) and LSVT of ARS, Ladol were analysed. The leaf nicotine varied from 4.65 to 9.88 %, while the reducing sugars varied from 1.51 to 3.56 %. The chloride content varied from 1.11 to 2.97 %.

4. **Berhampur:** A total number of 149 *pikka* tobacco leaf samples pertaining to the experiments DPT 2023, FERT 2023, MLT 2023, DTGE 2023, Exploratory Trial on *Rustica* and Jati of CPR, Berhampur conducted during 2023-24 were analysed. The leaf nicotine varied from 0.06 to 6.32 %, while the reducing sugars varied from 0.32 to 8.06 %. The chloride content varied from 0.28 to 1.37 %.

Salient findings/Achievements

- Total No. of samples analysed in tobacco for chemical quality parameters were **321** in FCV and **433** in Non-FCV

Table 1 VFRCHC 1: Summary of Chemical Quality Parameters (%)in FCV tobacco centres (2023-24)

Centre / Zone	Nicotine	Red. Sugars	Chlorides
CTRI RS, Kandukur (64)	0.95 to 2.56	7.39 to 16.90	1.42 to 3.93
CTRI RS, Hunsur (63)	0.65 to 1.71 (X) 0.62 to 1.79 (L)	11.14 to 21.50 (X) 8.79 to 20.36 (L)	1.15 to 2.57 (X) 1.08 to 2.33 (L)
CTRI RS, Jeelugumilli (8)	2.45 to 3.80 (X) 3.20 to 4.35 (L)	7.19 to 11.11 (X) 6.05 to 8.34 (L)	1.13 to 1.63 (X) 1.28 to 1.58 (L)
Shivamogga (186)	0.50 to 1.61	3.94 to 24.87	0.36 to 1.36

*Figures in parentheses represent the total number of samples analysed

Table 2 VFRCHC 1: Summary of Chemical Quality Parameters (%) in Non-FCV tobacco centres (2023-24)

Centre / Type of Tobacco	Nicotine	Reducing Sugars	Chlorides
Nandyal (*Bidi*-200)	0.60 to 8.24	1.11 to 7.22	1.64 to 5.48
Nipani (*Bidi* -42)	0.99 to 3.92 (X) 1.01 to 3.81 (L)	3.08 to 7.88 (X) 3.08 to 7.35 (L)	0.54 to 2.38 (X) 0.50 to 2.31(L)
Ladol (*Rustica*-42)	4.65 to 9.88	1.51 to 3.56	1.11 to 2.97
Berhampur (*pikka*- 149)	0.06 to 6.32	0.32 to 8.06	0.28 to 1.37

*Figures in parentheses represent the total number of samples analysed

CROP PROTECTION

CROP PROTECTION

I. ENTOMOLOGY

A. FCVTOBACCO

SHIVAMOGGA

Project No.: VFSEN 34

Research project title	**Population dynamics of insect pest complex and their natural enemies in tobacco ecosystem**
Objectives	▪ To record the insect pests occurring in tobacco ecosystem
Investigators	Prashantha C, T.M.Soumya & Shashikala S Kolakar
Year of start	2021
Year of completion	2025
Location	ZAHRS, Shivamogga

Cultivar : Sahyadri Season : *Kharif* 2023
Area : 100 m^2

Results

- In total five insect pest's *viz.,* Aphids, Whiteflies, tobacco caterpillar, budworm, and semi-looper (Table 1 VFSEN 34) and five natural enemies *viz.,* coccinellid beetles, spiders, mirid bug *Nesidiocoris* sp*.,* hoverfly *Ischiodon* sp*.* and reduviid bugs (Table 2VFSEN 34) were observed in tobacco ecosystem.
- Whiteflies and aphids had significant negative correlation with rainfall and significant positive correlation with maximum temperature. Whereas, it was negatively significant with minimum temperature and negatively non-significant with morning relative humidity and negatively significant with evening relative humidity (Table 3VFSEN 34).
- Population of Tobacco caterpillar *Spodoptera litura* were negatively significant with rainfall and positively non-significant with maximum temperature, whereas negatively non-significant with minimum temperature, morning and evening relative humidity (Table 3VFSEN 34).
- Populations of Capsule borer Helicoverpa armigera were negatively non-significant with rainfall and positively significant with maximum temperature. Whereas, minimum temperature, morning and evening relative humidity were negatively correlated (Table 3VFSEN 34).
- Semilooper population had negatively significant association with rainfall and was positively significant with maximum temperature and negatively significant with minimum temperature, morning and evening relative humidity (Table 3VFSEN 34).

Salient Findings:

- The aphid population was very high during the experimental period due to high temperature and humidity.
- Natural enemies like mirid bug and hoverfly were recorded more on aphid infested plants.

Table 1 VFSEN 34.1: Insect pests incidence in tobacco ecosystem during *Kharif* 2023

Week	Month	MSW	Number of nymphs or adults/leaf		Number of larvae/plant		
			Whiteflies *B. tabaci*	Aphids *M. persicae*	*S. litura*	*H. armigera*	Semilooper
1st week	July	28	0.00	0.00	0.00	0.00	0.00
2nd week		29	0.60	0.00	0.30	0.00	0.00
3rd week		30	0.80	8.50	1.20	0.00	0.00
4th week	August	31	1.90	10.20	1.40	0.00	0.00
5th week		32	2.70	80.30	1.30	0.00	0.00
6th week		33	2.90	192.10	1.40	0.00	0.40
7th week		34	3.20	210.90	1.90	0.10	0.20
8th week	September	35	3.40	244.60	2.10	0.00	0.40
9th week		36	4.10	230.70	3.00	0.20	1.20
10thweek		37	3.20	250.50	3.40	0.00	1.60
11thweek		38	4.00	292.00	3.70	0.10	1.90
12thweek	October	39	4.40	271.00	3.50	0.80	2.20
13thweek		40	3.60	232.50	3.40	0.00	2.10
14thweek		41	3.50	215.40	2.30	0.80	2.90
15thweek		42	3.70	251.30	1.40	1.50	2.60
16thweek		43	3.20	213.00	1.60	1.20	2.50
17thweek	November	44	2.30	220.00	0.60	0.60	1.80

MSW-Mean Standard Week

Table 2 VFSEN: Natural enemies observed in tobacco ecosystem during *Kharif* 2023

Weeks	Month	MSW	Number of natural enemies/plant				
			Coccinellid beetles	Spiders	*Mirid bug Nesidiocoris* sp.	*Hoverfly Ischiodon* sp.	Reduviid bug
1st week	July	28	0.00	0.00	0.00	0.00	0.00
2nd week		29	0.00	0.00	0.00	0.10	0.00
3rd week		30	0.00	0.10	0.00	0.00	0.00
4th week	August	31	0.20	0.30	1.20	0.2	0.30
5th week		32	0.00	0.10	2.00	0.50	0.00
6th week		33	0.40	0.00	2.30	0.40	0.20
7th week		34	0.30	0.60	3.30	0.80	0.10
8th week	September	35	0.00	0.50	3.10	1.10	0.40
9th week		36	0.10	0.60	3.50	1.30	0.10
10th week		37	0.40	0.70	2.30	2.30	0.10
11th week		38	0.00	0.50	3.80	3.20	0.20
12th week		39	0.80	0.60	4.10	2.30	0.30
13th week		40	0.90	0.40	4.40	3.10	0.30
14th week		41	0.70	0.30	3.70	2.20	0.10
15th week		42	0.20	0.10	3.80	1.30	0.20
16th week		43	0.00	0.40	2.90	0.90	0.00
17th week	November	44	0.20	0.00	2.10	0.60	0.00

MSW-Mean Standard Week, LBB-Lady Bird Beetle

Table 3 VFSEN: Correlation between incidence of insect pests of tobacco and weather parameters during *Kharif* 2023

Name of the insect pest	Correlation coefficient(r)				
	Meteorological parameters				
	RF	Max.Temp.	Min.Temp.	RH-1	RH-2
Whitefly Bemisia tabaci	-0.901**	0.757**	-0.563*	-0.316 NS	-0.612**
Aphid Myzus persicae	-0.756**	0.689**	-0.648**	-0.424 NS	-0.547*
Tobacco caterpillar Spodoptera litura	-0.639**	0.445NS	-0.279 NS	-0.151 NS	-0.283 NS
Budworm/Capsule borer Helicoverpa armigera	-0.418 NS	0.693**	-0.725**	-0.772**	-0.723**
Semilooper	-0.606**	0.808**	-0.857**	-0.842**	-0.757**

RF-Rainfall, RH 1-Morningrelative humidity,RH2-Afternoonrelative humidity

*Significant at 5% level of significance
**Significantat1%levelof significance
NS-Non significant

Project No.: VFSEN 37 (Modified)

Research project title	**Validation of IPM modules against *Spodoptera litura* in FCV tobacco**
Objectives	▪ To evaluate the different modules for the management of *Spodoptera litura*in FCV Tobacco
Investigators	Prashantha C, T.M.Soumya & Shashikala S Kolakar
Year of start	2023**(Modified)**
Year of completion	2024
Location	ZAHRS, Shivamogga

Experimental details

Design: RCBD
Replications: Five
Season: *Kharif* 2023
Duration: 2 years
Variety: Sahyadri
Treatments: 4 modules
Plot size: 7m X 7 m

Results

- The overall mean population of *S. litura* indicated that, the Module-1 has recorded lowest larval population of 0.30 per plant which was followed by Module–3 and Module-2 with 0.36 and 0.71 larva per plant, respectively. However, untreated control recorded highest mean larval population of 1.78 per plant (Table 3 VFSEN 37).
- The overall mean number of *S. litura* damaged leaves indicated that, module-1 has recorded lowest number of damaged leaves per plant (0.60 per plant) followed by module-3 (0.71 per plant).However, untreated control recorded highest number of damaged leaves per plant (3.48 per plant) followed by module 2 (1.42 per plant).
- The overall mean number of damaged leaves indicated that, module-1 has recorded lowest number of damaged leaves per plant (6.05% damaged leaves) followed by module-3 (7.12% damaged leaves).However, untreated control recorded highest number of damaged leaves per plant (26.91% damaged leaves) followed by module-2 (12.64% damaged leaves).
- The overall mean number of natural enemies indicated that, untreated control recorded highest number of 1.09 natural enemies per plant and module-2 and module-1 recorded 0.98 and 0.86 number of natural enemies per plant, respectively. However, module-3 recorded lowest number of natural enemies per plant (0.29).
- Significant differences in the leaf yield were noticed among all the modules. Module-1 recorded highest green and cured leaf yield of 11003 and 1314 kg/ha, respectively, followed by module-3 (10119 kg/ha and 1208 kg/ha). Module-2 recorded 9196 kg/ha and 1098 kg/ha of green and cured leaf yield, respectively. Lowest green and cured leaf yield was recorded in untreated control (5891 kg/ha and 701 kg/ha).
- The higher cost benefit ratio of 1:2.2 was recorded in IPM module followed by chemical module (1: 2.0) and bio-intensive module (1: 1.8). However, lowest cost benefits ratio of1: 1.2 was recorded in untreated control

Salient findings/ Achievements

- Among the different modules evaluated, the Module-I was found to be most promising with lowest incidence of *S. litura* and highest percent reduction over control. Integration of castor as a trap crop, collection and destruction of *S. litura* egg mass, use of pheromone trap & bird perches and need based foliar spray of insecticides could protect FCV tobacco from *S. litura.*

Table 1 VFSEN 37: Details of the different modules for the management of *Spodoptera litura* in FCV Tobacco

Treatments	Modules	Particulars
M_1	Integrated	• Sowing of trap crop (Castor) 15 days before planting • Collection and destruction of egg masses • Installation of pheromone traps (Spodlure/ Litlure)@ 4/acre at 15 DAP& erection of bird perches @ 20/acre • Need based spraying of Azadirachtin 10000 ppm @ 2 ml/L, *Bt kurstaki* @ 1.5 g/L, Emamectin benzoate 5SG @ 0.5 g/L
M_2	Bio-intensive	• Spray of Azadirachtin 10000 ppm @ 2 ml/L 15 DAP • *Bt kurstaki* @ 1.5 g/L at 45 DAP • *S*NPV @250 LE/ha at 60 DAP and • *Beauveria bassiana* at 75 DAP
M_3	Chemical	• First spray - Novaluron 10 EC @ 1ml/L 15 DAP • Second spray -Emamectin benzoate 5SG @0.5 g/L 45 DAP • Third spray - Chlorantraniliprole 18.5 SC @0.3 ml/L at 60 DAP
M_4	Control	• Untreated Control

Table 2 VFSEN 37: Number of *Spodoptera litura* egg masses per plant during *Kharif* 2023

Modules	Mean number of *S. litura* egg masses per plant												Overall Mean (No. of *S. litura* egg masses/ plant)	Percent reduction over control
	MSW													
	28	29	30	31	32	33	34	35	36	37	38	39		
M1	0.00 (0.71)	0.08 (0.76)	0.08 (0.76)	0.04 (0.73)^{c}	0.04 (0.73)^{c}	0.04 (0.73)^{c}	0.12 (0.79)^{c}	0.20 (0.84)^{c}	0.08 (0.76)^{c}	0.08 (0.76)^{c}	0.04 (0.73)^{c}	0.04 (0.73)^{c}	0.07	92.22
M2	0.04 (0.73)	0.12 (0.79)	0.20 (0.84)	0.36 (0.93)^{b}	0.44 (0.97)^{b}	0.40 (0.95)^{b}	0.48 (0.99)^{b}	0.52 (1.01)^{b}	0.64 (1.07)^{b}	0.60 (1.05)^{b}	0.56 (1.03)^{b}	0.40 (0.95)^{b}	0.40	55.93
M3	0.04 (0.73)	0.04 (0.73)	0.12 (0.79)	0.28 (0.88)^{b}	0.32 (0.91)^{b}	0.36 (0.93)^{b}	0.44 (0.97)^{b}	0.48 (0.99)^{b}	0.60 (1.04)^{b}	0.56 (1.03)^{b}	0.56 (1.03)^{b}	0.44 (0.97)^{b}	0.35	60.74
M4	0.16 (0.81)	0.20 (0.84)	0.36 (0.93)	0.56 (1.03)^{a}	0.72 (1.10)^{a}	0.76 (1.12)^{a}	1.20 (1.30)^{a}	1.52 (1.42)^{a}	1.60 (1.45)^{a}	1.40 (1.38)^{a}	1.32 (1.35)^{a}	1.00 (1.22)^{a}	0.90	0.00
F value	NS	NS	NS	*	*	*	*	*	*	*	*	*	-	-
SEm±	0.003	0.007	0.01	0.02	0.02	0.02	0.02	0.05	0.04	0.04	0.03	0.02	-	-
CV (%)	10.23	14.04	11.59	14.48	12.53	11.28	9.79	15.65	14.49	13.28	10.74	11.61	-	-
CD@5%	0.008	0.02	0.03	0.06	0.07	0.06	0.06	0.15	0.14	0.16	0.10	0.07	-	-

Numbers in the parenthesis are square root transformed value

* Significant at (P≤0.05); MSW- Meteorological Standard Week

Table 3 VFSEN 37: Number of *Spodoptera litura* larvae per plant during *Kharif* 2023

Modules	Mean number of *S. litura* larvae per plant												Overall Mean (No. of *S. litura* larvae/ plant)	Percent reduction over control
	MSW													
	28	29	30	31	32	33	34	35	36	37	38	39		
M1	0.36 (0.93)^{c}	0.44 (0.97)^{c}	0.32 (0.91)^{c}	0.44 (0.97)^{c}	0.44 (0.97)^{c}	0.36 (0.93)^{c}	0.32 (0.91)^{c}	0.28 (0.88)^{c}	0.24 (0.86)^{c}	0.20 (0.84)^{c}	0.12 (0.79)^{c}	0.08 (0.76)^{c}	0.30	83.11
M2	0.68 (1.09)^{b}	0.72 (1.10)^{b}	0.60 (1.05)^{b}	0.68 (1.09)^{b}	0.80 (1.14)^{b}	0.76 (1.12)^{b}	0.84 (1.16)^{b}	0.72 (1.10)^{b}	0.80 (1.14)^{b}	0.68 (1.09)^{b}	0.68 (1.09)^{b}	0.60 (1.05)^{b}	0.71	59.85
M3	0.40 (0.95)^{c}	0.44 (0.97)^{c}	0.40 (0.95)^{c}	0.48 (0.99)^{c}	0.52 (1.01)^{c}	0.40 (0.95)^{c}	0.40 (0.95)^{c}	0.32 (0.91)^{c}	0.32 (0.91)^{c}	0.24 (0.86)^{c}	0.20 (0.84)^{c}	0.16 (0.81)^{c}	0.36	79.92
M4	1.04 (1.24)^{a}	0.92 (1.19)^{a}	0.96 (1.21)^{a}	1.00 (1.22)^{a}	1.24 (1.32)^{a}	1.36 (1.36)^{a}	1.92 (1.56)^{a}	2.40 (1.70)^{a}	3.04 (1.88)^{a}	3.04 (1.88)^{a}	1.56 (1.43)^{a}	1.04 (1.24)^{a}	1.78	0.00
F value	*	*	*	*	*	*	*	*	*	*	*	*	-	-
SEm±	0.04	0.05	0.03	0.04	0.05	0.04	0.05	0.05	0.06	0.05	0.04	0.03	-	-
CV (%)	13.17	16.39	13.21	14.60	13.98	11.62	13.11	12.87	12.08	10.53	14.26	12.28	-	-
CD@5%	0.11	0.14	0.10	0.13	0.14	0.12	0.16	0.17	0.18	0.15	0.13	0.08	-	-

Numbers in the parenthesis are square root transformed value

* Significant at (P≤0.05); MSW- Meteorological Standard Week

Table 4 VFSEN 37: Number of *Spodoptera litura* damaged leaves per plant during *Kharif* 2023

Modules	Mean number of damaged leaves per plant												Overall Mean (No. of damaged leaves/ plant)	Percent reduction over control
	MSW													
	28	29	30	31	32	33	34	35	36	37	38	39		
M1	0.72 (1.10)^{c}	0.88 (1.17)^{b}	0.64 (1.07)^{c}	0.88 (1.17)^{b}	0.88 (1.17)^{c}	0.72 (1.10)^{c}	0.64 (1.07)^{c}	0.56 (1.03)^{c}	0.48 (0.99)^{c}	0.40 (0.95)^{c}	0.24 (0.86)^{c}	0.16 (0.81)^{c}	0.60	82.74
M2	1.28 (1.33)^{b}	1.44 (1.39)^{a}	1.20 (1.30)^{b}	1.32 (1.35)^{b}	1.60 (1.45)^{b}	1.52 (1.42)^{b}	1.68 (1.48)^{b}	1.44 (1.39)^{b}	1.60 (1.45)^{b}	1.36 (1.36)^{b}	1.36 (1.36)^{b}	1.20 (1.30)^{b}	1.42	59.25
M3	0.80 (1.14)^{c}	0.88 (1.17)^{b}	0.80 (1.14)^{c}	0.96 (1.21)^{b}	1.04 (1.24)^{c}	0.80 (1.14)^{c}	0.80 (1.14)^{c}	0.64 (1.07)^{bc}	0.64 (1.07)^{c}	0.48 (0.99)^{c}	0.40 (0.95)^{c}	0.32 (0.91)^{c}	0.71	79.48
M4	2.08 (1.61)^{a}	1.84 (1.53)^{a}	1.92 (1.56)^{a}	2.00 (1.58)^{a}	2.48 (1.73)^{a}	2.72 (1.79)^{a}	3.76 (2.06)^{a}	4.64 (2.27)^{a}	6.08 (2.57)^{a}	6.08 (2.57)^{a}	4.28 (2.19)^{a}	3.84 (2.08)^{a}	3.48	0.00
F value	*	*	*	*	*	*	*	*	*	*	*	*	-	-
SEm±	0.05	0.05	0.05	0.07	0.07	0.09	0.09	0.08	0.12	0.13	0.10	0.08	-	-
CV (%)	8.95	9.33	10.62	11.47	10.45	15.08	12.63	10.36	12.24	14.32	14.00	13.34	-	-
CD@5%	0.07	0.16	0.17	0.20	0.22	0.29	0.30	0.26	0.37	0.41	0.30	0.25	-	-

Numbers in the parenthesis are square root transformed value

* Significant at (P≤0.05); MSW- Meteorological Standard Week

Table 5 VFSEN 37: Per cent leaves damaged per plant during *Kharif* 2023 by *Spodoptera litura*

Modules	Mean per cent leaves damaged per plant												Overall Mean (% leaves damaged/ plant)	Percent reduction over control
	MSW													
	28	29	30	31	32	33	34	35	36	37	38	39		
M1	24.00 (29.33) c	0.88 (29.33) b	12.80 (20.96) c	8.80 (17.26) b	7.33 (15.71)c	4.80 (12.66)c	4.00 (11.54)c	3.11 (10.16)c	3.00 (9.97)c	2.00 (8.13)c	1.09 (6.00)c	0.73 (4.89)c	6.05	77.54
M2	42.67 (40.78) b	1.44 (48.00) a	24.00 (29.33) b	13.20 (21.30) b	13.33 (21.42) b	10.13 (18.56) b	10.50 (18.91)b	8.00 (16.43)b	10.00 (18.43) b	6.80 (15.12)b	6.18 (14.40) b	5.45 (13.51)b	12.64	53.03
M3	26.67 (31.09)c	0.88 (29.33) b	16.00 (23.58) c	9.60 (18.05) b	8.67 (17.12)c	5.33 (13.35)c	5.00 (12.92)c	3.56 (10.87)b c	4.00 (11.54)c	2.40 (8.91)c	1.82 (7.75)c	1.45 (6.93)c	7.12	73.56
M4	69.33 (56.37) a	1.84 (61.33)a	38.40 (38.29) a	20.00 (26.57) a	20.67 (27.04) a	18.13 (25.20) a	23.50 (29.00) a	25.78 (30.51)a	38.00 (38.06) a	30.40 (33.46) a	19.45 (26.17) a	17.45 (24.69)a	26.91	0.00
F value	*	*	*	*	*	*	*	*	*	*	*	*	-	-
SEm±	0.07	0.08	0.07	0.08	0.07	0.08	0.10	0.08	0.13	0.13	0.10	0.05	-	-
CV (%)	13.02	14.23	14.46	14.20	11.05	12.67	13.34	10.36	13.28	14.33	14.00	9.30	-	-
CD@ 5%	0.22	0.25	0.23	0.25	0.23	0.25	0.32	0.26	0.40	0.41	0.30	0.18	-	-

Numbers in the parenthesis are arcsine transformed value

* Significant at (P≤0.05); MSW- Meteorological Standard Week

Table 6 VFSEN 37: Effect of different IPM modules on natural enemies in FCV tobacco during *Kharif* 2023

Modules	Mean number of natural enemies per plant												Mean
	MSW												
	28	29	30	31	32	33	34	35	36	37	38	39	
M1	0.12 (0.79)	0.24 (0.86)^{a}	0.36 (0.93)^{b}	0.56 (1.03)^{a}	0.64 (1.07)^{b}	0.68 (1.09)^{b}	0.92 (1.19)^{a}	1.00 (1.22)^{b}	1.24 (1.32)^{a}	1.44 (1.39)^{a}	1.48 (1.41)^{b}	1.64 (1.46)^{a}	0.86
M2	0.12 (0.79)	0.24 (0.86)^{a}	0.40 (0.95)^{b}	0.60 (1.05)^{a}	0.72 1.10)^{ab}	0.92 (1.19)^{ab}	1.12 (1.27)^{a}	1.20 (1.30)^{b}	1.44 (1.39)^{a}	1.60 (1.45)^{a}	1.68 (1.48)^{a}	1.76 (1.50)^{a}	0.98
M3	0.04 (0.73)	0.08 (0.76)^{b}	0.12 (0.79)^{c}	0.16 (0.81)^{b}	0.12 0.79)^{c}	0.24 (0.86)^{c}	0.16 (0.81)^{b}	0.36 (0.93)^{c}	0.36 (0.93)^{b}	0.60 (1.05)^{b}	0.56 (1.03)^{c}	0.64 (1.07)^{b}	0.29
M4	0.12 (0.79)	0.24 (0.86)^{a}	0.52 (1.01)^{a}	0.72 (1.10)^{a}	0.88 1.17)^{a}	1.08 (1.26)^{a}	1.16 (1.29)^{a}	1.56 (1.44)^{a}	1.60 (1.45)^{a}	1.64 (1.46)^{a}	1.76 (1.50)^{a}	1.80 (1.52)^{a}	1.09
F value	NS	*	*	*	*	*	*	*	*	*	*	*	-
SEm±	0.006	0.01	0.02	0.02	0.03	0.04	0.04	0.07	0.06	0.06	0.06	0.06	-
CV (%)	13.70	14.26	13.32	9.22	11.58	11.46	9.57	14.38	11.18	9.54	9.61	9.83	-
CD@5%	0.02	0.04	0.06	0.06	0.09	0.12	0.11	0.20	0.18	0.17	0.18	0.20	-

Numbers in the parenthesis are square root transformed value

* Significant at (P≤0.05); MSW- Meteorological Standard Week

Table 7 VFSEN 37: Effect of IPM modules on yield of FCV tobacco during *Kharif* 2023

Modules	Green leaf yield (kg/ha)	Per cent increase in green leaf yield over control	Cured leaf yield (kg/ha)	Per cent increase in cured leaf yield over control
M1	11003	86.78	1314	87.41
M2	9196	56.10	1098	56.64
M3	10119	71.78	1208	72.31
M4	5891	-	701	-

Table 8 VFSEN 37: Cost benefit ratio of different modules against *Spodoptera litura* during *Kharif* 2023

Modules	Yield (Kg/ha)	Cost of protection (Rs. /ha)	Total cost of production (Rs. /ha)	Gross returns (Rs. /ha)	Net returns (Rs. /ha)	B:C
M1	1314	2339	159709	354780	195071	2.2
M2	1098	2940	160310	296460	136150	1.8
M3	1208	5564	162934	326160	163226	2.0
M4	701	0.00	157370	189270	31900	1.2

II. PLANT PATHOLOGY

A. *BIDI* TOBACCO

ANAND

Project No.: BDAPP 126

Research project title	**Monitoring of resistance development in *Pythium aphanidermatum* to fungicides**
Objectives	▪ A) Monitoring of resistance in *P. aphanidermatum* against Metalaxyl + Mancozeb ▪ B) Monitoring of resistance in *P. aphanidermatum* against azoxystrobin
Investigators	Y. M. Rojasara & N.A. Bhatt
Year of start	A) 2001-02 B) 2015-16
Year of completion	Long term
Location	BTRS, AAU, Anand

Damping-off caused by *Pythium aphanidermatum* is an economically important disease of bidi tobacco in nursery. Bordeaux mixture at 0.6 % gives reasonable control of the disease. Metalaxyl + Mancozeb and Azoxystrobin are found to be effective against the disease and is recommended for management in the nursery in Gujarat. Since both being systemic fungicides, there exists a possibility for development of resistance in the target pathogen to the product. In order to monitor this phenomenon in the pathogen, this long-term program has been planned.

Treatments:

1.	Metalaxyl + Mancozeb @ 2.16 kg ai/ha (i.e. 68 WP @ 3.17 kg/ha); 2-3 drenching as and when required starting from disease development…. …	(RDMZ)
2.	Bordeaux mixture (BM) at 0.6%; 4 to 5 drenching as and when required starting from disease development. …. …. ….	(BM)
3.	Control - No fungicide treatment. …. …. … … ….	(CON)

Methodology

Six beds each of 1.44 m^2 size for each of the above three treatments seeded with susceptible *bidi* tobacco variety Anand 119 were maintained and received respective treatments. Per cent incidence of damping-off in each case was worked out at the end of the season/experiment. The pathogen, which survived in the fungicide treated beds, was subjected to test against the fungicide, with three different concentrations using poisoned food technique in the laboratory and appropriate conclusion was drawn with respect to resistance development in the fungus.

RESULTS

Results (Table BDAPP 126 A_1) revealed that in nursery conditions 14 per cent damping-off disease incidence in comparison with control was recorded in the treatment of Metalaxyl + Mancozeb applied @ 2.16 kg/ha.

The pathogen, which survived in Metalaxyl +Mancozeb treated beds, was further screened in laboratory against the fungicide with three different concentrations (Table BDAPP 126 A_2) and 100 per cent inhibition of the pathogen was observed after 72 hrs. This showed that resistance has not been developed in the pathogen.

