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All India Network Project on Tobacco

Annual Report 2021-22

भाकृअनुप - केन्द्रीय तम्बाकू अनुसंधान संस्थान

ICAR - CENTRAL TOBACCO RESEARCH INSTITUTE

(An ISO 9001 : 2015 Certified Institute)

RAJAHMUNDRY - 533 105, ANDHRA PRADESH, INDIA

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Published by

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January, 2023

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EXECUTIVE SUMMARY

All India Coordinated research project on tobacco was established by Indian Council of Agricultural Research during 1970-71 with head quarters at Anand was subsequently shifted to ICAR-CTRI, Rajahmundry in 1998 and renamed as All India Network Project on Tobacco (AINPT). The mandate of AINPT is tobacco crop improvement through coordinated multi-disciplinary and multi-location research on different tobacco types (FCV, *Bidi*, *Rustica*, Chewing and *Natu*). In an effort to understand the crop behavior Agro-meteorological data, Seasonal features, Trends in Area, Production and Productivity of different tobacco centres were depicted in the Annual Report. During the year 2021-22 coordinated trails on varietal improvement were conducted in FCV, *Bidi* and *Rustica* types. A total number of 64 lines were evaluated in IVT/IHT, 59 lines in AVT/AHT and 22 lines in On-Farm Trails (OFT). In IVT, FCK-10, FCRH-13 and FCHH-2 lines/ hybrids were promoted to further evaluation in AVT/AHT. Evaluation under AVT/AHT, FCH-1, FCH-2, FCRH-6 & FCRH-4 lines/hybrids were promoted to On Farm Evaluation. In *Bidi* tobacco, the line ABD-228 was promoted to AVT and the hybrids NyBTH-152, 155 and 157 to On Farm Trials. In *Rustica* tobacco, the lines ArR-96, ArR-98, LR-96 and LR-97 were promoted to AVT.

Apart from the Crop Improvement, Crop Production and Protection programmes were implemented for the development of the site-specific technologies. Three technologies on moisture conservation, nematode management and cured leaf quality improvement were identified for farming community. All the network centres are maintaining the germplasm lines of the respective tobacco types for their use in varietal development and identification of specific traits. The network centres under the Universities are producing and supplying the pure and quality NON-FCV tobacco seed (~6500 kg) to the farmers. For dissemination of the technologies, OFTs, Field visits, Capacity Building Programmes and T & V Meetings were conducted. An android based Mobile App was also developed on NON-FCV tobaccos for quick and effective technology dissemination.

I. INTRODUCTION

India is the second largest producer and exporter of tobacco after China and Brazil respectively. It is grown in an area of 0.42 M ha producing 758 M kg of Tobacco. Tobacco contributes ~ Rs. 28,000 crores to the National exchequer in terms of excise revenue (~22,000 crores) and export earning (~6000 crores). 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 centers 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
2.	ZAHRS, Shivamogga, UAHS, Naveli (Karnataka)	1970-71	FCV
3.	BTRS, Anand, AAU (Gujarat)	1970-71	*Bidi, Chewing* & *Rustica*
B.	**Sub-Centres**		
4.	ICAR-CTRI RS, Dinhata (West Bengal)	1970-71	*Jati* & *Motihari*
5.	ICAR-CTRI RS, Hunsur (Karnataka)	1970-71	FCV
6.	ICAR-CTRI RS, Guntur (Andhra Pradesh)	1970-71	FCV & *Natu*
7.	RARS, Nandyal, ANGRAU (Andhra Pradesh)	1970-71	*Bidi* & *Natu*
8.	ARS, Nipani, UAS, Dharward (Karnataka)	1970-71	*Bidi*
9.	TRC, Berhampur, OUAT (Odisha)	1987-88	*Pikka*
10.	TRS, Araul, CSAUAT, Kanpur district (Uttar Pradesh)	1987-88	*Rustica*
C.	**Voluntary centres**		
11.	ARS, 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 XXV Tobacco Workshop of All India Network Project on Tobacco was held on 2nd December, 2021 in virtual mode at ICAR-CTRI, Rajahmundry. Dr. T. R. Sharma, DDG (CS) was the Chief Guest and Dr. R. K. Singh, ADG (CC) as the Guest of Honour. During the Workshop, experimental results of 2020-21 were reviewed and also future technical programme was finalized. In the plenary session one *rustica* tobacco variety, one *bidi* tobacco hybrid and three technologies were released to the farming community.

Table 2: Centre-wise approved experiments in different disciplines

Centre	PB	AG	SS & AC	EN	PP	NE	Total
Rajahmundry	-		1				1
Jeelugumilli	4						4
Kandukur	2						2
Guntur	-						-
Hunsur	4	1					5
Shivamogga	13	3		3			19
Anand	9	1		2	4	2	18
Nandyal	28	3					31
Nipani	18	3					21
Berhampur	7						7
Araul	6	1					7
Dinhata	1						1
Ladol	8						8
Vedasandur		2					2
Total	100	14	1	5	4	2	126

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

II. SEASONAL FEATURES

RAJAHMUNDRY

An amount of 1047 mm of rainfall was received during 2021-22 in 59 rainy days (Table R). The mean maximum temperature varied from 30.0°C to 37.6°C, whereas, the minimum temperature ranged from 17.2°C to 25.3°C.

Table R: Meteorological data at Rajahmundry centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs			
2021							
Apr.	37.3	24.1	78.1	52.5	11.4	2	4.2
May	37.6	25.0	80.9	68.8	41.0	4	4.4
Jun.	35.5	25.3	85.4	67.9	78.2	7	3.2
Jul.	32.1	24.4	88.5	75.6	274.8	13	3.1
Aug.	33.2	25.0	86.5	72.4	102.4	7	3.2
Sep.	32.5	24.1	87.7	74.2	295.2	12	2.8
Oct.	34.3	24.0	85.7	63.9	114.0	4	2.7
Nov.	31.4	22.1	86.0	69.7	92.4	5	2.3
Dec.	30.3	18.4	84.4	59.6	4.8	1	2.1
2022							
Jan.	30.0	18.3	87.5	65.5	30.0	3	2.0
Feb.	31.5	17.2	86.1	69.1	-	-	2.4
Mar.	34.4	21.1	90.2	74.0	2.8	1	3.7
Total					1047	59	

JEELUGUMILLI

An amount of 859.4 mm of rainfall was received during 2021-22 in 89 rainy days (Table J). The mean maximum temperature varied from 28.02°C to 36.41°C, whereas, the minimum temperature ranged from 12.94 °C to 25.31 °C.

Table J: Meteorological data at Jeelugumilli centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs			
2021							
Apr.	36.41	23.95	93.13	47.33	47.8	4	5.90
May	35.59	25.25	90.58	53.51	123.8	8	5.36
Jun.	33.58	25.31	91.60	62.37	41.7	9	3.87
Jul.	29.95	24.73	91.42	78.74	227.6	19	2.16
Aug.	31.44	25.17	90.55	70.81	78.3	13	2.75
Sep.	30.30	24.75	92.93	74.93	249.4	17	2.18
Oct.	32.42	24.39	93.03	64.42	37.3	7	2.96
Nov.	29.04	22.54	92.73	71.73	44.1	9	1.76
Dec.	29.13	17.55	91.42	54.39	-	-	2.61

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs			
2022							
Jan.	28.91	17.59	92.35	51.77	9.4	3	2.19
Feb.	28.02	12.94	93.04	46.11	-	-	3.60
Mar.	35.12	21.59	91.03	42.06	-	-	5.08
Total					859.4	89	

SHIVAMOGGA

Total rainfall of 1223.8 mm was received during the year 2021-22 in 98 rainy days. A maximum temperature of 35.5^{0}C was recorded during April and minimum temperature of 15.9^{0}C was recorded during January. Maximum Rainfall was received during the nursery and transplanting stages.

Table S: Meteorological data at Shivamogga centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evapo ration (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	35.5	21.9	80.0	42.2	37.4	02	8.2	5.9
May	32.3	22.2	85.8	66.5	121.2	13	6.4	5.5
Jun.	29.7	21.5	89.7	77.9	159.2	14	3.2	4.5
Jul.	27.9	21.5	92.7	81.7	298.8	21	2.6	3.6
Aug.	28.9	21.5	92.7	82.3	111.8	12	4.0	4.1
Sep.	28.9	21.0	92.0	80.9	77.6	10	3.7	4.5
Oct.	30.1	21.4	90.1	74.3	203.6	13	5.0	4.2
Nov.	28.9	20.5	93.8	79.9	208.4	11	3.8	3.7
Dec.	29.9	17.0	90.4	66.9	3.0	01	7.7	5.0
2022								
Jan.	30.6	15.9	86.1	51.5	0.0	0	8.9	5.4
Feb.	32.8	16.8	80.9	30.6	0.0	0	9.0	5.9
Mar.	34.6	20.2	76.5	34.4	2.8	1	7.5	6.3
Total					1223.8	98		

Table S-1: Rainfall received and rainy days during different FCV tobacco growth phases (2021-22)

Tobacco growth stages	Period	Rainfall (mm)	Rainy days
Pre nursery	26.03.2021 to 25.04.2021	17.2	02
Nursery	26.04.2021 to 08.07.2021	322.8	29
Transplanting	09.07.2021 to 24.07.2021	266.4	16
Growth	25.07.2021 to 06.09.2021	141.4	16
Harvesting	07.09.2021 to 30.10.2021	203.6	21
Total		951.4	84

Pest and diseases

Low incidence of damping off was observed in nursery. Field experiments were infested with Tobacco mosaic virus and leaf curl during the crop growth period. Experiments on crop improvement had higher incidence of TMV and leaf curl (65-70% and 15-20% respectively) compared to crop production experiments with an incidence of 30-35% TMV and 10-15% leaf curl. Incidence of *Spodoptera* and Budworm in the initial stages and aphids in the later stage was observed. Recommended Plant protection measures were taken for their management.

KANDUKUR

An amount of 1418.5 mm of rainfall was received during 2021-22 in 62 rainy days (Table K). Mean maximum temperature varied from 30.3°C to 37.0°C, whereas, the minimum temperature ranged from 21.1°C to 28.0°C.

Table K: Meteorological data at Kandukur centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)
	Max.	Min.	7.25 hrs	14.25 hrs			
2021							
Apr.	35.8	26.4	89.3	74.7	7.3	1	9.17
May	37.0	28.0	71.7	60.9	28.8	4	9.35
Jun.	35.6	27.0	81.6	71.0	25.0	4	9.0
Jul.	32.8	26.0	84.7	69.3	274.4	14	8.0
Aug.	33.4	26.0	90.4	77.3	179.5	8	8.3
Sep.	32.6	26.0	91.9	81.3	54.4	3	8.0
Oct.	33.9	26.1	91.4	78.4	103.1	4	8.1
Nov.	30.3	24.1	82.3	73.6	653.1	17	3.4
Dec.	31.0	21.1	89.0	71.3	60.9	4	7.6
2022							
Jan.	30.5	21.2	87.5	73.1	32	3	8.0
Feb.	32.4	21.3	91.0	70.1	-	-	8.3
Mar.	35.1	23.9	86.7	63.6	-	-	9.3
Total					1418.5	62	

GUNTUR

An amount of 1065.8 mm of rainfall was received during 2021-22 in 69 rainy days (Table G). Mean maximum temperature varied from 29.4 °C to 44.9 °C, whereas, the minimum temperature ranged from 22.8 °C to 28.4 °C.

Table G: Meteorological data at Guntur centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	40.4	25.8	81.9	44.7	5.0	1	9.25	6.8
May	44.9	28.4	86.2	23.4	57.0	5	8.40	9.1
Jun.	38.7	27.9	83.6	27.8	49.8	6	5.86	8.4
Jul.	36.6	26.3	94.4	43.5	251.0	14	5.30	7.2
Aug.	34.8	23.8	87.2	39.2	256.2	14	7.05	5.2
Sep.	36.5	24.5	92.5	44.5	166.4	8	8.21	4.9
Oct.	34.7	24.6	94.8	47.7	124.2	7	7.41	3.9
Nov.	29.4	23.9	89.8	42.1	105.2	10	6.11	3.5
Dec.	31.6	24.5	94.7	57.3	2.6	1	8.03	9.5
2022								
Jan.	30.2	23.2	94.8	65.9	48.4	3	6.47	5.6
Feb.	30.3	22.8	91.4	63.5	---	---	9.03	6.5
Mar.	33.7	24.5	95.9	65.7	---	---	8.25	4.0
Total					1065.8	69		

HUNSUR

An amount of 989.5 mm of rainfall was received during 2021-22 in 76 rainy days (Table H). Mean maximum temperature varied from 28.4°C to 34.6°C, whereas, the minimum temperature ranged from 7.4°C to 15.1°C. During the different crop growth stages 327.7 mm rainfall was received in 48 rainy days. Higher amount of rainfall received during the growth phase.

Table H: Meteorological data at Hunsur centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	34.6	15.1	91.0	47.7	31.5	2	1.7	3.8
May	32.3	13.8	90.7	61.0	79.0	8	3.8	4.0
Jun.	30.3	13.3	91.0	67.7	36.1	7	5.0	3.9
Jul.	28.8	12.9	91.0	70.3	93.5	14	3.2	2.8
Aug.	28.8	11.8	91.5	69.3	63.7	8	3.4	2.6
Sep.	29.9	11.4	91.4	65.8	31.5	5	4.7	4.7
Oct.	29.0	11.9	91.4	66.2	400.0	17	4.5	4.8
Nov.	28.4	10.2	91.5	69.5	230.0	12	4.5	3.5
Dec.	29.2	7.7	91.5	64.5	-	-	4.6	3.8
2022								
Jan.	30.1	7.4	91.0	56.4	0.20	-	4.8	3.9
Feb.	32.0	8.3	90.5	58.1	-	-	6.7	5.6
Mar.	33.2	11.0	91.1	58.0	24.0	3	6.8	6.0
Total					989.5	76		

Table H-1: Rainfall received and rainy days during different FCV tobacco growth phase (2021-22)

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	February to March 15th	4.0	1
2	Nursery	March 15th to May 15th	59.1	8
3	Transplanting	May 15th to June 1ST week	55.5	6
4	Growth	June 1st week to July 30th	123.9	22
5	Harvesting	Aug 1st to Sept 15th	84.7	11
		Total	327.7	48

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.

ANAND

Rainfall received during 2021-22 was 941.9 mm in 41 rainy days (Table A) which was more than the normal rainfall (862 mm) received in the middle Gujarat Agro-Climatic Zone. The rainfall received during the pre-nursery stage was useful for land preparation. During transplanting, 151.7 mm rainfall received within 10 rainy days which helped the transplanting of tobacco seedlings. Temperature during growth phase was normal and an amount of 193.6 mm rainfall was received. Pre-nursery period received maximum amount of rainfall followed by Growth phase. However, numbers of rainy days are less in pre-nursery.

Table A: Meteorological data at Anand centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	38.9	23.0	75.0	30.4	0.0	0.0	9.6	8.2
May	37.3	26.5	76.7	44.1	130.0	2.0	8.7	7.7
Jun.	34.8	26.8	85.8	60.2	343.6	7.0	7.3	5.5
Jul.	33.9	27.2	86.7	66.9	114.0	8.0	4.7	4.5
Aug.	32.4	26.1	88.0	66.7	31.6	2.0	3.5	3.9
Sep.	31.2	25.8	93.7	80.2	290.3	18.0	2.4	2.7
Oct.	33.9	22.9	85.7	47.6	18.4	2.0	7.9	3.5
Nov.	32.2	18.0	72.9	35.7	0.0	0.0	7.9	3.5
Dec.	26.7	15.0	84.3	54.2	14.0	2.0	6.2	2.4
2021								
Jan.	26.0	12.4	87.4	45.6	0.0	0.0	7.7	2.8
Feb.	30.6	13.6	83.3	34.4	0.0	0.0	9.3	3.8
Mar.	36.8	19.6	70.4	27.7	0.0	0.0	8.7	6.4
Total	--	--	--	--	941.9	41	--	--

Table A-1: Meteorological data during different bidi tobacco growth phases (2021-22)

Crop phase			Rainfall (mm)	Rainy days	Temperature °C	
					Maximum	Minimum
Hot weather	(2nd Apr. to 3rd Jun.)	(63)	130.0	2	38.0	25.0
Pre-nursery	(4th Jun. to 1st Jul.)	(28)	343.6	7	34.7	26.8
Nursery	(2nd July to 19th Aug.)	(49)	123.0	9	33.4	26.8
Transplanting	(20th Aug. to 16th Sept.)	(28)	151.7	10	31.9	25.9
Growth	(17th Sept. to 31st Dec.)	(106)	193.6	13	30.9	19.6
Harvesting	(1st Jan. to 1st Apr.)	(91)	0.0	0	31.1	15.2
Total		365				

** Figures in parentheses indicate number of days*

ARAUL

An amount of 998.29 mm of rainfall was received during 2021-22 in 58 rainy days (Table Ar). The mean maximum temperature varied from 18.70°C to 38.79C, whereas, the minimum temperature ranged from 7.70°C to 27.40°C. Among the different crop growth stages Pre-nursery and Nursery stages received maximum amount of Rainfall and Rainy days.

Table Ar: Meteorological data at Araul centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	38.79	20.11	42.80	14.43	0.36	01	8.27	3.99
May	35.60	27.40	78.23	51.33	95.30	11	8.34	5.32
Jun.	37.80	24.60	73.13	48.64	31.80	06	5.89	8.84
Jul.	37.73	24.40	89.10	66.16	461.10	13	7.80	7.10
Aug.	34.25	26.10	88.00	58.10	10.13	02	7.55	2.52
Sep.	32.90	26.00	84.72	65.16	190.90	11	2.95	2.63
Oct.	32.60	12.60	85.64	53.18	144.80	04	6.24	3.14
Nov.	27.80	9.80	91.74	44.43	1.20	01	5.04	2.86
Dec.	23.00	7.70	92.68	53.89	8.60	01	3.27	2.24
2022								
Jan.	18.70	9.70	93.47	68.89	41.10	07	2.80	1.39
Feb.	24.70	16.10	91.57	68.07	13.0	01	7.18	1.54
Mar.	33.40	25.95	81.94	35.99	0.00	00	7.01	2.49
Total					998.29	58		

Table Ar-1: Rainfall during different rustica tobacco growth phases (2021-22)

S.No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	April 2021 to August 2021	598.69	33
2	Nursery	Sept. 2021 to Oct. 2021	335.70	15
3	Transplanting	November – 2021	1.20	01
4	Growth	Dec. 2021 to Feb. 2022	62.70	09
5	Harvesting	March -2022	00.00	0.00
		Total	998.29	58

LADOL

Total amount of rainfall received during 2021-22 was 501.0 mm in 35 rainy days. Mean Maximum and Minimum temperatures varied from 26.3 to 36.4 and 9.9 to 25.3 respectively. During month of December, January and February minimum temperature was recorded from 7.9 ^{0}C to 9.9 ^{0}C and maximum temperature was from 26.3 ^{0}C to 29.4 ^{0}C which was favourable for crop growth, cured leaf yield and quality parameters.

Table L: Meteorological data at Ladol centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days
	Max.	Min.	7.25 hrs	14.25 hrs		
2021						
Jun.	34.6	24.9	85.9	79.8	98.0	5
Jul.	32.2	25.3	91.8	82.4	182.0	8
Aug.	31.3	23.7	90.9	79.5	20.0	4
Sep.	31.1	23.8	96.0	93.2	165.0	15
Oct.	33.4	19.7	88.3	84.7		
Nov.	31.2	13.9	82.6	80.4	33.0	2
Dec.	27.7	9.9	85.1	83.0	3.0	1
2022						
Jan.	26.3	7.9	89.0	82.5		
Feb.	29.4	9.4	88.5	81.9		
Mar.	36.4	15.0	81.7	68.9		
Total					501.0	35

Table L-1: Rainfall received and rainy days during tobacco growth phases-2021-22

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	May- Sept.	465.00	32
2	Nursery	Sept.- Oct.	-	-
3	Transplanting	Oct.-Nov.	33.00	2
4	Growth	Oct.-Mar.	3.00	1
5	Harvesting	Mar.-Apr.	0.00	
		Total	501.0	35

NIPANI

Total rainfall of 1508.0 mm was received during the year 2021 as against the average rainfall of 876.85 mm. The total rainfall received was 70.8% higher than the average rainfall and was spread over 75 rainy days. Due to heavy and continues rains in the month of June (356.8 mm) the *Kharif* sowing of Soybean, Groundnut and Maize was delayed till last week of June. However, the crop growth and yield were drastically affected due to incessant and heavy rains received in the month of July (550.8 mm), August (88.6 mm) and September (72.4 mm). Further, tobacco planting was in time but due to excess and continuous rains received in the month of September (72.4 mm), October (146.0 mm), November (56.4 mm) and December (51.2 mm) drastically affected the growth, yield and quality of tobacco. A total rainfall of 1479.4 mm was received during different growth stages of tobacco as against 749.49 mm average rainfall (last 77 years average). The total rainfall received during the year was 97.3% higher than average rainfall.

Table N: Meteorological data at Nipani centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days
	Max.	Min.	7.25 hrs	14.25 hrs		
2021						
Apr.	35.9	17.3	65.3	34.1	77.6	4
May	33.5	19.4	76.0	55.8	79.6	4
Jun.	29.0	18.3	86.3	76.4	356.8	11
Jul.	27.7	18.0	88.5	80.3	550.8	19
Aug.	28.4	17.8	86.5	79.6	88.6	12
Sep.	28.3	17.7	88.0	80.0	72.4	9
Oct.	32.5	17.1	81.8	60.1	146.0	6
Nov.	31.4	16.4	81.3	59.8	56.4	6
Dec.	30.6	11.6	83.2	59.7	51.2	1
2022						
Jan.	30.9	9.0	78.0	51.0	0	0
Feb.	34.6	11.1	68.0	35.2	0	0
Mar.	36.4	15.8	69.2	36.5	29.2	3
Total					1508	75

Table N-1: Rainfall during different bidi tobacco growth phases at Agricultural Research Station, Nipani

Tobacco growth stages		2021-22	
		Rainfall (mm)	Rainy days
Pre nursery	(1st April to 24th June)	509.8	17
Nursery	(25th June to 10th August)	586.4	25
Transplanting	(11th August to 15th September)	109.6	21
Growth	(16th September to 15th December)	273.6	14
Harvesting	(16th December to 27th January)	0.0	2
	Total	1479.4	79

Pest and diseases

Continued rainfall and water logging condition severely affected nursery by damping off in spite of plant protection measures. High incidence of aphids and moderate to low incidence of brown leaf spot and frog eye leaf spot and very low incidence of leaf curl and TMV were noticed in late planted tobacco. There was little /no rainfall during harvesting stage which helped for the easy harvesting and powdering of the tobacco in the main field.

NANDYAL

An amount of 862.3 mm of rainfall was received during 2021-22 in 51 rainy days (Table Ny). The mean maximum temperature varied from 30.3°C to 38.5^{0}C, whereas, the minimum temperature ranged from 19.1°C to 26.0°C.

Table Ny: Meteorological data at Nandyal centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	38.5	25.0	67.2	34.2	26.0	2	8.3	6.8
May	37.5	26.0	72.0	42.0	110.2	5	8.7	6.5
Jun.	33.7	25.4	77.1	53.4	170.7	8	5.1	4.8
Jul.	31.4	24.6	87.1	68.4	235.1	13	3.4	2.0
Aug.	32.8	25.1	80.2	63.7	48.0	5	4.2	3.1
Sep.	31.7	24.9	83.3	69.4	152.5	6	3.7	2.2
Oct.	32.1	24.9	82.5	67.7	28.0	4	6.4	2.8
Nov.	30.3	23.2	76.9	71.6	91.8	8	3.0	1.2
Dec.	31.3	19.1	84.3	59.0	0.0	0	7.3	1.2
2022								
Jan.	31.5	19.1	81.9	53.4	0.0	0	7.5	1.5
Feb.	34.6	19.0	81.1	48.1	0.00	0	8.6	4.2
Mar.	37.7	22.2	73.1	40.5	0.00	0	6.9	5.2
Total					862.3	51		

Table Ny-1: Rainfall received during different *bidi* tobacco growth phases (2021-22)

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre-Nursery	May 1st FN-July 1st FN	313.45	16.5
Nursery	July 2nd FN-September 1st FN	241.8	14.5
Transplanting	September 2nd FN-October 2nd FN	104.25	7
Growth	October 2nd FN-February 1st FN	91.8	8
Harvesting	February 2nd FN-March 2nd FN	-	-
	Total	751.3	46

BERHAMPUR

Total rainfall of 1259.6 mm (Table B) was received during the year 2021-22 which was 19.6 mm less than the normal rainfall (1276 mm). Number of rainy days (57) was also less as compared to normal (65). Rainfall and rainy days received during different growth stages of tobacco in 2021-22 were presented in Table 1.

Table B: Meteorological data at Berhampur centre (2021-22)

Month	Rainfall (mm)	Rainy days
2021		
Apr.	0.5 (36.6)	0 (2.8)
May	57.0 (65.4)	6 (4.1)
Jun.	45.0 (168.3)	4 (8.8)
Jul.	138.1 (220.8)	10 (11.8)
Aug.	213.0 (246.8)	12(12.5)
Sep.	311.0 (216.3)	10 (10.6)
Oct.	137.0 (177.7)	4 (6.9)
Nov.	249.0 (71.1)	6 (2.1)
Dec.	69.0 (7.1)	3 (0.5)
2022		
Jan.	39.0 (9.4)	2 (0.7)
Feb.	1.0 (24.1)	0 (1.5)
Mar.	0 (32.6)	0 (1.9)
Total /Avg.	1259.6 (1276.2)	57 (64.2)

**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 (2021-22)

Crop Stage	Period	Rainfall (mm)	Rainy days
Pre nursery	April to July	239.6	20
Nursery	August to September	525.0	22
Transplanting	October	19.0	1
Growth	November to January	475.0	14
Harvesting	February to March	1	0
	Total	1259.6	57

DINHATA

An amount of 2718.30 mm of rainfall was received during 2021-22 in 73 rainy days (Table D). The mean maximum temperature varied from 21.25°C to 33.16 °C, whereas, the minimum temperature ranged from 11.28°C to 25.82 °C.

Table D: Meteorological data at Dinhata centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)	Rainy days	Sun Shine (hrs)
	Max.	Min.	7.25 hrs	14.25 hrs			
2021							
Apr.	31.17	20.67	88.13	76.17	75.60	5	2.58
May	30.53	22.56	93.48	81.06	245.70	11	3.43
Jun.	31.97	25.69	95.27	86.53	187.40	8	2.40
Jul.	30.96	25.75	93.90	85.94	1,139.10	15	3.05
Aug.	31.22	24.80	92.55	89.03	298.00	18	1.78
Sep.	33.16	25.82	92.57	82.17	294.50	9	5.62
Oct.	31.83	23.11	92.35	78.81	470.80	6	5.95
Nov.	28.40	15.70	94.23	77.77	0.00	0	7.90
Dec.	25.82	12.18	94.94	74.06	0.00	0	6.37
2022							
Jan.	25.65	11.28	93.35	87.42	0.00	0	4.52
Feb.	21.25	11.40	91.21	75.93	0.00	0	5.35
Mar.	0.00	22.31	89.94	74.55	7.20	1	2.41
Total					2718.30	73	

VEDASANDUR

An amount of 1122.1 mm of rainfall was received during 2021-22 in 48 rainy days (Table V). The mean maximum temperature varied from 31°C to 38°C, whereas, the minimum temperature ranged from 20°C to 26°C. Among the different crop growth stages maximum amount of rainfall received during transplanting

Table V: Meteorological data at Vedasandur centre (2021-22)

Month	Temperature (°C)		Relative Humidity (%)		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2021								
Apr.	37	26	87	57	111.0	5	8.0	9.0
May	38	26	88	66	20.4	1	8.0	10.0
Jun.	36	25	87	63	161.4	5	8.0	9.0
Jul.	37	25	89	73	93.0	3	6.0	9.0
Aug.	35	25	88	64	15.8	1	6.0	10.0
Sep.	36	24	86	71	117.8	3	6.0	10.0
Oct.	33	24	91	77	215.3	10	5.0	5.0
Nov.	31	22	94	81	341.2	14	3.0	3.0
Dec.	31	20	92	72	20.8	3	7.0	8.0
2022								
Jan.	33	20	94	72	20.0	2	7.0	4.0
Feb.	35	21	94	77	0.2	0	8.0	6.0
Mar.	36	22	90	63	5.2	1	7.0	8.0
Total					1122.1	48		

Table V-1: Rainfall received during different chewing tobacco growth phases (2021-22)

S. No.	Crop Stage	Period	Rainfall (mm)	Rainy days
1	Pre nursery	May-July	274.8	9
2	Nursery	August- September	133.6	4
3	Transplanting	October- November	556.5	24
4	Growth	December- January	40.8	5
5	Harvesting	February- April	116.4	6
		Total	1122.1	48

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

Source: Tobacco Board, Guntur

SHIVAMOGGA

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

Source: Tobacco Board, Guntur

Table S-1: District-wise Area, Production and Productivity of FCV Tobacco during 2021 under Ramanathapura platform

S. No	Districts	Area (ha)	Production (tonnes)	Productivity (kg/ha)
1	Hassan(Holenarasipura & Arakalagudu)	3860	3.86	1000
2	Mysore (K. R. Nagara)	2100	0.92	441
3	Shivamogga	48	0.0027	47
4	Davanagere	241	0.045	190
5	Haveri	2	0	0
6	Chikkamagaluru	29	0	0
Total		**6280**	**4.8277**	**1678**

Source: Tobacco Board, Auction platform Ramanathapura

HUNSUR

Table H: Area, production and productivity in Karnataka during last 5 years

Year	Area (ha)	Production (M.Kg)	Productivity (kg/ha)
2017-18	81083	106.89	1320
2018-19	83696	85.08	1017
2019-20	81360	106.07	1307
2020-21	72650	88.40	1213
2021-22	71700	68104	959

Source: Regional manager officer, Tobacco board, Mysore

GUNTUR

Table G: Area and Production by different tobacco varieties during last year

S.No.	Variety Name	Area covered (%)	Total Area (ha)	Total Production (tonnes)	Productivity (kg/ha)
1.	Siri (FCV)	8.6	3,000	5000	1667
2.	HDBRG-2 (Non-FCV)	40.0	14,000	35000	2500
3.	Banket A1 (Non-FCV)	51.4	18,000	33000	1833

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

Source: Director of Agriculture, Gujarat

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

Source: Statistical Department, Directorate of Agriculture, Lucknow (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

NIPANI

Bidi tobacco is mainly grown in Chikodi, Hukkeri and Gokak talukas of Belagavi district. At present, it occupies an area of 6500 hectares with the production of about 9815 tonnes and productivity of 1510 kg/ha. The *bidi* tobacco produce of this area is known for its quality throughout the country. Even though, the area has been decreased by over 70.4 per cent, the productivity has reached close to 300 per cent compared to base year 2003-04.

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

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)	Percent change over(2003-04*)		
				Area	Production	Productivity
2003-04	21997	8379	381	-	-	-
2004-05	22000	18700	850	-0.0	123.2	123.1
2005-06	21598	16771	776	-1.8	100.2	103.7
2006-07	19826	7931	400	-9.9	-5.3	5.0
2007-08	25203	13162	522	14.6	57.1	37.0
2008-09	22104	13704	620	0.5	63.6	62.7
2009-10	20284	13793	680	-7.8	64.6	78.5
2010-11	19680	12398	630	-10.5	48.0	65.4
2011-12	18200	12922	710	-17.3	54.2	86.4
2012-13	17680	11810	668	-19.6	40.9	75.3
2013-14	11392	14240	1250	-48.2	69.9	228.1
2014-15	15107	19770	1308	-31.2	135.9	243.3
2015-16	13422	17449	1300	-39.0	108.2	241.2
2016-17	10889	17422	1599	-50.5	107.9	319.7
2017-18	11358	13750	1210	-48.4	64.1	217.6
2018-19	11675	14250	1221	-46.9	53.1	220.5
2019-20	7109	7484	1095	-67.7	-10.6	187.4
2020-21	7185	8026	1142	-67.3	-4.2	199.7
2021-22	6500	9815	1510	-70.4	17.1	296.3

**2003-04 as a base year*

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

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

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
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
2019-20*	130	90	692

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

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

VEDASANDUR

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

Year	Chewing			Cheroot		
	Area (ha)	Production (tonnes)	Average Productivity (kg/ha)	Area (ha)	Production (tonnes)	Average Productivity (kg/ha)
2010-11	17000	43300	2547	2000	3300	1650
2011-12	16000	40000	2500	1800	2800	1556
2012-13	15000	37500	2500	1600	2600	1625
2013-14	12000	28000	2333	1200	1800	1500
2014-15	11000	27500	2500	1200	1900	1583
2015-16	11000	27500	2500	1200	1900	1583
2016-17	11000	27500	2500	1200	1900	1583
2017-18	11000	27500	2500	1200	1900	1583
2018-19	11000	27500	2500	1200	1900	1583
2019-20	10000	25000	2500	1000	1600	1600
2020-21	10000	24500	2450			
2021-22	10000	25000	2500			

IV. RECOMMENDATIONS TO FARMING COMMUNITY

SHIVAMOGGA

- Application of areca husk (dry) as crop residue mulch @ 10 t/ha on the ridge at the time of planting of FCV tobacco increased the yield, moisture content and also soil fertility status in Karnataka Light Soils

ANAND

- Growing of mustard (25kg seed/ha) in *rabi* or sun hemp (100kg seed/ha) in summer and incorporation in soil at 50% flowering is recommended for managing Root-knot nematode incidence and increase in healthy transplantable seedlings

VEDASANDUR

- Palmyrah jaggery solution (10%) with coconut mesocarp or banana pseudo stem or banana peduncle solution (5%) could improve the chewability scores *viz.*, body, aroma, whitish encrustation, taste, pungency, saliva secretion, duration of pungency, stiffness in the mouth. By adopting this technology the farmers can get an addition of 13% net return

V. SALIENT RESEARCH FINDINGS

JEELUGUMILLI

- Out of three entries (FCK-8, FCK-9 AND FCK-10) assessed, the entry, FCK-10 recorded significantly higher green leaf (13275 kg/ha), cured leaf yields (2042 kg/ha) and grade index values (1645) than best control, CH-1. However, the entry found to be light cast in nature under NLS condition compared to green cast nature of NLS adopted varieties and hence, not promoted to AVT trials
- Out of three hybrid entries (FCHH-1, FCHH-2 and FCRH-13) assessed, FCRH-13 recorded significantly higher green leaf (13387 kg/ha), cured leaf yield (2445 kg/ha) and grade index (1630) than better control, Kanchan and promoted for testing under AHT in the ensuing season
- In AVT-I trial, FCRH-11 and FCRH-12 found to record significantly higher green (16% & 11%, respectively) and cured leaf (14% & 11%, respectively) and grade Index values (12% & 12%, respectively) than better control, LT Kanchan
- In pooled analysis Advanced Hybrid Trials (AVT-I &II) of yield data of last two years (2020-22), significant differences are observed among the entries for all the three characters *viz.*, green leaf, cured leaf and grade index. Both the tested entries, FCRH-6 and FCRH-7 recorded higher green (14%), cured leaf (14%) yields and grade out turn (17% & 16%, respectively) than better control, LT Kanchan
- Hence, the entries, FCRH-6 and FCRH-7 are recommended for further evaluation

SHIVAMOGGA

Crop Improvement

- The entry FCK- 10 recorded significantly higher GLY (10495 kg/ha), CLY (1447 kg/ha) and TGE (1028 kg/ha) compared to the check Sahyadri in IVT entries
- The entries FCRH-13 and FCHH-2 recorded significantly higher GLY (9333, 9319 kg/ha), CLY (1307, 1304 kg/ha) and TGE (938, 941 kg/ha) than the checks Kanchan and Sahyadri. FCHH-1 recorded significantly higher GLY (9046 kg/ha), CLY (1266 kg/ha) and TGE (916 kg/ha) than the check Sahyadri in IHT
- In AVT II, among the three entries, FCH-1 and FCH-2 recorded significantly higher CLY (1743, 1652 kg/ha) and TGE (1220, 1157 kg/ha) over all the three checks
- In AHT I, entry FCRH-4 recorded significantly higher GLY (6570 kg/ha), CLY (887 kg/ha) and TGE (652 kg/ha) over check Sahyadri. In the pooled analysis the performance of the entry FCRH-4 was non-significant over all the three checks
- The entry FCS-4 has recorded higher GLY (12715 kg/ha), higher CLY (1780 kg/ha) and TGE (1246 kg/ha) over the checks Kanchan, Sahyadri and Thrupthi
- Breeding in bulk evaluation trial for high seed yield and oil yield in both FCV and chewing tobacco: Lines NC-11271 (18.67 g), VA-309 (18.50 g), NC-567 (18.33 g), V-76 (18.00 g), TANTA (17.67 g) and VA-770 (17.67 g) recorded higher seed yield per plant (g) with respect to total capsule weight lines V-76 (37.00 g), VA-309 (36.00 g), NC-567(35.83 g), TANTA (35.50g), YELLOW SPECIAL A (35.50 g) and SPEIGHT G -58(34.83 g) recorded higher weight

Crop Production

- Soil application of hydrogel @ 5 kg/ha after a rainy day recorded significantly higher leaf area, higher green leaf yield, cured leaf yield, top grade equivalent and higher soil moisture
- Application of areca husk (dry) as crop residue mulch @ 10 t/ha on the ridge recorded higher plant height, higher leaf area , higher green leaf yield and cured leaf yield
- Higher leaf area, Higher cured leaf yield, and monetary advantage index was recorded in FCV tobacco with groundnut as intercrop
- IPM module is found to be superior with highest per cent reduction of TLCV (76.6) over control
- Among the different cultivars evaluated against TLCV, lowest per cent disease incidence was recorded in the cultivar area (3.8 per cent) at 120 days after transplanting, followed by Sahyadri (4.4 %) and Kanchan (4.9 %)

Crop Protection

- IPM module is found to be superior with highest per cent reduction of TLCV (76.6) over control
- Among the different cultivars evaluated against TLCV, lowest per cent disease incidence was recorded in the cultivar area (3.8 per cent) at 120 days after transplanting, followed by Sahyadri (4.4 %) and Kanchan (4.9 %)

KANDUKUR

- ❖ The entry FCK 10 was significantly superior to best check Siri with respect to green leaf yield and cured leaf yield in IVT

HUNSUR

Crop Improvement

- ❖ In the IHT trial, hybrids FCRH-13 and FCHH-2 were found promising as they have recorded higher green leaf yield, cured leaf yield, bright leaf yield and TGE
- ❖ In AHT-I, FCRH-11 was found promising with higher leaf yield potential
- ❖ In AVT-II, two entries FCH-2 and FCRH-4 were found superior to the checks
- ❖ Integrated weed management practices *viz.,* neem cake at 30 DAT + PE application of Imazethapyr and Neem cake + PE application of Paraqaut were found promising in reducing the *Orobanche* weed infestation and weed biomass production in the infested fields

ANAND

Crop Improvement

- ❖ In *bidi* tobacco, entries ABD- 228 ,ABD-211 and ABD-99 showed significantly superior cured leaf yield over check and ABD-211 in AVT-I. In AVT-II ABD- 199 showed significantly superior for cured leaf yield over better check
- ❖ In *rustica* tobacco, Line ArR- 83 showed significantly superior for cured leaf yield over better check in AVT- II

Crop Production

- ❖ Tobacco transplanted during 1st week of September registered significantly higher cured leaf yield being at par with 3rd week of August
- ❖ Significantly, highest cured leaf yield and leaf size were noticed in variety GABT 11 compared to MRGTH-1

Plant Pathology and Nematology

- ❖ In nursery 13, 40 and 36 per cent damping-off disease incidence was observed in comparison with control was recorded in the treatment metalaxyl MZ, azoxystrobin and azoxystrobin + difenoconazole, respectively. Screening in laboratory revealed 100 per cent inhibition of the pathogen with these fungicides after 72 hrs
- ❖ In a trial on efficacy of ready-mix fungicides, significantly minimum damped-off seedlings were registered in Metiram 55% + Pyraclostrobin 5% WG (0.105 %) (53/m^2) and it was at par with Metalaxyl MZ 72 WP (59/m^2). Maximum transplantable seedlings were recorded with Metalaxyl MZ 72 WP (553/m^2) and it was at par with Metiram 55% + Pyraclostrobin 5% WG (0.131%) (507/m2) and Metiram 55% + Pyraclostrobin 5% WG (0.105%) (447/m^2). Similar trend was observed in total transplantable seedlings
- ❖ Rotational study with resistant *Bidi* tobacco to manage Root-knot disease in *Bidi* tobacco revealed significant difference among the treatments for yield and Root-knot index. Four years of rotation in which first, second, third and four year were transplanted with a resistant variety (ABT- 10) registered 1604 kg/ha

cured leaf yield compared to susceptible variety (A-119) transplanted continuously, which yielded significantly lower cured leaf yield (1032 kg/ha) with Root-knot index of 0.90

- In a trial on effect of antagonistic crop on Root-knot nematode in *Bidi* tobacco nursery, maximum healthy transplantable seedlings were registered in a plot with Sun hemp (609/m^2) followed by Mustard (509/m^2). Mustard as green manure significantly reduced Root-knot disease compared to other treatments at 90 DAS
- Maximum transplantable seedlings (618/m^2) was registered with Sun hemp followed by Mustard (538/m^2). The treatment of Mustard as antagonistic crop significantly reduced Root-knot disease compared to other treatments
- Based on Agro-meteorological parameters, frog-eye spot disease in nursery and field can be predicted to tune of 80 % and 53% respectively

Entomology

- Studies on population dynamics of the important insect pests revealed that Rove beetle and leaf eating caterpillar in nursery, whitefly, *Spodoptera litura* and *Helicoverpa armigera* established correlation with weather parameters

ARAUL

Crop Improvement

- Entry ArR-96 (3631 kg/ha) followed ArR-98 (3609 kg/ha) found significantly superior over the best check Azad Kanchan (3130 kg/ha) with 16% and 15% increase in yield respectively and hence promoted to AVT-I
- Entry ArR-91 (4060 kg/ha) and LR-95 (3960 kg/ha) found significantly superior over Azad Kanchan (3212 kg/ha) 26.40% and 23.29% respectively
- In AVT-II line ArR-79 (3582 kg/ha) found significantly superior over the best check Azad Kanchan (2843 kg/ha) in respect of cured leaf yield with 26% increase. Entries ArR-104 (3478 kg/ha) and ArR-105 (3084 kg/ha) showed significant superiority over check Azad Kanchan (2763 kg/ha) for the cured leaf yield with 25.87% and 11.61% increase respectively. These two lines contributed for testing in IVT during *Rabi* 2022-23
- Line ArR-69 showed higher yield over the checks Azad Kanchan and SK-417 in bulk trial. Line ArR-69 showed higher yield than checks

Crop Production

- The higher Tobacco equivalent yield was higher for Potato as sole crop (2401 kg/ha) followed by Tobacco + Potato (2:4) (2062 kg/ha)

LADOL

Crop improvement

- In IVT, among six genotypes, 2 genotypes *viz.*, LR- 96 and LR-97 were found promising and showed significantly higher cured leaf yield

NIPANI

Crop Improvement

- ❖ Test entry, NBD-337 (1189 kg/ha) registered significantly superior leaf yield over the best check NBD-209 (922 kg/ha) in Station varietal trial.
- ❖ Test entries, NBD-342 (1377 kg/ha), NBD-343 (1481 kg/ha), NBD-344 (1392 kg/ha), NBD-345 (1392 kg/ha) and NBD-356 (1407 kg/ha) recorded significant superiority over the best check NBD-209 (888 kg/ha) for leaf yield in Preliminary Varietal Trial
- ❖ In the bulk trial, test entry NBD-316 (1323 kg/ha) registered higher yield compared to the best check NBD- 209 (1183 kg/ha)

Crop Production

- ❖ Pre and Post emergence application of Metribuzine @ 0.75 g/ha showed higher tobacco leaf yield as compared to weedy check and other pre-emergent weedicides
- ❖ Fallow tobacco with Neem cake @30 DAP followed by post emergent application of Imazethapyr on *Orobanche* spikes recorded the higher tobacco leaf yield

BERHAMPUR

- ❖ Genotype NF 4-27-3 (1322 kg/ha) and NF 4-20-2 (1192 kg/ha) were found superior over check Gajapati (1063 kg /ha) with yield improvement of 24.4 % and 12.1 % respectively in *pikka* tobacco bulk evaluation trial
- ❖ In replicated yield trial, Genotype 1072-IT (1368 kg/ha) and Natu Yelamanchali (1353 kg/ha) were found superior over check Gajapati (1110 kg/ha) with yield improvement of 23.8 and , 22.4 percent respectively
- ❖ In Yield evaluation trial, Genotype NGP- 89 (1464 kg/ha), II 1068 (1424 kg/ha), KFC (1413 kg/ha), II- 1873 (1404 kg/ha), Kommipaduvittanam (1386 kg/ha) and NG 61 (1376 kg/ha) were found superior over check Gajapati (1097 kg/ha) with more than 25% yield improvement
- ❖ In Multi location trial, Genotype BPT-7 expressed 19.6, 23.3, 21.1 and 21.3 per-cent higher cured leaf yield at Berhampur, Semiliguda, Jeypore and over locations respectively than check variety Gajapati. Genotype BPT-50 exhibited 12.7, 17.3, 15.0 and 15.0 percent higher cured leaf yield at Berhampur, Semiliguda and Jeypore respectively than check variety Gajapati

VEDASANDUR

Crop Production

- ❖ Application of Palmyrah jaggery at 10% solution with 5% solution of different astringent tasteners *viz.,* coconut mesocarp or banana peduncle or banana pseudostem increased the chewability scores *viz.*, body, aroma, whitish encrustation, taste, pungency, saliva secretion, duration of pungency, stiffness in the mouth, there by improved chewing quality
- ❖ Application of pongamia oil, Paraquat and Imazethapyr on *Orobanche* spikes reduced the *Orobanche* dry weight as compared to the control

VI. IMPORTANT EVENTS

HUNSUR

- One day workshop on good agricultural practices and input supply was conducted to selected beneficiary SC farmers and distributed tarpaulins for the SC beneficiaries under SC Sub plan on 31.03.2021 at CTRI RS Hunsur
- One day workshop was jointly organized by tobacco board, CTRI, and trade on sustainable practices in FCV tobacco for selected farmers of all the platforms and the field staff officials of the tobacco board at CTRI RS Hunsur on 30.07.2021
- One day Workshop on PHPM was conducted on 30.08.2021 by CTRI RS Hunsur for 50 FCV tobacco growers of Hunsur tobacco growing area

ANAND

- Scientists of the project attended 18th meeting of AGRESCO, AAU, Anand.
- Scientists of the project attended XV Workshop meeting (Virtual mode) of AINPT on Tobacco during 2021
- Scientists of the project organized training programme for farmers and field staff on "Scientific cultivation of *bidi* tobacco" at Dharmaj and AAU, Anand
- Scientists of the project visited FLD plot at different villages allotted to farmers

ARAUL

- Dr. A. K. Srivastava attended XXV Tobacco workshop of All India Network Research Project on Tobacco held on December 02, 2021 in Virtual Mode
- Participated in National Conference on "Climate Resilient and Sustainable Development of Horticulture" held from 28-31 May 2022

LADOL

- Dr. D. R. Chaudhari, Assistant Professor attended 18th AGRESCO Sub-committee Meeting of Crop Improvement, Plant Physiology and Bio-Technology on March 10, 2022 at SDAU, S.K.Nagar

NIPANI

- Dr. P. S. Matiwade attended the *kharif* Seed Production Meeting convened by Special Officer (Seeds), University of Agricultural Sciences, Dharwad (Virtual Meeting) on 7th May, 2021
- Dr. P. S. Matiwade, Dr. B. Arunkumar and Dr. Geeta Dandin attended the virtual meeting of ARS and AICRPS convened by Director of Research, University of Agricultural Sciences, Dharwad on 11th May, 2021
- Dr. P. S. Matiwade attended the Virtual Review Meeting of Seed Production (Crop Planning) of Agricultural Research Station Zone-8, 9 and 10 convened by Associate Director of Research (HQ), University of Agricultural Sciences, Dharwad on 5th June, 2021
- Dr. P. S. Matiwade attended the Virtual Review Meeting of Seed Production (Crop Planning) of Agricultural Research Station Zone-8, 9 and 10 convened by Special Officer (Seeds), University of Agricultural Sciences, Dharwad on 8th June, 2021

- Dr. M. B. Chetti, Hon'ble Vice Chancellor and Dr. J. S. Hilli, Special Officer (Seeds), University of Agricultural Sciences, Dharwad visited the research station, discussed about station activities including development activities on 4th July, 2021
- Dr. P.S. Matiwade visited the farmers field along with Joint Director of Agriculture, Belagavi, Deputy Director of Agriculture, Belagavi, Assistant Director Agriculture, Chikkodi, Agriculture Officer, RSK, Nipani, Scientist from ARS, Hukkeri, KVK, Tukanatti and other officials of Dept. of Agriculture as a part of survey and survelance of pest and diseases at Gayakanwadi and Shiraguppi villages of Nipani taluka on 7th July, 2021
- Dr. P. S. Matiwade and Dr. B. Arunkumar participated in two days Rabi NARP Meet 2021 (Virtual Mode) during the meet Agronomy technology 'Topping NBD-209 at 18 leaves has been adopted to include in the Package of Practice from 27th to 28th August, 2021
- Dr. P. S. Matiwade and Dr. B. Arunkumar participated in "Raitrondige Ondu Dina" a programme of Shri. B. C. Patil, Agriculture Minister, Sou. Shashikala Jolle, Waqt and Mujarai Minister, Govt. of Karnataka and Shri. Annasaheb Jolle, Member of Parliament. Participants on 28th September, 2021
- Dr. M. B. Chetti, Vice Chancellor and Dr. J. S. Hilli Special Officer (Seeds), UAS, Dharwad visited the research station discussed with staff about activities and problems faced by them on 26th November, 2021
- Dr. P. S. Matiwade, Dr. B. Arunkumar and Dr.(Mrs). Geeta Dandin participated and presented the experimental results of *bidi* tobacco 2020-21 and their technical programme 2021-22 during virtual XXV Workshop of AINP on Tobacco held at CTRI, Rajahmundry on 2nd December, 2021
- Dr. P. L. Patil, Director of Research and Dr. V. Rudra Naik, Deputy Director of Research, UAS, Dharwad visited the research station to monitor the tobacco experimental plots, discussed with scientists and staff and suggestion was made for development of the farm on 15th December, 2021
- Dr. P. S. Matiwade and Dr. B. Arunkumar participated in virtual google meet to create awareness on output-outcome targets and achievements organised by Nodal Officer, AINPT, CTRI, Rajahmundary on 28th December, 2021
- Dr. P. S. Matiwade and Dr. B. Arunkumar visited farmers tobacco fields (Mr. Rohit Shelar of Solapur, Mr. Raju Mokashi of Kanagala Tal: Hukkeri) where farm trials on performance of NBD-209 v/s A-119 topped at 18 leaves was conducted on 24th January, 2022
- Dr. B. Arunkumar visited farmer's tobacco fields of Galataga, Mamadapur and Akkol villages Tal: Nipani on 28th January, 2022
- Dr. B. Arunkumar, presented lead paper on Tobacco: A potential renewable energy crop for the future in Nation web conference on Journey of Biofuel production, marketing and value addition from 2-3 February,2022 organized by Bio fuel park, Thinthani, UAS, Raichur
- Dr. P. S. Matiwade participated in the meeting of Organic seed production programme convened by Director of Research, UAS, Dharwad and Indian Organic Farming, Dharwad on 18th February, 2022
- Dr. C. Chandrashekhar Rao, Nodal Officer, AINP(T), Rajahmundry visited the AINP(T) experiments and discussed with scientist about conduct of experiments and finance matter from 19th to 20th March, 2022

NANDYAL

- On 8-9-2021 the Assistant General Manager Sri. Jaichandra Reddy, of VST Company has visited our AINP on tobacco nursery at RARS Nandyal
- Honourable Vice- Chancellor, ANGRAU visited AINPT Agronomy, breeding experimental plots and has given suggestions to improve the technical programme on 20-10-2021
- On 12.10.2021 and 16.2.2022, University Head of Agronomy visited experimental field at RARS Nandyal and given valuable suggestions to improve the technical programme
- University Head of breeding visited experimental plots and monitoring the technical programme and verified basic records on 30th October, 2021
- Associate Director of Research RARS, Nandyal visited experimental field and given valuable suggestions to improve the technical programmes on 11.11.2021
- On 9.3.2022 to 11.3.2022 station level technical programme was conducted at RARS Nandyal and discussions were made and suggested to take up experiments on location specific problems
- On 24.3.2022 to 27.3.2022 attended pre- ZREAC programme was conducted at RARS Nandyal and discussions were made and suggested to take up experiments on location specific problems
- During ZREAC 2022-21 held during 20th&21st April 2022, presented significant research highlights for the year 2020-21 pertaining to AINP Breeding and Agronomy

BERHAMPUR

- Sri A. M. Prusti, Asst. Res. Scientist (PBG) participated and presented research achievement 2020-21 and technical programme 2021-22 of AINP on Tobacco at Zonal Research and Extension Advisory Council (ZREAC) virtual meeting held on 29.04.2021
- Dr. N. Senapati ,OIC, AINP on Tobacco participated and presented research achievement 2020-21 and technical programme 2021-22 of AINP on Tobacco at SLREC meeting, held at OUAT Bhubaneswar on hybrid mode from 23rd and 24th May, 2021
- Sri A. M. Prusti, Asst. Res. Scientist (PBG) participated and presented research achievement 2020-21 and technical programme 2021-22 of AINP on Tobacco at XXV Tobacco workshop of AINPT held virtually on 2.12.21

VII. STATUS OF GERMPLASM MAINTAINTED

Centre	Tobacco Type	Number of Germplasm
Rajahmundry	FCV	3386
Shivamogga	FCV	113
Guntur	*Natu*	151
Hunsur	FCV	506
Anand	*Bidi*	202
	Rustica	255
Araul	*Rustica*	390
Ladol	*Rustica*	278
Nipani	*Bidi*	245
Nandyal	*Bidi*	136
	Natu	76
Berhampur	*Pikka*	112
Dinhata	*Jati*	70
	Motihari	185
Vedasandur	*Chewing*	85
	Cigar & *Cheroot*	65

VIII. SEED SALE 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		27800	2500	750	300	60.75	72900	0.280	
2	A 119		443800	25500	7650	5380	4170.25	5004300	0.500	
3	A 145		4300	3500	1050	319.5	261	313200	0.200	
4	GT 4		50500	22000	6600	293.25	305.75	366900	0.300	
5	GT 5		127000	100000	30000	644	434.75	521700	0.400	
6	GT 7		309500	159500	47850	2300	1390	1668000	0.600	
7	GT 9		1800	1000	300	0	0	0	0.100	
8	ABT 10		11400	10000	3000	0	11.25	13500	0.100	
9	GABT 11		90250	73500	22050	38.25	42	50400	0.500	
10	MRGTH 1		232450	230500	82980	2.08	3.6	86400	Male	MRGTH 1
									Female	
11	GABTH 2		461050	448550	161478	3.44	3.465	83160	Male	GABTH 2
									Female	
	Total		**1759850**	**1076550**	**363708**	**9280.52**	**6682.815**	**8180460**	**3.48**	
Chewing Tobacco										
12	GT 8		800						0.050	
Rustica Tobacco										
13	GC 1		114900	33000	9900	1944	927.5	1391250	0.500	
14	GCT 2		86000	68000	20400	18	26.5	39750	0.300	
15	GCT 3		462900	207500	62250	1079.5	1052.75	1579125	0.700	
	Total		**663800**	**308500**	**92550**	**3041.5**	**2006.75**	**3010125**	**1.5**	
	Grand Total		**2424450**	**1385050**	**456258**	**12322**	**8690**	**11190585**	**5.03**	

NIPANI

S. No.	Variety	Area occupied (%)	Truthfully Labelled Seed (kg)		
			Produced	Sold	Amount Realised (Rs)
Bidi tobacco					
1	A-119	2600	12.5	12.5	6440
2	NBD 209	3185	13	8.64	6912
3	Bhagyashree	98	2	0.2	160
4	Bhavyashree	520	3	1.45	1160
5	Vedaganga-1	0	2	0	0
6	A-2	98	2	0.25	200
	Total	**6500**	**34.5**	**23.04**	**14872**

LADOL

S. No.	Variety	Area occupied (%)	Truthfully Labelled Seed (kg)			Breeder Seed Produced (kg)
			Produced	Sold	Amount Realised (Rs)	
1	GCT 3	Approx. 50	1179.0	1179.0	1768500	1.0
2	DCT 4	Approx. 40	909.0	908.8	1363200	1.0
3	GCT 5	Approx. 10	822.0	373.8	560700	1.0
	Total		2910.0	2461.6	3692400	3.0