Table BDAPP 126 A_1:

Treatment	No. of damped-off seedlings/m²	Per cent disease incidence in comparison with control	Transplantable seedlings/m²
Metalaxyl+Mancozeb	22	14	610
Bordeaux Mixture	30	18	546
Control	162		358

Table BDAPP 126 A_2:

Sr. No.	Treatments Concentrations	Mycelial growth in mm (Average of 06 Plates)			Per cent inhibition of pathogen isolated from diseased seedlings after 72 hrs
		24 hours	48 hours	72 hours	
01	Metalaxyl+Mancozeb 75 ppm	00	00	00	100
02	Metalaxyl+Mancozeb150 ppm	00	00	00	100
03	Metalaxyl+Mancozeb300 ppm	00	00	00	100
04	Control (Without Fungicide)	55	90	90	00

Salient findings/Achievements

- Resistance has not been developed in *Pythium aphanidermatum* to Metalaxyl + Mancozeb

Treatments

1.	Azoxystrobin 23 SC @ 0.023% (230g a.i./ha i.e. 10 ml/10 l water / 100m²) 2 -3 spray drenching	(AZO)
2.	Azoxystrobin (18.2) + Difenoconazole (11.4) 29.6 SC (372 g a.i./ha i.e. 12.6 ml/10 l water/100m²) 2-3 spray drenching	(AZO+DIF)
3.	Control - No fungicide treatment	(CON)

Methodology: As above in Metalaxyl + Mancozeb

RESULTS

Results (Table BDAPP 126 B_1) revealed that in nursery conditions 25 and 18 per cent damping-off disease incidence in comparison with control were recorded in the treatment of Azoxystrobin and Azoxystrobin + Difenoconazole, respectively.

The pathogen, which survived in Azoxystrobin and Azoxystrobin + Difenoconazole treated beds, were further screened in laboratory against the fungicides with three different concentrations (Table BDAPP 126 B_2) and 100 per cent inhibition of the pathogen were observed in both the fungicides after 72 hrs. This showed that resistance has not been developed in the pathogen.

Table BDAPP 126 B_1:

Sr. No.	Treatment	No. of damped-off seedlings/m^2	Per cent disease incidence in comparison with control	Transplantable seedlings/m^2
01	Azoxystrobin	35	20	634
02	Azoxystrobin +Difenoconazole	26	15	690
03	Control - No fungicide	168		360

Table BDAPP 126 B_2:

Sr. No.	Treatment / Concentration		Mycelial growth in mm (Average of 06 Plates)			Per cent inhibition of pathogen isolated from diseased seedlings after 72 hrs.
			24 hours	48 hours	72 hours	
01	Azoxystrobin	500 ppm*	00	00	00	100
02	Azoxystrobin	1000 ppm	00	00	00	100
03	Azoxystrobin	2000 ppm	00	00	00	100
04	Azoxystrobin + Difenoconazole	650 ppm	00	00	00	100
05	Azoxystrobin + Difenoconazole	1300 ppm	00	00	00	100
06	Azoxystrobin + Difenoconazole	2600 ppm	00	00	00	100
07	Control (Without Fungicide)		55	90	90	00

*based on fungicide product

Salient findings/Achievements

- Resistance has not been developed in *Pythium aphanidermatum* to azoxystrobin

Project No.: BDAPP 128

Research project title	**Screening for resistance to damping-off and root-knot in tobacco (Joint study by Plant Pathology and Plant Breeding sections)**
Objectives	▪ To identify damping-off and root-knot resistant/tolerant genotype(s)
Investigators	Y. M. Rojasara
Year of start	2002-03
Year of completion	Long term
Location	BTRS, AAU, Anand

Damping-off of tobacco caused by *Pythium aphanidermatum* is an economically important disease of nursery. The severity of pre and post-emergence damping-off leads to less seedling emergence. Under most congenial environmental conditions, the nursery gets completely destroyed. Due to relative ease in management of the disease by Metalaxyl + Mancozeb, due attention has not been paid for searching for resistance/tolerance in tobacco genotypes. There exists some variability but only preliminary and limited work to find differential response in tobacco genotypes has been done so far. Ultimately, it is essential to evolve damping-off resistant/tolerant cultivars to keep the cost of nursery raising at low level.

Root-knot incited by nematode *Meloidogyne incognita* and *M. javanica* is another important problem both in nursery and field. Losses due to root-knot nematode (RKN) to the tune of 50 % have been reported in *bidi* tobacco. Although effective technologies of RKN management in nursery have been evolved, concerted efforts need to be made so that its management in field crop is achieved to a satisfactory level. Finding resistance in cultivars would be a most appropriate proposition.

Methodology: Twenty numbers of tobacco genotypes/lines including check were evaluated separately for damping-off and root-knot diseases employing standard procedures in nursery and controlled conditions.

RESULTS

Results (Table 1 BDAPP128) revealed that out of 20 genotypes/lines, thirteen and seven line showed moderately susceptible and susceptible reaction, respectively to damping-off disease in the nursery conditions. Out of 20genotypes/lines (Table 2 BDAPP 128), One moderately resistant, one moderately susceptible, thirteen susceptible, four highly susceptible and one line showed highly resistant ABT 10 (Check), reaction to RKN in pots.

Salient findings/Achievements

- Thirteen and seven line showed moderately susceptible and susceptible reaction, respectively to damping-off disease in the nursery conditions.
- One moderately resistant, one moderately susceptible, thirteen susceptible, four highly susceptible and one line showed highly resistant ABT 10 (Check), reaction to RKN in pots.

Table 1 BDAPP 128: Reaction of different genotypes to damping-off disease in the nursery conditions

S.No.	Culture/ variety / line	Per cent damped-off seedlings	Reaction
1	ABD 275	40	MS
2	ABD 276	37	MS
3	ABD 277	49	MS
4	ABD 278	46	MS
5	ABD 279	45	MS
6	ABD 280	45	MS
7	ABD 281	45	MS
8	ABD 282	63	S
9	ABD 283	54	S
10	ABD 284	58	S
11	ABD 285	42	MS
12	ABD 286	52	S
13	ABD 287	46	MS
14	ABD 288	60	S
15	A 119 (C)	58	S
16	GT 7 (C)	50	MS
17	GABT 11 (C)	49	MS
18	MRGTH 1 (C)	47	MS
19	GABTH 2 (C)	53	S
20	ABT 10 (C)	44	MS

Table 2 BDAPP 128: Reaction of genotypes to root-knot nematode

S. No.	Culture/ variety / line	Root-knot index (0-5)*			Index range	Reaction on maximum index
		Nursery	Sick field	Pot		
1.	ABD 275	2.00	2.60	2.40	1-3	MS
2.	ABD 276	2.80	3.20	4.00	4	S
3.	ABD 277	2.64	3.00	3.60	3-4	S
4.	ABD 278	1.76	2.60	2.80	2-3	MS
5.	ABD 279	1.20	2.00	3.00	2-4	MS
6.	ABD 280	2.60	1.40	3.60	3-5	S
7.	ABD 281	2.88	1.80	4.20	4-5	HS
8.	ABD 282	2.20	1.80	3.20	2-4	S
9.	ABD 283	3.48	1.20	3.00	2-4	MS
10.	ABD 284	1.36	1.40	2.60	2-3	MS
11.	ABD 285	1.40	1.00	3.00	2-4	MS
12.	ABD 286	2.52	1.20	2.80	2-4	MS
13.	ABD 287	1.88	1.80	2.20	1-3	MS
14.	ABD 288	1.40	2.40	1.20	0-2	MR
15.	A 119 (C)	1.80	4.20	2.20	1-3	MS
16.	GT 7 (C)	2.80	4.20	2.60	2-3	MS
17.	GABT 11 (C)	2.96	2.60	2.20	1-3	MS
18.	MRGTH 1 (C)	2.20	2.40	2.60	1-4	MS
19.	GABTH 2 (C)	2.88	3.40	2.60	2-4	MS
20.	ABT 10 (C)	0.00	0.00	0.00	0	HR

*0=Free, 5=Maximum disease intensity, HR = Highly Resistant; R= Resistant; MR= Moderately Resistant; MS =Moderately Susceptible; S= Susceptible; HS = Highly Susceptible.

Project No.: BDAPP 686

Research project title	**Impact Of Organic Amendments and Varieties on Incidence of Root-Knot Nematode in *Bidi* Tobacco**
Objectives	▪ Impact of organic amendments and varieties on incidence of root-knot nematode in *bidi* tobacco
Investigators	Y. M. Rojasara
Year of start	2023-24
Year of completion	2025-26
Location	BTRS, AAU, Anand

Design : RBD (Factorial) Replications : 3
Variety : ABT 10 & A 119 Plot Size : Gross: 3.6 x 7.5 m
Net: 1.8 x 6.0 m

Treatment Details:

(A) Factor A: Varieties

1. ABT 10
2. A 119

(B) Factor B: Organic amendments

1. Poultry manure 3 ton/ha (PM)
2. Farm yard manure 10 ton/ha (FYM)
3. Vermicompost 4 ton/ha (VC)
4. Tobacco spent 2 ton/ha (TS)
5. Control (Con)

RESULTS

The results on impact of organic amendments and varieties on incidence of root-knot nematode in *bidi* tobacco indicated that the significant difference was found in varieties among cured leaf yield and root-knot index. Variety ABT-10 gave 2373 kg/ha yield and 0.00 root-knot index (RKI) as compared to A-119 which gave 1427 kg/ha with 3.87 RKI.

While in case of organic amendments, maximum cured leaf yield was found in the treatment of poultry manure (2144 kg/ha) which were at par with farm yard manure (2039 kg/ha) and vermicompost (1972 kg/ha). The lowest root-knot index was recorded from the treatment with poultry manure (1.48 RKI) which was followed by farm yard manure (1.53 RKI).

With respect to interaction effect between varieties and organic amendments, different treatment combinations failed to exert their significant effect on tobacco cured leaf yield but significant difference were found for root-knot index.

Salient findings/Achievements

- Variety ABT-10 gave 2373 kg/ha yield and 0.00 root-knot index (RKI) as compared to A-119 which gave 1427 kg/ha with 3.87 RKI.
- Maximum cured leaf yield was found in the treatment of poultry manure (2144 kg/ha) which were at par with farm yard manure (2039 kg/ha) and vermicompost (1972 kg/ha). The lowest root-knot index was recorded from the treatment with poultry manure (1.48 RKI) which was followed by farm yard manure (1.53 RKI).

Table 1 BDAPP 686: Effect of varieties and organic amendments on yield and root-knot index of *bidi* tobacco (2023-24)

Treatment	Cured leaf Yield (kg/ha)	Root-knot index (0-5)
A. Varieties (V)		
ABT 10	2373	1.00 (0.00)*
A 119	1427	2.19 (3.87)
S. Em. ±	52.00	0.03
C.D. 0.05	154.50	0.09
B. Organic amendments (OM)		
Poultry manure (PM)	2144.20	1.48 (1.43)
Farm yard manure (FYM)	2039.26	1.53 (1.65)
Vermicompost (VC)	1972.25	1.68 (2.28)
Tobacco spent (TS)	1668.89	1.60 (1.97)
Control	1673.33	1.69 (2.33)
S. Em. ±	82.22	0.05
C.D. 0.05	244.29	0.15
Int. V x OM	NS	0.21
C.V. %	10.60	7.53

*Figure in parenthesis is original value, while outside is $\sqrt{x+1}$transformation

Table 2BDAPP 686: Interaction effect of varieties and organic amendments on yield and root-knot index of *bidi* tobacco (2023-24)

V / OM	Cured leaf yield (kg/ha)		Root-knot index (0-5)	
	ABT 10	A 119	ABT 10	A 119
Poultry manure (PM)	2564.44	1723.95	1.00 (0.00)*	1.96 (2.87)
Farm yard manure (FYM)	2445.43	1633.09	1.00 (0.00)	2.07 (3.30)
Vermicompost (VC)	2440.30	1504.20	1.00 (0.00)	2.36 (4.57)
Tobacco spent (TS)	2230.62	1107.16	1.00 (0.00)	2.21 (3.93)
Control	2182.22	1164.44	1.00 (0.00)	2.38 (4.67)
S.Em.	116.28		0.07	
CD 0.05	NS		0.21	

*Figure in parenthesis is original value, while outside is $\sqrt{x+1}$transformation

Table 3 BDAPP 686: Effect of variety and organic amendments on root-knot nematode population (2023-24)

V / OM	INITIAL		FINAL	
	ABT 10	A 119	ABT 10	A 119
Poultry manure (PM)	75	72	178	300
Farm yard manure (FYM)	73	76	183	297
Vermicompost (VC)	77	74	178	317
Tobacco spent (TS)	70	77	187	376
Control	88	95	212	435

Project No.: BDAPP 811

Research project title	Validation of prediction model for frog-eye spot disease
Objectives	▪ To validate the model developed for frog-eye spot (FES) disease in nursery and field
Investigators	Y. M. Rojasara
Year of start	2016-17
Year of completion	Long term
Location	BTRS, AAU, Anand

Frog-eye spot disease caused by *Cercospora nicotianae* Ellis & Everh. on *bidi* tobacco is an endemic in nature. It occurs every year in moderate to severe form starting from nursery to field crop. Due to change in monsoon pattern and weather conditions, it was desirable to study the incidence and severity of the disease in relation to agro-meteorological parameters with ultimate goal to manage the disease and as outcome models were developed to predict the disease.

Methodology: Six beds each of 1.2 x 1.2m size in nursery and two hundred fifty square meter area in field of *bidi* tobacco cv. Anand 119 were earmarked and kept unprotected for this investigation. Weekly observations of frog-eye spot disease, using 0-5 scale, were recorded starting from the disease in nursery till the end of the disease in field crop. For recording observations, three blocks each in nursery and field were made and observations of 10 randomly selected seedlings/plants from each block were recorded in every standard week. Weather parameters such as daily temperature, relative humidity, rainfall etc. were correlated with the incidence and occurrence of the disease.

RESULTS

The results on prediction of FES disease in nursery and field revealed that according to the model it was true upto 70% and 78.94% in nursery and field, respectively.

Salient findings/Achievements

- Prediction model on FES disease was true upto 70% and 78.94% in nursery and field, respectively

Table 1 BDAPP 811: Validation of prediction model for FES (2023-2024): NURSERY

	Average value of preceding standard week						Value recorded and calculated for prediction				
Std. week	BSS (hrs.)	RDAY (no.)	MAX T (°C)	MIN T (°C)	VP_1	Total RF (mm)	FES index observed	Actual FES COD	Calculated value	Validation value	Prediction for FES occurrence
31	-	5.0	-	26.3	24.4	-	0	0	1.0	1	No
32	-	2.0	-	26.6	23.1	-	0	0	1.0	1	No
33	-	0.0	-	26.5	22.7	-	0	0	1.0	1	No
34	-	0.0	-	26.1	22.3	-	0.36	1	1.0	1	Yes
35	-	1.0	-	25.8	22.2	-	0.45	1	1.0	1	Yes
36	-	0.0	-	25.6	21.9	-	0.86	1	1.0	1	Yes
37	-	2.0	-	26.3	21.9	-	1.12	1	1.0	1	Yes
38	-	2.0	-	26.2	22.8	-	1.2	1	1.0	1	Yes
39	-	6.0	-	25.7	24.3	-	1.1	1	1.0	1	Yes
40	-	3.0	-	25.7	23.8	-	0.8	1	1.0	1	Yes
FIELD											
38	5.1	-	32.4	26.2	-	785	0	0	0.7	1	No
39	3.3	-	30.8	25.7	-	799.8	0	0	0.6	1	No
40	5.9	-	33.5	25.7	-	829.2	0.22	1	0.6	1	Yes
41	9.9	-	34.5	23.7	-	829.2	0.2	1	0.8	1	Yes
42	9.8	-	34.6	22.9	-	829.2	0.43	1	0.7	1	Yes
43	9.0	-	35.5	23.1	-	829.2	0.45	1	0.5	1	Yes
44	9.6	-	36.0	20.6	-	829.2	0.28	1	0.3	0	No
45	9.8	-	35.1	19.1	-	829.2	0	0	0.4	0	Yes
46	9.4	-	35.1	19.5	-	829.2	0	0	0.4	0	Yes
47	9.2	-	32.5	17.2	-	829.2	0	0	0.5	1	No
48	8.9	-	32.0	18.7	-	829.2	0.68	1	0.6	1	Yes
49	4.2	-	26.8	18.8	-	839.8	0.54	1	0.7	1	Yes
50	6.6	-	27.1	19.0	-	852.6	1.2	1	0.9	1	Yes
51	9.2	-	29.3	16.8	-	852.6	0.58	1	0.8	1	Yes
52	6.5	-	27.2	15.1	-	852.6	0.54	1	0.6	1	Yes
01	7.8	-	25.4	13.9	-	852.6	0.52	1	0.9	1	Yes
02	7.2	-	25.7	14.8	-	852.6	0.4	1	0.8	1	Yes
03	6.5	-	27.2	16.4	-	852.6	0.43	1	0.7	1	Yes
04	9.4	-	27.6	11.8	-	852.6	0.62	1	0.7	1	Yes

Yes= Validation confirmed; No= Validation deferred

Project No.: BDAPP 813

Research project title	**Evaluation of fungicides against frog-eye leaf spot and alternaria leaf spot in *bidi* tobacco**
Objectives	▪ To manage Frog-Eye leaf spot and Alternaria leaf spot in *bidi* tobacco with fungicides
Investigators	Y. M. Rojasara & N.A. Bhatt
Year of start	2022-23
Year of completion	2025-26
Location	BTRS, AAU, Anand

Frog-eye left spot disease caused by *Cercospora nicotianae* Ellis & Everh. on *bidi* tobacco is an endemic in nature. It's regular disease occurs in moderate to severe form starting from nursery to field crop. Due to change in monsoon pattern and weather conditions, it was desirable to study the incidence and severity of the disease in relation to agro-meteorological parameters with ultimate goal to manage the disease and as outcome models were developed to predict the disease.

Design: RBD	Replication: 3 (Three)
Variety: GT 7	Spacing: 90 x 75 cm
Plot size: Gross: 3.6 x 7.5 m	Net : 1.8 x 6.0 m

Treatments:

S.No.	Treatments	Conc. (%)	g a.i. /ha	Quantity of formulation required (g/10 litre water)
1	Carbendazim 12% + Mancozeb 63% WP	0.20	1000	26.25
2	Carbendazim 12% + Mancozeb 63% WP	0.26	1312.5	35.00
3	Carbendazim 12% + Mancozeb 63% WP	0.33	1650	43.75
4	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.329	164.81	11.25
5	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.044	219.75	15.00
6	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.0549	275	18.75
7	Zineb 68% + Hexaconazole 4% WP	0.108	540	15.00
8	Zineb 68% + Hexaconazole 4% WP	0.144	720	20.00
9	Zineb 68% + Hexaconazole 4% WP	0.18	900	25.00
10	Zineb 75% WP	0.144	1.125	20.00
11	Control			

Observations recorded:

1. Brown spot disease index (0-5)
2. Frog-eye spot disease index (0-5)
3. Cured leaf yield (kg/ha)

RESULTS

The results on evaluation of fungicides against frog-eye leaf spot and *Alternaria* leaf spot in *bidi* tobacco (Table.1) indicate that foliar spray of azoxystrobin 11% + tebuconazole 18.3% @ 0.0549 per cent immediately after appearance of the disease followed by another spray at 15 days interval recorded minimum per cent disease index (PDI) of 6.67 which was at par with Azoxystrobin 11% + Tebuconazole 18.3% @ 0.04395% (9.90 PDI) followed by Zineb 68% + Hexaconazole 4% @ 0.18 per cent (12.30 PDI). Among the fungicides, the performance of Zineb 75% @ 0.144 per cent (20.41 PDI) and Carbendazim 12% + Mancozeb 63% @ 0.20 and 0.26 per cent (20.07 and 19.22 PDI, respectively) in terms of checking the incidence of the disease was inferior. Maximum disease incidence was noticed in untreated plots (27.49 PDI).

The data on yield parameters revealed that cured leaf yield was maximum (2372 kg/ha) in Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0329 treatment followed by Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0549 (2339 kg/ha), Carbendazim 12% + Mancozeb 63% @ 0.26 per cent (2249 kg/ha), Azoxystrobin 11% + Tebuconazole 18.3% @ 0.04395 per cent (2207 kg/ha) and Zineb 68% + Hexaconazole 4% @ 0.144 per cent (2198 kg/ha). There was no significant difference of cured leaf yield between the treatments. The incidence of frog-eye spot was negligible and not destructive to the crop.

Salient findings/Achievements

- The minimum per cent disease index (PDI) was recorded in the treatment of Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0549 per cent (6.67 PDI) which was at par with Azoxystrobin 11% + Tebuconazole 18.3% @ 0.04395 per cent (9.90 PDI) followed by Zineb 68% + Hexaconazole 4% @ 0.18 per cent (12.30 PDI).

- The cured leaf yield was maximum (2372 kg/ha) in Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0329 treatment followed by Azoxystrobin 11% + Tebuconazole 18.3% @ 0.0549 (2339 kg/ha), Carbendazim 12% + Mancozeb 63% @ 0.26 per cent (2249 kg/ha), Azoxystrobin 11% + Tebuconazole 18.3% @ 0.04395 per cent (2207 kg/ha) and zineb 68% + Hexaconazole 4% @ 0.144 per cent (2198 kg/ha).

Table 1 BDAPP 813: Efficacy of fungicides against Frog-Eye Leaf spot and *Alternaria* leaf spot in *bidi* tobacco

Sr. no.	Treatments	Conc. (%)	PDI		Percent reduction over control	Cured leaf yield (kg/ha)
			ALS	FES	ALS	
1	Carbendazim 12% + Mancozeb 63% WP	0.20	26.62^{ab} (20.07)*	14.15^{ab} (5.98)	23.47	1913^{a}
2	Carbendazim 12% + Mancozeb 63% WP	0.26	26.00^{ab} (19.22)	14.47^{ab} (6.240)	26.16	2249^{a}
3	Carbendazim 12% + Mancozeb 63% WP	0.33	22.15^{bc} (14.21)	14.89^{ab} (6.60)	42.00	2183^{a}
4	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.329	21.04^{bcd} (12.89)	13.44^{ab} (5.41)	46.17	2372^{a}
5	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.04395	18.34^{cd} (9.90)	14.18^{ab} (6.00)	55.63	2207^{a}
6	Azoxystrobin 11% + Tebuconazole 18.3% SC	0.0549	14.96^{d} (6.67)	12.65^{b} (4.80)	65.85	2339^{a}
7	Zineb 68% + Hexaconazole 4% WP	0.108	21.35^{bcd} (13.25)	14.52^{ab} (6.29)	45.02	1882^{a}
8	Zineb 68% + Hexaconazole 4% WP	0.144	21.30^{bcd} (13.19)	14.12^{ab} (5.95)	45.22	2198^{a}
9	Zineb 68% + Hexaconazole 4% WP	0.18	20.53^{bcd} (12.30)	15.19^{a} (6.86)	48.06	2025^{a}
10	Zineb 75% WP	0.144	26.86^{ab} (20.41)	14.86^{ab} (6.58)	22.40	1902^{a}
11	Control	-	31.32^{a} (27.01)	15.23^{a} (6.90)	-	2050^{a}
	S. Em. $\pm$		1.96	0.68		145.57
	C.V.%		14.88	8.18		11.89

*Figures in parentheses are angular re-transformed values, ALS- Alternaria leaf spot, FES- Frog-eye spot

XVIII. Final Report of the Concluded Research Projects

CONCLUDED PROJECTS

RESULTS OF CONCLUDED PROJECTS

CROP PRODUCTION

FCV TOBACCO

HUNSUR

Project No.: VFHAG 17

Research project title	**Integrated management of *Orobanche* in FCV tobacco in KLS**
Objectives	▪ To find out the effect of integrated management practices on *Orobanche* infestation and growth ▪ To study the effect of integrated management practices of *Orobanche* on tobacco yield and quality
Investigators	M. Mahadevaswamy
Year of start	2021-2022
Year of completion	2023-2024
Location	ICAR-CTRI RS, Hunsur/ Farmers field

Treatments: 07

T1:	Neem cake application at 30 DAP + Hand removal of *Orobanche*
T2:	Neem cake application at 30 DAP + PE application of Neem oil on *Orobanche* spikes
T3:	Neem cake application at 30 DAP+ PE application of Pongamia oil on *Orobanche* spikes
T4:	Neem cake application at 30 DAP +PE application Paraquat on *Orobanche* Spikes
T5:	Neem cake application at 30 DAP +PE application of Imazethapyr on *Orobanche* Spikes
T6:	Hand removal of *Orobanche*
T7:	Non removal of *Orobanche*

RESULTS

Field Experiment was taken up to assess the effectiveness of various integrated weed management practices for the control of *Orobanche* in FCV Tobacco in KLS during the 2023-24 crop season in farmer's field location as per the technical programme. The crop was planted during the first week of May. However During the crop season 2023-24 the *Orobanche* infestations was not noticed in the trail plots and also in the stations fields. Hence, the *Orobanche* weed management practices/ treatments could not be imposed.

SHIVAMOGGA

Project No.: VFSAG 70

Research project title	Effect of hydrogel on FCV tobacco yield and quality in KLS (Modified)
Objectives	▪ To standardize the quantity of hydrogel application in FCV Tobacco under KLS ▪ To study the performance of FCV tobacco with the application of hydrogel for moisture conservation
Investigators	T. M. Soumya, Rajashekarappa K. & Shashikala S Kolakar
Year of start	2021-2022
Year of completion	2023-2024
Location	AINP (T), ZAHRS, Navile, Shivamogga

Treatments: 07

T_1: Soil application of hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) before planting
T_2: Soil application of hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) before planting
T_3: Soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) before planting
T_4: Soil application of hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) after a rainy day*
T_5: Soil application of hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) after a rainy day
T_6: Soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day
T_7: Control

*Any rainy day after 30 DAP during crop growth period

Material and methods

The effect of hydrogel application on FCV tobacco yield and quality in KLS region was evaluated by adopting following material and methods.

Hydrogel: Vaaridhar Pusa hydrogel used in the study is a semi synthetic, cross linked, derivatized cellulose-graft-anionic polyacrylate super absorbent polymer. The swelling potential of the hydrogel varies from 350 – 500 times its weight in pure water. It was procured from Vishwa Hydrogel Pvt. Ltd., New Delhi, India. The procured hydrogel was in granular texture, brown in colour and contain mainly coated carboxy methyl cellulose.

Experimental details

The performance of FCV tobacco (KST-28 variety) with the application of hydrogel was evaluated during *Kharif*- 2022 with seven treatments and three replications.

The details of the experiment are presented below

Design	:	RCBD	Variety	:	KST-28 (Sahyadri)
Replications	:	Three	Duration	:	02 years
Treatments	:	Seven	Season	:	*Kharif*
Gross plot size	:	7.2m x 4.2m	Date of Sowing	:	30.04.2021 & 30.04.2023
Net plot size	:	5.4m x 3.0 m	Date of Planting	:	16.07.2021 & 30.06.2023

Seedlings were raised in raised bed following soil solarization. FYM at the rate of 12.5 t ha^{-1} was applied 20 days prior to planting. Seedlings of 55-60 days old were transplanted at 90 cm × 60 cm spacing in main field 12th July, 2021 and on 30th June, 2023. Crop was managed as per package of practices of university.

Treatments T_1 to T_3 received hydrogel at the time of planting. Hydrogel was placed around the plant at a distance of 8-10 cm from plant and at a depth of 7.5 to 10 cm. Similarly, for the treatment T_4 to T_6 hydrogel was applied as described above on 12thAugust 2021 and 04th July, 2023 after a rainy-day during crop growth. Hydrogel was applied at the rate of 2.5 kg ha^{-1} (0.14 g $plant^{-1}$), 3.75 kg ha^{-1} (0.20 g $plant^{-1}$) and 5.0 kg ha^{-1} (0.30 g $plant^{-1}$). The last (8th) picking was carried out on 30th October, 2021 and 13th October, 2023.

Biometric observations

Biometric observations were recorded on 45 DAP, at first picking and at final harvest. The observations on plant height (cm), number of leaves per plant were averaged from randomly identified five plants in net plot. Leaf area (cm^2) was calculated using leaf length, breadth and factor (Suggs *et al.,* 1960). Number of leaves harvested per plant from five labeled plants, weight of green leaf and cured leaf at each picking was recorded from net plot. Influence of moisture conservation materials on root characteristics were also studied by destructive sampling at 45 DAP and at final harvest. Root length (cm) was measured using thread and scale while volume (cc) was determined by volume displacement method. The soil moisture content was measured at the time of planting, 10 and 15 days after cessation of rainfall and at final harvest using digital soil moisture sensor which reports soil moisture content in per cent.

RESULTS

Application of hydrogel at different rates and time significantly influenced growth and yield of FCV tobacco. Pooled data showed that soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day recorded significantly higher plant height (145.7 cm) and number of leaves (14.8) at final picking. Significantly higher number of leaves harvested per plant was recorded in soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day (21.3). Soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day recorded significantly higher leaf area of leaf at X position (901.2 cm^2) and leaf at L position (746.9 cm^2). At final picking significantly higher root length (44.78 cm) and root volume (143.8 cc) was recorded in soil application of hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) after a rainy day. Pooled

data revealed that the soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day recorded significantly higher green leaf yield (10073 kg/ha), cured leaf yield (1215 kg/ha) and top-grade equivalent (859 kg/ ha). At 10 days after cessation of rainfall and after final harvest, significantly higher soil moisture content was recorded in soil application of hydrogel @ 5kg/ha (0.30 g plant/ hole) after a rainy day 8.5 % and 12.4 %, respectively.

All the three chemical constitutes *viz.*, nicotine, reducing sugar and chloride were within the acceptable standards and there was no significant difference among the different treatment in X and L position leaves. Soil chemical properties, soil nutrient content and plant uptake registered non-significant difference among the treatments in both the years of study. Significantly higher benefit cost ratio was recorded with the soil application of hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day (1.48).

Conclusion

Application of hydrogel at different rates and time significantly influenced growth and yield of FCV tobacco with a marginal benefit of 0.10 to 0.26 over control.

Table 1 VFSAG 70: Rainfall received at different crop growth stages in VFSAG 70 (2021-22 and 2023-24)

Particulars	2021-22			2023-24		
	Date	Rainfall (mm)	No. of rainy days	Date	Rainfall (mm)	No. of rainy days
Rainfall received during the experiment (mm)	12.07.2021 to 30.10.2021	656.8	51	30.06.2023 to 13.10.2023	337.6	33
Rainfall received from planting to 30 DAP (mm)	12.07.2021 to 10.08.2021	307.8	18	30.06.2023 to 29.07.2023	234.2	22
Rainfall received between 30 and 45 DAP (mm)	11.08.2021 to 25.08.2021	46.4	7	29.07.2023 to 15.08.2023	8.4	1
Rainfall received from planting to 45 DAP (mm)	12.07.2021 to 25.08.2021	354.2	25	30.06.2023 to 15.08.2023	241.8	23
Rainfall received between 45 DAP to final harvest (mm)	25.08.2021 to 30.10.2021	302.6	26	15.08.2023 to 13.10.2023	81.6	9
Crop duration (Days)	12.07.2021 to 30.10.2021	112		30.06.2023 to 13.10.2023	106	
Crop duration receiving rainfall (%) during the experiment (Both rainy days and days with rainfall in traces)	62			59		
Crop duration not receiving any rainfall (%)	38			41		
Crop duration receiving > 2.5 mm rainfall (%)	46			30		

Table 2 VFSAG 70: Rainfall received during different stages of crop growth during 2021-22 and 2023-24

Crop growth stages	Rainfall (mm)		No. of rainy days		No. of days with rain in traces		Days without rainfall	
	2021	2023	2021	2023	2021	2023	2021	2023
Knee height stage (30 DAP)	307.8	234.2	18	22	8	8	4	0
Rapid growth and elongation (30-60 days)	99.4	42.0	14	5	3	8	13	17
Flowering stage (lower leaves ready to harvest) (60-80 days)	42.6	46.4	4	4	4	7	12	9
Upper leaves ready to harvest (80-120 days)	207.0	15	15	2	3	10	14	14
Total	656.8	337.6	51	33	18	33	43	40

Table 3 VFSAG 70: Rainfall and evaporation at ZAHRS, Shivamogga during 2021-22

July-2021						August-2021						September-2021						October-2021					
Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E
1	7.6	5.3	16	4.8	3.2	1	1.0	5.8	16	0.0	3.0	1	11.8	4.2	16	0.0	5.8	1	38.0	4.4	16	0.0	3.7
2	0.0	5.7	17	28.8	2.7	2	1.6	4.6	17	6.2	2.1	2	0.0	4.9	17	0.0	6.0	2	7.0	5.4	17	0.0	3.9
3	0.0	5.0	18	54.2	0.0	3	17.8	4.1	18	6.0	4.2	3	0.0	3.8	18	0.0	5.9	3	4.0	5.7	18	0.0	4.0
4	0.6	5.4	19	3.6	3.8	4	2.0	3.6	19	1.2	3.8	4	0.0	4.8	19	0.0	6.0	4	7.0	4.5	19	0.0	4.2
5	0.0	4.7	20	15.6	1.2	5	1.0	3.8	20	0.0	4.7	5	0.4	5.1	20	0.0	5.8	5	24.4	3.7	20	3.8	3.6
6	0.0	5.2	21	11.0	1.0	6	14.2	3.6	21	0.0	5.4	6	6.2	4.0	21	0.0	4.4	6	37.4	0.0	21	40.8	0.0
7	0.0	5.4	22	55.0	0.0	7	6.4	3.0	22	0.0	5.8	7	5.8	3.4	22	1.8	4.7	7	0.0	5.2	22	0.4	4.8
8	13.0	4.9	23	22.0	2.0	8	0.0	6.5	23	3.6	5.6	8	4.8	3.9	23	0.0	4.3	8	0.0	5.6	23	4.8	4.0
9	5.6	3.4	24	7.2	3.0	9	0.0	5.3	24	12.0	5.4	9	2.6	4.1	24	0.0	5.9	9	0.0	4.2	24	14.8	3.8
10	3.4	4.2	25	2.6	4.3	10	0.0	3.2	25	0.0	4.0	10	1.0	5.7	25	0.0	5.4	10	0.0	5.3	25	0.0	4.3
11	4.8	2.9	26	0.0	3.8	11	2.8	5.1	26	0.0	4.4	11	20.6	3.3	26	0.0	5.3	11	6.4	4.1	26	0.0	4.1
12	11.0	2.8	27	1.0	4.7	12	11.4	2.7	27	3.0	2.2	12	4.4	3.1	27	0.0	4.9	12	1.0	2.3	27	0.0	5.5
13	13.2	2.2	28	1.2	5.4	13	0.4	3.5	28	18.4	2.0	13	7.8	2.9	28	1.8	3.2	13	1.4	5.2	28	0.0	5.6
14	21.4	1.2	29	3.8	5.6	14	0.0	4.2	29	0.0	3.4	14	4.4	3.0	29	0.8	4.1	14	0.0	4.9	29	5.4	4.7
15	4.8	2.5	30	1.4	5.3	15	2.8	4.2	30	0.0	4.8	15	0.0	3.6	30	3.4	4.2	15	7.0	2.5	30	0.0	4.8
			31	1.2	4.8				31	0.0	3.4				31						31		

RF: Rainfall (mm) E: Evaporation (mm)

Table 4 VFSAG 70: Rainfall and evaporation at ZAHRS, Shivamogga during 2023-24

June-2023			July-2023			August-2023			September-2023			October-2023											
Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E
16	0.0	5.5	1	0.8	3.4	16	0.6	4.5	1	0.2	4.9	16	0.2	5.1	1	0.0	5.6	16	2.4	4.4	1	1.2	4.1
17	0.0	4.9	2	4.4	3.2	17	6.6	4.4	2	0.0	4.4	17	2.6	4.9	2	0.0	5.5	17	0.0	4.1	2	0.4	4.9
18	0.0	4.2	3	4.2	3.3	18	2.6	4.6	3	0.8	3.1	18	2.6	4.0	3	0.0	4.3	18	0.0	4.9	3	0.0	5.1
19	0.0	4.6	4	11.4	3.0	19	7.2	4.3	4	1.0	2.8	19	0.8	4.4	4	9.4	4.0	19	2.8	3.5	4	0.0	4.3
20	27.8	4.3	5	13.0	2.6	20	7.4	3.4	5	4.2	3.8	20	0.0	5.4	5	11.8	3.8	20	0.2	3.8	5	0.0	4.8
21	3.8	4.1	6	8.6	2.9	21	10.2	2.9	6	0.2	4.3	21	0.0	5.9	6	1.8	3.9	21	0.4	3.4	6	0.0	3.8
22	0.0	4.5	7	16.2	2.5	22	45.4	2.1	7	0.0	4.0	22	0.0	5.7	7	0.2	4.1	22	0.0	4.1	7	0.0	4.1
23	0.2	4.3	8	1.2	3.2	23	21.4	0.0	8	0.0	3.6	23	0.0	5.4	8	1.2	4.5	23	0.0	4.7	8	0.0	4.4
24	1.8	3.3	9	2.8	3.0	24	33.2	1.6	9	0.0	4.8	24	0.0	5.1	9	0.0	5.4	24	3.8	5.2	9	0.0	3.9
25	2.0	3.0	10	0.2	4.0	25	7.4	0.0	10	0.0	4.5	25	14.8	5.2	10	0.0	5.3	25	0.0	5.4	10	0.0	4.5
26	0.0	4.2	11	1.2	4.2	26	3.0	1.2	11	0.0	4.7	26	0.0	4.5	11	0.0	5.1	26	0.8	4.1	11	1.2	4.6
27	3.0	2.8	12	7.2	4.4	27	4.2	1.8	12	0.0	4.4	27	12.6	5.4	12	1.6	5.4	27	0.0	4.7	12	0.0	4.6
28	3.4	2.7	13	5.8	3.8	28	2.0	3.0	13	0.0	4.6	28	0.0	4.9	13	0.0	5.0	28	0.8	4.6	13	0.0	5.0
29	6.4	3.1	14	1.6	3.9	29	0.8	4.1	14	0.0	3.8	29	0.0	5.7	14	4.2	3.4	29	0.6	4.2			
30	2.2	4.0	15	1.4	4.7	30	1.2	3.7	15	0.0	4.5	30	0.0	5.9	15	0.4	4.8	30	2.0	3.8			
						31	0.0	5.2				31	0.0	5.8									

RF: Rainfall (mm) E: Evaporation (mm)

Table 5 VFSAG 70: Effect of rate and time of hydrogel application on plant height (cm) at different stages of crop growth in FCV Tobacco

Treatment	Plant height(cm)								
	45 DAP			At first picking			At final picking		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) before planting	38.9	40.1	39.5	44.1	50.3	47.2	128.3	127.8	128.0
T_2: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) before planting	41.3	42.6	42.0	46.7	51.0	48.8	131.2	135.4	133.3
T_3: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) before planting	38.0	47.3	42.7	45.7	51.2	48.4	135.1	139.0	137.0
T_4: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) after a rainy day	36.5	40.5	38.5	42.2	51.1	46.7	129.9	137.5	133.7
T_5: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) after a rainy day	38.6	44.2	41.4	44.6	52.8	48.7	141.6	140.5	141.0
T_6: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) after a rainy day	37.6	47.4	42.5	45.1	53.3	49.2	148.4	143.0	145.7
T_7: Control	32.2	38.0	35.1	40.9	46.2	43.5	116.9	117.3	117.1
S. Em±	2.50	2.37	2.84	1.96	2.43	1.46	5.25	2.72	3.48
C.D. at 5%	NS	NS	NS	NS	NS	NS	16.19	8.37	10.72

*Any rainy day after 30 DAP during crop growth period
During 2021-22 and 2023-24 hydrogel applied on 32 DAP and 37 DAP, respectively
During 2022-23 the crop was vitiated due to heavy rainfall and blank shank disease, NS: Non-significant

Table 6 VFSAG 70: Effect of rate and time of hydrogel application on number of leaves plant^{-1} and total number of leaves harvested plant^{-1} at different stages of crop growth in FCV Tobacco

Treatment	Number of leaves plant^{-1}						Total number of leaves harvested plant^{-1}		
	45 DAP			At first picking					
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) before planting	10.3	10.1	10.2	13.5	11.5	12.5	20.6	14.9	17.8
T_2: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) before planting	11.8	10.6	11.2	14.5	12.3	13.4	21.5	15.2	18.4
T_3: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) before planting	11.7	11.3	11.5	13.9	12.8	13.3	21.8	17.6	19.7
T_4: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) after a rainy day	10.1	10.8	10.5	14.7	12.6	13.7	20.4	16.1	18.3
T_5: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) after a rainy day	11.6	11.7	11.6	15.1	13.1	14.1	21.6	19.1	20.4
T_6: Soil application of Hydrogel @ 5 kg/ha(0.30 g plant hole^{-1}) after a rainy day	11.3	12.2	11.7	15.5	14.0	14.8	22.5	20.0	21.3
T_7: Control	9.8	9.1	9.5	12.5	10.7	11.6	17.9	12.8	15.4
S. Em±	0.73	0.62	0.61	0.74	0.40	0.48	0.74	0.21	0.42
C.D. at 5%	NS	NS	NS	NS	1.22	1.47	2.29	0.64	1.28

*Any rainy day after 30 DAP during crop growth period

During 2021-22 and 2023-24 hydrogel was applied on 32 DAP and 37 DAP, respectively

During 2022-23 the crop was vitiated due to heavy rainfall and blank shank disease

NS: Non-significant

Table 7 VFSAG 70: Effect of rate and time of hydrogel application on leaf area at different stages of crop growth in FCV tobacco

Treatment	Leaf area (cm²/leaf)														
	45 DAP			At first picking			Leaf at X position			Leaf at L position			At final picking		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha before planting	399.6	361.8	380.7	503.4	490.1	496.8	850.6	858.8	854.7	658.6	693.2	675.9	349.8	324.6	337.2
T_2: Soil application of Hydrogel @ 3.75 kg/habefore planting	404.5	375.2	389.8	511.2	495.3	503.3	862.2	880.7	871.4	689.6	713.1	701.4	387.9	329.2	358.6
T_3: Soil application of Hydrogel @ 5 kg/habefore planting	403.6	380.1	391.8	523.9	512.6	518.2	872.4	874.1	873.3	730.3	698.0	714.2	364.7	327.2	346.0
T_4: Soil application of Hydrogel @ 2.5 kg/haafter a rainy day	376.1	376.5	376.3	476.0	500.4	488.2	856.4	790.4	823.4	691.7	653.7	672.7	323.2	321.4	322.3
T_5: Soil application of Hydrogel @ 3.75 kg/haafter a rainy day	389.8	386.1	388.0	537.3	520.7	529.0	875.7	883.2	879.5	716.3	718.4	717.4	359.5	337.7	348.6
T_6: Soil application of Hydrogel @ 5 kg/ha after a rainy day	364.7	395.6	380.2	561.4	531.0	546.2	915.3	887.0	901.2	773.2	720.6	746.9	348.7	341.4	345.0
T_7: Control	329.4	298.6	314.0	458.9	421.8	440.3	783.5	731.6	757.5	565.3	554.8	560.1	315.2	238.8	277.0
S. Em±	27.42	12.25	11.38	32.85	7.02	11.96	36.07	18.30	9.71	32.51	19.44	15.41	36.81	12.34	11.62
C.D. at 5%	NS	37.74	35.07	NS	21.63	36.85	110.32	56.39	29.91	98.24	59.91	47.49	NS	38.02	35.80

Table 8 VFSAG 70: Effect of rate and time of hydrogel application on green leaf and cured leaf yield and TGE of FCV tobacco

Treatment	Green leaf yield (kg ha^{-1})			Cured leaf yield (kg ha^{-1})			TGE (kg ha^{-1})		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) before planting	10858	6374	8616	1213	857	1035	854	589	721
T_2: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) before planting	11326	6813	9070	1294	906	1100	917	634	776
T_3: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) before planting	11824	7550	9687	1345	938	1142	936	671	804
T_4: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) after a rainy day	11240	7276	9258	1298	924	1111	860	664	762
T_5: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) after a rainy day	11650	7734	9692	1380	945	1163	948	684	816
T_6: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) after a rainy day	12062	8084	10073	1432	998	1215	993	726	859
T_7: Control	10210	5897	8053	1079	743	911	748	482	615
S. Em±	355.3	365.3	290.8	60.4	35.7	32.8	45.6	31.7	26.0
C.D. at 5%	1094.7	1125.7	896.1	186.2	110.0	101.2	140.5	97.6	80.1

*Any rainy day after 30 DAP during crop growth period

During 2021-22 and 2023-24 applied hydrogel on 32 DAP and 37 DAP, respectively

During 2022-23 the crop was vitiated due to heavy rainfall and blank shank disease

NS: Non-significant

Table 9 VFSAG 70: Effect of hydrogel application on root length (cm) and root volume (cc) at different growth stages of FCV tobacco

Treatment	Root length (cm)						Root volume (cc)					
	45 DAP			At final picking			45 DAP			At final picking		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha(0.14 g plant hole^{-1}) before planting	30.13	33.18	31.66	41.13	42.43	41.78	68.33	65.63	66.98	124.3	135.9	130.1
T_2: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) before planting	29.64	35.75	32.70	40.64	42.62	41.63	57.67	68.16	62.91	115.6	128.7	122.2
T_3: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) before planting	29.67	35.49	32.58	38.13	41.08	39.60	58.67	63.19	60.93	130.0	134.4	132.2
T_4: Soil application of Hydrogel @ 2.5 kg/ha(0.14 g plant hole^{-1}) after a rainy day	30.04	35.94	32.99	45.04	44.53	44.78	59.00	67.35	63.18	142.6	145.1	143.8
T_5: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) after a rainy day	30.67	33.51	32.09	41.67	43.01	42.34	60.33	63.73	62.03	128.3	135.7	132.0
T_6: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) after a rainy day	31.43	34.07	32.75	43.43	44.76	44.09	68.87	69.29	69.08	135.6	139.7	137.7
T_7: Control	31.01	36.86	33.93	48.21	47.45	47.83	69.21	72.23	70.72	164.3	147.5	155.9
S. Em±	1.32	2.26	1.85	2.12	0.76	0.69	3.63	3.27	2.24	10.24	3.70	3.92
C.D. at 5%	NS	NS	NS	7.35	2.35	2.13	NS	NS	NS	32.23	11.41	12.07

*Any rainy day after 30 DAP during crop growth period

During 2021-22 and 2023-24 applied hydrogel on 32 DAP and 37 DAP, respectively

During 2022-23 the crop was vitiated due to heavy rainfall and blank shank disease, NS: Non-significant

Table 10 VFSAG 70: Effect of hydrogel application on soil moisture content (%) in FCV tobacco

Treatment	10 DACR			15 DACR	Final harvest		
	2021	2023	Pooled	2021	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha(0.14 g plant hole^{-1}) before planting	7.4	6.2	6.8	6.0	12.6	8.9	10.7
T_2: Soil application of Hydrogel @ 3.75 kg/ha(0.20 g plant hole^{-1}) before planting	7.7	6.7	7.2	6.1	12.2	9.1	10.6
T_3: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) before planting	8.1	7.2	7.6	6.6	13.2	9.8	11.5
T_4: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) after a rainy day	7.7	7.0	7.3	6.2	12.4	9.5	10.9
T_5: Soil application of Hydrogel @ 3.75 kg/ha(0.20 g plant hole^{-1}) after a rainy day	8.5	7.8	8.2	6.7	12.8	10.9	11.8
T_6: Soil application of Hydrogel @ 5 kg/ha(0.30 g plant hole^{-1}) after a rainy day	8.9	8.2	8.5	7.4	13.5	11.3	12.4
T_7: Control	6.9	5.8	6.4	5.9	10.2	7.8	9.0
S. Em±	0.38	0.20	0.27	0.28	0.85	0.22	0.22
C.D. at 5%	1.16	0.61	0.82	0.86	2.41	0.67	0.67

*Any rainy day after 30 DAP during crop growth period (applied on 32 DAP)

During 2021-22 and 2023-24 applied hydrogel on 32 DAP and 37 DAP, respectively

DACR- Days after cessation of rainfall; Field capacity of soil: 13.8%

10 DACR: 24.09.2021; 15.09.2023

15 DACR: 29.09.2021

During 2022-23 the crop was vitiated due to heavy rainfall and blank shank disease

NS: Non-significant

First picking: 55 DAP

Table 11 VFSAG 70: Cost of cultivation of FCV tobacco as influenced by rate of application of hydrogel

Treatment	Cost of cultivation (Rs.) (a)			Imposition of treatment (Rs.) (b)			Additional cost on fuel wood (Rs.) (c)			Other additional cost on harvesting, curing and grading (Rs.) (d)			Total cost (Rs.) (a +b +c + d)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha before planting	153250	160790	157020	4200	4200	4200	2010	2840	2425	844	715	780	160304	168545	164424
T_2: Soil application of Hydrogel @ 3.75 kg/ha before planting	153250	160790	157020	5700	5700	5700	3225	4084	3655	1335	1014	1175	163510	171589	167549
T_3: Soil application of Hydrogel @ 5 kg/ha before planting	153250	160790	157020	7200	7200	7200	3990	4882	4436	1650	1211	1431	166090	174083	170086
T_4: Soil application of Hydrogel @ 2.5 kg/ha after a rainy day	153250	160790	157020	4200	4200	4200	3285	4522	3903	1360	1123	1241	162095	170634	166365
T_5: Soil application of Hydrogel @ 3.75 kg/ha after a rainy day	153250	160790	157020	5700	5700	5700	4515	5062	4788	1870	1258	1564	165335	172809	169072
T_6: Soil application of Hydrogel @ 5 kg/ha after a rainy day	153250	160790	157020	7200	7200	7200	5295	6384	5839	2190	1584	1887	167935	175958	171946
T_7: Control	153250	160790	157020	-	-	-	-	-	-	-	-	-	153250	160790	157020

2021-22
Note:
Selling price : Rs. 180 per kg
Labour cost : Rs. 280 per day Hydrogel : Rs. 1200 per kg

2023-24
Selling price: Rs. 252 per kg
Labour cost: Rs. 300 per day

Additional cost on fuel wood @ Rs. 3000 t^{-1}; 5 kg fuel wood per kg of cured leaf. Cost on imposition of treatment includes material cost and application cost

Table 12 VFSAG 70: Economics of FCV Tobacco as influenced by different rate of hydrogel application

Treatment	Total Cost of cultivation Rs ha^{-1}			Gross return Rs ha^{-1}			Net Return Rs ha^{-1}			B:C		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant hole^{-1}) before planting	160304	168545	164424	218340	215859	217100	58036	47314	52675	1.36	1.28	1.32
T_2: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant hole^{-1}) before planting	163510	171589	167549	232920	228407	230664	69410	56819	63114	1.42	1.33	1.38
T_3: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant hole^{-1}) before planting	166090	174083	170086	242100	236444	239272	76010	62362	69186	1.46	1.36	1.41
T_4: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant hole^{-1}) after a rainy day	162095	170634	166365	233640	232815	233227	71545	62180	66863	1.44	1.36	1.40
T_5: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant hole^{-1}) after a rainy day	165335	172809	169072	248400	238259	243330	83065	65450	74258	1.50	1.38	1.44
T_6: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant hole^{-1}) after a rainy day	167935	175958	171946	257760	251585	254673	89825	75627	82726	1.53	1.43	1.48
T_7: Control	153250	160790	157020	194220	187237	190729	40970	26447	33709	1.27	1.16	1.22

2021-22

Note:

Selling price : Rs. 180 per kg

Labour cost : Rs. 280 per day Hydrogel : Rs. 1200 per kg

Additional cost on fuel wood @ Rs. 3000 t^{-1} ; 5 kg fuel wood per kg of cured leaf. Cost on imposition of treatment includes material cost and application cost

2023-24

Selling price: Rs. 252 per kg

Labour cost: Rs. 300 per day

Table 13 VFSAG 70: Effect of rate and time of hydrogel application on chemical quality constituents of X position leaf in FCV tobacco

Treatment	Nicotine (%)			Reducing Sugars (%)			Chloride (%)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) before planting	1.12	0.87	0.99	11.63	17.42	14.52	0.16	0.72	0.44
T_2: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) before planting	1.20	1.06	1.13	12.94	18.73	15.84	0.20	0.93	0.57
T_3: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) before planting	0.70	1.05	0.88	11.98	21.46	16.72	0.18	0.95	0.57
T_4: Soil application of Hydrogel @ 2.5 kg/ha (0.14 g plant hole^{-1}) after a rainy day	1.06	0.91	0.99	12.34	19.90	16.12	0.17	0.73	0.45
T_5: Soil application of Hydrogel @ 3.75 kg/ha (0.20 g plant hole^{-1}) after a rainy day	1.15	0.74	0.95	12.09	19.26	15.68	0.20	0.82	0.51
T_6: Soil application of Hydrogel @ 5 kg/ha (0.30 g plant hole^{-1}) after a rainy day	1.11	0.98	1.04	12.38	19.69	16.04	0.15	0.79	0.47
T_7: Control	1.00	1.10	1.05	14.84	18.82	16.83	0.19	0.71	0.45
S. Em±	0.12	0.16	0.12	1.42	1.66	1.03	0.02	0.09	0.04
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 14 VFSAG 70: Effect of rate and time of hydrogel application on chemical quality constituents of L position leaf in FCV tobacco

Treatment	Nicotine (%)			Reducing Sugars (%)			Chloride (%)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) before planting	1.03	0.95	0.99	14.95	20.08	17.52	0.13	0.88	0.50
T_2: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) before planting	1.45	1.08	1.27	13.45	17.87	15.66	0.14	0.82	0.48
T_3: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) before planting	0.80	1.00	0.90	14.76	20.38	17.57	0.14	0.71	0.43
T_4: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) after a rainy day	1.30	0.98	1.14	14.45	17.23	15.84	0.13	0.77	0.45
T_5: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) after a rainy day	1.36	0.92	1.14	11.53	18.30	14.92	0.16	0.85	0.50
T_6: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day	0.86	0.78	0.82	12.99	18.10	15.55	0.16	0.78	0.47
T_7: Control	1.20	1.06	1.13	16.77	18.71	17.74	0.14	0.75	0.44
S. Em±	0.11	0.14	0.09	2.07	0.82	1.14	0.02	0.08	0.04
C.D. at 5%	0.35	NS	NS	NS	NS	NS	NS	NS	NS

Table 15 VFSAG 70: Effect of hydrogel application on soil chemical properties after harvest of FCV tobacco

Treatment	pH			EC (d Sm^{-1})			OC (g kg^{-1})		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) before planting	5.75	6.27	6.01	0.34	0.35	0.35	4.08	3.94	4.01
T_2: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) before planting	5.31	6.07	5.69	0.32	0.34	0.33	5.06	5.46	5.26
T_3: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) before planting	5.66	5.93	5.79	0.44	0.38	0.41	4.72	5.20	4.96
T_4: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) after a rainy day	5.93	5.97	5.95	0.23	0.34	0.28	4.98	5.37	5.17
T_5: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) after a rainy day	5.85	5.74	5.79	0.46	0.37	0.42	4.54	4.26	4.40
T_6: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day	5.21	5.58	5.40	0.32	0.39	0.35	5.32	5.52	5.42
T_7: Control	5.40	5.91	5.66	0.27	0.35	0.31	5.01	4.92	4.96
S. Em±	0.40	0.19	0.08	0.08	0.02	0.02	0.27	0.43	0.22
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Initial soil test value:
pH – 6.6, EC – 0.30 dSm^{-1}, OC-5.6 g kg^{-1}

Table 16 VFSAG 70: Effect of hydrogel application on soil nutrient status after harvest of FCV tobacco

Treatment	N (kg/ha)			P_2O_5 (kg/ha)			K_2O (kg/ha)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) before planting	192.2	219.2	205.7	83.7	86.5	85.1	394.1	411.9	403.0
T_2: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) before planting	186.5	197.0	191.7	82.9	80.9	81.9	388.6	405.9	397.3
T_3: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) before planting	175.0	183.3	179.1	74.9	69.2	72.1	381.6	401.2	391.4
T_4: Soil application of Hydrogel @ 2.5 kg ha^{-1} (0.14 g plant $hole^{-1}$) after a rainy day	185.8	191.6	188.7	80.1	84.0	82.0	383.3	404.6	394.0
T_5: Soil application of Hydrogel @ 3.75 kg ha^{-1} (0.20 g plant $hole^{-1}$) after a rainy day	177.3	182.6	179.9	73.9	73.7	73.8	372.7	385.5	379.1
T_6: Soil application of Hydrogel @ 5 kg ha^{-1} (0.30 g plant $hole^{-1}$) after a rainy day	171.0	192.4	181.7	69.0	66.9	68.0	367.2	369.5	368.4
T_7: Control	187.9	199.5	193.7	85.4	87.4	86.4	403.7	424.3	414.0
S. Em±	16.18	21.97	15.52	4.79	6.22	4.11	23.11	28.62	22.26
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Initial soil test value:
N - 272.5 kg ha^{-1}, P_2O_5 - 91.8 kg ha^{-1}, K_2O - 289.4 kg ha^{-1}

Project No.: VFSAG 72

Research project title	Crop intensification in FCV tobacco for additional farm income
Objectives	▪ To study the feasibility of different legumes as intercrops and their influence on growth, yield and quality of FCV tobacco ▪ To calculate the economic viability of inter cropping of in FCV tobacco under *rainfed* condition of KLS region
Investigators	T. M. Soumya, Rajashekarappa K. & Shashikala SKolakar
Year of start	2021-2022
Year of completion	2023-2024
Location	AINP (T), ZAHRS, Navile, Shivamogga

Treatments: 11

T1: FCV Tobacco + Green gram (Skip row)	T2: FCV Tobacco + Black gram (Skip row)
T3: FCV Tobacco + Cowpea (Skip row)	T4: FCV Tobacco + Field bean (Skip row)
T5: FCV Tobacco + Groundnut (Skip row)	T6: Sole FCV Tobacco
T7: Sole Green gram	T8: Sole Black gram
T9: Sole Cowpea	T10: Sole Field bean
T11: Sole Groundnut	

Material and methods

Feasibility of crop intensification through intercropping of legumes in FCV tobacco was evaluated by adopting following material and methods. Present study was carried out to know the effect of five different legumes in tobacco.