IX. EXTENTION ACTIVITIES

SHIVAMOGGA

A. **On-farm trials/ Field visits**

- On 24.06.2021 Dr. T. M. Soumya visited farmers' fields at Jeenally, Nyamati taluk and Kattige, Honnali taluk, Davanagere district and Balluru village of Shikaripura taluk of Shivamogga district and suggested the management of damping off and black shank in FCV tobacco nursery
- On 25.08.2021 Dr. T. M. Soumya visited farmer field of Basavarajappa, Jeenally, Nyamati taluk Davanagere district and suggested the method of fertilizer application and management of aphids
- On 25.08.2021 Dr. T. M. Soumya visited farmers' field of J. Ramappa and Neelamma, Jeenally, Nyamati taluk Davanagere district and noticed the incidence of black shank disease and suggested management practices for black shank
- On 25.08.2021 Dr. T. M. Soumya visited farmer field of Chandregowda, Jeenally, Nyamati taluk Davanagere district and suggested proper method of fertilizer application
- On 25.08.2021 Dr. T. M. Soumya visited farmer field of Sannamallappa, Jeenally, Nyamati taluk Davanagere district and suggested the proper management practices *viz.,* inter cultivation, weeding and disease management
- On 07.09.2021 Dr. Shashikala S. Kolakar visited farmer field of Basavarajappa, Jeenally, Nyamati taluk Davanagere district and suggested topping practices in FCV tobacco
- On 07.09.2021 Dr. Shashikala S. Kolakar visited farmer field of Chandregowda, Jeenally, Nyamati taluk Davanagere district and suggested practices of *Spodoptera litura*
- On 07.09.2021 Dr. Shashikala S. Kolakar visited farmer field of Basavalingappa, Kattige, Honnali taluk, Davanagere district and suggested practices of *Spodoptera litura* and topping in FCV tobacco
- On 08.10.2021 Dr. T. M. Soumya visited farmer field of Basavalingappa, Kattige, Honnali taluk, Davanagere district and suggested curing practices in FCV tobacco
- On 08.10.2021 Dr. T. M. Soumya visited farmer field of Kuberappa, Kattige, Honnali taluk, Davanagere district suggested the bulking and curing of leaves in FCV tobacco
- On 08.10.2021 Dr. T. M. Soumya visited farmer field of Rajendrappa, Balluru, Shikaripura taluk, Shivamogga district suggested the bulking and curing of leaves in FCV tobacco

B. **Demonstrations**

- AINP (T) scientists organized the method demonstration on Soil Solarization technique in FCV tobacco nursery on 24.03.2022 to the FCV tobacco growing farmers at AINP (T), ZAHRS, Shivamogga

C. **Training programmes organized**

- Dr. T. M. Soumya conducted training programme on Nursery management practices and disease management in nursery on 02.05.2021 at Katttige, Honnali taluk Davanagere district
- Dr. T. M. Soumya conducted training programme on Post planting operations in FCV tobacco for yield and quality on 25.08.2021 at Jeenally, Nyamati taluk, Davanagere district
- Dr.Shashikala S. Kolakar conducted training programme on Scientific nursery management in FCV tobacco on 24.03.2022 to the FCV tobacco growing farmers at AINP (T), ZAHRS, Shivamogga

D. **Lectures delivered as resource person during training programmes**

- Dr. Shashikala S. Kolakar delivered lecture on importance of improved varieties in cultivation of FCV tobacco in the training programme on Scientific nursery management in FCV tobacco on 24.03.2022 at AINP (T), ZAHRS, Shivamogga
- Dr. T. M. Soumya delivered lecture on soil solarisation technique in FCV tobacco nursery in the training programme on Scientific nursery management in FCV tobacco on 24.03.2022 at AINP (T), ZAHRS, Shivamogga
- Dr. Rajashekharappa, K. delivered lecture on pest and disease management in FCV tobacco nursery in the training programme on Scientific nursery management in FCV tobacco on 24.03.2022 at AINP (T), ZAHRS, Shivamogga

E. **Participated in Meetings/Workshops/Training Programmes/ Guest lectures**

- AINP (T) scientists participated and presented the research results of 2020-21 during Zonal Research and Extension Programme held on 17.05.2021, 18.05.2021 and 21.05.2021 at ZAHRS, KSNUAHS, Shivamogga
- Dr.Shashikala S Kolakar participated in the 2nd International Agrobiodiversity Congress (Virtual) held from 15-11-2021 to 18-11-2011 at Indian Society of Plant Genetic Resources, New Delhi
- AINP (T) Scientists participated in the XXV Tobacco Workshop of AINPT (virtual mode) on 02.12.2021
- Dr. T. M. Soumya presented the achievements and technical programme conducted during 2020-21 in the XXV Tobacco Workshop of AINPT' (virtual mode) on 02.12.2021

HUNSUR

- Thirty six village level training programmes were conducted to impart training programme to FCV tobacco growers on all phases of FCV tobacco crop in various tobacco APF areas of KLS

ANAND

- Examined more than 30 diseased samples of *bidi* and *rustica* tobacco and advised the farmers during 2021-22
- Scientist 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

ARAUL

A. Extension activities

- Kishan Gosthi was organized at farmer's field in Gursahaiganj with objective for awareness of farmers for scientific cultivation of tobacco

B. Efforts on Transfer of Technology

- Farmers training programme was organized at KVK centres for dissemination of technology identified regarding awareness and scaling up of the farmers on remunerative scientific cultivation of tobacco

LADOL

- Dr. D. R. Chaudhari, Shri. D. R. Patel, Dr. R. K. Sharma, Shri. M. M. Patel visited Mandali and Hirpura on 12-01-2022 and 22-02-2022 for Good Agril. Practices and plant disease and insect management in GCT 3 and DCT4

NIPANI

A. Field visits

- Farmers field visit at Solapur Tq-Hukkeri
- Visit to the farmers field infested with Orobanche at Kanagala Tq-Hukkeri
- Farmers field visit at Akkol Tq-Nipani
- Farmers field visit at Pattanakudi Tq-Nipani
- Farmers field visit at Lakhanapur Tq-Nipani
- Farmers field visit at Khadaklat Tq-Chikkodi
- Farmers field visit at Shirpewadi Tq-Nipani
- Farmers field visit at Kodni Tq-Nipani
- Interaction with the farmer regarding the Processing of Tobacco at Khadaklat Tq-Chikkodi
- Visit of Director of Research, UAS, Dharwad to Tobacco experimental field
- Visit of Associate Director of Research (HQ), and University Research Monitoring Team UAS, Dharwad to Tobacco experimental field
- Visit of Dr. C. Chandra Sekhar Rao, Nodal Officer, AINP-Tobacco, CTRI, Rajahmundry to the farmer field at Khadaklat village who is a Tobacco based multi entrepreneur

NANDYAL

A. On-farm trials

- On-farm trial of ABD-132, NBD- 289, NBD-290 and NyBD- 56 was conducted, each in six locations at Pudicherla, Kethavaram, Choutkur Midthur, Parumanchala and Gargeyapuram villages of Nandikotkur Div. during 2020-21

B. Particulars of farmers training programme and FLD's conducted by AINP on Tobacco scheme, RARS, Nandyal

- On 27.01.2021 visited FLDs and conducted training programes to farmers on best management practices in tobacco at Kethavaram, Pudicherla and Gargeyapuram villages of Orvakal and Nandikotukurumandalam
- On 20.02.2021 visited ABD-132 field on conducted training programme on production recommendations of Nandyal Pogaku-1 and ABD-132 at VST company fields of AllampurMandal

C. Field Visits

- On 20-2-2020 field visit at Alampur & Vundavalli villages of Alampur mandal for observation of ABD-132 variety
- Attended diagnostic field visit from 2.9-2020 to 3.9-2020
- On 27-10-2020 field visit at Kethavaram, Pudicherla and Gargeyapuram villages of Orvakalmandal to observe the Tobacco on-farm entries
- Organized field day on 16-12-2020
- On 18-12-2020 field visit at Parumanchala village of Nandikotkur mandal of Nandikotkur division to observe the Tobacco on-farm entries

D. T & V Meetings

Attended by Smt.P.PulliBai Scientist (Breeding)

- On 07-8-2020 attended in T & V Meeting at RARS Nandyal, as resource person and give lecture on details of seed availability in *bidi* tobacco
- On 05-9-2020 attended in T & V Meeting at RARS Nandyal, as resource person and gave lecture on Pests and Disease management in nursery
- On 21-11-2020 attended in T & V Meeting at RARS Nandyal, as resource person and explained control measures on *Spodoptera litura* and requested the department officials to give the information on actual area under the tobacco cultivation in Kurnool Dt
- On 19-12-2020 attended in T & V Meeting at RARS Nandyal, as resource person and explained on pest & disease control measures in *bidi* tobacco
- On 29-1-2021 attended in T & V Meeting at RARS Nandyal, as resource person and on Impact points on *bidi* tobacco harvesting & curing
- On 22-03-2021 attended in T & V Meeting at RARS Nandyal, as resource person, to popularize and promote *bidi* tobacco variety Nandyal Pogaku-1

Attended by Sri.K.Sathish Babu, Scientist (Agronomy)

- Attended T & V Meeting on 29-1-2021 at RARS Nandyal as resource person and delivered lecturer on Nutrient Management in *Bidi* tobacco.
- Attended T & V Meeting on 22-03-2021, 31-07-2021, 25-09-2021, 23-10-2021, 26-11-2021, 18-12-2021, 29-01-2022, 28-02-2022, 28-03-2022 at RARS Nandyal as resource person and discuses about Management practices for improving the productivity of *Bidi* tobacco

E. Training Programmes

Attended by Smt.P.PulliBai Scientist (Breeding)

- On 24th June, 2020 participated in National webinar on "Recent Biotechnological Tools for Crop Improvement "at NAHEP, ANGRAU, Lam, Guntur, A.P. organized by NAHEP, ANGRAU, Lam, Guntur, A.P

Attended by Sri.K.SathishBabu, Scientist (Agronomy)

- Participated in training programme on 04.10.2021 to 24.10.2021 (21 days training programme) on Agricultural Research methodologies, practices and there management by virtual mode Organised by Samagra Vikas Welfare Society (SVWS) and college of Horticulture & Forestry, central Agricultural University Pasighat, Arunachal Pradesh, India
- Participated in training programme on Organic farming practices from 21.10.2021 to 01.11.2021 (10days) Organised by RARS, Chintapalli ANGRAU Guntur

BERHAMPUR

A. Capacity building programmes for farmers and farm women

- Capacity building programme was organised for 25 nos. farmers and farm women on 'Insect pest Management in *pikka* tobacco on 11.01.21 at village Badi Ambagam
- Capacity building programme was organised for 25 nos. farmers and farm women on 'Nursery Management in *Pikka* Tobacco on 31.12.21 at village Khajipalli
- Capacity building programme was organised for 25 nos. farmers and farm women on 'Nursery Management in *Pikka* Tobacco on 10.01.22 at village Raghunathpur.
- Capacity building programme was organised for 25 nos. farmers and farm women on 'Topping, Sucker control and curing in *Pikka* Tobacco on 16.03.22 at village Nimigam
- Capacity building programme was organised for 25 nos. farmers and farm women on 'Disease Management in *pikka* tobacco on 21.03.22 at village Darubhadra

B. Capacity building programmes for farmers and farm women (Agriculture Department Programme)

- Capacity building programme was organised for 50 nos. farmers and farm women on 'INM concept, important practices on 16.11.21 at village Hinjilikatu
- Capacity building programme was organised for 50 nos. farmers and farm women on Organic manures (vermicompost, enriched compost, green manuring, and biofertilizers on 17.11.21 at village Hinjilikatu
- Capacity building programme was organised for 50 nos. farmers and farm women on Organic manures(vermicompost, enriched compost, green manuring, and biofertilizers on 26.11.21 at village Hinjilikatu and Gudisara
- Capacity building programme was organised for 50 nos. farmers and farm women on INM concept, important practices on 27.11.21 at village Hinjilikatu

VEDASANDUR

- Dr. P. Manivel, Principal Scientist & Head, Dr. M. Venkatesan, Scientist, and Mr.C.Muruganandam, ACTO, RS, ICAR-CTRI, Vedasandur, Dindigul, gave training to SC farmers on the topic of "*Importance of integrated nutrient and pest management*" and supplied manual hand weeders to 20 SC farmers in Saptur block Madurai Dt on 29.10.2021
- Dr. P. Manivel, Principal Scientist & Head, RS, ICAR-CTRI, Vedasandur, Dindigul, gave one day training through virtual mode on "Organic farming cultivation of major commercial crops" in collaboration with Dept of Agriculture, Govt. of Tamil Nadu. Around 30 farmers participated in the training on 11.11.2021

X. PUBLICATIONS/SYMPOSIA/WORKSHOP/SEMINARS

SHIVAMOGGA

A. Publications on Tobacco in peer reviewed journals

- Rajashekharappa, K, Ambarish, S and Soumya T.M, 2021, Incidence of *spodoptera litura* (fab.) (Noctuide: Lepidoptera) in tobacco nursery. *Insect environment.* 24 (4): 548-549

B. Abstracts

- Soumya, T. M., Akshatha M.K, Abhiram, G.J and Deepa A.G, 2021, Choice of fuel wood and its type: Its efficiency in curing FCV tobacco pp.307 in XV Agricultural Science Congress on Energy and Agriculture: Challenges in 21st century held during November 13th to 16th, 2021
- Soumya T.M., Akshatha M.K, Abhiram, G.J and Deepa A.G, 2021, Barn modification: AN approach to save fuel wood consumption in curing FCV tobacco pp. 359 in XV Agricultural Science Congress on Energy and Agriculture: Challenges in 21st century held during November 13th to 16th, 2021
- Soumya T.M., Abhiram, G.J. and Akshatha M.K, 2021 Influence of different moisture conservation materials on growth and yield of FCV tobacco pp. 593 in XV Agricultural Science Congress on Energy and Agriculture: Challenges in 21st century held during November 13th to 16th, 2021

C. Popular articles

- Soumya, T.M. 2021, FCV Tobacco harvesting, curing and grading http://www.newsnext.co/2021/12/013
- Ambarish, S and Rajashekharappa, K, 2022, Sucking insect pests of tobacco and their management, Krishi Science – eMagazine for Agricultural Sciences, http://krishiscience.in/, **3** (1):42-44
- Soumya, T.M. and Abhiram, G.J.2022, FCV Tobacco harvesting and post harvesting technologies, Krushi Munnade, **35** (02):17-20

HUNSUR

Seminar/Symposium/Workshops

- Dr. S. Ramkrishan and M. Swamy participated in virtual training programme through videoconferencing in tobacco workshop on Improving bright grade productivity in KLS on 29-04-2021 and 30-04-2021 for Periyapatna and Mysore zone farmers and Tobacco Board officials respectively

ANAND

A. Research Papers:

National level

- Jalpa Panchal, Gediya, K.M., Padhiyar, G.M. and Patel, J.N. (2021). Agronomic and economic evaluation of alternative cropping systems for *bidi* tobacco in middle Gujarat conditions. *Indian Journal of Agronomy*, 66 (4): 462-465

International level

- Gediya, K.M. and Jalpa Panchal (2021). Production potential of *kharif* based cropping system for *bidi* tobacco in central Gujarat. *The Pharma Innovation*, 10 (8): 292-296

B. Seminar/Symposium/Workshops

- Jalapa Panchal and Gediya, K.M. (2021). Feasibility and economic viability of chewing tobacco based intercropping system. An extended summary presented in 5th International Agronomy Congress on *"Agri Innovations to Combat Food and Nutrition Challenges"* held at PJTSAU, Hyderabad 500030, India during 23rd -27th November, 2021

ARAUL

A. Abstract

- Abstracts on Production Potential of Hookah Tobacco + Vegetable pea based intercropping System is submitted during National Conference on "Climate Resilient and Sustainable Development of Horticulture" held from 28-31 May 2022

B. Symposium/ workshops/ seminar attended

- Dr. A. K. Srivastava attended XXV Tobacco workshop of All India Network Research Project on Tobacco held on December 02, 2021 in Virtual Mode
- AINPT meeting with Nodal Officer and P.I. Crop Improvement on 28.12.2021
- Participated in National Conference on "*Climate Resilient and Sustainable Development of Horticulture*" held from 28-31 May 2022

LADOL

A. Research papers

- Bhavik Rathod, D. R. Chaudhari, J. M. Patel, S. K. Patel and R. M. Patel "Correlation and Path Analysis Studies in Rustica Tobacco (Nicotiana rustica L.)" Ind. J. Pure App. Biosci. (2021) 9(5). 70-74, ISSN 2582-2845

NANDYAL

A. Research papers

- Genetic variability, correlation path analysis for cured leaf and its components in bidi tobacco *(Nicotiana tabacum L.) The Pharma Innovation journal* 10(19): 1696-16299 PulliBai, K.Satishbabu, N. K. Gayatri, Dr. K. Sarala and Dr. C. Chandrasekhar Rao

B. Effect of different irrigation schedules and climate regimes on growth on yield of Maize. *5th international Agronomy congress* on 23-27 November 2021 at PJTSAU Hyderabad: 699-701

C. Pamphlets

- Beedi mariyu cigarette natu pogaaku adhika digubadi ki yaajamaanya paddathulu by P. Pulli Bai, K. Sathish Babu ,Dr. S. Jaffar Basha, & Dr. C. Chandra Sekhara Rao
- A pamphlet named Beedi pogaku saguku samagrayajamanya paddathulu by P. Pulli Bai, K. Sathish Babu, Dr. S. Jaffar Basha, & Dr. C. Chandra Sekhara Rao

BERHAMPUR

A. Research papers

- Prusti AM and Prusty, AA (2021) Development of nicotine - free, nontransgenic tobacco by genome editing. Poster presentation and in abstract of 22ndOdishaBigyan 'O' Paribesh Congress and National seminar on " Overcoming the Challenge: Role of Science and Technology, jointly organized by the Orissa Environment Society and Ravenshaw University, Cuttack, 20.11.21 to 21. 11.21 page 172-173

B. Extension bulletins/ Booklets:

- Unnatapranaliremugachasa 'O' taraparichalana
- Unnatapranalirebirichasa 'O' taraparichalana

C. Symposium/ workshop/ seminarattended

- Twenty second Odisha Bigyan 'O' Paribesh Congress and National seminar on " Overcoming the Challenge: Role of Science and Technology Ravenshaw University, Cuttack from 20.11.21 to 21. 11.21

VEDASANDUR

- Dr. M. Kumaresan, in the "5th International conference on Advances in Agriculture, Environmental and Biosciences for sustainable Development" held on 05-07, August 2021
- Dr. P. Manivel, Principal Scientist & Head, Dr. M. Kumaresan, Principal Scientist (Agronomy), and Dr. M. Venkatesan, Scientist, RS, ICAR-CTRI, Vedasandur, Dindigul participated an event on 31.08.2021, organized by Ministry of Agriculture and Farmers welfare along with Ministry of AYUSH to celebrate 75th years of independence of our nation, free distribution medicinal plants were distributed to the farmers. The function was attended by 50 progressive farmers in and around Vedasandur (Tk). from Dindigal Dt. Vedasandur GH, Siddha Doctor, explained the benefits and uses of medicinal plants, how to use and other benefits
- Dr. M. Kumaresan, participated in the -5th International Agronomy congress; *Agri innovations to combat food and nutritional challenges* held during 23-27 Nov.2021 (Virtual)
- Dr. P. Manivel, Dr. M. Kumaresan, and Dr. M. Venkatesan, participated, the XXV Tobacco Workshop of AINPT organized by ICAR-CTRI, Rajahmundry on 02.12.2021, through zoom meeting and (Virtual)
- Dr. P. Manivel, Dr. M.Kumaresan, and Dr. M. Venkatesan, attended the IRC meetings held at ICAR CTRI Rajahamundry from 23-24 December, 2021

XI. 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 31-12-2022)

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. Rajashekarappa K
4.	Shivamogga	Technical	Field Assistant	Rajappa K
5.	Shivamogga	Technical	Curer	Nagaraja
6.	Shivamogga	Administrative	Assistant	Shruthi C
7.	Nipani	Scientific	Scientist (Plant Breeding)	Dr. B. Arunkumar
8.	Nipani	Scientific	Scientist (Agronomy)	Dr. P.S. Matiwade
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.	Berhampur	Scientific	Scientist (Plant Breeding)	Arjun Mohan Prusti
14.	Araul	Scientific	Scientist (Plant Breeding)	Dr. Achila Singh
15.	Araul	Scientific	Scientist (Agronomy)	Dr. K. C. Arya
16.	Araul	Technical	Technical Assistant	Dr. N.B. Singh
17.	Araul	Technical	Agriculture Assistant	Sri. Vivek Kumar Singh
18.	Anand	Scientific	Scientist (Plant Breeding)	Dr. Jyotindra N Patel
19.	Anand	Scientific	Scientist (Agronomy)	Dr. K M Gediya
20.	Anand	Scientific	Scientist (Nematology)	Dr. Y. M. Rojasara
21.	Anand	Technical	Senior Research Assistant	Mis. Jalpa P Panchal
22.	Anand	Technical	Senior Research Assistant	Vekariya K J
23.	Anand	Technical	Senior Research Assistant	Bhuvela S B
24.	Anand	Technical	Lab. Technician	Mrs. Hiral Upadhyay
25.	Anand	Supporting	Lab. Attendar	Mr. Rayaji J Gohil

XII. BUDGET

Revised Estimates for the year 2021-22: AINPT (ICAR Share)

Head	Amount (Rs. in Lakhs)
Grant in aid Salaries	278.30
Grant in aid Capital	1.04
Grant in aid General	101.30
Total	380.64

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.	-7.63	61.39	**47.81**
2	Travelling allowance	0.00	0.60	**0.11**
3	Recurring contingencies	2.09	17.33	**11.62**
	Total	5.54	79.32	**59.54**
ANAND				
1	Salary of Research Staff & Est.	-1.69	86.76	78.79
2	Travelling allowance		0.80	0.09
3	Recurring contingencies	3.64	26.50	27.54
	Total	1.95	114.06	106.42
ARAUL				
1	Salary of Research Staff & Est.	-1.38	41.85	36.23
2	Travelling allowance	0.94	0.20	0.15
3	Recurring contingencies	4.14	9.00	5.71
	Total	3.70	51.05	42.09
NIPANI				
1	Salary of Research Staff & Est.	-0.08	49.92	53.70
2	Travelling allowance	-0.31	0.40	0.23
3	Recurring contingencies	2.21	18.40	8.92
	Total	1.82	68.72	62.85
NANDYAL				
1	Salary of Research Staff & Est.	4.68	24.92	16.98
2	Travelling allowance	0.12	0.40	0.16
3	Recurring contingencies	0.00	15.90	11.39
	Total	4.70	41.22	28.53
BERHAMPUR				
1	Salary of Research Staff & Est.	5.36	13.46	11.27
2	Travelling allowance	0.00	0.20	0.03
3	Recurring contingencies	0.00	6.10	3.56
	Total	5.36	19.76	14.86

XIII. CO-ORDINATION UNIT, RAJAHMUNDRY

The XXV Tobacco Workshop of All India Network Project on Tobacco was held on 2nd December, 2021 in virtual mode at ICAR-CTRI, Rajahmundry. Dr. T. R. Sharma, DDG (CS) was Chief Guest and Dr. R. K. Singh, ADG (CC) was the Guest of Honour. Scientists from various AINPT centres and other delegates from all over India participated in the Workshop. The experimental results of 2020-21 were reviewed and also formulated the future technical programme.

- A total number of 64 lines were evaluated in IVT/IHT, 59 in AVT/AHT, 22 in On-farm trials. Promising lines were evaluated in on-farm trials includes FCV (FCR-51, FCR-60, FCR-47, FCS-4, FCJ-36, and FCJ-49) and *Bidi* (BTH-318, ABD-145, ABD-146 ABD-163, ABD-166, ABD-169, ABD-173, ABD-174, NBD-277, NBD-289, NBD-290 and NyBD-56)
- Four important publications *viz.*, AINPT Annual Report 2020-21; AINPT Research Achievements and Work Plan - 2021; Sustainable management practices for *Rustica* Tobacco grown in North Gujarat and All India Network Project on Tobacco - A Glance were released by Hon'ble DDG virtually
- Prepared and submitted budget proposals (Budget Estimates/ Revised Estimates), for the year 2021-22 and 2022-23 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 through Google Meet for discussing issues viz., Outcome/Output targets and Achievements, Budget, NEH proposals, SCSP Proposals etc., during the year
- An interaction meeting with AINPT centres was held on 23rd November 2022 at ICAR-CTRI, Rajahmundry in virtual mode. Dr. M. Sheshu Madhav interacted with the Scientists of all the centres. All the Heads gave a brief about their centres. The scientists discussed about the technical programmes. Director appreciated the work done and given suggestions for improvement
- A Brain Storming session on Yield Gap Analysis of Tobacco-Strategies and Way Forward was held on 30th December 2022 at ICAR-CTRI, Rajahmundry in Hybrid mode. Dignitaries *viz*., Dr. A. Sridhar Babu, IAS (Executive Director), Dr. G. Krishna Kumar (Chief Executive Officer) and Y. S. Patil, AGM participated in the programme
- Compiled the Annual Report of 2021-22 and Research Achievements and Work Plan 2023
- Compiled the proceedings of XXV Tobacco Workshop of AINPT

AINPT 01: Project on Development of Mobile Application for Non-FCV tobacco

Year of start	:	2021-22
Year of completion	:	2023-24
Location of the project	:	Co-Unit, Rajahmundry

Results

Android Based Static Mobile App was developed using Java and XML languages on Good Agricultural Practices (GAPs) of NON-FCV tobacco for global accessing of the information through smart phones by tobacco farmers and stake holders. This app provides complete information on 11 types of Non-FCV tobaccos, state-wise which includes Research Infrastructure, Varieties and GAPs. This quick and instant accessing assist the tobacco farmers in raising their crop in a more scientific way for achieving higher yields. It also assists the Institute in transferring the latest technology in no time and improves the Institute visibility at the national level. It is an icon based user-friendly menu driven application for easy and instant accessing of the complete information on NON-FCV tobaccos. Template designing, software development and content management completed. Testing and debugging are in progress.

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

Year of start : 2021-22

Initial Varietal Trial (IVT) was conducted at four centres *viz.*, Jeelugumilli, Kandukur, Hunsur and Shivamogga, with 3 entries along with their respective check varieties.

Entries: 03 (Three)

1. FCK-8
2. FCK-9
3. FCK-10

Checks at different Centres:

Jeelugumilli	:	1. Kanchan	2. LT-Kanchan	3. CH 1
Kandukur	:	1. VT 1158	2. Siri	3. N-98
Hunsur	:	1. Kanchan	2. FCH-222	3. CH 3
Shivamogga	:	1. Thrupthi	2. Kanchan	3. Sahyadri

Design	:	RBD
Total treatments	:	03 + checks as given above
Replications	:	Five

The trials were laid out as per plot size and spacing recommended for the respective centres

Centre	Plot size	Spacing
Jeelugumilli	2.0 × 12.0 m	1.0 × 0.6 m
Kandukur	2.6 × 5.85 m	0.65 × 0.65 m
Hunsur	2.0 × 6.6 m	1.0 × 0.55 m
Shivamogga	3.6 × 6.0 m	0.9 × 0.6 m

Results

Data on yield characteristics at different centres are presented in Tables 1 to 10 IVT VFC TOBACCO. The results are discussed centre-wise.

JEELUGUMILLI

A trial was conducted with three entries (FCK-8,FCK-9 AND FCK-10) along with three control varieties *viz.,* Kanchan, LT Kanchan and CH-1.The trial was laid out as per plot size and spacing, and followed all the standard cultural conditions. Significant differences observed among the entries tested for all the three characters *viz.*, green leaf, cured leaf and grade index. The entry, FCK-10 recorded significantly higher green leaf (13275 kg/ha), cured leaf yields (2042 kg/ha) and grade index values (1645) than best control, CH-1. However, the entry found to be light cast in nature under NLS condition compared to green cast nature of NLS adopted varieties. The leaves of FCK-10 showed less puckering and leaf maturing was uneven compared to NLS varieties. In view of this, the entry was **not promoted** to AVT trials.

Morphological characterization: In general, the entries tested (FCK-8, FCK-9 and FCK-10) recorded higher plant height, number of leaves and internodal length than controls (Table 2). Most of the cases, the tested entries recorded higher leaf length and width values than checks Kanchan and LT Kanchan. However, leaf length was higher in CH-1 in most cases than the tested entries.

Disease /Pest incidence: Incidence of pests (caterpillar & aphids) and diseases (Black Shank, CMV& leaf curl) observed under naturalcondition among the entries and controls. The entries, FCK-8, FCK-9 and FCK-10 recorded lower incidence of caterpillar and FCK-8relatively higher incidence of black shank. Leaf curl incidence was more or less similar in all the entries. Kanchan (C) recorded higher CMV infected plats. Aphid incidence was nil in all the entries. Under artificial inoculation, the entry, FCK-8 recorded resistance reaction to TMV and others showed susceptible reaction.

KANDUKUR

During the year 2021-22, IVT was conducted with the three test entries FCK-8, FCK-9 and FCK-10 along with checks *viz.*, Siri, VT-1158 and N-98. Results revealed that entries differed significantly for all four traits. Test entry FCK-10 recorded significantly superior green leaf yield and cured leaf yield of 11399 kg/ha and 1763 kg/ha over popular check Siri (9958 kg/ha and 1548 kg/ha respectively). Hence entry FCK-10 was advanced for further testing in **AVT-I.**

HUNSUR

Initial varietal trial (IVT) was conducted with three entries (FCK-8, FCK-9 and FCK-10) and three checks (Kanchan, FCH-222 and CH-3) in a RBD trial with five replications. Observations on morphological characters and incidence of pests and diseases were recorded. Data in respect of green leaf cure leaf, bright leaf and TGE was recorded and subjected to statistical analysis. The results indicated significant differences among the entries however, **none of the tested entries** were significantly superior over the checks with respect to green leaf, cured leaf, bright leaf and TGE. No major diseases incidence were noticed in the trial, however, incidence of diseases and root knot was recorded

SHIVAMOGGA

Three entries were tested in replicated trial along with three checks. The results revealed that FCK-10 has recorded significantly higher GLY (10495 kg/ha), CLY (1447 kg/ha) and TGE (1028 kg/ha) over Sahyadri. FCK-10 has recorded 51.04 % higher cured leaf yield over Sahyadri. **None** of the entries are promoted to Advanced Varietal Trial-I in view of their non significant yields over the best check.

Table 1 IVT VFC TOBACCO: Green leaf yield (kg/ha) in IVT at different centres (2021-22)

Entries	Jeelugumilli	Kandukur	Hunsur	Shivamogga
FCK-8	11342	9252	6177	7730
FCK-9	12131	10123	6652	7079
FCK-10	13275*	11399*	8558	10495
Kanchan (C)	10792		9210	10199
LT-Kanchan (C)	10983			
CH-1 (C)	11258			
N-98 (C)		9119		
Siri (C)		9958		
VT 1158 (C)		8730		
FCH 222 (C)			9048	
CH-3 (C)			9460	
Thrupthi (C)				10282
Sahyadri (C)				6888
G. Mean	11630	9763		8779
S. Em±	543	301	424	722
C.D. at 5%	1570	909	1250	2175
C.V. (%)	10.43	6.17	11.58	16

**Significant at 5%*

Table 2 IVT VFC TOBACCO: Cured leaf yield (kg/ha) in IVT at different centres (2021-22)

Entries	Jeelugumilli	Kandukur	Hunsur	Shivamogga
FCK-8	1745	1439	1060	1070
FCK-9	1866	1643	1147	999
FCK-10	2042*	1763*	1605	1447
Kanchan (C)	1660		1505	1429
LT-Kanchan (C)	1690			
CH-1 (C)	1732			
N-98 (C)		1405		
Siri (C)		1548		
VT- 1158 (C)		1528		
FCH- 222 (C)			1274	
CH-3 (C)			1758	
Thrupthi (C)				1408
Sahyadri (C)				958
G. Mean	1789	1554		1218
S. Em±	83	68.5	74	103
C.D. at 5%	241	206	219	309
C.V. (%)	10.43	8.83	11.95	17

Table 3 IVT VFC TOBACCO: Bright leaf yield (kg/ha) in IVT at different centres (2021-22)

Entries	Kandukur	Hunsur
FCK-8	575	783
FCK-9	841	821
FCK-10	1241	1108
N-98 (C)	818	
Siri (C)	1037	
VT- 1158 (C)	1022	
Kanchan (C)		1076
FCH- 222 (C)		876
CH-3 (C)		1294
G. Mean	922	
S. Em±	74.09	51
C.D. at 5%	223	120
C.V. (%)	16.06	11.46

Table 4 IVT VFC TOBACCO: Grade index/TGE (kg/ha) in IVT at different centres (2021-22)

Entries	Jeelugumilli	Kandukur	Hunsur	Shivamogga
FCK-8	1188	712	791	758
FCK-9	1242	956	867	694
FCK-10	1645*	1293	1219	1029
Kanchan (C)	1259		1133	1000
LT-Kanchan (C)	1249			
CH-1 (C)	1288			
N-98 (C)		887		
Siri (C)		1099		
VT- 1158 (C)		1107		
FCH- 222 (C)			944	
CH-3 (C)			1344	
Thrupthi (C)				1008
Sahyadri (C)				675
G. Mean	1312	1009		860
S. Em±	72	65	54	71
C.D. at 5%	209	196	159	213
C.V. (%)	12.33	12.9	11.47	16

**Significant at 5%*

Table 5 IVT VFC TOBACCO: Morphological characters of the entries of IVT at Jeelugumilli (2021-22)

Entries	Plant height	No. of leaves/ plant	Internodal length
FCK-8	168	27	6
FCK-9	165	27	5
FCK-10	143	31	4
Kanchan (C)	110	22	3
LT-Kanchan (C)	120	24	4
CH-1 (C)	100	20	4

Table 6 IVT VFC TOBACCO: Morphological characters of the entries of IVT at Hunsur (2021-22)

Entries	Plant height	No. of leaves/ plant	Internodal length
FCK-8	130.80	22.00	5.95
FCK-9	100.60	18.20	5.53
FCK-10	132.20	22.80	5.80
Kanchan (C)	107.00	18.00	5.94
FCH 222 (C)	105.40	20.80	5.07
CH-3 (C)	128.20	21.40	5.99

Table 7 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Jeelugumilli (2021-22)

Entries	Natural Condition (Mean No. of plants infected / plot (40 plants)					Artificial Inoculation With TMV (Reaction*)
	Caterpillar	Leaf Curl	Black Shank	CMV	Aphids	
FCK-8	6	15	2	5	NIL	R
FCK-9	6	13	0	7	NIL	S
FCK-10	8	10	0	8	NIL	S
Kanchan (C)	13	25	1	20	NIL	S
LT-Kanchan (C)	10	13	1	6	NIL	S
CH-1(C)	13	11	0	5	NIL	S

**R: Resistance; S: Susceptible*

Table 8 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Hunsur (2021-22)

Entries	Disease data					
	LC	TMV	F. wilt	CMV	Aphids	RKI
FCK-8	2	7	0	0	0	4.33
FCK-9	5	7	0	0	1	2.00
FCK-10	1	5	0	0	0	4.00
Kanchan (C)	0	6	0	0	0	3.66
FCH- 222 (C)	2	6	0	1	0	2.66
CH-3 (C)	2	8	0	0	0	3.00

Table 9 IVT VFC TOBACCO: Diseases reaction (%) in the entries of IVT at Shivamogga (2021-22)

Entries	Black shank	Frog eye leaf spot	Root knot
FCK-8	8.0(MR)	38.0 (MR)	2.0(MR)
FCK-9	9.0(MR)	33.0 (MR)	2.0(MR)
FCK-10	10.0(MR)	39.0 (MR)	2.0(MR)
Thrupthi (C)	27.0(MS)	43.0 (MS)	3.0(MS)
Kanchan (C)	24.0(MS)	42.0 (MS)	3.0(MS)
Sahyadri (C)	28.0(MS)	43.0 (MS)	3.0(MS)

MS: Moderately Susceptible MR: Moderately Resistant

Table 10 IVT VFC TOBACCO: Chemical quality parameters in IVT entries at Hunsur (2021-22)

Entries	Nicotine		Reducing Sugars		Chlorides	
	X	L	X	L	X	L
FCK-8	1.06	0.97	13.91	13.69	0.17	0.17
FCK-9	1.69	1.59	14.69	11.28	0.16	0.26
FCK-10	1.55	2.06	16.75	10.50	0.23	0.24
Kanchan (C)	1.24	1.26	16.62	14.11	0.11	0.16
FCH- 222 (C)	1.30	1.21	15.46	9.25	0.20	0.17
CH 3 (C)	1.20	1.28	17.15	10.98	0.28	0.20

IHT ON VFC TOBACCO-HYBRIDS

VFJBRC/ VFKBRC/ VFHBRC/ VFSBRC 3: INITIAL HYBRID TRIAL ON FCV TOBACCO

Year of start : 2021-22

Initial Hybrid Trial (IHT) was conducted at four centres *viz.*, Jeelugumilli, Kandukur, Hunsur and Shivamogga, with 3 entries along with respective check varieties.

Entries: 03

1. FCHH-1
2. FCHH-2
3. FCRH-13

Checks at different centres

Jeelugumilli	:	1. Kanchan	2. LT-Kanchan	3. CH 1
Kandukur	:	1. VT 1158	2. Siri	3. N-98
Hunsur	:	1. Kanchan	2. FCH-222	3. CH 3
Shivamogga	:	1. Thrupthi	2. Kanchan	3. Sahyadri

The trials were laid out as per plot size and spacing's recommended for the respective centres

Centre	Plot size	Spacing
Jeelugumilli	2.0 × 12.0 m	1.0 × 0.6 m
Kandukur	2.6 × 5.85 m	0.65 × 0.65 m
Hunsur	2.0 × 6.6 m	1.0 × 0.55 m
Shivamogga	3.6 × 6.0 m	0.9 × 0.6 m

Design : RBD
Total treatments : 3 + checks as given above
Replications : Five

Results

Data on yield characteristics at different centres are presented in Tables 1 to 10 IHT VFC TOBACCO. The results are discussed centre-wise.

JEELUGUMILLI

A replicated trial was conducted with three entries(FCHH-1, FCHH-2 and FCRH-13) along with three control varieties *viz.*, Kanchan, LT-Kanchan and CH-1. The trial was laid out as per plot size and spacing, and followed all the standard cultural conditions. Significant differences observed among the entries tested for all the three characters *viz.*, green leaf, cured leaf and grade index. Among the entries tested, FCRH-13 recorded higher green leaf (13387 kg/ha), cured leaf yields (2445 kg/ha) and grade index values (1630) than other lines and controls. FCRH-13found to record significantly higher green (12%) and cured leaf (18%) and higher grade Index values (21%) than better control, Kanchan. In view of higher yield, **FCRH-13 is promoted** for testing under AHT-I in the ensuing season.

Morphological characterization: The entries, FCHH-2 and FCRH-13 recorded higher plant height, FCRH-13 more number of leaves and FCHH-2 higher internodal length than other lines and controls. The entry, FCHH-2 recorded higher leaf length and width values.

Disease /Pest incidence: Incidence of pests (caterpillar&aphids) and diseases (Black Shank, CMV& leaf curl) observed under natural condition among the entries and controls. The entries, FCHH-1, FCHH-2 and FCRH-13 recorded lower incidence of caterpillar and FCHH-1 and CH-1 relatively higher incidence of black shank. Leaf curl incidence was more or less similar in all the entries. LT Kanchan (C) recorded higher CMV infected plats. Aphid incidence was nil in all the entries. Under artificial inoculation, all the entries recorded susceptible reaction to TMV.

KANDUKUR

IHT was conducted at CTRI, RS, Kandukur during the year 2021-22 with three entries *i.e.,* FCRH-13, KLSH-26 and KLSH-27 and three check varieties Siri, VT-1158 and N-98. None of the test hybrids were significantly superior over the best check variety Siri in all the yield parameters. Hence **no hybrid** was advanced for further testing.

HUNSUR

Three entries *viz.*, FCRH-13, FCHH-1and FCHH-2 were evaluated along with two popular varietal checks Kanchan and FCH-222 and one hybrid check CH-3 in RBD. The data in respect of green leaf, cured leaf, bright leaf and TGE were recorded. 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. Leaf quality parameters *viz.*, Nicotine, Reducing sugars and chlorides were estimated. Yield data was subjected to statistical analysis and yields were expressed in terms of kg/ha.The results of the trial indicated that the entries exhibited significant differences for all yield forms except green leaf yield.

Significant differences were not noticed among the entries tested for green leaf yield. However, two hybrids, FCRH-13 (9911 kg/ha) and FCHH-2 (9383 kg/ha) recorded numerically higher green leaf yield over the hybrid check CH- 3 respectively. Hybrids tested FCRH-13 (1851 kg/ha) and FCHH-2 (1845 kg/ha) recorded significantly higher cured leaf yield over hybrid check CH3with an improvement 17.6% and 17.2% respectively.

Bright leaf yield differences was significant among the hybrids tested and two of the tested hybrids, FCRH-13 and FCHH-2 recorded highest significant bright leaf yield of 1402 kg/ha and 1399 kg/ha with 31 per cent improvement over the hybrid check CH-3. Hybrids differed significantly for Top Grade Equivalent (TGE) and hybrid, FCRH-13 (1402 kg/ha) and FCHH-2 (1407 kg/ha) recorded highest significant TGE with 22 and 22.6 per cent improvement over the hybrid check CH-3 respectively.Leaf quality analysis estimated in terms of Nicotine, Reducing sugars and chlorides, revealed that the parameters were well within the prescribed limits.There was no major incidence of fungal diseases, incidence of viruses and root knot nematode were recorded.

Conclusion: Entries FCRH-13 and FCHH-2 recorded significantly higher yields over the hybrid check CH-3 and thus **promoted** to AHT-I.

SHIVAMOGGA

Among the three entries, FCRH-13 and FCHH-2 have recorded significantly higher GLY (9333, 9319 kg/ha), CLY (1307, 1304 kg/ha) and TGE (938, 941 kg/ha) over Kanchan and Sahyadri. FCHH-1 has recorded significantly higher GLY (9046 kg/ha), CLY (1266 kg/ha) and TGE (916 kg/ha) over Sahyadri. FCRH-13 has recorded 18.71 % higher cured leaf yield over Kanchan and FCHH-2 has recorded 18.43% higher cured leaf yield over Kanchan. **None** of the entries were superior over best check Thrupthi, hence the trial was not advanced further.

Table 1 IHT VFC TOBACCO: Green leaf yield (kg/ha) in IHT at different centres (2021-22)

Entries	Jeelugumilli	Kandukur	Hunsur	Shivamogga
FCHH-1	12075	6557	8792	9046
FCHH-2	12208	8310	9383	9319
FCRH-13	13387*(12)	10520	9911	9333
Kanchan (C)	11908		8851	7862
LT-Kanchan (C)	10758			
CH-1 (C)	10908			
FCH- 222 (C)			8562	
CH-3 (C)			9147	
Sahyadri (C)				6704
Thrupthi (C)				9940
N-98 (C)		9310		
Siri (C)		11878		
VT -1158 (C)		9160		
G. Mean	11874	9289		8701
S. Em+	511	515	408	445
C.D. at 5%	1478	1553	NS	1343
C.V. (%)	9.63	11.09	10.02	10

**Significant at 5%* *Figures in Parenthesis indicate percentage increase over better check.*

Table 2 IHT VFC TOBACCO: Cured leaf yield (kg/ha) in IHT at different centres (2021-22)

Entries	Jeelugumilli	Kandukur	Hunsur	Shivamogga
FCHH-1	2055	1010	1545	1266*
FCHH-2	2077	1328	1845* (17.2)	1304
FCRH-13	2445*(18)	1626	1851* (17.6)	1307
Kanchan (C)	2077		1572	1101
LT-Kanchan (C)	1966			
CH-1 (C)	1999			
Thrupthi (C)				1392
FCH -222 (C)			1415	
CH-3 (C)			1574	
Sahyadri (C)				939
N-98 (C)		1383		
Siri (C)		1828		
VT 1158 (C)		1457		
G. Mean	2103	1438		1218
S. Em+	103	79	84	62
C.D. at 5%	299	239	247	188
C.V. (%)	10.99	11.05	11.46	10

**Significant at 5%* *Figures in Parenthesis indicate percentage increase over better check.*

Table 3 IHT VFC TOBACCO: Bright leaf yield (kg/ha) in IHT at different centres (2021-22)

Entries	Kandukur	Hunsur
FCHH-1	676	1177
FCHH-2	936	1399*(30.9)
FCRH-13	1079	1402*(31)
Kanchan (C)		1065
FCH -222 (C)		1140
CH-3 (C)		1069
N-98 (C)	877	
Siri (C)	1234	
VT- 1158 (C)	962	
G. Mean	961	
S. Em+	86	57
C.D. at 5%	261	168
C.V. (%)	18.05	10.51

**Significant at 5%* *Figures in Parenthesis indicate percentage increase over better check.*

Table 4 IHT VFC TOBACCO: Grade index/TGE (kg/ha) in IHT at different centres (2021-22)

Entries	Jeelugumilli	Kandukur	Hunsur	Shivamogga
FCHH-1	1395	724	1178	916
FCHH-2	1415	989	1407* (22.6)	941
FCRH-13	1630 (21)	1137	1402* (22)	938
Kanchan (C)	1342		1157	799
LT-Kanchan (C)	1320			
CH-1 (C)	1323			
Thrupthi (C)				996
FCH- 222 (C)			1104	
CH-3 (C)			1148	
Sahyadri (C)				673
N-98 (C)		931		
Siri (C)		1276		
VT 1158 (C)		1020		
G. Mean	1404	1013		877
S. Em+	86	82	54	44
C.D. at 5%	NS	248	160	133
C.V. (%)	13.65	16.2	9.83	10

**Significant at 5% Figures in Parenthesis indicate percentage increase over better check.*

Table 5 IHT VFC TOBACCO: Morphological characters of the entries of IHT at Jeelugumilli (2021-22)

Entries	Plant height	No. of leaves/ plant	Internodal length
FCHH-1	117	23	3
FCHH-2	145	23	6
FCRH-13	129	29	4
Kanchan (C)	115	22	3
LT-Kanchan (C)	118	23	5
CH-1 (C)	119	22	5

Table 6 IHT VFC TOBACCO: Morphological characters of the entries of IHT at Hunsur (2021-22)

Entries	Plant height	No. of leaves/ plant	Internodal length
FCHH-1	123.00	20.40	6.03
FCHH-2	120.40	19.20	6.27
FCRH-13	121.20	22.40	5.41
Kanchan (C)	94.80	18.00	5.27
FCH- 222 (C)	124.20	20.80	5.97
CH-3 (C)	115.80	18.20	6.36

Table 7 IHT VFC TOBACCO: Incidence of pest and diseases in the entries of IHT at Jeelugumilli (2021-22)

Entries	Natural Condition (Mean No. of plants infected / plot (40 plants)					Artificial Inoculation With TMV (Reaction*)
	Caterpillar	Leaf Curl	Black Shank	CMV	Aphids	
FCHH-1	4	12	2	5	NIL	S
FCHH-2	4	17	1	7	NIL	S
FCRH-13	3	10	1	6	NIL	S
Kanchan (C)	6	13	1	6	NIL	S
LT-Kanchan (C)	5	11	1	14	NIL	S
CH-1 (C)	4	7	2	5	NIL	S

**R: Resistance; S: Susceptible*

Table 8 IHT VFC TOBACCO: Incidence of diseases in the entries of IHT at Hunsur (2021-22)

Entries	LC	TMV	F. wilt	CMV	Aphids	RKI
FCHH-1		3	0	0	0	4.66
FCHH-2	1	5	0	0	0	4.33
FCRH-13	2	7	0	1	0	5.00
Kanchan (C)	3	7	0	0	0	1.33
FCH- 222 (C)	0	3	0	0	0	2.00
CH-3 (C)	2	4	0	2	0	2.30

Table 9 IHT VFC TOBACCO: Diseases reaction content in the entries of IHT at Shivamogga (2021-22)

Entries	Black shank (%)	Frog eye leaf spot (%)	Root knot (%)
FCHH-1	4.0(MR)	34.0	2.0(MR)
FCHH-2	4.0(MR)	35.0	2.0(MR)
FCRH-13	6.0(MR)	37.0	2.0(MR)
Thrupthi (C)	25.0(MS)	44.0	3.0(MS)
Kanchan (C)	24.0(MS)	42.0	3.0(MS)
Sahyadri (C)	26.0(MS)	45.0	3.0(MS)

MS: Moderately Susceptible MR: Moderately Resistant

Table 10 IHT VFC TOBACCO: Chemical quality parameter (%) of the entries at Hunsur (2021-22)

Entries	Nicotine		R. Sugars		Chlorides	
	X	L	X	L	X	L
FCHH-1	1.00	1.14	17.23	10.81	0.21	0.31
FCHH-2	1.40	1.33	14.36	12.30	0.20	0.25
FCRH-13	1.59	1.24	16.10	10.88	0.41	0.18
Kanchan (C)	1.29	1.49	19.10	14.00	0.22	0.29
FCH- 222 (C)	1.09	0.91	10.06	18.10	0.33	0.19
CH-3 (C)	1.11	1.26	17.17	13.22	0.15	0.21

JEELUGUMILLI

VFJBRC 3.1: ADVANCED HYBRID TRIAL I

Year of start: 2021-22

Design	: RBD	Replications	: Five
Plot size	: 2.0 m × 12.0 m	Spacing	: 1.0 m × 0.6 m
Treatments	: 2 Entries + 3 checks		

Results

Two entries *viz.*, FCRH-11 and FCRH-12 are tested in RBD along with three checks following standard cultural practices (Table 1 VFJBRC 3.1). Significant differences are observed among the entries for green leaf, cured leaf yield and grade index. Entries, FCRH-11 and FCRH-12 recorded higher green leaf (13433 kg/ha and 12867kg/ha, respectively), cured leaf yield (2274 kg/ha and 2225 kg/ha) and grade index values (1435 and 1433) than other lines and controls. Both the entries, FCRH-11 and FCRH-12 found to record significantly higher green (16% & 11%, respectively) and cured leaf (14% & 11%, respectively) and grade Index values (12% & 12%, respectively) than better control, LT Kanchan. The trial is proposed to continue as AHT-2 in the ensuing season.

Morphological characterization: The entries, FCRH-11 and FCRH-12 recorded higher plant height, FCRH-11 more number of leaves and CH-1 higher internodal length than other lines (Table 2 VFJBRC 3.1). The test entries, FCRH-11 and FCRH-12 recorded lower leaf length and higher width values than best controls.

Disease /Pest incidence: Incidence of pests (caterpillar & aphids) and diseases (Black Shank, CMV& leaf curl) observed under natural condition among the entries and controls are given at Table 3 VFJBRC 3.1. The entries, FCRH-11 and Kanchan (C) recorded lower incidence of caterpillar and FCRH-12 lower leaf curl and CMV. In FCRH-11, Kanchan and LT Kanchan (C) black shank incidence was not recorded. Aphid incidence was nil in all the entries. Under artificial inoculation, all the entries recorded susceptible reaction to TMV.

Chemical quality: The chemical quality parameters *viz.*, nicotine and reducing sugars of tested entries in both 'X' and 'L' positions are comparable to controls and are in acceptable limits. Chlorides of tested entries are comparable to controls.

Table 1 VFJBRC 3.1: Yield and morphological characters of AHT-I entries (2021-22)

Entries	Yield (kg/ha)			Morphological characters		
	Green leaf	Cured leaf	Grade Index	Plant height (cm)	No. of leaves	Inter-nodal length (cm)
FCRH-11	13433*(16)	2274*(14)	1435*(12)	143	27	4
FCRH-12	12867*(11)	2225*(11)	1433*(12)	125	24	4
Kanchan (C)	11417	1970	1239	117	22	3
LT Kanchan (C)	11600	1999	1280	123	26	4
CH-1 (C)	11167	1895	1196	107	23	5
Grand mean	12097	2072	1317			
S.Em. ±	405	75	47			
C.D. at 5%	1216	224	141			
C.V. %	7.50	8.06	7.98			

*Significantly superior over check, LT-Kanchan
Figures in Parenthesis indicate percentage increase over better check.

Table 2 VFJBRC 3.1: Pest and disease incidence in AHT-I entries (2021-22)

Entries	Mean No. of plants infected/plot (40 plants)*					Artificial Inoculation with TMV (Reaction)
	Caterpillar	Leaf Curl	Black Shank	CMV	Aphids	
FCRH-11	4	8	3	6	NIL	S
FCRH-12	7	7	0	4	NIL	S
Kanchan (C)	4	13	0	8	NIL	S
LT Kanchan (C)	6	12	0	6	NIL	S
CH-1 (C)	5	10	2	6	NIL	S

* Observed under Natural conditions S: Susceptible

Table 3 VFJBRC 3.1: Chemical quality characters (%) of entries in AHT-I (2021-22)

Entries	Nicotine		Reducing Sugars		Chlorides	
	'X' position	'L' position	'X' position	'L' position	'X' position	'L' position
FCRH-11	1.92	2.72	8.99	5.62	1.86	1.72
FCRH-12	2.05	2.42	12.59	12.52	1.46	1.35
Kanchan (C)	2.03	2.49	11.98	12.74	1.39	1.34
LT-Kanchan (C)	1.94	2.50	15.98	14.29	1.64	1.25
CH-1(C)	2.37	2.45	14.92	13.26	1.52	1.60

VFJBRC3.2: ADVANCED HYBRID TRIAL II

Year of start: 2020-21

Design	: RBD	Replications	: Five
Plot size	: 2.0 m × 12.0 m	Spacing	: 1.0 m × 0.6 m
Treatments	: 2 Entries + 3 checks		

Results

Two entries *viz.*, FCRH-6 and FCRH-7 are tested in RBD along with three checks following standard cultural practices (Table 1 VFJBRC 3.2). Significant differences are observed among the entries for green leaf, cured leaf yield and grade index. Entries, FCRH-6 and FCRH-7 recorded higher green leaf (12017 kg/ha and 11900 kg/ha, respectively), cured leaf yields (1857 kg/ha and 1838 kg/ha, respectively) and grade index values (1259 and 1223, respectively) than other lines and controls. Both the entries, FCRH-6 and FCRH-7 found to record significantly higher green (13% & 12%, respectively) and cured leaf (14% & 13%, respectively) and grade Index values (20% & 16%, respectively) than better control, LT Kanchan.

Morphological characterization: The entries, FCRH-6 and FCRH-7 recorded higher plant height, FCRH-6 more number of leaves and FCRH-6 & FCRH-7 lower internodal length than other lines (Table 1 VFJBRC 3.2). The test entries, FCRH-6 and FCRH-7 recorded lower leaf length and higher width values than best control, Kanchan.

Disease /Pest incidence: Incidence of pests (caterpillar&aphids) and diseases (Black Shank, CMV& leaf curl) observed under natural condition among the entries and controls are given at Table 2 VFJBRC 3.2. The entries, FCRH-6 and Kanchan (C) recorded lower incidence of caterpillar and CH-1 lower leaf curl and FCRH-7 lower CMV. In FCRH-7 black shank incidence was not recorded. Aphid incidence was nil in all the entries. Under artificial inoculation, all the entries recorded susceptible reaction to TMV.

Chemical quality: The chemical quality parameters *viz.*, nicotine and reducing sugars of tested entries in both 'X' and 'L' positions are mostly comparable to controls and are in acceptable limits (Table 3 VFJBRC 3.2). Chlorides of tested entries are comparable to controls.

Results of Pooled Analysis

In pooled analysis of data of two years (2020-22), significant differences are observed among the entries for all the three characters *viz.*, green leaf, cured leaf and grade index (Table 4 VFJBRC 3.2). Both the tested entries, FCRH-6 and FCRH-7 recorded higher green (14 %), cured leaf (14%) yields and grade out turn (17% & 16%, respectively) than better control, LT Kanchan.

Table 1 VFJBRC 3.2: Yield and morphological of AHT-II entries (2021-22)

Entries	Yield (kg/ha)			Morphological characters		
	Green leaf	Cured leaf	Grade Index	Plant height (cm)	No. of leaves	Inter-nodal length (cm)
FCRH-6	12017* (13)	1857* (14)	1259* (20)	128	25	3
FCRH-7	11900* (12)	1838* (13)	1223* (16)	118	23	3
Kanchan (C)	10233	1583	1015	113	23	4
LT Kanchan (C)	10608	1629	1053	117	23	4
CH-1 (C)	9442	1735	942	113	23	4
Grand mean	10840	1467	1098			
S.Em. ±	459	68	51			
C.D. at 5%	1376	205	154			
C.V. %	9.47	9.13	10.43			

*Significantly superior over check, LT-Kanchan
Figures in Parenthesis indicate percentage increase over better check.