Experimental details

Seeds of KST -28 (Sahyadri) variety of FCV tobacco were sown following soil solarization. Main field was ploughed with tractor drawn disc plough followed by passing of cultivator twice. After the land preparation, farm yard manure @ 12.5 t ha^{-1} was applied two weeks before transplanting and was mixed with soil immediately. Later, the field was uniformly leveled and ridges were formed using a ridger at a distance of 90 cm. Seedlings were transplanted to main field. In respective treatments legumes *viz.,* Green gram, Black gram, Cowpea, Field bean and Groundnut were sown in every alternate row of tobacco as skip row inter cropping system. All other cultural operations were carried out as per package of practices of the University. The details of experiment are presented below

Design	:	RCBD
Replications	:	Three
Treatments	:	Eleven
Variety	:	KST-28 (Sahyadri)
Duration	:	02 Years
Year of start	:	2021-22
Season	:	*Kharif*
Gross plot size	:	7.2 m X6.0 m

Sole crop	Net plot size	Nutrients
Tobacco	: 3.6 x3.6 m	Base crop (FCV tobacco): 40:30:80 kg N: P_2O_5: K_2O /ha
Green gram, blackgram and Groundnut	: 4.8 x5.2 m	Component crop (Legumes): Nutrients were supplied proportionate to plant population through Urea, DAP and SOP as per recommended package of practices
Cowpea	: 3.6 x 5.2 m	
Field bean	: 3.6 x 4.8 m	
Date of transplanting of FCV tobacco		24-07-2021
Date of sowing of FCV legumes		30-06-2023

Biometric Observations

Biometric observations were recorded on 45 DAP, at first picking and at final harvest. The observations on plant height (cm), number of leaves per plant, number of leaves harvested per plant in FCV tobacco were averaged from randomly identified 5 plants in net plot. Leaf area (cm^2) was calculated using leaf length, breadth and factor (Suggs *et al.*, 1960). Weight of green leaf and cured leaf at each picking was recorded from net plot. Grain/pod yield of inter crops was recorded as and when they attained physiological maturity.

Crop indices *viz.,* CEY, LER, ATER, MAI were calculated using the following formula

$$CEY = \sum_{i=1}^{n} Y_i e_i$$

$$e = \frac{Pbc}{Pi}$$

Y_i = yield of i^{th} component

e_i = equivalent factor

Pi = Price of the i^{th} crop

Pbc= Price of the crop to which yield is converted

$$LER = \sum_{i=1}^{n} \frac{Y_{ij}}{Y_{ii}}$$

$Y_{ij:\ yield}$ of ith component from a unit area of intercrop expressed as a fraction of yield

Y_{ii}: yield of i^{th} component grown as sole crop over the same area

$$ATER = \frac{(LAxDA)+(LBxDB)}{T}$$

LA and LB are relative yields or partial LER of component crops A and B

DA and DB are duration of crops A and B and T is the total duration of the intercropping system

$$MAI = \text{[Value of combined intercrop yield]} \times \frac{(LER-1)}{LER}$$

RESULTS

Results of the experiment on feasibility of crop intensification through intercropping of legumes in FCV tobacco influenced the crop growth and yield parameters. In pooled data (2021-22 and 2023-24) significantly higher plant height was recorded in FCV tobacco with groundnut intercropping system (115.3 cm) at final picking. Significantly higher leaf area was recorded in FCV tobacco grown with groundnut as intercrop leaf at X position (957.0 cm^2) and leaf at L position leaves (719.2 cm^2). Significantly higher number of leaves harvested per plant (21.8), green leaf yield (12993 kg ha^{-1}), cured leaf yield (1642 kg ha^{-1}), tobacco equivalent yield (1948 kg ha^{-1}), land equivalent ratio (1.71), area time equivalent ratio (1.53), monetary advantage index (Rs. 1,41,097 ha^{-1}) and benefit cost ratio (2.60) were also recorded in FCV tobacco grown with groundnut as intercrop.

In pooled data the chemical quality parameters such as nicotine, reducing sugar and chloride were under acceptable limits and there was no significant difference among the treatments. Significantly lower reducing sugar content in X position leaf was recorded in FCV tobacco with green gram (9.88 %) intercropping system. The system productivity parameters *viz.*, production efficiency (17.55 kg TEY ha^{-1} day^{-1}), profitability of the system (Rs. 2297 ha^{-1} day^{-1}) and land use efficiency (32.05 %) were significantly higher in FCV tobacco with groundnut intercropping system.

Conclusion

Intercropping of FCV tobacco with groundnut in alternate rows under additional series is superior in terms of yield, land utilization and economic advantage over sole crop of FCV tobacco

Table 1 VFSAG72: Details of varieties used in the experiment and their characteristics

Crop	Variety	Duration (days)	Characteristics	Yield
FCV tobacco	Sahyadri	70-75	Average cured yield potential of 2000-2300 kg ha^{-1}. Moderately resistant to black shank disease and root-knot nematode	CLY: 2000-2300 kg/ha
Green gram	KKM - 3	60-65	Seeds are bold and of shining green colour. Average yield ranging from 8 to 9 q ha^{-1}. Moderately tolerant to powdery mildew, yellow mosaic virus and resistant to pod borer.	Grain: 5 - 7.5 q/ ha
Black gram	LBG-625	70 -75	Produces high biomass with less yield and shiny seeds. Susceptible to yellow mosaic incidence.	Grain: 5-7.5 kg/ha
Cowpea	Sahyadri Yukthi	80 -85	Short stature and grown well in limited moisture conditions. The seeds are medium bold.	Grain: 5-7.5 q/ ha
Field bean	HA-4	95 -105	Pods are soft and yield potential of 6t ha^{-1}.	Pod: 30-37.5 q/ ha Grain: 7.5-10 q/ ha
Groundnut	GPBD 4	105 -110	It is resistant to late leaf spot and rust. GPBD 4 is early maturing with high pod growth rate, partitioning coefficient, and shelling out turn. It has high oil content and oleic acid / linoleic acid ratio	Pod: 20-25 q/ ha

Table 2VFSAG72: Experimental Details

2021			2023		
DOT of FCV tobacco & DOS of legumes	24.07.2021		DOT of FCV tobacco & DOS of legumes	30.06.2023	
Date of final harvest	First picking	Final picking	Date of final harvest	First picking	Final picking
FCV tobacco (92 days)	22.09.2021	24.10.2021	FCV tobacco (99 days)	23.08.2023	06.10.2023
Green gram (77 days)	-	08.10.2021	Green gram (81 days)	-	18.09.2023
Black gram (85 days)	-	16.10.2021	Black gram (88 days)	-	25.09.2023
Cowpea (86 days)	05.10.2021	17.10.2021	Cowpea (95 days)	18.09.2023	02.10.2023
Field bean (121 days)	21.09.2021	21.11.2021	Field bean (113 days)	25.09.2023	20.10.2023
Groundnut (111 days)	-	11.11.2021	Groundnut (107 days)	-	14.10.2023
Number of pickings	FCV Tobacco	07	Number of pickings	FCV Tobacco	07
	Cowpea	02		Cowpea	02
	Field bean	02		Field bean	02
Gross plot size	7.2 × 6.0 m		Gross plot size	7.2 × 6.0 m	
Net plot size	3.6 × 3.6 m		Net plot size	3.6 × 3.6 m	

Table 3 VFSAG72: Details of input used and operation followed in the experiment (1 ha area)

Crops	Tobacco	Green gram	Black gram	Cowpea	Field bean	Groundnut
Variety	Sahyadri	KKM-3	LBG-625	Sahyadri Yukti	HA-4	GPBD 4
Spacing (cm)	90 × 60	30 × 10	30 × 10	45 × 10	45 × 15	30 × 10
Seed rate	25 g ha^{-1}	15-20 kg ha^{-1}	15-20 kg ha^{-1}	20-25 kg ha^{-1}	95-105 kg ha^{-1}	45-50 kg ha^{-1}
Duration (days)	110-120	60-65	70-75	80-85	95-105	105-110
Fertilizer dose (kg ha^{-1})	40:30:80	12.5:25:25	12.5:25:25	25:50:25	25:50:25	25:50:25
Population under sole cropping (plants/ ha)	18,518	3,33,333	3,33,333	2,22,222	1,48,148	3,33,333
Population under skip row (plants ha^{-1})	18,518	1,66,666	1,66,666	1,11,111	74,074	1,66,666
Reduction in population (%)	-	50	50	50	50	50
Area occupied by intercrop (%)	-	50	50	50	50	50

Table 4 VFSAG 72: Details of inputs used per gross plot (43.2 m²) in experiment on feasibility of crop intensification through intercropping of legumes in FCV tobacco

Crops	Tobacco	Green gram	Black gram	Cowpea	Field bean	Groundnut
Population under sole cropping (no. of plants/ gross plot)	80	1440	1440	960	640	1440
Population under skip row (no. of plants / gross plot)	80	720	720	480	320	720
% Reduction in population	-	50%	50%	50%	50%	50%
Quantity of fertilizer applied per plot (sole crop)	581 g Amm. SO_4 282 g DAP 691 g SOP	26 g Urea 234 g DAP 216 g SOP	26 g Urea 234 g DAP 216 g SOP	50 g Urea 470 g DAP 216 g SOP	50 g Urea 470 g DAP 216 g SOP	50 g Urea 470 g DAP 216 g SOP
Quantity of fertilizer applied per plot (skip row)	581 g Amm. SO_4 282 g DAP 691 g SOP	13 g Urea 117 g DAP 108 g SOP	13 g Urea 117 g DAP 108 g SOP	25 g Urea 235 g DAP 108 g SOP	25 g Urea 235 g DAP 108 g SOP	25 g Urea 235 g DAP 95.04 g SOP
Area occupied by intercrop (m^2)	-	21.6	21.6	21.6	21.6	21.6
Net plot area-sole crop ($m^{2)}$	12.96	24.96	24.96	18.72	17.28	24.96
Net plot area-inter crop (m^2)	--	12.96	12.96	12.96	12.96	12.96

Table 5 VFSAG72: Rainfall and evaporation at ZAHRS, Shivamogga during 2021-22

July-2021						August-2021						September-2021						October-2021					
Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E
1	7.6	5.3	16	4.8	3.2	1	1.0	5.8	16	0.0	3.0	1	11.8	4.2	16	0.0	5.8	1	38.0	4.4	16	0.0	3.7
2	0.0	5.7	17	28.8	2.7	2	1.6	4.6	17	6.2	2.1	2	0.0	4.9	17	0.0	6.0	2	7.0	5.4	17	0.0	3.9
3	0.0	5.0	18	54.2	0.0	3	17.8	4.1	18	6.0	4.2	3	0.0	3.8	18	0.0	5.9	3	4.0	5.7	18	0.0	4.0
4	0.6	5.4	19	3.6	3.8	4	2.0	3.6	19	1.2	3.8	4	0.0	4.8	19	0.0	6.0	4	7.0	4.5	19	0.0	4.2
5	0.0	4.7	20	15.6	1.2	5	1.0	3.8	20	0.0	4.7	5	0.4	5.1	20	0.0	5.8	5	24.4	3.7	20	3.8	3.6
6	0.0	5.2	21	11.0	1.0	6	14.2	3.6	21	0.0	5.4	6	6.2	4.0	21	0.0	4.4	6	37.4	0	21	40.8	0.0
7	0.0	5.4	22	55.0	0.0	7	6.4	3.0	22	0.0	5.8	7	5.8	3.4	22	1.8	4.7	7	0.0	5.2	22	0.4	4.8
8	13.0	4.9	23	22.0	2.0	8	0.0	6.5	23	3.6	5.6	8	4.8	3.9	23	0.0	4.3	8	0.0	5.6	23	4.8	4.0
9	5.6	3.4	24	7.2	3.0	9	0.0	5.3	24	12.0	5.4	9	2.6	4.1	24	0.0	5.9	9	0.0	4.2	24	14.8	3.8
10	3.4	4.2	25	2.6	4.3	10	0.0	3.2	25	0.0	4.0	10	1.0	5.7	25	0.0	5.4	10	0.0	5.3	25	0.0	4.3
11	4.8	2.9	26	0.0	3.8	11	2.8	5.1	26	0.0	4.4	11	20.6	3.3	26	0.0	5.3	11	6.4	4.1	26	0.0	4.1
12	11.0	2.8	27	1.0	4.7	12	11.4	2.7	27	3.0	2.2	12	4.4	3.1	27	0.0	4.9	12	1.0	2.3	27	0.0	5.5
13	13.2	2.2	28	1.2	5.4	13	0.4	3.5	28	18.4	2.0	13	7.8	2.9	28	1.8	3.2	13	1.4	5.2	28	0.0	5.6
14	21.4	1.2	29	3.8	5.6	14	0.0	4.2	29	0.0	3.4	14	4.4	3.0	29	0.8	4.1	14	0.0	4.9	29	5.4	4.7
15	4.8	2.5	30	1.4	5.3	15	2.8	4.2	30	0.0	4.8	15	0.0	3.6	30	3.4	4.2	15	7.0	2.5	30	0.0	4.8
			31	1.2	4.8				31	0.0	3.4				31						31		

RF: Rainfall (mm) E: Evaporation (mm)

Table 6 VFSAG72: Rainfall and evaporation at ZAHRS, Shivamogga during 2023-24

June-2023			July-2023			August-2023						September-2023									October-2023		
Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E	Day	RF	E
16	0.0	5.5	1	0.8	3.4	16	0.6	4.5	1	0.2	4.9	16	0.2	5.1	1	0.0	5.6	16	2.4	4.4	1	1.2	4.1
17	0.0	4.9	2	4.4	3.2	17	6.6	4.4	2	0.0	4.4	17	2.6	4.9	2	0.0	5.5	17	0.0	4.1	2	0.4	4.9
18	0.0	4.2	3	4.2	3.3	18	2.6	4.6	3	0.8	3.1	18	2.6	4.0	3	0.0	4.3	18	0.0	4.9	3	0.0	5.1
19	0.0	4.6	4	11.4	3.0	19	7.2	4.3	4	1.0	2.8	19	0.8	4.4	4	9.4	4.0	19	2.8	3.5	4	0.0	4.3
20	27.8	4.3	5	13.0	2.6	20	7.4	3.4	5	4.2	3.8	20	0.0	5.4	5	11.8	3.8	20	0.2	3.8	5	0.0	4.8
21	3.8	4.1	6	8.6	2.9	21	10.2	2.9	6	0.2	4.3	21	0.0	5.9	6	1.8	3.9	21	0.4	3.4	6	0.0	3.8
22	0.0	4.5	7	16.2	2.5	22	45.4	2.1	7	0.0	4.0	22	0.0	5.7	7	0.2	4.1	22	0.0	4.1	7	0.0	4.1
23	0.2	4.3	8	1.2	3.2	23	21.4	0.0	8	0.0	3.6	23	0.0	5.4	8	1.2	4.5	23	0.0	4.7	8	0.0	4.4
24	1.8	3.3	9	2.8	3.0	24	33.2	1.6	9	0.0	4.8	24	0.0	5.1	9	0.0	5.4	24	3.8	5.2	9	0.0	3.9
25	2.0	3.0	10	0.2	4.0	25	7.4	0.0	10	0.0	4.5	25	14.8	5.2	10	0.0	5.3	25	0.0	5.4	10	0.0	4.5
26	0.0	4.2	11	1.2	4.2	26	3.0	1.2	11	0.0	4.7	26	0.0	4.5	11	0.0	5.1	26	0.8	4.1	11	1.2	4.6
27	3.0	2.8	12	7.2	4.4	27	4.2	1.8	12	0.0	4.4	27	12.6	5.4	12	1.6	5.4	27	0.0	4.7	12	0.0	4.6
28	3.4	2.7	13	5.8	3.8	28	2.0	3.0	13	0.0	4.6	28	0.0	4.9	13	0.0	5.0	28	0.8	4.6	13	0.0	5.0
29	6.4	3.1	14	1.6	3.9	29	0.8	4.1	14	0.0	3.8	29	0.0	5.7	14	4.2	3.4	29	0.6	4.2			
30	2.2	4.0	15	1.4	4.7	30	1.2	3.7	15	0.0	4.5	30	0.0	5.9	15	0.4	4.8	30	2.0	3.8			
						31	0.0	5.2				31	0.0	5.8									

RF: Rainfall (mm) E: Evaporation (mm)

Table 7 VFSAG72: Effect of intercropping of legumes on plant height of FCV tobacco

Treatment	Plant height (cm)								
	45 DAP			At first picking			At final picking		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: FCV Tobacco + Green gram (Skip row)	57.6	45.1	51.4	82.3	67.4	74.9	112.5	107.1	109.8
T_2: FCV Tobacco + Black gram (Skip row)	57.1	41.6	49.3	81.2	65.1	73.2	112.3	110.4	111.3
T_3: FCV Tobacco + Cow pea (Skip row)	50.6	37.2	43.9	72.4	55.8	64.1	93.2	91.7	92.5
T_4: FCV Tobacco + Field bean (Skip row)	54.5	38.3	46.4	76.5	60.7	68.6	100.2	101.9	101.1
T_5: FCV Tobacco + Groundnut (Skip row)	59.1	48.8	53.9	84.6	71.9	78.2	116.4	114.2	115.3
T_6: FCV Tobacco (Sole)	56.8	39.8	48.3	78.1	63.3	70.7	107.2	112.7	110.0
S. Em±	0.43	1.21	0.91	0.52	2.03	1.35	1.14	0.71	1.44
C.D. at 5%	1.30	3.64	2.74	1.55	6.11	4.06	3.45	2.13	4.33

Table 8 VFSAG72: Effect of intercropping of legumes on number of leaves per plant of FCV tobacco

Treatment	Number of leaves plant^{-1}						Cumulative number of leaves harvested plant^{-1}		
	45 DAP			At first picking					
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: FCV Tobacco + Green gram (Skip row)	10.3	9.4	9.9	16.3	14.4	15.4	21.2	19.6	20.4
T_2: FCV Tobacco + Black gram (Skip row)	9.9	8.8	9.3	16.3	13.9	15.1	20.3	18.7	19.5
T_3: FCV Tobacco + Cow pea (Skip row)	8.9	7.2	8.1	13.5	12.0	12.8	18.2	14.1	16.2
T_4: FCV Tobacco + Field bean (Skip row)	9.9	7.9	8.9	14.8	12.5	13.6	19.3	16.3	17.8
T_5: FCV Tobacco + Groundnut (Skip row)	10.6	9.9	10.2	16.7	15.1	15.9	22.2	21.5	21.8
T_6: FCV Tobacco (Sole)	10.3	8.6	9.4	16.1	12.8	14.5	20.3	17.2	18.7
S. Em±	0.11	0.26	0.18	0.12	0.49	0.23	0.30	0.62	0.56
C.D. at 5%	0.32	0.78	0.55	0.38	1.47	0.70	0.90	1.87	1.70

Table 9 VFSAG72: Effect of intercropping of legumes on leaf area of FCV tobacco

Treatment	Average leaf area (cm^2 $leaf^{-1}$)											
	45 DAP			At first picking			At X position			At L position		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: FCV Tobacco + Green gram (Skip row)	538.2	503.4	520.8	765.8	715.0	740.4	976.3	903.6	940.0	718.3	696.4	707.3
T_2 : FCV Tobacco + Black gram (Skip row)	529.2	493.8	511.5	760.2	697.7	729.0	963.2	887.7	925.5	715.2	702.9	709.0
T_3 : FCV Tobacco + Cow pea (Skip row)	400.2	391.8	396.0	416.4	482.6	449.5	650.4	662.8	656.6	552.3	603.2	577.7
T_4 : FCV Tobacco + Field bean (Skip row)	486.3	456.5	471.4	698.2	660.7	679.5	852.3	745.7	799.0	685.2	643.7	664.5
T_5: FCV Tobacco + Groundnut (Skip row)	554.0	528.4	541.2	773.2	748.9	761.1	992.5	921.5	957.0	722.1	716.2	719.2
T_6 : FCV Tobacco (Sole)	528.3	489.1	508.7	752.3	673.9	713.1	955.4	860.5	908.0	702.1	682.5	692.3
S. Em±	8.80	10.56	10.65	14.44	24.73	14.25	12.50	14.51	10.10	5.00	5.03	3.99
C.D. at 5%	26.50	31.83	32.11	43.52	74.56	42.95	37.67	43.74	30.45	15.07	15.17	12.03

Table 10 VFSAG72: Effect of intercropping of legumes on green leaf and cured leaf yield of FCV tobacco and intercrop yield

Treatment	Green leaf yield (kg ha^{-1})			Cured leaf yield (kg ha^{-1})			Intercrop yield (kg ha^{-1})		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1 : FCV Tobacco + Green gram (Skip row)	13070	11098	12084	1683	1407	1545	251	262	256
T_2 : FCV Tobacco + Black gram (Skip row)	12030	10481	11256	1675	1385	1530	297	317	307
T_3 : FCV Tobacco + Cow pea (Skip row)	7789	6808	7299	1146	893	1019	344	410	377
T_4 : FCV Tobacco + Field bean (Skip row)	10550	8557	9554	1422	1034	1228	1451*	1234*	1342*
T_5 : FCV Tobacco + Groundnut (Skip row)	13795	12190	12993	1771	1512	1642	1141*	1012*	1077*
T_6 : FCV Tobacco (Sole)	11139	10247	10693	1555	1191	1373	-	-	-
T_7: Sole Green gram	-	-	-	-	-	-	536	595	565
T_8: Sole Black gram	-	-	-	-	-	-	645	764	705
T_9: Sole Cowpea	-	-	-	-	-	-	743	814	778
T_{10}: Sole Field bean	-	-	-	-	-	-	3206*	2564*	2885*
T_{11}: Sole Groundnut	-	-	-	-	-	-	2468*	1997*	2232*
S. Em±	916	507	415	77	61	43	-	-	-
C.D. at 5%	2761	1529	1251	233	183	131	-	-	-

* Pod yield

Table 11 VFSAG 72: Tobacco equivalent yield and crop indices are influenced by FCV tobacco based intercropping system

Treatment	Tobacco equivalent yield (kg ha^{-1})			LER			ATER			MAI (Rs.)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: FCV Tobacco + Green gram (Skip row)	1821	1510	1666	1.55	1.63	1.59	1.47	1.55	1.51	116275	148373	132324
T_2: FCV Tobacco + Black gram (Skip row)	1842	1523	1682	1.55	1.59	1.57	1.51	1.55	1.53	117868	139548	128708
T_3: FCV Tobacco + Cow pea (Skip row)	1252	990	1121	1.27	1.26	1.27	1.24	1.24	1.24	51746	50123	50935
T_4: FCV Tobacco + Field bean (Skip row)	1663	1279	1471	1.40	1.38	1.39	1.18	1.27	1.23	86529	86275	86402
T_5: FCV Tobacco + Groundnut (Skip row)	2124	1773	1948	1.62	1.79	1.71	1.43	1.63	1.53	147472	195665	141097
T_6: FCV Tobacco (Sole)	1555	1191	1373	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
T_7: Sole Green gram	293	236	265	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
T_8: Sole Black gram	361	303	332	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
T_9: Sole Cowpea	227	194	210	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
T_{10}: Sole Field bean	534	509	522	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
T_{11}: Sole Groundnut	762	515	638	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00
S. Em±	49	50	35	0.03	0.05	0.03	0.02	0.05	0.03	3652	10458	5229
C.D. at 5%	146	145	101	0.10	0.16	0.08	0.06	0.15	0.08	11254	30204	15102

Table 12 VFSAG72: Economics of FCV tobacco-legume based intercropping system (2021)

Treatment	Cost of cultivation (Rs. ha^{-1})			Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			B:C
	FCV tobacco	Legumes	Total	FCV tobacco	Legumes	Total	FCV tobacco	Legumes	Total	
Tobacco + Gg	134674	16098	150772	302940	24743	327683	168266	8646	176912	2.17
Tobacco + Bg	134674	16049	150723	301500	29969	331469	166826	13920	180746	2.20
Tobacco + Cp	134674	13132	147806	206280	37088	243368	71606	23955	95561	1.65
Tobacco + FB	134674	20351	155025	255960	43533	299493	121286	23182	144468	1.93
Tobacco + GN	134674	26899	161573	318780	63399	382179	184106	36500	220606	2.37
FCV Tobacco	134674	-	134674	279900	-	279900	145226	-	145226	2.08
Green gram	-	45435	45435	-	62816	62816	-	17380	17380	1.38
Black gram	-	45337	45337	-	64917	64917	-	19580	19580	1.43
Cowpea	-	38665	38665	-	60785	60785	-	22121	22121	1.57
Field bean	-	51542	51542	-	96180	96180	-	44638	44638	1.87
Groundnut	-	72504	72504	-	137097	137097	-	70593	70593	1.89

Table 13 VFSAG72: Economics of FCV tobacco-legume based intercropping system (2023)

Treatment	Cost of cultivation (Rs. ha^{-1})			Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			B:C
	FCV tobacco	Legumes	Total	FCV tobacco	Legumes	Total	FCV tobacco	Legumes	Total	
Tobacco + Gg	131271	21033	152304	354453	26172	380626	223182	5140	228322	2.50
Tobacco + Bg	131271	19180	150451	348917	34818	383735	217646	15638	233284	2.55
Tobacco + Cp	131271	15403	146674	224929	24586	249515	93658	9184	102842	1.70
Tobacco + FB	131271	23140	154411	260668	61690	322358	129397	38550	167947	2.09
Tobacco + GN	131271	26220	157491	381044	65802	446847	249773	39582	289356	2.84
FCV Tobacco	131271	-	131271	300174	-	300174	168903	-	168903	2.29
Green gram	-	46525	46525	-	59452	59452	-	12927	12927	1.28
Black gram	-	47320	47320	-	76421	76421	-	29101	29101	1.61
Cowpea	-	40105	40105	-	48824	48824	-	8719	8719	1.22
Field bean	-	54980	54980	-	128187	128187	-	73207	73207	2.33
Groundnut	-	65040	65040	-	129809	129809	-	64769	64769	2.00

Table 14 VFSAG72: Economics of FCV Tobacco-legume based intercropping system (Pooled)

Treatment	Cost of cultivation (Rs. ha^{-1})			Gross return (Rs. ha^{-1})			Net return (Rs. ha^{-1})			B:C
	FCV tobacco	Legumes	Total	FCV tobacco	Legumes	Total	FCV tobacco	Legumes	Total	
Tobacco + Gg	132973	18565	151538	328697	25458	354154	195724	6893	202617	2.34
Tobacco + Bg	132973	17615	150587	325209	32394	357602	192236	14779	207015	2.37
Tobacco + Cp	132973	14267	147240	215605	30837	246442	82632	16569	99201	1.67
Tobacco + FB	132973	21746	154718	258314	52611	310925	125341	30866	156207	2.01
Tobacco + GN	132973	26560	159532	349912	64601	414513	216940	38041	254981	2.60
FCV Tobacco	132973	-	132973	290037	-	290037	157065	-	157065	2.18
Green gram	-	45980	45980	-	61134	61134	-	15154	15154	1.33
Black gram	-	46329	46329	-	70669	70669	-	24340	24340	1.52
Cowpea	-	39385	39385	-	54805	54805	-	15420	15420	1.39
Field bean	-	53261	53261	-	112184	112184	-	58923	58923	2.10
Groundnut	-	68772	68772	-	133453	133453	-	67681	67681	1.94

Price of crop produce		
	2021	2023
FCV Tobacco	Rs. 18000 q^{-1}	Rs. 25200 q^{-1}
Green gram	Rs. 9850 q^{-1}	Rs. 10000 q^{-1}
Black gram	Rs. 10060 q^{-1}	Rs. 11000 q^{-1}
Cowpea	Rs. 5500 q^{-1}	Rs. 6000 q^{-1}
Field bean	Rs. 3000 q^{-1}	Rs. 5000 q^{-1}
Groundnut	Rs. 5850 q^{-1}	Rs. 6000 q^{-1}

Table 15 VFSAG72: Effect of intercropping of legumes on chemical quality constituents of X position leaf in FCV tobacco

Treatment	Nicotine (%)			Reducing Sugars (%)			Chloride (%)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: FCV Tobacco + Green gram (Skip row)	1.23	0.92	1.08	8.08	11.68	9.88	0.25	0.79	0.52
T_2: FCV Tobacco + Black gram (Skip row)	1.22	1.11	1.17	11.84	16.86	14.35	0.22	0.74	0.48
T_3: FCV Tobacco + Cow pea (Skip row)	0.92	1.11	1.02	12.47	14.90	13.69	0.24	0.85	0.55
T_4: FCV Tobacco + Field bean (Skip row)	1.02	0.93	0.98	12.83	17.07	14.95	0.20	1.05	0.63
T_5: FCV Tobacco + Groundnut (Skip row)	1.12	1.16	1.14	12.47	17.10	14.79	0.27	0.81	0.54
T_6: FCV Tobacco (Sole)	1.16	1.05	1.11	11.77	17.14	14.46	0.23	0.84	0.53
S. Em±	0.15	0.06	0.07	0.45	1.27	0.77	0.02	0.08	0.05
C.D. at 5%	NS	NS	NS	1.36	3.82	2.33	NS	NS	NS

Table 16 VFSAG 72: Effect of intercropping of legumes on chemical quality constituents of L position leaf in FCV tobacco