Table 2 VFJBRC3.2: Pest and disease incidence in AHT-II entries (2021-22)

Entries	Mean No. of plants infected/plot (40 plants)*					Artificial Inoculation with TMV (Reaction)
	Caterpillar	Leaf Curl	Black Shank	CMV	Aphids	
FCRH-6	5	10	1	12	NIL	S
FCRH-7	8	15	0	6	NIL	S
Kanchan (C)	5	13	1	7	NIL	S
LT Kanchan (C)	8	15	1	18	NIL	S
CH-1 (C)	4	8	1	9	NIL	S

* Observed under Natural conditions S: Susceptible

Table 3 VFJBRC 3.2: Chemical quality characters (%) of entries in AHT-I (2021-22)

Entries	Nicotine		Reducing Sugars		Chlorides	
	'X' position	'L' position	'X' position	'L' position	'X' position	'L' position
FCRH-6	2.00	2.39	10.65	15.18	1.44	1.48
FCRH-7	1.58	2.50	6.47	10.60	1.76	1.63
Kanchan (C)	2.20	2.02	8.48	9.76	1.33	1.63
LT-Kanchan (C)	2.26	1.96	13.83	12.30	1.92	1.38
CH-1(C)	2.18	2.69	12.28	11.26	1.66	1.34

Table 4 VFRJBR 3.2: Pooled data on yield parametersof advanced lines in AHT-II (2020-22)

Treatments	(Yield in kg/ha)		Grade Index
	Green Leaf	Cured Leaf	
FCRH-6	12358* (14)	2006* (14)	1377* (17)
FCRH-7	12292* (14)	2000* (14)	1371* (16)
Kanchan (C)	9442	1553	1020
LT-Kanchan (C)	10817	1758	1180
CH-1(C)	9817	1601	1067
G. Mean	10945	1784	1203
S.Em. ±	274	41	35
C.D. at 5%	760	114	96
C.V. %	7.92	7.31	9.08
Seasons			
2020-21	11050	1893	1309
2021-22	10840	1675	1098
S.Em. ±	396	72	41
C.D. at 5%	NS	NS	133
C.V. %	18.08	20.05	16.89
Seasons X treatments			
S.Em. ±	388	58	49
C.D. at 5%	1075	162	135

*Significantly superior than better control, LT Kanchan
Figures in the parenthesis are percent increase over control, LT Kanchan

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VFHBRC 1.2: ADVANCED VARIETAL/HYBRID TRIAL (AVT/AHT-II)

Year of start :2020-21
Design : RBD
Replications : Five
Plot size : 2.0 × 6.6 m
Spacing : 1.0 × 0.55 m
Treatments : 2 entries +3 checks

FCH-2 (Varietal line)	Kanchan (C)
FCRH-4 (Hybrid line)	FCH 222 (C)
	CH-3 (C)

Results

In Advanced Varietal Trial-II, one entry FCH-2, one hybrid, FCRH-4 and three checks were evaluated in a RBD trial with five replications. Both the lines under testing had recorded significantly higher cured leaf yield, bright leaf yield and TGE over the varietal checks, Kanchan and FCH-222 and were on par with the hydrid check CH-3. However, the difference in green leaf yield was not significant among the entries tested (Table 1 VFHBRC 1.2).Morphological characters like plant height, number of leaves, intermodal length, *etc*., were recorded (Table 2 VFHBRC 1.2). The leaf quality parameters *viz*., Nicotine, Reducing sugars and Chlorides were estimated and they are in prescribed limit (Table 3VFHBRC 1.2). The natural incidence of pest and diseases were recorded (Table 4 VFHBRC 1.2).

Results of Pooled Analysis

Pooled analysis of the data for two years (2020-2022) also indicated that significant differences among the entries tested and the entries tested were significantly superior against the checks tested(Table 5VFHBRC 1.2).

Entry FCH-2 recorded significantly highest green leaf, cured leaf, bright leaf yield and TGE (13471 kg/ha, 1928 kg/ha, 1369 kg/ha and 1479 respectively), followed by hybrid FCRH-4 which recorded green leaf yield of 13178 kg/ha, Cured leaf yield of 1890 kg/ha, , bright leaf yield of 1302 kg/ha and TGE value of 1419. FCH-2 recorded an improvement of 13%, 12%, 14 % and 15% over check CH-3 and improvement over Kanchan/FCH-222 were 19%, 22%, 32% and 30% in terms of green leaf yield, cured leaf yield, bright leaf yield and TGE. FCRH-4 showed 10%increment in green leaf, cured leaf , TGE value and 8% increment in bright leaf yield over CH-3, while yield increment over Kanchan/FCH-222 were 16%, 19%, 25% and 24% in terms of green leaf yield, cured leaf yield, bright leaf yield and TGE values respectively. There was significant difference between the means of two seasons for all yield parameters except green leaf yield, while season and treatment interaction was not significant.

Conclusion: The two entries FCH- 2 and FCRH- 4 were superior to the checks and thus were promoted to the bulk trial and OFT

Table 1 VFHBRC 1.2: Yield parameters of AVT/AHT-II (2021-22)

Entries	Yield (kg/ha)			
	Green leaf	Cured leaf	Bright leaf	Top Grade Equivalent
FCH-2	13235	1999*(16) (20)[F]	1555*(30)[K] (24)[F]	1598*(26)[K] (22)[F]
FCRH-4	12815	1963*(14)[K] (18)[F]	1509*(26)[K] (20)[F]	1593*(26)[K] (22)[F]
Kanchan (C)	11952	1728	1194	1264
FCH 222 (C)	11214	1663	1253	1310
CH-3 (C)	12442	1940	1505	1536
S.Em ±	487	78	85	75
C.D. at 5%	NS	234	255	226
C.V. (%)	8.83	9.39	13.55	11.54

**Significant at 5%* *Figures in Parenthesis indicate percentage increase over better check* Kanchan[K] and or FCH 222[F]

Table 2 VFHBRC 1.2: Plant Morphological traits with different entries AVT/AHT-II(2021-22)

Entries	Plant height (cm)	No. of leaves	Internodal length
FCH-2	128.80	19.60	6.57
FCRH-4	128.20	20.00	6.41
Kanchan (C)	125.40	19.40	6.46
FCH 222 (C)	129.00	21.40	6.03
CH-3 (C)	128.20	20.60	6.22

Table 3 VFHBRC1.2: Chemical quality parametersin (%) - AVT/AHT-II (2021-22)

Entries	Nicotine		Reducing Sugars		Chlorides	
	X	L	X	L	X	L
FCH-2	1.32	1.98	15.46	14.04	0.48	0.55
FCRH-4	1.03	1.67	15.59	12.65	0.35	0.63
Kanchan (C)	1.27	2.06	17.11	14.26	0.63	0.71
FCH 222 (C)	1.44	1.64	15.38	15.61	0.49	0.47
CH-3 (C)	1.16	1.88	14.43	15.33	0.43	0.51

Table 4 VFHBRC 1.2: Incidence of pest and diseases in (%) -AVT/AHT-II (2021-22)

Entries	LC	TMV	F. wilt	CMV	Aphids	RKI
FCH-2	-	2	-	-	-	1.66
FCRH-4	-	4	-	-	-	3.00
Kanchan (C)	2	-	-	1	-	1.66
FCH 222 (C)	5	7	-	-	1	4.33
CH-3 (C)	3	5	-	-	-	1.00

Table 1 VFHBRC 1.2: Pooled yield parameters of AVT/AHT-II (2020-22)

Entries	Yield (kg/ha)			
	Green leaf	**Cured leaf**	**Bright leaf**	**Top Grade Equivalent**
FCH-2	13471* (13)^{C}(19)^{KF}	1928* (12)^{C}(22)^{KF}	1369* (14)^{C}(32)^{KF}	1479* (15)^{C}(30)^{KF}
FCRH-4	13178* (10)^{C}(16)^{KF}	1890* (10)^{C}(19)^{KF}	1302* (8)^{C}(25)^{KF}	1419* (10)^{C}(24)^{KF}
Kanchan (C)	11324	1586	1039	1141
FCH 222 (C)	11045	1558	1037	1142
CH-3 (C)	11945	1722	1203	1288
S.Em ±	378	62	50	44
C.D. at 5%	1047	171	139	122
C.V. (%)	9.8	11.22	13.28	10.79
Seasons				
2020-21 Mean	12053	1614	977	1128
2021-22 Mean	12332	1859	1403	1460
S.Em ±	283	57	34	44
C.D. at 5%	NS	185	111	143
Seasons x Treatments				
S.Em ±	534	87	70.63	63
C.D. at 5%	NS	NS	NS	NS

* Significant at 5% over either CH-3 or Kanchan/FCH222. Figures in parenthesis indicate percent improvement over check Kanchan^{K} , FCH222^{F} and CH3^{C} respectively

VFHBRC 3.1: ADVANCED HYBRID TRIAL I (AHT-I)

Year of start : 2020-21

Design : RBD
Replications : Five
Plot size : 2.0 × 6.6 m
Spacing : 1.0 × 0.55 m
Treatments : 2 entries +3 checks

Results

Advanced Hybrid Trial-I consisting of only one entry, FCRH-11 was evaluated against checks (Kanchan, FCH-222 and CH-3) in a RBD trial consisting of six replications. The hybrid entry recorded significantly higher cured leaf yield (2673 kg/ha) and bright leaf yield (1913 kg/ha) over the better hybrid check CH-3 with an improvement of 16.9% and 15.6% respectively (Table 1 VFHBRC 3.1). Morphological characters like plant height, number of leaves, intermodal length, etc., were recorded(Table 2 VFHBRC 3.1). The leaf chemical parameters of the entries tested were in the prescribed limit except for slightly higher chlorides in L position (Table 3 VFHBRC 3.1). Observations on the natural incidence of pest and diseases were recorded (Table 4 VFHBRC 3.1).

Conclusion: Hybrid entry, FCRH-11 recorded significantly higher cured leaf and bright leaf yield. The trial will be conducted for the **second** year as AHT-II.

Table 1 VFHBRC 3.1: Yield parameters of AHT-I (2021-22)

Entries	Yield (kg/ha)			
	Green leaf	**Cured leaf**	**Bright leaf**	**Top Grade Equivalent**
FCRH-11	15869 (3.5)	2673*(16.9)	1913(15.6)	2041(18)
Kanchan (C)	13652	2008	1434	1647
FCH 222 (C)	15934	2183	1606	1693
CH-3(C)	15340	2287	1655	1730
S.Em ±	368	100	80	101
C.D. at 5%	1110	302	242	NS
C.V. (%)	5.94	10.74	11.91	13.98

**Significant at 5%* *Figures in parenthesis indicate percentage increase over better check.*

Table 2 VFHBRC 3.1: Plant Morphological traits with different entries AHT-I (2021-22)

Entries	Plant height (cm)	No. of leaves	Internodal length
FCRH-11	129.80	21.60	6.01
Kanchan (C)	130.00	21.00	6.19
FCH 222 (C)	135.60	22.40	6.05
CH-3(C)	121.80	19.20	6.34

Table 3 VFHBRC 3.1: Chemical quality (%) parameters (2021-22)

Entries	Nicotine		Reducing Sugars		Chlorides	
	X	L	X	L	X	L
FCRH-11	1.46	1.70	13.17	15.07	0.40	0.65
Kanchan (C)	1.22	1.83	17.48	16.60	0.49	0.49
FCH 222 (C)	1.19	1.86	13.25	14.33	0.51	0.73
CH-3 (C)	1.25	1.95	18.36	16.42	0.46	0.60

Table 4 VFHBRC 3.1: Incidence of pest and disease (%) (2021-22)

Entries	LC	TMV	F. wilt	CMV	Aphids	RKI
FCRH-11	2	3	0	1	0	2.33
Kanchan (C)	2	2	0	1	0	2.00
FCH 222 (C)	2	1	0	0	0	2.33
CH-3 (C)	4	0	0	0	0	2.00

SHIVAMOGGA

VFSBRC 1.2: ADVANCED VARIETAL TRIAL II

Year of start:2020-21

Design : RCBD
Replications : Four
Plot size : 3.6×6.0 m
DOS : 27.04.2020
DOP :06.07.2020
Treatments : 3 Entries + 3 Checks
Entries : FCH-1, FCH-2, FCR-67
Fertilizer dose: 40:30:80 (kg/ha) NPK

Results

Among the three entries tested in the replicated trial, FCH-1 has recorded significantly higher GLY (12580 kg / ha), CLY (1761 kg/ha) and TGE (1233 kg/ha) over all the three checks. FCH-2 has recorded significantly higher GLY (11750 kg/ha), CLY (1645 kg/ha) and TGE (1151 kg/ha) over Kanchan and Sahyadri. However, FCR-67 has recorded significant GLY (10525 kg/ha), CLY (1473 kg/ha) and TGE (1031 kg/ha) over Sahyadri. FCH-1 has recorded 19.95% higher cured leaf yield over high yielding check Thrupthi. FCH- 2 has recorded 19.89 % higher cured leaf yield over Kanchan (Table 1 VFSBRC 1.2).

Results of Pooled Analysis

In pooled analysis, among the three entries, FCH-1 and FCH-2 has recorded significantly higher CLY (1743, 1652 kg/ha) and TGE (1220, 1157 kg/ha) over all the three checks. FCH-1 was significant over all the three checks for GLY (12925 kg/ha). FCH-1 has recorded 19.13% higher cured leaf yield over high yielding check Kanchan. FCH-2 has recorded 12.92 % higher cured leaf yield over Kanchan (Table 4 VFSBRC 1.2). All the three chemical quality constituents' *viz.*, nicotine, reducing sugar and chloride were within the acceptable standards. There was no significant difference among the different genotypes both in X and L position except nicotine content at L position (Table 3 VFSBRC 1.2).

Conclusion: The entries FCH-1, FCH-2 were significantly superior over all the three checks hence they can be promoted to bulk and**OFT trials**.

Table 1 VFSBRC 1.2: Yield characters of AVT-II entries (2021-22)

Entries	Yield (kg/ha)		
	Green leaf	Cured leaf	TGE
FCH-1	12580*	1761* (19.95%)	1233*
FCH-2	11750*	1645* (19.89 %)	1151*
FCR-67	10525*	1473	1031*
Sahyadri (C)	8789	1230	861
Kanchan (C)	9801	1372	960
Thrupthi (C)	10486	1468	1028
Mean	10655	1492	1044
S.Em. ±	505	71	49
C.D. at 5%	1522	213	149
C.V. %	9	9	9

**Significant at 5%* *Figures in parenthesis indicate percentage increase over better check.*

Table 2 VFSBRC 1.2: Diseases reaction in the entries of AVT-II (2021-22)

Entries	Black shank (%)	Frog eye leaf spot (%)	Root knot (%)
FCH-1	6.0(MR)	36.0	2.0(MR)
FCH-2	6.0(MR)	37.0	2.0(MR)
FCR-67	9.0(MR)	39.0	2.0(MR)
Sahyadri (C)	24.0(MS)	43.0	3.0(MS)
Kanchan (C)	26.0(MS)	45.0	3.0(MS)
Thrupthi (C)	25.0(MS)	44.0	3.0(MS)

MR: Moderately Resistant *MS: Moderately Susceptible*

Table 3 VFSBRC 1.2: Chemical quality parameters of AVT-II entries (2021-22)

Entries	X Position (%)			L Position (%)		
	Nicotine	R.Sugars	Chloride	Nicotine	R.Sugars	Chloride
FCH-1	1.62	7.19	0.2	1.41	7.38	0.2
FCH-2	1.63	7.73	0.19	1.59	8.44	0.26
FCR-67	1.63	7.75	0.17	1.42	6.69	0.2
Sahyadri (C)	1.46	6.62	0.35	2.41	4.29	0.27
Kanchan (C)	1.43	10.49	0.18	1.63	6.86	0.18
Thrupthi (C)	1.21	8.87	0.24	1.57	6.94	0.18
S.Em. ±	0.19	1.11	0.03	0.19	1.05	0.03
C.D. at 5%	NS	NS	NS	0.60	NS	NS

Table 4 VFSBRC 1.2: Pooled data of yield parameters of AVT-II entries (2020-22)

Entries	Yield (kg/ha)		
	Green leaf	Cured leaf	TGE
FCH-1	12925*	1743* (19.13 %)	1220*
FCH-2	12259*	1652* (12.92 %)	1157*
FCR-67	10930	1473	1031
Sahyadri (C)	9818	1320	924
Kanchan (C)	10874	1463	1024
Thrupthi (C)	10611	1447	1018
Mean	11236	1516	1062
S.Em. ±	385	52	35
C.D. at 5%	1401	188	129
C.V. %	4.85	4.83	4.71

**Significant at 5%* *Figures in parenthesis indicate percentage increase over better check.*

VFSBRC 3.2: ADVANCED HYBRID TRIAL II (AHT-II)

Year of start: 2020-21

Design : RCBD
Replications : Five
Plot size : 3.6×6.0 m
Fertilizer dose: 40:30:80 NPK
DOS : 14.06.2021
DOP : 19.08.2021
Treatments : 1 Entry + 3 Checks
Entry : FCRH-4

Results

In the advanced hybrid trial –II, the entry FCRH-4 was tested with three checks *viz.,* Thrupthi, Sahyadri and Kanchan. The result revealed entry FCRH-4 recorded significantly higher GLY (6570 kg/ha), CLY (887kg/ha) and TGE (652kg/ha) over check Sahyadri.

Results of Pooled Analysis: In the pooled analysis the entry FCRH-4 was **non-significant** over all the three checks. Hence it is not promoted to further studies.

Table 1 VFSBRC3.2: Yield characters of AHT-II entries (2021-22)

Entries	Yield (kg/ha)		
	Green leaf	Cured leaf	TGE
FCRH-4	6570	887	652
Sahyadri (C)	3101	434	307
Kanchan (C)	5605	785	555
Thrupthi (C)	6398	896	630
Mean	5419	750	536
S.Em. ±	440	58	536
C.D. at 5%	1326	176	130
C.V. %	20	19	18

Table 2 VFSBRC 3.2: Incidence of pest and diseases of AHT-II entries (2021-22)

Entries	Black shank	Frog eye leaf spot	RKI
FCRH-4			
Sahyadri (C)	24.0(MS)	44.0	3.0(MS)
Kanchan (C)	26.0(MS)	46.0	3.0(MS)
Thrupthi (C)	26.0(MS)	47.0	3.0(MS)

Table 3 VFSBRC 3.2: Pooled data of yield parameters of AHT-II entries (2020-22)

Entries	Yield (kg/ha)		
	Green leaf	Cured leaf	TGE
FCRH-4	9791	1289	918
Sahyadri (C)	7110	940	659
Kanchan (C)	8912	1187	833
Thrupthi (C)	8660	1158	812
Mean	8618	1143	806
S.Em. ±	718	100	70
C.D. at 5%	NS	NS	NS
C.V. %	11.79	12.38	12.28

BT: BULK TRIAL

DOS: 26.04.2021 DOP: 10.07.2021 Entry: FCS-4

Results

The entry FCS-4 has recorded higher GLY (12715kg/ha), higher CLY (1780 kg/ha) and TGE (1246 kg/ha) over the checks. There were no sufficient seedlings of FCJ-36 and trial was conducted with only FCS-4. The entry FCS-4 has recorded 10.35 % higher cured leaf yield over Kanchan. Hence entry FCS-4 is **under farm trial**.

Table 1 BT: Yield (kg/ha) characters and Incidence of Pest and disease of entries (2021-22)

Entries	Green leaf	Cured leaf	TGE	Black shank	Frog Eye leaf spot	RKI
FCS-4	12715	1780 (10.35%)	1246	5.0(MR)	35.0	2.0(MR)
Thrupti (C)	10721	1501	1051	27.0(MS)	44.0	3.0(MS)
Kanchan (C)	11519	1613	1129	28.0(MS)	46.0	3.0(MS)
Sahyadri (C)	9219	1291	903	26.0(MS)	45.0	3.0(MS)

VFSBR 4.1: STATION TRIAL-I ON FCV TOBACCO

Objective: To identify high yielding good quality FCV tobacco varieties for zone 7

Design	: RCBD	Replications	: Three
Plot size	: 6.0 × 3.6 m	Date of sowing	: 26.04.2021
Date of planting	: 09.07.2021	Fertilizer dose	: 40:30:80 N:P:K (kg/ha)

Results

Ten entries were tested in replicated trial along with three checks. Among the ten entries tested, none of the entry has recorded significantly higher GLY, CLY and TGE over the checks. Hence it is not promoted to station trial-II.

Table 1 VFSBR 4.1: Yield (kg/ha) characters of Station Trial-I entries (2021-22)

Genotype	Green leaf	Cured leaf	TGE
ST-6 (Tobios - 6 × Sahyadri)	10126	1362	992
ST-7 (Tobios - 6 × Thrupthi)	11060	1512	1083
ST-8 (Tobios - 5 × Thrupthi)	10880	1464	1066
ST-9 (Tobios - 5 × Kanchan)	6520	1063	639
ST- 10(NLSH -1 × Kanchan)	8435	1324	826
NC- 37- NF	6868	982	673
DELCREST - 66	9250	1310	906
Olior - 10	7042	1082	690
VA - 115	4728	712	463
VA - 4219	6974	1019	683
Thrupthi (C)	9465	1396	927
Kanchan (C)	10027	1433	982
Sahyadri (C)	9933	1516	973
Mean	8562	1244	839
S. Em. ±	849	121	83
C.D. at 5%	NS	NS	NS
C.V. %	17	16	17

Table 2 VFSBRC 4: Diseases reaction in the Station Trial-I entries (2021-22)

Genotype	Black shank (%)	Frog eye leaf spot (%)	Root knot (%)
ST-6 (Tobios - 6 × Sahyadri)	4(MR)	36(MR)	2(MR)
ST-7 (Tobios - 6 × Thrupthi)	5(MR)	34(MR)	2(MR)
ST-8 (Tobios - 5 × Thrupthi)	6(MR)	33(MR)	2(MR)
ST-9 (Tobios - 5 × Kanchan)	10(MR)	37(MR)	2(MR)
ST- 10(NLSH -1 × Kanchan)	9(MR)	34(MR)	2(MR)
NC 37 NF	4(MR)	32(MR)	3(MS)
DELCREST - 66	5(MR)	36(MR)	2(MR)

Genotype	Black shank (%)	Frog eye leaf spot (%)	Root knot (%)
Olior - 10	4(MR)	34(MR)	3(MS)
VA - 115	4(MR)	32(MR)	3(MS)
VA - 4219	8(MR)	33(MR)	3(MS)
Thrupthi (C)	24(MS)	45(MS)	3(MS)
Kanchan (C)	25(MS)	42(MS)	3(MS)
Sahyadri (C)	26(MS)	47(MS)	3(MS)

MR: Moderately Resistant MS: Moderately Susceptible

VFSBR 4.2: STATION TRIAL-II ON FCV TOBACCO

Objective: To identify high yielding good quality FCV tobacco varieties for zone 7

Design : RCBD Replications : Three
Plot size : 6.0 × 3.6 m Date of sowing : 26.04.2021
Date of planting : 09.07.2021 Fertilizer dose : 40:30:80 N:P:K (kg/ha)
Treatments : 8

Results

Among the five entries tested with checks, none of the entries have recorded higher GLY, CLY and TGE over the checks.Hence they are not promoted to Initial varietal trials.

Table 1 VFSBR 4: Yield (kg/ha) characters of station trial entries (2021-22)

Genotype	Green leaf	Cured leaf	TGE
ST-1 (Bhavya × Tobios-6-S1)	9571	1694	879
ST-2 (Bhavya × Tobios-5)	7809	1406	711
ST-3 (CY 139 × Sahyadri)	8178	1438	734
ST-4 (V-4267 × Bhavya)	7865	1402	719
ST-5 (Bhavya × Tobios-6-S-2)	8582	1439	751
Thrupthi (C)	11636	2025	1061
Kanchan (C)	9560	1664	853
Sahyadri (C)	9315	1586	855
Mean	9065	1582	820
S. Em. ±	802	128.58	75
C.D. at 5%	NS	NS	NS
C.V. %	15	15	14

Table 2 VFSBRC 4: Diseases reaction in the station trial entries (2021-22)

Genotype	Black shank (%)	Frog eye leaf spot (%)	Root knot (%)
ST-1 (Bhavya × Tobios-6-S1)	4.0(MR)	34.0	2.0(MR)
ST-2 (Bhavya × Tobios-5)	5.0(MR)	35.0	2.0(MR)
ST-3 (CY 139 × Sahyadri)	5.0(MR)	35.0	2.0(MR)
ST-4 (V-4267 × Bhavya)	6.0(MR)	37.0	2.0(MR)
ST-5 (Bhavya × Tobios-6-S-2)	4.0(MR)	34.0	2.0(MR)
Thrupthi (C)	24.0(MS)	44.0	3.0(MS)
Kanchan (C)	28.0(MS)	47.0	3.0(MS)
Sahyadri (C)	29.0(MS)	48.0	3.0(MS)

MR: Moderately Resistant *MS: Moderately Susceptible*

VFSBR 5: EVALUATION, CHARACTERIZATION, MAINTENANCE AND UTILIZATION OF FCV TOBACCO GERMPLASM

Objective: Collection, evaluation, maintenance and utilization of tobacco germplasm

Design : RCBD Replications : Two
Plot size : 6.0 × 3.6 m Date of sowing : 26-04-2021
Date of planting : 12-07-2021 Fertilizer dose : 40:30:80 N:P:K (kg/ha)

Results

There were 113 entries and 3 checks evaluated for green leaf yield, cured leaf yield and TGE. Among 113 entries evaluated, VA-119 (2560.65 kg/ha), NC-2326 (2301.16 kg/ha), SPEIGHT NF-3(2270.83 kg/ha), YELLOW GOLD (2185.42 kg/ha), and A-23 (2113.19 kg/ha) recorded higher GLY (kg/ha) than the other entries. NC-2326 (322.16 kg/ha), VA 119 (358.49 kg/ha), SPEIGHT NF -3 (317.92kg/ha), YELLOW GOLD (305.96 kg/ha), A-23 (295.85 kg/ha) recorded higher CLY and the same entries recorded higher TGE.

Table 1 VFSBR 5: Leaf yield characterization in FCV genotypes during 2021-22

S. No.	Genotypes	GLY	CLY	TGE
		(kg/ ha)		
1	T-1-163	1235.42	172.96	121.07
2	T-165	846.76	118.55	82.98
3	TANTA-1	396.99	55.58	38.91
4	TB-22	581.71	81.44	57.01
5	TRC-1-96	714.58	100.04	70.03
6	VA-21	570.60	79.88	55.92
7	VA-45	800.46	112.07	78.45
8	VA-259	1046.99	146.58	102.61
9	VA-309	1136.57	159.12	111.38
10	VA-310	671.76	94.05	65.83

S. No.	Genotypes	GLY	CLY	TGE
		(kg/ha)		
11	VA-405	1078.94	151.051	105.74
12	VA-509	1681.71	235.44	164.81
13	VA-770	1399.54	195.94	137.15
14	AUREA	1088.89	152.444	106.71
15	V-373(SER)	1768.98	247.66	173.36
16	WHITE MAMMOTH	822.22	115.11	80.58
17	NC-11271	1189.12	166.48	116.53
18	**NC-2326**	**2301.16**	**322.16**	**225.51**
19	NC-3150	1323.15	185.24	129.67
20	NIS NICTINOVY-1122	1025.93	143.63	100.54
21	NC-401	908.33	127.17	89.02
22	NLS-1	1301.85	182.26	127.58
23	NLS-2	1147.69	160.68	112.47
24	NLS-5	1242.82	173.99	121.80
25	NOO-90	833.80	116.73	81.71
26	OXFORD-1	600.23	84.032	58.82
27	PULAWASAKA-13	701.85	98.26	68.78
28	PYKY-171	1311.81	183.65	128.56
29	Q-46	1498.61	209.81	146.86
30	REAM -51-NO-1	1321.99	185.08	129.56
31	RHOMAS-7	1624.31	227.41	159.18
32	RIWAKA-3	1360.42	190.46	133.32
33	RK-70	756.02	105.84	74.09
34	SALTE IMPROVED GOLDEN LEAF	658.10	92.13	64.49
35	SILVER DONAR	1385.88	194.02	135.82
36	SILK LEAF	1010.88	141.52	99.07
37	SUPER GOLD	1097.45	153.64	107.55
38	SPEIGHT G -23	1237.27	173.22	121.25
39	SPEIGHT G -28	1354.63	189.65	132.75
40	SPEIGHT G -36	1269.91	177.79	124.45
41	SPEIGHT G -41	908.33	127.17	89.02
42	SPEIGHT G -58	1056.02	147.84	103.49
43	SPEIGHT G -103	1526.85	213.76	149.63
44	SPEIGHT G -168	967.82	135.49	94.85
45	T-117	1236.57	173.12	121.18
46	NC-810	758.10	106.13	74.29
47	NC-940	1490.74	208.70	146.09
48	OXOFORD 414 NA	773.15	108.24	75.77
49	REAMS -126	1152.78	161.39	112.97
50	REAMS-134	1228.24	171.95	120.37
51	REAMS-744	1443.98	202.16	141.51
52	RG-13	1297.22	181.61	127.13
53	RG-17	1438.66	201.41	140.99
54	SPEIGHT G -80	893.75	125.13	87.59

S. No.	Genotypes	GLY	CLY	TGE
		(kg/ ha)		
55	SPEIGHT G -102	660.19	92.43	64.70
56	SPEIGHT G -108	1932.18	270.51	189.35
57	SPEIGHT G -120	1213.89	169.94	118.96
58	SPEIGHT G -152	1571.53	220.01	154.01
59	SPEIGHT G -172	1531.94	214.47	150.13
60	SPEIGHT G -178	1932.64	270.57	189.40
61	**SPEIGHT NF -3**	**2270.83**	**317.92**	**222.54**
62	**VA 119**	**2560.65**	**358.49**	**250.94**
63	VA -76	1152.55	161.36	112.95
64	YELLOW SPECIAL	1119.68	156.75	109.73
65	YELLOW SPECIAL A	2077.78	290.88	203.62
66	**YELLOW GOLD**	**2185.42**	**305.96**	**214.17**
67	T 1 -832	1109.03	155.26	108.68
68	EC-554926	1488.43	208.38	145.87
69	EC-55429	1017.36	142.43	99.70
70	EC-554930	1434.95	200.89	140.63
71	COKER-176	1615.74	226.20	158.34
72	CU-387	745.83	104.41	73.09
73	GL-939	866.90	121.36	84.96
74	GK-149	1306.94	182.97	128.08
75	K-317	931.94	130.47	91.33
76	NC-207	1115.97	156.23	109.37
77	NC-567	1356.44	189.90	132.93
78	NC-606	909.95	127.39	89.18
79	NC-729	1547.69	216.67	151.67
80	(NC-13)	1207.18	169.00	118.30
81	Vamorr-50	1187.96	166.31	116.42
82	PCT-8	1473.84	206.33	144.44
83	Vinca-5	1296.99	181.57	127.11
84	Samsar-940	1101.16	154.16	107.91
85	Bright capsule#2	1375.23	192.53	134.77
86	Adcock	2081.71	291.44	204.01
87	A-23	2113.19	295.85	207.09
88	3127 (Albacueulatcy)	1049.31	146.90	102.83
89	MC-1	1413.43	197.88	138.52
90	Dixic Bright-101	1066.20	149.26	104.49
91	Coller -547	913.19	127.84	89.49
92	Coller -3719	1299.54	181.93	127.35
93	Nambiar	1225.93	171.63	120.14
94	Hicks	924.07	129.37	90.56
95	HE-2	762.27	106.71	74.70
96	Golden wilt	1213.43	169.88	118.92
97	Golden cure	894.91	125.28	87.70
98	GSH-2	1142.59	159.96	111.97

S. No.	Genotypes	GLY	CLY	TGE
		(kg/ha)		
99	F-220	1055.79	147.81	103.47
100	Maryland	1348.84	188.83	132.19
101	TI-1112	692.13	96.89	67.83
102	TANTA-2	499.54	69.93	48.95
103	TI-836	916.90	128.36	89.86
104	VA-116	583.33	81.67	57.17
105	Y-156	890.74	124.70	87.29
106	VESTA-5	1335.65	186.99	130.89
107	6-6 RMS	1123.15	157.24	110.07
108	V-4848	1166.20	163.26	114.29
109	V-4955	733.10	102.63	71.84
110	L1136	1234.26	172.79	120.96
111	L621	1294.91	181.28	126.90
112	JS117	742.82	103.99	72.80
113	IS129	615.28	86.13	60.30
114	Sahyadri (C)	9810.52	131.67	923.67
115	Kanchan (C)	10873.22	1460.32	1024.22
116	Thrupthi (C)	10611.13	1447.41	1018.24
117	S. Em. ±	89.76	12.566	8.80
118	C.D. at 5%	251.51 (NS)	35.21 (NS)	24.65 (NS)
119	C.V. %	10.70	10.69	10.70

VFSBR 6: BACK CROSS BREEDING PROGRAMME: CONVERSION OF THRUPTHI, SAHYADRI, TOBIOS-6, BHAVYA & FCH-222 INTO MALE STERILE LINES (BC_7)

Objective

- Conversion of Thrupthi, Sahyadri, Bhavya, Tobios-6& FCH-222 into male sterile lines
- These transformed male sterile varieties will be utilized for development of hybrids.

DOS: 01.05.2021 DOP: 19.07.2021

Results

Conversion of Thrupthi, Sahyadri, FCH-222, Tobios-6 and Bhavya in to male sterile lines is in BC_7 generation. These confirmed male sterile lines will be evaluated for combining ability.

Table 1 VFSBR 6: Backcross Generation (BC_7) with male sterile lines

BACKCROSS GENERATION WITH MALE STERILE LINES(BC_6 GENERATION)	
1.	MSVT × TOBIOS -6
2.	C1 MS KANCHAN× FCH-222
3.	C1 MS KANCHAN× BHAVYA
4.	C1 MS KANCHAN× SAHYADRI
5.	C1 MS KANCHAN× TOBIOS -6
6.	C4 MS KANCHAN× FCH-222
7.	C4 MS KANCHAN× BHAVYA
8.	C4 MS KANCHAN× SAHYADRI
9.	C4 MS KANCHAN× TOBIOS -6
10.	C4 MS KANCHAN× THRUPTHI

VFSBR 7: NEW CROSSES AND EARLY GENERATION STUDIES

Objectives: To develop high yielding good quality FCV tobacco varieties for Karnataka light soils.
To develop/ identify FCV tobacco varieties for moisture stress.

Date of sowing : 26-04-2021 **Date of planting** : 22-07-2021

Results

Phenotypically superior genotypes are selected from early generations and carried forward to next generation. Five F_5 (Tobios-6 x Thrupthi, Tobios-6 x Sahyadri, Tobios-6 x Kanchan, Tobios-5 x Thrupthi and Tobios-5 x Kanchan) and F_6 (TB-70 x TB-102, TB-100 x TB-102, Tobios-6 x Sahyadri, Tobios-5 x Kanchan and NLST-2 x FCH-221) populations were raised and selections were made based on the phenotypic characters.

F_5 – Generation	F_6 – Generation
Tobios-6 X Thrupthi	TB-70 X TB-102
Tobios-6 X Sahyadri	TB-100 X TB-102
Tobios-6 X Kanchan	Tobios-6 X Sahyadri
Tobios-5 X Thrupthi	Tobios-5 X Kanchan
Tobios-5 X Kanchan	NLST-2 X FCH-221

VFSBR 8: DEVELOPMENT OF HIGH YIELDING AND QUALITY HYBRIDS IN FCV TOBACCO USING MALE STERILITY SYSTEM

Objectives: Converted CMS lines (Thrupthi, Sahyadri, Bhavya, Tobios-6 and FCH-222) will be evaluated for combing ability and

These transformed male sterile varieties will be utilized for development of hybrids.

Results

In this experiment, the following crosses were affected. FCH- 222 (C4 MS KANCHAN) X FCS-4, TOBIOS -6 (C4 MS KANCHAN) X FCS-4, SAHYADRI (C1 MS KANCHAN) X FCS-4, SAHYADRI (C4 MS KANCHAN) X FCS-4. However it was suggested to study the combining ability of the CMS lines using FCS4, FCJ-38, FCJ- 11 and NLCR-7 due to the late receipt of the seeds of FCJ-38, FCJ-11and NLCR-7 were not affected.

Crosses effected

1. FCH 222 (C4 MS KANCHAN) X FCS-4
2. TOBIOS-6 (C4 MS KANCHAN) X FCS-4
3. SAHYADRI (C1 MS KANCHAN) X FCS-4
4. SAHYADRI (C4 MS KANCHAN) X FCS-4

VFSBR 9: HYBRIDIZATION AND DOUBLE HAPLOID (DH) PRODUCTION TO IDENTIFY RESISTANT LINES FOR BLACK SHANK AND TMV AND FOR OTHER AGRONOMIC TRAITS

Objectives: Standardization of protocol for DH production and hybridization in FCV tobacco

To develop high yielding good quality and resistant FCV tobacco hybrids for zone 7(KLS region)

Results

The crosses attempted under this experiment were SAHYADRI X FCR-68, SAHYADRI X CTRI Sulakshana, SAHYADRI X VT-1158, TRUPTHI X FCR-68, TRUPTHI X CTRI Sulakshana, TRUPTHI X VT-1158, KANCHAN X FCR-68, KANCHAN X CTRI Sulakshana, KANCHAN X VT-1158. In the work shop held on 02-12-2021 the external expert opined that establishment of laboratory requires huge investments and skilled assistance when the facilities are created then only one can take up such (double haploid production) research work. Hence this objective was dropped.

The crosses attempted

1. SAHYADRI X FCR-68
2. SAHYADRI X CTRI Sulakshana
3. SAHYADRI X VT-1158
4. TRUPTHI X FCR-68
5. TRUPTHI X CTRI Sulakshana
6. TRUPTHI X VT-1158
7. KANCHAN X FCR-68
8. KANCHAN X CTRI Sulakshana
9. KANCHAN X VT-1158

VFSBR 10: 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).

Design	: RCBD
Replications	: Two
Plot size	: 6.0 × 3.6 m
Date of sowing	: 26-04-2021
Date of planting	: 12-07-2021
Fertilizer dose	: 40:30:80 N:P:K (kg/ha)

Results

Among 113 germplasm evaluated, PULAWASAKA-13 (244.17), NC-13 (222.50), NC-3150 (216.67), RIWAKA-3 (215.83), SILVER DONAR (214.17) and F-220 (210.67) recorded higher number of capsules per plant. The lines VA-45 (0.296 g), Coller-3719 (0.249 g), L-1136(0.225g), VA-309(0.219 g), NC-11271 (0.219g), 3127-Albacueulatcy (0.219 g) and VA-259 (0.215g) recorded higher capsule weight, Capsule length was higher in TRC-1-96 (18.38mm), VA-259 (17.73 mm), Dixic Bright-101(17.34 mm),VA-45 (17.28 mm) and 3127-Albacueulatcy (17.00 mm), capsule width was higher in VA-45(11.45 mm), 3127 - Albacueulatcy (11.28 mm), RG-13 (11.26 mm), SPEIGHT NF-3(11.22mm) and VA-76 (11.17mm). Lines NC-11271 (18.67g), VA-309 (18.50 g), NC-567 (18.33 g), VA-76 (18.00 g), TANTA -1 (17.67 g) and VA-770 (17.67 g) recorded higher seed yield per plant (g) with respect to total capsule weight lines VA-76 (37.00 g), VA-309 (36.00 g), NC-567(35.83 g), TANTA-1 (35.50g), YELLOW SPECIAL A (35.50 g) and SPEIGHT G-58(34.83 g) recorded higher weight.

Table 1 VFSBR 10: Evaluation of different FCV Tobacco germplasm for high seed yield and oil yield

S. No.	Genotypes	No. of capsules per plant	Individual Capsule weight (g)	Capsule length (mm)	Capsule width (mm)	Seed yield /plant (g)	Total Capsule weight (g)
1	T-1-163	131.67	0.191	14.81	10.76	13.83	20.00
2	T-165	125.00	0.197	15.21	10.17	13.83	28.50
3	TANTA-1	176.67	0.179	16.04	10.34	**17.67**	**35.50**
4	TB-22	113.00	0.204	15.24	10.17	10.17	21.83
5	TRC-1-96	173.33	0.170	**18.38**	10.36	12.50	25.00
6	VA-21	150.00	0.193	15.35	9.54	11.33	24.00
7	VA-45	151.67	**0.296**	**17.28**	**11.45**	14.50	31.00
8	VA-259	146.67	**0.215**	**17.73**	10.62	12.83	26.00
9	VA-309	200.00	**0.219**	16.01	10.86	**18.50**	**36.00**
10	VA-310	207.67	0.201	15.22	10.78	15.67	31.17
11	VA-405	162.00	0.160	14.43	9.23	11.83	27.83
12	VA-509	158.33	0.147	14.63	9.45	12.00	24.33
13	VA-770	185.00	0.146	15.48	10.20	**17.67**	28.83
14	AUREA	153.33	0.171	14.78	10.21	13.00	26.83
15	V-373(SER)	174.17	0.162	14.62	9.52	14.33	24.83
16	WHITE MAMMOTH	141.00	0.139	15.60	10.60	15.00	26.83
17	NC-11271	189.17	0.209	15.16	10.17	**18.67**	30.00
18	NC-2326	201.33	0.156	15.77	10.99	16.50	30.50
19	NC-3150	**216.67**	0.165	15.67	10.67	16.67	29.33
20	NIS NICTINOVY-1122	130.00	0.168	15.26	10.39	11.33	23.67
21	NC-401	156.67	0.185	15.61	10.27	13.83	27.50
22	NLS-1	160.00	0.151	15.25	10.14	12.67	26.00
23	NLS-2	168.17	0.155	15.20	9.78	12.00	21.67
24	NLS-5	159.17	0.165	14.81	10.37	10.67	23.17
25	NOO-90	141.67	0.172	16.95	11.08	10.83	23.17
26	OXFORD-1	164.17	0.129	15.49	9.95	11.33	23.67
27	PULAWASAKA-13	**244.17**	0.163	14.97	10.61	17.17	33.33
28	PYKY-171	162.50	0.195	15.77	11.10	13.67	28.83
29	Q-46	165.00	0.207	15.44	10.52	15.17	28.33
30	REAM -51-NO-1	181.67	0.180	15.51	10.22	11.33	24.17
31	RHOMAS-7	164.17	0.156	15.71	10.20	12.17	25.83
32	RIWAKA-3	**215.83**	0.153	13.90	10.05	17.17	30.00
33	RK-70	138.33	0.109	15.26	10.68	10.83	22.33
34	SALTE IMPROVED GOLDEN LEAF	171.50	0.158	15.64	10.43	14.50	27.50
35	SILVER DONAR	**214.17**	0.143	15.12	9.67	15.50	29.83
36	SILK LEAF	198.33	0.152	14.56	9.33	15.67	32.50
37	SUPER GOLD	207.50	0.167	15.32	10.92	13.17	26.33
38	SPEIGHT G -23	188.67	0.162	15.09	10.37	15.00	30.83
39	SPEIGHT G -28	157.50	0.162	15.66	10.54	10.67	23.00
40	SPEIGHT G -36	135.00	0.147	14.22	9.06	13.50	26.33
41	SPEIGHT G -41	145.00	0.167	14.56	9.86	14.33	29.17

S. No.	Genotypes	No. of capsules per plant	Individual Capsule weight (g)	Capsule length (mm)	Capsule width (mm)	Seed yield /plant (g)	Total Capsule weight (g)
42	SPEIGHT G -58	160.83	0.166	14.93	9.71	16.50	**34.83**
43	SPEIGHT G -103	149.83	0.140	15.40	10.03	12.50	25.33
44	SPEIGHT G -168	133.50	0.181	15.33	10.46	10.83	23.17
45	T-117	141.17	0.172	16.01	10.18	11.17	23.67
46	NC-810	142.50	0.153	15.57	11.12	13.17	26.83
47	NC-940	116.00	0.161	14.64	11.03	11.83	23.67
48	OXOFORD 414 NA	108.67	0.177	14.70	10.16	13.00	26.33
49	REAMS -126	121.67	0.157	15.31	9.93	10.67	21.83
50	REAMS-134	175.83	0.200	15.16	9.58	14.00	24.50
51	REAMS-744	130.50	0.189	14.41	10.64	10.83	22.17
52	RG-13	126.67	0.205	15.29	**11.26**	13.83	28.17
53	RG-17	136.67	0.136	14.18	9.92	9.50	19.83
54	SPEIGHT G -80	142.33	0.186	15.90	10.50	13.00	26.50
55	SPEIGHT G -102	156.67	0.180	15.45	11.92	9.33	19.33
56	SPEIGHT G -108	168.00	0.166	15.57	10.50	11.17	23.00
57	SPEIGHT G -120	136.33	0.155	14.46	10.24	11.83	24.33
58	SPEIGHT G -152	155.83	0.152	15.68	11.03	14.17	27.50
59	SPEIGHT G -172	156.33	0.138	15.88	11.08	9.83	20.83
60	SPEIGHT G -178	102.17	0.173	14.68	10.09	11.17	23.33
61	SPEIGHT NF -3	150.00	0.160	15.85	**11.22**	10.33	23.83
62	VA- 119	164.17	0.168	15.45	10.56	14.83	30.33
63	VA -76	154.17	0.188	16.83	**11.17**	**18.00**	**37.00**
64	YELLOW SPECIAL	138.33	0.183	15.27	10.00	11.33	24.33
65	YELLOW SPECIAL A	165.83	0.190	15.36	10.69	17.67	**35.50**
66	YELLOW GOLD	170.83	0.139	15.42	10.58	15.17	31.50
67	T 1 -832	125.83	0.201	15.46	10.60	12.83	26.33
68	EC-554926	177.33	0.145	15.67	10.28	15.00	26.50
69	EC-55429	152.50	0.171	16.15	10.89	15.33	30.83
70	EC-554930	176.67	0.137	14.32	10.24	13.83	27.00
71	COKER-176	161.67	0.184	16.09	10.08	13.83	27.33
72	CU-387	162.50	0.200	16.64	9.72	13.00	26.17
73	GL-939	154.17	0.150	14.84	10.26	13.17	26.83
74	GK-149	155.83	0.186	16.40	9.23	13.33	27.33
75	K-317	160.83	0.156	15.00	9.31	12.67	27.50
76	NC-207	114.17	0.150	15.46	9.83	10.83	22.17
77	NC-567	190.83	0.201	14.95	9.12	**18.33**	**35.83**
78	NC-606	127.17	0.200	15.03	10.10	13.83	28.17
79	NC-729	133.00	0.165	14.80	10.37	11.83	24.17
80	NC-13	**222.50**	0.203	13.99	9.58	13.50	27.00
81	Vamorr-50	146.67	0.183	15.48	10.95	12.67	24.33
82	PCT-8	143.83	**0.215**	14.56	10.16	13.50	27.50
83	Vinca-5	139.17	0.183	14.66	10.42	11.50	24.33
84	Samsar-940	147.83	0.164	15.34	10.60	15.50	32.33
85	Bright capsule#2	147.50	0.168	13.57	9.62	13.33	27.17
86	Adcock	146.00	0.175	15.38	10.61	13.50	28.17
87	A-23	113.00	0.156	15.27	9.97	11.50	25.33
88	3127 (Albacueulatcy)	106.33	**0.219**	**17.00**	**11.28**	13.17	27.17

S. No.	Genotypes	No. of capsules per plant	Individual Capsule weight (g)	Capsule length (mm)	Capsule width (mm)	Seed yield /plant (g)	Total Capsule weight (g)
89	MC-1	119.67	0.173	15.74	10.87	13.00	26.00
90	Dixic Bright-101	138.50	0.151	**17.34**	10.41	12.17	25.17
91	Coller -547	139.17	0.190	15.47	10.42	11.50	23.67
92	Coller -3719	141.67	**0.249**	16.16	10.42	14.83	29.83
93	Nambiar	136.83	0.126	16.91	9.37	13.50	27.33
94	Hicks	126.17	0.126	16.00	10.30	10.83	22.50
95	HE-2	164.17	0.206	14.83	10.64	16.00	**33.17**
96	Golden wilt	130.00	0.204	15.29	10.70	12.00	24.50
97	Golden cure	159.17	0.185	14.66	10.59	12.00	25.17
98	GSH-2	165.83	0.183	14.63	10.67	14.67	30.50
99	F-220	**210.67**	0.193	14.82	10.14	15.17	31.33
100	Maryland	175.00	0.183	15.37	10.63	12.67	25.67
101	TI-1112	145.00	0.174	16.03	10.75	12.00	25.50
102	TANTA-2	122.83	0.160	15.98	9.91	10.83	21.67
103	TI-836	139.67	0.181	15.66	10.03	13.33	24.33
104	VA-116	157.50	0.161	14.18	8.85	10.83	23.00
105	Y-156	173.83	0.204	16.56	10.32	15.50	29.83
106	VESTA-5	198.33	0.166	14.51	9.60	12.00	25.00
107	6-6 RMS	142.17	0.201	15.29	9.74	13.33	27.33
108	V-4848	130.00	0.171	15.96	11.05	10.33	21.50
109	V-4955	164.17	0.165	13.89	10.06	12.83	26.67
110	L-1136	115.67	**0.225**	16.01	11.14	13.67	26.50
111	L-621	105.83	0.192	14.60	10.06	11.83	24.50
112	JS-117	151.33	0.178	15.68	10.66	10.17	20.83
113	IS-129	149.17	0.200	15.30	10.92	13.00	26.67
117	S. Em. ±	21.48	0.019	0.63	0.47	1.59	2.91
118	C.D. at 5%	60.20	0.053	1.76	1.33	4.45	8.15
119	C.V. %	19.58	15.33	5.77	6.49	16.94	15.45

B. *BIDI* TOBACCO

COORDINATED EVALUATION OF *BIDI* TOBACCO GENOTYPES

IVT ON *BIDI* TOBACCO

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

Year of start: 2021-22

Initial Varietal Trial on *bidi* tobacco was conducted with five entries and recommended checks at three centres *viz.*, Anand, Nandyal and Nipani.

Entries: 05 (Five)

1. ABD 226
2. ABD 228
3. ABD 229
4. NyBD 68
5. NyBD 69

Design : RBD
Replications : Three

Checks at different centres

Anand	:	1. ABT 10	2. MRGTH 1	3. GT 7	4. GABT 11
Nipani	:	1. Vedaganga-1	2. A 119	3. Bhavyashree	4. NBD-209
Nandyal	:	1. A 119	2. Nandyala Pogaku-1		

The trials were laid out as per plot size and spacing given below by the respective centres.

Centre	Plot size	Spacing
Anand	1.8 × 7.5 m	90 × 75cm
Nipani	4.0× 7.5 m	100 × 75 cm
Nandyal	6.75 × 2.25 m	75 ×75 cm

Results

Yield data and morphological characters at different centres are presented in Table 1 to 6 IVT *Bidi* Tobacco. The results are presented centre-wise.

ANAND

The results revealed significant yield differences among the entries tested. ABD- 228 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. These entries are (ABD-226, ABD-228, ABD-229 and NyBD-69) forwarded to AVT-I.

NIPANI

The Initial Varietal Trial (IVT) trial consists of five test entries (ABD-226, ABD-228, ABD-229, NyBD-68 and NyBD-69) and four checks (Vedaganga, Bhavyashree, A-119 and NBD-209). None of the test entries registered superior leaf yield (kg/ha) over the best checks NBD-209 (1680.00 kg/ha) and A-119 (1422.22 kg/ha). Five test entries and four checks were screened against major diseases and pests under natural conditions. Two checks and two test entries (ABD-226 and NyBD-68) recorded the incidence of Frog eye spot with score of one. Brown leaf spot was noticed in all the entries except check Vedaganga-1. However, there was no incidence of leaf spot, black shank and TMV in the entries evaluated. With respect to Aphids all the entries recorded 5 score.

NANDYAL

In IVT trial, five entries are tested against two checks. ABD-229, ABD-226 and ABD-228 are having on par cured leaf yield when compared to best check NandyalPogaku-1 (2108 kg/ha).

Table 1 IVT *Bidi* Tobacco: Cured leaf yield and morphological characters in IVT entries at different centres (2021-22)

Entry	Yield (kg/ha)			No. of leaves/ plant	
	Anand	Nipani	Nandyal	Anand	Nipani
ABD- 226	2407	864	2142	19	14.87
ABD -228	3385*	1322	2131	25	15.27
ABD- 229	2105	1107	2152	22	12.93
NyBD- 68	1465	844	2014	22	13.53
NyBD- 69	1605	922	1990	24	13.27
Vedaganga-1 (C)		1294			13.20
Bhavyashree (C)		1400			10.33
NBD- 209 (C)		1680			13.37
GT -7 (C)	2607			20	
MRGTH- 1(C)	3042			17	
GABT- 11 (C)	2828			22	
A -119 (C)	2292	1422	1522	17	9.73
Nandyal Pogaku-1 (C)			2108		
Grand Mean		1206	2008		12.93
S.Em. ±	103.5	13.78	68.63	1.30	12.77
C.D. at 5%	310.3	287.81	279.38	3.90	2.86
C.V. %	7.42	96	6.83	10.66	0.95

Table 2 IVT *Bidi* Tobacco: Morphological characters of IVT entries at different centres (2021-22)

Entries	Plant height (cm)			Leaf length (cm)			Leaf width (cm)		
	A	N	Ny	A	N	Ny	A	N	Ny
ABD- 226	79.8	83.80	90.3	52.3	47.76	48.7	21.4	17.99	19.8
ABD -228	80.7	49.53	77.8	54.7	46.89	45.4	22.1	17.31	18.8
ABD -229	75.9	99.40	106.8	51.4	44.69	48.9	22.5	17.89	21.3
NyBD -68	105.7	98.20	100.6	53.1	50.60	42.6	21.7	20.88	16.5
NyBD- 69	102.5	107.20	94.9	58.6	50.03	43.0	26.8	19.24	16.2
A- 119 (C)	77.7	103.40	76.3	53.1	49.61	41.5	22.3	18.89	14.8
Nandyal Pogaku-1(C)			95.9			47.9			19.3
Vedaganga-1 (C)		123.60			53.97			19.43	
Bhavyashree (C)		121.80			49.03			18.20	
NBD- 209 (C)		118.67			53.72			20.29	
GT -7 (C)	87.2			52.5			20.5		
MRGTH- 1(C)	80.1			55.7			22.9		
GABT- 11 (C)	81.7			56.3			24.5		
Grand Mean		100.62	91.8		49.59	45.4		18.9	18.1
S.Em. ±	1.73	10.17	3.14	2.37	7.21	1.63	1.30	8.86	1.06
C.D. at 5%	5.18	17.71	9.33	NS	6.18	4.85	NS	2.9	3.16
C.V. %	3.49	5.91	6.85	7.56	2.06	7.18	9.93	0.97	11.77

A: Anand; N: Nipani; Ny: Nandyal

Table 3 IVT *Bidi* Tobacco: Some morphological data of IVT entries at Anand, Nipani & Nandyal centres (2021-22)

Entry	Anand			Nipani	Nandyal		
	Days to flower	Leaf thickness (mm)	Days to maturity	Internodal length (cm)	Days to 50% flowering	Leaf thickness (mm)	Spangle score
ABD- 226	72	10.96	171	4.03	146	10.03	6.0
ABD -228	108	9.83	182	1.91	146	9.55	6.0
ABD -229	89	10.16	177	5.09	132	11.40	6.3
NyBD -68	93	8.14	179	5.16	125	10.23	6.0
NyBD -69	108	11.89	180	5.17	124	9.55	7.5
A- 119 (C)	66	11.89	173	6.44	125	8.78	7.5
Nandyala Pogaku-1 (C)					126	10.33	8.8
Vedaganga-1 (C)				6.13			
Bhavyashree(C)				6.48			
NBD- 209 (C)				5.80			
GT -7 (C)	60	11.06	171				
MRGTH- 1(C)	65	12.20	168				
GABT -11 (C)	93	10.11	182				
Grand Mean				5.13	132	9.98	6.9
S.Em. ±	5.30		2.47	17.89	0.75	0.66	0.44
C.D. at 5%	15.88		7.41	1.59	2.22	NS	1.31
C.V. %	10.94		2.44	0.53	1.13	13.20	12.89

Table 4 IVT *Bidi* Tobacco: Pest & Disease incidence among IVT entries at Anand centre (2021-22)

ENTRIES	TMV (%)	Aphid	Caterpillar	CMV	LEAF CURL (%)				
					LCA	LCB	LCC	LCD	LCX
ABD- 226	90.00	-	-	-	-	-	-	-	Yes
ABD- 228	93.33	-	-	-	-	-	-	-	Yes
ABD- 229	78.33	-	-	-	-	-	-	-	Yes
NYBD- 68	66.67		-	-	-	-	-	-	Yes
NYBD- 69	68.33		-	-	-	-	-	-	Yes
A -119 (C)	68.33		-	-	-	-	-	-	Yes
GT -7 (C)	76.67	-	-	-	-	-	-	-	Yes
MRGTH- 1(C)	68.33	-	-	-	-	-	-	-	Yes
GABT- 11 (C)	80.00	-	-	-	-	-	-	-	Yes

Where, LCA = Low, LCB = 10%, LCC = 10-20%, LCD = 20-30%, LCX = highly affected/Severe

Table 5 IVT *Bidi* Tobacco: Chemical quality parameters in IVT at Anand (2021-22)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
ABD -226	5.85	4.86	0.674
ABD- 228	5.10	4.15	0.461
ABD- 229	4.90	4.35	0.639
NYBD- 68	4.51	4.45	0.532
NYBD- 69	6.57	6.13	0.781
A- 119 (C)	6.08	5.20	0.461
GT- 7 (C)	7.50	6.10	0.604
MRGTH- 1(C)	5.75	4.97	0.639
GABT- 11 (C)	5.12	4.18	0.710

Table 6 IVT *Bidi* Tobacco: Pests & Diseases incidence among IVT entries at Nipani centre (2021-22)

Entries	Pests	Diseases				
	Aphids (0-5)	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)
ABD -226	5	1	2	0	0	0
ABD- 228	5	0	2	0	0	0
ABD -229	5	0	1	0	0	0
NyBD- 68	5	1	1	0	0	0
NyBD- 69	5	0	1	0	0	0
Vedaganga-1 (C)	5	0	0	0	0	0
A- 119 (C)	5	1	1	0	0	0
Bhavyashree (C)	5	1	1	0	0	0
NBD- 209 (C)	5	0	1	0	0	0

ANAND

BDABRC 1.1: ADVANCE VARIETAL TRIAL I ON *BIDI* TOBACCO

Year of start:2021-22

Design : RBD
Replications : Three
Plot size : 1.8 × 7.5 m
Spacing : 90 × 75 m
Treatments : 2 entries + 4 checks

Results

The results revealed significant yield differences among the entries tested. ABD-211 showed significant superior for cured leaf yield over better check (Table 1& 2 BDABRC 1.1). None of the lines under testing was free from leaf curl and tobacco mosaic virus diseases. The trial will be repeated as AVT-II.