Treatment	Nicotine (%)			Reducing Sugars (%)			Chloride (%)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1: FCV Tobacco + Green gram (Skip row)	1.38	1.04	1.21	10.83	16.19	13.51	0.33	0.67	0.50
T_2: FCV Tobacco + Black gram (Skip row)	1.45	0.90	1.18	11.31	15.53	13.42	0.26	0.95	0.60
T_3: FCV Tobacco + Cow pea (Skip row)	1.19	0.91	1.05	12.92	13.20	13.06	0.27	0.72	0.50
T_4: FCV Tobacco + Field bean (Skip row)	1.50	0.84	1.17	13.45	13.72	13.59	0.31	0.77	0.54
T_5: FCV Tobacco + Groundnut (Skip row)	1.28	1.17	1.23	11.66	14.46	13.06	0.34	0.91	0.62
T_6: FCV Tobacco (Sole)	1.22	1.00	1.11	11.13	11.80	11.46	0.27	0.57	0.42
S. Em±	0.15	0.08	0.08	0.34	1.00	0.81	0.02	0.06	0.03
C.D. at 5%	NS	NS	NS	1.03	NS	NS	NS	0.18	0.09

Table 17 VFSAG 72: Effect of intercropping of legumes in FCV tobacco on soil chemical properties

Treatment	pH			EC (d Sm^{-1})			OC (g kg^{-1})		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1 : FCV Tobacco + Green gram (Skip row)	5.7	6.1	5.9	0.75	0.53	0.64	5.27	5.32	5.29
T_2 : FCV Tobacco + Blackgram (Skip row)	5.5	5.9	5.7	0.70	0.50	0.60	5.23	5.28	5.26
T_3 : FCV Tobacco + Cow pea (Skip row)	6.3	6.3	6.3	0.72	0.51	0.61	4.97	5.11	5.04
T_4 : FCV Tobacco + Field bean (Skip row)	6.2	6.3	6.3	0.72	0.52	0.62	4.97	5.08	5.03
T_5 : FCV Tobacco + Groundnut (Skip row)	5.9	6.0	5.9	0.74	0.54	0.64	5.00	5.15	5.07
T_6: FCV Tobacco (Sole)	6.9	6.4	6.7	0.69	0.48	0.58	4.90	5.01	4.96
T_7 : Sole Green gram	5.9	5.7	5.8	0.77	0.58	0.67	5.30	5.42	5.36
T_8 : Sole Black gram	5.7	6.0	5.9	0.74	0.57	0.66	5.28	5.39	5.34
T_9 : Sole Cow pea	6.4	6.6	6.5	0.76	0.59	0.68	5.09	5.13	5.11
T_{10} : Sole Field bean	6.0	6.2	6.1	0.77	0.61	0.69	5.20	5.36	5.28
T_{11}: Sole Groundnut	6.3	6.4	6.3	0.79	0.64	0.71	5.31	5.45	5.38
S. Em±	0.04	0.18	0.21	0.01	0.04	0.03	0.07	0.12	0.13
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

Initial soil test value:
pH – 5.6 EC – 0.80 dSm^{-1} OC-4.7 g kg^{-1}

Table 18 VFSAG 72: Effect of intercropping of legumes in FCV tobacco on soil available nutrient status after harvest (kg ha^{-1})

Treatment	N			P_2O_5			K_2O		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
T_1 : FCV Tobacco + Green gram (Skip row)	271.3	280.8	276.0	61.6	63.9	62.7	250.0	241.6	245.8
T_2 : FCV Tobacco + Blackgram (Skip row)	307.0	341.3	324.1	57.7	61.0	59.4	215.5	237.9	226.7
T_3 : FCV Tobacco + Cow pea (Skip row)	324.7	335.7	330.2	75.9	71.2	73.5	260.7	255.6	258.1
T_4 : FCV Tobacco + Field bean (Skip row)	250.6	278.9	264.8	74.8	70.5	72.6	228.1	223.8	225.9
T_5 : FCV Tobacco + Groundnut (Skip row)	300.1	322.7	311.4	73.2	69.0	71.1	242.3	237.1	239.7
T_6: FCV Tobacco (Sole)	220.0	238.9	229.5	52.4	57.9	55.1	188.5	202.5	195.5
T_7 : Sole Green gram	362.6	366.5	364.6	68.7	64.3	66.5	296.4	276.2	286.3
T_8 : Sole Black gram	350.1	356.3	353.2	59.5	58.7	59.1	281.5	263.7	272.6
T_9 : Sole Cow pea	325.1	326.7	325.9	78.9	74.0	76.5	308.1	303.2	305.7
T_{10} : Sole Field bean	312.6	342.1	327.4	76.3	71.8	74.1	288.6	274.1	281.4
T_{11}: Sole Groundnut	450.1	457.7	453.9	75.9	70.8	73.4	302.2	287.0	294.6
S. Em±	6.33	4.67	5.77	2.35	4.00	3.51	5.71	9.97	7.46
C.D. at 5%	18.69	13.48	16.68	NS	NS	NS	16.84	28.80	21.54

Initial soil test value: N - 252.3 kg ha^{-1}, P_2O_5 – 77.08 kg ha^{-1}, K_2O – 135.72 kg ha^{-1}

Table 19 VFSAG 72: Effect of different intercropping systems on population of insect pests and per cent disease incidence of FCV tobacco

Treatment	Number of *Spodoptera litura* arvae/plant				Number of *Myzus persicae*/plant				Number of whiteflies/plants				Disease incidence (%)	
	30 DAP	60 DAP	90 DAP	Mean	30 DAP	60 DAP	90 DAP	Mean	30 DAP	60 DAP	90 DAP	Mean	Tobacco Mosaic Virus	Tobacco Leaf Curl Virus
FCV Tobacco + Greengram	0.4	1.0	0.6	0.7	5.9	1.3	0.9	2.7	1.1	8.8	12.7	7.5	13.3	23.3
FCV Tobacco + Black gram	0.2	1.0	0.6	0.6	5.7	1.3	0.9	2.6	1.1	8.3	11.9	7.1	10.0	16.6
FCV Tobacco + Cowpea	0.6	2.0	1.2	1.3	3.6	0.8	0.6	1.7	0.6	5.5	8.8	4.9	6.6	10.0
FCV Tobacco + Field bean	0.2	1.6	0.8	0.9	4.2	0.9	0.7	2.0	0.7	5.6	8.9	5.0	6.6	10.0
FCV Tobacco + Groundnut	0.4	0.8	0.6	0.6	5.3	1.1	0.8	2.4	1.0	8.1	11.6	6.9	10.0	16.6
FCV Tobacco (Sole)	0.2	1.0	0.6	0.6	7.05	2.0	1.5	3.5	1.6	9.8	14.4	8.6	23.3	33.3

Table 20 VFSAG 72: Effect of different intercropping systems on population of natural enemies of FCV tobacco

Treatment	Number of *Coccinella spp.*/plant				Number of spider/plant			
	30 DAP	60 DAP	90 DAP	Mean	30 DAP	60 DAP	90 DAP	Mean
FCV Tobacco + Green gram (Skip row)	1.8	1.2	0.6	1.2	1.2	2.1	1.0	1.4
FCV Tobacco + Black gram (Skip row)	1.9	0.9	0.4	1.1	0.8	2.0	1.1	1.3
FCV Tobacco + Cowpea (Skip row)	2.0	1.3	0.8	1.3	1.8	3.1	2.0	2.3
FCV Tobacco + Field bean (Skip row)	1.9	1.2	0.7	1.3	1.6	2.8	1.8	2.0
FCV Tobacco + Groundnut (Skip row)	1.9	1.1	0.5	1.1	0.8	1.9	0.9	1.2
FCV Tobacco (Sole)	1.5	1.0	0.4	0.9	0.7	1.5	0.7	1.0

Table 21 VFSAG72: System productivity of FCV tobacco based intercropping system

Treatment	Production Efficiency (kg TEY/ha/day)			Profitability of the System (Rs./ha/day)			Land Use Efficiency (%)		
	2021	2023	Pooled	2021	2023	Pooled	2021	2023	Pooled
$T_{1:}$ FCV Tobacco + Green gram (Skip row)	19.80	15.26	17.53	1923	2306	2115	25.21	27.12	26.16
$T_{2:}$ FCV Tobacco + Black gram (Skip row)	20.02	15.38	17.70	1965	2356	2161	25.21	27.12	26.16
$T_{3:}$ FCV Tobacco + Cow pea (Skip row)	13.60	10.00	11.80	1039	1039	1039	25.21	27.12	26.16
$T_{4:}$ FCV Tobacco + Field bean (Skip row)	13.75	11.32	12.53	1194	1486	1340	33.15	30.96	32.05
T_5: FCV Tobacco + Groundnut (Skip row)	19.13	15.97	17.55	1987	2607	2297	30.41	30.41	30.41
$T_{6:}$ FCV Tobacco (Sole)	16.90	12.03	14.47	1579	1706	1642	25.21	27.12	26.16
T_7: Sole Green gram	3.81	2.91	3.36	226	160	193	21.10	22.19	21.64
T_8: Sole Black gram	4.24	3.45	3.84	230	331	281	23.29	24.11	23.70
T_9: Sole Cowpea	2.64	2.04	2.34	257	92	174	23.56	26.03	24.79
T_{10}: Sole Field bean	4.42	4.50	4.46	369	648	508	33.15	30.96	32.05
T_{11}: Sole Groundnut	6.86	4.81	5.84	636	605	621	30.41	29.32	29.86
S. Em±	0.35	0.51	0.35	-	-	-	-	-	-
C.D. at 5%	1.01	1.46	1.01	-	-	-	-	-	-

Production Efficiency (kg TEY/ha/day) = Tobacco Equivalent Yield / Crop Duration of the System

Profitability of the System (Rs. /ha/day) = System Net Returns / Crop Duration of the System

Land Use Efficiency (%) = (Crop Duration / 365) *100

RUSTICA TOBACCO

ARAUL

Project No.: VFSAG 70

Research project title	**Studies on economical viability of tobacco / non tobacco crop of *rabi* season**
Objectives	• To find out the best cost benefit best cost benefit ration among different Rabi crops with comparison *Rustica* Tobacco Variety ArR-27 (Nath)
Investigators	K. C. Arya
Year of start	2022-2023
Year of completion	2023-2024
Location	Tobacco Research Station, Araul

RESULTS

In order to work out economics of tobacco/ non-tobacco crops of season *Rabi*, an experiment was conducted during 2023-24 at Tobacco Research Station, Araul, Kanpur, U.P. The soil of experiment site was Sandy loam. The experiments consist of four treatments. The analysis indicated that tobacco equivalent yield were significantly affected under various treatments. The higher tobacco equivalent yield recorded under the **Treatment-2** (Chickpea) i.e. 3268 Kg/ha followed by **Treatment-4** [Vegetable pea] i.e. 2190 Kg/ha. Economics of the treatment revealed that highest monitory return of Rs. 79584.00 was recorded by Treatment-2 with benefit cost ratio of 1.78.

In order to work out economics of tobacco/ non-tobacco crops of season *Rabi*, an experiment consist of four treatments viz, **T_1**- Vegetable pea, **T_2**- Chickpea, **T_3**- Linseed and **T_4**- Tobacco was conducted (2022-23 & 2023-24) at Tobacco Research Station, Araul, Kanpur, U.P. to study the Economical viability of Tobacco/ Non Tobacco crop of Rabi. The soil of experiment site was Sandy loam. The pooled analysis indicated that tobacco equivalent yield were significant, affected under various treatments. The higher tobacco equivalent yield recorded under the Treatment-2 (Chickpea) i.e. 3190 Kg/ha followed by Treatment-1 [Vegetable pea] i.e. 2242 Kg/ha. Economics of the treatment revealed that highest monitory return of Rs. 78045.00 was recorded by Treatment-2 with benefit cost ratio of 1.81.

Salient research findings/achievements

- The higher tobacco equivalent yield recorded under the **Treatment-2** (Chickpea) i.e. 3190 Kg/ha followed by **Treatment-1** [Vegetable pea] i.e. 2242 Kg/ha. Economics of the treatment revealed that highest monitory return of Rs. 78045.00 was recorded by **Treatment-2** with benefit cost ratio of 1.81 and it will go as remunerated recommendation to farming community.

Table 1 RuArAG-30: Data on Tobacco equivalent yield and morphological characters with non-tobacco crops of *Rabi* season (2023-24)

Treatments	Tobacco/Non-Tobacco yield Kg/ha)	Plant Height (Cm)	Leaf Length (Cm)	Leaf Width (Cm)	No. Curable Levels
T_1- Vegetable pea (Var.AP-3)	1650	-	-	-	-
T_2- Chickpea (Var. Avrodhi)	2070	-	-	-	-
T_3- Linseed (Var. Neelam)	1870	-	-	-	-
T_4- Tobacco (Var. ArR-27)	2190	64.77	44.10	38.28	16

Table 2 RuArAG-30: Economics Analysis

Treatments	Tobacco equivalent yield Kg/ha)	Gross Return (Rs./ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B.C. Ratio
T_1- Vegetable pea (Var.AP-3)	2171	82498	48400	34098	0.70
T_2- Chickpea (Var. Avrodhi)	3268	124184	44600	79584	1.78
T_3- Linseed (Var. Neelam)	1378	52364	40300	12064	0.30
T_4- Tobacco (Var. ArR-27)	2190	83220	45900	37320	0.81

Tobacco Price: Rs. 38.00/ kg, Vegetable pea: Rs. 50.00/kg, Chickpea: Rs. 60.00/kg, Linseed: 28.00/kg.

Table 3 RuArAG-30: Cost Economics of different crops as influence by treatments (Pooled-2022-23 & 2023-24)

Treatments	Tobacco equivalent yield Kg/ha)	Gross Return (Rs./ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B.C. Ratio
T_1- Vegetable pea (Var.AP-3)	2242	85196	46350	38846	0.84
T_2- Chickpea (Var. Avrodhi)	3190	121220	43175	78045	1.81
T_3- Linseed (Var. Neelam)	1459	55442	39950	15492	0.39
T_4- Tobacco (Var. ArR-27)	2040	77520	45700	31820	0.70

Tobacco Price: Rs. 38.00/ kg., Vegetable pea: Rs. 50.00/kg, Chickpea: Rs. 60.00/kg, Linseed: 28.00/kg.

PIKKA TOBACCO

BERHAMPUR

Project No.: PBAG 27

Research project title	**Response of *pikka* tobacco genotypes to different dates of planting**
Objectives	▪ To study the response of promising *pikka* tobacco genotype BPT 7 and BPT 50 to different planting time.
Investigators	A. M. Prusti
Year of start	2022-23
Year of completion	2023-24
Location	AINP on Tobacco, CPR, Berhampur

Experiment details

Treatments: 12

Main plot: 3 Transplanting dates	Sub Plot: 4 Genotypes
D_1: 16th August, 2022	G_1: BPT 7
D_2 :1st September 2022	G_2: BPT 50
D_3 :16thSeptember, 2022	G_3: Gajapat
	G_4: JP local

Design : Split Plot	Spacing: 75 x 50 cm
Replications: 3	Plot size: Gross (4.5 X 5.0 m) Net (3.0 x 4.0 m)
Manurial schedule: RDF N:P:K :: 80:40:40 kg/ha	

RESULTS

Two genotypes of *pikka* tobacco (BPT 7 and BPT 50) along with two check varieties Gajapati and JP local were evaluated during *kharif* 2023 in split plot design with three replications for cured leaf yield and ancillary characters. Three transplanting dates (D1:16.8.2023,D2: 1.9.2023 and D3: 16.9.2023) were assigned to three main plots and four genotypes (G1: BPT 7, G2: BPT 50, G3: Gajapati and G4: JP Local) were assigned to sub plots. Analysis of variance of cured leaf yield and ancillary characters of pikka tobacco genotypes are presented in Table 1 PBAG 27, Significant differences existed among transplanting dates and genotypes for cured leaf yield and all ancillary characters and significant interaction component observed for cured leaf yield, topped plant height and number of leaves per plant.

Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes are presented in Table2 PBAG 27, It was observed that planting dates affect the performance of all *pikka* tobacco genotypes. Transplanting tobacco on 1st September (September first fortnight) recorded significantly higher cured leaf yield (2301 kg/ha) than 16th August (1892 kg/ha) but at par with 16th September (September second fortnight) transplanting

(2093kg/ha). There was no significant difference in cured leaf yield between transplanting of tobacco on 16th September (September second fortnight) and 16th August transplanting .Among four genotypes BPT 7 (2374 kg/ha) and BPT 50 (2301)produced significantly higher cured leaf yield than check variety Gajapati (1939 kg/ha) (Table 2 PBAG 27-3). Genotype BPT 7 (2374 kg/ha) and BPT 50 (2301 kg/ha) produced 22.4 and 18.7 % higher cured leaf yield over check var. Gajapati. Cured leaf yield ranged from 1572 kg/ha (D3JP Local) to 2729 kg/ha (D2 BPT 50) with an average yield of 2096 kg/ha (Table3 PBAG 27).

Pooled ANOVA of cured leaf yield in *pikka* tobacco (Table 4 PBAG 27) revealed that year (Y), dates of transplanting (D) and genotypes (G) had significant impact on cured leaf yield in tobacco. Also the interaction component of G x D, G x Y and D x G x Y were also found highly significant reflecting that the weather parameters (Y), dates of transplanting (D) individually and boththe weather parameters (Y), dates of transplanting (D) influenced the cured leaf yield performance of tobacco genotype.

Pooled response of *pikka* tobacco genotypes to different dates of transplanting (Table 2 PBAG 27) revealed that transplanting tobacco on 1St September produced significantly higher cured leaf yield (2069kg/ha) than transplanting on both 16th August (1581 kg/ha) and 16th September (1901 kg/ha). Transplanting on 16th September (1901 kg/ha) also produced significant higher cured leaf yield than transplanting on both 16th August (1581 kg/ha). Lowest cured leaf yield was observed when tobacco was transplanted in 16th August (1581 kg/ha).

It was also found that all genotypes including check varieties in tobacco expressed maximum cured leaf yield when transplanted on 1St September and minimum cured leaf yield when transplanted on 16thAugust (Table 5 PBAG 27).

Effect of different dates of transplanting on chemical parameters such as Nicotine (%), Reducing Sugar (%) and Chloride (%) on different genotypes are presented in Table 6 PBAG 27 and Table 7 PBAG 27. Analysis of variance of chemical parameters in *pikka* tobacco during 2023 (Table 6 PBAG 27) revealed that dates of transplanting had no significant effect on chemical parameters such as Nicotine (%), Reducing Sugar (%) and Chloride (%). Similarly there was no significant difference among test entries for Nicotine (%), Reducing Sugar (%) and Chloride (%) content. It was further revealed from Table 7 PBAG 27 that though maximum nicotine content (0.80%) and minimum chloride content (0.62%) were expressed when transplanted on 16.9.23, but they were found at par with other dates of transplanting. Similarly transplanting on 01.09.2023 produced maximum reducing sugar (1.95%), but at par with other dates of transplanting. It was found from Table 7 PBAG 27 that all genotypes had acceptable range of chemical parameters.

Salient findings/Achievements

- Two years study showed that the optimum trans planting time for *pikka* tobacco genotype BPT 7 is 1st September which is producing higher cured leaf yield of 2337 kg/ha than 16th September and 16th August yielding 2203 and 1819 kg/ha respectively.

Conclusion: Two years study showed that 1st September is optimum time for transplanting of *pikka* tobacco genotype BPT 7 and BPT 50 for obtaining maximum cured leaf yield than 16th August and 1st September transplanting.

Table 1 PBAG 27:cured leaf yield and ancillary characters in *pikka* tobacco 2023

Source	df	MSS				
		Cured leaf yield (kg/ha)	Topped Plant Height (cm)	No. of leaves/ plant	Leaf Length (cm)	Leaf Breadth (cm)
Replication	2	85500.111	2608.489*	9.294*	93.744**	34.396*
Dates of transplanting (D)	2	502313.444*	2973.841**	12.054*	67.962**	48.017*
Error a	**4**	**47104.028**	**148.934**	**0.821**	**0.862**	**4.640**
Genotypes (G)	3	756026.102**	2926.036**	8.503**	87.669**	23.120**
D X G	6	366895.852**	557.550**	2.740*	9.483	4.033
Error b	18	**35867.463**	**102.752**	**0.734**	**12.456**	**2.530**

**, ** significant at 5% and 1% levels respectively*

Table 2 PBAG 27: Response of *pikka* tobacco genotypes to different dates of transplanting (DPT 2022)

Dates of transplanting Genotypes	Cured leaf yield (kg/ha)			Plant Height (cm)	No. of leaves / plant	Leaf Length (cm)	Leaf Breadth (cm)
	2022	2023	Pooled				
Main Factor: Transplanting dates							
D1 (16.8.23)	1271	1892	1581	104.0	19.3	43.7	20.3
D2 (1.9.23)	1836	2301	2069	133.7	18.2	47.5	21.7
D3 (16.9.23)	1710	2093	1901	127.9	17.3	48.1	24.3
Mean	1605	2096	1850	121.9	18.3	46.4	22.1
C.D. at 5%	91.8	246	109.0	13.8	1.0	1.1	2.4
C.V. (%)	5.0	10.4		10.0	5.0	7.0	9.7
Sub Factor: Genotypes							
G1 (BPT 7)	1865	2374	2120	114.8	18.7	50.1	22.6
G2 (BPT 50)	1626	2301	1964	128.2	19.4	48.0	21.9
G3 (Gajapati-C)	1455	1939	1697	101.2	17.9	44.2	20.1
G4(JP Local-C)	1475	1767	1621	143.2	17.1	43.5	23.9
Mean	1605	2096	1850	121.9	18.3	46.4	22.1
C.D. at 5%	142	188	113.7	10.0	0.8	3.5	1.6
C.V. (%)	9.0	9.0		8.3	4.7	7.6	7.2

Table 3 PBAG 27: Cured leaf yield (kg/ha) of *pikka* tobacco genotypes under different dates of planting in 2023

	Cured leaf yield (kg/ha)				
Dates of transplanting / Genotypes	BPT 7	BPT 50	Gajapati (C)	JP Local (C)	Mean
D1 (16.8.23)	2296	1506	1928	1838	1892
D2 (1.9.23)	2525	2729	2060	1892	2301
D3 (16.9.23)	2302	2668	1830	1572	2093
Mean	2374	2301	1939	1767	2096
C.D. at 5% D/T					246
C.V. (%) D/T					10.4
C.D. at 5% genotypes					188
C.V. (%) genotypes					9.0
C.D. at 5%	Between 2 D/T at same level of genotype				370
C.D. at 5%	Between 2 genotypes at same level of D/T				325

Table 4 PBAG 27: Pooled ANOVA of cured leaf yield in *pikka* tobacco

Source	df	MSS
		Cured leaf yield (kg/ha)
Replication		42092.43
Year (Y)	1	4326211.13**
Dates of transplanting (D)	2	1469795.43**
Y x D	2	87827.38
Error a	8	**26830.74**
Genotypes (G)	3	968017.24**
G x D	6	271562.04**
G x Y	3	110427.94*
D x G x Y	6	174765.91**
Error b	36	**28279.65**
Total	71	

*, ** significant at 5% and 1% levels respectively

Table 5 PBAG 27: Pooled cured leaf yield (kg/ha) of *pikka* tobacco genotypes under different dates of planting

Dates of transplanting / Genotypes	Cured leaf yield (kg/ha)				
	BPT 7	BPT 50	Gajapati (C)	JP Local (C)	Mean
D1 (16.8.23)	1819	1366	1638	1503	1581
D2 (1.9.23)	2337	2335	1787	1816	2069
D3 (16.9.23)	2203	2191	1666	1545	1901
Mean	2120	1964	1697	1621	1850
C.D. at 5% D/T					109.0
C.D. at 5% genotypes					113.7
C.D. at 5%Between 2 Dates at same level of genotype					**219.9**
C.D. at 5%Between 2 genotypes at same level of Date					**113.7**

Table 6 PBAG 27: ANOVA of chemical parameters in*pikka* tobacco during 2023

Source	df	MSS		
		Nicotine (%)	Reducing Sugar (%)	Chloride (%)
Replication	2	1.203*	13.520**	0.129*
Dates of transplanting (D)	2	0.105	1.503	0.049
Error a	4	0.103	0.610	0.012
Genotypes (G)	3	0.085	1.424	0.059
D X G	6	0.164	1.413	0.090
Error b	18	0.135	1.246	0.035
Total	35			

*, ** significant at 5% and 1% levels respectively

Table 7 PBAG 27: Chemical parameters response of *pikka* tobacco genotypes to different dates of transplanting during 2023

Dates of transplanting, 2023	Nicotine (%)	Reducing Sugar (%)	Chloride (%)
D1 (16.8.23)	0.61	1.25	0.75
D2 (1.9.23)	0.67	1.95	0.70
D3 (16.9.23)	0.80	1.49	0.62
Mean	0.69	1.56	0.69
C.D. at 5%	NS	NS	NS
G1 (BPT 7)	0.78	1.71	0.67
G2 (BPT 50)	0.67	1.31	0.73
G3 (Gajapati-C)	0.76	1.18	0.77
G4 (JP Local-C)	0.57	2.06	0.59
Mean	0.69	1.56	0.69
C.D. at 5%	NS	NS	NS

Project No.: PBAG 28

Research project title	**Response of *pikka* tobacco genotypes to different fertility levels**
Objectives	▪ To study the response of promising *pikka* tobacco genotype BPT-7 and BPT-50 to different fertility levels
Investigators	A. M. Prusti
Year of start	2022-23
Year of completion	2024-25
Location	AINP on Tobacco, CPR, Berhampur

Experiment details

Treatments: 12

Main plot: 3 fertilizer doses	Sub Plot: 4 Genotypes
F_1: N:P_2O_5:K_2O @ 60:30:30 kg /ha	G_1: BPT 7
F_2 :N:P_2O_5:K_2O @ 80:40:40 kg/ha	G_2: BPT 50
F_3 : N:P_2O_5:K_2O @ 100:50:50 kg /ha	G_3: Gajapat
	G_4: JP local

Design : Split Plot	Spacing: 75 x 50 cm
Replications: 3	Plot size: Gross (4.5 X 5.0 m) Net (3.0 x 4.0 m)
Manurial schedule: as per treatment.	

RESULTS

Two genotypes of *pikka* tobacco (BPT 7 and BPT 50) along with two check varieties Gajapati and JP local were evaluated during *kharif* 2023 in split plot design with three replications for cured leaf yield and ancillary characters. Three fertilizer doses (F_1: N:P_2O_5:K_2O @ 60:30:30kg /ha, F_2: N:P_2O_5:K_2O @ 80:40:40kg /ha and F_3: N:P_2O_5:K_2O @ 100:50:50kg /ha) were assigned to three main plots and four genotypes (G_1: BPT 7, G_2: BPT 50, G_3: Gajapati and G_4: JP Local) were assigned to sub plots. Analysis of variance of cured leaf yield and ancillary characters of *pikka* tobacco genotypes are presented in Table 1 PBAG 28, significant differences existed among fertilizer levels and genotypes effects for cured leaf yield and ancillary characters. Significant differences existed for interaction component (F x G) for all characters except leaf width and cured leaf yield.

Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes grown during 2023 are presented in Table2 PBAG 28. It was observed that fertility levels had strong effect on the performance of all *pikka* tobacco genotypes. Application of F_3: N:P_2O_5:K_2O @ 100:50:50 kg /ha recorded significantly higher cured leaf yield (2575 kg/ha) than F_1: N:P_2O_5:K_2O @ 60:30:30 kg /ha (2060kg /ha) but at par with F_2: N:P_2O_5:K_2O @ 80:40:40kg /ha (2472 kg /ha). Application of F_2: N:P_2O_5:K_2O @ 80:40:40kg/ha (2472kg /ha) also produced significantly higher cured leaf yield than F_1:

$N:P_2O_5:K_2O$ @ 60:30:30kg /ha(2060 kg /ha). Application of F_3: $N:P_2O_5:K_2O$ @ 100:50:50kg/ha produced 25.0 % and 4.2 % higher cured leaf yield than F_1: $N:P_2O_5:K_2O$ @ 60:30:30 kg /ha and F_2: $N:P_2O_5:K_2O$ @ 80:40:40 kg /ha respectively. Among two test genotypes BPT 7 (2505 kg/ha) produced significantly higher cured leaf yield over better variety Gajapati (2358 kg/ha) produced 6.23% higher cured leaf yield.

Cured leaf yield during 2023 ranged from 1848 kg/ha ($F_{1\ JP}$ Local) to 2712 kg/ha (F_3 BPT 7) with an average yield of 2369 kg/ha (Table3 PBAG 28). Interaction of genotypes and fertilizer doses indicated that all genotypes responded positively when fertilizer dose enhanced from F_1: $N:P_2O_5:K_2O$ @ 60:30:30kg /ha (2060 kg/ha) to F_3: $N:P_2O_5:K_2O$ @ 100:50:50kg /ha(2575 kg/ha). Application of both F_2: $N:P_2O_5:K_2O$ @ 80:40:40kg /ha (2472 kg/ha) and F_3: $N:P_2O_5:K_2O$ @ 100:50:50kg /ha(2575 kg/ha) significantly enhanced cured leaf yield over F_1: $N:P_2O_5:K_2O$ @ 60:30:30kg /ha (2060 kg/ha). Performance of genotype BPT 7 and BPT 50 with respect to cured leaf yield were found significantly higher than check variety JP Local but at par with check variety Gajapati at three levels of fertility.