BDABRC 1.2: ADVANCE VARIETAL TRIAL II ON *BIDI* TOBACCO

Year of start: 2020-21

Design : RBD
Replications : Three
Plot size : 1.8 × 7.5 m
Spacing : 90 × 75 m
Treatments : 4 entries + 3 checks

Results

The results revealed significant yield differences among the entries tested. ABD- 199 showed significant superior for cured leaf yield over better check. None of the lines under testing was free from leaf curl and tobacco mosaic virus (except MR GTH 1) diseases.

Results of Pooled Analysis

The pooled results revealed significant yield differences among the entries tested (Table 1, 2 & 3 BDABRC 1.2). None of the line showed significant superior for cured leaf yield over better check (GT 7). Interaction effect also found significant among the genotypes tested.

Table 1 BDABRC 1. 1: Yield, morphological characters and disease incidence (AVT-I)at Anand centre (2021-22)

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height	Leaf length	Leaf width	Leaf thick-ness (mg/ cm^2)	Days to flower	Days to maturity	TMV (%)	Leaf curl (%)				
			----- cm -----							LCA	LCB	LCC	LCD	LCX
ABD- 209	2588	22	91.2	57.3	25.8	12.04	85	182	68.33	-	-	-	-	Yes
ABD -211	3148*	21	90.7	56.9	24.6	8.13	90	184	56.67	-	-	-	Yes	
GT -7 (C)	2359	20	88.5	53.7	20.3	11.20	67	179	60.00	-	-	-	-	Yes
ABT- 10 (C)	1821	19	102.8	53.9	21.5	9.59	77	182	52.50	-	-	-	Yes	-
GABT- 11 (C)	2801	25	79.8	58.3	24.4	8.65	96	182	71.67	-	-	-	Yes	-
MRGTH- 1(C)	2613	18	88.8	52.9	23.2	11.39	66	177	0.0	-	-	-	Yes	-
S.Em ±	70.0	1.40	2.95	0.58	0.96	-	4.99	1.10						
C.D. at 5%	203.9	NS	8.59	1.69	2.80	-	14.55	3.20						
C.V. (%)	6.71	16.83	8.00	2.63	10.11	-	15.84	1.48						

Where, LCA = Low, **LCB** = 10%, **LCC** = 10-20%, **LCD** = 20-30%, **LCX**= highly affected/Severe

Table 2 BDABRC 1. 1: Chemical quality parameters (%) in AVT I at Anand centre (2021-22)

Entries	Nicotine	Reducing Sugars	Chlorides
ABD- 209	6.75	4.29	0.639
ABD -211	6.08	4.10	0.604
GT -7 (C)	5.35	4.97	0.715
ABT- 10 (C)	6.50	5.13	0.650
GABT- 11 (C)	7.25	4.33	0.816
MRGTH- 1(C)	6.07	4.97	0.745

Table 1 BDABRC 1. 2: Yield, morphological characters and disease incidence (AVT-II) at Anand centre (2021-22)

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height	Leaf length	Leaf width	Leaf thickness (mg/cm^2)	Days to flower	Days to maturity	TMV (%)	Leaf curl (%)				
			----- cm -----							LCA	LCB	LCC	LCD	LCX
ABD- 196	2385	20	82.5	50.2	20.8	12.37	68	175	50.00	-	-	-	Yes	-
ABD- 197	2766	19	85.1	54.3	25.1	9.01	68	181	55.00	-	-	-	Yes	-
ABD- 199	3191*	23	82.9	49.8	20.5	9.04	86	171	66.67	-	-	-	Yes	-
NyBD- 62	1364	18	90.9	46.5	19.5	13.53	54	176	50.00	-	-	Yes		-
NyBD -63	1208	19	92.7	52.2	19.7	11.47	58	177	45.00	-	-	-	Yes	-
A-119 (C)	1721	16	80.1	48.2	19.3	12.37	60	173	46.67	-	-	-	Yes	-
GT- 7 (C)	2885	19	99.1	52.7	22.2	12.93	58	173	35.00	-	-	-	-	Yes
ABT- 10 (C)	2040	19	102.4	55.3	22.1	11.07	74	169	71.67	-	-	Yes	-	
MRGTH- 1 (C)	2902	18	92.1	54.1	22.8	12.72	70	178	0.0	-	-		Yes	
S.Em ±	88.72	1.01	3.49	2.38	1.08	-	3.58	2.21						
C.D. at 5%	266.0	3.02	10.45	NS	3.24	-	10.72	6.62						
C.V. (%)	6.76	9.29	6.73	7.99	8.78	-	9.35	2.19						

Where, LCA = Low, **LCB** = 10%, **LCC** = 10-20%, **LCD** = 20-30%, **LCX**= highly affected/Severe

Table 2 BDABRC 1. 2: Chemical quality parameters (%) in AVT II at Anand centre (2021-22)

Entries	Nicotine	Reducing Sugars	Chlorides
ABD- 196	6.05	5.20	0.497
ABD -197	6.27	5.29	0.532
ABD- 199	7.50	4.98	0.426
NyBD- 62	6.08	5.25	0.461
NyBD- 63	6.20	5.10	0.532
A-119 (C)	4.55	4.97	0.461
GT- 7 (C)	6.07	5.36	0.604
ABT- 10 (C)	5.57	5.39	0.532
MRGTH- 1 (C)	6.13	5.30	0.604

Table 3 BDABRC 1. 2: Pooled analysis of AVT-I & II at Anand centre

Treatment/ Year	2020-21	2021-22	Pooled mean
	1st year	2nd year	
ABD- 196	3422	2385	2904
ABD-197	3511	2766	3139
ABD -199	2527	3191*	2859
NyBD -62	2230	1364	1797
NyBD- 63	2863	1208	2035
A-119 (C)	2122	1721	1922
GT- 7 (C)	3164	2885	3025
ABT- 10 (C)	2481	2040	2261
MRGTH- 1 (C)	3043	2902	2973
S.Em.±	207.85	88.72	323.3
C.D. at 5 %	623.19	266.1	**1054.2**
C.V. %	12.77	6.76	10.87
Years			
S.Em.±	-	-	152.39
C.D. at 5 %	-	-	496.97
Years ×Treatments			
S.Em.±	-	-	159.81
C.D. at 5 %	-	-	460.59

BDABR 22: SEARCH FOR MATERIALS RESISTANT TO ROOT-KNOT DISEASE (JOINT STUDY BY PLANT BREEDING AND PLANT PATHOLOGY SECTIONS)

Year of start: 1968-69

In light soils of Gujarat, tobacco crop is severely affected by two species of root-knot nematodes *viz., Meloidogyneincognita* and *M. javanica*, which sometimes results in complete failure of the crop. Hence, this experiment for isolation/breeding of resistant cultivars has been planned. Out of 57 genotypes along with segregation materials screened, 21genotypes / cultures were found free from root-knot index in root-knot sick field and selected for further screening in the next year. Whereas, in Natural field condition 40 genotypes of different experiments, 26 genotypes / cultures were found no infestation of root- knot index along with 4 checks.

BDABR 23: SCREENINGOF ADVANCED BREEDING MATERIALS/INTRODUCTIONS FOR LEAF CURL AND CERCOSPORA LEAF SPOT DISEASES UNDER FIELD CONDITIONS (JOINT STUDY BY PLANT PATHOLOGY AND PLANT BREEDING SECTIONS)

Year of start: 1970-71

During the year 2021-22, 63 entries of experiments and advanced breeding materials / segregation materials of *bidi* tobacco and 42 entries of *rustica* tobacco were examined for leaf curl and *Cercospora* leaf spot diseases. Observations revealed that out of them, 4 in *bidi* and 14 in *rustica* tobacco were found free from leaf curl infection during the year; leaf spot disease was not noticed.

BDABR 31: BREEDING FOR RESISTANCE TO TOBACCO MOSAIC IN *BIDI* TOBACCO (JOINT STUDY BY PLANT PATHOLOGY AND PLANT BREEDING SECTIONS)

Year of start: 1981-82

During the year under report, total 67 (including twenty five mosaic resistant cultures) entries grown in different generations were artificially inoculated with tobacco mosaic virus and evaluated for resistance to mosaic. Out of these, 65 entries including segregation materials showed resistance to the disease and these materials are maintained by plant breeding section for further breeding work.

NIPANI

BDNBRC 1.1: ADVANCED VARIETAL TRIAL I

Year of start : 2021-22

Design : RBD
Plot Size : 4 × 7.5 m

Replications : Three
Entries : 2 + 4 (C)

Results: The Advanced Varietal Trial-I (AVT-I) trial consists of six entries including four checks. None of the test entries registered superior leaf yield (kg/ha) over the best checks NBD-209 (1638 kg/ha) and A-119 (1653 kg/ha) (Table 1 BDNBR 1.1).Six entries including four checks were evaluated under natural conditions against insect pests and diseases. Frog eye leaf spot (1-2 score) and Brown Leaf Spot (1-3 score) diseases were noticed in all the entries. There was no incidence of leaf curl and TMV. With respect to Black shank, none of entries showed incidence except ABD-209. With respect to Aphids all the entries recorded 5 score. None of the test entries registered superior leaf yield (kg/ha) over the best checks NBD-209 (1638 kg/ha) and A-119 (1653 kg/ha) in AVT-I.

Table 1 BDNBRC 1.1: Yield data and morphological characters AVT-I (2020 *Kharif*)

Entries	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
ABD- 209	1200	72.30	17.00	2.60	54	22.20
ABD- 190	1242	65.75	14.06	3.22	46	18.65
Vedaganga-1 (C)	933	106.10	15.77	3.85	51	19.34
A-119 (C)	1653	87.80	14.03	3.51	51	20.55
Bhavyashree (C)	1031	100.20	15.7	4.01	52	20.96
NBD-209 (C)	1638	115.40	17.17	4.04	55	22.11
Mean	1323	91.26	15.49	3.54	51.49	20.64
S.Em ±	95.35	7.86	0.80	0.44	1.03	0.71
C.D. at 5%	277.72	22.89	2.32	1.28	3	2.08
C.V. (%)	17.65	21.10	12.61	30.37	4.49	8.48

Table 2 BDNBRC 1.1: Incidence of diseases and pest under Natural conditions

Entries	Diseases					Pests
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5))	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
ABD- 209	1	2	0	1	0	5
ABD- 190	1	3	0	0	0	5
Vedaganga-1 (C)	1	1	0	0	0	5
A-119 (C)	2	1	0	0	0	5
Bhavyashree (C)	1	1	0	0	0	5
NBD-209 (C)	1	2	0	0	0	5

BDNBRC 1.2: ADVANCED VARIETAL TRIAL II

Year of start : 2020-21
Design : RBD Replications : 3
Plot Size : 4 × 7.5 m Entries : 4 + 4 (C)

Results

A total of nine entries including four checks (Vedaganga-1, Bhavyashree, A-119 and NBD-209) were evaluated in Advanced Varietal Trial-II (AVT-II). None of the test entries were superior to the checks in terms of leaf yield (kg/ha). In pooled analysis over two years also none of the test entries were superior to the checks (Table 1 BDNBRC 1.2).

The nicotine content ranged from 0.7 % to 1.42 % among the test entries compared to the checks (0.66 to 0.88%). Highest nicotine content of 1.42 % was recorded by two test entries namely, ABD-197 and NyBD-62. The test entry NyBD-63 (6.87 %) recorded highest reducing Sugars among the entries tested. With respect to chlorides, test entries NyBD-63 (1.62 %) and NyBD-62 (1.60 %) recorded higher amounts compared to the checks.

Nine entries were evaluated under natural condition for scoring against major diseases and insect pests. Frog eye leaf spot and Brown Leaf Spot diseases have observed majorly in the entries.Leaf Curl, Blank Shank and TMV were not noticed in this trial. The Frog Eye Spot and Brown leaf spot disease score ranged from 0-2 and 0-3 score, respectively. With respect to Aphids all the entries recorded 5 score (Table 2 BDNBRC 1.2). None of the test entries were superior to the checks NBD 209 (789 kg/ha) and A 119 (767 kg/ha) in terms of leaf yield in AVT-II.

Table 1 BDNBRC 1.2: Yield data and morphological characters AVT-II (2021*Kharif)*

Entries	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
ABD-196	728	77.00	9.87	3.72	38.75	14.80
ABD-197	511	99.38	16.13	4.20	37.23	14.23
ABD-199	633	101.40	15.93	4.72	41.49	15.28
NyBD-62	522	98.33	18.47	4.03	35.11	13.03
NyBD-63	494	84.00	14.07	3.57	44.27	16.45
Vedaganga-1 (C)	700	95.27	17.33	3.71	45.48	18.80
A-119 (C)	767	66.50	12.60	2.63	40.09	16.97
Bhavyashree (C)	594	94.20	12.87	2.81	39.87	14.33
NBD-209 (C)	789	77.67	16.80	2.49	41.77	16.77
Mean	637.65	89.72	13.89	3.54	40.45	15.63
S.Em ±	42.58	8.83	2.71	0.65	2.49	1.46
C.D. at 5%	127.65	26.47	8.12	1.96	7.47	4.37
C.V. (%)	11.57	17.05	33.78	31.92	10.67	16.15

Table 2 BDNBRC 1.2: Incidence of diseases and pest under Natural conditions

Entries	Diseases					Pests
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5))	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
ABD-196	1	2	0	0	0	5
ABD-197	1	1	0	0	0	5
ABD-199	1	3	0	0	0	5
NyBD-62	2	1	0	0	0	5
NyBD-63	1	1	0	0	0	5
Vedaganga-1 (C)	1	0	0	0	0	5
A-119 (C)	2	2	0	1	0	5
Bhavyashree (C)	1	0	0	0	0	5
NBD-209 (C)	0	1	0	1	0	5

Table 3BDNBRC 1.2: Chemical Quality parameters (%)in AVT-II (2021-22)

Entries	Nicotine	Reducing Sugars	Chlorides
ABD-196	0.75	5.74	1.21
ABD-197	1.42	3.47	1.23
ABD-199	1.24	3.90	1.31
NyBD-62	1.42	4.00	1.60
NyBD-63	0.71	6.87	1.62
Vedaganga-1 (C)	0.88	6.23	1.37
A-119 (C)	0.66	5.74	1.22
Bhavyashree (C)	0.59	6.01	1.37
NBD-209 (C)	0.80	6.18	0.87

Table 4 BDNBRC 1.2: Pooled data of AVT-II (2020-21 & 2021-22)

Entries	2020-21	2021-22	Pooled
ABD-196	1139	728	933
ABD-197	621	511	566
ABD-199	659	633	646
NyBD-62	612	522	567
NyBD-63	478	494	486
Vedaganga-1 (C)	656	700	678
A-119 (C)	495	767	631
Bhavyashree (C)	669	594	632
NBD-209 (C)	1263	789	1026
Mean	732.59	637.65	685.05
S.Em ±	19.70	11.57	23.52
C.D. at 5%	245.8	127.65	371.55
C.V. (%)	83.32	42.58	113.93

BULK TRIAL

Year of start : 2021-22

Results

Two entries namely, NBD 316 and NBD 277 were evaluated with two checks A-119 and NBD 209 in plot size of 8 m x 37.5 m (400 plants) to identify promising line for yield over the popular and best check varieties. The promising entry NBD 316 has recorded highest leaf yield of 1323 kg/ha followed by best check NBD 209 (1183 kg/ha) (Table 1 BT). Four entries were screened under natural condition for scoring against major diseases and insect pests in this trial. The disease score for frog eye spot was one for all the test entries and brown leaf spot ranged from 1-3. No incidence of leaf curl, black shank and TMV were noticed. The aphid score ranged between 3 and 5.

Conclusion: The promising entry NBD-316 will be tested in Large Scale Trial in the farm as well as in the farmer's field during 2022-23.

Note

1. Since we do not have facility (designated locations/centers other than ARS, Nipani) to test the promising entries in multi-locations, we are conducting the Large Scale Trial during 2022-23 to generate data for accepting to next stage.
2. It is mandatory to test the promising entry in any one of the trial, till it is accepted for release.

Table 1 BT: Data on yield and morphological characters in Bulk Trial

Entries	leaf yield (kg/ha)	Plant Height (cm)	No. of leaves	Inter-nodal length (cm)	leaf length (cm)	leaf breadth (cm)
NBD- 316	1323	127.00	13	6	48.16	19.88
NBD- 277	1023	101.60	12	6	43.96	19.36
A-119 (C)	820	127.00	19	6	42.36	17.64
NBD- 209 (C)	1183	132.60	19	7	49.96	18.52

Table 2 BT: Incidence of diseases under Natural conditions

Entries	Diseases					Aphids
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	
NBD- 316	1	1	0	0	0	3
NBD- 277	1	2	0	0	0	4
A-119 (C)	1	3	0	0	0	5
NBD- 209 (C)	1	3	0	0	0	4

BDNBR 4.1: STATION VARIETAL TRIAL I (SVT-I)

Year of start : 2021-22

Design : RBD
Plot Size : 4 × 7.5 m

Replications : 3
Entries : 4 + 4 (C)

Results

The Station Varietal Trial-I consisted of four test entries and four checks. Among the test entries, entry NBD-337 (1189 kg/ha) registered significant superior leaf yield over the best check NBD-209 (922 kg/ha). Pooled analysis of this trial also revealed the significant superiority of NBD-337 (1194 kg/ha) over the best check NBD-209 (1023kg/ha). The disease score for frog eye spot and brown leaf spot ranged from 0-3 among the test entries. No incidence of leaf curl, black shank and TMV noticed. The aphid score ranged between 4 and 5.The trial will be evaluated for one more year (2021-22) **as SVT-II**.

Table 1 BDNBR 4.1: Data on yield and morphological characters SVT-I (2021 *Kharif*)

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD- 337	1189	114.73	17	4.73	48.52	16.72
NBD- 338	789	75.67	18	3.28	38.49	13.57
NBD- 340	711	80.20	11	4.47	42.03	14.95
NBD- 341	761	88.40	13	3.75	39.15	11.47
Vedaganga-1 (C)	767	110.87	12	4.33	45.67	13.27
A-119 (C)	672	77.20	10	4.62	38.77	12.43
Bhavyashree (C)	600	86.97	13	3.72	33.97	11.42
NBD-209 (C)	922	104.13	16	4.19	42.23	13.92
Mean	801.39	92.27	14	4.14	41.1	13.47
S.Em ±	69.12	4.41	1.47	0.32	2.86	1.21
C.D. at 5%	209.66	13.37	4.46	0.98	8.68	3.68
C.V. (%)	14.94	8.27	18.32	13.53	12.07	15.61

Table 2 BDNBR 4.1: Incidence of diseases & pests under Natural conditions

Entries	Diseases					Pests
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids
NBD- 337	3	0	0	0	0	4
NBD- 338	1	0	0	0	0	4
NBD- 340	2	2	0	0	0	5
NBD- 341	0	0	0	0	0	5
Vedaganga-1 (C)	2	1	0	0	0	5
A-119 (C)	2	0	0	0	0	5
Bhavyashree(C)	1	3	0	0	0	5
NBD-209 (C)	0	2	0	0	0	5

Table 3 BDNBR 4.1: Pooled data of cured leaf yield in SVT-I (2020-2022)

Entries	Leaf yield (kg/ha)		Pooled
	2020-21 (PVT)	2021-22 (SVT)	
NBD- 337	1200	1188.89	1194.45
NBD- 338	907	788.89	847.95
NBD- 340	935	711.11	823.06
NBD- 341	873	761.11	817.06
Vedaganga-1 (C)	1013	766.67	889.84
A-119 (C)	784	672.22	728.11
Bhavyashree (C)	808	600	704.00
NBD-209 (C)	1124	922.22	1023.11
Mean	955.44	801.39	878.44
S.Em ±	12.77	14.94	6.57
C.D. at 5%	213.76	209.66	132.37
C.V. (%)	70.47	69.12	39.58

BDNBR 4.2: STATION VARIETAL TRIAL II (REPEAT)

Year of start : 2021-22

Design : RBD
Replications : 3
Plot Size : 4 × 7.5 m
Entries : 10 + 4 (C)

Results

The Station Varietal Trial -Repeat consisted of ten test entries and four checks. Among the test entries, entry NBD-330 (1111 kg/ha) registered numerically superior leaf yield over the best check NBD-209 (1006 kg/ha). There was no incidence of frog eye spot among the test entries compared to the checks. The disease score for brown leaf spot ranged from 0-3 and no incidence of leaf curl,black shank and TMV were noticed.The aphid score ranged between 4 and 5.

In pooled analysis NBD-334 (1454 kg/ha), registered numerically superior leaf yield over the best check NBD-209 (1282.39kg/ha). None of the test entries were significantly superior over the checks for leaf yield.

Table 1 BDNBR 4.2: Data on yield and morphological characters (2021*Kharif*)

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD - 327	800	97.40	13	4.16	42	15.27
NBD - 328	628	94.13	14	3.37	33	14.93
NBD - 329	722	88.53	11	4.24	38	14.2
NBD - 330	1111	100.27	12	4.85	46	15.73
NBD - 331	606	100.00	11	4.55	46	16.62
NBD - 332	622	91.00	10	4.19	40	16.45
NBD - 333	750	111.73	13	4.69	47	18.83
NBD - 334	778	84.87	9	4.97	42	16.11
NBD - 335	978	108.27	10	5.19	44	18.2
NBD - 336	872	97.07	10	5.24	45	16.03
Vedaganga-1 (C)	983	114.00	9	5.07	49	16.53
A-119 (C)	800	96.13	9	5.88	45	14.8
Bhavyashree (C)	856	94.00	9	3.67	35	14.92
NBD-209 (C)	1006	80.07	10	5.56	42	14.47
Mean	822.22	96.96	10.81	4.69	42.29	15.93
S.Em ±	77.26	5.84	1.44	0.49	2.58	1.23
C.D. at 5%	224.59	16.99	4.19	1.44	7.5	3.57
C.V. (%)	16.27	10.44	23.09	18.26	10.56	13.33

Table 2 BDNBR 4.2: Incidence of diseases & pests under Natural conditions

Entries	Diseases					Pests
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids
NBD - 327	0	1	0	0	0	4
NBD - 328	0	2	0	0	0	4
NBD - 329	0	2	0	0	0	5
NBD - 330	0	2	0	0	0	4
NBD - 331	0	1	0	0	0	5
NBD - 332	0	2	0	0	0	5
NBD - 333	2	2	0	0	0	5
NBD - 334	0	2	0	0	0	5
NBD - 335	0	1	0	0	0	5
NBD - 336	0	0	0	0	0	5
Vedaganga-1 (C)	0	1	0	0	0	5
A-119 (C)	2	3	0	0	0	5
Bhavyashree (C)	2	2	0	0	0	5
NBD-209 (C)	1	2	0	0	0	5

Table 3 BDNBR 4.2: Pooled data of cured leaf yield in SVT-II – (2018-2022)

Entries	Leaf yield (kg/ha)				
	2018-19 (PVT)	**2019-20**	**2020-21 (SVT-I Repeat)**	**2021-22 (SVT-II Repeat)**	**Pooled**
NBD - 327	1944	894	1307	800.00	1236.25
NBD - 328	1683	559	1093	627.78	990.7
NBD - 329	2028	545	1276	722.22	1142.81
NBD - 330	1528	510	1124	1111.11	1068.28
NBD - 331	1856	410	1229	605 .56	1165
NBD - 332	2078	524	1300	622.22	1131.06
NBD - 333	1933	692	1509	750.00	1221
NBD - 334	2544	807	1689	777.78	1454.45
NBD - 335	1964	408	1375	977.78	1181.2
NBD - 336	1933	433	1334	872.22	1143.06
Vedaganga-1 (C)	2028	489	1501	983.33	1250.33
Bhavyashree (C)	1622	370	1700	800.00	1123
A-119 (C)	1956	365	1384	855.56	1140.14
NBD-209 (C)	2211	613	1300	1005.56	1282.39
Mean	1951	544	1366.00	822.22	1180.97
S.Em ±	191.02	61.51	193.32	77.26	98.94
C.D. at 5%	583.6	187.94	567.91	224.59	283.02
C.V. (%)	13.85	16.77	24.52	16.27	16.76

BDNBR 4.4: STATION HYBRID TRIAL II (SHT-II)
(The trial is repeated with the same set of entries)

Year of start : 2021-22
Design : RBD
Replications : Two
Plot Size : 4 × 7.5 m
Entries : 5 + 4 (C) + 8 Parents

Results

The Station Hybrid Trial (SHT-I) consists of 17 entries (five test hybrids, eight parents and four checks). Test hybrid NBTH-1003 (1683 kg/ha) was numerically superior to the best check NBD-209 (1400 kg/ha) in leaf yield. Five hybrids along with four checks and parents were screened against major diseases andpests. The entries scored 0-1 for frog Eye Spot and 1-3 for brown leaf spot. There was no incidence of leaf curl and blank shank was noticed with a score of one in test hybrid **NBTH-1007** and check A-119.For the aphids the entries scored between 4 and 5.

In Pooled analysis over three years, hybrids NBTH-1003 (1578kg/ha) and NBTH-1016 (1508) were numerically superior over check NBD-209 (1260 kg/ha).None of the test hybrids were significantly superior over the checks for leaf yield.

Table 1 BDNBR 4.4: Data on yield and morphological characters (SHT-II)

Entries	Parentage	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH-1003	MS NBD 209 × ArBD- 7	1683	103.00	12.9	4.54	44.72	16.12
NBTH-1006	MS PL-5 × ABD-101	1133	106.66	15	5.38	45.22	15.98
NBTH-1007	MS PL-5 × ABD-115	1300	125.60	15.5	4.68	46.8	16.24
NBTH-1008	MS Bhavyashree × GT-4	1500	122.20	16.9	5.28	45.68	15.98
NBTH-1016	MS NBD-209 × NBD-316	1567	111.80	10.5	5	42.84	15.24
CHECKS							
Vedaganga-1		1000	101.20	10.5	5.54	43.36	15.46
A-119		1033	70.20	8.7	4.58	44.7	17.54
Bhavyashree		883	94.20	9.8	4.96	42.54	14.77
NBD-209		1400	117.20	16.5	4.42	42.74	14.24
PARENTS							
ArBD-7 (GRPM-143)		1200	102.70	10.4	5.34	44.62	15.76
ABD-101 (GRPM 115)		1200	102.70	12.7	4.98	43.14	15.68
ABD-115 (GRPM 125)		1250	86.3	10.4	6.24	43.36	16.00
GT-4 (GRPM-5)		1367	160.9	21	5	43.68	14.32
NBD- 316 (GRPM-222)		1500	115.4	9.9	5.32	46.54	17.68
MS NBD- 209		1433	105.4	12.6	4.36	42.7	15.54
MS Bhavyashree		1200	105.9	10.2	5.36	46.56	17.3
MS PL-5		1350	105.5	8.6	5.46	49.12	19.22
Mean		1294.12	108.04	12.48	5.08	44.61	16.06
S.Em ±		111.41	11.98	1.86	0.36	2.81	1.21
C.D. at 5%		334.02	35.9	5.58	1.08	8.43	3.63
C.V. (%)		12.18	15.68	21.08	10.04	8.91	10.66

Table 2 BDNBR 4.4: Incidence of diseases & pests under Natural conditions

Entries	Parentage	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shan k (%)	TMV (%)	Aphids
NBTH-1003	MS NBD 209 × ArBD- 7	1	1	0	0	0	4
NBTH-1006	MS PL-5 × ABD- 101	0	0	0	0	0	4
NBTH-1007	MS PL-5 × ABD- 115	0	1	0	1	0	4
NBTH-1008	MS Bhavyashree × GT-4	0	1	0	0	0	5
NBTH-1016	MS NBD 209 × NBD-316	0	0	0	0	0	5
CHECKS							
Vedaganga-1	-	1	1	0	0	0	4
A-119	-	0	2	0	1	0	5
Bhavyashree	-	0	0	0	0	0	4
NBD-209	-	0	1	0	0	0	4
PARENTS							
ArBD-7 (GRPM-143)	-	0	1	0	0	0	4

Entries	Parentage	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shan k (%)	TMV (%)	Aphids
ABD-101 (GRPM- 115)	-	1	1	0	0	0	4
ABD-115 (GRPM 125)	-	1	1	0	0	0	4
GT-4 (GRPM-5)	-	0	2	0	0	0	5
NBD 316 (GRPM-222)	-	0	0	0	0	0	4
MS NBD- 209	-	1	3	0	0	0	4
MS Bhavyashree	-	0	1	0	0	0	4
MS PL-5	-	1	1	0	0	0	5

Table 3 BDNBR 4.4: Pooled data of cured leaf yield in SHT(2019-2022)

Entries	Parentage	2019-20	2020-21	201-22	Pooled
NBTH-1003	MS NBD 209 × ArBD- 7	1200	1850	1683	1578
NBTH-1006	MS PL-5 × ABD-101	756	760	1133	883
NBTH-1007	MS PL-5 × ABD-115	667	800	1300	922
NBTH-1008	MS Bhavyashree × GT-4	1227	1600	1500	1442
NBTH-1016	MS NBD 209 × NBD-316	1279	1677	1567	1508
CHECKS					
Vedaganga-1	-	853	1000	1000	951
A-119	-	650	850	1033	844
Bhavyashree	-	738	700	883	774
NBD-209	-	1379	1000	1400	1260
PARENTS					
ArBD-7 (GRPM-143)	-	953	1000	1200	1051
ABD-101 (GRPM 115)	-	1080	850	1200	1043
ABD-115 (GRPM 125)	-	683	800	1250	911
GT-4 (GRPM-5)	-	1443	1000	1367	1270
NBD 316 (GRPM-222)	-	1021	1000	1500	1174
MS NBD- 209	-	1079	1023	1433	1178
MS Bhavyashree	-	950	920	1200	1023
MS PL-5	-	1062	827	1350	1080
Mean	-	977.49	1038.63	1294.12	1111.31
S.Em ±	-	101.68	116.73	12.18	13.711
C.D. at 5%	-	296.80	349.94	334.02	253.41
C.V. (%)	-	14.71	15.89	111.41	87.97

BDNBR 4.5: PRELIMINARY VARIETAL TRIAL (PVT)

Year of start : 2021-22

Design : RBD
Plot Size : 4 × 7.5 m

Replications : Three
Entries : 5 + 4 (C)

Results

The Preliminary Varietal Trial consisted of 18 test entries and four checks. Among the test entries, NBD-342 (1378 kg/ha), NBD-343 (1481 kg/ha), NBD-344 (1393 kg/ha), NBD-345 (1393 kg/ha) and NBD 346 (1244.44 kg/ha),NBD 347 (1259.26 kg/ha), NBD 349 (1288.89 kg/ha), NBD 351 (1229.63 kg/ha)(Table 1 BDNBR 4.5).The disease score for frog eye spot and brown leaf spot ranged from 0-1 and 0-4, respectively among the tested entries. No incidence of leaf curl, and TMV were noticed.However, black shank was noticed in test entry NBD-342 with a score of one.The aphid score ranged between 3 and 5 (Table 2 BDNBR 4.5).

Conclusion: The best test entries will be evaluated in Station Varietal Trial-I during 2022-23.

Table 1 BDNBR 4.5: Data on yield and morphological characters (PVT)

Entries	Leaf yield (kg/ha)	Plant height (cm)	Leave s /plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD- 342	1378	117.53	17.13	5.05	44.05	17.51
NBD -343	1482	121.6	13.8	4.84	42.47	18.09
NBD- 344	1393	82.67	12.67	4.8	41.8	16.91
NBD- 345	1393	89.07	15.00	4.81	42.35	17.03
NBD- 346	1244	88.27	16.00	4.2	45.07	17.80
NBD- 347	1260	88.73	15.80	4.65	45.8	18.04
NBD- 348	984	102.4	16.40	5.07	44.72	17.16
NBD- 349	1289	104.2	15.53	4.67	53.64	18.03
NBD- 350	1126	106.47	16.73	5.25	50.37	17.21
NBD- 351	1230	87.33	14.93	4.52	49.59	16.87
NBD- 352	578	70.47	10.47	4.09	45.85	16.64
NBD- 353	711	76.33	10.73	4.96	40.56	15.00
NBD- 354	815	77.20	12.33	4.6	43.03	15.43
NBD- 355	993	106.20	18.03	4.43	45.29	16.48
NBD- 356	1407	122.67	18.47	5.04	48.12	18.29
NBD- 357	607	102.40	17.13	4.63	51.85	19.56
NBD- 358	1052	120.33	18.33	5.16	48.59	18.28
NBD- 359	741	109.67	18.87	4.69	48.91	18.48

Vedaganga -1 (C)	785	105.87	15.2	5.24	47.96	17.47
A-119 (C)	689	82	11	4.39	46.15	17.35
Bhavyashree (C)	622	107	15.6	4.8	37.48	13.93
NBD-209 (C)	889	113.8	17.6	4.77	40.07	15.52
Mean	1030.24	99.19	15.35	4.76	45.62	17.14
S.Em ±	106.63	7.73	0.5	0.36	2.02	0.79
C.D. at 5%	304.31	22.07	1.42	1.03	5.76	2.25
C.V. (%)	17.93	13.51	5.62	13.14	7.67	7.96

Table 2 BDNBR 4.5: Incidence of diseases & pests under Natural conditions

Entries	Diseases					Pests
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
NBD- 342	0	0	0	1	0	4
NBD- 343	0	2	0	0	0	5
NBD- 344	0	3	0	0	0	5
NBD- 345	1	1	0	0	0	4
NBD- 346	0	1	0	0	0	4
NBD- 347	0	2	0	0	0	3
NBD- 348	0	3	0	0	0	3
NBD- 349	1	2	0	0	0	4
NBD- 350	1	3	0	0	0	4
NBD- 351	0	2	0	0	0	4
NBD- 352	1	1	0	0	0	4
NBD- 353	0	1	0	0	0	3
NBD- 354	2	3	0	0	0	3
NBD- 355	1	1	0	0	0	3
NBD- 356	0	0	0	0	0	4
NBD- 357	1	4	0	0	0	3
NBD- 358	0	1	0	0	0	3
NBD- 359	1	1	0	0	0	3
Vedaganga-1 (C)	1	2	0	0	0	4
A-119 (C)	0	3	0	0	0	4
Bhavyashree (C)	1	2	0	0	0	3
NBD-209 (C)	0	2	0	0	0	3

BDNBR 4.6: PRELIMINARYHYBRID TRIAL (PHT)

Year of start : 2021-22

Design : RBD
Plot Size : 2 × 7.5 m

Replications : Three
Entries : 10+ 4 (C)

Results

The Preliminary Hybrid Trial (PHT) consists of 17 entries (six test hybrids, seven parents and four checks). Test hybrids NBTH-1024 (1933 kg/ha) and NBTH-1028 (1900 kg/ha) were numerically superior to the best check NBD-209 (1767kg/ha) in leaf yield. Six hybrids along with four checks and parents were screened against major diseases andpests. The entries scored 0-1 for Frog Eye Spot and 1-3 for Brown leaf spot. There was no incidence of leaf curl and blank shank was noticed only in check A119.For the aphids the entries scored between 3 and 5.

Conclusion: All the test hybrids will be evaluated as SHT along with the four checks viz., Vedaganga-1, A-119, Bhavyashree and NBD 209 during 2022-23.

Table 1 BDNBR 4.6: Data on yield and morphological characters (PHT)

Entries	Parentage	Leaf yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH-1023	MS NPN 22 x NBD- 277	1667	109.1	10.5	6.26	55.14	21.08
NBTH-1024	MS Bhagyashree x NBD- 277	1933	98.5	9.7	6.38	55.94	20.66
NBTH-1025	MS Vedaganga-1 x NBD-277	1667	113.3	10.8	6.56	52.38	19.72
NBTH-1026	MS PL-5 x NBD-277	1167	104.2	11.3	6.26	51.96	19.7
NBTH-1027	MS NPN 22 x NBD-316	1600	118.6	12.2	6.72	52.43	18.6
NBTH-1028	MS NPN-22 x ABD-196	1900	94.3	9.1	5.9	54.94	18.94
CHECKS							
Vedaganga-1		1217	110.8	11.3	5.9	50.7	17.88
A-119		1133	87.3	9.7	5.74	44.38	16.23
Bhavyashree		983	113	9.9	5.8	45.38	15.32
NBD-209		1767	118	13.9	5.64	53.78	18.3
PARENTS							
MS NPN- 22		1333.33	108.3	9.3	5.92	50.2	17.12
MS Bhagyashree		1683.33	100.1	7.6	6.46	54.26	18.82

MS Vedaganga	1400	126	13.4	6.6	56.66	20.54
MS PL-5	1666.67	109.7	10.1	6.2	55.38	20.98
NBD- 316	1583.33	117.6	10.6	6.84	51.8	19.54
ABD- 196	933.33	77.75	11.15	5.21	48.46	17.52
NBD- 277	1150	84.4	8.3	6.8	46.82	17.42
Mean	1457.84	105.35	10.52	6.19	51.8	18.73
S.Em ±	104.98	7.46	1.39	0.5	1.67	1.01
C.D. at 5%	314.72	22.35	4.17	1.5	5.01	3.02
C.V. (%)	10.18	10.01	18.69	11.4	4.56	7.6

Table 2 BDNBR 4.4: Incidence of diseases & pests under Natural conditions

Entries	Parentage	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids
NBTH-1023	MS NPN 22 x NBD- 277	0	1	0	0	0	3
NBTH-1024	MS Bhagyashree x NBD- 277	0	3	0	0	0	4
NBTH-1025	MS Vedaganga-1 x NBD- 277	0	2	0	0	0	4
NBTH-1026	MS PL-5 x NBD- 277	1	1	0	0	0	4
NBTH-1027	MS NPN 22 x NBD- 316	1	1	0	0	0	3
NBTH-1028	MS NPN-22 x ABD- 196	0	2	0	0	0	4
Checks							
Vedaganga-1	-	1	3	0	0	0	4
A-119	-	0	1	0	1	0	4
Bhavyashree	-	0	1	0	0	0	5
NBD-209	-	0	3	0	0	0	5
Parents							
MS NPN- 22	-	0	2	0	0	0	5
MS Bhagyashree	-	0	1	0	0	0	5
MS Vedaganga-1	-	0	2	0	0	0	5
MS PL-5	-	1	1	0	0	0	4
NBD- 316	-	0	2	0	0	0	4
ABD- 196	-	1	1	0	0	0	4
NBD- 277	-	0	2	0	0	0	5

BDNBR 5: GENERATION OF BREEDING MATERIAL

BDNBR 5.1: GENERATION OF NEW CROSSES

Objective: Breeding for higher yield and quality coupled with disease resistance

Year of start : 2020-21

Results

A total of thirty two new inter varietal crosses and forty six MS based crosses were generated for leaf yield, quality and disease and pest resistance.

Conclusion: The new cross combinations will be evaluated for their yield and agronomic characters during 2022-23

Table 1 BDNBR 5.1: List of crosses generated during 2021-22

Crosses	Purpose
A-119 X 114-1	High leaf yield and good quality
A-119 X S-20	High leaf yield and good quality
A-119 X Gundsurti	High leaf yield and good quality
A-119 X NBD-111	High leaf yield and good quality
A-119 X ABD-101	High leaf yield and good quality
A-119 X ABD-95	High leaf yield and good quality
A-119 X ABD-92	High leaf yield and good quality
A-119 X Red rusion	High leaf yield and good quality
Vedaganga-1 X 114-1	High leaf yield and good quality
Vedaganga-1 X S-20	High leaf yield and good quality
Vedaganga-1 X Gundsurti	High leaf yield and good quality
Vedaganga-1 X NBD- 111	High leaf yield and good quality
Vedaganga-1 X ABD-101	High leaf yield and good quality
Vedaganga-1 X ABD-95	High leaf yield and good quality
Vedaganga-1 X ABD-92	High leaf yield and good quality
Vedaganga-1 X Red rusion	High leaf yield and good quality
NBD- 277 X 114-1	High, quality leaf yield coupled with disease & pest resistance
NBD- 277 X S-20	High, quality leaf yield coupled with disease & pest resistance

Crosses	Purpose
NBD- 277 X Gundsurti	High, quality leaf yield coupled with disease & pest resistance
NBD- 277 X NBD-111	High, quality leaf yield coupled with disease & pest resistance
NBD- 277 X ABD -101	High, quality leaf yield coupled with disease & pest resistance
NBD- 277 X ABD-95	High, quality leaf yield coupled with disease & pest resistance
NBD- 277 X ABD- 92	High, quality leaf yield coupled with disease & pest resistance
NBD- 277 X Red rusion	High, quality leaf yield coupled with disease & pest resistance
NBD- 316 X 114-1	High, quality leaf yield coupled with disease & pest resistance
NBD- 316 X S-20	High quality leaf yield coupled with disease & pest resistance
NBD- 316 X Gundsurti	High quality leaf yield coupled with disease & pest resistance
NBD- 316 X NBD- 111	High quality leaf yield coupled with disease & pest resistance
NBD- 316 X ABD-101	High quality leaf yield coupled with disease & pest resistance
NBD- 316 X ABD-95	High quality leaf yield coupled with disease & pest resistance
NBD- 316 X ABD-92	High quality leaf yield coupled with disease & pest resistance
NBD- 316 X Red rusion	High quality leaf yield coupled with disease & pest resistance

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

Table 2 BDNBR 5.1: List of new MS based crosses generated during 2021-22

1	MS A-2 X 114-4	24	MS Vedaganga-1 X NBD 316
2	MS A-2 X S-20	25	MS PL-5 X NBD 316
3	MS A-2 X NBD- 111	26	MS A-2 X NBD 316
4	MS A-2 X ABD- 101	27	MS GT-5 X NBD 316
5	MS A-2 X ABD- 95	28	MS Vedaganga X A-119
6	MS A-2 X ABD- 92	29	MS Vedaganga X A-428
7	MS A-2 X Red Russion	30	MS Bhavyashree X A-119
8	MS Bhavyashree X 114-4	31	MS Bhavyashree X A-428
9	MS Bhavyashree X S-20	32	MS Vedaganga X Bhavyashree
10	MS Bhavyashree X Gundsutri	33	MS Bhavyashree X Vedaganga
11	MS Bhavyashree X NBD- 111	34	MS GT -5 X 114-4
12	MS Bhavyashree X ABD- 101	35	MS GT -5 X S-20
13	MS Bhavyashree X ABD- 95	36	MS GT -5 X Gundsutri
14	MS Bhavyashree X ABD- 92	37	MS GT -5 X NBD 111
15	MS Bhavyashree X Red Russion	38	MS GT -5 X ABD 101
16	MS NBD-209 X 114-4	39	MS GT -5 X ABD 95
17	MS NBD- 209 X S-20	40	MS GT -5 X Red Russion
18	MS NBD- 209 X NBD- 111	41	MS PL-5 X 114-4
19	MS NBD- 209 X ABD- 101	42	MS MS PL -5 X NBD 111
20	MS NBD- 209 X ABD- 95	43	MS MS PL -5 X ABD 101
21	MS NBD- 209 X ABD- 92	44	MS MS PL -5 X ABD 95
22	MS NBD- 209 X Red Russion	45	MS MS PL -5 X ABD 95
23	MS A-119 X NBD- 316	46	MS MS PL -5 X Red Russion

BDNBR 5.2: GENERATION BREEDING MATERIAL (F_1 evaluation)

Objective: Breeding for higher yield and quality coupled with disease resistance.

Year of start : 2021-22
Design : RBD
Replications : Three
Plot Size : 2 × 7.5 m
Entries : 12 + 4 (C)

Results

A total of 12 F_1s were evaluated along with four checks *viz.*, Vedaganga-1, A-119. Bhavyashree & NBD-209 in a randomized block design with three replications. The potential heterotic cross combinations selected based on yield performance will be advanced to next generation.

12 F_1s were screened along with four checks for their reaction to major diseases and pests. The score for frog eye spot and brown leaf spot ranged between 0-1 and 0-4, respectively. The disease score for black shank ranged from 0 to 2. Only one entry, A-119 recorded the incidence of leaf curl and no incidence of TMV was noticed among the entries in this trial.

Conclusion: Out of 12 F_1s, the cross combinations NBD 209 x NBD 277 (1631 kg/ha), A-2 x NBD-277 (1577 kg/ha), A-119 x NBD-277 (1498 kg/ha) and Vedaganga-1 x NBD-277 (1418 kg/ha), were found to be potential heterotic cross combinations and will be advanced to F_2 generation during 2022-23.

Table 1 BDNBR 5.2: Data on yield and morphological characters in F_1 evaluation (2021-22)

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Inter-nodal length (cm)	Leaf length (cm)	Leaf width (cm)
A-119 x NBD 276	1179	81	8	6	43	14
A-119 x NBD 277	1498	103	7	7	52	20
NBD 209 x NBD 277	1631	114	10	7	51	19
Vedaganga x NBD 277	1418	125	10	6	50	19
A-2 x NBD 277	1577	110	8	7	53	21
PL-5 x NBD 277	367	128	8	6	46	19
A-119 x ABD 174	764	105	9	6	50	16
NBD 209 x NyBD 62	1171	118	8	8	48	19
NPN 22 x NBD 276	776	87	9	5	42	15
NPN 22 x NBD 277	637	82	9	5	39	14
NBD 209 x NBD 276	936	92	8	5	42	15
Bhavyashree x NBD 277	638	81	9	4	40	15
Vedaganga-1 (C)	1151	107	10	6	45	16
A-119 (C)	1322	88	8	7	45	17
Bhavyashree (C)	1151	103	9	6	42	15
NBD-209 (C)	1662	119.87	11.80	5.65	47.01	17.12
Mean	1117.3	102.80	9.00	6.04	45.80	16.85
S.Em ±	21.93	12.79	12.35	11.53	12.24	13.69
C.D. at 5%	408.65	21.93	1.85	1.16	9.35	3.85
C.V. (%)	141.49	7.59	0.64	0.4	3.24	1.33

Table 1 BDNBR 5.2: Selected F_1s for advancement of F_2

S. No	F_1	Leaf yield potential (kg/ha)
1	Vedaganga x NBD 277	1417.8
2	A-119 x NBD 277	1497.8
3	A-2 x NBD 277	1576.7
4	NBD 209 x NBD 277	1631.1

Table3 BDNBR 5.2: Evaluation of F_1 against diseases under Natural conditions

Entries	Diseases					Pests
	Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids
A-119 x NBD 276	0	3	0	0	0	5
A-119 x NBD 277	0	3	0	0	0	5
NBD 209 x NBD 277	0	4	0	1	0	4
Vedaganga x NBD 277	0	2	0	0	0	5
A-2 x NBD 277	0	0	0	0	0	5
PL-5 x NBD 277	0	2	0	0	0	5
A-119 x ABD 174	1	1	0	0	0	5
NBD 209 x NyBD 62	0	3	0	1	0	4
NPN 22 x NBD 276	0	4	0	0	0	4
NPN 22 x NBD 277	0	2	0	0	0	5
NBD 209 x NBD 276	0	2	0	0	0	4
Bhavyashree x NBD 277	1	2	0	1	0	5
Vedaganga-1 (C)	0	3	0	2	0	5
A-119 (C)	1	2	1	1	0	5
Bhavyashree (C)	1	1	0	0	0	5
NBD-209 (C)	1	4	0	2	0	**5**

BDNBR 5.3: GENERATION BREEDING MATERIAL (F_2 population)

Objective: Breeding for higher yield with quality coupled with disease resistance

Year of start : 2021-22
Entries : 4 + 4 (C)

Results
Four F_2 populations namely, Bhavyashree X ABD-174, Vedaganga-1 X ABD-174, Bhavyashree X NBD 316 and NBD-209 X ABD 190 were evaluated.

Conclusion: A total of 40 plants were selected based on the visual observation and will be advanced to F_3 generation

Table 1 BDNBR 5.3: Data on Selected F_2s for advancement of F_3

Entries	Initial Selection (No. of plants)	Final Selection (No. of plants)
Bhavyashree X ABD 174	490	12
Vedaganga-1 X ABD 174	440	08
Bhavyashree X NBD 316	510	10
NBD 209 X ABD 190	450	10
	Total	**40**

BDNBR 5.4: GENERATION OF BREEDING MATERIAL (F_3 population)

Objective: Breeding for higher yield with quality coupled with disease resistance

Year of start : 2018-19

Results

Six F_3 families of the two crosses NBD 209 X ABD 166 and NBD 209 X ABD 167 were evaluated for leaf yield and its attributes

Conclusion: Twenty six superior progenies selected from theses six F_3 families of NBD 209 X ABD 166 and NBD 209 X ABD 167 will be advanced to next generation (F_4).

Table 1 BDNBR 5.4: Data on Selected F_3s for advancement of F_4

Entry code	Pedigree	Initial Selection (No. of plants)
2020-1-3-7	NBD 209 X ABD 166	5
2020-1-11-1	NBD 209 X ABD 166	5
2020-1-13-10	NBD 209 X ABD 166	4
2020-1-14-10	NBD 209 X ABD 166	5
2020-4-5-5	NBD 209 X ABD 167	4
2020-4-6-2	NBD 209 X ABD 167	3
	Total	**26**

BDNBR 5.5: GENERATION OF BREEDING MATERIAL (F_4 population)

Objective: Breeding for higher yield with quality coupled with disease resistance

Year of start : 2017-18
Plot Size : 5 × 7.5 m

Results

Twelve F_4 lines evaluated in plot size of 5 rows of 7.5 m length in an un replicated yield trial. The F_4 lines were evaluated for yield and yield attributes and superior lines (Entry No. 5, 7, 9 and 11) were selected and will be tested in PVT during 2022-23.

Conclusion: Plants selected from four F_4 lines were forwarded to PVT from F_4 generation

Table 1 BDNBR 5.5:F_4 lines forwarded to PVT

S. No.	Entry code	Pedigree
1.	2020-5-6-5	NBD 209 X Vedaganga-1
2.	2020-7-10-6	NBD 209 X A-2
3.	2020-8-3-10	NBD 209 X A-2
4.	2020-8-5-9	NBD 209 X A-2

BDNBR 6: EVALUATION OF EARLY GENERATION BREEDING MATERIAL (F_4 POPULATIONS-SEEDS)

Objective: Breeding for higher yield with quality coupled with disease resistance

Year of start : 2017-18
Plot Size:6 × 7.5 m

Results

Twenty F_4 progenies were evaluated for seeds purpose with two checks A-145 and A 119 with a plot size of 6 rows of 7.5 m length in an un-replicated yield trial.

Conclusion: Plants selected from Ten F4 progenies will be evaluated in preliminary varietal trial during 2022-23.

Table 1 BDNBR 6: F_4progenies evaluated and selected for seeds purpose

S.No	Entry Code	Pedigree
1.	2020-2-10-6	A-119 X ArBD-7
2.	2020-5-6-10	ABD 119 X ABD 69
3.	2020-5-8-3	ABD 119 X ABD 69
4.	2020-5-8-4	ABD 119 X ABD 69
5.	2020-6-7-4	ABD 119 X ABD 69
6.	2020-10-4-2	Bhagyashree x ArBD-7
7.	2020-10-4-4	Bhagyashree x ArBD-7
8.	2020-10-5-4	Bhagyashree x ArBD-7
9.	2020-10-6-3	Bhagyashree x ArBD-7
10.	2020-12-10-2	NBD 259 x TI-525

BDNBR 6.5: EVALUATION OF ADVANCED BREEDING MATERIAL (M_4 PROGENIES)

Objective: Creating new genetic variability for quality, yield and resistance to biotic stresses

Year of start : 2018-19
Entries : 5 varieties
Varieties : NBD 122, NBD 259, ABD 119, ArBD-4 & ArBD-7
Dosages : 250, 300, 350, 400, 450 and 500 Gy(5 Gamma irradiation dosages)
Plot Size : 5 × 7.5 m

Results

Eighteen M_4 progenies were evaluated with checks A-145 and A 119 and parents NBD-122, NBD-119 and ArBD-7 with a plot size of 5 rows of 7.5 m length in an un-replicated yield trial. Plants were selected from entry 2020-3-1-2 (NBD-122-450 Gy).

Conclusion:Plants selected from M_4 progeny entry 2020-3-1-2 (NBD-122-450 Gy) will be evaluated in Preliminary Varietal Trial during 2022-23.

BDNBR 1: COLLECTION, EVALUATION AND MAINTENANCE OF GERMPLASM LINES IN *BIDI* TOBACCO

Objective: To maintain selected genetic stocks and to utilize in the Breeding programme

Design : Non replicated single line of 10 plants each
Entries : 245
Plot Size : 1 × 7.5 m

Results

A total of 245 germplasm lines were evaluated for different agronomic characters and screened for major diseases and pests under natural conditions andare maintained. Distinct germplasm were identified (Table 1 BDNBR 1).

Table 1 BDNBR 1: Number of germplasm lines maintainedduring 2021-22

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
1.	Keliu-20	0.1	98.33	16	22	37.07	13
2.	Anand -23	0.1	109.67	15.67	19.33	38	13.13
3.	Anand -119	0.9	122.20	17	4.20	48.40	19.64
4.	Anand-2	0.16	96.33	11.33	20.33	33.4	12.67
5.	GT-4	0.14	66.67	12.33	15.67	35.2	12.13

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
6.	Kukumarthi	0.92	83	13	18.33	35.33	13.13
7.	103-9-101	0.1	115.67	16.67	19.33	34.47	11.07
8.	783-51	0.1	93.33	11	17	31	11
9.	114-4 (RPK type)	0.24	112.33	12.67	19.33	31.27	10.33
10.	Peschtere 28	0.06	99	12.33	15.67	28.13	9.73
11.	S-20	0.26	110	11.33	26.67	39.67	15.33
12.	S-12	0.12	110	11	24.67	35.53	15.87
13.	S-112	0.14	95.33	11.67	24	36.6	12.93
14.	Akol	0.22	87.33	12	21.67	37.33	14
15.	Gundsurti	0.26	116	14.67	28	43.07	15.13
16.	Kodani	0.16	105.67	14.67	21.33	35.87	12.33
17.	V-54	0.1	62.33	6.67	14	18.73	6.53
18.	Dumbara	0.2	86.67	11.33	19.67	30.6	9.6
19.	Smyrna	0.2	105.67	11.67	21	37.93	14.73
20.	Sanand local	0.22	114.67	13.67	22.33	40.13	16.07
21.	Subhelav selection	0.12	110	16.67	20.67	40.67	16.27
22.	Red Russion	0.26	88.33	10.67	23.33	35.87	13.8
23.	Bankete A-1	0.3	65.40	11	4.20	50.72	21.08
24.	V-58	0.14	106	11.67	21	34	12.67
25.	Keliu-49	0.2	98.33	10	21	34.67	12.4
26.	Pilliu-19	0.1	41.67	5	12.67	21.8	9.27
27.	BL 4-2	0.08	81.33	11.33	19	31.2	11.93
28.	103-9-101-28-31 (A-2 x Olor)	0.14	73.67	11.33	17.33	35.2	13.73
29.	ABD -7	0.2	76.67	9.67	17.33	38.33	13.47
30.	ABD -15	0.04	96.60	13	5.20	47.52	20.04
31.	ABD 119	0.08	80	8	17.66667	29.07	9.87
32.	ABD 24	0.32	98	10.33	24.33	43.93	14.93
33.	ABD 30	0.4	120	10.67	27.33	49.53	19.47
34.	ABD 36	0.46	120.67	13	27.67	54.2	21.47
35.	GT-9	0.76	155.33	18.67	23.67	58.87	23.87
36.	TI-421	0.54	168.33	24.33	26.67	49	19.6
37.	TI-525	0.78	138.33	18.33	25.67	47.8	17.8
38.	KDH-959	0.4	136.67	17.67	20	43.47	13.93
39.	Abirami	0.2	88.33	11.67	24.67	38.27	13.87
40.	Jayalaxmi	0.18	91.67	16.33	23.67	38.67	15.07
41.	575-28-110	0.32	110.67	15.33	25	45.33	16.93
42.	GT-5	0.46	131	20.33	27.33	42.6	16
43.	GT-7	0.32	101.67	16.33	20.67	41.73	15.27
44.	NBD 119	0.32	122.67	17.67	25.33	45.13	18
45.	NBD-239-4	0.44	131.67	14.67	29.33	47.4	17.53
46.	NBD 257	0.42	91.33	13	25	38.27	13
47.	NBD 259	0.2	96.40	12	5.08	37.56	15.36
48.	NBD 260	0.44	92.33	12.67	22	39.33	15.07

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
49.	NBD 239-4	0.52	111.33	10	27	43.27	17.93
50.	NBD 209	0.98	131.67	20	23.67	48.33	15.67
51.	NBD 122	0.35	103.67	12	30.33	41.53	15.87
52.	NBD 261	0.72	94	10.67	33.33	43.6	17.27
53.	K-20-Plule leaves	0.43	107.67	12	32.33	51	19.8
54.	RPK-1-2	0.72	116.67	11	26	44.8	16.47
55.	NBD-48-1	0.64	90	10	22.33	38.93	13.8
56.	22-10-1 (11-47-Sokha)	0.68	92.33	6.67	25.67	40.27	14.73
57.	35-19-39-24	0.2	87.33	11	23.33	34.47	11.13
58.	169-19-16 (88-47-Sokha)	0.8	82.33	9	21.33	34.93	13.07
59.	SB-154	0.6	81.67	8	29.67	45.27	16.2
60.	169-19-6 (88-47-Sokha)	0.58	96.67	14.67	21.33	46.27	19.8
61.	A-1-11-65	0.36	111.67	15	24	46.53	17
62.	169-2 (N&L)	0.62	92.33	6.67	35	46.07	15.13
63.	Jhakhari Rampur	0.18	30	3.33	6.67	12.53	4.4
64.	AKBT-03-02	0.3	100	15	19.67	40.2	13.8
65.	ABT-10	0.6	112.33	14.67	27.67	50.87	19.27
66.	Bhavyashree	0.36	109	12.33	26.3333	43.6	18.333
67.	NBD 43	0.32	85.33	10.33	24.33	8	14.53
68.	NBDS-57-1	0.3	95	14.67	18.67	33.33	11.13
69.	NBD-57-1	0.28	106	12.33	24.33	38.07	14.4
70.	NBD-71	0.18	38.67	3	11	10.47	3.93
71.	NBD-80-1	0.3	115	11.67	27	41.87	16.13
72.	NBD-80-2	0.38	105.67	14.67	26.33	41.47	14.67
73.	NBD 85	0.24	71.67	10.67	24.67	40.4	14.67
74.	NBD 95	0.18	94	14	20.33	42.47	14.93
75.	NBD 111	0.10	94.00	12	4.28	54.44	22.24
76.	NBD 115	0.10	63.33	13.67	17.33	23.93	10.27
77.	NBD 136	0.18	65	10.67	18.67	23.2	9.07
78.	NBD 154	0.24	95.00	18	4.40	48.48	17.24
79.	NBD 155	0.06	106.00	16	4.60	51.56	20.44
80.	NBD 159	0.04	99.00	11	6.88	50.44	23.12
81.	NBD 164	0.3	40.67	6	10.33		5.67
82.	NBD 236	0.38	76.60	10	3.40	35.84	14.32
83.	NBD 271	0.18	106.00	12	5.04	46.00	14.76
84.	NBD 276	0.08	66.67	13	17.33	26.33	9.47
85.	NBD 277	0.22	87.33	13	20.33	30.33	12.53
86.	ABD 43	0.6	80	17.33	15	29.6	11.8
87.	ABD 46	0.08	65	13.33	20.67	29	10.13
88.	ABD 50	0.2	108.80	20	4.60	37.48	14.20
89.	ABD 51	0.04	102.20	19	4.24	34.96	14.36
90.	ABD 52	0.25	23.33	5	9.67	16.8	6.27
91.	ABD 54	0.14	39.33	8.67	12.67	21.87	9.6

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
92.	ABD 60	0.1	72.80	13	3.52	36.36	14.48
93.	ABD 61	0.06	63.33	11	17	21	9.47
94.	ABD 62	0.10	52.67	10.33	15.33	23	9.2
95.	ABD 67	0.10	84.00	12	3.80	41.36	16.32
96.	ABD 68	0.08	69	11	20.67	30.2	15.73
97.	ABD 69	0.06	58.33	10	17	25	8.93
98.	ABD 70	0.18	85	9.67	25.33	31.53	12.13
99.	ABD 71	0.18	77.33	11.67	22.67	35.8	12.73
100.	ABD 72	0.1	81.67	11.33	26	35.27	13.53
101.	ABD 73	0.1	85	13	22.67	31.53	12.07
102.	ABD 77	0.68	62.33	9	25.33	37.2	14.6
103.	ABD 78	0.08	81.67	7.67	24.33	30.4	12.87
104.	ABD 79	0.24	83.33	7.67	23.67	48.4	27.67
105.	ABD 84	0.12	80	8.33	26	40.33	13.87
106.	ABD 87	0.6	78.67	7	25	43.73	16
107.	ABD 90	0.62	81.67	10	19.33	45.47	17.4
108.	ABD 91	1.4	137.33	16.67	29.67	53.53	20.8
109.	ABD 92	0.79	136.67	19.33	34	51.4	20.2
110.	ABD 94	0.48	135	20	26	49.73	17.33
111.	ABD 95	0.6	116.67	10.33	31.67	46.47	19
112.	ABD 96	0.52	127	14	29.33	47.13	18.73
113.	ABD 99	0.72	131.67	14.67	28.33	47.93	18.13
114.	ABD 100	0.46	125.67	14.67	30	45.53	17.4
115.	ABD 101	0.32	123	15	25.33	45.4	17.27
116.	ABD 102	0.42	114	18.33	25	41.73	12.8
117.	ABD 103	0.32	115.33	12.67	24.67	41.8	15.53
118.	ABD 104	0.66	83.33	10	23.33	36.13	11.8
119.	ABD 107	0.34	98.33	13.67	25.33	45.6	15.27
120.	ABD 109	0.38	106.67	13	29.33	46.67	18.73
121.	ABD 110	0.58	119.67	12.67	28.67	49	16.93
122.	ABD 111	0.42	105	13.33	25.67	41.6	14
123.	ABD 112	0.34	108.67	13	25	39.27	14.27
124.	ABD 113	0.72	114.33	12.67	27.67	42.53	16
125.	ABD 115	0.5	92.33	12	27.67	43.07	16.93
126.	ABD 116	0.14	44.33	11	2.27	29.07	9.93
127.	ABD 117	0.54	69	13	21.67	31.93	12.33
128.	ABD 118	0.54	98.67	14.33	22.33	33.93	15.87
129.	ABD 120	0.64	93.33	12.33	24.67	38.2	15.73
130.	ABD 121	0.54	68.33	10	21.67	36.73	14.8
131.	ABD 123	0.74	79	10.67	22.67	40.13	16.6
132.	ABD 124	0.82	91	12	22.33	41.33	12.67
133.	ABD 125	0.44	67.33	10	22.33	36.4	13.27
134.	ABD 127	0.46	90.67	15	21.67	36.4	14.4
135.	ABD 128	0.62	93.33	15	23.33	36.4	14.47

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
136.	ABD 130	0.42	93.33	14	20.33	32.13	14.07
137.	ABD 131	0.27	81.67	11.67	21	31.67	10.4
138.	ABD 132	0.50		13	3.92	46.04	17.76
139.	ABD 146	0.58	96.67	16	21	33.4	10.47
140.	ABD 152	0.64	93.33	15.67	20.33	26.67	11.07
141.	ArBD-4	0.62	98.33	14	23	27.27	11.2
142.	ArBD-5	0.42	93.33	14.67	18.67	34.6	12.87
143.	ArBD-7	0.3	92.33	13.33	20	32.2	12.2
144.	ArBD-8	0.28	76.67	10	20.67	35.8	15.27
145.	ArBD-9	0.34	80	14.33	20	26.67	10.07
146.	ArBD-32	0.32	96.67	16	19	35.73	13.13
147.	ArBD-33	0.32	93.33	14.33	20.67	34.2	13
148.	NyBD-3	0.12	66.67	12.67	17.67	30.47	11.4
149.	NyBD-4	0.1	71.00	11	3.36	48.60	18.88
150.	NyBD-5	0.16	109.00	15	4.20	45.52	17.88
151.	NyBD-56	0.12	98.00	10	2.92	37.29	13.96
152.	NyBD-59	0.14	84.00	12	4.28	46.44	18.04
153.	G.M. Koyali	0.15	64.00	11	3.64	39.04	13.68
154.	Line{34-30 x(A-119)2}103-6-1-40-22-34-26-35-22-25-2		76.00	12	3.56	44.56	16.28
155.	Line 543-41-12-14 (RPK type)		72.00	12	4.00	38.36	13.48
156.	Line-1-1		71.67	12	17	24.13	8.67
157.	Pilliu-37		80	12	18.67	25.6	10.13
158.	Line-169-119 (upper leaves long internode)		83.333	14.33	21	27.47	8.87
159.	B.S.P (Black Spangle parent)		93.33	12.67	19	27.07	9.33
160.	N.C.D. (Necrotic Crinkle Dwarf)		106.67	14	2.40	44.53	15.47
161.	Line 93-103-93 (88-47 x Sokh)	0.12	71.00	15	4.00	33.88	11.88
162.	Line 114-16 (Female parent of GT-4)	0.34	63.67	13	14.33	31.27	10.73
163.	Line 181-83-1 (S-20 xK-20)	0.54	100	14.67	89.33	37.47	16.4
164.	Line 132-2-2 {K-20 x Skh} x K-20	0.14	86.67	12.33	20.33	33.13	20.07
165.	Line 543-37-38-24 (A-119 x Olar)	0.1	90	14	19.33	29.67	10.47
166.	Line 121-13-27-29 (108-15 x Olar)	0.1	89.67	13	20.67	24.67	9.73
167.	ABD 10	0.12	66.67	12.67	16.67	24.13	9.13
168.	ABD 65	0.06	18.20	13	3.68	32.84	10.5
169.	ABD 66	0.2	101.67	14.67	22.67	31.33	14.53

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
170.	ABD 67	0.16	107	13.67	23.67	31.67	14
171.	ABD-101 (GABT-11)	0.14	90	12.33	24.33	32.67	12.8
172.	ABD 118	0.2	91.67	12.33	21	31.53	11.73
173.	C-11	0.12	88.33	15	23	32	13.13
174.	KL	0.42	101.67	15.33	24.33	36.13	14.67
175.	Oriental	0.52	95	15	24.67	41.27	17.07
176.	Xanthi	0.76	91.67	14	27.67	47.53	19.33
177.	Samsan	0.74	80	14.33	27.67	45.27	16.53
178.	Trabizonal	0.6	101.67	15.33	26	37.87	15.4
179.	Viswanath	0.69	93.33	14.33	26	50.6	19.87
180.	Sender patti special	0.96	108.33	13.67	26	43.07	109.33
181.	Bhagyalakshmi	0.84	105	20	21	38.07	15.67
182.	HDBRG-LP-2	1.02	106.67	17.67	21.67	39.93	16.27
183.	F-7-127	1.04	105	17.67	21.67	41.93	15
184.	Margadhan	0.74	101.67	16.33	24.33	39.6	16.67
185.	Bhagya	0.84	85	12.67	20.67	41.53	16.53
186.	320-2-30-28-18-I	0.54	81.67	13	20	39	14.67
187.	Jati Patti	0.56	90	14	22	37.27	14.0
188.	320-2-30-28-20-12	0.4	55	11.67	14.33	27.2	9.4
189.	16-12-21-106-4-26	0.8	85	12.67	21.67	45.13	29.8
190.	DWFC	0.46	80	13.33	22.67	65.6	15.4
191.	Thangam	0.68	90	14.33	23.67	37.47	15
192.	320-2-80-25-84-10-I	0.42	85	11.33	20	37.26	14.87
193.	Jati	0.52	82	14.33	19.67	32.2	12.13
194.	Kunkumarthi	0.42	76.67	11.67	22.67	31.47	11.07
195.	GT-5	0.5	100	14.33	27.33	36	16.33
196.	Vairam	0.76	98.33	15	30.33	41.13	18.53
197.	F-7-124	0.48	98.33	13.67	25.67	40	17.87
198.	NPN 63	0.72	93.33	11	26	38.53	16.27
199.	NPN 64	0.74	105	14	25	30.6	14.73
200.	NPN-65	0.68	98.33	13.67	22	40.67	15.6
201.	NPN 66	0.72	83.33	12.67	26.67	37.13	15.2
202.	NPN 73	0.76	96.67	15.67	22.67	31.2	11.2
203.	NPN 75	0.78	103.67	11.67	25.67	42.4	13.87
204.	NPN 81	0.7	114	10.33	27	34.07	13.33
205.	NPN 30	0.94	91.33	9.67	23.67	34.4	13.93
206.	A-428	0.7	103.33	12.67	20.67	29.4	12.13
207.	NBD 289	0.4	82.33	12.67	20	31.53	11.93
208.	NBD 290	0.46	105	14.67	23.33	30.33	11.47
209.	NyBD 55	0.72	97.67	12.67	25	34.53	12.87
210.	ABD 138	0.28	106.67	10.33	25.33	40.2	15.4
211.	ABD 151	0.58	91.67	10.33	22.33	24.73	8.87
212.	ArBD-39	0.44	94	12	22.33	29.87	11.6
213.	ArBD-40	0.68	76.33	12.67	20.33	41.2	15.53

S. No.	Entries	Yield / plot (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
214.	NBD 309	0.66	95.80	12	4.36	47.68	17.48
215.	NBD 312	0.6	94.33	11	21.67	30.8	10.6
216.	NBD 314	0.38	96.67	11.67	21	31.47	10.27
217.	NBD 300	0.4	106	10.33	25.33	35.13	13.67
218.	NBD 292	0.18	91.67	11.67	25.33	32.4	13.13
219.	NBD 302	0.32	95	10	22.67	31.6	13.53
220.	NBD 297	0.6	86.67	10.67	24.67	41.53	16.87
221.	NBD 315	0.18	90	10.67	29.67	44.53	17.33
222.	NBD 316	0.12	115	11	24.33	41.06	15.73
223.	NBD 317	0.12	115	12.67	26	38.13	15
224.	NBD 318	0.16	68.33	9.67	17.67	28.07	10.87
225.	NBD 319	0.12	98.80	19	4.96	42.52	19.08
226.	NBD 307	0.16	93.33	11.67	17	29.07	9.4
227.	NBD 308	0.12	97.40	12	4.88	45.04	17.60
228.	NBD 310	0.20	101.00	14	3.92	47.12	18.36
229.	NBD 311	0.12	99.00	12	4.48	45.96	17.80
230.	NBD 313	0.08	102.00	9	5.44	45.52	17.52
231.	ABD 145	0.14	28.33	3.33	6.67	9.6	3.13
232.	ABD 163	0.16	101.67	11.33	22.33	30.07	9.93
233.	ABD 167	0.16	80	8	15.67	32.6	12.8
234.	NBD 320	0.22	155	17	33.33	45.47	14.6
235.	NBD 321	0.18	94.00	21	4.20	47.04	18.44
236.	NBD 322	0.16	93.33	10	22.33	39.53	12.87
237.	NBD 323	0.36	103.33	12	23.67	35.13	10.67
238.	NBD 324	0.16	120	13	20.67	40.2	14.4
239.	NBD 325	0.38	50.33	6	11.67	19.33	6.47
240.	NBD 326	0.16	66.67	7	14.67	23.93	8.2
241.	NBD 327	0.2	80	9.67	16.33	25.87	9.27
242.	NBD 334	0.18	105.20	18	4.48	37.56	20.04
243.	ABD 164	0.16	93.00	20	3.40	46.20	18.20
244.	ABD 173	0.38	86.67	13	19.33	32.8	11
245.	ABD 174	0.2	72.33	10.67	14.33	29.67	9.6

Table 2 BDNBR 1: Screening of germplasm lines against diseases and pests under natural conditions during 2021-22

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
1	Keliu-20	0	0	0	0	0	2
2	Anand-23	0	0	0	0	0	1
3	Anand-119	1	1	0	0	0	1

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
4	Anand-2	1	0	0	1	0	2
5	GT-4	0	1	5	1	0	1
6	Kukumarthi	1	2	0	0	0	2
7	103-9-101	1	0	0	1	0	1
8	783-51	0	1	0	1	0	2
9	114-4 (RPK type)	1	0	0	0	0	1
10	Peschtere 28	0	1	0	0	0	2
11	S-20	1	0	0	1	0	2
12	S-12	1	0	0	1	0	1
13	S-112	0	1	0	0	0	1
14	Akol	0	0	0	1	0	1
15	Gundsurti	0	1	0	1	0	1
16	Kodani	0	0	0	1	0	2
17	V-54	0	1	0	0	0	2
18	Dumbara	0	0	0	1	0	1
19	Smyrna	0	0	0	0	0	2
20	Sanand local	0	0	0	0	0	2
21	Subhelav selection	1	0	0	1	0	1
22	Red Russion	1	1	0	0	0	1
23	Bankete A-1	0	0	0	1	0	2
24	V-58	1	1	0	0	0	2
25	Keliu-49	1	0	0	1	0	2
26	Pilliu-19	1	1	0	0	0	2
27	BL 4-2	1	1	0	0	0	2
28	103-9-101-28-31 (A-2 X Olor)	0	0	0	0	0	2
29	ABD-7	1	0	0	1	0	2
30	ABD-15	0	0	0	0	0	1
31	ABD-119	1	1	0	0	0	1
32	ABD-24	1	1	0	0	0	2
33	ABD-30	0	0	0	0	0	2
34	ABD-36	0	0	0	0	0	3
35	GT-9	1	1	0	0	0	2
36	TI-421	0	0	0	0	0	3
37	TI-525	0	0	0	0	0	1
38	KDH-959	0	0	0	0	0	2
39	Abirami	1	1	0	0	0	1
40	Jayalakshmi	0	0	0	0	0	2
41	575-28-110	0	0	0	0	0	1
42	GT-5	1	0	0	0	0	3

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
43	GT-7	1	0	0	0	0	2
44	NBD-119	0	0	0	0	0	2
45	NBD-239-2	0	0	0	0	0	4
46	NBD-257	0	0	0	0	0	2
47	NBD-259	0	0	0	0	0	3
48	NBD-260	1	1	0	0	0	2
49	NBD-239-4	1	0	0	1	0	3
50	NBD-209	0	0	0	0	0	3
51	NBD-122	0	0	0	0	0	2
52	NBD-261	1	1	0	0	0	1
53	K-20-Plule leaves	1	0	0	0	0	3
54	RPK-1-2	0	0	0	0	0	2
55	NBD - 48 – 1	2	0	0	0	0	2
56	22-10-1 (11-47-Sokha)	0	0	0	0	0	2
57	35 - 19 - 39 – 24	0	0	0	0	0	2
58	169-19-16 (88-47-Sokha)	0	0	0	0	0	3
59	SB -154	0	1	0	0	0	4
60	169-19-6 (88-47-Sokha)	1	1	0	0	0	3
61	A-1-11-65	0	0	0	0	0	3
62	169-2 (N & L)	1	1	0	0	0	2
63	Jhakhari Rampur	0	0	0	0	0	1
64	AKBT-03-02	0	0	0	1	0	3
65	ABT-10	0	0	0	0	0	3
66	Bhavyashree	0	0	0	0	0	3
67	NBD-43	1	0	0	0	0	4
68	NBD-53	0	1	0	0	0	3
69	NBD-57-1	0	0	0	0	0	2
70	NBD-71	0	1	0	0	0	3
71	NBD-80-1	1	1	0	0	0	3
72	NBD-80-2	0	0	0	0	0	3
73	NBD-85	0	0	0	1	0	4
74	NBD-95	0	1	0	0	0	2
75	NBD-111	1	1	0	0	0	2
76	NBD-115	0	0	0	0	0	3
77	NBD-136	1	0	0	0	0	3
78	NBD-154	0	0	0	0	0	2
79	NBD-155	1	1	0	0	0	2
80	NBD-159	0	1	0	0	0	2
81	NBD-164	1	1	0	0	0	2
82	NBD-236	0	1	0	0	0	1

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
83	NBD-271	0	1	0	0	0	2
84	NBD-276	1	1	0	0	0	2
85	NBD-277	0	0	0	0	0	3
86	ABD-43	1	0	0	0	0	2
87	ABD-46	1	1	0	1	0	3
88	ABD-50	0	0	0	0	0	3
89	ABD-51	1	1	0	0	0	3
90	ABD-52	0	0	0	0	0	3
91	ABD-54	1	0	0	0	0	3
92	ABD-60	0	1	0	0	0	3
93	ABD-61	0	0	0	0	0	3
94	ABD-62	0	1	0	0	0	2
95	ABD-67	0	0	0	0	0	1
96	ABD-68	1	0	0	0	0	2
97	ABD-69	1	1	0	0	0	1
98	ABD-70	0	1	0	0	0	2
99	ABD-71	1	1	0	0	0	3
100	ABD-72	0	0	0	0	0	3
101	ABD-73	1	1	0	0	0	2
102	ABD-77	1	0	0	0	0	3
103	ABD-78	0	1	0	0	0	1
104	ABD-79	1	1	0	0	0	2
105	ABD-84	0	2	0	0	0	2
106	ABD-87	1	2	0	0	0	3
107	ABD-90	2	1	0	0	0	1
108	ABD-91	1	0	0	0	0	2
109	ABD-92	1	1	0	0	0	2
110	ABD-94	0	1	0	0	0	2
111	ABD-95	1	2	0	0	0	1
112	ABD-96	2	0	0	0	0	1
113	ABD-99	1	1	0	0	0	1
114	ABD-100	0	0	0	0	0	3
115	ABD-101	1	1	0	0	0	2
116	ABD-102	0	1	0	0	0	2
117	ABD-103	1	1	0	0	0	2
118	ABD-104	0	1	0	0	0	1
119	ABD-107	1	0	0	0	0	1
120	ABD-109	1	1	0	0	0	1
121	ABD-110	0	0	0	1	0	3

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
122	ABD-111	1	0	0	1	0	3
123	ABD-112	1	1	0	0	0	3
124	ABD-113	0	1	0	0	0	3
125	ABD-115	0	0	0	0	0	2
126	ABD-116	1	1	0	0	0	1
127	ABD-117	1	0	0	0	0	2
128	ABD-118	1	1	0	0	0	1
129	ABD-120	1	1	0	0	0	4
130	ABD-121	0	0	0	0	0	1
131	ABD-123	1	1	0	0	0	3
132	ABD-124	1	1	0	0	0	3
133	ABD-125	1	1	0	0	0	2
134	ABD-127	1	1	0	0	0	1
135	ABD-128	1	1	0	0	0	3
136	ABD-130	1	0	0	0	0	4
137	ABD-131	1	1	0	0	0	3
138	ABD-132	1	0	0	0	0	3
139	ABD-146	0	0	0	0	0	2
140	ABD-152	1	0	0	0	0	1
141	ArBD-4	1	1	0	0	0	2
142	ArBD-5	0	0	0	0	0	4
143	ArBD-7	0	1	0	0	0	4
144	ArBD-8	1	0	0	0	0	2
145	ArBD-9	1	1	0	0	0	2
146	ArBD-32	1	0	0	0	0	1
147	ArBD-33	0	1	0	0	0	2
148	NyBD-3	0	1	0	0	0	1
149	NyBD-4	1	1	0	0	0	2
150	NyBD-5	0	0	0	0	0	3
151	NyBD-56	0	0	0	0	0	1
152	NyBD-59	1	1	0	0	0	3
153	G.M.Koyali	0	1	0	0	0	2
154	Line {34-30 X (A-119)2} 103-6-1-40	1	1	0	0	0	1
155	Line 543-41-12-14 (RPK type)	1	0	0	0	0	1
156	Line-1-1	0	1	0	0	0	1
157	Pilliu-37	1	1	0	0	0	3
158	Line-169-119 (Upper leaves long	1	0	0	0	0	3

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
159	Black Spangle Parent (B.S.P)	1	1	0	0	0	3
160	Necrotic Crinkle Dwarf (N.C.D)	1	0	0	0	0	3
161	Line 93-103-93 (88- 47 X Sokh)	0	0	0			4
162	Line 114-16 (Female parent of GT-4)	0	0	0	0	0	2
163	Line 181-83-1 (S-20 X K-20)	1	0	0	0	0	1
164	Line 134-2-2 {K-20 X Sokh} X K-20	0	0	0	0	0	3
165	Line 543-37-38-24 (A-119 X Olor)	1	0	0	0	0	2
166	Line 121-13-27-29 (108-15 X Olar)	0	0	0	0	0	4
167	ABD-10	0	1	0	0	0	1
168	ABD-65	1	0	0	0	0	2
169	ABD-66	0	1	0	0	0	1
170	ABD-67	0	0	0	0	0	3
171	ABD-101 (GABT-11)	0	1	0	0	0	2
172	ABD-118	1	1	0	0	0	4
173	C-11	1	0	0	1	0	2
174	KL	0	1	0	0	0	1
175	Oriental	0	1	0	0	0	2
176	Xanthi	1	1	0	0	0	3
177	Samsan	0	0	0	0	0	1
178	Trabizonal	1	2	0	0	0	2
179	Viswanath	0	0	0	0	0	2
180	Sender Patti Special	1	0	0	0	0	3
181	Bhagyalakshmi	1	1	0	0	0	3
182	HDBRG-LP-2	1	1	0	0	0	3
183	F7-127	1	0	0	0	0	2
184	Margadhan	0	1	0	0	0	3
185	Bhagya	1	1	0	0	0	1
186	320-2-30-28-18-I	0	0	0	0	0	3
187	Jati Patti	1	1	0	0	0	3
188	320-2-30-28-20-12	2	0	0	1	0	3
189	16-12-21-106-4-26	1	1	0	0	0	1
190	DWFC	1	1	0	0	0	2
191	Thangam	0	1	0	0	0	1
192	320-2-80-25-84-10-I	1	1	0	0	0	3

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
193	Jati	0	1	0	0	0	3
194	Kunkumarthi	0	1	0	0	0	3
195	GT-5	0	0	0	0	0	2
196	Vairam	0	1	0	0	0	2
197	F-7-124	0	0	0	0	0	2
198	NPN-63	1	2	0	0	0	3
199	NPN-64	0	0	0	0	0	2
200	NPN-65	1	0	0	1	0	2
201	NPN-66	0	1	0	0	0	1
202	NPN-73	1	1	0	0	0	3
203	NPN-75	1	1	0	0	0	3
204	NPN-81	0	0	0	0	0	3
205	NPN-30	0	2	0	0	0	3
206	A-428	0	0	0	0	0	3
207	NBD-289	0	1	0	0	0	2
208	NBD-290	1	1	0	0	0	3
209	NyBD-55	1	1	0	0	0	2
210	ABD-138	1	0	0	0	0	3
211	ABD-151	1	1	0	0	0	3
212	ArBD-39	1	0	0	0	0	2
213	ArBD-40	1	0	0	0	0	2
214	NBD-309	1	0	0	0	0	4
215	NBD-312	0	1	0	0	0	3
216	NBD-314	1	1	0	0	0	1
217	NBD-300	0	0	0	0	0	1
218	NBD-292	0	0	0	0	0	3
219	NBD-302	1	1	0	0	0	3
220	NBD-297	0	0	0	0	0	3
221	NBD-315	1	0	0	0	0	3
222	NBD-316	1	0	0	0	0	2
223	NBD-317	0	0	0	0	0	2
224	NBD-318	1	1	0	0	0	2
225	NBD-319	1	1	0	0	0	2
226	NBD-307	0	0	0	0	0	3
227	NBD-308	1	1	0	0	0	1
228	NBD-310	1	0	0	0	0	3
229	NBD-311	0	1	0	0	0	3
230	NBD-313	0	1	0	0	0	1
231	ABD-145	0	0	0	0	0	3

S. No.	Entries	Diseases					Pests
		Frog Eye Spot (0-5)	Brown Leaf Spot (0-5)	Leaf Curl (%)	Blank Shank (%)	TMV (%)	Aphids (0-5)
232	ABD-163	0	0	0	0	0	3
233	ABD-167	0	1	0	0	0	2
234	NBD-320	0	0	0	0	0	1
235	NBD-321	1	0	0	0	0	1
236	NBD-322	0	1	0	0	0	2
237	NBD-323	0	0	0	0	0	1
238	NBD-324	1	1	0	0	0	2
239	NBD-325	0	0	0	0	0	2
240	NBD-326	0	0	0	0	0	1
241	NBD 237	0	0	0	0	0	2
242	NBD 334	0	1	0	0	0	3
243	ABD 164	0	0	0	0	0	2
244	ABD 173	0	0	0	0	0	2
245	ABD 174	0	0	0	0	0	4

MAINTENANCE OF A/B LINES AND RELEASED VARIETIES

Objective :To maintain A lines & released varieties

Design : Non replicated, two lines of 10 plants each
Entries : 8 A lines and 8 varieties were maintained
Plot Size : 2×7.5 m

Results: Eight A lines and eight varieties were maintained

Table 1: Maintenance of A lines and released varieties

S. No.	A line	S. No.	Varieties
1.	MS A-119 × A-119	1.	A-119
2.	MS NBD-209 × NBD 209	2.	NBD-209
3.	MS Bhavyashree × Bhavyashree	3.	Bhavyashree
4.	MS Bhagyashree × Bhagyashree	4.	Bhagyashree
5.	MS Vedagandga-1 × Vedaganga-1	5.	Vedaganga-1
6.	MS A-2 × A-2	6.	A-2
7.	MS PL-5 × PL-5	7.	PL-5
8.	MS GT-5 × GT-5	8.	GT-5

NANDYAL

BDNyBRC 1.1: ADVANCED VARIETAL TRIAL-I ON *BIDI* TOBACCO

Year of Start: 2021-22

Design : R.B.D
Replications : Six
Plot size : 6.75 × 1.5 m
Spacing : 0.75 × 0.75 m
Entries : 2 entries + 2 Checks

Results

Two varieties are tested against two checks. ABD-211 recorded high cure leaf yield (2034 kg/ha) with yield advantage of 8% over best check Nandyal Pogaku-1 (1889 kg/ha).

Table 1 BDNyBRC 1.1: Morphological characters and yield and in AVT I (2021-22)

Entries	Days to 50% flowe-ring	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf thick-ness (mm)	Cured Leaf yield (kg/ ha)	% IOC (NP-1)
ABD 209	144	68.0	52.9	21.9	5.5	11.97	1834	-
ABD 211	146	87.5	52.1	21.2	6.5	12.74	2034	8
Nandyala Pogaku-1 (C)	124	84.5	45.8	18.9	7.8	12.10	1889	-
A-119 (C)	123	78.7	42.6	16.6	6.7	8.34	1284	-
GM	134	79.7	48.4	19.6	6.6	11.29	1760	
S.Em ±	0.76	5.68	2.20	1.28	0.54	0.66	69.69	
C.D. at 5%	2.30	NS	6.62	3.86	NS	1.97	210.08	
C.V. (%)	1.39	17.45	11.13	15.95	19.98	14.22	9.70	

BDNyBRC 1.2: ADVANCED VARIETAL TRIAL-II ON *BIDI* TOBACCO

Year of Start: 2020-21

Design : R.B.D
Replications : Four
Plot size : 6.75 × 1.5 m
Spacing : 0.75 × 0.75 m
Entries : 5 entries + 2 Checks

Results

Five entries along with two checks were evaluated. The entry ABD 196 (1964 kg/ha) and NyBD 63 (1926 kg/ha) recorded on par cure leaf yield with best check Nandyal Pogaku-1 (1924 kg/ha).

Based on **pooled data** for two years, NyBD-62 (1597 kg/ha) and ABD 196 (1577 kg/ha) recorded on par yield with best check Nandyal Pogaku-1 (1570 kg/ha).

Table 1 BDNyBRC 1.2: Morphological characters &leaf yield in AVT-II (2020-21)

Entries	Days to 50% flowering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf thick-ness (mm)	Cured Leaf yield (kg/ ha)	% IOC (NP-1)
NyBD 62	126	85.8	44.9	18.2	6.0	12.60	1920	-
NyBD 63	127	74.8	47.1	18.8	6.0	9.83	1926	-
ABD 196	130	85.5	44.8	17.2	7.0	9.93	1964	2
ABD 197	131	83.0	46.0	18.3	6.5	10.30	1884	-
ABD 199	132	92.5	43.7	17.0	7.3	10.55	1887	-
Nandyala Pogaku-1 (C)	124	90.8	47.0	18.3	7.5	10.85	1924	-
A-119 (C)	120	86.0	40.5	15.5	7.0	10.03	1436	-
GM	127	85.5	44.8	17.6	6.8	10.58	1849	
S.Em ±	0.67	2.93	1.60	0.91	0.52	0.85	74.35	
C.D. at 5%	1.99	8.70	NS	NS	NS	NS	220.9	
C.V. (%)	1.05	6.85	7.12	10.38	15.42	16.11	8.04	

Table 2 BDNyBR 1.2: Pooled data on cured leaf yield in AVT-II (2020-22)

Entries	Cured leaf yield (kg/ha)		Mean Cured leaf yield (kg/ha)
	2020-21	**2021-22**	
NyBD 62	1275	1920	1597
NyBD 63	1194	1926	1560
ABD 196	1189	1964	1577
ABD 197	1209	1884	1547
ABD 199	1214	1887	1550
Nandyala Pogaku-1 (C)	1215	1924	1570
A-119 (C)	1082	1436	1259
GM	1197	1849	1523
			Years × Entries
S.Em ±			65.67
C.D. at 5%			**202.43**

BDNyBRC 3.1: ADVANCED HYBRID TRIAL-I ON *BIDI* TOBACCO

Year of start: 2021-22

Design : RBD
Replications : Five
Plot size : 6.75 × 2.25 m
Spacing : 75 × 75 cm
Treatments : 2 Entries + 3 checks

Results

Two entries are tested along with three checks. The entries NyBTH-170 (2260 kg/ha) and NyBTH-171 (2223 kg/ha) have recorded higher cure leaf yield with an improvement of 10% and 8% when compared to the best check A-119 (2063 kg/ha). The trail will be forwarded for testing in **AHT-II** during 2022-23.

Table 1 BDNyBRC 3.1 : Morphological characters & cured leaf yield in AHT I (2021-22)

Entries	Days to 50% flowe-ring	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf thick-ness (mg/cm²)	Cured leaf yield (kg/ha)	% IOC
NyBTH-170	123	95.4	51.5	24.1	22.0	11.18	2260	10
NyBTH-171	123	90.4	59.4	27.5	8.2	10.48	2223	8
A119 (C)	121	99.2	51.4	23.0	7.8	11.58	2063	-
MRGTH 1 (C)	117	82.2	42.5	16.4	7.6	9.82	1577	-
Nandyal pogaku-1 (C)	131	103.6	58.2	25.6	7.0	12.06	1540	-
GM	123	94.2	52.6	23.3	10.5	11.024	1933	
S.Em ±	0.60	1.52	1.24	0.77	6.55	0.85	48.9	
C.D.@5%	1.79	4.56	3.73	2.30	NS	NS	146.7	
C.V%	1.09	3.61	5.29	7.37	139.21	17.31	5.7	

BDNyBRC 3.2: ADVANCED HYBRID TRIAL-II ON *BIDI* TOBACCO

Year of start: 2021-22

Design : RBD
Replications : Four
Plot size : 6.75 × 2.25 m
Spacing : 75 × 75 cm
Treatments : 3 Entries + 3 checks

Results

Three entries are tested along with three checks. The entries NyBTH-152 (2283 kg/ha), NyBTH-155 (2279 kg/ha) and NyBTH-157 (2267 kg/ha)) have recorded significantly higher cure leaf yield with increaseof 16%, 16% and 15% when compared to the best check MRGTH-1 (1973 kg/ha).

Based on thetwo years pooled data, NyBTH-157 (2140 kg/ha), NyBTH-155 (2119 kg/ha) and NyBT-152 (2058 Kg/ha) recorded significantly higher yield with increase of 39%, 38% and 34% respectively over best check MRGTH-1 (1534 kg/ha). The three entries will be forwarded to On-Farm Trail **(OFT)**testing during 2022-23.

Table 1 BDNyBRC 3.2: Morphological characters & cured leaf yield in AHT-II (2021-22)

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf thick-ness (mg/cm^2)	Cured leaf yield (kg/ha)	% IOC
NyBTH-152	124	95.2	56.6	23.3	5.3	12.18	2283	16
NyBTH-155	123	92.4	58.9	25.4	5.8	12.13	2279	16
NyBTH-157	124	91.8	56.3	24.6	7.3	10.90	2267	15
MRGTH-1 (C)	119	93.5	44.5	17.4	7.5	6.93	1973	
Nandyal pogaku-1 (C)	129	103.0	58.4	25.8	7.5	12.00	1630	
A119 (C)	118	100.9	49.5	22.6	6.5	10.20	1512	
GM	123	96.1	54.0	23.2	6.6	10.72	1991	
S.Em ±	1.10	3.30	1.85	1.24	0.89	0.85	86	
C.D.@5%	3.30	NS	5.59	3.75	NS	2.57	259.2	
C.V%	1.79	6.87	6.87	10.73	26.75	15.91	8.64	

Table 2 BDNyBR 3.2: Pooled data on cured leaf yield in AHT-II (2020-22)

Entries	Cured leaf yield (kg/ha)		Mean Cured leaf yield (kg/ha)	% Increase over check
	2020-21	2021-22		
NyBTH-152	2283	1833	2058*	34.15
NyBTH-155	2279	1959	2119*	38.13
NyBTH-157	2267	2012	2140*	39.50
MRGTH-1 (C)	1973	1095	**1534**	
Nandyal Pogaku-1 (C)	1630	1235	1432	
A-119 (C)	1512	1216	1364	
GM				
			Years × Entries	
S.Em ±			84.29	
C.D. at 5%			**265.09**	

BT: BULK TRIAL

Year of Start: 2020-21

Results

Five entries are tested against two checks. NBD-316 recorded on par yield (1518 kg/ha) with best check Nandyal Pogaku-1 (1477 kg/ha).

Table 1 BT: Bulk trial on *bidi* tobacco 2020-21

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf thick-ness (mm)	Cured leaf yield (kg/ ha)	% IOC (NP-1)
NBD-316	148	92.4	45.1	17.3	8	12.2	1518	3
ABD169	148	89.4	43.0	18.0	9	8.5	1365.50	-
ABD174	149	102.4	39.2	13.2	8	12.6	1336.35	-
ABD189	148	104.0	40.0	16.8	6	14.2	1293.60	-
NyBD-61	141	91.8	42.3	15.9	7	12.7	1353.05	-
Nandyala Pogaku-1 (C)	121	99.6	42.6	17.4	9	12.9	1476.80	-
A 119 (C)	124	87.0	38.4	14.5	9	9.5	1124.05	-

OFT: ON FARM TRIAL ON *BIDI* TOBACCO

Year of Start: 2021-22
Replications : Non replicated
Spacing : 0.75 m × 0.75 m
Plot size : 1000 m^2
Fertilizer :110N +70 P_2O_5 +50 K_2O kg/ha
Treatments : 3 Entries + 3 checks

Results

Three entries are tested against two checks. None of the entries performed better than the check variety A-119 (1349 kg/ha).

Table 1 OFT: On-farm trial on *bidi* tobacco 2021-22

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf thick-ness (mm)	Cured leaf yield (kg/ ha)
ABD 145	147	80.0	39.7	15.8	7	14.94	1232.86
NBD 289	124	103.8	43.1	17.6	6	9.82	1167.19
ABD 163	147	84.0	42.4	17.6	8	13.21	1020.57
Nandyala Pogaku-1 (C)	126	107.4	42.6	17.4	8	12.05	1289.00
A 119 (C)	125	84.2	36.8	15.2	7	6.58	1349.50

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

BDNyBR 4.1: STATION HYBRID TRIAL -I ON *BIDI* TOBACCO

Design : R.B.D Replications : Three
Plot size : 6.75 × 2.25 m Spacing : 0.75 × 0.75 m
Entries : 9 + 3 (C)

Results

Nine entries along with three checks, NyBTH 193, NyBTH 194, NyBTH 195, NyBTH 196, NyBTH 197, NyBTH 198, NyBTH 199, NyBTH 200, NyBTH 201 were evaluated. Out of nine entries, NyBTH-201 (2048 kg/ha) has recorded on par cured leaf yield with best check variety MRGTH-1 (2030 kg/ha). The trial will be tested as SHT-II during 2022-23

Table 1 BDNyBR 4.1: Station Hybrid trial –I on *bidi* tobacco 2021-22

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf Thick-ness (mm)	Cured leaf yield kg/ha
NyBTH-193	125	79.1	36.7	14.0	10.7	1905
NyBTH-194	127	84.8	41.2	15.5	11.0	1911
NyBTH-195	120	83.6	40.3	15.2	11.8	1822
NyBTH-196	129	80.0	41.8	16.9	11.6	1958
NyBTH-197	132	85.7	37.9	15.5	10.3	1988
NyBTH-198	130	85.9	40.1	16.8	10.7	1899
NyBTH-199	133	83.1	38.4	15.5	11.5	1934
NyBTH-200	132	71.9	41.1	15.4	11.3	2018
NyBTH -201	134	77.7	40.7	17.4	11.5	2048
Nandyala	122	92.5	46.3	18.5	13.7	1974

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf Thick-ness (mm)	Cured leaf yield kg/ha
Pogaku-1 (C)						
MRGTH-1 (C)	133	72.5	40.5	15.2	10.1	2030
A-119 (C)	132	76.9	38.1	13.5	10.4	1788
GM	129	81	40.3	15.8	11.2	1940
S.Em ±	1.17	3.29	1.46	0.72	0.43	52.4
C.D. at 5%	3.43	9.66	NS	2.12	1.27	153.69
C.V. (%)	1.58	6.86	6.4	8.01	6.76	4.74

BDNyBR 4.2: STATION HYBRID TRIAL -II ON *BIDI* TOBACCO

Design : R.B.D Replications : Two
Plot size : 6.75 × 2.25 m Spacing : 0.75 × 0.75 m
Entries : 12 + 3 (C)

Results

Twelve entries are tested against three checks. Out of twelve entries, NyBTH-183 (2122 kg/ha) and NyBTH-185 (2107 kg/ha) has recorded 10% and 9% yield inceasee over best check Nandyal Pogaku-1 (1931 kg/ha). Based on two years pooled data, **none of the entries**recorded significantly higher yield over best check Nandyal Pogaku-1 (1654 kg/ha).

Table 1 BDNyBR 4.1: Station Hybrid trial –II on *bidi* tobacco 2021-22

Entries	Days to 50% flowering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf Thickness (mm)	Cured leaf yield kg/ha	% IOC (NP-1)
NyBTH 181	128	62	44	17	11	1959	2
NyBTH 182	131	78	47	18	9	1995	3
NyBTH 183	134	76	45	17	10	2122	10
NyBTH 184	132	74	38	12	12	2004	4
NyBTH 185	134	80	38	12	12	2107	9
NyBTH 186	136	80	39	12	10	2027	5
NyBTH 187	133	73	40	14	10	1678	
NyBTH 188	133	61	41	14	12	1730	
NyBTH 189	131	62	39	14	12	2010	4
NyBTH 190	130	68	41	14	14	1757	
NyBTH 191	131	71	39	13	11	1711	
NyBTH 192	132	77	39	13	11	1715	
Nandyala Pogaku-1 (C)	122	87	42	14	12	1931	
MRGTH-1 (C)	132	62	40	14	11	1567	

Entries	Days to 50% flowering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf Thickness (mm)	Cured leaf yield kg/ha	% IOC (NP-1)
A-119 (C)	125	65	33	9	9	1528	
GM	131	71.8	40.4	13.9	11.2	1856	
S.Em ±	1.93	0.92	4.05	2.8	0.55	101.2	
C.D. at 5%	2.79	12.29	NS	3.05	1.67	307	
C.V. (%)	0.98	7.67	7.52	9.69	7.42	7.21	

Table 2 BDNyBR 4.2: Pooled data on cured yield in SHT-II (2020-22)

Entries	Cured leaf yield (kg/ha)		Mean Cured leaf yield (kg/ha)
	2020-21	**2021-22**	
NyBTH 181	1959	1233	1596
NyBTH 182	1995	1293	1644
NyBTH 183	2122	1393	1757
NyBTH 184	2004	1446	1725
NyBTH 185	2107	1482	1794
NyBTH 186	2027	1473	1750
NyBTH 187	1678	1456	1567
NyBTH 188	1730	1416	1573
NyBTH 189	2010	1466	1738
NyBTH 190	1757	1428	1592
NyBTH 191	1711	1421	1566
NyBTH 192	1715	1440	1578
Nandyala Pogaku-1 (C)	1931	1378	**1654**
MRGTH-1 (C)	1567	1241	1404
A-119 (C)	1528	1230	1379
GM	1856	1386	1621
	Years	**Entries**	**Years × Entries**
S.Em ±			77.25
C.D. at 5%			228.20

BDNyBR 4.3: OBSERVATIONAL VARIETAL TRIAL (OVT) ON *BIDI* TOBACCO

Design : R.B.D
Replications : Three
Plot size : 6.75 × 2.25 m
Spacing : 0.75 × 0.75 m
Fertilizer : 110 N + 70 P_2O_5 + 50 K_2O kg/ha
Entries : 10 + 2 (C)

Results

Ten entries are tested against two checks. Out of ten entries, NyBD 86 (2059 Kg/ha) has recorded 6% yield advantage over best check variety A 119 (1937 Kg/ha). The ten entries along with two checks *viz.*, NyBD 78, NyBD 79, NyBD 80, NyBD 81, NyBD 82, NyBD 83, NyBD 84, NyBD 85, NyBD 86, NyBD 87, Nandyal Pogaku-1(C) & A119(C) are subjected to be tested in SVT-I *bidi* trial in 2022-23.

Table 1 BDNyBR 4.3 : Morphological characters and cured yield in OVT on *bidi* tobacco 2021-22

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf Thick-ness (mm)	Cured leaf yield kg/ha	% IOC (NP-1)
NyBD-78	144	86.9	42.7	15.4	7.7	9.03	1960	1.2
NyBD-79	146	93.9	38.7	14.9	6.3	8.27	1353	
NyBD-80	142	83.0	39.6	15.6	5.7	9.53	1362	
NyBD-81	135	90.8	41.4	14.6	5.7	7.50	1716	
NyBD-82	139	81.8	38.6	15.1	5.3	9.13	1537	
NyBD-83	139	86.3	39.9	14.8	5.0	9.30	1726	
NyBD-84	144	78.3	44.1	19.3	5.0	10.10	1776	
NyBD-85	131	81.7	48.1	20.1	5.7	11.03	1940	
NyBD-86	134	73.9	44.1	16.1	5.3	11.33	2059	6.3
NyBD-87	138	74.7	46.2	19.8	5.3	10.50	1873	
Nandyala Pogaku-1 (C)	131	81.5	37.1	14.2	6.0	8.30	1490	
A-119 (C)	132	93.7	48.0	20.8	5.7	9.97	1937	
GM	138	83.9	42.4	16.7	5.7	9.50	1727	
S.Em ±	1.58	2.57	1.89	1.15	0.53	0.86	66.6	
C.D. at 5%	4.62	7.55	5.55	3.36	NS	NS	195.3	
C.V. (%)	1.98	5.32	7.74	11.88	15.93	15.66	7.06	

BDNyBR 4.4: PRELIMINARY YIELD TRIAL ON *BIDI* TOBACCO

Design : R.B.D
Replications : Three
Plot size : 6.75 × 2.25 m
Spacing : 0.75 × 0.75 m
Fertilizer : 110 N + 70 P_2O_5 + 50 K_2O kg/ha
Entries : 6 + 2 (C)

Results

Six entries are tested against two check varieties. None of the entries performed better than the best check variety Nandyal Pogaku-1 (1534 kg/ha).

Table 1 BDNyBR 4.4 : Morphological characters and cured yield in PYT on *bidi* tobacco 2021-22

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf Thick-ness (mm)	Cured leaf yield kg/ha
NyBD-72	140	75.0	41.5	18.3	7.7	10.70	1378
NyBD-73	142	74.0	48.7	21.2	8.7	9.57	1362
NyBD-74	142	83.3	43.0	15.2	6.7	9.93	1373
NyBD-75	141	66.3	39.9	14.2	5.7	10.40	1459
NyBD-76	143	78.1	39.3	14.1	5.3	9.97	1404
NyBD-77	143	83.5	42.9	15.9	6.7	9.17	1486
Nandyala Pogaku-1 (C)	128	86.6	47.1	18.7	8.0	10.60	1534
A-119 (C)	129	65.0	37.7	12.7	8.7	8.87	1333
GM	139	76.5	42.5	16.3	7.2	9.90	1416
S.Em ±	1.12	4.64	2.19	1.72	0.42	0.51	38.8
C.D. at 5%	3.39	14.09	6.64	5.22	1.29	NS	117.6
C.V. (%)	1.40	10.52	8.92	18.31	10.27	9.00	4.70

BDNyBR 4.5: ADVANCED YIELD TRIAL ON *BIDI* TOBACCO

Design : R.B.D
Replications : Three
Plot size : 6.75 × 2.25 m
Spacing : 0.75 × 0.75 m
Fertilizer : 110 N + 70 P_2O_5 + 50 K_2O kg/ha
Entries : 6 + 2 (C)

Results

Four entries are tested against two check varieties. NyBD-66 (2045 Kg/ha) has recorded on par yield with best check variety A 119 (2046 Kg/ha).

Table 1 BDNyBR 4.4 : Morphological characters and cured yield in PYT on *bidi* tobacco 2021-22

Entries	Days to 50% flow-ering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Spangle score	Leaf Thick-ness (mm)	Cured leaf yield kg/ha
NyBD-66	132	69.3	40.0	13.6	7.5	9.03	2045
NyBD-67	129	70.0	39.9	14.7	8.0	10.28	1801
NyBD-70	133	73.0	42.3	15.6	6.8	9.45	1927
NyBD-71	133	72.3	41.1	15.1	7.3	9.63	1919
Nandyala Pogaku-1 (C)	118	78.8	37.1	13.7	8.3	9.53	1462
A-119 (C)	120	92.3	49.2	18.3	7.5	10.38	2046
GM	127	75.9	41.6	15.1	7.5	9.71	1867
S.Em ±	1.25	3.45	1.88	0.84	0.51	0.66	69.1
C.D. at 5%	3.76	10.40	5.66	2.52	NS	NS	217.6
C.V. (%)	1.96	9.09	9.03	11.04	13.61	13.67	6.4

BDNyBR 5 : STUDY AND GENERATION OF BREEDING MATERIAL IN *BIDI* TOBACCO

BDNyBR 5.1 : New crosses made (Hybridization and study of segregating generations in *bidi* tobacco)

Objective: Drought tolerant with higher cured leaf yield and leaf quality

DOS: 03.08.2021 DOT: 30.09.2021

These six hybrids *viz.*, NyBTH-202, NyBTH-203, NyBTH-204, NyBTH-205, NyBTH-206, NyBTH-207, MRGTH-1(C), A-119(C) & Nandyal pogaku-1 (C) are subjected to test in SHT-I during 2022-23.

i) For development of *bidi* tobacco hybrids

S. No.	Crosses proposed	Objective
1.	CMS GT7 X ABD211	Drought tolerant higher cure leaf yield
2.	CMS GT7 X NyBD56	Drought tolerant higher cure leaf yield
3.	CMS GT4 X NyBD56	Higher cure leaf yield with good leaf quality
4.	CMS GT4 XABD211	Higher cure leaf yield with good leaf quality
5.	CMS A119XABD211	Higher cure leaf yield with good leaf quality
6.	CMS A119 XNyBD56	Higher cure leaf yield with good leaf quality

ii) For improvement of *bidi* tobacco varieties

S. No.	Crosses	Objective
1.	GT 7 X ABD 211	Drought tolerant higher cure leaf yield
2.	GT 7 X NyBD-56	Drought tolerant higher cure leaf yield
3.	GT 4 X NyBD-56	Higher cure leaf yield with good leaf quality
4.	GT 4 XABD-211	Higher cure leaf yield with good leaf quality
5.	A 119XABD-211	Higher cure leaf yield with good leaf quality
6.	A 119 XNyBD-56	Higher cure leaf yield with good leaf quality

BDNyBR 5.2: Evaluation of F_1 generation

DOS: 04.08.2021 DOT: 04.10.2021

$F_1 \rightarrow F_2$: 6 F_1 crosses were evaluated for leaf yield and other traits; these will be evaluated under F_2 generation during 2022-23.

S. No.	Crosses	Objective
1.	GT4 XABD-196	Drought tolerant higher cure leaf yield with less smoke toxicants
2.	GT4 XNyBD-62	
3.	GT7 X ABD-196	
4.	GT7 X NyBD-62	
5.	A119 XABD-196	
6.	A119 XNyBD-62	

BDNyBR 5.3: Evaluation of F_2 generation

Objective: Drought tolerant with high yielding and leaf quality

$F_2 \rightarrow F_3$: 6 F_2crosses were evaluated for leaf yield and other traits; these will be evaluated under F_3 generation during 2022-23. Four crosses A 119 × ABD 189, GT 7 × ABD 189, GT 7 × NBD 316 and GT 4 × ABD 189 are the best F_2s in *bidi* tobacco (based on physical appearance)

S.No	Crosses	Objective	No. of SPs
1	GT 4 × NBD 316	**Drought tolerant high yielding with good leaf quality**	4
2	GT 4 × ABD 189		5
3	GT 7 × NBD 316		6
4	GT 7 × ABD 189		6
5	A 119 × NBD 316		5
6	A 119 × ABD 189		4
	Total		**30**

BDNyBR 5.4: Evaluation of F_3 generation

Objective: Drought tolerant high yielding with good leaf quality

DOS: 06.08.2021 DOT: 05.10.2021

$F_3 \rightarrow F_4$: Six F_3*bidi* crosses were evaluated from 64 single progenies 28 superior single plants were selected and promoted to F4 generation during 2022-23.

S. No.	Crosses	No. of single progenies studied	No. of SPs
1	GT4XABD174	10	5
2	GT4XABD166	10	3
3	GT7XABD174	14	4
4	GT7XABD166	12	8
5	A119XABD174	8	3
6	A119XABD166	10	5
	Total	**64**	**28**

BDNyBR 5.5: Evaluation of F_4 generation

DOS: 06&.07-08-2021 DOT: 05&06-10.2021

Objective: Drought tolerant high yielding with good leaf quality

$F_4 \rightarrow F_5$: Eighteen F_4 *bidi* crosses were evaluated from 108 single progenies 86 superior single plants were selected and promoted to F_5generation during 2022-23.

S. No.	Cross	SPs studied	SPs	S. No.	Cross	SPs studied	SPs
1	GT 4 × ABD 145	9	8	**10**	GT 7 × ABD 119	7	6
2	GT 4 × ABD 163	6	5	**11**	GT 4 × ABD 132	4	2
3	GT 4 × ABD 167	6	5	**12**	GT 4 × NBD 289	6	4
4	A 119 × ABD 145	4	4	**13**	GT 4 × NBD 260	4	3
5	A 119 × ABD 163	6	5	**14**	GT 4 × ABD 119	7	5
6	A 119 × ABD 167	10	9	**15**	A 119 × ABD 132	4	3
7	GT 7 × ABD 132	4	2	**16**	A 119 × NBD 289	4	3
8	GT 7 × NBD 289	3	2	**17**	A 119 × NBD 260	4	4
9	GT 7 × NBD 260	12	10	**18**	A 119 × ABD 119	8	6
	Total					**108**	**86**

BDNyBR 5.6: Evaluation of F_5 generation (for development of varieties)

Objective: Drought tolerant, high cure leaf yield better smoking quality with profuse spangling.

DOS: 07.08.2021 DOT: 07.10.2021

$F_5 \rightarrow F_6$: 2 F_5 *bidi* crosses were evaluated from 35 single progenies 23 superior single plants were selected and promoted to F_6 generation during 2022-23.

S.No.	Cross Combination	Objective	SPs studied	SPs selected
1.	ABD 132 × ABD 65	**Drought tolerant, low suckering habit, higher yield**	25	15
2.	NBD 289 × ABD 138		10	8
	Total		**35**	**23**

BDNyBR 5.7: F_6 Generation (for development of varieties)

Objective: Drought tolerant, high cure leaf yield better smoking quality with profuse spangling.

DOS: 07.08.2021 DOT: 08 & 09.10.2021

F_6→SVT-I: In F_6 generation, 15 single plant progenies were evaluated during 2021-22. Twenty seven uniform bulks were selected and to be evaluated in SVT -I during 2022-23.