Pooled ANOVA of cured leaf yield in *pikka* tobacco (Table 4 PBAG 28) revealed that leaf yield in tobacco was significantly influenced by year (Y), fertility levels (F), genotypes (G) and interaction of above mentioned components such as Y*F, Y*G, F*G and Y*F*G.

Pooled analysis (Table 2 PBAG 28) revealed that application of F_2: $N:P_2O_5:K_2O$ @ 80:40:40kg /ha recorded significantly higher cured leaf yield (2206 kg /ha) than F_1: $N:P_2O_5:K_2O$ @ 60:30:30 kg /ha (1805 kg /ha) but at par with F_3: $N:P_2O_5:K_2O$ @ 100:50:50 kg /ha (2172 kg /ha). Also F_3 produced significantly higher cured leaf yield than $F_{1.}$ Among genotypes BPT 7 recorded significantly higher cured leaf yield (2249 kg /ha) over other genotypes. Performance of BPT 50 with respect to cured leaf yield was at par with Check variety Gajapati.

It was indicated from two years pooled data (Table 5 PBAG 28) that cured leaf yield ranged from 1724 kg /ha (F 1 JP Local) to 2459kg /ha (F3 BPT 7) with average yield of 2061 kg /ha. All entries including checks produced significantly lowest cured leaf yield at F_1: $N:P_2O_5:K_2O$ @ 60:30:30 kg /ha than F_3: $N:P_2O_5:K_2O$ @ 100:50:50 kg /ha and F_2: $N:P_2O_5:K_2O$ @ 80:40:40kg /ha and produced maximum cured leaf yield at F_3: $N:P_2O_5:K_2O$ @ 100:50:50 kg /ha except BPT 50 which recorded maximum yield at F_2: $N:P_2O_5:K_2O$ @ 80:40:40 kg /ha (2310 kg /ha).

Genotype BPT 7 and check varieties Gajapati and JP Local though produced maximum leaf yield at F_3: $N:P_2O_5:K_2O$ @ 100:50:50 kg /ha level their performance found to be at par with F_2: $N:P_2O_5:K_2O$ @ 80:40:40kg /ha . Further it was revealed that there was no significant difference among test entries at F1(60:30:30) level. Genotype BPT 7 recorded significantly higher cured leaf yield over better check variety Gajapati at F 2(80:40:40 kg /ha) and F3(100:50:50 kg /ha) levels. Genotype BPT 50 exhibited significantly higher cured leaf yield over better check variety Gajapati at F2(80:40:40 kg /ha) level only. Therefore, it appears from two years experiment that application of N: $P_2\ O_5:K_2O$ @80:40:40 kg /ha is optimum for higher cured leaf yield for test entries BPT 7 and BPT 50.

Effect of different fertility levels on chemical parameters such as Nicotine (%), Reducing Sugar (%) and Chloride (%) on different genotypes are presented in Table 6 PBAG 28 and Table 7 PBAG 28. Analysis of variance of chemical parameters in pikka tobacco during 2023 (Table 6 PBAG 28) revealed that fertility levels had no significant effect on chemical parameters such as Nicotine (%) and Reducing Sugar (%) except Chloride (%). Similarly there was no significant difference among test entries for Nicotine (%), Reducing Sugar (%) and Chloride (%) content. It was further revealed from Table 7 PBAG 27 that maximum nicotine content (1.70 %), maximum reducing sugar (1.59%) and minimum chloride content (0.51%) were expressed by F3(100:50:50), F 1(60:30:30) and F 2(80:40:40) respectively but they were found at par with other fertility levels. It was also found that there was no significant difference among test entries with respect to chemical parameters such as Nicotine (%) and Reducing Sugar (%) except Chloride (%).It was found from Table 7 PBAG 27 that all genotypes had acceptable range of chemical parameters.

Conclusion: Two years data revealed that application of N: P_2O_5:K_2O @80:40:40 kg /ha is optimum for higher cured leaf yield for test entries BPT 7 and BPT 50.

Table 1 PBAG 28: Cured leaf yield and ancillary characters in pikka tobacco 2023

Source	df	MSS				
		Cured leaf yield (kg/ha)	Topped Plant Height (cm)	No. of leaves/ plant	Leaf Length (cm)	Leaf Breadth (cm)
Replication	2	291258.86**	697.994**	1.922	33.280**	4.493
Main plot (Fertility levels)	2	893939.53**	854.327**	7.981*	53.206**	53.147**
Error a	4	14655.78	11.092	0.990	1.596	1.351
Sub plot (Genotypes)	3	234003.74**	1678.522**	5.111**	41.916**	12.729*
Interaction	6	3061.60	174.210*	2.410*	3.478*	1.905
Error b	18	27386.06	53.879	0.761	1.187	3.407
Total	35					

**, ** significant at 5% and 1% levels respectively*

Table 2 PBAG 28: Response of *pikka* tobacco genotypes to different Fertility levels

Treatments	Cured leaf yield (kg/ha)			Topped Plant Height (cm)	No. of leaves / plant	Leaf length (cm)	Leaf breadth (cm)
	2022	2023	Pooled				
Main Factor: Fertility levels (F)							
F1 (60:30:30)	1550	2060	1805	107.2	17.8	51.3	22.8
F2(80:40:40)	1940	2472	2206	124.0	19.2	55.2	26.9
F3(100:50:50)	1768	2575	2172	117.5	19.2	54.5	25.7
Mean	1753	2369	2061	116.2	18.7	53.7	25.1
C.D. at 5%	133	137	79	3.8	1.1	1.4	1.3
C.V. (%)	6.7	5.1		2.9	5.3	2.4	4.6
Sub Factor: Genotypes							
G1 (BPT 7)	1994	2505	2249	112.9	19.8	56.7	26.8
G2 (BPT 50)	1694	2467	2081	132.0	18.3	52.9	24.8
G3 (Gajapati-C)	1645	2358	2001	99.4	18.1	51.6	24.8
G4 (JP Local-C)	1677	2146	1912	120.6	18.8	53.5	24.1
Mean	1753	2369	2061	116.2	18.7	53.7	25.1
C.D. at 5%	123	164	99	7.3	0.9	1.1	1.8
C.V. (%)	7.1	7.0		6.3	4.7	2.0	7.3
C.D. at 5%F within G	226	280	168	11.5	1.7	11	3.0
C.D. at 5%G within F	213	284	171	12.6	1.5	1.9	3.2

Table 3 PBAG 28: Cured leaf yield (kg/ha) of *pikka* tobacco genotypes under different Fertility levels

	Cured leaf yield (kg/ha)				
Fertility / Genotypes	BPT 7	BPT 50	Gajapati (C)	JP Local (C)	Mean
F1 (60:30:30)	2202	2186	2002	1848	2060
F2 (80:40:40)	2601	2537	2491	2260	2472
F3 (100:50:50)	2712	2679	2581	2330	2575
Mean	2505	2467	2358	2146	2369
C.D. at 5% Fertility					137
C.D. at 5% genotypes					164
C.D. at 5%Between 2 fertility at same level of genotype					280
C.D. at 5%Between 2 genotypes at same level of fertility					284

Table 4 PBAG 28: Pooled ANOVA of cured leaf yield in *pikka* tobacco

Source	df	MSS
		Cured leaf yield (kg/ha)
Year (Y)	1	6837602.00**
Rep	4	**8556.35**
Fertility Level (F)	2	1186473.01**
Y*F	2	164946.54**
Er a	8	**14254.28**
Genotypes (G)	3	370822.48**
F*G	6	62268.33*
Y*G	3	100526.19**
Y*F*G	6	74574.34*
Er b	36	**21389.39**
Total	71	

*, ** significant at 5% and 1% levels respectively

Table 5 PBAG 28: Pooled data on cured leaf yield (kg/ha) of *pikka* tobacco genotypes under different Fertility levels

Fertility / Genotypes	Pooled cured leaf yield (kg/ha)				
	BPT 7	BPT 50	Gajapati (C)	JP Local (C)	Mean
F1 (60:30:30)	1878	1874	1744	1724	1805
F2 (80:40:40)	2411	2310	2105	1998	2206
F3 (100:50:50)	2459	2059	2155	2014	2172
Mean	2249	2081	2001	1912	2061
C.D. at 5% Fertility					79
C.D. at 5% Genotypes					99
C.D. at 5%Between 2 fertility at same level of genotype					168
C.D. at 5%Between 2 genotypes at same level of fertility					171

Table 6 PBAG 28: ANOVA of chemical parameters in*pikka* tobacco during 2023

Source	df	MSS		
		Nicotine (%)	Reducing Sugar (%)	Chloride (%)
Replication	2	1.373	0.820	0.008
Main plot (Fertility levels)	2	1.330	0.428	0.096
Error a	4	0.255	1.583	0.013
Sub plot (Genotypes)	3	0.553	1.343	0.039
Interaction	6	0.095	0.702	0.023
Error b	18	0.405	0.730	0.038
Total	35			

Table 7 PBAG 28: Chemical parameters response of *pikka* tobacco genotypes to different dates of transplanting during 2023

Dates of transplanting, 2023	Nicotine (%)	Reducing Sugar (%)	Chloride (%)
F1 (60:30:30)	1.11	1.59	0.57
F2 (80:40:40)	1.15	1.21	0.51
F3 (100:50:50)	1.70	1.38	0.69
Mean	1.32	1.39	0.59
C.D. at 5%	NS	NS	NS
G1 (BPT 7)	1.19	1.22	0.57
G2 (BPT 50)	1.30	1.29	0.65
G3 (Gajapati-C)	1.67	1.10	0.51
G4 (JP Local-C)	1.12	1.96	0.63
Mean	1.32	1.39	0.59
C.D. at 5%	NS	NS	NS

CROP PROTECTION: ENTOMOLOGY

FCV TOBACCO

SHIVAMOGGA

Project No.: BDAPP 135

Research project title	**Screening of tobacco cultivars against leaf curl virus transmitted by whitefly, *Bemisia tabaci* under field condition**
Objectives	▪ To identify the resistant cultivar for the management of Tobacco Leaf Curl Virus under field condition
Investigators	Prashantha C., Rajashekarappa K.,T. M. Soumya, Shashikala S Kolakar
Year of start	2021
Year of completion	2023
Location	AINP (T), ZAHRS, Shivamogga

Experimental details:

Design : RBD
Replications : 3
Cultivars : 16
Season : *kharif*

Results

Among the 16 cultivars evaluated in field condition against Tobacco leaf curl virus which is transmitted by whitefly (*Bemisia tabaci*) five cultivars *viz*., Aurea, Sahyadri, Kanchan, FCS-4, Thrupthi shown resistant and five cultivars *viz*., Rhomas-7, RG-13, NC-37-NF, SPEIGTT-G-28, DELCRAST-66 were moderately resistant and remaining six cultivars *viz*., VA-770, VA-310, VA-509, TANTA, REAM-151 and VA-21 were moderately susceptible (Table 1).

Table 1 VFSEN 35: Incidence of whitefly, *Bemisia tabaci* on different cultivars of tobacco during *kharif*,2021

Sl. No.	Variety	No.ofwhiteflies perleaf				
		30DAT	60DAT	90DAT	120DAT	Mean
1	Aurea	2.03 (1.59)^{i}	3.00 (1.87)^{e}	3.35 (1.95)^{g}	1.70 (1.48)^{f}	2.52
2	Sahyadri	2.33 (0167)^{h}	3.10 (1.88)^{de}	3.53 (2.01)^{fg}	1.80 (1.51)^{ef}	2.69
3	VA-770	3.79 (2.07)^{a}	5.70 (2.48)^{a}	6.10 (2.56)^{a}	4.50 (2.24)^{a}	5.02
4	VA-310	3.70 (2.04)^{a}	5.57 (2.46)^{a}	5.93 (2.53)^{ab}	4.17 (2.16)^{ab}	4.84
5	Kanchan	2.43 (1.71)^{gh}	3.37 (1.94)^{cde}	3.77 (2.06)^{ef}	2.00 (1.58)^{def}	2.89
6	FCS-4	2.65 (1.76)^{fg}	3.53 (2.00)^{cd}	3.90 (2.09)^{ef}	2.17 (1.63)^{def}	3.06
7	VA-509	3.68 (2.04)^{a}	5.50 (2.44)^{a}	5.90 (2.52)^{ab}	4.07 (2.13)^{ab}	4.79
8	TANTA	3.60 (2.02)^{ab}	5.30 (2.41)^{a}	5.74 (2.50)^{ab}	3.93 (2.10)^{abc}	4.64
9	REAM-151	3.34 (1.95)^{bc}	5.23 (2.38)^{a}	5.67 (2.48)^{abc}	3.87 (2.09)^{abc}	4.53
10	Thrupthi	2.53 (1.72)^{gh}	3.50 (2.00)^{cde}	3.87 (2.07)^{ef}	2.13 (1.61)^{def}	3.01
11	VA-21	3.70 (2.05)^{a}	5.60 (2.46)^{a}	5.97 (2.54)^{ab}	4.20 (2.17)^{ab}	4.87
12	Rhomas-7	3.33 (1.95)^{bc}	5.17 (2.38)^{a}	5.53 (2.45)^{abc}	3.83 (2.08)^{abc}	4.47
13	RG-13	3.20 (1.92)^{cd}	4.87 (2.30)^{a}	5.23 (2.39)^{bc}	3.43 (1.98)^{bc}	4.18
14	NC-37-NF	2.87 (1.83)^{ef}	3.63 (2.03)^{cd}	3.93 (2.08)^{ef}	2.27 (1.66)^{de}	3.18
15	SPEIGTT-G-28	2.97 (1.86)^{de}	3.95 (2.10)^{bc}	4.31 (2.18)^{de}	2.53 (1.74)^{d}	3.44
16	DELCRAST-66	3.07 (1.88)^{j}	4.57 (2.24)^{ab}	4.94 (2.33)^{cd}	3.20 (1.92)^{c}	3.94
Fvalue		*	*	*	*	-
S.Em±		0.03	0.07	0.06	0.08	-
CV(%)		5.87	7.90	6.39	10.52	-
CD@5%		0.11	0.23	0.19	0.24	-

Numbers in the parenthesis are square root transformed values
* -Significant at (P≤0.05); DAT- Days after transplanting

Table 2 VFSEN 35: Incidence of whitefly, *Bemisia tabaci* on different cultivars of tobacco during *kharif* 2023

Sl.no.	Variety	No. of whiteflies per leaf				
		30 DAT	60 DAT	90 DAT	120 DAT	Over all mean
1	Aurea	2.53 (1.74)^{d}	3.06 (1.85)^{d}	3.52 (1.98)^{d}	1.81 (1.50)^{e}	2.73
2	Sahyadri	2.70 (1.78)^{d}	3.32 (1.93)^{d}	3.60 (2.02)^{d}	1.90 (1.55)^{de}	2.88
3	VA-770	4.88 (2.31)^{abc}	6.68 (2.66)^{abc}	7.80 (2.85)^{a}	3.52 (1.94)^{abc}	5.72
4	VA-310	5.25 (2.37)^{ab}	7.50 (2.83)^{ab}	8.90 (3.06)^{a}	4.11 (2.09)^{a}	6.44
5	Kanchan	2.60 (1.75)^{d}	3.32 (1.88)^{d}	4.51 (2.19)^{cd}	3.00 (1.87)^{abcd}	3.36
6	FCS-4	2.80 (1.81)^{d}	3.52 (1.96)^{d}	4.80 (2.30)^{bcd}	3.17 (1.91)^{abc}	3.57
7	VA-509	3.88 (2.08)^{abcd}	7.83 (2.87)^{ab}	6.80 (2.70)^{ab}	3.78 (2.01)^{ab}	5.57
8	TANTA	3.78 (2.06)^{abcd}	7.20 (2.76)^{ab}	6.90 (2.72)^{ab}	3.70 (2.05)^{ab}	5.39
9	REAM-151	3.42 (1.98)^{cd}	8.10 (2.93)^{a}	6.50 (2.64)^{abc}	3.10 (1.90)^{abcd}	5.28
10	Thrupti	2.60 (1.75)^{d}	5.53 (2.41)^{abcd}	4.70 (2.23)^{bcd}	2.80 (1.79)^{abcd}	3.91
11	VA-21	5.44 (2.41)^{a}	7.55 (2.83)^{ab}	8.80 (3.05)^{a}	3.90 (2.10)^{a}	6.42
12	Rhomas-7	3.52 (2.00)^{bcd}	6.32 (2.61)^{abc}	8.20 (2.95)^{a}	3.10 (1.90)^{abcd}	5.29
13	RG-13	3.42 (1.98)^{cd}	4.90 (2.28)^{bcd}	7.90 (2.90)^{a}	2.40 (1.70)^{bcde}	4.66
14	NC-37-NF	2.89 (1.83)^{d}	3.59 (1.95)^{d}	6.95 (2.72)^{ab}	2.10 (1.61)^{cde}	3.88
15	SPEIGTT-G-28	311 (1.89)^{d}	4.11 (2.13)^{cd}	7.11 (2.72)^{ab}	2.20 (1.61)^{cde}	4.13
16	DELCRAST-66	3.32 (1.95)^{cd}	4.11 (2.13)^{cd}	7.50 (2.83)^{a}	2.60 (1.76)^{abcd}	4.38
F value		*	*	*	*	-
SEm±		0.13	0.21	0.17	0.12	-
CV(%)		11.72	15.21	11.39	11.65	-
CD@5%		0.39	0.60	0.50	0.36	-

Numbers in the parenthesis are square root transformed values

* -Significant at (P≤0.05); DAT- Days after transplanting

Table 3 VFSEN 35: Leaf curl disease incidence on tobacco cultivars during *kharif* 2021

S. No.	Variety	Disease Incidence (%)				
		30 DAT	60 DAT	90 DAT	120 DAT	Mean
1	Aurea	2.80 (9.56)^{e}	6.88 (15.17)^{f}	11.77 (19.99)^{f}	18.47 (25.44)^{g}	9.98
2	Sahyadri	4.13 (11.65)^{de}	8.21 (16.65)^{ef}	13.77 (21.68)^{f}	20.13 (26.62)^{fg}	11.56
3	VA-770	57.80 (49.56)^{a}	61.88 (52.18)^{a}	69.77 (56.73)^{a}	71.13 (57.58)^{a}	65.15
4	VA-310	55.80 (48.41)^{a}	59.88 (51.03)^{a}	67.77 (55.56)^{a}	69.13 (56.31)^{ab}	63.15
5	Kanchan	5.47 (13.20)^{de}	9.55 (17.89)^{ef}	16.77 (24.17)^{ef}	22.47 (28.28)^{efg}	13.56
6	FCS-4	8.13 (16.27)^{d}	12.21 (20.45)^{cdef}	19.44 (26.13)^{def}	25.13 (30.09)^{defg}	16.23
7	VA-509	54.13 (47.46)^{ab}	58.21 (50.05)^{a}	66.10 (54.60)^{a}	67.47 (55.33)^{ab}	61.48
8	TANTA	52.47 (46.49)^{ab}	56.55 (49.09)^{a}	64.44 (53.65)^{ab}	65.80 (54.36)^{ab}	59.81
9	REAM-151	50.47 (45.31)^{ab}	54.55 (47.88)^{a}	62.44 (52.49)^{ab}	63.80 (53.15)^{ab}	57.81
10	Thrupthi	6.80 (15.02)^{de}	10.88 (19.17)^{def}	18.10 (25.13)^{def}	23.80 (29.19)^{defg}	14.90
11	VA-21	56.80 (48.98)^{a}	60.88 (51.61)^{a}	68.77 (56.14)^{a}	70.13 (56.91)^{a}	64.15
12	Rhomas-7	45.13 (42.17)^{b}	49.88 (44.91)^{a}	54.44 (47.63)^{b}	59.13 (50.32)^{b}	52.15
13	RG-13	22.80 (28.51)^{c}	27.55 (31.64)^{b}	32.10 (34.48)^{c}	36.80 (37.28)^{c}	29.81
14	NC-37-NF	14.80 (22.44)^{c}	19.55 (26.23)^{bcde}	24.10 (29.37)^{cde}	28.80 (32.42)^{cdef}	21.81
15	SPEIGTT-G-28	18.13 (25.08)^{c}	22.88 (28.48)^{bcd}	27.44 (31.54)^{cd}	32.13 (34.44)^{cde}	25.15
16	DELCRAST-66	19.80 (26.41)^{c}	24.55 (29.65)^{bc}	29.10 (32.64)^{c}	33.80 (35.41)^{cd}	26.81
F value		*	*	*	*	-
S. Em±		2.03	3.36	2.16	2.15	
C.V.(%)		11.81	17.52	10.01	9.37	-
C.D. at 5%		6.11	10.08	6.49	6.47	-

Numbers in the parenthesis are arcsine transformed values
* -Significant at (P≤0.05); DAT- Days after transplanting

Table 4 VFSEN 35: Leaf curl disease incidence in tobacco cultivars during *kharif* 2023

Sl. No.	Variety	Disease Incidence (%)				
		30DAT	60DAT	90DAT	120DAT	Overall mean
1	Aurea	3.10 (10.13)^{g}	7.50 (15.88)^{e}	13.80 (21.78)^{e}	25.40 (30.24)^{cde}	12.45
2	Sahyadri	4.50 (12.23)^{fg}	9.90 (18.32)^{e}	16.10 (23.63)^{de}	26.60 (31.02)^{bcde}	14.28
3	VA-770	37.01 (37.24)^{a}	58.80 (50.17)^{a}	54.56 (47.79)^{a}	55.70 (48.30)^{a}	51.52
4	VA-310	34.97 (35.98)^{a}	57.27 (49.31)^{a}	52.19 (46.33)^{a}	52.33 (46.54)^{a}	49.19
5	Kanchan	7.40 (15.77)^{ef}	10.50 (18.89)^{e}	24.10 (29.37)^{bcd}	22.40 (28.22)^{de}	16.10
6	FCS-4	9.80 (18.22)^{de}	14.21 (22.04)^{de}	26.30 (30.83)^{bcd}	20.90 (27.18)^{e}	17.80
7	VA-509	32.99 (35.00)^{a}	48.09 (43.89)^{a}	54.10 (47.37)^{a}	55.60 (48.24)^{a}	47.70
8	TANTA	29.05 (32.58)^{ab}	45.60 (42.47)^{a}	53.10 (46.79)^{a}	54.80 (47.78)^{a}	45.64
9	REAM-151	25.03 (29.99)^{b}	55.40 (48.12)^{a}	49.50 (44.71)^{a}	53.80 (47.20)^{a}	45.93
10	Thrupti	8.60 (17.03)^{ef}	12.63 (20.77)^{de}	21.56 (27.63)^{cde}	23.80 (29.17)^{cde}	16.65
11	VA-21	31.19 (33.92)^{ab}	52.46 (46.43)^{a}	50.02 (44.96)^{a}	56.10 (48.53)^{a}	47.44
12	Rhomas-7	29.05 (32.58)^{ab}	45.90 (42.61)^{a}	47.90 (43.79)^{a}	52.30 (46.33)^{a}	43.79
13	RG-13	16.02 (23.57)^{c}	29.51 (32.51)^{b}	32.80 (34.91)^{bc}	37.60 (37.80)^{b}	28.98
14	NC-37-NF	12.07 (20.31)^{cde}	19.50 (26.18)^{cd}	29.70 (33.00)^{bc}	32.80 (34.91)^{bcd}	23.52
15	SPEIGTT-G-28	15.05 (22.80)^{cd}	28.19 (31.91)^{bc}	31.22 (33.61)^{bc}	34.10 (35.70)^{bc}	27.14
16	DELCRAST-66	16.01 (23.56)^{c}	25.40 (30.24)^{bc}	34.20 (35.76)^{b}	31.50 (34.12)^{bcde}	26.78
F value		*	*	*	*	-
S. Em±		1.69	2.18	2.53	2.51	-
C.V.(%)		11.72	11.46	11.86	11.18	-
C.D. at 5%		4.90	6.29	7.32	7.24	-

Numbers in the parenthesis are arcsine transformed values

* -Significant at (P≤0.05); DAT- Days after transplanting

Table 5 VFSEN 35: Categorization of tobacco cultivars against leaf curl disease incidence during *kharif* 2021 and 2023

Sl. No.	Cultivar	Leaf curl incidence (%)			Damage score	Resistance category
		2021	2023	Pooled		
1	Aurea	9.98	12.45	11.22	2	Resistant
2	Sahyadri	11.56	14.28	12.92	2	Resistant
3	VA-770	65.15	51.52	58.34	4	Moderately Susceptible
4	VA-310	63.15	49.19	56.17	4	Moderately Susceptible
5	Kanchan	13.56	16.10	14.83	2	Resistant
6	FCS-4	16.23	17.80	17.02	2	Resistant
7	VA-509	61.48	47.70	54.59	4	Moderately Susceptible
8	TANTA	59.81	45.64	52.73	4	Moderately Susceptible
9	REAM-151	57.81	45.93	51.87	4	Moderately Susceptible
10	Thrupthi	14.90	16.65	15.78	2	Resistant
11	VA-21	64.15	47.44	55.80	4	Moderately Susceptible
12	Rhomas-7	52.15	43.79	47.97	3	Moderately Resistant
13	RG-13	29.81	28.98	29.40	3	Moderately Resistant
14	NC-37-NF	21.81	23.52	22.67	3	Moderately Resistant
15	SPEIGTT-G-28	25.15	27.14	26.15	3	Moderately Resistant
16	DELCRAST-66	26.81	26.78	26.80	3	Moderately Resistant

Project No.: BDAPP 36

Research project title	**Management of Tobacco leaf curl virus vector, Whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) by using different modules**
Objectives	▪ To evaluate different modules for the management of Tobacco Leaf Curl Virus transmitted by whitefly, *Bemisia tabaci*
Investigators	Prashantha C., Rajashekarappa K.,T. M. Soumya, Shashikala S Kolakar
Year of start	2021
Year of completion	2023
Location	AINP (T), ZAHRS, Shivamogga

Experimental details:

Treatments: 4 Replications :5 Design: RBD

Season: *Kharif* Variety: Sahyadri

Observations:

- Number of whiteflies per leaf and percent disease incidence at 30, 60, 90 and 120 days after transplanting
- Number of different natural enemies in each treatment
- Green and cured leaf yield (kg ha^{-1})

RESULTS

Among the different modules evaluated against whitefly *B. tabaci*, the module-1 (IPM module) found to be superior with a highest per cent reduction of whitefly population (80.98), followed by module-2 (69.81%) and module-3 (59.87%) (Table 2 VFSEN 36). Among the different modules evaluated during 2023 against whitefly *B.tabaci*, the module-1 (IPM module) found to be superior with a highest per cent reduction of 60.71 whitefly population, followed by the module-2 (56.60 %) and the module-3 (30.49 %) (Table 3 VFSEN 36). Pooled data shows that, module-1 (IPM module) found to be superior with a highest per cent reduction of 71.69 whitefly population, followed by module-2 (67.10 %) and module-3 (47.93 %) (Table 4 VFSEN 36). During 2022 Tobacco Leaf Curl Virus disease in module-1 (IPM module) with 76.59 per cent reduction in TLCV followed by module-2 (73.36 %)(Table 5 VFSEN 36). Tobacco Leaf Curl Virus disease incidence is less in module-1 (IPM module) with 63.32 per cent reduction in TLCV followed by module-2 (52.94 %)(Table 6 VFSEN 36). Pooled data of 2022 and 2023 indicated that Tobacco Leaf Curl Virus disease was found less in module-1 (IPM module) with 71.64 per cent reduction of TLCV followed by module-2 (65.31 %) (Table 7 VFSEN 36). The highest mean natural enemies (3.14 per plant) were recorded in module-4 (Untreated control) followed by module-3 (2.63/plant) (Table 8 VFSEN 36). The significantly highest cured leaf yield was recorded in module-1(Integrated module) (1592 kg/ha) followed by module 2 (1474kg/ha). (Table 9 VFSEN 36). The highest C:B ratio of 1:2.2 was recorded in module-1 (Integrated module), followed by module-2 with C:B ratio of 1:2.1, whereas lowest C:B ratio was recorded in untreated control (1:1.5). (Table 10 VFSEN 36). The present investigation indicated that IPM module proved to be effective in minimizing the whitefly infestation, reducing the Tobacco Leaf Curl Virus disease by enhancing the natural enemy activity with high C:B ratio (Table 10 VFSEN 36).