Crosses	Objectives	No. of Progenies studied	Uniform bulks
ABD 146 x ArBD-32	**Drought tolerant, higher cure leaf yield better smoking quality with profuse spangling.**	2	4
ABD 146 x NyBD-56		4	3
ABD 146 x ArBD-33		2	5
NyBD 56 x ArBD-32		2	4
ArBD 32 x ArBD-33		1	3
NyBD 56x ABD-146		3	4
ArBD 32 x ABD-146		1	4
	Total	**15**	**27**

BDNyBR 6: EVALUATION OF NEWLY DEVELOPED *BIDI* TOBACCO GENOTYPES FOR SEED OIL

Year of start: 2018-19
Replications: Three
Plot size: 6.75 × 2.25 m

Design: RBD
Treatments: Entries 6 + 2 checks
Spacing: 75 ×75 cm

Results

This trial was evaluated from 2018-19 to 2020-2021.Based on 3 years mean yield data there is no significant seed yield (560 kg/ha) and oil% (29-31%) recorded.The oil analysis process is also difficult as it costs Rs.500/- per each sample and analysis was done at AAU, Biotechnology Lab. Based on the above observations this trial was not continued during 2021-22.

BDNyBR 1: COLLECTION, EVALUATION ANDMAINTENANCE OF *BIDI* TOBACCO GERMPLASM

New germplasm lines received from different centers are being evaluated and already existing germplasm lines were maintained once in 2 years. During *kharif* 2020-21, 64 *bidi* tobacco germplasm lines were evaluated.

Design : Non replicated rows
No. of entries: 59
Plot size : Each entry in one row of 9 m length.
Spacing : 75 × 75 cm
Fertilizer :110N + $70P_2O_5$ + 50 K_2O kg/ha

Results

One thirty six *bidi* tobacco germplasm lines were maintained. During *kharif* 2021-22, Out of which 59 bidi tobacco germplasm lines are evaluated. Data pertaining to the characters i.e. Days to 50% flowering:114 days (Nandyal Pogaku-1) to 158 days (ABD-228), inter-nodal length:range 2-3 cm; leaf length: 48 cm (NyBD-87, ABD-196) to 75 cm (NyBTH-171), leaf width: 13.2 cm (NyBD-87) to 32 cm (NyBTH-171, NyBTH-157, NyBD-85, NyBTH-155, ABD-132): Suckering habit: low (21 entries), medium (21 entries) and high (34 entries); plant height: 85 cm (ABD-228) to 132 cm (NyBD-62); leaf thickness (mg/cm2): 7.09 (NyBD-3) to 13.41 (NyBTH-152); leaf colour: light green to dark green, leaf shape: lanceolate, oblong and ovate; Gummyness: low (10 entries), medium (63 entries) and high (3 entries); days to maturity: 142 days (GT 4) to 188 days (ABD-228) and cured leaf yield per plant (g/pl.):52.5 (NyBD-73) to 91 (NyBTH-152)were observed and furnished in the Table 1 to 2 BDNyBR 1.

Table 1 BDNyBR1: Character ranges of *bidi* tobacco germplasm lines during 2021-22

S. No.	Entries	Days to flowe-ring	P.ht (cm)	LL (cm)	LW (cm)	Spangle score	LT (mg/ cm^2)	Suck-ering habit	RWC (%)
1.	NyBTH-171	118	110	75.0	32.0	4	11.65	Low	69.00
2.	NyBTH-170	118	108	68.0	30.0	6	10.35	High	79.00
3.	NyBD-75	120	100	53.0	14.6	7	9.85	Medium	59.00
4.	NyBD-87	121	102	48.0	13.2	7	10.90	High	59.00
5.	NyBD-73	114	98	55.0	15.0	8	11.40	High	61.00
6.	ABD-209	137	90	56.0	22.0	8	14.32	High	71.00
7.	NyBTH-152	119	120	55.0	22.0	8	13.41	High	69.00
8.	NyBD-86	117	110	67.0	30.0	7	12.45	High	69.00
9.	NyBD-76	117	115	55.0	22.0	7	9.25	High	43.00
10.	NyBTH-157	119	130	69.0	32.0	6	12.25	High	67.00
11.	NyBD-60	119	95	56.0	24.0	6	10.20	Low	68.00
12.	NyBD-56	117	110	62.0	30.0	8	12.63	High	73.00
13.	NyBD-62	119	125	58.0	25.0	6	11.37	High	75.00

S. No.	Entries	Days to flowe-ring	P.ht (cm)	LL (cm)	LW (cm)	Spangle score	LT (mg/ cm^2)	Suck-ering habit	RWC (%)
14.	NyBD-63	119	120	62.0	30.0	6	10.32	High	63.00
15.	NyBD-61	127	110	52.0	17.0	7	8.25	Low	74.00
16.	ABD-169	131	108	58.0	20.0	7	10.35	Low	71.00
17.	NyBD-62	129	132	55.0	22.0	8	11.20	Medium	76.00
18.	ABD-196	142	98	48.0	19.0	8	10.25	Medium	74.00
19.	NyBD-68	125	99	55.0	20.0	7	10.80	High	72.00
20.	ABD-197	131	110	62.0	18.0	6	9.32	High	72.00
21.	ABD-189	132	113	58.0	22.0	8	10.25	High	70.00
22.	NyBD-63	127	120	62.0	25.0	7	12.30	High	73.00
23.	ABD-211	153	96	65.0	30.0	6	13.25	High	72.00
24.	NyBD-85	142	105	70.0	32.0	6	10.22	High	79.00
25.	ABD-226	155	103	58.0	21.0	6	10.95	Low	80.00
26.	NyBD-72	142	110	70.0	28.0	6	9.14	Medium	70.00
27.	NyBD-74	144	108	72.0	30.0	6	9.52	Medium	88.00
28.	ABD-199	145	105	60.0	27.0	5	10.32	High	66.00
29.	ABD-228	158	85	62.0	26.0	7	9.86	Low	68.00
30.	NyBD-69	134	112	65.0	30.0	6	10.72	Medium	73.00
31.	NBD-316	145	105	58.0	24.0	8	9.82	Medium	70.00
32.	NyBTH-155	121	125	72.0	32.0	4	12.25	Low	65.00
33.	NyBD-76	127	99	58.0	22.0	6	10.32	Medium	73.00
34.	ABD-229	135	127	72.0	26.0	7	11.34	Medium	68.00
35.	NyBD-69	129	88	55.0	18.0	8	10.45	High	67.00
36.	NyBD-68	131	98	65.0	30.0	6	10.32	High	62.00
37.	NyBD-77	132	110	58.0	22.0	7	10.65	High	69.00
38.	NyBD-66	139	104	62.0	29.0	8	9.65	High	69.00
39.	NyBD-67	138	109	61.0	25.0	6	8.47	High	72.00
40.	ABD-145	143	97	59.0	25.0	8	10.45	High	64.00
41.	ABD-163	145	110	58.0	22.0	7	11.42	High	65.00
42.	NBD-289	137	129	60.0	28.0	6	10.45	High	62.00
43.	NyBD-82	143	120	58.0	25.0	8	10.73	Medium	76.00
44.	NyBD-83	141	122	55.0	20.0	8	10.82	Medium	75.00
45.	ABD-132	156	214	72.0	32.0	7	10.35	Low	72.00
46.	NyBD-84	142	128	65.0	25.0	7	11.03	Medium	77.00
47.	NyBD-81	144	129	58.0	26.0	6	11.05	Medium	70.00
48.	NyBD-78	145	135	60.0	30.0	6	10.72	Medium	65.00
49.	NyBD-79	141	128	59.0	23.0	6	10.84	High	64.00
50.	NyBD-80	144	140	58.0	25.0	7	11.02	High	76.00
51.	ABD-174	137	152	64.0	30.0	7	10.26	High	71.00
52.	NyBD-3	145	110	52.0	25.0	9	7.09	High	82.00
53.	BURLEY	119	120	58.0	22.0	5	9.45	Low	70.00
54.	GT-4	144	89	52.0	17.0	4	9.55	Low	66.00
55.	GT-5	145	95	55.0	18.0	5	8.25	High	56.00
56.	GT-7	128	100	58.0	18.0	4	9.20	High	48.00
57.	Nandyal Pogaku-1 (C)	114	112	55.0	22.0	5	13.15	High	77.00
58.	A119 (C)	144	89	52.0	17.0	5	9.55	Low	66.00
59.	MRGTH-1	143	108	60.0	21.0	5	9.53	Medium	71.00

Table 2 BDNyBR1: Morphological characters and cured leaf yield of *bidi* tobacco Germplasm lines during 2021-22

Entries	Inter-nodal length (cm)	Leaf colour	Leaf shape	Gummyness	Economic leaf number	No. of Days to Maturity	Root length (cm)	Cured Leaf yield (g/pl.)
NyBTH-171	3	Dark Green	Lanceo late	Medium	22	148	31.5	86.5
NyBTH-170	3	Green	Lanceolate	Medium	20	148	28.0	87.6
NyBD-75	3	Green	Lanceolate	Medium	28	150	10.9	53.5
NyBD-87	2	Green	Lanceolate	Medium	28	151	38.0	74.5
NyBD-73	3	Green	Lanceolate	Medium	27	144	42.0	52.5
ABD-209	3	Green	Lanceolate	Medium	25	167	40.0	73.2
NyBTH-152	4	Green	Lanceolate	Medium	32	149	39.0	91.0
NyBD-86	2	Green	Ovate	Low	28	147	33.0	82.5
NyBD-76	3	Green	Ovate	Low	27	147	35.0	56.0
NyBTH-157	3	Green	Ovate	Medium	18	146	40.0	90.5
NyBD-60	3	Green	Oblong	Low	28	149	43.0	70.5
NyBD-56	3	Green	Oblong	Low	21	146	40.0	78.0
NyBD-62	2	Green	Oblong	Medium	24	147	42.0	89.5
NyBD-63	2	Green	Oblong	High	17	149	39.0	71.5
NyBD-61	2	Green	Oblong	Low	20	160	32.0	72.5
ABD-169	2	Green	Oblong	Low	22	145	35.0	88.5
NyBD-62	4	Green	Oblong	Medium	26	160	30.0	72.5
ABD-196	2	Green	Oblong	High	27	162	29.0	78.6
NyBD-68	3	Green	Oblong	Medium	17	147	25.0	80.5
ABD-197	3	Green	Oblong	Medium	28	180	28.0	75.2
ABD-189	3	Green	Oblong	Medium	28	160	30.0	66.5
NyBD-63	4	Green	Oblong	Medium	23	160	32.0	76.5
ABD-211	3	Green	Ovate	Medium	24	180	40.0	81.5

Entries	Inter-nodal length (cm)	Leaf colour	Leaf shape	Gummyness	Economic leaf number	No. of Days to Maturity	Root length (cm)	Cured Leaf yield (g/pl.)
NyBD-85	2	Green	Ovate	Medium	25	162	38.0	78.0
ABD-226	2	Green	Ovate	Medium	33	164	42.0	85.5
NyBD-72	4	Green	Ovate	Medium	16	165	39.0	64.5
NyBD-74	3	Green	Ovate	Medium	22	166	35.0	58.2
ABD-199	2	Green	Ovate	Medium	27	165	30.0	76.5
ABD-228	3	Green	Ovate	Medium	26	188	27.0	85.2
NyBD-69	3	Green	Ovate	Medium	14	164	31.0	68.5
NBD-316	3	Green	Oblong	Medium	27	165	40.0	78.5
NyBTH-155	3	Green	Oblong	Medium	24	151	28.0	85.5
NyBD-76	2	Green	Oblong	Medium	18	157	25.0	65.0
ABD-229	3	Green	Oblong	Medium	24	170	39.0	86.0
NyBD-69	2	Green	Oblong	Medium	16	152	45.0	60.8
NyBD-68	3	Green	Oblong	Medium	22	155	38.0	59.5
NyBD-77	3	Green	Oblong	Medium	23	158	25.0	59.5
NyBD-66	4	Green	Oblong	Medium	23	152	28.0	81.5
NyBD-67	2	Green	Oblong	Medium	24	147	34.0	73.5
ABD-145	2	Green	Oblong	Medium	22	153	38.0	90.5
ABD-163	2	Green	Oblong	Medium	27	165	36.0	85.5
NBD-289	3	Green	Oblong	Medium	24	160	37.0	90.5
NyBD-82	2	Green	Oblong	Medium	22	153	34.0	61.5
NyBD-83	3	Green	Lanceolate	Medium	23	155	32.0	68.5
ABD-132	2	Green	Lanceolate	Medium	25	186	29.0	75.0
NyBD-84	3	Green	Lanceolate	Medium	22	160	36.0	71.5
NyBD-81	2	Green	Lanceolate	Medium	24	155	42.0	68.5
NyBD-78	2	Green	Lanceolate	Medium	24	155	42.0	68.5
NyBD-79	3	Green	Lanceolate	Medium	26	164	40.0	71.5

Entries	Inter-nodal length (cm)	Leaf colour	Leaf shape	Gummyness	Economic leaf number	No. of Days to Maturity	Root length (cm)	Cured Leaf yield (g/pl.)
NyBD-80	2	Green	Lanceolate	Medium	23	150	45.0	65.0
ABD-174	2	Green	Lanceolate	Medium	28	157	48.0	56.5
NyBD-3	2	Green	Lanceolate	Medium	24	167	44.0	78.5
BURLEY	2	Light Green	Lanceolate	Medium	26	149	30.0	59.5
GT-4	2	Green	Lanceolate	Medium	22	142	39.5	60.2
GT-5	3	Green	Lanceolate	Medium	20	150	30.5	58.5
GT-7	2	Green	Lanceolate	Medium	22	152	35.0	62.0
Nandyal Pogaku-1 (C)	2	Green	Oblong	Medium	26	144	45.0	84.2
A119 (C)	2	Green	Lanceolate	Medium	20	154	42.0	60.5
MRGTH-1	2	Green	Oblong	Medium	23	168	32.0	63.5

C.*NATU/PIKKA* TOBACCO

NANDYAL

NTNyBR1: COLLECTION, EVALUATION ANDMAINTENANCE OF *NATU* TOBACCO GERMPLASM

Design : Non replicated rows
Plot size : Each entry in one row of 7m length
Spacing :70 × 70 cm
Fertilizer :40N + 50 P_2O_5 + 50K_2O

Results

Seventy six*natu* tobacco germplasm lines were maintained. During kharif 2021-22, 17 natu tobacco germplasm lines are evaluated. Data pertaining to the characters i.e. Days to 50% flowering: 112 days (NyNT-94) to 139 days (WAF); inter nodal length-42 cm (NyNT- 64) to 72 cm (Bhairavi); 13.2 cm (NyNT-92) to 30 cm (NyNT-94); Suckering habit – 89 cm (NyNT-65) to 132 cm (Bhairavi); leaf thickness (mg/cm2) – 7.35 (NG-50) to 12.25 (II 1870); days to maturity –142 days (NyNT -94) to 165 (Bhairavi) and cured leaf yield per plant (g/pl.) – 45.5 (NyNT- 89) to 80 (WAF)were observed and furnished in the Table 1to 2NTNyBR 1.

Table 1 NTNyBR 1: Data on morphological characters during 2021-22

Entries	Days to flowe-ring	Plant height (cm)	LL (cm)	LW (cm)	Span gle score	LT (mg/ cm^2)	Suck-ering Habit	RWC %
NyNT94 (NG64XNG61)	112	118	69.0	30.0	6	10.25	High	69.00
NG.50	135	110	63.0	20.0	8	7.35	M	86.00
K-20	121	128	56.0	20.0	8	10.25	M	80.00
NyNT-65	135	89	58.0	22.0	6	10.20	Low	68.00
II-1870	127	92	54.0	20.0	5	12.25	Low	75.00
NyNY-64	115	95	42.0	15.5	7	11.85	Low	65.00
LINE-372	125	93	65.0	28.0	6	10.50	Low	65.00
ll-1872	119	110	53.0	21.0	6	10.25	M	69.00
NyNT-88	131	122	60.0	24.0	5	9.73	M	74.00
NyNT-91	134	110	65.0	15.5	6	9.85	Low	70.00
NyNT-89	129	105	52.0	16.0	8	9.55	Low	70.00
NyNT-93	132	110	55.0	14.0	7	8.63	Low	79.00
NyNT-92	131	115	62.0	13.2	6	8.72	Low	71.00
NyNT-70	142	106	60.0	15.0	9	10.56	M	71.00
WAF	139	106	58.0	22.0	7	8.49	Low	71.00
Kommipaduvi thanam	125	110	49.0	14.6	4	10.20	Low	68.00
Bhairavi	135	132	72.0	18.0	5	9.85	M	69.00

Table 2 NTNyBR 1: Data on characteristics and yield during 2021-22

S.No.	Entries	Inter-nodal length (cm)	Leaf colour	Leaf shape	Gummyness	Economic leaf number	No.of Days to Maturity	Root length (cm)	Cured Leaf yield (g/pl.)
1.	NyNT- 94 (NG64XNG61)	4	Light Green	Oblong	Medium	20	142	42.0	68.0
2.	NG.50	2	Green	Lanceolate	Medium	28	155	42.0	72.0
3.	K-20	3	Light Green	Lanceolate	Low	30	151	38.0	60.2
4.	NyNT- 65	4	Dark Green	Lanceolate	Low	23	155	39.0	72.5
5.	II-1870	3	Light Green	Lanceolate	Medium	15	157	40.0	68.5
6.	NyNY- 64	3	Green	Oblong	Low	21	146	40.0	78.0
7.	LINE-372	3	Green	Oblong	Medium	24	157	28.0	70.0
8.	II -1872	3	Light Green	Lanceolate	Medium	20	149	32.0	66.0
9.	NyNT- 88	3	Green	Oblong	Low	25	161	38.0	46.5
10.	NyNT- 91	3	Green	Oblong	Medium	26	164	28.0	68.5
11.	NyNT- 89	3	Green	Oblong	Medium	25	159	27.0	45.5
12.	NyNT- 93	3	Green	Oblong	Medium	16	150	30.0	49.5
13.	NyNT- 92	3	Green	Oblong	Medium	23	151	32.0	46.5
14.	NyNT-70	2	Green	Oblong	Medium	22	152	35.0	77.5
15.	WAF	3	Green	Lanceolate	Medium	26	155	48.0	80.0
16.	Kommipaduvitha nam	3	Light Green	Lanceolate	High	15	152	28.0	58.2
17.	Bhairavi	2	Green	Oblong	Medium	26	165	35.0	58.5

NTNyBR 4.5: ADVANCED YIELD TRIAL-II ON *NATU* TOBACCO

Advanced Yield Trial-I on *Natu* Tobacco was not promoted to AYT-II during 2021-22. Due to low chemical quality and lower cured leaf yield improvement 6.8% than check Bhairavi

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

NTNyBR 5.1: New crosses made (Hybridization and study of segregating generations in *Natu* tobacco)

DOS: 03.08.2021 DOT: 30.09.2021

During 2021-22, the following new crosses were made for the improvement of *natu* tobacco varieties.

S.No.	Crosses	Objective
1	Bhairavi X Line 361	Drought tolerant higher cured leaf yield
2	Bhairavi X NG 50	

NTNyBR 5.2: F_1 Generation

DOS: 04-07.08.2021 DOT: 04-09.10.2021

$F_1 \rightarrow F_2$: 2 F_1 crosses were evaluated for leaf yield and other traits; these entries will be evaluated under F_2 generation during 2022-23.

S.No.	Crosses	Objective
1	Bhairavi X Peddavittanam	High yielding drought tolerant with good quality
2	Bhairavi X Natunoonepalli	

NTNyBR 5.3: F_2 Generation ($F_2 \rightarrow F_3$)

S. No.	Cross combination	Objective
1.	Bhairavi X Kavali	Drought tolerant high yielding varieties
2.	Bhairavi X Natuparchur	

NTNyBR 5.4: Evaluation of F_3 generation

$F_3 \rightarrow F_4$: During 2021-22, 35 superior single plant progenies of two natutobacco crosses were evaluated under F_3 generation. 11 superior single plantswere selected and to be evaluated during 2022-23.

S. No.	F_3 Crosses	Objective	No. of progenies studied	No. of SPs
1.	Bhairavi ×WAF	Drought tolerant high yielder	20	5
2.	Bhairavi ×Natu spl.		15	6
	Total		**35**	**11**

NTNyBR 5.5: Evaluation of F_4 generation

$F_4 \rightarrow F_5$: During 2021-22, 21 progenies of 2 crosses were evaluated under F4 generation. 11 superior single plantswere selected and to be evaluated during 2022-23.

F_4 Crosses	Objective	No. of progenies studied	No. of uniform bulks
Bhairavi x KFC	Drought tolerant, high yielder	12	5
Bhairavi x Talmariaku		9	6
Total		**21**	**11**

NTNyBR 5.6: Evaluation of F_5 generation

$F_5 \rightarrow F_6$:During 2021-22, 16 single plant progenies of 2 natu tobacco crosses were evaluated under F_5 generation. 11 superior single plantswere selected and to be evaluated during F_6 in 2022-23.

S. No	Cross combination	Objective	Progenies studied	No. of uniform bulks
1	NGP89 X Ongole		8	6
2	Talmariaku X KFC		8	5
	Total		**16**	**11**

NTNyBR 5.7: Evaluation of F_6 generation

In F_6 generation, 16 progenies evaluated during 2021-22. 32 uniform bulkswere selected. The entries namely, NyNT 94, NyNT 95, NyNT 96, NyNT 97, NyNT 98, NyNT 99, NyNT 100, NyNT 101, NyNT 102, Bhairavi (C)are going to be evaluatedin SVT-1 natuduring 2022-23.

S. No	Cross combination	Objective	Progenies studied	No. of uniform bulks
1.	Natukavali x Kommipaduvithanam	Higher cured leaf yield potential, good leaf quality & within the range of chemical parameters.	2	3
2.	II1068 x Bhairavi		2	4
3.	II 1873 xBhairavi		2	4
4.	Bhairavi x Kommipaduvithanam		2	5
5.	NGP-87 x Line-61		3	4
6.	Kawali x natuparchuru		2	5
7.	Chebrolu x Yelamanchali		1	4
8.	Narasaraopeta x Tokaaku farm		2	3
	Total		**16**	**32**

BERHAMPUR

PBBR 2: COLLECTION, EVALUATION AND MAINTENANCE OF INDIGENOUS *PIKKA* TOBACCO GERMPLASM

Objective: To collect, evaluate and maintain tobacco germplasm for future use.

Results

One hundred twelve genotypes were maintained for future breeding programme.

PBBR 5: BULK EVALUATION TRIAL (BET) ON *PIKKA* TOBACCO

Objective: To evaluate superior *pikka* tobacco genotypes selected from Replicated Yield Trial (RYT) in larger plots for on farm testing or MLT.

Year of start	: 2021-22	Year of completion	: 2022-23
Treatment	: 3+1 (C)	Plot size	: 22.5 × 5.0 m
Spacing	: 75 × 50 cm		
Manurial schedule	: Fertilizer dose N:P:K :: 80:40:40 kg/ha.		

Results

A bulk trial was conducted during 2021 at AINPT, Berhampur with three entries *viz.* NF-4-27-3, NF-4-20-2 and NF-4-10-2 and one local check variety (Gajapati) for cured leaf yield and yield attributing 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 BET 2021 are given in Table PBBR 1. Differences observed for all characters. Topped plant height ranged from 61.0 cm (NF 4-27-3) to 70.3 cm (NF 4-20-2) signifying that NF 4-20-2 was the tallest genotype and NF 4-27-3 was the shortest genotype among test entries. Genotype NF 4-10-2 and check variety Gajapati exhibited plant height of 62.5 and 65.7 cm respectively. Maximum leaf number (15.2) and minimum leaf number (13.4) were expressed by genotype NF 4-20-2 and check variety Gajapati. Other two genotypes had higher leaf number than check variety Gajapati.Maximum leaf length (61.3 cm) as expressed by NF 4-27-3 followed by NF 4-10-2 (57.0 cm), NF 4-20-2 (56.1 cm) and check variety Gajapati (54.3 cm). All test entries exhibited higher leaf width than check variety Gajapati (20.3 cm). Among the treatments, cured leaf yield was higher in NF 4-27-3 (1322 kg/ha) followed by NF 4-20-2 (1192 kg/ha)and NF-4-10-2 (1137 kg /ha) with an increase of 24.4, 12.1 and 7% higher than check variety Gajapati (1063 kg /ha). NF4-27-3 exhibited higher leaf length (61.3 cm) and leaf breadth (25.5 cm) and NF 4-20-2 expressed higher number of leaves / plant (15.2).

Conclusion: This trial may be repeated for second year in 2022-23 for valid conclusion.

Table 1 PBBR 5: Data on morphological characters of *pikka* tobacco genotypes in BET 2021*kharif* season

Treatments	Topped plant height (cm)	No. of leaves / plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
NF-4-27-3	61.0	14.5	61.3	25.5	1322	24.4
NF-4-20-2	70.3	15.2	56.1	24.8	1192	12.1
NF-4-10-2	62.5	13.7	57.0	21.7	1137	7.0
Gajapati (C)	65.7	13.4	54.3	20.3	1063	

PBBR 8: YIELD EVALUATION TRIAL IN *PIKKA* TOBACCO

Objective: To evaluate promising genotypes in Yield Evaluation Trial (YET) for selection of superior genotypes for further testing in Replicated Yield Trial (RYT)

Year of start : 2021-22
Year of completion : 2022-23

Design : RBD Replications : Two
Plot size : 5.0×3.75 m Spacing : 75 × 50 cm
Treatment : 20+2 (c)
Manurial schedule : a) Fertilizer dose N: P: K:: 80:40:40 kg/ha.

Results

Twenty pikka tobacco genotypes along with two check varieties, Gajapati and JP Local were evaluated during 2021 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 2021 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 59.0 cm (WAF) to 117.5 cm (II 1068), the average being 83.7 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 9.7 (Kawali) to 21.8 (Chebrolu) with an average of 16.1. Fourteen genotypes (Chebrolu, , II 1068, II 1873, KFC, Line 61, Narasaraopeta, Natunoonepalli, Natuparacheru, Natu Special, NG 61, NG 64, Ongole, PottiVittanam and Talmariaku) expressed significantly more leaf numbers / plant than check variety Gajapati (12.8). Leaf length is another economically important character which has significant contribution to cured leaf yield. Leaf length ranged from 24.1 cm (Kawali) to 60.8 cm (II 1068) with a mean value of 48.5 cm. Ten genotypes (II 1068, II 1873, Kawali, KFC, Natuparacheru, Natu Special, NG-

64, NGP-89, Ongole, Potti Vittanam and Talmariaku) were found significantly superior in leaf length over check variety Gajapati (42.7 cm). Leaf width of test entries ranged from 7.1 cm (Chebrolu) to 21.9 cm (II 1068) with an average value of 14.6 cm. Six genotypes (Kommipadu vittanam, II 1068, II 1873, Kawali, NG 61, and WAF) exhibited significantly higher leaf breadth than check variety Gajapati (15.2 cm). Cured leaf yield of the test entries ranged from 587 kg/ha (Kawali) to 1464 kg/ha (NGP 89) with a mean value of 1200 kg/ha. . Twelve genotypes (NGP 89 (1464 kg/ha), II 1068 (1424 kg/ha), KFC (1413 kg/ha), II 1873 (1404 kg/ha), Kommipadu vittanam (1386 kg/ha), NG 61 (1376 kg/ha), Natu Special (1366 kg/ha), Bhairavi (1339 kg/ha), WAF (1332 kg/ha), Natu Noonepalli (1331 kg/ha), Ongole (1256 kg/ha) and Line 61(1254 kg/ha) recorded significantly higher cured leaf yield than check variety Gajapati (1097 kg/ha). These twelve genotypes showed yield advantage of 14.3% (Line 61) to 33.5% (NGP 89) over the check variety Gajapati. Cured leaf yield of genotypes Bhairavi, Kommipadu vittanam, II 1068, II 1873, KFC, Natunoonepalli, Natu Special and NG 61 were statistically at par with top yielding genotype NGP 89(1464 kg/ha).

Conclusion: This trial may be repeated for second year in 2022-23 for valid conclusion.

Table 1 PBBR 8: Data on morphological characters and pooled cured leaf yield of *pikka* tobacco genotypes in YET (2021)

Treatments	Topped plant height (cm)	No. of leaves / plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
Bhairavi	95.6	14.0	41.5	16.3	1339*	22.1
Chebrolu	82.4	21.8*	49.1	7.1	1139	
Kommipadu vittanam	102.7	13.6	39.5	21.8*	1386*	26.3
II 1068	117.5	17.6*	60.8*	21.9*	1424*	29.8
II 1873	97.1	16.5*	58.2*	19.3*	1404*	28.0
KFC	80.2	17.2*	56.2*	13.1	1413*	28.8
Line 61	85.1	17.8*	46.4	9.2	1254*	14.3
Narasaraopeta	88.9	20.2*	49.5	9.1	1189	
Natu Noonepalli	81.3	16.7*	48.0	14.3	1331*	21.3
Natuparacheru	83.7	17.2*	52.3*	14.6	976	
Natu Special	96.2	20.3*	52.9*	13.2	1366*	24.5
NG-61	91.4	17.2*	43.1	19.5*	1376*	25.4
NG-64	78.2	17.8*	51.6*	10.9	1154	
NGP-89	79.8	15.5	51.4*	18.8*	1464*	33.5
Ongole	73.1	16.7*	53.8*	13.2	1256*	14.5
Pedavittanam	69.6	15.1	50.0	14.3	938	
Pottivittanam	79.6	16.3*	56.3*	12.4	968	
Talmariaku	80.6	16.5*	54.0*	12.7	1007	
Kawali	93.3	9.7	24.1	11.3	587	
WAF	59.0	12.4	44.0	18.5*	1332*	21.4
GAJAPATI (C)	59.8	12.8	42.7	15.2	1097	

Treatments	Topped plant height (cm)	No. of leaves / plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
JP LOCAL(C)	66.2	12.4	41.1	15.0	997	
GM	83.7	16.1	48.5	14.6	1200	
S.Em ±	5.31	1.0	2.9	1.1	53.1	
C.D. at 5%	15.60	2.9	8.5	3.1	156.1	
C.V. (%)	8.97	8.6	8.4	10.2	6.3	

PBBR 9: REPLICATED YIELD TRIAL IN *PIKKA* TOBACCO

Objective: To evaluate some superior *pikka* tobacco genotypes selected from Yield Evaluation Trial (YET) and to select some promising lines for Bulk Evaluation Test (BET).

Year of start : 2021-22
Year of completion : 2022-23
Treatment : 5+1 (C)
Fertilizer dose N:P:K :: 80:40:40 kg/ha.

Design : RBD
Replications : Three
Plot size : 5.0 × 3.0 m
Spacing : 75 × 50 cm

Results

Five genotypes of *pikka* tobacco along with one check variety Gajapati were evaluated during 2021, in RBD with four replications for cured leaf yield and ancillary characters *viz.,* 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 RYT-2021 (Table 1 PBBR 9). Test entries differed significantly for cured leaf yield and yield attributing characters such as topped plant height (cm), no. of leaves / plant, leaf length (cm) and leaf width (cm). (Table PBBR 2). Topped plant height ranged from 62.1cm (Rayala (Ankreddy Palam)) to 100.8 cm (Natu Noonepalli) reflecting that genotype Rayala (Ankreddy Palam had shortest plant height and genotype NatuNoonepalli was the tallest plant among all tested genotypes. NatuNoonepalli ,NatuYelamanchali and NatuAnkapalli expressed significantly higher Topped plant height than check variety Gajapati (80.4 cm). NatuNoonepalli and NatuYelamanchali showed significantly higher number of leaves/ plant than check variety Gajapati (14.1). All genotypes except Rayala (AnkreddyPalam) exhibited significantly higher leaf length than check variety Gajapati (47.7 cm). Among test entries, three entries namely 1072 – IT,NatuAnkapalli and NatuYelamanchali had significantly higher leaf width than check variety Gajapati (16.0 cm).

Genotypes 1072–IT,NatuYelamanchali, NatuNoonepalliandNatuAnkapallirecorded significantly higher cured leaf yield of 1368 and 1353 kg/ha respectively over check variety Gajapati (1105 kg/ha). Genotypes 1072 – IT, Natu Yelamanchali, Natu Noonepalliand Natu Ankapalli expressed yield advantages of 23.8, 22.4, 14.9 and 13% respectively over check variety Gajapati. Yield superiority of genotype 1072–IT and Natu Ankapalli were as due to significantly higher leaf length and leaf width whereas yield superiority of Natu Yelamanchali was due to significantly higher number of leaves per plant, leaf length and leaf width. Higher cured leaf yield of Natu Noonepalli may be attributed to higher leaf number and leaf length.

Conclusion: This trial may be repeated for second year in 2022-23 for valid conclusion.

Table 1 PBBR 9: Data on morphological characters and pooled cured leaf yield of *pikka* tobaccogenotypes in RYT 2021 *kharif* season

Genotype	Topped plant height (cm)	No. of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
Rayala (Ankreddy Palam)	62.1	14.1	46.0	15.5	1226	
NatuNoonepalli	100.8	15.7*	51.7*	16.7	1270*	14.9
1072 – IT	89.3	14.0	52.5*	18.4*	1368*	23.8
NatuAnkapalli	97.3	13.7	51.8*	18.0*	1249*	13.0
NatuYelamanchali	100.3	16.0*	52.7*	18.0*	1353*	22.4
Gajapati (C)	80.4	14.1	47.7	16.0	1105	
Mean	88.3	14.6	50.4	17.1	1262	
S.Em ±	3.7	0.5	1.3	0.6	46.3	
C.D. at 5%	11.3	1.5	3.9	1.9	139.5	
C.V. (%)	8.5	7.0	5.1	7.5	7.3	

PBBR 11: EXPLORATORY TRIAL ON TOBACCO

Objective: To evaluate *Rustica* and *Jati* tobacco varieties under Odisha condition.

Year of start : 2020-21
Year of completion : 2021-22

Design : Unreplicated
Treatment : *Rustica* (4 varieties) and *Jati* (3 varieties)
Spacing : 60× 50 cm(*Rustica*) and 75 × 50 cm (Jati)
Manurial schedule : Fertilizer dose *Jati* and *Rustica* N:P:K :: 100:50:50 kg/ha

Observation recorded

1. Cured leaf yield (kg/ha)

Results

***Rustica* tobacco:** During 2021-22, cured leaf yield of *rustica* tobacco varieties ranged from 1480 kg/ha (GC 1) to 1664 kg/ha (DCT 4). All four varieties namely DCT 4 (1664 kg/ha), GCT 2 (1647 kg/ha), GCT 3 (1566 kg/ha) and GC 1 (1480 kg/ha) with more than 1400 kg /ha cured leaf yield were found promising(**Table 1 PBBR11**).*Rustica* varieties Torsa, DD-437, Dharla and Bitri were not included in the trial as their performance during 2020-21, was not satisfactory under Odisha condition.Two years pooled results revealed that among four *rustica* varieties DCT 4 recorded maximum cured leaf yield of 1841 kg/ha followed by GCT 2 (1804 kg/ha) and GCT 3 (1694 kg/ha). *Rustica* variety GC 1 produced lowest cured leaf yield of 1530 kg/ha. Since all four varieties produced cured leaf yield of more than 1500 kg/ha, their performance was satisfactory under Odisha condition.

***Jati* tobacco:** All three varieties of jati tobacco were produced cured leaf yield more than 1400 kg/ha and found promising **Table 1 PBBR 11.** Among three varieties, Manasi recorded 1672 kg/ha cured leaf yield followed by Chama (1504 kg/ha) and Podali (1456 kg/ha).It was revealed from two years pooled results that among three *Jati* varieties Manasi recorded maximum cured leaf yield of 1855 kg/ha followed by Chama (1646 kg/ha) and Podali (1574 kg/ha). Since all three varieties produced cured leaf yield of more than 1500 kg/ha, their performance was satisfactory under Odisha condition.

***Bidi* tobacco:** Among four *bidi* tobacco tested during 2020-21, Performance of Vedaganga-1 and GT 7 was satisfactory. However, there was very little demand of *bidi* tobacco in the local market, therefore they were not included in the experiment.

Conclusion: *Rustica* and *Jati* tobacco's performance was satisfactory under Odisha condition

Table 1 PBBR 11: Pooled data on cured leaf yield of different tobacco types

Type of tobacco	Variety	Cured Leaf yield (kg/ha)			Rank
		2020	**2021**	**Mean**	
Rustica	GCT 2	1961	1647	1804	II
Rustica	GC 1	1579	1480	1530	
Rustica	DCT 4	2017	1664	1841	I
Rustica	GCT 3	1821	1566	1694	III
Jati	CHAMA	1787	1504	1646	II
Jati	Manasi	2037	1672	1855	I
Jati	PODALI	1692	1456	1574	III

PBBR 12: MULTI LOCATION TRIAL IN *PIKKA* TOBACCO

Objective: To evaluate promising genotypes indifferent locations for Yield and yield attributing characters and identify suitability for general cultivation

Year of start : 2021-22
Year of completion : 2022-23
Design : RBD
Replications : Five
Plot size : 5.0 × 3.75 m
Spacing : 75 × 50 cm
Treatment : 2+2 (C)
Fertilizer dose N:P:K: 80:40:40 kg/ha.

Results

Two promising pikka tobacco genotypes (BPT 7 and BPT 50) along with two check varieties, Gajapati and JP Local were evaluated at three locations namely CPR, Berhampur, RRTTS Semiliguda and RRTTSS Jeyporeduring 2021 in RBD with five 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 2021 are given in Table 1 to 4 PBBR 12.

Genotype BPT 7 exhibited significantly higher leaf number (14.8), leaf length (60.7 cm) leaf width (26.3 cm) and cured leaf yield (1195 kg/ha) than check variety Gajapati (13.2, 53.4 cm, 22.9 cm and 999kg/ha respectively) at Berhampur. This entry also showed significant increase over check variety Gajapati in leaf number, leaf width and cured leaf yield at Semiliguda, Jeypore and location pooled. Genotype BPT 50 showed significantly higher cured leaf yield than check variety Gajapati at all locations and in pooled result. It also had significantly higher leaf number at all locations and pooled data except Jeypore. Leaf width was found significantly higher at Semiliguda and Jeypore locations. BPT 7 expressed 19.6, 23.3, 21.1 and 21.3% higher cured leaf yield at Berhampur, Semiliguda, Jeypore station and pooled locations respectively than check varietyGajapati. Similarly BPT 50exhibited 12.7, 17.3, 15.0 and 15.0 percent higher cured leaf yield at Berhampur, Semiliguda, Jeypore station and pooled locations respectively than check variety, Gajapati.

Conclusion: This trial may be repeated for second year in 2022-23 for valid conclusion and as per requirement of SVRC.

Table 1 PBBR 12 : Cured leaf yield and ancillary characters of *pikka* tobacco genotypes in MLT 2021 at Berhampur

Genotype	Topped plant height (cm)	No. of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
BPT-7	88.8	**14.8***	**60.7***	**26.3***	**1195***	**19.6**
BPT-50	99.9	**14.6***	53.4	21.7	**1126***	**12.7**
GAJAPATI (C)	76.4	13.2	53.4	22.9	999	
JP LOCAL(C)	83.0	12.3	51.4	22.5	931	
GM	87.0	13.7	54.7	23.3	1063	
S.Em ±	4.5	0.4	1.3	1.0	38.1	
C.D. at 5%	13.8	1.2	3.9	3.1	117.4	
C.V. (%)	11.5	6.6	5.1	9.6	8.0	

Table 2 PBBR 12: Cured leaf yield and ancillary characters of *pikka* tobacco genotypes in MLT 2021 at Semiliguda

Genotype	Topped plant height (cm)	No. of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
BPT-7	113	**12***	48.34	**16***	**1238***	23.3
BPT-50	157	**10***	46.82	**15***	**1178***	17.3
GAJAPATI (C)	141	8	47.50	13	1004	
JP LOCAL(C)	120	7	46.12	15	962	
GM	133	9	47.2	15	1095	
S.Em ±	2.9	0.5	1.5	0.4	49.84	
C.D. at 5%	9	1.6	4.7	1.1	153.55	
C.V. (%)	4.9	11.9	7.3	5.4	10.17	

Table 3 PBBR 12: Cured leaf yield and ancillary characters of pikka tobacco genotypes in MLT 2021 at Jeypore

Genotype	Topped plant height (cm)	No. of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
BPT-7	115	13.0*	45.9	**16.4***	**1204***	21.1
BPT-50	160	11.4	40.2	**14.5***	**1143***	15.0
GAJAPATI (C)	143	9.6	47.2	13.1	994	
JP LOCAL(C)	123	8.6	43.7	15.2	917	
GM	135	10.7	44.2	14.8	1065	
S.Em ±	2.9	0.7	0.8	0.4	43.78	
C.D. at 5%	9.0	2.3	2.4	1.1	134.89	
C.V. (%)	4.8	15.5	3.9	5.4	9.20	

Table 4 PBBR 12 : Cured leaf yield and ancillary characters of pikka tobacco genotypes in MLT 2021 (Pooled)

Genotype	Topped plant height (cm)	No. of leaves/ plant	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)	% increase over check
BPT-7	105.8	**18.3***	51.7	**19.7***	**1212***	21.3
BPT-50	138.8	**17.8***	46.8	16.9	**1149***	15.0
GAJAPATI (C)	120.1	15.4	48.7	16.2	999	
JP LOCAL(C)	108.6	15.0	47.8	17.8	937	
GM	118.3	16.6	48.7	17.7	1074.	
S.Em ±	3.53	0.80	1.23	0.65	44.17	
C.D. at 5%	10.11	2.28	3.52	1.85	126.67	
C.V. (%)	6.66	10.71	5.64	8.19	9.19	

PBBR 13: MORPHOLOGICAL CHARACTERISATION IN *PIKKA* TOBACCO

Objective: To study the diversity pattern among twenty genotypes collected from AINPT Nandyal and to identify genotypically divergent parents for hybridization programme

Year of start : 2021-22
Year of completion : 2023-24

Design : RBD
Replications : Three
Plot size : 5.0 × 1.5 m
Spacing : 75 × 50 cm
Treatment : 20+2 (C)
Fertilizer dose N:P:K : 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 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 characters exhibited medium to high phenotypic variability.

Table 1 PBBR 12: Ancillary characters of *pikka* tobacco genotypes in MLT 2021 at Berhampur

Parameter	Range		
Plant Habit (cm)	1.Erect (2): (II 1068, NGP 89)	2.Semi erect (7): (Natu Noonepalli, NG 64)	3.Open (13): (KFC, Chebrolu)
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)
Gummyness	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): (NatuNoonepalli, KFC)	
Leaf margin	1.Wavy (8): Gajapati, PottiVithanam)	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): (Kommipaduvithanam, II 1068)	2.Open (7) : (KFC, NatuNoonepalli)	3.Branched (4):(Natu Special, NG- 61)
Flower colour	1.Pink (21): (Chebrolu, 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

RESULTS OF INCIDENCE ON INSECT AND PESTS

PBEN 2: REACTION OF PROMISING *PIKKA* TOBACCO GENOTYPES TO MAJOR INSECTS PESTS UNDER NATURAL CONDITION

Objective: To assess the response of promising pikka tobacco genotypes to major insects pests under natural condition

Year of start : 2021-22
Year of completion : 2021-22

Design : RBD
Replications : Three
Plot size : 5.0 × 1.5 m
Spacing : 75 × 50 cm
Treatment : 9+1 (C)

Observations recorded:

1. Percentage of aphid infested plants.
2. Percentage of leaves damaged by Spodoptera larvae
3. Cured leaf yield (kg/ha)

Results

Nine genotypes of *pikka* tobacco along with one check variety Gajapati were evaluated during *kharif* -2021, in RBD with three replications to assess the response of promising *pikka* tobacco genotypes to major insects pests (*Spodoptera* and aphid)and cured leaf yield (kg/ha)under natural condition. Data onpercentage of leaves damaged by *Spodoptera* larvae and cured leaf yield are given in Table PBEN 2. Aphid pest load was very low during 2021-22 crop season. Twenty six plots out of 30 plots (ten treatments * three replications) were completely aphids free. Therefore, aphid infestation information was not taken into consideration for discussion.

During 2021-22 crop season, lowest leaf damaged by Spodoptera larvae was expressed by three genotypes BPT 39, BPT 50 and NF 4-10-2 (11.2 % each) followed by BPT 49 (11.4%), BPT 7 (11.5), and NF 4-27-3 (11.6%) and NF 4-20-2 (12.3%) indicating less *Spodoptera* larvae infestation than check variety Gajapati 13.8%). All entries except NF-4-18-3 were found at par with check variety Gajapati for *Spodoptera* infestation and showed moderately resistant reaction. However, significantlyhigher leaf infestation by *Spodoptera* larvae was shown by genotype NF 4-18-3 (26.6 %) reflecting most susceptible genotype among all treatments. Under natural conditions*i.e.,* without application of pesticides, it was found that NF 4-20-2 recorded significantly higher cured leaf yield of 1099 kg/ha followed by BPT-50 (1064 kg/ha), BPT-7 (1057 kg/ha), and NF 4-27-3 (1007 kg/ha) exhibiting more yielding potential than check variety Gajapati (893 kg/ha). Other genotypes namely BPT 49 (973 kg/ha) and BPT-39 (928 kg/ha)were found at par with check variety Gajapati indicatingsimilar yield potential with check variety Gajapati.

Two years pooled data revealed that genotype NF-4-27-3 expressed lowest *Spodoptera* leaf infestation (12.4%) followed by BPT-50(14.6%), NF-4-20-2 (14.7%), BPT-49(15.2%) and BPT-7 (15.3%) and expressed moderately resistant (10-15% damage) reaction to *Spodoptera* infestation. On the other hand, check variety Gajapati, NF-4-2-3, NF-4-10-2, NF-4-18-3 and BPT-39 showed moderately susceptible reaction (16 to 20% leaf damage) to *Spodoptera*. Two years pooled data revealed that genotypes NF-4-20-2 (1222 kg/ha), NF-4-27-3 (1193 kg/ha), BPT-50 (1178 kg/ha), BPT-7 (1177 kg/ha) produced significantly higher cured leaf yield than check variety Gajapati (986 kg/ha) under natural condition.

Conclusion: Two years trial revealed that under natural conditions *i.e.,* without application of pesticides,*pikka* tobacco genotypes NF-4-20-2 (1222 kg/ha), NF-4-27-3 (1193 kg/ha), BPT-50 (1178 kg/ha), BPT-7 (1177 kg/ha) produced significantly higher cured leaf yield than check variety Gajapati (986 kg/ha) and also expressed lower *Spodoptera*infestation (12.4 to 15.3%) than check variety Gajapati(16.9%) thereby found promising.

Table PBEN 2: Leaf damage by *Spodoptera* on *pikka* tobacco under natural condition. (Out of 60 plants)

Genotypes	Percentage of leaves damaged by *Spodoptera* larvae						Cured leaf yield (Kg/ha		
	2020-21		2021-22		Pooled		2020-21	2021-22	Pooled
BPT 7	19.0	(4.4)	11.5	(3.2)	15.3	(3.8)	1296	1057	1177
BPT 39	28.3	(5.4)	11.2	(3.3)	19.8	(4.3)	1211	928	1070
BPT 49	19.0	(4.4)	11.4	(3.2)	15.2	(3.8)	1049	973	1011
BPT 50	18.0.	(4.3)	11.2	(3.0)	14.6	(3.6)	1291	1064	1178
NF-4-2-3	19.3	(4.4)	14.2	(3.8)	16.7	(4.1)	1296	769	1033
NF-4-10-2	23.7	(4.9)	11.2	(3.4)	17.5	(4.2)	1141	867	1004
NF-4-18-3	19.0	(4.4)	26.6	(5.2)	18.0	(4.8)	1275	835	1055
NF-4-20-2	17.0	(4.2)	12.3	(3.1)	14.7	(3.7)	1345	1099	1222
NF-4-27-3	13.3	(3.7)	11.6	(3.0)	12.4	(3.4)	1379	1007	1193
GAJAPATI (C)	20.0	(4.5)	13.8	(3.3)	16.9	(3.9)	1079	893	986
GM	19.7	(4.5)	13.5	(3.45)	16.1	(3.96)	1236	941	1093
S.Em ±	1.52	(0.17)	2.7	(0.5)	1.7	(0.2)	66.13	32.7	30.1
C.D. at 5%	4.53	(0.5)	7.9	(1.5)	4.9	(0.6)	196.45	97.3	86.4
C.V. (%)	13.4	(6.5)	34.2	(25.2)			9.3	6.0	

Figures in parenthesis are squre root transformed values

PBEN 3: REACTION OF YET GENOTYPES TO MAJOR INSECTS PESTS UNDER NATURAL CONDITION

Objective: To assess the response of promising *pikka* tobacco genotypes to major insects pests under natural condition

Year of start : 2021-22
Year of completion : 2021-22

Design : RBD
Replications : Two
Plot size : 5.0 × 1.5 m
Spacing : 75 × 50 cm
Treatment : 20+2 (C)

Observations recorded:

1. Percentage of aphid infested plants.
2. Percentage of leaves damaged by Spodoptera larvae
3. Cured leaf yield (kg/ha)

Results

Twenty genotypes of *pikka* tobacco along with two check varieties Gajapatiand JP local were evaluated during *kharif* -2021 to assess their response to major insects pests under natural condition. The trial was laid out in RBD with two replications..Data on percentage of leaves damaged by *Spodoptera* larvae and cured leaf yield (kg/ha)are given in Table PBEN 3. Aphid pest load was very low during 2021-22 crop season. Thirty five plots out of 44 plots (twenty two treatments * two replications) were completely aphids free. Therefore, aphid infestation information was not taken into consideration for discussion.During 2021-22 crop season, lowest percentage of leaf damaged by *Spodoptera* larvae was expressed bygenotypes NatuNoonepalli, Line 61 (6.2% each), followed by JP local (6.5%), Narasraopeta (6.7%), Bhairavi, NG-64 (7.0% each), Kommipaduvittanam (7.3%), II 1068 (7.5%), Peddavittanam (8.0%), and Natuparacheru (8.6%)where as 18.7% leaf damage showed by check variety Gajapati. These above mentioned genotypes showed moderate resistant to *Spodoptera.* However, significantly higher leaf infestation by *Spodoptera* larvae was shown by genotype WAF (31.9%) reflecting most susceptible genotype among test entries.

Under natural condition i.e., without application of pesticides, it was found thatKFC recorded significantly higher cured leaf yield of 1214 kg/ha followed by NGP 89 (1156 kg/ha), Natu special (1152 kg/ha), II 1068 (1150 kg/ha), NatuNoonepalli (1132 kg/ha) NG 61 (1131 kg/ha) and WAF (1057 kg/ha) exhibiting better yield potential than check variety Gajapati (907 kg/ha). Other genotypes namely Bhairavi(1026 kg/ha), II 1873 (996 kg/ha), KommipaduVittanam (982 kg/ha), Line 61, NatuOngole(each 970 kg/ha), NG 64 (957 kg/ha)and Narasaraopeta (950kg/ha) were found at par with check variety Gajapati indicating similar yield potential with check variety Gajapati.

Conclusion: It was revealed from this trial that under natural condition i.e., without application of pesticides,*pikka* tobacco genotypes NGP 89(1156 kg/ha),II 1068 (1150 kg/ha) and NatuNoonepalli (1132 kg/ha) were found promising due to their significantly higher yield potential and lower percentage of leaves damage (6.2 to 12.8%) by *Spodoptera* larvae than check variety Gajapati(907 kg/ha). Since this is first year trial, this may be repeated one more year for confirmation

Table PBEN 3: Leaf damage by *Spodoptera* on *pikka* tobacco under natural condition (Out of 40 plants)

Genotypes	Percentage of leaves damaged by *Spodoptera* larvae	Cured leaf yield (kg/ha)
Bhairavi	7.0	1026
Chebroli	15.4	872
Kommipaduvittanam	7.3	982
II 1068	7.5	1150
II 1873	13.0	996
KFC	19.1	1214
Line 61	6.2	970
NarasaraoPeta	6.7	950
NatuNoonepalli	6.2	1132
Natuparacheru	8.6	782
Natu Special	12.0	1152
NG-61	21.5	1131
NG-64	7.0	957
NGP-89	12.8	1156
NatuOngole	11.9	970
PedaVittanam	8.0	756
PottiVittanam	14.4	739
Talamariaku	12.0	702
Kawali	18.6	909
WAF	31.9	1057
GAJAPATI (C)	18.7	907
JP LOCAL(C)	6.5	789
GM	12.4	968
S.Em ±	4.0	47.0
C.D. at 5%	11.8	138.1
C.V. (%)	45.9	6.9

PBPP 2: REACTION OF PROMISING PIKKA TOBACCO GENOTYPES TO MAJOR DISEASES UNDER NATURAL CONDITION

Objective: To assess the response of promisingpikka tobacco genotypes to major diseases under natural condition

Year of start : 2021-22
Year of completion : 2021-22

Design : RBD
Replications : Three
Plot size : 5.0 × 1.5 m
Spacing : 75 × 50 cm
Treatment : 9+1 (C)

Observations recorded:

1. Black shank infected plant (%)
2. Brown spot infected plant (%)
3. Cured leaf yield (kg/ha)

Results

Nine genotypes of pikka tobacco along with one check varietyGajapati were evaluated during*Kharif* ,2021, in RBD with three replications to assess the response of promising*pikka* tobacco genotypes to major diseases (black shank and brown spot) and cured leaf yield (kg/ha)under natural condition(without fungicides application). Data on natural incidence of diseases on *pikka* tobacco during 2021 are given in Table PBPP 2. During 2021-22, occurrence of black shank disease was less in comparison to 2020-21. There was significant difference among genotypes for reaction to black shank disease. Among test entries, lowest infection was observed by BPT-7, BPT-50, and NF-4-20-2 (3.3% each) reflecting more tolerance to black shank disease than check variety Gajapati (5.0%). Genotype BPT 49 (10.0%) recorded significantly higher black shank infected plants indicating most susceptible genotype among test entries to black shank disease and significantly different from check variety Gajapati.

During 2021-22, occurrence of brown spot disease was more in comparison to 2020-21. Genotype BPT 7 expressed lowest brown spot infected plants (11.67%) followed by NF 4-27-3 (12.67%) and NF-4-18-3 (13.33%) indicating more tolerant to brown spot disease than check variety Gajapati (17.67%). However, significantly higher brown spot infected plants was shown by genotype NF-4-10-2 (21.33%) reflecting most susceptible genotype among the test entries.

Under natural condition i.e., without application of fungicides, it was found thatfour genotypes namely BPT 7(1276 kg/ha), BPT-50 (1174) NF-4-20-2 (1131 kg/ha) and NF-4-27-3 (997 kg/ha) recorded significantly higher cured leaf yield than check variety

Gajapati (907 kg/ha) reflecting better yield potential. Genotype NF-4-2-3 (775 kg/ha) was the lowest yielder among the test entries studied and found significantly inferiorthan check variety Gajapatiunder natural condition.

Two years pooled data revealed that among test entries, genotype BPT 50 expressed lowest black shank disease incidence (4.2%) reflecting most tolerant test entry to black shank disease and significantly different from check variety Gajapati (6.7%), and this genotype was followed by BPT 7 and NF 4-20-2 (5.0% each) indicating more tolerant than check variety Gajapati.It was found from two years pooled data that lowest brown spot disease incidence was observed in genotype BPT 7 (10.0%) indicating more tolerant to brown spot disease and was closely followed by NF 4-27-3 (10.5%), BPT 50(10.7%). These three test entries were significantly superior than check variety Gajapati (14.7%) with respect to brown spot disease incidence. Among all test entries, Genotype NF 4-10-2 (17.3%) was found to be the most susceptible test entry forbrown spot disease,

It was revealed from two years pooled data that under natural condition *i.e.,* without application of fungicides, genotype BPT-50 produced maximum cured leaf yield of 1422 kg/ha followed by NF-4-20-2 (1321 kg/ha), BPT-7 (1314 kg/ha) and NF-4-27-3 (1201 kg/ha) producing significantly higher cured leaf yield than check variety Gajapati (982 kg/ha).

Conclusion: It was revealed from the study that disease incidence directly influenced the cured leaf yield. Genotypes more tolerant to disease like black shank and brown spot diseases produced higher cured leaf yield. This study showed that genotype BPT 50 showed lowest black shank disease incidence (4.2%) and lower incidence of brown spot disease (10.7%) produced maximum cured leaf yield of 1422 kg/ha. Similarly genotypes BPT-7, NF-4-20-2 and NF-4-27-3 expressed black shank disease incidence of 5.0, 5.0and 6.7% respectively and brown spot disease incidence of 10.0, 13.0 and 10.5% respectively producedcured leaf yield of 1314, 1321 and 1201 kg /ha respectively. These above mentioned four entries were significantly superior to check variety Gajapati with respect to black shank, brown spot disease incidence and cured leaf yield.

Table PBPP 2: Black shank and Brown spot disease incidence under natural condition

Treat-ments	Black shank infected plant (%)			Brown spot infected plant (%)			Cured leaf yield (kg/ha)		
	2020	2021	Pooled	2020	2021	Pooled	2020	2021	Pooled
BPT-7	6.7 (2.65)	3.3 (1.8)	5.0 (2.2)	8.33 (2.94)	11.67 (3.45)	10.0 (3.2)	1352	1276	1314
BPT 39	8.3 (2.94)	6.7 (2.6)	7.5 (2.8)	11.67 (3.47)	17.67 (4.24)	14.7 (3.9)	940	882	911
BPT 49	10.0 (3.24)	10.0 (3.2)	10.0 (3.2)	11.67 (3.47)	17.33 (4.19)	14.5 (3.8)	951	924	937
BPT 50	5.0 (2.35)	3.3 (1.8)	4.2 (2.1)	6.67 (2.65)	14.67 (3.87)	10.7 (3.3)	1669	1174	1422
NF 4-2-3	11.7 (3.47)	6.7 (2.6)	9.2 (3.1)	15.00 (3.90)	19.67 (4.47)	17.3 (4.2)	708	775	741
NF 4-10-2	11.7 (3.47)	5.0 (2.4)	8.3 (2.9)	13.33 (3.71)	21.33 (4.66)	17.3 (4.2)	760	863	811
NF-4-18-3	8.3 (2.94)	5.0 (2.4)	6.7 (2.6)	10.00 (3.18)	13.33 (3.68)	11.7 (3.4)	1067	960	1014
NF-4-20-2	6.7 (2.65)	3.3 (1.8)	5.0 (2.2)	6.67 (2.65)	19.33 (4.43)	13.0 (3.5)	1511	1131	1321
NF-4-27-3	6.7 (2.65)	6.7 (2.6)	6.7 (2.6)	8.33 (2.94)	12.67 (3.59)	10.5 (3.3)	1405	997	1201
GAJAPATI (C)	8.3 (2.94)	5.0 (2.4)	6.7 (2.6)	11.67 (3.47)	17.67 (4.24)	14.7 (3.9)	1056	907	982
GM	8.3 (2.93)	5.5 (2.4)	6.9 (2.6)	10.33 (3.24)	16.53 (4.08)	13.4 (3.7)	1142	989	1065
S.Em ±	1.53 (0.26)	1.33 (0.34)	0.66 (0.14)	1.93 (0.30)	2.8 (0.3)	1.07 (0.14)	68.30	29.751	37.2
C.D. at 5%	4.55 (0.77)	3.94 (1.02)	1.83 (0.38)	5.74 (0.89)	8.4 (1.0)	2.98 (0.4)	202.89	88.38	103.8
C.V. (%)	31.8 (15.3)	41.77 (25.3)		32.4 (16.1)	29.8 (14.8)		10.4	5.21	

Figures in parenthesis are squre root transformed values

PBPP 3: REACTION OF YET GENOTYPES TO MAJOR DISEASES UNDER NATURAL CONDITION

Objective: To assessthe response of YET genotypes to major diseases under natural condition

Year of start : 2021-22
Year of completion : 2022-23

Design : RBD
Replications : Two
Plot size : 5.0 × 1.5 m
Spacing : 75 × 50 cm
Treatment : 20+2 (C)

Observations recorded:

1. Black shank infected plant (%)
2. Brown spot infected plant (%)
3. Cured leaf yield (kg/ha)

Results

Twenty genotypes of *pikka* tobacco along with two check varieties (Gajapati and JP local) were evaluated during*Kharif* ,2021, in RBD with two replications to asses the response of YET genotypes to major diseases (black shank andbrown spot) and cured leaf yield (kg/ha)under natural condition(without fungicides application). Data on natural incidence of diseases on *pikka* tobacco during 2021 are given in Table PBPP 3.There was significant difference among genotypes for reaction to black shank disease Among test entries, lowest infection was observed by Bhairavi (2.5%) followed by Natu Noonepalli, NGP-89 and WAF (5% each)reflecting more tolerant to black shank disease than check variety Gajapati (10.0%) under natural condition. Genotype PottiVitanam (30.0%) followed by Narasraopeta NG 64 and Talamariaku (27.5% each) recorded significantly higher black shank infected plants indicating more susceptible genotypes among test entries to black shank disease and significantly different from check variety Gajapati.

Genotype NGP 89 expressed significantly lowest brown spot infected plants (6.00%)followed by II 1068 (6.50%)indicating more tolerant to brown spot disease than check variety Gajapati (16.50%). However, maximum brown spot infected plants were shown by genotype Pedavitanam and Kawali(24.0% each) reflecting most susceptible genotype among the treatments. Under natural condition *i.e.,* without application of fungicides, it was found thateleven genotypes namely NGP-89 (1295 kg/ha), II 1068 (1150kg/ha), II 1873 (1111 kg/ha), KFC (1099 kg/ha), Kommipaduvitanam (1053kg/ha), NG-61 (1035kg/ha), Natu special (999kg/ha), Bhairavi (988kg/ha), WAF (979kg/ha), NatuNoonepalli (971kg/ha) and Line 61 (959 kg/ha) recorded significantly higher cured leaf yield than check variety Gajapati (850 kg/ha) reflecting better yield potential.

Genotype PedaVitanam, Pottivitanam and Kawaliproduced significantly lower yield (748,734 and 734 kg/ha respectively)than check variety Gajapati (850 kg/ha)under natural condition.

Conclusion: It was revealed from the first year study that under natural condition, disease incidence directly influenced the cured leaf yield. Genotypes more tolerant to disease like black shank and brown spotdiseases produced higher cured leaf yield. This study showed that genotype NGP 89 showed lower black shank disease incidence (5.0%) and lowest incidence of brown spot disease produced maximum cured leaf yield of 1295 kg /ha. Similarly genotypesII 1068, II 1873, KFC, and Kommipaduvitanam, expressed brown spot disease incidence of 6.5, 7.5, 10.5 and 12.0% respectively producedcured leaf yield of 1150,1111, 1099 and 1053 kg/ha respectively. These above mentioned four entries were significantly superior than check variety Gajapati with respect to brown spot disease incidence and cured leaf yield.

Table PBPP 3: Black shank and Brown spot disease incidence under natural condition

Genotypes	Black shank infected plant (%)	Square root transformed values	Brown spot damaged leaf (%)	Cured leaf yield (kg/ha)
Bhairavi	2.5	1.53	9.50	988
Chebrolu	12.5	3.59	19.50	843
Kommipaduvittanam	15.0	3.89	12.00	1053
II 1068	20.0	4.50	6.50	1150
II 1873	10.0	3.24	7.50	1111
KFC	15.0	3.89	10.50	1099
Line 61	20.0	4.50	17.00	959
Narasaraopeta	27.5	5.29	21.50	823
NatuNoonepalli	5.0	1.98	16.50	971
Natuparacheru	10.0	3.24	15.50	821
Natu Special	10.0	2.62	11.50	999
NG 61	7.5	2.80	11.50	1035
NG 64	27.5	5.29	21.50	821
NGP 89	5.0	2.35	6.00	1295
Ongole	17.5	4.24	19.00	844
Pedavittanam	17.5	4.24	24.00	748
Pottivittanam	30.0	5.52	23.50	734
Talmariaku	27.5	5.29	21.50	796
Kawali	17.5	4.24	24.00	734
WAF	5.0	1.98	11.00	979
GAJAPATI (C)	10.0	3.24	16.50	850
JP LOCAL(C)	10	3.15	21.00	840
GM	14.66	3.66	15.77	931
S.Em ±	3.93	0.68	3.30	33.45
C.D. at 5%	11.55	2.01	9.71	98.35
C.V. (%)	37.90	26.42	29.61	5.08

PBPP 4: LEAF SPOT DISEASE MANAGEMENT IN MOTIHARI TOBACCO

Objective: To find an effective chemical control methodfor management of leaf spot disease in *Motihari* tobacco.

Year of start : 2021-22
Year of completion : 2023-24

Design : RBD
Replications : Three
Plot size : 5.0 × 3 m
Spacing : 60 × 50 cm
Treatment : 6+1 (C)

Observations recorded:

1. Percent disease index (%)
2. Cured leaf yield (kg/ha)

Results

Leaf spot diseases caused by *Alternaria* and *Cercospora*species are important diseases in *rustica* tobacco. Yield loss uptoforty per cent is very common. Therefore one experiment was conducted during 2021-22 at AINPT, Berhampur to evaluate different chemical molecules for control of leaf spot disease in *rustica* (motihari) tobacco. The experiment consisted of six chemical treatments and one control laid out in RBD with three replications. Observation were recorded on percent diseaseindex (%) and cured leaf yield (kg/ha) and presented in Table PBPP 4. It was revealed from the study that expression of disease severity directly associated with loss of cured leaf yield in tobacco. Chemical control measures were helpful in reducing the disease severity and increasing cured leaf yield in tobacco.

Maximum disease severity and lowest cured leaf yield were observed in control plot (43.3%, 1130 kg/ha respectively). Minimum disease severity (24.3%) and highest cured leaf yield 1624 kg/ha) were observed due to foliar spray of Propiconazole 25% EC @ 1ml/l (T3). Disease severity and cured leaf yield of T3(Foliar spray of Propiconazole 25% EC @ 1ml/l) were at par with T6(Foliar spray of Carbendazim 50%WP @ 2g + Mancozeb 75%WP @ 2g /l) , T1(Foliar spray of Azoxystrobin 23% SC @ 1ml/l) and T4 (Foliar spray of Hexaconazole 5% EC@ 1 ml/l) but significantly different from other treatments. All chemical control measures were significantly superior over control plot in reducing leaf spot disease severity as well as in increasingcured leaf yield in motihari tobacco. Due to application of chemicals,cured leaf yield was enhanced from 27.6% (T2: Foliar spray of Tebuconazole 25.9% EC @1ml/l) to 43.7% (T3: Foliar spray of Propiconazole 25% EC @ 1ml/l).

Conclusion: Chemical control measures were helpful in reducing the leaf spot disease severity and increasing cured leaf yield in *Motihari* tobacco. Lowest disease severity (24.3%) and highest cured leaf yield (1624 kg/ha) were obtained from T3(Foliar spray of Propiconazole 25% EC @ 1ml/l) which was at par with treatment T6 (Foliar spray of Carbendazim 50%WP @ 2g + Mancozeb 75% WP @ 2g /l), T1(Foliar spray of Azoxystrobin 23% SC @ 1ml/l) and T4(Foliar spray of Hexaconazole 5% EC@ 1 ml/l) but significantly different from other treatments with respect to disease severity and increasing cured leaf yield.

Table PBPP 4: Percent Disease Index (%) and cured leaf yield (kg/ha) in *rustica* tobacco

Treatments	Percent disease index (%)	Cured leaf yield (kg/ha)	Percent increase over control (%)
T1:Foliar spray of Azoxystrobin 23% SC @ 1ml/l	28.1	1531	35.5
T2: Foliar spray of Tebuconazole 25.9% EC @1ml/l	31.0	1442	27.6
T3: Foliar spray of Propiconazole 25% EC @ 1ml/l	24.3	1624	43.7
T4: Foliar spray of Hexaconazole 5% EC@ 1 ml/l	28.0	1541	36.4
T5: Foliar spray of Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.75g/l	30.8	1443	27.7
T6: Foliar spray of Carbendazim 50%WP @ 2g + Mancozeb 75%WP @ 2g /l	27.2	1562	38.2
T7: Control	43.3	1130	
Mean	30.38	1467	
S.Em ±	1.61	55.37	
C.D. at 5%	4.97	170.60	
C.V. (%)	9.21	6.54	

D.*RUSTICA* TOBACCO

COORDINATED EVALUATION OF RUSTICA TOBACCO GENOTYPES

RUABRC/ RULdBRC/ RUDBRC/ RUArBRC 2: INITIAL VARIETAL TRIAL ON *RUSTICA* TOBACCO

Initial varietal trial on *Rustica* tobacco with four entries was conducted at four centres (Anand, Araul, Dinhata andLadol) during 2019-20. The details of the trial are given below.

Year of start: 2021-22

Layout : RBD
Treatments : 4 entries + checks
Replications : Four

Entries: 4 (Four)

1. ArR 96
2. ArR 98
3. LR 96
4. LR 97

Checks at different centres :

Anand Centre	: 1. GC 1	2. GCT 2	3. GCT 3
Araul Centre	: 1. Azad Kanchan	2. SK 417	
Dinhata Centre	: 1. DD 437	2. Dharla	
Ladol Centre	: 1. GCT 3	2. DCT 4	

Results

Morphological characters, yield data and percent increase over best check at different centres are consolidated and given respectively in Tables 1 to 6 IVT *RUSTICA* TOBACCO. The results are discussed centre-wise.

ANAND

The yield differences were significant among the entries tested. None of the entry showed their superiority over better check for cured leaf yield. None of the entries was free from tobacco mosaic and leaf curl disease.

ARAUL

The four entries were tested with two checks in randomized block design with four replications. The yield differences were significant among the entries tested. The entries ArR-96 (3631 Kg/ha) followed by entry ArR-98 (3609 Kg/ha) found significantly superior over the best check Azad Kanchan (3110 Kg/ha) with 16.01% and 15.03% increase yield respectively.

DINHATA

In IVT 4 lines i.e. ArR-96, ArR-98, LR-96 and LR-97 were tested with two local varieties i.e. DD-437 and Dharla for their cured leaves and first grade leaf yields. Among four lines none of them recorded significantly higher yield than local control Dharla. However, line ArR-96 and ArR-98 recorded cured leaf yield more thanDD-437. The DD-437 showed highest quality outturn (42.48%) followed by ArR-96 (41.37%). No major incidence of diseases was noticed in the trial.**None**of the entries were found promising.

LADOL

Significant differences for cured leaf yield, plant height and no. of leaves per plant, leaf length and leaf width were found for the entries tested in IVT. Entry LR-96 (5335 kg/ha) was first rank and gave 12.05% high cured leaf yield fallowed by entries LR-97 (5276 kg/ha) reflecting 10.82% respectively higher cured leaf yield over best check DCT 4 (4761 kg/ha).Entry LR-96 (5335 kg/ha) was first rank and gave 12.05% high cured leaf yield fallowed by entries LR-97 (5276 kg/ha) reflecting 10.82% respectively higher cured leaf yield over best check DCT 4 (4761 kg/ha).

Table 1 IVT *RUSTICA* TOBACCO: Yield data of IVT *rustica* entries at different centres (2021-22)

Entries	Cured leaf yield at different centres (kg/ha)			
	Anand	**Araul**	**Dinhata**	**Ladol**
ArR-96	2912	3631*	1798	4559
ArR-98	2309	3609*	1641	4462
LR-96	2000	3090	1390	5335*
LR-97	2498	2468	1460	5276*
GC 1 (C)	2523			
GCT 2 (C)	2703			
GCT 3 (C)	3094			4612
DCT 4 (C)				4761
Azad Kanchan (C)		3130		
SK-417 (C)		2550		
DD 437 (C)			1556	
Dharla (C)			1871	
Grand Mean				4834
S.Em ±	194.8	**153.70**	113.21	154
C.D. at 5%	578.7	**471.0**	331.19	463
C.V. (%)	15.12	**9.95**	0.14	6.36

**Significant at 5%*

Table 2IVT *RUSTICA* TOBACCO: Morphological characters of IVT entries of *rustica* tobacco at different centres (2021-22)

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
ArR-96	15	12	7	11	51.8	55.68	26.25	58.8	43.0	36.14	25.77	41.1	27.2	30.10	24.29	40.8
ArR-98	13	12	7	11	47.8	52.18	30.73	49.3	41.9	33.64	25.42	40.0	30.3	29.18	21.32	40.9
LR-96	13	11	7	12	41.5	44.90	23.47	46.9	39.9	30.13	30.05	40.8	27.7	27.33	22.7	40.3
LR-97	13	10	6	12	47.4	45.89	31.42	48.7	40.5	29.87	24.32	40.0	27.5	26.18	20.12	39.5
GC1 (C)	13				41.8				45.3				34.4			
GCT 2 (C)	14				51.6				45.2				30.1			
GCT 3 (C)	14			11	48.4			75.1	44.4			34.0	28.8			35.7
DCT 4 (C)				12				67.0				37.2				36.1
DD 437 (C)			7				34.82				25				20.5	
Dharla (C)			7				34.82				28				20.55	
Azad Kanchan(C)		10				56.33				30.33				25.18		
SK 417 (C)		11				54.32				29.18				26.68		
S.Em ±	0.31		0.32	0.38	1.63		1.40	1.97	1.18		1.53	0.84	1.36		1.58	0.85
C.D. at 5%	0.93		0.95	1.15	4.84		4.10	5.94	3.50		4.47	2.52	4.04		4.62	2.56
C.V. (%)	4.57		0.10	6.61	6.91		0.09	6.84	5.49		0.12	4.31	9.25		0.15	4.37

***A**:Anand* ***Ar**:Araul* ***D**:Dinhata* ***L**: Ladol*

Table 3 IVT *RUSTICA* TOBACCO: Other morphological characters in IVT *rustica* entries at different centres (2021-22)

Entries	Leaf thickness	Days to flower	Days to maturity		Inter-nodal length	Plant stand
	Anand	Anand	Anand	Araul	Dinhata	Ladol
ArR-96	6.67	55	120	113	5.67	39
ArR-98	10.01	47	120	109	6.85	38
LR-96	9.90	58	121	110	3.95	40
LR-97	13.05	54	119	114	4.92	40
GC 1 (C)	15.18	50	121			
GCT 2 (C)	12.30	62	123			
GCT 3 (C)	16.47	54	125			39
DCT 4 (C)						39
Azad Kanchan (C)				110		
SK 417 (C)				111		
DD-437 (C)					7.6	
Dharla (C)					5.9	
S.Em ±	-	1.36	1.10		0.75	0.47
C.D. at 5%	-	4.05	3.26		2.19	NS
C.V. (%)	-	5.03	1.81		0.26	2.41

Table 4 IVT *RUSTICA* TOBACCO : First grade leaf yields and quality leaf outturn at Dinhata Centre (2021-22)

Treatments	First grade leaf (kg/ha)	Quality leaf(%)
ArR-96	744	41.37
ArR-98	571	33.79
LR-96	506	36.40
LR-97	533	36.50
DD-437 (C)	661	42.48
Dharla (C)	700	37.41
S.Em ±	74.29	
C.D. at 5%	217.33	
C.V. (%)	0.24	

Table 5 IVT *RUSTICA* TOBACCO: Disease incidence and quality parametersin IVT *rustica* entries at Anand Centre (2021-22)

Entries	TMV (%)	Leaf curl (%)			Nicotine (%)	R. Sugars (%)	Chlorides (%)
		LCA	LCB	LCC			
ArR-96	48.75	-	-	Yes	6.50	3.70	1.313
ArR-98	43.75	-	Yes	-	5.08	4.33	1.243
LR-96	40.00	-	Yes	-	4.50	3.78	1.065
LR-97	35.00	Yes	-	-	4.55	3.75	1.526
GC 1 (C)	42.50	Yes	-	-	5.25	4.75	1.243
GCT 2 (C)	46.25	Yes	-	-	5.35	3.75	0.887
GCT 3 (C)	38.75	Yes	-	-	5.67	3.78	1.420

***Where, LCA** = Low, **LCB** = 10%*

Table 6 IVT *RUSTICA* TOBACCO: Data on chemical and disease incidence in IVT *rustica* entries at Ladol Centre (2021-22)

Entries	Chemical parameters (%)			Disease (%)	
	Nicotine	Reducing Sugars	Chlorides	LCV	LMV
ArR-96	2.47	4.21	1.23	0.00	3.25
ArR-98	2.09	4.91	0.85	0.00	2.65
LR-96	3.79	3.85	1.25	0.00	0.63
LR-97	3.76	2.36	0.92	0.00	0.63
GCT3 (C)	3.63	2.21	1.58	0.00	0.00
DCT 4 (C)	2.51	1.76	1.21	0.64	0.00

ANAND

RUABRC 1.1: ADVANCED VARIETAL TRIAL I ON *RUSTICA* TOBACCO

Year of start : 2021-22
Treatments : 4 Entries + 3 checks
Design : R.B.D.
Replications : Four
Plot size : 1.2 × 6.0 m
Spacing : 60 × 60 cm

Results

The yield differences were significant among the entries tested. None of the entry showed significant superiority for cured leaf yield over better check. None of the entries was free from tobacco mosaic and leaf curl disease.

Table 1 RUABRC 1.2: Yield and morphological characters of AVT-I (2021-22)

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thick-ness	Days to flower	Days to maturity
LR 94	2451	15	51.1	42.7	26.6	13.74	48	126
LR 95	2695	15	51.6	43.4	29.4	10.11	56	126
ArR 89	2096	13	46.9	42.0	27.1	14.54	56	125
ArR 91	2581	15	47.7	42.4	27.6	14.29	57	126
GC 1(c)	2532	13	43.9	46.2	33.1	13.18	53	123
GCT 2 (c)	2373	15	45.8	39.6	25.2	11.42	64	129
GCT 3 (c)	3039	14	47.6	44.9	30.6	16.55	55	127
S. Em. ±	167.9	0.46	1.54	1.58	1.60	-	1.25	0.69
C.D.at 5%	498.8	1.37	4.57	NS	4.76	-	3.73	2.06
C.V. (%)	13.23	6.44	6.44	7.36	11.26	-	4.52	1.10

Table 2 RUABRC 1.2: Data on disease incidence of AVT-I (2021-22)

Entries	TMV (%)	Leaf curl (%)		
		LCA	LCB	LCC
LR 94	41.25	Yes	-	-
LR 95	45.00	-	-	Yes
ArR 89	38.75	Yes	-	-
ArR 91	42.50	Yes	-	-
GC 1(c)	33.75	Yes	-	-
GCT 2 (c)	32.50	Yes	-	-
GCT 3 (c)	37.50	Yes	-	
S. Em. ±	-	-	-	-
C.D. at 5%	-	-	-	-
C.V. (%)	-	-	-	-

*Where, **LCA** = Low, **LCB** = 10%, **LCC** = 10-20%, **LCD** = 20-30%, **LCX**= highly affected/Severe*

Table 3 RUABRC 1.2: Chemical quality parameter (%) in AVT-II (2021-22)

Entries	Nicotine	Reducing Sugar	Chlorides
LR 94	5.45	3.70	1.136
LR 95	4.67	4.25	1.172
ArR 89	4..90	4.28	1.314
ArR 91	5.25	3.75	1.030
GC 1(c)	5.05	3.37	1.207
GCT 2 (c)	4.92	4.02	1.065
GCT 3 (c)	5.00	4.67	0.887

RUABRC 1.2: ADVANCED VARIETAL TRIAL II ON *RUSTICA*TOBACCO

Year of start : 2021-22
Treatments : 4 Entries + 3 checks
Design : R.B.D.
Replications : Four
Plot size : 1.2 × 6.0 m
Spacing : 60 × 60 cm

Results

The yield differences were significant among the entries tested. Line ArR 83 showed significant superiority for cured leaf yield over better check. None of the entries was free from tobacco mosaic and leaf curl disease.The **pooledanalysis** results revealed significant yield differences among the entries tested. ArR-83 showed significantly superior for cured leaf yield over the checks. Interaction effect was found non-significant yield differences among the genotypes tested.

Table 1 RUABRC 1.2: Yield and morphological characters of AVT-II (2021-22)

Entries	Yield (kg/ha)	No. of leaves/ plant	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thick-ness	Days to flower	Days to maturity
LR 92	2227	14	43.5	46.0	28.1	8.99	57	130
LR 93	1723	14	53.5	39.3	23.8	12.99	58	125
ArR 79	1571	12	47.4	40.5	26.6	13.69	50	127
ArR 83	2510*	13	47.8	45.6	33.9	9.81	55	125
GC 1(c)	2099	12	43.3	44.0	30.3	15.62	48	120
GCT 2 (c)	1948	14	47.7	37.9	26.1	10.42	62	131
GCT 3 (c)	2181	13	46.0	42.3	29.3	12.32	53	130
S. Em. ±	101.6	0.51	1.23	1.59	2.13	-	1.12	0.84
C.D. at 5%	301.9	NS	3.64	4.71	NS	-	3.33	2.50
C.V. (%)	10.0	7.78	5.22	7.52	15.06	-	4.12	1.33

Table 2 RUABRC 1.2: Data on disease incidence of AVT-II (2021-22)

Entries	TMV (%)	Leaf curl (%)		
		LCA	LCB	LCC
LR 92	41.25	Yes	-	-
LR 93	37.50	Yes	-	-
ArR 79	43.75	Yes	-	-
ArR 83	47.50	-	-	Yes
GC 1(c)	38.75	Yes	-	-
GCT 2 (c)	33.75	Yes	-	-
GCT 3 (c)	30.00	-	Yes	-
S. Em. ±	-	-	-	-
C.D. at 5%	-	-	-	-
C.V. (%)	-	-	-	-

***Where, LCA** = Low, **LCB** = 10%, **LCC** = 10-20%, **LCD** = 20-30%, **LCX**= highly affected/Severe*

Table 3 RUABRC 1.2: Chemical quality parameter (%) in AVT-II (2021-22)

Entries	Nicotine	Reducing Sugar	Chlorides
LR 92	6.50	4.72	1.207
LR 93	4.38	4.00	1.065
ArR 79	4.98	4.67	1.136
ArR 83	6.07	4.00	1.136
GC 1(C)	6.27	4.15	1.105
GCT 2 (C)	6.18	4.25	1.243
GCT 3 (C)	6.78	4.67	1.172

Table 4 RUABRC 1.2: Pooled AVT-I & II, *Rustica* 2020-21 and 2021-22, Anand

Treatment	2020-21	2021-22	Pooled mean
LR 92	2345	2227	2286
LR 93	2139	1723	1931
ArR 79	1788	1571	1679
ArR 83	2457	2510	2484*
GC 1 (C)	2448	2099	2274
GCT 2 (C)	2332	1948	2140
GCT 3 (C)	2306	2181	2243
S. Em. ±	98.89	101.5	70.9
C.D. at 5%	293.9	301.7	203.4
C.V. (%)	8.75	9.97	9.33
Y			
S. Em. ±	-	-	37.88
C.D. at 5%	-	-	108.74
Y×T			
S. Em. ±	-	-	100.22
C.D. at 5%	-	-	NS

ARAUL

RUArBRC 1.1: ADVANCED VARIETAL TRIAL I ON *RUSTICA* TOBACCO

Year of start: 2021-22

Design : RBD
Replications : Five
Plot size : 4.5 m × 2.25 m
Treatments : 2 entries + 2 checks

Results

Two lines *viz.* ArR-91 and LR-95 were evaluated in RBD with five replications along with two check *viz.* Azad Kanchan and SK-417 for yield and quality in AVT-I. The data revealed that entry ArR-91 (4060 kg/ha) followed by entry LR-95 (3960 kg/ha) found significantly superior over the best check Azad Kanchan (3212 kg/ha) in respect of cured leaf yield with 26.40% and 23.29% increase respectively. Data is given in Table 1 RuArBRC-1.1

Table 1 RUArBRC 1.1: Yield data and morphological characters in AVT I during *rabi* 2021-22

Treatment	Yield (kg/ha)	Days to Maturity	Av. Curable leaves/ plant	Plant Height (cm)	Leaf (cm)		% Increase Over Azad Kanchan
					Length	Width	
ArR-91	4060	115	12	51.20	39.30	35.78	26.40
LR-95	3960	113	10	49.32	36.65	31.20	23.29
Azad Kanchan (C)	3212	111	10	50.48	32.65	26.65	
SK-417 (LC)	3068	111	10	51.10	30.22	25.42	
S. Em. ±	190						
C.D. at 5%	550						
C.V. (%)	9.02						

RUArBRC 1.2: ADVANCED VARIETAL TRIAL II ON *RUSTICA* TOBACCO

Year of start: 2020-21

Design : RBD
Replications : Five
Plot size : 4.5 m × 2.25 m
Treatments : 3 entries + 2 checks

Results

Three lines *viz;* ArR-79, ArR-83 and LR-93 were evaluated in RBD with Five replications along with two checks *viz,* Azad Kanchan and SK-417 for yield and qualityin AVT-II. The data revealed that line ArR-79 (3582 kg/ha) found significantly superior over the best check Azad Kanchan (2843 kg/ha) in respect of cured leaf yield with 25.99% increase on pooled analysis. Data is given in Table 1 RuArBRC1.2

Table 1 RUArBRC 1.2: Pooled data on cured leaf yield and percent increase over checks in AVT II during *rabi* 2021-22

Treatment	**Cured leaf yield (kg/ha)**			**% Increase Over Azad Kanchan**
	2020-21	**2021-22**	**Pooled**	
ArR-79	3333	3830	3582	25.99
ArR-83	2910	3433	3172	
LR-93	2915	3110	3013	
Azad Kanchan (C)	2690	2995	2843	
SK-417 (LC)	2610	2860	2735	
Mean	2892	3246	3069	
S. Em. ±	118.22	152.18	132.10	
C.D. at 5%	310.10	448.10	379.45	
C.V. (%)	11.72	11.68	10.92	
Season				
S. Em. ±			198.12	
C.D. at 5%			NS	
Season x Treatments				
S. Em. ±			181.10	
C.D. at 5%			NS	

BT: BULKTRIAL ON *RUSTICA* TOBACCO

Year of start: 2021-22

Advanced breeding line ArR-69 of hookah tobacco was evaluated along with checks Azad Kanchan and SK-417 for cured leaf yield and quality on bulk trial. Line ArR-69 showed higher yield than checks.

Table 1BT: Yield potential and Morphological traits of line ArR-58 (2021-22)

Entries	Yield (kg/ha)	No. of leaves/ Plant	Plant Height (cm)	Days to maturity (Days)	Leaf (cm)	
					Length	Width
ArR-69	4113	13	60.61	113	40.10	32.33
Azad Kanchan (C)	3155	11	59.12	111	30.13	26.05
SK-417 (C)	3092	11	57.31	111	30.05	25.42

RUArBR 5: PRELIMINARY YIELDEVALUATION TRIAL - I OF *RUSTICA* TOBACCO

Year of start : *Rabi* 2021-22
Design : RBD
Replications : Three
Plot size : 4.5 m × 1.35 m
Treatments : 8 entries + 2 checks

Results

The trial consist of eight entries were evaluated in RBD with three replications along with two checks *viz.* in PYET-I trial which showed significant differences among all the entries were noticed for cured leaf yield. Entry, ArR-111 (3815 kg/ha) and entry ArR-116 (3610 kg/ha) recorded highest cured leaf yield reflecting 26.32% and 19.54% increase over check variety Azad Kanchan (3020 kg/ha) respectively. The data is given in table 1 RUArBR 5.

Table 1 RUArBR 5: Performance of *Hookah* tobacco lines in PYET-I during *rabi* 2021-22

Treatment	Days to Matu-rity	Av. Curable leaves/ plant	Plant Height (cm)	Leaf (cm)		Yield (kg/ha)	% Increase Over Azad Kanchan
				Length	Width		
ArR-111	113	13	60.40	40.12	33.13	3815	26.32
ArR-112	110	11	60.30	38.42	29.81	3020	
ArR-113	114	9	55.65	21.12	19.13	1644	
ArR-114	110	9	51.48	29.10	24.12	2260	

Treatment	Days to Matu-rity	Av. Curable leaves/ plant	Plant Height (cm)	Leaf (cm)		Yield (kg/ha)	% Increase Over Azad Kanchan
				Length	Width		
ArR-115	109	9	48.60	31.30	26.68	225	
ArR-116	110	12	58.65	39.65	33.13	3610	19.54
ArR-117	115	11	44.10	26.70	23.68	2160	
ArR-118	109	10	49.13	29.90	24.18	2625	
Azad Kanchan (C)	111	10	51.10	32.10	26.75	3020	
SK-417 (LC)	111	10	50.15	30.33	26.05	2995	
S. Em. ±						191.06	
C.D. at 5%						574.03	
C.V. (%)						14.81	

RUArBR 5A: PRELIMINARY YIELD EVALUATION TRIAL – II OF *RUSTICA* TOBACCO

Objective: To identify the high yielding promising genotypes of *Hookah* tobacco.

Year of start: 2020-21

Design : R B D Replication : Three

Plot size : 4.5 × 1.35 m Treatments : 8 Entries + 2 checks

Results

Combined statistical analysis of the data collected over two seasons *Rabi* (2020-21 and 2021-22) was done for identifying most promising lines. Results indicated significant differences among the entries for cured leaf yieldentry ArR-104 (3478 kg/ha) followed by entry ArR-105 (3084 kg/ha) showed significant superiority over check Azad Kanchan (2763 Kg/ha) with 25.87% and 11.61% increase respectively on pooled basis over the last two years. The data is presented in table RUArBR 5A.These two lines are contributed for testing in IVT 2022-23.

Table 1 RUArBR 5A: Pooled results of *Hookah* tobacco in PYET II during *rabi* 2020-21& 2021-22

Treatment	Cured leaf yield(kg/ha)			% increase over Azad Kanchan
	2020-21	2021-22	Mean	
ArR-103	2915	2655	2785	
ArR-104	3380	3575	3478	25.87
ArR-105	3218	2950	3084	11.61
ArR-106	3010	2985	2998	
ArR-107	2210	1950	2080	
ArR-108	1915	2235	2075	
ArR-109	2130	2270	2200	
ArR-110	2675	2385	2530	
Azad Kanchan (C)	2695	2830	2763	
SK-417 (LC)	2675	2795	2735	
Mean	2682	2663	2673	
S. Em. ±	131.75	148.15		
C.D. at 5%	333.10	288.35		
C.V. (%)	12.12	10.11		
SEASONS				
S. Em. ±			142.00	
C.D. at 5%			305.30	
SEASONS × TREATMENTS				
C.D. at 5%			205.10	

LADOL

RULdBRS 1: INITIAL EVALUATION TRIAL ON *RUSTICA* TOBACCO

Year of start : 2021-22

Design : RBD

Replications : Three

Plot size : 2.4 × 4.5 m

Spacing : 60 × 45 cm

Treatments : 5 Entries + 2 checks

Irrigated/ rainfed : Irrigated

Results

In IET, seven entries were included in which Entry LR 20-4 and LR 20-1 were found significantly superior and gave 11.12 and 10.61 per cent higher cured leaf yield than best check DCT 4 (4901 kg/ha).

Table 1 RULdBRS 1: Morphological characters of entries in IET (2021-22)

Entries	Plant Stand	Plant Height(cm)	Leaf (cm)		No. of leaves /plant
			Length	Width	
LR 20-1	39	55.1	45.3	43.9	12
LR 20-4	39	57.9	42.7	40.5	13
LR 20-6	39	62.2	39.6	40.2	11
LR 20-7	38	52.6	39.5	38.5	10
LR 20-9	39	58.0	41.4	41.4	13
GCT 3 (C)	39	62.3	36.5	35.4	13
DCT 4 (C)	39	60.4	39.5	36.1	13
S. Em. ±	0.76	2.08	1.11	1.10	0.46
C.D. at 5%	NS	6.42	3.42	3.40	1.42
C.V. (%)	3.41	6.18	4.73	4.84	6.59

Table 2 RULdBRS 1: Yield (kg/ha) & Disease incidence (2021-22)

Entries	Yield (kg/ha)	Rank	% increase Over better check	Disease (%)	
				LCV	LMV
LR 20-1	5421	2	10.61	0.00	0.00
LR 20-4	5446	1	11.12	0.00	0.00
LR 20-6	4712			0.00	2.59
LR 20-7	4275			0.00	0.86
LR 20-9	5280			0.00	0.00
GCT 3 (C)	4740			0.00	0.00
DCT 4 (C)	4901			0.00	0.00
Grand Mean	4968				
S. Em. ±	167				
C.D. at 5%	514				
C.V. (%)	5.81				

**Significant @ 5%*

Table 3 RULdBRS 1: Data on quality parameters in 2021-22

Treatment	Nicotine(%)	Reducing sugar(%)	Chlorides(%)
LR 20-1	3.01	3.60	1.11
LR 20-4	2.85	3.48	1.35
LR 20-6	2.22	5.36	1.60
LR 20-7	3.24	3.06	1.55
LR 20-9	2.58	6.77	1.39
GCT 3 (C)	1.96	4.54	1.30
DCT 4 (C)	2.21	4.41	1.54

RULdBRS 2: PRELIMINARY YIELD TRIAL ON *RUSTICA* TOBACCO

Year of start : 2021-22

Design : RBD
Plot size : Gross: 2.4 × 4.5 m
Treatments : 9 Entries + 2 checks

Replications : Three
Spacing : 60 × 45 cm
Irrigated/ rainfed : Irrigated

Results

In PYT, out of eleven entries, two entries were significantly superior and gave better performance than best check DCT 4. Entry LR 21-5 and LR 21-7 were gave 12.66 and 11.02 per cent respectively higher cured leaf yield than best check DCT 4 (4875 kg/ha). These two entries will be promoted for testing in station trial-1.

Table 1 RULdBRS 2: Morphological characters of entries in PYT (2020-21)

Entries	Plant Stand	Plant Height(cm)	Leaf (cm)		No. of leaves /plant
			Length	Width	
LR 21-1	40	51.1	40.4	37.1	14
LR 21-2	39	54.7	40.8	37.9	10
LR 21-3	38	48.3	40.8	37.6	11
LR 21-4	39	63.6	40.4	37.3	12
LR 21-5	39	73.1	47.6	44.9	13
LR 21-6	39	52.4	39.1	36.1	12
LR 21-7	40	63.8	46.5	43.1	13
LR 21-8	39	75.6	45.8	42.6	14
LR 21-9	39	53.0	39.4	41.4	13
GCT 3 (C)	40	67.4	35.5	33.1	12
DCT 4 (C)	39	60.0	37.3	35.1	13
S. Em. ±	0.68	2.15	1.04	1.12	0.45
C.D. at 5%	NS	6.33	3.07	3.30	1.32
C.V. (%)	3.03	6.16	4.37	4.99	6.18

Table 2 RULdBRS 2: Yield (kg/ha) & Disease incidence (2021-22)

Entries	Yield (kg/ha)	Rank	% increase Over better check	Disease (%)	
				LCV	LMV
LR 21-1	5156			0.00	0.84
LR 21-2	4057			0.85	2.56
LR 21-3	4424			0.00	3.48
LR 21-4	4597			0.00	0.86
LR 21-5	**5492**	**1**	**12.66**	0.00	0.00
LR 21-6	4558			0.00	0.85
LR 21-7	**5412**	**2**	**11.02**	0.00	0.00
LR 21-8	5236			0.00	0.85
LR 21-9	4753			0.00	0.86
GCT 3 (C)	4635			0.00	0.00
DCT 4 (C)	4875			0.86	0.00
Grand Mean	4836				
S. Em. ±	176				
C.D. at 5%	520				
C.V. (%)	6.31				

**Significant @ 5%*

Table 3 RULdBRS 2: Data on quality parameters in 2021-22

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
LR 21-1	2.57	3.77	0.35
LR 21-2	2.12	4.98	1.20
LR 21-3	2.88	5.01	1.41
LR 21-4	1.69	5.48	1.03
LR 21-5	1.97	3.92	1.22
LR 21-6	2.32	4.74	1.32
LR 21-7	1.69	4.84	1.08
LR 21-8	1.83	4.88	1.21
LR 21-9	3.22	3.02	1.60
GCT 3 (C)	2.25	2.76	1.60
DCT 4 (C)	2.00	2.80	1.53

RULdBRS 3: LARGE SCALE VARIETAL TRIAL

Year of start : 2021-22

Design : RBD
Spacing : 60 × 45 cm
Treatments : 4 Entries + 2 checks

Replications : Four
Plot size : 2.4mx4.5m
Irrigated/ rainfed : Irrigated

Results

In LSVT trial, six entries were included in which significant differences among all the entries were noticed for cured leaf yield. Entry LR 94 (5370 kg/ha) recorded highest cured leaf yield fallowed by entry LR 96 (5323 kg/ha) reflecting 11.23 and 10.25 per cent respectively high cured leaf yield over best check DCT 4 (4828 kg/ha). Significant difference was found in plant height, no. of leaves and leaf length and leaf width (Table 1 & 2 RULdBRS 3).

Table 1 RULdBRS 3: Yield and morphological characters of entries in LSVT (2021-22)

Entries	Yield (kg /ha)	Rank	% increase over better check	Plant stand	Plant Height (cm)	Leaf (cm)		No. of leaves /plant
						Length	Width	
LR 94	5370	1	11.23	40	57.5	40.7	38.4	13
LR 95	4845			38	78.4	37.3	33.8	14
LR 96	5323	2	10.25	39	44.7	39.6	39.2	12
LR 97	5149			40	50.5	39.5	40.0	12
GCT 3 (C)	4597			38	70.6	36.5	34.8	12
DCT 4 (C)	4828			39	66.0	38.9	36.5	12
G. Mean	5019							
S. Em. +	159			0.64	1.98	0.73	0.85	0.44
C.D. at 5%	479			NS	5.98	2.20	2.55	1.31
C.V. (%)	6.33			3.29	6.47	3.76	4.56	6.98

Table 2 RULdBRS 3: Data on quality parameters& Disease incidence (%)

Entries	Nicotine	Reducing Sugars	Chlorides	Disease	
				LCV	LMV
LR 94	2.14	5.23	1.11	0.63	0.00
LR 95	2.20	3.84	1.67	1.31	0.00
LR 96	3.38	3.46	1.35	0.00	0.65
LR 97	2.44	5.24	1.64	0.00	0.63
GCT 3 (C)	2.61	2.37	1.29	0.66	1.32
DCT 4 (C)	2.30	2.89	1.41	0.00	0.65

RULdBRS 4: BREEDING WORK IN *RUSTICA* TOBACCO

A. CROSSES MADE: Total 278 genotypes/varieties comprising both indigenous and exotic materials were maintained at this station. Among them, sixty five genotypes/varieties were raised during the year 2021-22. Using these materials, ten single and five multiple crosses were made. All single and multiple crosses were obtained

B. GENERATION ADVANCEMENT AND EVALUATING SEGREGATING MATERIALS: To develop high cured leaf yield, medium duration lines with resistance to Leaf mosaic virus and Leaf curl disease, following breeding/segregating materials were grown for further selection and generation advancement. The details of selection made are given as under

Generation advancement and evaluation of segregating materials

S.No.	Generation	No of crosses grown	Number of progenies		
			Grown	Selected	
			No. of progenies	No. of progenies	Bulk
1	F1	13	13	12	
2	F2	11	11	102	
3	F3	20	142	79	
4	F4	16	61	39	
5	F5	12	43	23	
6	Promising bulk	9	24	-	12
Total		81	294	255	12

C. **MAINTENANCE AND EVALUATION RUSTICA GERMPLASM:** Two hundred seventy eight accessions of *rustica* germplasm were maintained for next season during 2021-22 and high cured leaf yield and resistant lines were utilized in crossing programme.

D. SEED PRODUCTION PROGRAMME: With a view to facilitate seed production of *rustica* tobacco variety in next crop season 2910.0 kg. Labelled seed was produced of three varieties and will be allotted to farmers during 2022-23.

Seed Production (Kilograms)

Crop	*Rustica* Tobacco			
Variety	GCT 3	DCT 4	GCT 5	Total
Production	1179	909	822	2910

CROP PRODUCTION

CROP PRODUCTION

A. VFC TOBACCO

HUNSUR

VFHAG 17: 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

Field Experiment was conducted to assess the effectiveness of various integrated weed management practices for the control of *Orobanche* weed in FCV Tobacco in KLS during the first year crop season of 2021-22 in farmer's field location.

Treatment details

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*

Biometric observations

The observations on the incidence of *Orobanche* (no.of *Orobanche* spikes) and the weed biomass production were taken at 50 days and 65 days stage of the crop. Treatments involving Neem cake application at 30 DAT reduced the *Orobanche* infestation by 27-37% and also the *Orobanche* weed biomass by 28.0-39.5% at 50 days. At 65 days stage of crop, all the integrated *Orobanche* weed management practices were found to reduce the *Orobanche* weed infestation and weed biomass production by 38 to 70% and 58.0 to 79.7% respectively (Table 1VFHAG 17).However *Orobanche* weed infestation and weed biomass production was minimum with the integration of Neem cake at 30 DAT+PE application of Imazethapyr (70 & 79.7 %) followed by Neem cake + PE application of paraqaut (53.5 & 73% respectively) while the manual control by hand removal of *Orobanche* weeds resulted in 39 & 60.7% reduction in weeds over the check.

Results

Various integrated weed management practices increased the Green leaf yield, Cured leaf yield and bright grade productivity of FCV tobacco by 17.8 to 29.6% over the check (Table 2 VFHAG 17). The maximum cured leaf productivity was observed in the treatment involving Neem cake at 30 DAT + PE application of Imazethapyr 29.6% and Neem cake + PE application of Paraqaut (24.0%) while the neem cake + hand removal of *Orobanche* and only hand removal of *Orobanche* treatments resulted in 20.9 and 18.8% increased productivity respectively. Similar trends were observed in bright grade productivity also.

The cured leaf quality parameters like nicotine, sugars and chlorides were not altered by the various *Orobanche* weed management practices adopted and the values were found to be in the normal range (Table 3VFHAG 17).

Table1VFHAG 17 : Effect of Integrated weed management practices on incidence of *Orobanche* in FCV tobacco

Treatments	No. of spikes / plot at 50 DAT	Weed biomass kg/plot at 50 DAT	No. of spikes / plot at 65 DAT	Weed biomass kg/plot at 65 DAT
T1: Neem cake application at 30 DAP + Hand removal of *Orobanche*	180 (37.0)	1.85 (38.0)	173 (48.8)	1.42 (64.0)
T2: New cake application at 30 DAP + PE application of neem oil on *Orobanche* spikes	185 (35.5)	1.82 (39.5)	208 (38.4)	1.65 (58.2)
T3: Neem cake application at 30 DAP+ PE application of pongamia oil on *Orobanche* spikes	206 (28.0)	1.90 (36.6)	210 (37.8)	1.57 (60.8)
T4: Neem cake application at 30 DAP +PE application Paraquat on *Orobanche* Spikes	213 (25.0)	2.05 (31.6)	157 (53.5)	1.06 (73.0)
T5: Neem cake application at 30 DAP +PE application of Imazethapyr on *Orobanche* Spikes	208 (27.0)	2.15 (28.0)	101 (70.1)	0.80 (79.7)
T6: Hand removal of *Orobanche*	285 <1.00	2.97 (1.00)	206 (39.0)	1.55 (60.7)
T7: Non removal of *Orobanche*	287 (-)	3.00 (-)	338 (-)	3.95 (-)

Table2 VFHAG 17 : Effect of Integrated Weed Management practices on yield parameters FCV tobacco

Treatments	Green Leaf Yield (kg/ha)	Cured Leaf Yield (kg/ha)	Bright grade (kg/ha)
T1: Neem cake application at 30 DAP + Hand removal of *Orobanche*	9575	1312 (20.9)	669 (25.7)
T2: New cake application at 30 DAP + PE application of neem oil on *Orobanche* spikes	9393	1278 (17.8)	651 (22.3)
T3: Neem cake application at 30 DAP+ PE application of pongamia oil on *Orobanche* spikes	9453	1284 (18.3)	658 (23.6)
T4: Neem cake application at 30 DAP +PE application Paraquat on *Orobanche* Spikes	10756	1345 (24.0)	699 (31.4)
T5: Neem cake application at 30 DAP +PE application of Imazethapyr on *Orobanche* Spikes	11968	1406 (29.6)	748 (40.6)
T6: Hand removal of *Orobanche*	9544	1289 (18.8)	664 (24.8)
T7: Non removal of *Orobanche*	8029	1085 (-)	532 (-)

Table 3 VFHAG 17 : Effect of Integrated weed management practices on cured leaf quality parameters (%)

Treatments	Nicotine	Reducing sugars	Chlorides
T1: Neem cake application at 30 DAP + Hand removal of *Orobanche*	0.93	17.74	0.94
T2: New cake application at 30 DAP + PE application of neem oil on *Orobanche* spikes	0.90	19.79	0.90
T3: Neem cake application at 30 DAP+ PE application of pongamia oil on *Orobanche* spikes	0.95	16.83	0.87
T4: Neem cake application at 30 DAP +PE application Paraquat on *Orobanche* Spikes	1.09	19.51	0.98
T5: Neem cake application at 30 DAP +PE application of Imazethapyr on *Orobanche* Spikes	1.18	19.51	0.81
T6: Hand removal of *Orobanche*	0.97	17.79	0.99
T7 :Non removal of *Orobanche*	1.12	16.62	0.85

SHIVAMOGGA

VFSAG 70: EFFECT OF HYDROGEL ON FCV TOBACCO YIELD AND QUALITY IN KLS

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

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:VaaridharPusa hydrogel used in the study is a semi synthetic, cross linked, derivatized cellulose-graft-anionic polyacrylate superabsorbent 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*- 2020 with seven treatments and three replications. The details of the experiment are presented below

Design	:	RCBD	**Duration**	:	02 years
Replications	:	Three	**Year of start**	:	2019-20
Treatments	:	Seven	**Season**	:	*Kharif*
Gross plot size	:	6.3× 5.4 m	**Date of sowing**	:	30-04-2021
Net plot size	:	4.5× 3.0 m	**Date of planting**	:	12-07-2021
Variety	:	KST-28 (Sahyadri)			

Treatment details

T1: Soil application of Hydrogel @ 0.14 g per plant hole before planting
T2: Soil application of Hydrogel @ 0.20 g per plant hole before planting
T3: Soil application of Hydrogel @ 0.30 g per plant hole before planting
T4: Soil application of Hydrogel @ 0.14 g per plant after a rainy day *
T5: Soil application of Hydrogel @ 0.20 g per plant after a rainy day
T6: Soil application of Hydrogel @ 0.30 g per plant after a rainy day
T7: Control

*Any rainy day after 30 DAP during crop growth period

Seedlings were raised onraised bed following soil solarization. FYM at the rate of 12.5 t/ha was applied 20 days prior to planting. Seedlings of 55-60 days old were transplanted at 90× 60 cm spacing in main field on 12th July, 2021.Crop was managed as per Package of Practices of University.

Treatments T1 to T3 received hydrogel at the time of planting. Hydrogel was placed around the plant at a distance of 8-10 cm at a depth of 7.5 to 10 cm. Similarly, for the treatment T4 to T6 hydrogel was applied as described above on 12th August, 2021 after a rainy day during crop growth (at 32DAP). Hydrogel was applied at the rate of 2.5 kg/ha(0.14g/plant), 3.75 kg/ha (0.20 g/plant) and 5.0kg/ha (0.30 g/plant).Rainfall received during the experiment was 656.8 mm with 51 rainy days. Crop has not received any rainy day between 15th September and 29th September 2021. There were no rains for 15 days except 4.4 mm rainfall spread in 3 days on 8th, 14th and 15th day during gap period. The last (10th) picking was carried out on 30th October, 2021.

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 5 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 5 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. Soil application of hydrogel @ 5 kg/ ha (0.30 g plant/ hole) after a rainy day recorded significantly higher plant height at final picking (148.4 cm). Significantly higher number of leaves harvested per plant was recorded in the treatment receiving application of hydrogel @ 5 kg/ha (0.30 g plant/ hole) after a rainy day (22.5). Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day recorded significantly higher leaf area of leaf at X position (915.3 cm^2) and leaf at L position (773.2 cm^2). Significantly higher root length was recorded in the control (48.21 cm) at final picking. Application of hydrogel @ 5 kg/ ha (0.30 g plant/hole) after a rainy day recorded significantly higher green leaf yield (12062 kg/ha), cured leaf yield (1432 kg/ha) and top grade equivalent (993 kg/ha). During final harvest significantly higher soil moisture content was recorded in soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day (13.5 %). All the three chemical quality constituents' *viz.,* nicotine, reducing sugar and chloride were within the acceptable standards. There was no significant difference among the different treatments both in X and L position leaves except for nicotine content at L position. Significantly higher nicotine (1.45 %) was recorded with the soil application of hydrogel @ 3.75 kg/ha (0.20 g/ plant hole) before planting.

Table 1 VFSAG 70: Rainfall received at different crop growth stages

Parameters	Date	Rainfall (mm)	No. of rainy days
Rainfall received during the experiment (mm)	12.07.2021 to 30.10.2021	656.8	51
Rainfall received from planting to 30 DAP (mm)	12.07.2021 to 10.08.2021	307.8	18
Rainfall received between 30 and 45 DAP (mm)	11.08.2021 to 25.08.2021	46.4	7
Rainfall received from planting to 45 DAP (mm)	12.07.2021 to 25.08.2021	354.2	25
Rainfall received between 45 DAP to final harvest (mm)	25.08.2021 to 30.10.2021	302.6	26
Crop duration (Days)	12.07.2021 to 30.10.2021	112	
Crop duration receiving rainfall (%) (Both rainy days and days with rainfall in traces)	62		
Crop duration not receiving any rainfall (%)	38		
Crop duration receiving > 2.5 mm rainfall (%)	46		

Table 2 VFSAG 70: Rainfall received during different stages of crop growth during 2021-22

Crop growth stages	Rainfall (mm)	No. of rainy days	No. of days in traces	Days without rainfall
Knee height stage (30 DAP)	307.8	18	8	4
Rapid growth and elongation (30-60 days)	99.4	14	3	13
Flowering stage (lower leaves ready to harvest) (60-80 days)	42.6	4	4	12
Upper leaves ready to harvest (80-120 days)	207.0	15	3	14
Total	656.8	51	18	43

Table 3 VFSAG 70: Effect of rate and time of hydrogel application on plant height (cm), number of leaves per plant and total leaves harvested per plant at different stages of crop growth in FCV tobacco

Treatments	Plant height (cm)			Number of leaves		Total no. of leaves harvested per plant
	45 DAP	At first picking	At final picking	45DAP	At first picking	
T1: Soil application of hydrogel @ 2.5 kg/ha(0.14 g plant/hole) before planting	38.9	44.1	128.3	10.3	13.5	20.6 (2.1)*
T2: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) before planting	41.3	46.7	131.2	11.8	14.5	21.5 (2.2)
T3: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) before planting	38.0	45.7	135.1	11.7	13.9	21.8 (2.2)
T4: Soil application of hydrogel @ 2.5 kg/ ha (0.14 g plant/ hole) after a rainy day	36.5	42.2	129.9	10.1	14.7	20.4 (2.0)
T5: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) after a rainy day	38.6	44.6	141.6	11.6	15.1	21.6 (2.2)
T6: Soil application of hydrogel @ 5 kg/ ha (0.30 g plant/hole) after a rainy day	37.6	45.1	148.4	11.3	15.5	22.5 (2.3)
T7: Control	32.2	40.9	116.9	9.8	12.5	17.9 (1.8)
S.Em±	2.50	1.96	5.25	0.73	0.74	0.74
C.D. (p=0.05)	NS	NS	16.9	NS	NS	2.29

**Any rainy day after 30 DAP during crop growth period (applied on 32 DAP)*
NS: Non-significant
First picking: - 57 DAP

Table 4 VFSAG 70: Effect of hydrogel application on leaf area (cm^2) at different growth stages of FCV tobacco

Treatment	Leaf area (cm^2)				
	45 DAP	At First picking	X position leaves	L position leaves	At final picking
T1: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) before planting	399.6	503.4	850.6	658.6	349.8
T2: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) before planting	404.5	511.2	862.2	689.6	387.9
T3: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) before planting	403.6	523.9	872.4	730.3	364.7
T4: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) after a rainy day	376.1	476.0	856.4	691.7	323.2
T5: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) after a rainy day	389.8	537.3	875.7	716.3	359.5
T6: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day	364.7	561.4	915.3	773.2	348.7
T7: Control	329.4	458.9	783.5	565.3	315.2
S.Em±	27.42	32.85	36.07	32.51	36.81
CD (p=0.05)	NS	NS	110.32	98.24	NS

**Any rainy day after 30 DAP during crop growth period (applied on 32 DAP)*
NS: Non-significant
First picking: - 57 DAP

Table 5 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
T1: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) before planting	30.13	41.13	68.33	124.30
T2: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) before planting	29.64	40.64	57.67	115.60
T3: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole)before planting	29.67	38.13	58.67	130.00
T4: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole)after a rainy day	30.04	45.04	59.00	142.60
T5: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole)after a rainy day	30.67	41.67	60.33	128.30
T6: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole)after a rainy day	31.43	43.43	68.87	135.60
T7: Control	31.01	48.21	69.21	164.30
S. Em±	1.32	2.12	3.63	10.24
C.D. at 5%	NS	7.35	NS	32.23

**Any rainy day after 30 DAP during crop growth period (applied on 32 DAP); NS: Non significant; First picking: 57 DAP*

Table 6 VFSAG 70: Effect of hydrogel application on green leaf and cured leaf yield and TGE of FCV tobacco

Treatment	Green leaf yield	Cured leaf yield	TGE
	Kg/ha		
T1: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) before planting	10858	1213	854
T2: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) before planting	11326	1294	917
T3: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) before planting	11824	1345	936
T4: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) after a rainy day	11240	1298	860
T5: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) after a rainy day	11650	1380	948
T6: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day	12062	1432	993
T7: Control	10210	1079	748
S. Em±	355.28	60.48	45.59
C.D. at 5%	1094.73	186.18	140.47

Table 7 VFSAG 70: Effect of hydrogel application on soil moisture content in FCV tobacco

Treatment	Moisture content (%) at 10 cm depth		
	10DACR	15DACR	Final harvest
T1: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) before planting	7.4	6.0	12.6
T2: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) before planting	7.7	6.1	12.2
T3: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) before planting	8.1	6.6	13.2
T4: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) after a rainy day	7.7	6.2	12.4
T5: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) after a rainy day	8.5	6.7	12.8
T6: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day	8.9	7.4	13.5
T7: Control	6.9	5.9	10.2
S. Em±	0.38	0.28	0.85
C.D. at 5%	1.16	0.86	2.41

**Any rainy day after 30 DAP during crop growth period (applied on 32 DAP)*

DACR- Days after cessation of rainfall

Field capacity of soil: 13.8% , 10 DACR : 24.09.2021, 15 DACR : 29.09.2021

Table 8VFSAG 70: Economics of FCV Tobacco as influenced by application of hydrogel

Treatment	Cured leaf yield	Cost of cultivation	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)
T1: Soil application of hydrogel @ 2.5 kg/ha(0.14 g plant/hole) before planting	1213	153250	4200	2010	844	160304
T2: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) before planting	1294	153250	5700	3225	1335	163510
T3: Soil application of hydrogel @ 5 kg/ha(0.30 g plant/hole) before planting	1345	153250	7200	3990	1650	166090
T4: Soil application of hydrogel @ 2.5 kg/ha(0.14 g plant/hole) after a rainy day	1298	153250	4200	3285	1360	162095
T5: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) after a rainy day	1380	153250	5700	4515	1870	165335
T6: Soil application of hydrogel @ 5 kg/ha(0.30 g plant/hole) after a rainy day	1432	153250	7200	5295	2190	167935
T7: Control	1079	153250	-	-	-	153250

Note:
Selling price: Rs. 180 per kg
Labour cost: Rs. 280 per day

Table 9 VFSAG 70: Economics of FCV Tobacco as influenced by application of hydrogel

Treatment	Total cost of cultivation	Gross return Rs ha-1	Net return Rs ha-1	B:C
T1: Soil application of hydrogel @ 2.5 kg/ha(0.14 g plant/hole) before planting	160405	218340	58036	1.36
T2: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) before planting	166326	232920	69410	1.42
T3: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) before planting	165111	242100	76010	1.46
T4: Soil application of hydrogel @ 2.5 kg/ha (0.14 g plant/hole) after a rainy day	159928	233640	71545	1.44
T5: Soil application of hydrogel @ 3.75 kg/ha (0.20 g plant/hole) after a rainy day	164977	248400	83065	1.50
T6: Soil application of hydrogel @ 5 kg/ha (0.30 g plant/hole) after a rainy day	164765	257760	89825	1.53
T7: Control	153250	194220	40970	1.27

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

Table 10 VFSAG 70: Effect of hydrogel application on chemical quality constituents in FCV tobacco

	X position			Y position		
Treatment	**Nicotine (%)**	**Reducing sugars (%)**	**Chloride**	**Nicotine (%)**	**Reducing sugars (%)**	**Chloride**
T1: Soil application of hydrogel @ 2.5 kg/ha(0.14 g plant/hole) before planting	1.12	11.63	0.16	1.03	14.95	0.13
T2: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) before planting	1.20	12.94	0.20	1.45	13.45	0.14
T3: Soil application of hydrogel @ 5 kg/ha(0.30 g plant/hole) before planting	0.70	11.98	0.18	0.80	14.76	0.14
T4: Soil application of hydrogel @ 2.5 kg/ha(0.14 g plant/hole) after a rainy day	1.06	12.34	0.17	1.30	14.45	0.13
T5: Soil application of hydrogel @ 3.75 kg/ha(0.20 g plant/hole) after a rainy day	1.15	12.09	0.20	1.36	11.53	0.16
T6: Soil application of hydrogel @ 5 kg/ha(0.30 g plant/hole) after a rainy day	1.11	12.38	0.15	0.86	12.99	0.16
T7: Control	1.00	14.84	0.19	1.20	16.77	0.14
S.Em±	0.12	1.42	0.02	0.11	0.02	0.02
C.D. at 5%	NS	NS	NS	0.35	NS	NS

VFSAG 71: STUDY ON INFLUENCE OF DIFFERENT MOISTURE CONSERVATION MATERIALS ON FCV TOBACCO

Objectives

- To conserve soil moisture during crop growth period in FCV tobacco
- To know the effectiveness of biodegradable agro wastes as moisture conservation material

Material and methods

Effect of in-situ moisture conservation through different mulches on growth and yield of FCV tobacco was evaluated by adopting following material and methods.