Table 1 VFSEN 36: Details of the different modules for the management of whitefly, *B. tabaci* in FCV Tobacco during

Treatment	Module	Particulars
M_1	Integrated	• Foliar spray of seedlings with Imidacloprid 17.8 SL @ 0.3 ml/l one day before planting • Maize as a barrier crop (sow maize 10 days before tobacco transplanting) • Yellow sticky traps @ 10/acre^{-1} • Two sprays of Azadirachtin 1EC @ 2ml/l @ 20 and 30 DAT • Need based spray of Imidacloprid 17.8 SL @ 0.3 ml/l
M_2	Chemical	• Two sprays of Imidacloprid 17.8 SL @ 0.3 ml/l@10 and 40 DAT • Two sprays Thiamethoxam 25 WG @ 0.3 g/l @ 25 and 55 DAT
M_3	Bio-intensive	• Maize as a barrier crop (sow maize 10 days before tobacco transplanting) • Two sprays of Azadirachtin 1EC @ 2ml/l @ 10 and 20 DAT • One spray of *Lecanicilium lecanii* @ 5.0 g/l @ 30 DAT • One spray of *Metarhizium rileyi* @ 3.0 g/l@ 40 DAT
M_4	Control	• Untreated Control

Table 2 VFSEN 36: Population of whitefly, *B. tabaci* in different modules of FCV tobacco during 2022

Module	No. of whiteflies per leaf					Per cent Reduction Over Control
	30 DAT	60 DAT	90 DAT	120 DAT	Overall Mean	
Module-1 (Integrated)	0.73 (4.88)^{d}	1.32 (6.60)^{d}	1.93 (7.99)^{a}	2.61 (9.22)^{c}	1.65	80.98
Module-2 (Chemical)	1.38 (6.72)^{c}	2.18 (8.50)^{c}	3.21 (10.30)^{b}	3.69 (11.07)^{b}	2.62	69.81
Module-3 (Bio- intensive)	2.39 (8.89)^{b}	2.91 (9.80)^{b}	4.08 (11.62)^{c}	4.54 (12.29)^{b}	3.48	59.87
Module-4 (Untreated control)	3.62 (10.96)^{a}	5.63 (13.68)^{a}	8.18 (16.57)^{d}	9.33 (17.76)^{a}	6.69	-
F value	*	*	*	*	-	-
S. Em±	0.07	0.14	0.14	0.19	-	-
C.V. (%)	5.9	8.83	8.23	7.99	-	-
C.D. at 5%	0.641	1.17	1.31	1.38	-	-

Numbers in the parenthesis are square root transformed values
DAT- Days After Transplanting,

Table 3 VFSEN 36: Population of whitefly, *B. tabaci* in different modules of FCV tobacco during 2023

Module	No. of whiteflies per leaf				Overall mean	Per cent Reduction Over Control
	30 DAT	60 DAT	90 DAT	120 DAT		
Module-1 (Integrated)	0.72 (1.10)[a]	1.68 (1.48)[a]	1.72 (1.49)[a]	1.43 (1.39)[a]	1.39	60.71
Module-2 (Chemical)	0.92 (1.19)[a]	2.00 (1.58)[a]	1.68 (1.48)[a]	1.53 (1.43)[a]	1.53	56.60
Module-3 (Bio-intensive)	1.32 (1.35)[b]	3.24 (1.93)[b]	2.72 (1.79)[b]	2.54 (1.74)[b]	2.46	30.49
Module-4 (untreated Control)	2.36 (1.69)[c]	4.08 (2.14)[c]	4.04 (2.13)[c]	3.65 (2.04)[c]	3.53	-
F value	*	*	*	*	-	-
S. Em±	0.08	0.14	0.12	0.13	-	-
C.V. (%)	13.22	11.69	10.78	13.08	-	-
C.D. at 5%	0.24	0.44	0.38	0.39	-	-

Numbers in the parenthesis are square root transformed values
DAT- Days After Transplanting

Table 4 VFSEN 36: Population of whitefly, *B. tabaci* in different modules of FCV Tobacco (pooled data of 2022 & 2023)

Module	Mean number of whiteflies/ leaf				Overall mean	Per cent Reduction Over Control
	30 DAT	60 DAT	90 DAT	120 DAT		
Module-1 (Integrated)	0.59 (1.04)[a]	1.42 (1.38)[a]	1.41 (1.38)[a]	1.26 (1.33)[a]	1.17	71.69
Module-2 (Chemical)	0.80 (1.14)[a]	1.74 (1.50)[a]	1.40 (1.38)[a]	1.50 (1.42)[a]	1.36	67.10
Module-3 (Bio- intensive)	1.18 (1.30)[b]	2.65 (1.78)[b]	2.53 (1.74)[b]	2.25 (1.66)[b]	2.15	47.93
Module-4 (Control)	2.91 (1.85)[c]	4.67 (2.27)[c]	4.59 (2.26)[c]	4.37 (2.21)[c]	4.13	-
F value	*	*	*	*	-	-
S. Em±	0.06	0.13	0.12	0.11	-	-
C.V. (%)	11.27	10.94	10.58	10.61	-	-
C.D. at 5%	0.21	0.39	0.36	0.34	-	-

Numbers in the parenthesis are square root transformed values
DAT- Days After Transplanting

Table 5 VFSEN 36: Incidence of Tobacco Leaf Curl Virus disease in different modules of FCV Tobacco during 2022

Module	Disease Incidence (%)					Per cent Reduction Over Control
	30 DAT	60 DAT	90 DAT	120 DAT	Overall Mean	
Module-1 (Integrated)	1.25 (6.38)[c]	1.62 (7.26)[c]	2.05 (8.23)[d]	3.21 (10.26)[c]	2.03	76.59
Module-2 (Chemical)	1.36 (6.65)[c]	1.63 (7.28)[c]	3.09 (10.13)[c]	3.15 (10.02)[c]	2.31	73.36
Module-3 (Bio-intensive)	2.27 (8.65)[b]	3.33 (10.48)[b]	4.34 (11.98)[b]	6.56 (14.82)[b]	4.13	52.42
Module-4 (Control)	3.8 (11.26)[a]	7.34 (15.70)[a]	10.63 (19.01)[a]	16.30 (23.78)[a]	9.52	-
F value	*	*	*	*	-	-
S. Em±	0.208	0.236	0.198	0.384	-	-
C.V. (%)	9.20	8.42	5.85	9.47	-	-
C.D. at 5%	1.04	1.18	0.99	1.92	-	-

Numbers in the parenthesis are arcsine transformed values,
DAT- Days After Transplanting

Table 6 VFSEN 36: Incidence of Tobacco Leaf Curl Virus disease in different modules of FCV Tobacco during 2023

Module	Disease Incidence (%)				Overall mean	Per cent Reduction Over Control
	30 DAT	60 DAT	90 DAT	120 DAT		
Module-1 (Integrated)	1.77 (7.45)[a]	2.50 (8.99)[a]	3.75 (10.93)[a]	3.75 (10.93)[a]	2.94	63.32
Module-2 (Chemical)	1.77 (7.45)[a]	3.75 (11.08)[a]	4.58 (12.32a)[b]	5.00 (12.86)[a]	3.78	52.94
Module-3 (Bio-intensive)	2.92 (9.69)[b]	5.83 (13.86)[b]	6.67 (14.86)[b]	7.08 (15.40)[b]	5.62	29.87
Module-4 (Control)	3.75 (11.08)[b]	7.50 (15.86)[b]	10.42 (18.60)[c]	10.42 (18.60)[c]	8.02	-
F value	*	*	*	*	-	-
S. Em±	0.52	0.81	0.75	0.77	-	-
C.V. (%)	13.09	14.49	11.79	11.99	-	-
C.D. at 5%	1.61	2.49	2.31	2.39	-	-

Numbers in the parenthesis are arcsine transformed values
DAT- Days After Transplanting

Table 7 VFSEN 36: Incidence of Tobacco Leaf Curl Virus disease in different modules of FCV Tobacco (Pooled data of 2022 & 2023)

Module	Disease Incidence (%)				Overall mean	Per cent Reduction Over Control
	30 DAT	60 DAT	90 DAT	120 DAT		
Module-1 (Integrated)	1.51 (7.05)[a]	2.06 (8.22)[a]	2.90 (9.77)[a]	3.48 (10.71)[a]	2.48	71.64
Module-2 (Chemical)	1.57 (7.19)[a]	2.69 (9.43)[a]	3.84 (11.28)[a]	4.08 (11.58)[a]	3.04	65.31
Module-3 (Bio-intensive)	2.59 (9.24)[b]	4.58 (12.29)[b]	5.50 (13.51)[b]	6.82 (15.14)[b]	4.87	44.43
Module-4 Control	3.79 (11.20)[c]	7.42 (15.80)[c]	10.52 (18.92)[c]	13.36 (21.42)[c]	8.77	-
F value	*	*	*	*	-	-
S. Em±	0.16	0.27	0.37	0.32	-	-
C.V. (%)	14.67	14.35	14.54	10.42	-	-
C.D. at 5%	0.48	0.83	1.14	1.01	-	-

Numbers in the parenthesis are arcsine transformed values
DAT- Days After Transplanting

Table 8 VFSEN 36: Effect of IPM modules on natural enemies in FCV tobacco

Module	Mean number of Natural Enemies / Plant		
	2022	2023	Pooled
Module-1 (Integrated)	1.93 (1.56)	2.21 (1.64)	2.07 (1.60)
Module-2 (Chemical)	1.32 (1.35)	1.22 (1.31)	1.27 (1.33)
Module-3 (Bio-intensive)	2.28 (1.67)	2.98 (1.87)	2.63 (1.77)
Module-4 (Untreated control)	3.07 (1.89)	3.21 (1.93)	3.14 (1.91)
F value	*	*	*
S. Em±	0.16	0.16	0.16
C.V. (%)	16.84	15.35	16.03
C.D. at 5%	0.49	0.50	0.52

Numbers in the parenthesis are square root transformed values

Table 9 VFSEN 36: Evaluation of IPM modules on Yield of FCV Tobacco (Pooled data of 2022 & 2023)

Module	Green Leaf Yield (kg/ha)	Cured leaf yield (kg/ha)	Per cent increase in yield over control (%)
Module-1 (Integrated)	12132	1592	56.90
Module-2 (Chemical)	11676	1474	45.29
Module-3 (Bio-intensive)	10593	1330	31.08
Module-4 (Untreated control)	8662	1015	-
F value	*	*	-
S. Em±	504.27	66.68	-
C.V. (%)	10.47	11.02	-
C.D. at 5%	1553.82	205.46	-

Table 10 VFSEN 36: Cost benefit ratio of different modules against whitefly, *Bemisia tabaci* on FCV tobacco during (Pooled data of 2022 & 2023)

Modules	Cost of protection (Rs./ha)	Total cost of production (Rs./ ha)	Gross returns (Rs./ha)	Net returns (Rs./ha)	C:B ratio
Module-1 (Integrated)	6090	168460	374120	205660	1:2.2
Module-2 (Chemical)	2700	164070	346390	182320	1:2.1
Module-3 (Bio-intensive)	5840	166210	312550	146340	1:1.9
Module-4 (Control)	00	157370	238525	81155	1:1.5

TECHNICAL PROGRAMME

A. VFC TOBACCO

RAJAHMUNDRY

PLANT BREEDING

Experiment No	**VFRBRC 2:** IVT
Entries	IET-124, IET-125, IET-126, IET-127, IET-128, IET-129, IET-130, IET-131, IET-132, IET-133, IET-134, IET-135, IET-136
Checks	Siri, CTRI Sulakshana, CTRI Shrestaand Kanchan
Design	RBD
Replications	03

Experiment No	**VFRBRC 1.1:** AVT-I
Entries	FCR-71, FCR-72, FCR-73, IET-101, IET-102, IET-103, IET-104, IET-107, IET-109 & IET-110
Checks	Siri, CTRI Sulakshana, CTRI Shresta and Kanchan
Design	RBD
Replications	03

CROP PRODUCTION

VFRAGC/VFJAGC/ VFKAGC/ VFHAGC 1:

Research Project Title:	Effect of humic acid as bio-stimulants for healthy tobacco seedling production
Investigators	S. Kasturi Krishna, T.Kiran Kumar, S.V. Krishna Reddy, M .Anuradha, M. Mahadevaswamy
Year of Start:	2023-24
Year of Completion	2024-25
Location of the project:	CTRI, Rajahmundry, CTRIRS Jeelugumilli, CTRI RS Kandukur, CTRI RS Hunsur
Remarks	On going

NEW PROJECT PROPOSAL

CROP PRODUCTION

VFSAGC/ VFRAGC/CHVsAGC 2: Effect of integration of natural farming inputs on the performance of FCV tobacco

The experimental details are furnished at Shivamogga centre.

GUNTUR

PLANT BREEDING

Experiment No	**VFRBRC 2:** IVT
Entries	IET-124, IET-125, IET-126, IET-127, IET-128, IET-129, IET-130, IET-131, IET-132, IET-133, IET-134, IET-135, IET-136
Checks	Siri, CTRI Sulakshana, CTRI Shresta and Kanchan
Design	RBD
Replications	03

Experiment No	**VFRBRC 1.1:** AVT-I
Entries	FCR-71, FCR-72, FCR-73, IET-101, IET-102, IET-103, IET-104, IET-107, IET-109 & IET-110
Checks	Siri, CTRI Sulakshana, CTRI Shresta and Kanchan
Design	RBD
Replications	03

NEW PROJECT PROPOSAL

CROP PROTECTION

VFSENC /VFGENC/ VFKENC3: Evaluation of different insecticides against sucking pest of FCV tobacco

The experimental details are furnished at Shivamogga centre.

JEELUGUMILLI

PLANT BREEDING

Experiment No	**VFRBRC 2:** IVT
Entries	IET-124, IET-125, IET-126, IET-127, IET-128, IET-129, IET-130, IET-131, IET-132, IET-133, IET-134, IET-135, IET-136
Checks	Siri, CTRI Sulakshana, CTRI Shresta and Kanchan
Design	RBD
Replications	03

Experiment No	**VFRBRC 1.1:** AVT-I
Entries	FCR-71, FCR-72, FCR-73, IET-101, IET-102, IET-103, IET-104, IET-107, IET-109 & IET-110
Checks	Siri, CTRI Sulakshana and CTRI Shresta
Design	RBD
Replications	03

CROP PRODUCTION

Research Project Title:	**VFRAGC/VFJAGC/ VFKAGC/ VFHAGC 1:** Effect of humic acid as bio-stimulants for healthy tobacco seedling production
Year of Start:	2023-24
Year of Completion	2024-25
Location of the project:	CTRI, Rajahmundry, CTRIRS Jeelugumilli, CTRI RS Kandukur, CTRI RS Hunsur
Remarks	On going

KANDUKUR

Experiment No	**VFRBRC 2:** IVT
Entries	IET-124, IET-125, IET-126, IET-127, IET-128, IET-129, IET-130, IET-131, IET-132, IET-133, IET-134, IET-135, IET-136
Checks	Siri, CTRI Sulakshana, CTRI Shresta and Kanchan
Design	RBD
Replications	03

Experiment No	**VFRBRC 1.1:** AVT-I
Entries	FCR-71, FCR-72, FCR-73, IET-101, IET-102, IET-103, IET-104, IET-107, IET-109 & IET-110
Checks	Siri, CTRI Sulakshana, CTRI Shresta and Kanchan
Design	RBD
Replications	03

Experiment No	**VFKBRC1.2:** AVT-II
Entries	FCK-10
Checks	Siri, VT 1158 and N-98
Design	RBD
Replications	04

Experiment No	**OFT:** On Farm Trail
Entries	FCR-63 and FCR-47
Checks	Siri, CTRI Shresta

CROP PRODUCTION

Research Project Title:	**VFRAGC/VFJAGC/ VFKAGC/ VFHAGC 1:** Effect of humic acid as bio-stimulants for healthy tobacco seedling production
Year of Start:	2023-24
Year of Completion	2024-25
Location of the project:	CTRI, Rajahmundry, CTRIRS Jeelugumilli, CTRI RS Kandukur, CTRI RS Hunsur
Remarks	On going

CROP PROTECTION

NEW EXPERIMENT

VFSENC /VFGENC/ VFKENC3: Evaluation of different insecticides against sucking pest of FCV tobacco

The experimental details are furnished at Shivamogga centre.

HUNSUR

PLANT BREEDING

Experiment No	VFRBRC 2: IVT
Entries	IET-124, IET-125, IET-126, IET-127, IET-128, IET-129, IET-130, IET-131, IET-132, IET-133, IET-134, IET-135, IET-136
Checks	Kanchan, FCH 222 and CH-3
Design	RBD
Replications	03

Experiment No	VFHBRC 1.1: AVT-I
Entries	FCR-72, FCR-73, IET-107, IET-109 and IET-110
Checks	Kanchan, FCH 222 and CH-3
Design	RBD
Replications	03

SHIVAMOGGA

PLANT BREEDING

Experiment No	VFRBRC 2: IVT
Entries	IET-124, IET-125, IET-126, IET-127, IET-128, IET-129, IET-130, IET-131, IET-132, IET-133, IET-134, IET-135, IET-136
Checks	Sahyadri,CH-3 and Kanchan
Design	RBD
Replications	03

Experiment No	VFHBRC 1.1: AVT-I
Entries	FCR-72, FCR-73, IET-102, IET-103, IET-104, IET-107& IET-109
Checks	Thrupthi, Sahyadri and Kanchan
Design	RBD
Replications	03

Experiment No	**BULK:**Bulk Trail
Entries	FCH-1 and FCH-2
Checks	Thrupthi, Sahyadri and Kanchan

Experiment No	**VFSBR 4.2:** Observational Trial - II
Entries	Tobios-6 x Thrupthi (Sel 2), Tobios-6 x Thrupthi (Sel 3), Tobios-6 x Sahyadri (Sel 2), Tobios-6 x Sahyadri (Sel 3), Tobios-6 x Kanchan (Sel 2), Tobios-6 x Kanchan (Sel 3), Tobios-5 x Thrupthi (Sel 2), Tobios-6 x Kanchan (Sel 3), Tobios-5 x Kanchan (Sel 1) and Tobios-5 x Kanchan (Sel 2)
Checks	Thrupthi, Sahyadri and Kanchan

Experiment No	**VFSBR-5:** Evaluation and evaluation of FCV tobacco germplasm (repeated)
Entries	113 germplasm lines/Twenty-five entries will be characterized once again for the morphological characters and the trial will be continued.
Germplasm characterization	
1.	VA-770
2.	V-373[SER]
3.	NC-2326
4.	Q-46
5.	RHOMAS-7
6.	SPEIGHT-G-103
7.	NC-940
8.	REAMS-744
9.	RG-17
10.	SPEIGHT-G-152
11.	SPEIGHT-G-172
12.	SPEIGHT-G-178
13.	SPEIGHT-NF-3
14.	VA-119
15.	YELLOW SPECIAL-A
16.	EC-554926
17.	EC-554930
18.	COKER-176
19.	NC-37-NF
20.	NC-729
21.	Delcrest-66
22.	A-23
23.	Olior-10
24.	VA-115
25.	VA-4219
26.	Thrupthi
27.	Kanchan
28.	Sahyadri

Experiment No	**VFSBR 6:** Back cross breeding programme: Conversion of Thrupthi, Sahyadri, Tobios-6, FCH-222 &Bhavya into male sterile lines
Entries	Maintenance of male sterile lines will be continued.

Experiment No	**VFSBR 7:** New crosses & early generation studies
Entries	All the nine F_3 (Sahyadrix FCR 68,Sahyadrix CTRI Sulakshana, Sahyadrix VT1158,) population will be evaluated for yield and disease resistance at field level.

Experiment No	**VFSBR11:** Conversion of FCH-1, FCH-2&FCS-4 into male sterile lines

CROP PRODUCTION

Experiment No.	**VFSAG74:** Feasibility of crop intensification through relay-inter cropping in FCV tobacco
Year of start	2023-2024
Year of completion	2024-2025
Location	AINP (T), ZAHRS, Navile, Shivamogga
Remarks	On going

VFSAGC/ VFRAGC/CHVsAGC 2: Effect of integration of natural farming inputs on the performance of FCV tobacco

Experiment No.	**VFSAG 73**: Effect of integration of natural farming inputs on the performance of tobacco The modified experiment is to be conducted at **Ramanathapura** instead at Shivamogga during 2025-26. In this project, pest and disease data, along with yield measurements, should be recorded. Additionally, the experiment should also be implemented in Rajahmundry and Jeelugumilli, involving nematologists and pathologists from the concerned centre. The fertilizer recommendation should be changed to the following ratios : 60:40:120
Objective:	To study the performance of tobacco with the incorporation of natural farming components
Year of start	2025-2026
Location	Ramanathapura

Experimental details:

Design	:	RCBD
Replications	:	Three
Treatments	:	Seven
Gross plot size	:	7.2 m x 4.2 m (30.24 m^2)
Net plot size	:	5.4 m x 3.0 m(16.20 m^2)
Variety	:	KST-28 (Sahyadri) for Shivamogga Centre **The other centres can be changed accordingly with the respective type and variety of tobacco**
Year of start	:	2023-24 2025-26 (Modified) for Shivamogga Centre **2024-25 for Rajahmundry and Vedasandur centres**
Duration	:	02 years
Location	:	Ramanathpura or its surroundings (Shivamogga Centre) Rajahmundry centre Vedasandur centre

NOTE: Packages of practices may be changed accordingly

Treatments

T_1: FYM 12.5 t ha^{-1} 15 days before planting + RDF (60:40:120 kg ha^{-1}) at 10 DAP
T_2: FYM 12.5 t ha^{-1} 15 days before planting + RDF (60:40:120 kg ha^{-1}) at 10 DAP + KNO_3 @ 2% at 45 DAP and 55 DAP
T_3:RDF (60:40:120 kg ha^{-1}) at 10 DAP + Ghanajeevamrutha @ 1 t ha^{-1} (Soil application at the time of planting)
T_4:RDF (60:40:120 kg ha^{-1}) at 10 DAP + Jeevamrutha @ 500 liter ha^{-1} (Soil application for 03 times at an interval of 15 days from 15 DAP)
T_5:RDF (60:40:120 kg ha^{-1}) at 10 DAP + Ghanajeevamrutha @ 1 t ha^{-1} (Soil application at the time of planting) + Jeevamrutha @ 500 liter ha^{-1} (Soil application for 03 times at an interval of 15 days from 15 DAP)
T_6:RDF (60:40:120 kg ha^{-1}) at 10 DAP + Ghanajeevamrutha @ 1 t ha^{-1} (Soil application at the time of planting) + Jeevamrutha @ 500liter ha^{-1} (Soil application for 03

times at an interval of 15 days from 15 DAP) + KNO_3 @ 2% at 45 DAP and 55 DAP
T_7: FYM 12.5 t ha^{-1} 15 days before planting + Ghanajeevamrutha @ 1 t ha^{-1} (Soil application at the time of planting) + Jeevamrutha @ 500liter ha^{-1} (Soil application for 03 times at an interval of 15 days from 15 DAP) + KNO_3 @ 2% at 45 DAP and 55 DAP

Treatment imposition

- Application of Ghana jeevamrutha**:** Ghana jeevamruthaat the rate of 1 t ha^{-1} (3.024 kg per 30.24 m^2) to be applied to the well-prepared soil at the time of planting of FCV tobacco to the plots as per the treatment.
- Application of Jeevamrutha: Jeevamrutha was applied at the rate of 500 l ha^{-1} (1.512 liters per 30.24 m^2) was applied to soil at the time of sowing and at 30, 60 and 90 days after sowing as per the treatment.Jeevamrutha is to be diluted by adding water to make it to apply @ 100 ml per plant.

Procedure to prepare 100 kg Ghana Jeevamrutha

Initially 100 kg of dried desi cow dung is spread on the polythene sheet, twolitres of desi cow urine, 2 kg of powdered jaggery and 2 kg pulse flour is added to the desi cow dung. All the materials are thoroughly mixed with desi cow dung and the mixture is kept under shade by covering with wet gunny bag to maintain 60% moisture for 24 hours. On next day, this mixture is to be made into small balls or cakes and to be kept for drying under shade for 21days. Ghana jeevamruthais applied to the soil by powdering the balls or cakes as one-time application at the time of planting as per the treatment.

Procedure to prepare 200 litres of Jeevamrutha

Jeevamrutha is prepared by mixing 10 kg desi cow dung, 10 litres of cow urine, 2 kg jaggery, 2 kg pulse flour and hand full of soil collected from the field near bund. All these are put in 200 litres plastic or cement drum and mixed thoroughly by adding water until volume is made up to 200 litres. The mixture is stirred well in clock wise direction thrice a day using wooden stick until the mixture becomes homogeneous. Plastic drum is kept under shade covered with wet gunny bag.Turning of the mixture is done twice a day up to 7 days to improve the aeration and microbial population. After 7 days of turning jeevamrutha is ready for its application in the field. Well fermented jeevamrutha is applied manually at 15 DAP, 30 DAP and at 45 DAP as in the treatment. Prepared jeevamrutha could be used used for two to seven days.

Observations to be recorded

- Plant height (cm) at 30DAS, 45 DAS and at first picking
- Number of leaves per plant at 30DAS, 45 DAS and at first picking
- Cumulative number of leaves harvested per plant
- Leaf area of X and L position leaves
- Green leaf yield (kg /ha)
- Cured leaf yield (kg/ha)
- Microbial count (Initial and after harvest of the crop)
- Nutrient content and soil chemical properties pH, EC, OC, N, P and K content(Initial and after harvest of the crop)

CROP PROTECTION

ENTOMOLOGY

Experiment No.	**VFSEN 34:** Population dynamics of insect pest complex and their *natur*al enemies in tobacco ecosystem
	Ongoing project

Experiment No.	**VFSEN 37:** Validation of IPM modules against *S. litura* in tobacco
	Ongoing project

Experiment No.	**VFSEN 36:**Management of Tobacco leaf curl vector, Whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae) using different modules
	Ongoing project

NEW PROJECT PROPOSAL

VFSENC/VFGENC/ VFKENC3: Validation of IPM module against sucking pests of FCV tobacco / integrated management of sucking pests of FCV tobacco

Objective: To identify best insecticide for the management of tobacco aphid (*Myzus persicae*) and whitefly (*Bemisia tabaci*) in FCV tobacco under Karnataka Light Soil region.

IPM Module (M1): Sowing two rows of jowar as border/barrier crop one week before planting tobacco; setting up of yellow sticky traps @ 25/ha; one spray of NSKE 2% at 30 DAP; one spray of *Lecanicillium lecanii* @ $3X10^{12}$ CFU/ha at 45 DAP and one spray of afidopyropen 50 DC @ 0.03% at 60 DAP.

Chemical Module (M2): One spray of imidacloprid 17.8 SL @ 0.03% at 30 DAP; one spray of pymetrozine 50 WG @ 0.04% at 45 DAP and one spray of flonicamid 50 WG @ 0.04% at 60 DAP

Control (M3): Control (without pest management measures)

Experimental details:

Locations	:	ZAHRS, Shivamogga and Ramanathapura Guntur centre Kandukur centre
Design		RBD
Duration	:	2 years
Season	:	*Kharif* 2024 & 2025 (Shivamogga centre) *Rabi* 2024-25 & 2025-26 (Guntur &Kandukur centres)
Replications	:	3
Treatments	:	8
Variety	:	Sahyadri (Shivamogga); CTRI Sreshta (Guntur & Kandukur)
Plot size	:	0.25 acres (1000sq.m) for each module

Observations

1. Per cent aphid infested plants in 10 rows in each plot at 30, 40, 50, 60 and 70 DAP
2. Per cent leaf curl infested plants in 10 rows in each plot at 30, 40, 50, 60 and 70 DAP
3. Aphid population (score) on ten randomly infested plants on top and middle leaf in each plot at 30, 40, 50, 60 and 70 DAP
4. Per cent sooty mold infested plants (low, medium & high) in 10 rows in each plot at 70 DAP
5. Yield parameters (green leaf, cured leaf, bright leaf and grade index) in each plot

Analysis: paired "t" test

Aphid score

Score	Aphid population / leaf
0	0
1	1-50
2	51-250
3	251-500
4	501-1000
5	>1000

B. *BIDI* TOBACCO

ANAND

PLANT BREEDING

Experiment No.	**BDABRC 2:** IVT
Entries	IET-137, IET-138, IET-139, IET-140, IET-141, IET-142
Checks	A 119, GT 7, GABT-11, GABTH-2
Design	RBD
Replications	03

Experiment No.	**BDABRC 1.1:** AVT-I
Entries	IET-113, IET-114, IET-115
Checks	A 119, GT 7, GABT-11, GABTH-2
Design	RBD
Replications	04

Experiment No.	**BDABRC 1.1:** AVT-II
Entries	ABD-239 and ABD-244
Checks	A 119, GT 7, GABT-11, GABTH-2
Design	RBD
Replications	04

Experiment No.	**BDABR 22:** Search for Materials Resistant to Root-Knot Disease (Joint Study by Plant Breeding and Plant Pathology Sections)
Remarks	Continuing

Experiment No.	**BDABR 23:** Screening of Advanced Breeding Materials /Introductions for Leaf Curl and *Cercospora* Leaf Spot Diseases Under Field Conditions (Joint Study by Plant Pathology and Plant Breeding Sections)
	Continuing

Experiment No.	**BDABR 31:**Breeding for Resistance to Tobacco Mosaic Virus in*Bidi* Tobacco (Joint Study by Plant Breeding and PlantPathology Sections)
Remarks	Continuing

CROP PRODUCTION

Research project title	**BDAAG 166:** Evaluation of different fertilizer doses on growth, yield and quality of *bidi* tobacco grown in middle Gujarat
Year of start	2023-24 **(Modified)**
Year of completion	2025-26
Location	BTRS, AAU, Anand

PLANT PATHOLOGY and NEMATOLOGY

Experiment No.	**Remarks**
BDAPP 126 (A) : Resistance Development in *Pythium aphanidermatum* to Metalaxyl MZ	Ongoing project
BDAPP 126 (B) : Resistance Development in *Pythium aphanidermatum* to Azoxystrobin	Ongoing project
BDAPP 128 : Screening for resistance to damping-off and root knot in tobacco	Ongoing project
BDAPP 511: Screening of Advanced Breeding Materials /Introductions/Genotypes to Diseases Under Field and Control Conditions	Ongoing project
BDAPP 686: Impact of Organic Amendments And Varieties on Incidence of Root-Knot Nematode In *bidi* Tobacco	Ongoing project
BDAPP 811: Validation of prediction model for frog eye spot disease	Ongoing project
BDAPP 813: Evaluation of Fungicides Against Frog-Eye Leaf Spot And *Alternaria* Leaf Spot in *Bidi* Tobacco	Ongoing project

NEW PROJECT PROPOSALS

CROP PRODUCTION

BDAAGC/ BDNAGC / BDNyAGC 1: Evaluation of pre and post emergent herbicides for weed management in *bidi* tobacco

Objective	▪ To identify the suitable pre-and post-emergence herbicides for *bidi* tobacco ▪ To study the performance of pre-and post emergence herbicides on weed dynamics and crop growth and yield of *bidi* tobacco
Year of start	2024-25
Year of completion	2025-26
Locations	**Anand, Nipani & Nanydal centres**

Crop	*Bidi* tobacco (A 119) **The other centres can be changed accordingly with the respective variety**
Design	RBD
Replication	3
RDP	As per Package of practice

Treatment details

T_1:	Pre-plant application (before 3DAP) of Clomazone 50EC @ 400 g ai/ha (1.6 ml/lit of water)
T_2:	Pre- plant application of Clomazone 50 EC @ 450 g ai/ha (2.0 ml/lit of water)
T_3:	Pre-plant application of Sulfentrazone39.6% SC @ 0.25kg ai/ha (1.25 ml/litre)
T_4:	Pre-plant application of Sulfentrazone 39.6% SC (Authority) @ 0.30 kg ai/ha (1.5 ml/litre)
T_5:	Pre- plant application of sulfentrazone28%+ Clomazone30 WP (Authority NXT) @ 0.30 kg ai/ha (1.5 g/litre)
T_6:	Pre- plant application of sulfentrazone28%+ Clomazone30 WP (Authority NXT)@ 0.40 kg ai/ha(2.0 g/litre)
T_7 :	Pre-plant application of Clomazone 50 EC @ 400 g ai/ha + Post emergence (PoE) application of Quizalofop ethyl 5 EC @ 50 g ai/ha
T_8 :	Pre- plant application of Sulfentrazone 39.6% SC @ 0.25kg ai/ha (1.25 ml/litre) + Post emergence (PoE) application of Quizalofop ethyl 5 EC @ 50 g ai/ha
T_9 :	Pre- plant application of sulfentrazone28%+ Clomazone30 WP (Authority NXT)@ 0.28kg +030 ai/ha (Authority NXT) ai/ha (2.0 g/litre) + Post emergence (PoE) application of Quizalofop ethyl 5 EC @ 50 g ai/ha
T_{10} :	Two inter cultivation + Two hand weeding (Farmers practice)
T_{11} :	Weed free check
T_{12} :	Unweeded check

Note: Two inter cultivation at 30 and 45 DAS

Observations to be recorded

Weed parameters • Weed species identified monocots &dicots throughout season • Weed density (no./m2) at 45 & 90 DATP and at harvest • Weed dry weight (g/m2) at 45 & 90 DATPand at harvest • Weed control efficiency (%) • Weed index (%) • Phytotoxicity scoring, if any (0-10 scale)	Growth parameters • Plant height (cm) • Leaf length (cm) • Leaf width (cm) • Dry wt/unit leaf area(mg/cm-2)
Yield parameters • Green leaf yield • Cured leaf yield (kg/ha)	Chemical parameters • Nicotine (%) • Reducing sugars (%) • Chlorides (%)
Economics of herbicide treatments	

PLANT PATHOLOGY and NEMATOLOGY

BDANC / BDNNC /BDNyNC 1: Field evaluation and demonstration of nematode antagonists enriched coco-peat Technology against root knot nematodes in tobacco nursery and main field crop

Year of start	2024-25
Year of completion	2026-27
Locations	**Anand, Nipani & Nanydal centres**
Variety	Location specific variety
Design	RBD
Replication	5
Bed size:	Gross: 1.2 m x 1.2 m Net :1.0 m x 1.0 m

I and II Year

1. NURSERY EVALUATION

Treatments

TI	*Trichoderma viride*@ 15g+ *Paecilomyces lilacinus* @ 15g enriched coco-peat @ 500g / sq.m nursery bed
T2	Carbofuran 3G @ 10g / sq.m nursery bed.
T3	Fluopyrum @ 0.05%
T4	Untreated Check

Observations

a. Seedlings growth characteristics
b. Root knot free and Disease-free seedlings count
c. Root knot Index at Final pulling
d. Per cent incidence of Damping off, blight and Black shank
e. Mean initial Soil population (juveniles / 100 g soil)
f. Mean Final Soil Population (juveniles / 100 g soil)

2. FIELD EVALUATION

Treatments

TI	Planting *Trichoderma viride*@ 30g/kg+ *Paecilomyces lilacinus* @ 30g/kg coco-peat enriched seedlings alone
T2	Planting *Trichoderma viride*@ 30g/kg+ *Paecilomyces lilacinus* @ 30g/kg coco-peat enriched seedlings + *T. viride* & *P. lilacinus* enriched coco-peat @ 10 g/ plant at planting + *T. viride* &*P. lilacinus* enriched coco-peat @ 10g/plant at 30 DAP
T3	Normal Seedlings + Carbofuran 3G @ 1g per plant at planting
T4	Normal Seedlings + Fluopyrum @ 0.05%drenching at planting
T5	Untreated Check (Planting Normal seedlings alone)

Plot size: 40 sq.m

Observations

a. Plant growth characteristics
b. Tobacco yield parameters
c. Root knot Index at Final pulling(0-5 Scale)
d. Mean initial Soil population (juveniles / 100 g soil)
e. Mean Final Soil Population (juveniles / 100 g soil)
f. Per cent incidence of *Fusarium* wilt or Black shank
g. Number of Egg mass / g. root
h. Cost: Benefit ratio

III year

Demonstration of **Nematode antagonists** (*Trichoderma viride*@ 30 g/kg + *Paecilomyces lilacinus*@ 30g/kg coco-peat) **enriched Technology** under Farmer's Field Condition in both Nursery and Main Field

NIPANI

PLANT BREEDING

Experiment No	**BDABRC 2:** IVT
Entries	IET-137, IET-138, IET-139, IET-140, IET-141, IET-142
Checks	A-119, Bhavyasree, NBD-209
Design	RBD
Replications	03

Experiment No	**BDABRC 1.1:** AVT-I
Entries	IET-113, IET-114, IET-115
Checks	A-119, Bhavyasree, NBD-209
Design	RBD
Replications	04

Experiment No	**BDNBRC 1.1:** AVT-II
Entries	ABD-239 and ABD-244
Checks	A-119, Bhavyasree, NBD-209
Design	RBD
Replications	04

Experiment No	**BDNBR 4.1:** SVT-I (R)
Entries	NBD-360, NBD-361, NBD-365, NBD-368, NBD-373, NBD-374, NBD-375, NBD-376, NBD-380
Checks	A-119, Bhavyasree, NBD-209
Design	RBD
Replications	03

Experiment No	**BDNBR 4.1:** SVT-I
Entries	NBD 381, NBD 387, NBD 388, NBD 390, NBD 393, NBD 398, NBD 406, NBD 407
Checks	A-119, Vedaganga-1,Bhavyasree, NBD-209
Design	RBD
Replications	03

Experiment No	**BDNBR 3.3:** SVT-Seed
Entries	NBD-S-3, NBD-S-20, NBD-S-21, NBD-S-22, NBD-S-24, NBD-S-26, NBD-S-27
Checks	A-145,A-119, Vedaganga-1,Bhavyasree, NBD-209
Design	RBD
Replications	03

Experiment No	**BDNBR 4.3:** SHT (R)
Entries	NBTH 1030, NBTH 1035, NBTH 1045, NBTH 1052, NBTH 1053, NBTH 1054, NBTH 1055, NBTH 1058, NBTH 1059, NBTH 1060, NBTH 1062, NBTH 1063
Checks	A-119, Vedaganga-1,Bhavyasree, NBD-209
Replications	02

Experiment No	**BDNBR 4.3:** SHT
Entries	NBTH 1067, NBTH 1068, NBTH 1069, NBTH 1070, NBTH 1071, NBTH 1072,NBTH 1073, NBTH 1074, NBTH 1075, NBTH 1076, NBTH 1077, NBTH 1078, NBTH 1079, NBTH 1080, NBTH 1081, NBTH 1082, NBTH 1083, NBTH 1084,NBTH 1094, NBTH 1095, NBTH 1098, NBTH 1099, NBTH 1101, NBTH 1102, NBTH 1103
Checks	A-119, Vedaganga-1,Bhavyasree, NBD-209
Replications	02

Experiment No	**BDNBR 4.6:** PHT
Entries	NBTH 1104, NBTH 1105, NBTH 1106, NBTH 1107, NBTH 1108, NBTH 1109, NBTH 1110, NBTH 1111, NBTH 1112, NBTH 1113, NBTH 1114, NBTH 1115, NBTH 1116, NBTH 1117, NBTH 1118, NBTH 1119, NBTH 1120, NBTH 1121, NBTH 1122, NBTH 1123, NBTH 1124, NBTH 1125, NBTH 1126, NBTH 1127, NBTH 1128, NBTH 1129
Design	RBD
Replications	2

Experiment No	Generation of Breeding Materials (F1's, F2, F3, F4, F5)
Entries	F1: 45; F2:8, F3:12; F4:16; F5:26

Experiment No.	Collection, Evaluation and maintenance of germplasm lines in *bidi* tobacco	
Experiment No.	Maintenance of A and B lines	
No. of Entries	**A lines**	**B lines**
	MS A-119 x A-119	A-119
	MS NBD-209 x NBD 209	NBD-209
	MS Bhavyashree x Bhavyashree	Bhavyashree
	MS Bhagyashree x Bhagyashree	Bhagyashree
	MS Vedagandga x Vedaganga	Vedaganga
	MS A-2 x A-2	A-2
	MS PL-5 x PL-5	PL-5
	MS GT-5 x GT-5	GT-5

CROP PRODUCTION

Experiment No.	**BDNAG 57**: Doubling of the farmer's income by tobacco based cropping system under mulches
Year of start	2021-22
Year of completion	2024-25
Remarks	Ongoing

Experiment No.	**BDNAG 58**: Integrated management of *Orobanche* in *bidi* tobacco
Year of start	2021-22
Year of completion	2025-26
Remarks	Ongoing

NEW PROJECT PROPOSALS

CROP PRODUCTION

BDAAGC/ BDNAGC / BDNyAGC 1: Evaluation of pre and post emergent herbicides for weed management in *bidi* tobacco

The experimental details are furnished at Anand centre.

Experiment No.	**BDNAG 59: Response of tobacco to changing climate situation on yield and quality** **A:** To study the impact of water logging on tobacco yield and quality
Objectives	▪ To find out the effect of water logging on growth and yield of tobacco ▪ To study the Impact of water logging on quality of tobacco
Year of start	2024-25
Year of completion	2025-26
Design	Split plot Design
Replications	3
Plot size	9 x 6 m
RDP	As per Package of practice

Treatment details:

I. Main Plot (Water stagnation period) (M)	II. Sub Plot (Ameliorative measures / Control measures) (S)
M_1: 2 days	S_1: Urea spray @2% before and after water stagnation
M_2: 4 days	S_2: Ammonium sulphate spray @2% before and after water stagnation
M_3: 6 days	S_3: K_2SO_4 spray @2% before and after water stagnation
	S_4: Humic acid spray @2% before and after water stagnation
	S_5: Control (No Control Measures)

Experiment No.	BDNAG 59: Response of tobacco to changing climate situation on yield and quality B: Response of tobacco to different Sowing windows
Objectives	▪ To find out the effect of different sowing windows on growth and yield of tobacco ▪ To the effect of different sowing windows on pest and disease incidence and economics of tobacco cultivation
Year of start	2024-25
Year of completion	2025-26
Design	Split plot Design
Replications	3
Plot size	9 x 6 m
RDP	As per Package of practice

Treatment details:

T1	Planting I fort night of August
T2	Planting II fort night of August
T3	Planting I fort night of September
T4	Planting II fort night of September
T5	Planting I fort night of October
T6	Planting II fort night of October
T7	Planting I fort night of November
T8	Planting II fort night of November

PLANT PATHOLOGY and NEMATOLOGY

BDANC / BDNNC /BDNyNC 1: Field evaluation and demonstration of nematode antagonists enriched coco-peat Technology against root knot nematodes in tobacco nursery and main field crop

The experimental details are furnished at Anand centre.

NANDYAL

PLANT BREEDING

Experiment No	**BDABRC 2:** IVT
Entries	IET-137, IET-138, IET-139, IET-140, IET-141, IET-142
Checks	A119, Nandyal pogaku-1and Nandyal pogaku-2
Design	RBD
Replications	03

Experiment No	**BDABRC 1.1:** AVT-I
Entries	IET-113, IET-114, IET-115
Checks	A119, Nandyal pogaku-1and Nandyal pogaku-2
Design	RBD
Replications	04

Experiment No	**BDNyBRC 1.1:** AVT-II
Entries	ABD-239 and ABD-244
Checks	A119, Nandyal pogaku-1and Nandyal pogaku-2
Design	RBD
Replications	05

Experiment No	**OFT:** On Farm Trail
Entries	NyBTH 152, NyBTH 157
Checks	A119, Nandyal pogaku-1, GABTH-2 and Nandyal pogaku-2

BDNyBR 4: Hybridization and selection to evolve superior *bidi* tobacco varieties hybrids

Experiment No	**BDNyBR4.2:** OHT-II
Entries	NyBTH 208 (CMS GT7 X NBD 276), NyBTH 209 (CMS GT7 X ABD146), NyBTH 210 (CMS GT7 X NBD 289), NyBTH 211 (CMS GT4 X NBD 276), NyBTH 212 (CMS GT4 X ABD 146) , NyBTH 213(CMS GT4 X NBD 289), NyBTH 214(CMS A119 X NBD 276), NyBTH 215(CMS A119 X ABD 146), NyBTH 216(CMS A119 X NBD 289)
Checks	A119, Nandyal pogaku-1, Nandyal pogaku-2and GABTH-2
Design	RBD
Replications	02

Experiment No	**BDNyBR 4.3:** OVT-I
Entries	NyBD 97 (GT4XABD145),NyBD 98 (GT4XABD163), NyBD 99 (GT4XABD167), NyBD 100 (A119XABD145), NyBD 101 (A119XABD163), NyBD102 (A119XABD167), NyBD 103 (GT7 X ABD132), NyBD 104 (GT7 X NBD289), NyBD 105 (GT7 X NBD260), NyBD 106 (GT7 X ABD119), NyBD 107 (GT4 X ABD132), NyBD 108 (GT4 X NBD289), NyBD 109 (GT4 X NBD260), NyBD 110 (GT4 X ABD119), NyBD 111 (A119 X ABD132), NyBD 112 (A119 X NBD289), NyBD 113 (A119 X NBD260) , NyBD 114 (A119 X ABD119)
Checks	A119, Nandyal pogaku-1 and Nandyal pogaku-2
Design	RBD
Replications	03

Experiment No	**BDNyBR 4.4:** OVT-II
Entries	NyBD 95 (ABD132 X ABD65),NyBD 96 (NBD289 X ABD138),
Checks	A119, Nandyal pogaku-1 and Nandyal pogaku-2
Design	RBD
Replications	03

Experiment No	**BDNyBRC-1:** Collection, maintenance, cataloguing and utilization of germplasm lines of *bidi* tobacco
Entries	New germplasm lines received from different centers and already existing germplasm lines of 50*bidi* tobacco will be evaluated.

CROP PRODUCTION

Experiment No.	**BDNyAG 20:** Study on identification of soil fertility status of *bidi* tobacco growing areas of Nandyal& Kurnool district
Year of start :	2023-24
Remarks	Ongoing

Experiment No.	**BDNyAG 21:** Integrated Management of broomrape (*Orobanche spp*) in *bidi* tobacco
Year of start :	2023-24
Remarks	Ongoing

NEW PROJECT PROPOSALS

CROP PRODUCTION

BDAAGC/ BDNAGC / BDNyAGC 1: **Evaluation of pre and post emergent herbicides for weed management in *bidi* tobacco**

The experimental details are furnished at Anand centre.

CROP PROTECTION

PLANT PATHOLOGY and NEMATOLOGY

BDANC /BDNNC /BDNyNC 1: Field evaluation and demonstration of nematode antagonists enriched coco-peat Technology against root knot nematodes in tobacco nursery and main field crop

The experimental details are furnished at Anand centre.

C. *NATU/ PIKKA* TOBACCO

GUNTUR

Experiment No	**NTJBRC 1.1:** AVT-I
Entries	IET- 118, IET-119, IET-121
Checks	Bhairavi and WAF
Design	RBD
Replications	05

JEELUGUMILLI

Experiment No	**NTJBRC 1.1:** AVT-I
Entries	IET- 118, IET-119, IET-121
Checks	Kommagudem and Rangapuram
Design	RBD
Replications	05

NANDYAL

Experiment No	**NTNyBRC1.1::** AVT-I
Entries	IET- 118, IET-119, IET-121
Checks	Bhairavi and WAF
Design	RBD
Replications	05

BDNyBR 4:Hybridization and selection to evolve superior *natu* tobacco varieties / hybrids

Experiment No	**BDNyBR 4.1**: OVT-I
Entries	NyNT 105,NyNT 106
Checks	Bhairavi and WAF
Design	RBD
Replications	05

Experiment No	**BDNyBR 4.2:** OVT-II
Entries	NGP89 X Ongole (NyNT 103), Talmariaku X KFC (NyNT 104)
Checks	Bhairavi and WAF
Design	RBD
Replications	05

Experiment No	**BDNyBRC-1:** Collection, maintenance, cataloguing and utilization of germplasm lines of *natu* tobacco
Entries	New germplasm lines received from different centers and already existing germplasm lines 30 *natu* tobacco will be evaluated.

BERHAMPUR

Experiment No	**NTBBRC 2::** AVT-I
Entries	IET- 118, IET-119, IET-121
Checks	Gajapati and JP Local
Design	RBD
Replications	05

Experiment No.	**PBBR 2 :** Collection, evaluation and maintenance of tobacco germplasm
No. of treatments	110 + 4 Checks
Design	Augumented
Blocks	11

Experiment No.	**PBBR 10:** Evaluation of Drought tolerant genotypes
No. of treatments	20
Checks	Gajapati and JP Local
Design	RBD
Replications	03

Experiment No.	**PBBR 11 (A):** Exploratory trial on *Rustica* tobacco
No. of treatments	4
Checks	GC 1
Design	Unreplicated

Experiment No.	**PBBR 11 (B):** Exploratory trial on *Jati* tobacco
No. of treatments	3
Checks	DJ-1
Design	Unreplicated

Experiment No.	MLT of *pikka* tobacco genotype at 3 locations
No. of treatments	BPT 7, BPT 50, NF 4-27-3 and NF 4-20-2
Checks	Gajapati and JP Local
Design	RBD
Replications	04

D. CHEWING TOBACCO

ANAND

PLANT BREEDING

Experiment No	**CHABRC 2:** IVT (R)
Entries	IET-122 and IET-123
Checks	GT 6, GT 8 and A 145
Design	RBD
Replications	06

DINHATA

PLANT BREEDING

Experiment No	**CHDBRC 2:** IVT (R)
Entries	IET-122 and IET-123
Checks	Chama, Podali and Manasi
Design	RBD
Replications	06

VEDASANDUR

PLANT BREEDING

Experiment No	**CHVBRC 2:** IVT (REPEAT)
Entries	IET-122 and IET-123
Checks	Meenakshi (CR), Bhagyalakshmi, Abirami
Design	RBD
Replications	06

CROP PRODUCTION

VFSAGC/ VFRAGC/CHVsAGC 2: Effect of integration of natural farming inputs on the performance of FCV tobacco

The experimental details are furnished at Shivamogga centre.

E. *RUSTICA* TOBACCO

ANAND

PLANT BREEDING

Experiment No	**RUABRC 2:** IVT
Entries	IET-143, IET-144 and IET-145
Checks	GC 1, GCT 2, GCT 3
Design	RBD
Replications	05

Experiment No	**RUABRC 1.1:** AVT-I
Entries	IET-116 and IET-117
Checks	GC 1, GCT 2, GCT 3
Design	RBD
Replications	05

Experiment No	**RUABRC 1.2:** AVT-II
Entries	AR-182, AR-184, ArR -105
Checks	GC 1, GCT 2, GCT 3
Design	RBD
Replications	05

CROP PRODUCTION

Experiment No	**RUAAG 23**: Evaluation of different fertilizer doses on growth, yield and quality of *rustica* tobacco grown in middle Gujarat
Year of start	2023-24
Year of completion	2025-26
Design	RBD (Factorial)
Replications	03

ARAUL

PLANT BREEDING

Experiment No	**RUArBRC 2:** IVT
Entries	IET-143, IET-144 and IET-145
Checks	Azad Kanchan and SK 417
Design	RBD
Replications	05

Experiment No	**RUArBRC 1.1:** AVT-I
Entries	IET-116 and IET-117
Checks	Azad Kanchan and SK 417
Design	RBD
Replications	05

Experiment No	**RUArBRC 1.2:** AVT-II
Entries	AR-182, AR -184, ArR -105
Checks	Azad Kanchan and SK 417
Design	RBD
Replications	05

Experiment No	**RUArBR 5:** PYT-I
Entries	ArR-135, ArR-136, ArR-137, ArR-138, ArR-139, ArR-140, ArR-141, ArR-142
Checks	Azad Kanchan and SK 417
Design	RBD
Replications	03

Experiment No	**RUArBR 5A:** PYT-II
Entries	ArR-127, ArR-128, ArR-129, ArR-130, ArR-131, ArR-132, ArR-133, ArR-134
Checks	Azad Kanchan and SK 417
Design	RBD
Replications	03

CROP PRODUCTION

Experiment No.	**RUArAG31-A**: Studies on Economical viability of Tobacco/ Non Tobacco crop of *Rabi.*
Design	RBD
Replications	05
Remarks	Ongoing

Experiment No.	**RUArAG31-B**: Studies on Economics of Tobacco-Bengalgram inter-cropping system.
Design	RBD
Replications	04
Remarks	Ongoing

NEW PROJECTPROPOSAL

Experiment No.	**RUArAG31-B:** Alternative Crops to Hookah Tobacco in Uttar Pradesh.
Objective	To determine alternative crops to Hookah Tobacco
Year of Start	Rabi - 2024-25
Design	RBD
Replications	04
Plot Size	5.0 X5.0 m
Treatments	
• T1- Chilli	50 x30
• T2- Tomato	60x45
• T3-Onion	20x15
• T4- Garlic	45x20
• T5-Brinjal	20x15
• T6-Potato	45x45
• T7-Tobacco	50x30

DINHATA

PLANT BREEDING

Experiment No	**RUDBRC 2:** IVT
Entries	IET-143, IET-144 and IET-145
Checks	DD 437 , Dharla, DJ-1
Design	RBD
Replications	05

Experiment No	**RUDBRC 2:** AVT-I
Entries	IET-116 and IET-117
Checks	DD 437 , Dharla, DJ-1
Design	RBD
Replications	05

Experiment No	**RUDBRC 1.1: AVT-II**
Entries	AR-182, AR -184, ArR -105
Checks	DD 437, Dharla, DJ-1
Design	RBD
Replications	05

LADOL

PLANT BREEDING

Experiment No	**RULdRC 2:** IVT
Entries	IET-143, IET-144 and IET-145
Checks	GCT 3, DCT 4, GCT-5
Design	RBD
Replications	05

Experiment No	**RULdRC 2:** AVT-I
Entries	IET-116 and IET-117
Checks	GCT 3, DCT 4, GCT-5
Design	RBD
Replications	05

Experiment No	**RULdRC 1.1:** AVT-II
Entries	LR-96, LR-97, AR-182, AR -184, ArR -105
Checks	GCT 3, DCT 4, GCT-5
Design	RBD
Replications	04

Experiment No.	**RULdBRS 1:** ST-1 (IET)
No. of Entries	LR-22-2, LR-22-5, LR-23-10, LR-23-7, LR-23-9, LR-23-5, LR-23-3, LR-23-4, LR-23-8
Checks	GCT 3, DCT 4, GCT-5
Design	RBD
Replications	03

Experiment No.	**RULdBRS 2:** ST-2 (PYT)
No. of Entries	LR 24-1, LR 24-2, LR 24-3, LR 24-4, LR 24-5, LR 24-6, LR 24-7, LR 24-8, LR 24-9, LR 24-10, LR 24-11
Checks	GCT-3, DCT-4,GCT-5
Design	RBD
Replications	03

Experiment No.	**RULdBRS 4:** LSVT
No. of Entries	LR-101, LR-96, LR-97
Checks	GCT-3, DCT-4,GCT-5
Design	RBD
Replications	04

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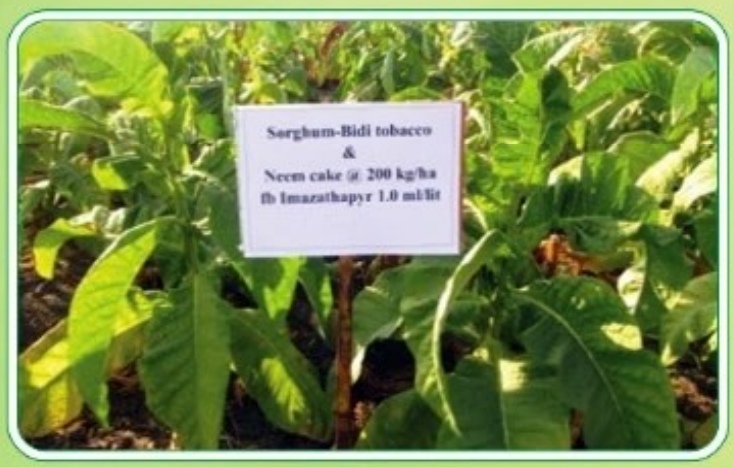
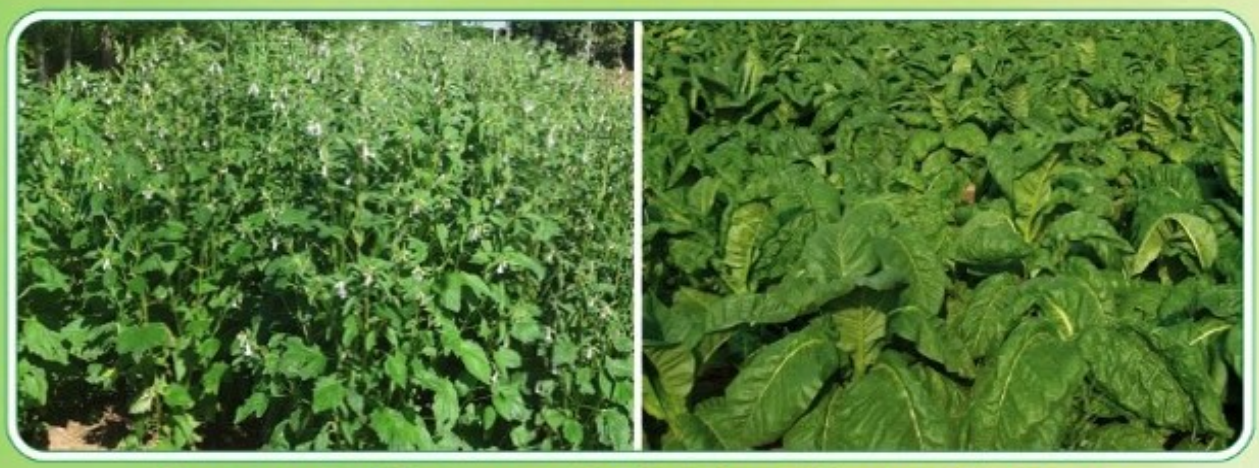
Management of damping-off disease in *bidi* tobacco nursery



Management of broomrape (*Orobanche* spp) in *bidi* tobacco



Management of broomrape (*Orobanche* spp) in chewing tobacco