Different moisture conservation materials

Present study is carried out to know the effect of five different mulch materials and application of hydrogel @ 3 g per plant at the time of planting along with control *i.e.*, no moisture conservation practices in conserving soil moisture. The details of mulch materials used in the study are summarized in Table 1 VFSAG 71. Among the mulch materials, gunny bag and areca husk are of organic in nature and transparent polyethylene film, mulch sheets and weed mat are non organic. Areca husk at moisture content of 12 per cent was used to cover the ridge at the rate of 1 kg/m of 80 cm width ridge. Hydrogel was applied around the plant at a distance of 8-10 cm from plant and at a depth of 7.5 to 10 cm.

Experimental details

Seeds of KST-28 (Sahyadri) variety of FCV tobacco were sown following soil solarization. Main field was thoroughly ploughed and ridges were raised. Mulch materials *viz.*, weed mat, transparent polyethylene film, gunny bag and black mulch sheets were laid on ridges. A hole of 15 cm diameter on these materials was made for planting. While for areca husk, hydrogel and control treatment planting point was marked. Care was taken to cover 80 cm width of ridge by mulch materials uniformly for all treatments. Seedlings were transplanted to main field. All other cultural operations were carried out as per package of practices of the University. The details of experiment are presented below

Design	:	RCBD	**Duration**	:	03 Years
Replications	:	Three	**Year of start**	:	2019-20
Treatments	:	Eight	**Season**	:	*Kharif*
Gross plot size	:	6.3× 4.2 m	**Date of sowing**	:	30-04-2021
Net plot size	:	4.5× 3.0 m	**Date of planting**	:	16-07-2021
Variety	:	KST-28 (Sahyadri)			

Treatment details

T1: Control (No cover)
T2: Soil application of Hydrogel @ 3 g per plant hole before planting
T3: Covering the ridge with gunny bag (Whole bag with two layers)
T4: Covering the ridge with gunny bag (Single layer)
T5: Covering the ridge with transparent polyethylene film
T6: Covering the ridge with HDPE weed mat
T7: Covering the ridges with mulching sheets
T8: Application of areca husk (dry) as crop residue mulch @ 10 t/ha on the ridge

Table 1 VFSAG 71: Details of different materials used in the study

Sl. No.	Mulching materials	Common usage	Thickness (mm)
1)	Transparent Polyethylene plastic film	Soil solarization	0.025
2)	Gunny bag (single layer)	Package material	1.30
3)	Gunny bag (double layer)	Package material	2.62
4)	HDPE Weed mat	To control weeds in commercial nursery/ landscape/ garden	0.16
5)	Mulching sheet	Vegetable cultivation	0.05
6)	Areca husk (Dry)	Bio-waste	0.65
7)	Hydrogel @ 3 g/plant	Super absorbent	-

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 5 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 5 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 days 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

Results of the experiment on moisture conservation materials indicated that the application of moisture conservation materials significantly influence the crop growth parameters. Significantly higher plant height was recorded with application of areca husk (dry) as crop residue mulch @ 10 t per ha on the ridge (49.6 cm, 61.2 cm and 155.0 cm at 45 DAP, first picking and at final picking, respectively). Similarly, application of areca husk (dry) as crop residue @ 10 t per ha on the ridge recorded significantly higher number of leaves per plant 12.7 and 16.3 at 45 DAP and first picking. Significantly higher leaf area was recorded with application of areca husk (dry) as crop residue @ 10 t per ha on the ridge 797.9 cm^2at X position and 648.5 cm^2at L position respectively.

Yield performance of FCV tobacco was influenced significantly with the application of different moisture conservation materials. The data revealed that significantly higher green leaf yield (12280 kg/ha) and cured leaf yield (1696 kg/ha) was recorded with the application of areca husk (dry) as crop residue mulch @ 10 t per ha on the ridge. Significantly lower green leaf yield (9582 kg/ha) and cured leaf yield (1173 kg/ha) was recorded in control. Leaf quality in terms of TGE also followed the similar trend. Significantly higher soil moisture content was recorded in the treatment with the application of areca husk (dry) as crop residue @ 10 t per ha on the ridge at 10 days after cessation of rainfall (8.8%) and at final picking (12.2%).

All the three chemical quality constituents' *viz*., nicotine, reducing sugar and chloride were within the acceptable standards. There was no significant difference among the different treatments both in X and L position.

Table 2 VFSAG 71 : Rainfall received at different crop growth stages (2019 to 2021)

<table>
<tr><th rowspan="2">Parameters</th><th colspan="2">2019</th><th colspan="2">2020</th><th colspan="2">2021</th></tr>
<tr><th>Rainfall (mm)</th><th>No. of rainy days</th><th>Rainfall (mm)</th><th>No. of rainy days</th><th>Rainfall (mm)</th><th>No. of rainy days</th></tr>
<tr><td>Rainfall received during the experiment (mm)</td><td>998.6</td><td>62</td><td>701.2</td><td>49</td><td>606.4</td><td>46</td></tr>
<tr><td>Rainfall received from planting to 30 DAP (mm)</td><td>420.0</td><td>18</td><td>259.0</td><td>18</td><td>272.0</td><td>16</td></tr>
<tr><td>Rainfall received between 30 and 45 DAP (mm)</td><td>68.4</td><td>7</td><td>115.6</td><td>10</td><td>53.2</td><td>7</td></tr>
<tr><td>Rainfall received from planting to 45 DAP (mm)</td><td>488.4</td><td>25</td><td>361.6</td><td>27</td><td>325.2</td><td>23</td></tr>
<tr><td>Rainfall received between 45 DAP to final harvest (mm)</td><td>510.2</td><td>37</td><td>339.8</td><td>22</td><td>281.2</td><td>23</td></tr>
<tr><td>Crop duration</td><td colspan="2">112</td><td colspan="2">112</td><td colspan="2">107</td></tr>
<tr><td rowspan="2">Crop duration receiving rainfall (%)during the experiment (Both rainy days and days with rainfall in traces)</td><td colspan="2">80</td><td colspan="2">65</td><td colspan="2">60</td></tr>
<tr><td colspan="6">68</td></tr>
<tr><td rowspan="2">Crop duration not receiving any rainfall (%)</td><td colspan="2">20</td><td colspan="2">35</td><td colspan="2">40</td></tr>
<tr><td colspan="6">32</td></tr>
<tr><td rowspan="2">Crop duration receiving > 2.5 mm rainfall (%)</td><td colspan="2">55</td><td colspan="2">44</td><td colspan="2">43</td></tr>
<tr><td colspan="6">47</td></tr>
</table>

Table 3 VFSAG 71: Rainfall received during different stages of crop growth

Crop growth stage	Rainfall (mm)			Number of rainy days			No. of days with rain in traces			Days without rainfall		
	2019	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**	**2019**	**2020**	**2021**
Knee height stage(30 DAP)	420.0	259.0	272.0	18	18	16	6	7	9	6	5	5
Rapid growth and elongation (30-60 days)	131.2	234.6	118.6	16	14	15	11	4	3	3	12	12
Flowering stage(lower leaves ready to harvest) (60-80 days)	87.4	58.6	61.2	8	9	5	4	7	3	8	3	12
Upper leaves ready to harvest (80-120 days)	360.0	149.0	154.6	20	8	10	6	20	3	6	10	14
Total	998.6	701.2	606.4	62	49	46	27	35	18	23	28	43

Table 4 VFSAG 71: Effect of moisture conservation materials on plant height (cm) at different stages of crop growth in FCV Tobacco

Treatment	Plant height (cm)											
	45 DAP				First picking				Final picking			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	31.9	41.6	42.1	**38.9**	51.2	49.8	49.1	**50.0**	130.4	126.0	131.5	129.3
T2: Soil application of Hydrogel @ 3 g plant hole-1 before planting	34.9	47.4	48.8	**43.7**	52.0	54.2	54.8	**53.7**	140.8	131.8	139.6	137.4
T3: Covering the ridge with gunny bag (Whole bag with two layers)	38.1	49.1	44.5	**43.9**	54.9	52.7	51.5	**53.0**	143.1	136.1	138.2	139.1
T4: Covering the ridge with gunny bag (Single layer)	37.9	48.0	42.4	**42.8**	52.8	53.0	53.4	**53.1**	133.5	139.6	135.6	136.2
T5: Covering the ridge with transparent polyethylene film	35.6	49.7	43.6	**42.9**	54.9	57.5	54.6	**55.7**	133.0	137.7	140.2	136.9
T6: Covering the ridge with HDPE weed mat	40.6	50.1	46.0	**45.6**	55.6	58.1	55.0	**56.2**	143.1	142.6	153.4	146.3
T7: Covering the ridges with mulching sheets	40.0	50.8	47.7	**46.2**	54.6	59.3	58.7	**57.5**	147.2	144.0	150.2	147.1
T8: Application of areca husk (dry) as crop residue mulch@ 10 t ha-1 on the ridge	42.3	52.9	53.6	**49.6**	59.7	62.3	61.6	**61.2**	157.5	149.1	158.4	155.0
S.Em±	1.8	1.86	1.9	**1.5**	1.5	2.5	1.9	**1.8**	5.38	4.31	4.2	2.8
C.D. at 5%	5.4	5.7	5.6	**4.6**	4.4	7.5	6.8	**5.4**	16.3	13.1	12.8	6.9

No. of pickings: 2019- 9 2020 & 2021-10

First picking: 2019-20:- 60 DAP; 2020-21:- 50 DAP; 2021-22:- 53 DAP

Table 5 VFSAG 71: Effect of moisture conservation materials on plant height (cm) at final picking of FCV Tobacco

Treatment	Plant height (cm) at final picking			
	2019	2020	2021	Pooled
T1: Control (No cover)	130.4	126.0	131.5	129.3
T2: Soil application of Hydrogel @ 3 g plant hole-1 before planting	140.8	131.8	139.6	137.4
T3: Covering the ridge with gunny bag (Whole bag with two layers)	143.1	136.1	138.2	139.1
T4: Covering the ridge with gunny bag (Single layer)	133.5	139.6	135.6	136.2
T5: Covering the ridge with transparent polyethylene film	133.0	137.7	140.2	136.9
T6: Covering the ridge with HDPE weed mat	143.1	142.6	153.4	146.3
T7: Covering the ridges with mulching sheets	147.2	144.0	150.2	147.1
T8: Application of areca husk (dry) as crop residue mulch@ 10 t ha-1 on the ridge	157.5	149.1	158.4	155.0
S.Em±	5.4	4.3	4.2	2.8
C.D. at 5%	16.3	13.1	12.8	6.9

Table 6 VFSAG 71: Effect of moisture conservation materials on number of leaves per plantat 45DAP and at first picking in FCV tobacco

Treatment	No. of leaves per plant							
	45 DAP				At first picking			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	5.2	10.5	10.8	8.8	11.3	13.1	11.4	11.9
T2:Soil application of hydrogel @ 3 g plant/hole before planting	6.0	12.9	12.2	10.4	12.7	14.6	12.8	13.4
T3: Covering the ridge with gunny bag (Whole bag with two layers)	5.8	11.5	11.6	9.6	13.8	13.9	12.6	13.4
T4: Covering the ridge with gunny bag (Single layer)	6.1	12.3	11.8	10.1	12.3	14.3	12.8	13.1
T5:Covering the ridge with transparent polyethylenefilm	7.3	13.0	12.5	10.9	13.2	15.0	13.2	13.8
T6: Covering the ridge with HDPE weed mat	6.3	12.9	13.2	10.8	13.9	14.7	13.9	14.2
T7: Covering the ridges with mulching sheets	7.3	14.1	13.8	12.0	14.9	15.9	14.6	15.1
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	7.5	15.2	15.3	12.7	15.3	16.8	16.9	16.3
S.Em±	0.5	0.8	0.7	0.5	0.7	0.6	0.8	0.8
C.D. at 5%	1.4	2.4	2.3	1.8	2.3	1.8	2.3	2.4

Note: No. of pickings: 2019- 9 2020 & 2021-10 First picking: 2019-20: 60 DAP; 2020-21: 50 DAP; 2021-22: 53 DAP

Table 7 VFSAG 71: Effect of moisture conservation materials on number of leaves harvested per plant in FCV Tobacco

Treatment	Number of leaves harvested per plant			
	2019	2020	2021	Pooled
T1: Control (No cover)	19.2 (2.1)*	20.1 (2.0)	19.4(1.9)	19.6(2.0)
T2: Soil application of Hydrogel @ 3 g plant hole-1 before planting	20.9(2.3)	21.1 (2.1)	20.8 (2.1)	20.9 (2.2)
T3: Covering the ridge with gunny bag (Whole bag with two layers)	19.5(2.2)	20.5 (2.1)	20.5 (2.1)	20.2 (2.1)
T4: Covering the ridge with gunny bag (Single layer)	19.3(2.1)	20.6 (2.1)	19.8 (2.0)	19.9 (2.1)
T5: Covering the ridge with transparent polyethylene film	20.8(2.3)	22.7 (2.3)	21.1 (2.1)	21.5 (2.2)
T6: Covering the ridge with HDPE weed mat	21.3(2.4)	21.4 (2.1)	22.8 (2.3)	21.8 (2.3)
T7: Covering the ridges with mulching sheets	21.6(2.4)	23.2 (2.3)	23.9 (2.4)	22.9 (2.4)
T8: Application of areca husk (dry) as crop residue mulch@ 10 t ha-1 on the ridge	23.9(2.7)	24.2 (2.4)	24.8 (2.5)	24.3 (2.6)
S.Em±	0.6	0.8	0.9	0.5
C.D. at 5%	2.0	2.4	2.8	1.6

**Figures in the parenthesis indicate average number of leaves per picking*

Table 8 VFSAG 71: Effect of moisture conservation materials on leaf area (cm^2) at different growth stages of FCV Tobacco

Treatment	Leaf area (cm^2)							
	45 DAP				At first picking			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	196.3	266.2	280.3	247.6	367.4	358.0	324.5	350.0
T2:Soil application of hydrogel @ 3 g plant/holebefore planting	202.7	321.2	315.5	279.8	383.1	361.3	342.2	362.2
T3: Covering the ridge with gunny bag (Whole bag with two layers)	273.4	352.4	340.2	322.0	472.6	390.7	365.2	409.5
T4: Covering the ridge with gunny bag (Single layer)	254.1	322.6	310.5	295.7	415.9	360.4	345.3	373.9
T5:Covering the ridge with transparent polyethylenefilm	259.3	344.8	351.3	318.5	426.1	440.0	371.2	412.4
T6: Covering the ridge with HDPE weed mat	276.4	358.4	374.3	336.4	476.1	377.3	398.5	417.3
T7: Covering the ridges with mulching sheets	298.4	392.9	408.5	366.6	477.1	455.0	438.2	456.8
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	346.0	433.2	452.2	410.5	506.3	484.0	488.6	493.0
S.Em±	24.3	30.0	27.2	26.5	20.7	26.2	28.2	18.2
C.D. at 5%	73.9	91.1	85.3	76.2	62.9	79.6	85.3	55.3

Note: No. of pickings: 2019- 9 2020 & 2021-10 *First picking: 2019-20: 60 DAP; 2020-21: 50 DAP; 2021-22: 53 DAP*

Table 9 VFSAG 71: Effect of moisture conservation materials on leaf area (cm^2) at different growth stages of FCV Tobacco

Treatments	No. of leaves per plant							
	X position leaves				L position leaves			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	728.8	524.7	602.3	618.6	490.5	401.7	470.2	454.1
T2:Soil application of hydrogel @ 3 g plant/hole before planting	743.8	634.7	685.2	687.9	515.8	476.3	512.3	501.5
T3:Covering the ridge with gunny bag (Whole bag with two layers)	808.7	557.3	660.3	675.4	529.5	469.3	548.5	515.8
T4: Covering the ridge with gunny bag (Single layer)	773.4	547.7	683.4	668.2	518.4	407.3	536.4	487.4
T5:Covering the ridge with transparent polyethylenefilm	791.8	620.0	702.5	704.8	531.0	520.3	568.7	540.0
T6: Covering the ridge with HDPE weed mat	818.2	644.3	732.5	731.7	550.9	525.0	620.2	565.4
T7: Covering the ridges with mulching sheets	824.4	660.0	760.3	748.2	624.4	529.0	645.8	599.7
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	862.5	741.0	790.2	797.9	670.3	560.0	715.3	648.5
S.Em±	26.3	35.0	33.2	23.8	29.5	30.3	27.3	20.3
C.D. at 5%	79.9	106.3	96.4	76.5	89.4	91.9	82.5	68.2

Note: No. of pickings: 2019- 9 2020 & 2021-10 *First picking: 2019-20:- 60 DAP; 2020-21: 50 DAP; 2021-22: 53 DAP*

Table 10 VFSAG 71: Effect of moisture conservation materials on root length (cm) in FCV Tobacco

Treatments	Root length (cm)							
	45 DAP				At first picking			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	15.9	32.5	28.6	25.7	43.9	48.8	47.6	46.8
T2:Soil application of hydrogel @ 3 g plant/hole before planting	10.7	21.4	21.7	17.9	31.3	33.5	40.2	35.0
T3: Covering the ridge with gunny bag (Whole bag with two layers)	11.8	25.1	19.0	18.6	39.0	39.3	36.1	38.1
T4: Covering the ridge with gunny bag (Single layer)	11.3	20.3	18.1	16.6	35.3	36.8	40.5	37.5
T5:Covering the ridge with transparent polyethylenefilm	11.4	26.3	21.8	19.8	43.2	40.5	38.5	40.7
T6: Covering the ridge with HDPE weed mat	14.2	24.0	20.7	19.6	38.9	34.6	42.3	38.6
T7: Covering the ridges with mulching sheets	11.2	23.5	20.4	18.4	37.3	38.8	42.2	39.4
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	10.4	22.6	26.0	19.7	34.3	35.9	48.5	39.6
S.Em±	1.1	2.2	1.9	1.1	2.6	2.7	2.1	2.0
C.D. at 5%	3.4	6.5	5.9	3.4	7.8	8.2	6.4	6.3

Table 11 VFSAG 71: Effect of moisture conservation materials on root volume (cc) in FCV Tobacco

Treatment	Root volume (cc)							
	45 DAP				At final picking			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	17.6	69.1	52.2	46.3	93.1	120.0	100.2	104.4
T2:Soil application of hydrogel @ 3 g plant/hole before planting	13.0	45.9	46.2	35.0	64.9	86.7	76.5	76.0
T3: Covering the ridge with gunny bag (Whole bag with two layers)	15.4	46.8	45.3	35.8	74.1	90.0	88.6	84.2
T4: Covering the ridge with gunny bag (Single layer)	14.1	50.1	49.2	37.8	65.2	106.7	105.6	92.5
T5:Covering the ridge with transparent polyethylenefilm	13.1	48.1	41.2	34.1	88.8	100.0	90.2	93.0
T6: Covering the ridge with HDPE weed mat	17.4	55.0	46.2	39.5	71.9	90.0	98.6	86.8
T7: Covering the ridges with mulching sheets	12.5	60.0	44.3	38.9	66.8	84.7	104.8	85.4
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	11.6	53.5	50.3	38.5	67.1	80.7	115.4	87.7
S.Em±	1.3	4.6	3.2	4.2	4.4	7.8	6.9	6.2
C.D. at 5%	4.1	14.0	9.6	13.5	13.3	23.5	21.2	19.2

Table 12 VFSAG 71: Effect of moisture conservation materials on green leaf yield of FCV Tobacco

Treatment	Green leaf yield (kg/ ha)			
	2019	2020	2021	Pooled
T1: Control (No cover)	9656	9146	9945	9582
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	10017	9989	10456	10154
T3: Covering the ridge with gunny bag (Whole bag with two layers)	10857	10270	10607	10578
T4: Covering the ridge with gunny bag (Single layer)	10538	9877	10229	10215
T5: Covering the ridge with transparent polyethylene film	10546	10399	10854	10600
T6: Covering the ridge with HDPE weed mat	10921	10153	11087	10720
T7: Covering the ridges with mulching sheets	11951	11187	11686	11608
T8: Application of areca husk (dry) as crop residue mulch@ 10 t/ ha on the ridge	13434	11336	12072	12280
S.Em±	719.9	416.9	358.2	333.4
C.D. at 5%	2183.6	1264.5	1068.0	1028.2

Table 13 VFSAG 71: Effect of moisture conservation materials on cured leaf yield and TGE of FCV tobacco

Treatment	Cured leaf yield (kg/ha)				TGE (kg/ha)			
	2019	**2020**	**2021**	**Pooled**	**2019**	**2020**	**2021**	**Pooled**
T1: Control (No cover)	1473	1031	1014	1173	767	584	712	688
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	1562	1295	1160	1339	773	636	765	741
T3: Covering the ridge with gunny bag (Whole bag with two layers)	1730	1319	1291	1447	874	717	806	774
T4: Covering the ridge with gunny bag (Single layer)	1598	12766	1208	1361	798	693	774	747
T5:Covering the ridge with transparent polyethylenefilm	1613	1415	1302	1443	822	699	817	796
T6: Covering the ridge with HDPE weed mat	1764	1281	1319	1455	838	672	836	783
T7: Covering the ridges with mulching sheets	1838	1492	1398	1576	914	723	887	841
T8: Application of areca husk (dry) as crop residue mulch @ 10 t/ ha on the ridge	2039	1569	1479	1696	1002	740	963	902
S.Em±	83.4	72.0	86.5	34.0	45.3	75.3	45.5	26.5
C.D. at 5%	253.1	218.2	262.2	103.5	137.5	231.5	136.6	79.6

Table 14VFSAG 71: Yield and economics of FCV tobacco as influenced by different moisture conservation materials (Pooled)

Treatments	Cured leaf yield (kg/ha)	Cost of cultivation (Rs)	Material cost + imposition of treatment (Rs)	Cost on weeding (Rs.)	Additional cost on fuel wood (Rs.)	Other additional cost on harvesting, curing and grading (Rs)	Total cost (Rs.) (a+b + c+d+e)
		a	b	c	d	e	
T1: Control (No cover)	1173	147221	-	8320	0	0	155541
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	1339	147221	68450	8320	609	1105	225705
T3: Covering the ridge with gunny bag (Whole bag with two layers)	1447	147221	67620	3000	1204	2334	221379
T4: Covering the ridge with gunny bag (Single layer)	1361	147221	36160	4250	768	1850	190249
T5:Covering the ridge with transparent polyethylenefilm	1443	147221	205550	530	1597	2133	172031
T6: Covering the ridge with HDPE weed mat	1455	147221	82000	530	1786	2633	234170
T7: Covering the ridges with mulching sheets	1576	147221	32812	530	3142	4223	187928
T8: Application of areca husk (dry) as crop residue mulch @ 10 t/ ha on the ridge	1696	147221	4000	530	3719	5808	161278

**Total number of labors required for weeding of one ha (16*2) =32,*

Labor cost: Rs.250 per day (2019 & 2020), Rs. 280 per day (2021) 6 Labours for covering the ridges with mulching materials per ha and 5 labour for application of hydrogel per ha

Cost of cultivation for the year 2020 includes additional cost incurred on management of Tobacco mosaic virus and leaf curl

Table 15 VFSAG 71: Economics of FCV tobacco as influenced by different moisture conservation materials (Pooled)

Treatment	Total cost of cultivation Rs ha^{-1}				Gross return Rs ha^{-1}			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	153254	157004	156364	**155541**	**265140**	**185580**	**182520**	**211080**
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	223096	227134	226884	225705	281160	233100	208800	241020
T3: Covering the ridge with gunny bag (Whole bag with two layers)	220195	221964	221979	221379	311400	237420	232380	260400
T4: Covering the ridge with gunny bag (Single layer)	188789	190819	191139	190249	287640	229680	217440	244920
T5:Covering the ridge with transparent polyethylenefilm	169724	173369	172999	172031	290340	254700	234360	259800
T6: Covering the ridge with HDPE weed mat	232377	234554	235579	234170	317520	230580	237420	261840
T7: Covering the ridges with mulching sheets	187161	188916	187706	2187928	330840	268560	251640	283680
T8: Application of areca husk (dry) as crop residue mulch @ 10 t/ haon the ridge	161452	161489	160894	161278	367020	282420	266220	305220

**Selling price of Tobacco Rs. 180 kg^{-1}*

Table 16 VFSAG 71: Economics of FCV tobacco as influenced by different moisture conservation materials (Pooled)

Treatment	Net return Rs ha^{-1}				B:C			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled
T1: Control (No cover)	111886	28576	26156	55539	1.7	1.2	1.2	1.4
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	58064	5966	-18084	15315	1.3	1.0	0.9	1.1
T3: Covering the ridge with gunny bag (Whole bag with two layers)	91205	15456	10401	3021	1.4	1.1	1.0	1.2
T4: Covering the ridge with gunny bag (Single layer)	98851	38861	26301	54671	1.5	1.2	1.1	1.3
T5:Covering the ridge with transparent polyethylenefilm	120616	81331	61361	87769	1.7	15	1.4	1.5
T6: Covering the ridge with HDPE weed mat	85143	-3674	1841	2670	1.4	1.0	1.0	1.1
T7: Covering the ridges with mulching sheets	143679	79644	63934	95752	1.8	1.4	1.3	1.5
T8: Application of areca husk (dry) as crop residue mulch @ 10 t 10 t/ haon the ridge	205568	12093 1	105326	143942	2.3	1.7	1.7	1.9

**Selling price of Tobacco Rs. 180 kg^{-1}*

Table 17 VFSAG 71: Effect of moisture conservation on soil moisture content in FCV tobacco

Treatment	Moisture content (%) at 10 cm depth							
	2019-20	2020-21				2021-22		
	Final harvest	10 DACR 01.09.2020	10 DACR 02.10.2020	15 DACR 07.10.2020	Final harvest	24.09.2021 10DACR	29.09.2021 15 DACR	Final harvest
T1: Control (No cover)	18.8	6.8	6.2	4.2	9.3	6.8	5.8	10.2
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	20.6	8.2	8.0	5.3	11.2	7.4	6.3	11.3
T3: Covering the ridge with gunny bag (Whole bag with two layers)	19.2	7.8	7.1	5.0	10.5	6.9	5.8	10.8
T4: Covering the ridge with gunny bag (Single layer)	19.8	7.3	6.8	4.6	9.9	7.3	6.5	11.3
T5:Covering the ridge with transparent polyethylenefilm	18.1	8.0	8.8	5.8	11.4	7.5	6.8	11.0
T6: Covering the ridge with HDPE weed mat	18.2	9.2	8.6	6.2	12.1	7.8	6.3	10.1
T7: Covering the ridges with mulching sheets	18.9	8.5	8.6	7.0	11.2	8.1	6.9	11.4
T8: Application of areca husk (dry) as crop residue mulch @ 10 10 t/ haon the ridge	22.3	9.6	9.0	7.5	13.2	8.8	7.5	12.2
S.Em±	0.99	0.6	0.4	0.4	0.8	0.5	0.4	0.4
C.D. at 5%	NS	1.9	1.4	1.3	2.4	1.4	1.4	1.3

DACR- Days after cessation of rainfall

2019-20: Continuous rainfall during the entire month of October

Table 18 VFSAG 71: Effect of moisture conservation materials on chemical quality constituents at X position in FCV tobacco

Treatment	Nicotine (%)				Reducing sugars (%)				Chloride (%)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	2022
T1: Control (No cover)	1.08	1.30	1.24	1.21	12.10	20.53	12.27	14.97	0.20	0.21	0.15	0.19
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	1.00	1.87	1.02	1.30	11.99	15.32	13.04	13.45	0.17	0.25	0.20	0.21
T3: Covering the ridge with gunny bag (Whole bag with two layers)	1.24	1.50	0.98	1.24	12.03	17.67	13.11	14.27	0.14	0.21	0.23	0.19
T4: Covering the ridge with gunny bag (Single layer)	1.19	1.33	0.87	1.13	12.51	21.17	11.12	14.93	0.19	0.20	0.21	0.20
T5:Covering the ridge with transparent polyethylenefilm	1.24	1.44	1.01	1.23	11.19	19.45	12.22	14.29	0.17	0.24	0.20	0.20
T6: Covering the ridge with HDPE weed mat	1.15	1.71	0.99	1.28	11.74	15.32	13.88	13.65	0.18	0.22	0.23	0.21
T7: Covering the ridges with mulching sheets	1.18	1.62	0.84	1.21	11.63	16.98	12.70	13.77	0.24	0.22	0.18	0.21
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	1.19	1.54	1.14	1.29	13.29	19.21	13.01	15.17	0.18	0.25	0.19	0.21
S.Em±	0.05	0.16	0.11	0.09	0.54	1.8	1.13	0.89	0.02	0.03	0.03	0.02
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 19 VFSAG 71: Effect of moisture conservation materials on chemical quality constituents at L position in FCV tobacco

Treatment	Nicotine (%)				Reducing sugars (%)				Chloride (%)			
	2019	2020	2021	Pooled	2019	2020	2021	Pooled	2019	2020	2021	2022
T1: Control (No cover)	1.15	1.60	0.93	1.23	11.45	17.30	11.88	13.45	0.17	0.26	0.14	0.19
T2: Soil application of Hydrogel @ 3 g plant/hole before planting	0.93	1.73	1.08	1.25	13.46	17.34	10.32	13.71	0.14	0.30	0.15	0.20
T3: Covering the ridge with gunny bag (Whole bag with two layers)	1.12	1.52	1.38	1.34	12.43	19.71	10.93	14.36	0.14	0.27	0.13	0.18
T4: Covering the ridge with gunny bag (Single layer)	1.29	1.36	1.14	1.26	10.66	21.85	10.47	14.33	0.17	0.21	0.18	0.19
T5:Covering the ridge with transparent olyethylenefilm	1.35	1.44	1.20	1.33	12.58	23.70	9.89	15.39	0.17	0.29	0.19	0.22
T6: Covering the ridge with HDPE weed mat	1.23	1.55	0.96	1.25	12.64	17.33	12.95	14.31	0.17	0.23	0.18	0.19
T7: Covering the ridges with mulching sheets	1.23	1.50	1.31	1.35	11.91	17.76	10.96	13.54	0.14	0.24	0.19	0.19
T8: Application of areca husk (dry) as crop residue mulch @ 10 t ha-1 on the ridge	134	1.64	1.00	1.33	10.44	15.65	13.95	13.35	0.20	0.23	0.15	0.19
S.Em±	0.04	0.16	1.04	0.09	0.53	2.14	1.04	1.23	0.01	0.03	0.03	0.02
C.D. at 5%	0.13	NS	NS	NS	1.62	NS	NS	NS	0.03	NS	NS	NS

VFSAG 72: CROP INTENSIFICATION IN FCV TOBACCO FOR ADDITIONAL FARM INCOME

Objectives

- To study different pulses as compatible inter crop in FCV tobacco
- To calculate the economic viability of inter cropping of pulses in FCV tobacco under rainfed condition of KLS region

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. The detail of the study is summarized in Table

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/ hawas applied two weeks before transplanting and was mixed with soil immediately. Later, the field was uniformly levelled 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	**Duration**	:	02 Years
Replications	:	Three	**Year of start**	:	2021-22
Treatments	:	Eleven	**Season**	:	*Kharif*
Gross plot size	:	7.2 x 6.0 m	**Date of sowing**	:	27-04-2021
Variety	:	KST-28 (Sahyadri)	**Date of planting**	:	24-07-2021

Sole crop	**Net plot size**	**Nutrients**
Tobacco	: 3.6m x3.6m	Base crop (FCV tobacco): 40:30:80 kg N: P_2O_5: K_2O /ha
Green gram, blackgram and Groundnut	: 4.8m x5.2m	Component crop (Legumes): Nutrients will be supplied proportionate through urea, DAP and SOP as per recommended package of practices
Cowpea	: 3.6mx 5.2m	
Fieldbean	: 3.6m x 4.8m	

Treatment details

T1: FCV Tobacco + Green gram (Skip row 1:3)	T2: FCV Tobacco + Black gram (Skip row 1:3)
T3: FCV Tobacco + Cowpea (Skip row 1:2)	T4: FCV Tobacco + Field bean (Skip row 1:2)
T5: FCV Tobacco + Groundnut (Skip row 1:3)	T6: Sole FCV Tobacco
T7: Sole Green gram	T8: Sole Black gram
T9: Sole Cowpea	T10: Sole Field bean
T11: Sole Groundnut	

Table 1 VFSAG 72: Details of varieties used in the experiment and their characteristics

S. No.	Crop	Variety	Duration (days)	Characteristics	Yield
1	FCV tobacco	Sahyadri	70-75	Average cured yield potential of 2000-2300 kg/ha. Moderately resistant to black shank disease and root-knot nematode	CLY: 2000-2300 kg/ha
2	Green gram	KKM - 3	60-65	Seeds are bold and of shining green colour. Average yield ranging from 8 to 9 q/ha. Moderately tolerant to powdery mildew, yellow mosaic virus and resistant to pod borer.	Grain: 5 - 7.5 q/ha
3	Black gram	LBG - 625	70 -75	Produces high biomass with less yield and shiny seeds. Susceptible to yellow mosaic incidence.	Grain: 5-7.5 q/ha
4	Cowpea	Sahyadri Yukti	80 -85	Short stature and grown well in limited moisture conditions. The seeds are medium bold.	Grain: 5 - 7.5 q/ha
5	Field bean	HA-4	95 -105	Pods are soft and Yield potential of 6t/ha.	Pod: 30-37.5 q/ha Grain: 7.5-10 q/ha
6	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 2 VFSAG 72: 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	15-20 kg/ha	15-20 kg/ ha	25-30 kg/ ha	25-30 kg/ ha	100-110 kg/ ha
Duration (days)	110-120	60-65	70-75	80-85	95-105	105-110
Fertilizer dose (kg/ ha)	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)	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 3 VFSAG 72: Details of input used and operation followed in the experiment

Crops		Tobacco	Greengram	Blackgram	Cowpea	Fieldbean	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. SO4 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)		-	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 (m2)		-	21.6	21.6	21.6	21.6	21.6
Net plot area-sole crop (m2)		12.96	24.96	24.96	18.72	17.28	24.96
Net plot area-inter crop (m2)		--	12.96	12.96	12.96	12.96	12.96
Date of planting of tobacco/ sowing of legumes		24.07.2021	24.07.2021	24.07.2021	24.07.2021	24.07.2021	24.07.2021
Date of harvest	First	22.09.2021	-	-	05.10.2021	21.09.2021	-
	Final	24.10.2021	08.10.2021	16.10.2021	17.10.2021	21.11.2021	11.11.2021
No. of pickings		7	1	1	2	4	1
Duration (Days)		92	77	85	86	121	111

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

$$CEY = \sum_{i=1}^{n} Yi\ e\ i$$

$$e= \frac{Pbc}{Pi}$$

Yi= yield of ith component
e i= equivalent factor
Pi = Price of the ith crop
Pbc= Price of the crop to which yield is converted

$$LER = \sum_{i=1}^{n} \frac{Yij}{Yii}$$

Y ij : yield of ith component from a unit area of intercrop expressed as a fraction of yield
Y ii : yield of ith 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

$$MAI= [\text{Value of combined intercrop yield}] \times \frac{(LER-1)}{LER}$$

Result

Results of the experiment on feasibility of crop intensification through intercropping of legumes in FCV tobacco indicated that the intercropping influence the crop growth parameters. Higher plant height was recorded in FCV tobacco grown with groundnut as intercrops at 45 DAP and at first picking and at final picking (59.1 cm, 84.6 cm and 116.4 cm respectively). Higher leaf area was recorded in the FCV tobacco grown with groundnut as intercrop leaf at X position (992.5 cm2) and leaf at L position leaves (722.1 cm^2). Highest number of leaves harvested per plant was 22.2 in the FCV tobacco grown with groundnut as intercrop. Higher cured leaf yield (1771 kg ha-1) was recorded in the FCV tobacco grown with groundnut. Higher land equivalent ratio (1.62) and monetary advantage index (Rs.147472) were recorded in the FCV tobacco grown with groundnut as intercrop.The chemical quality parameters such as nicotine, reducing sugars and chloride contents were under acceptable limits. The significantly lower reducing sugar content in 'X' and 'L' position leaf was recorded under FCV Tobacco + Green gram (8.08 and 10.83%) intercropping system respectively.

Table 4 VFSAG 72: Effect of intercropping of legumes in FCV tobacco on plant height and numberof leaves per plant in FCV tobacco

Treatment	Plant height (cm) of FCV tobacco			Number of leaves per plant in FCV tobacco		No. of leaves harvested per plant
	45 DAP	First picking	Final picking	45 DAP	First picking	
T1: FCV Tobacco + Green gram (Skip row 1:3)	57.6 (1.4)	82.3 (5.3)	112.5 (4.6)	10.3 (0.0)	16.3 (1.2)	21.2 (4.4)
T2: FCV Tobacco + Black gram (Skip row 1:3)	57.1 (0.6)	81.2 (3.9)	112.3(4.4)	9.9 (-3.9)	16.3 (1.2)	20.3 (0.0)
T3: FCV Tobacco + Cowpea (Skip row 1:2)	50.6 (-11.0)	72.4 (-7.3)	93.2 (-13.3)	8.9 (-11.3)	13.5 (-16.1)	18.2 (-10.3)
T4: FCV Tobacco + Field bean (Skip row 1:2)	54.5(-4.0)	76.5 (-2.1)	100.2 (-6.8)	9.9 (-0.7)	14.8 (-8.0)	19.3 (-4.9)
T5: FCV Tobacco + Groundnut (Skip row 1:3)	59.1 (4.1)	84.6 (8.2)	116.4 (8.3)	10.6(2.9)	16.7 (3.27)	22.2 (9.4)
T6: FCV Tobacco (Sole)	56.8 (0.0)	78.1 (0.0)	107.2 (0.0)	10.3 (0.0)	16.1 (0.0)	20.3 (0.0)

First picking of tobacco: 61 DAP (22.09.2021)

**Figures in the parenthesis indicate percent change over sole crop of FCV tobacco*

Table 5 VFSAG 72: Effect of intercropping of legumes in FCV tobacco on leaf area of FCV tobacco

Treatment	Leaf area(cm^2)			
	45 DAP	First picking	X Position leaves	Y Position leaves
T_1: FCV Tobacco + Green gram (Skip row 1:3)	538.2 (2.3)	765.8 (1.8)	976.3 (2.1)	718.3 (2.3)
T_2: FCV Tobacco + Black gram (Skip row 1:3)	529.2 (0.5)	760.2 (1.0)	936.2 (0.8)	715.2 (1.8)
T_3: FCV Tobacco + Cowpea (Skip row 1:2)	400.2 (-24.1)	416.4 (-44.7)	650.4 (-32.0)	552.3 (-21.4)
T_4: FCV Tobacco + Field bean (Skip row 1:2)	486.3 (-7.6)	698.2 (-7.2)	82.3 (-10.3)	685.2 (-2.4)
T_5: FCV Tobacco + Groundnut (Skip row 1:3)	554.0 (5.3)	773.2 (2.8)	992.5 (3.8)	722.1 (2.8)
T_6: FCV Tobacco (Sole)	528.3 (0)	752.3 (0.0)	955.4 (0.0)	702.1 (0.0)

Figures in the parenthesis indicate percent change over sole crop of FCV tobacco

Table 6 VFSAG 72: Effect of intercropping of legumes in FCV tobacco on main crop yield, intercrop yield and tobacco equivalent yield

Treatment	Yield (kg/ ha)		Intercrop yield (kg/ ha)	Tobacco equivalent yield (kg/ha)
	Green leaf	Cured leaf	Grain pod	
T_1: FCV Tobacco + Green gram (Skip row 1:3)	13070 (17.3)	1683 (8.2)	251	1821
T_2: FCV Tobacco + Black gram(Skip row 1:3)	12030 (8.0)	1675 (7.7)	297	1842
T_3: FCV Tobacco + Cowpea(Skip row 1:2)	7789 (-30.1)	1146 (-26.0)	3444	1252
T_4: FCV Tobacco + Field bean (Skip row 1:2)	10550 (-5.3)	1422 (-8.6)	1451	1663
T_5: FCV Tobacco + Groundnut(Skip row 1:3)	13795 (23.8)	1771 (13.9)	1141	2124
T_6: FCV Tobacco (Sole)	11139 (0.0)	1555 (0.0)		1555
T_7: Sole Green gram			536	293
T_8: Sole Black gram			645	361
T_9: Sole Cowpea			743	227
T_{10}: Sole Field bean			3206	534
T_{11}: Sole Groundnut			248	762
S.Em±				49
C.D. at 5%				146

Figures in the parenthesis indicate percent change over sole crop of FCV tobacco

Table 7 VFSAG 72: Land equivalent ratio(LER), Area Time Equivalent Ratio(ATER) and Monetary Advantage Index(MAI) of FCV tobacco as influenced by FCV tobacco intercropping

Treatment	LER	ATER	MAI (Rs)
T1: FCV Tobacco + Green gram (Skip row 1:3)	1.55	1.47	116275
T2: FCV Tobacco + Black gram (Skip row 1:3)	1.55	1.51	117868
T3: FCV Tobacco + Cowpea (Skip row 1:2)	1.27	1.24	51746
T4: FCV Tobacco + Field bean (Skip row 1:2)	1.40	1.18	86529
T5: FCV Tobacco + Groundnut (Skip row 1:3)	1.62	1.43	147472
T6: FCV Tobacco (Sole)	-	-	-
T7: Sole Green gram	-	-	-
T8: Sole Black gram	-	-	-
T9: Sole Cowpea	-	-	-
T10: Sole Field bean	-	-	-
T11: Sole Groundnut	-	-	-

Prices of crop produce

FCV Tobacco : Rs. 18000/q
Green gram : Rs. 9850/q
Black gram : Rs. 10060/q
Cowpea : Rs. 5500 /q
Field bean : Rs. 3000/ q
Groundnut : Rs. 5850/ q

Table 8 VFSAG 72: Economics as influenced by FCV tobacco based intercropping (Rs/ha)

Treatments	Total COC	Total Gross Return	Total Net Return	B:C ratio for crop intensification
T1: FCV Tobacco + Green gram (Skip row 1:3)	150772	327683	176912	2.2
T2: FCV Tobacco + Black gram (Skip row 1:3)	150723	331469	180746	2.2
T3: FCV Tobacco + Cowpea (Skip row 1:2)	147806	243368	95561	1.6
T4: FCV Tobacco + Field bean (Skip row 1:2)	155025	299493	144468	1.9
T5: FCV Tobacco + Groundnut (Skip row 1:3)	161573	382179	220606	2.4
T6: FCV Tobacco (Sole)	134674	279900	145226	2.1
T7: Sole Green gram	45435	62816	17380	1.4
T8: Sole Black gram	45337	64917	19580	1.4
T9: Sole Cowpea	38665	60785	22121	1.6
T10: Sole Field bean	51542	96180	44638	1.9
T11: Sole Groundnut	66504	137097	70593	1.9

Table 9 VFSAG 72: Effect of different intercropping system on quality leaf in FCV tobacco

Treatment	X position (%)			L position (%)		
	Nicotine	Reducing sugar	Chloride	Nicotine	Reducing sugar	Chloride
T1: FCV tobacco + Greengram	1.23	8.08	0.25	1.38	10.83	0.33
T2: FCV tobacco + Blackgram	1.22	11.84	0.22	1.45	11.31	0.26
T3: FCV tobacco + Cowpea	0.92	12.47	0.24	1.19	12.92	0.27
T4: FCV tobacco + Field bean	1.02	12.83	0.20	1.50	13.45	0.31
T5: FCV tobacco + Groundnut	1.12	12.47	0.27	1.28	11.66	0.34
T6: Sole FCV tobacco	1.16	11.77	0.23	1.22	11.13	0.27
S.Em±	0.15	0.45	0.02	0.15	0.34	0.03
C.D. at 5%	NS	1.36	NS	NS	1.03	NS

B. *BIDI* TOBACCO

ANAND

BDAAG 164 : EFFECT OF VARIETY AND PLANTING DATES ON YIELD AND QUALITY OF *BIDI* TOBACCO VARIETIES

Experiment Details

Design	:	SPD	**Spacing**	:	90 × 75 cm
Replication	:	Four	**Fertilizer kg/ha**	:	RDF (200 kg/ha)
Crop	:	*Bidi* Tobacco	**Plot size**	:	4.5 × 6.0 m
Year of start	:	2020-21 (*Kharif -Rabi*)	**Year of completion**	:	2022-23

Treatments: 4 x 2 =8 combinations

A. **Main plots: Planting dates (D): Four**
   - D1: August 3rd week
   - D2: September 1st week
   - D3: September 3rd week
   - D4: October 1st week

B. **Sub plot: Variety (V): Two**
   - V1: GABT 11
   - V2: MRGTH 1

Results

Experimental results depicted in Table 1 BDAAG 164 revealed that different dates of transplanting established their significant influence on tobacco cured leaf yield, leaf size and plant height except dry weight per unit leaf area. Tobacco transplanted during 1st week of September registered significantly higher cured leaf yield (3853 kg/ha) being at par with 3rd week of August and showed its superiority over rest of transplanting dates. Similar trend was also observed in case of leaf length, leaf width and plant height. Both tobacco varieties gave significant effect on tobacco cured leaf yield, leaf size, plant height and dry weight per unit leaf area. Significantly the highest cured leaf yield (3931 kg/ha) and leaf size were noticed in variety GABT 11 whereas, significantly the highest plant height and leaf thickness were recorded in variety MRGTH 1. With respect to different interaction effects between different transplanting dates and both varieties, different treatment combinations failed to exert their significant effect on tobacco yield and yield attributes.

Further, data illustrated in (Table 2 BDAAG 164) revealed that different transplanting dates as well as both varieties gave significant effect on quality parameters *viz.,* nicotine, reducing sugar and chloride contents. Tobacco transplanting during 3rd week of August registered significantly the highest nicotine and lowest reducing sugar contents. Significantly lower value of chloride content was found when tobacco transplant during 1st week of October. Whereas, GABT 11 gave significantly the highest nicotine and the lowest values of reducing sugar as well as chloride contents.

With respect to different interaction effects between different transplanting dates and both varieties, different treatment combinations gave their significant effect on nicotine, reducing sugar and chloride contents. Data predicted in (Table 3 BDAAG 164) revealed that treatment combination D1V1 gave significantly the highest nicotine content as well as the lowest reducing sugar content as compared to rest of treatment combinations. While, treatment combination D4V1 gave significantly the lowest value of chloride content

Table 1 BDAAG 164 : Response of date of transplanting and varietyon yield and morphological characters of *bidi* tobacco (2021-22)

Treatment	Yield (kg/ha)	Leaf length	Leaf width	Plant height	Dry weight per leaf area (mg/cm^2)
		(cm)			
A. Date of transplanting (D)					
D1: August 3rd week	3630	52.55	21.80	75.68	9.94
D2: September 1st week	3853	55.63	23.43	77.95	9.35
D3: September 3rd week	3270	49.53	20.17	70.95	9.73
D4: October 1st week	3266	48.70	21.05	66.90	9.51
S. Em±	128.1	1.47	0.63	2.40	0.24
C.D. at 5%	409.9	4.71	2.02	7.68	NS
C.V. (%)	10.3	8.1	8.3	9.3	7.1
B. Variety (V)					
V1: GABT 11	3931	55.35	22.90	69.33	8.48
V2: MRGTH 1	3079	47.85	20.32	76.41	10.78
S. Em±	86.2	1.9	0.7	2.1	0.3
C.D. at 5%	265.5	5.9	2.2	6.4	0.8
Int. D x V	NS	NS	NS	NS	NS
C.V. (%)	9.8	14.8	13.4	11.4	10.8

Table 2BDAAG 164 : Response of date of transplanting and variety on quality parameters of *bidi* tobacco (2021-22)

Treatment	Quality parameters (%)		
	Nicotine	Reducing Sugar	Chloride
A. Date of transplanting (D)			
D1: August 3rd week	5.46	3.89	1.14
D2: September 1st week	5.06	4.43	1.33
D3: September 3rd week	4.88	4.18	1.14
D4: October 1st week	4.49	4.55	1.05
S. Em±	0.03	0.03	0.02
C.D. at 5%	0.10	0.10	0.05
C.V. (%)	1.7	2.0	3.8
B. Variety (V)			
V1: GABT 11	5.17	4.07	1.15
V2: MRGTH 1	4.77	4.46	1.18
S. Em. ±	0.02	0.02	0.01
C.D. 0.05	0.05	0.07	0.03
Int. D x V	Sig.	Sig.	Sig.
C.V. (%)	1.3	2.1	3.6

Table 3 BDAAG 164: Interaction effect of transplanting date and varieties on nicotine, reducing sugar and chloride contents of *bidi* tobacco (2021-22)

Nicotine content (%)				Reducing sugar content (%)				Chloride content (%)		
D / V	V1	V2		D / V	V1	V2		D / V	V1	V2
D1	**5.77**	**5.15**		**D1**	**3.67**	**4.11**		**D1**	**1.16**	**1.12**
D2	**4.84**	**5.28**		**D2**	**4.14**	**4.73**		**D2**	**1.47**	**1.18**
D3	**5.53**	**4.24**		**D3**	**4.21**	**4.15**		**D3**	**1.17**	**1.12**
D4	**4.54**	**4.43**		**D4**	**4.26**	**4.83**		**D4**	**0.79**	**1.31**
S. Em±	0.03			S. Em+	0.04			S. Em+	0.02	
C.D. at 5%	0.10			C.D. at 5%	0.14			C.D. at 5%	0.06	
C.V. (%)	1.30			C.V. (%)	2.08			C.V. (%)	3.58	

NIPANI

BDNAG 56: EVALUATION OF PRE AND POST EMERGENT HERBICIDE MOLECULES AGAINST WEEDS IN TOBACCO ECOSYSTEM

Objective: To evaluate the herbicide molecules against monocot and dicot weeds and in-turn impact on tobacco yield and quality

Year of start: 2019-20 Design : RBD

Replications : 3 Plot size : 10 × 5 m

Treatment details: 11 (Eleven)

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 0.5lit/ha	Post-emergent	20-25 days after planting/Any time after planting
9	Metribuzine @ 0.75 kg/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	-	-

Results

Results indicated that, though the tobacco leaf yields are very low, there is a significant variation between the treatments imposed. The significantly higher leaf yield of tobacco (465 kg/ha) was recorded in the treatment, where the weeds in the crop sprayed (pre and post emergent) with Metribuzine @ 0.75 kg/ha as compared to weedy check (170 kg/ha) and other pre-emergent weedicides.

However, it was on par with weedicide propaquizofop Ethyl 10EC @ 0.5lit/ha (459 kg/ha), one inter-cultivation followed by 2 hand weeding's (382 kg/ha) and Quizalofop ethyl 5EC @ 0.5 lit/ha (374 kg/ha). Similar trend was followed in growth and yield parameters.

Table 1 BDNAG 56: Yield and morphological characters of *bidi* tobacco influenced by influenced by different weedicides

Treatments	Leaf yield kg/ha	Plant height (cm)	No. of. Leaves/ plant	Leaf Length (cm)	Leaf Width (cm)
Pendimethalin 30 EC @ 3.25 lit/ha	185	73.20	12.00	22.81	12.27
Pendimethalin 38.7 CS @ 1.5 lit/ha	270	79.07	12.40	23.16	12.89
Clomazone 50 EC @ 0.5 lit/ha	256	79.27	12.20	25.43	12.21
Chlorimeron Ethyl 25 WP @ 4 g/ha	276	77.07	10.27	25.86	12.40
Butachlor 5% @ 0.5 lit/ha	228	83.07	13.00	23.28	12.21
Quizalofop ethyl 5EC @ 0.5 lit/ha	374	84.93	12.20	24.26	12.62
Propaquizofop Ethyl 10 EC	459	87.70	12.73	29.44	12.57
Fenoxapop-p-ethyl 9 EC 0.5 lit/ha	304	80.67	13.47	27.01	12.60
Metribuzine @ 0.75 g/ha	465	90.93	13.40	27.31	13.32
One inter cultivation followed by 2 HW	382	76.60	13.73	22.61	12.67
Weedy check	170	72.67	9.50	20.08	11.99
Mean	306	80.47	12.26	24.66	12.52
S. Em$\pm$	54	13.58	2.01	4.22	1.90
C.D. at 5%	161	NS	NS	NS	NS

BDNAG 57: DOUBLING OF THE FARMER'S INCOME BY TOBACCO BASED CROPPING SYSTERM UNDER MULCHES

Objective: To study the tobacco cropping system under mulches to double the farmer's income

Year of start : 2020- 21
Replications : Six

Design : Factorial RBD
Plot size : 10 × 5 m

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

Results

The results revealed that there is significant impact of mulches and cropping systems on tobacco leaf yield. The maximum leaf yield of 1761 kg/ha was produced when tobacco was planted on crop residue mulch and it was significantly higher than the tobacco yield when planted on black plastic mulch (1470 kg/ha), soil mulch (1357 kg/ha) and trash (1164 kg/ha). Similar trend was followed in growth and yield parameters of tobacco, but did not differ significantly to each other.

Under various tobacco based sequence cropping systems, tobacco planted alone gave maximum leaf yield of 1657 kg/ha) and it was significantly higher than the yield obtained by the tobacco in Soybean-Tobacco-Maize (1309 kg/ha), Soybean-Tobacco-Sugarcane (1295 kg/ha) and Sunhemp- Tobacco-Sugarcane (1159 kg/ha) sequence cropping systems. However, it was on par with tobacco obtained in Tomato-Tobacco-Summer groundnut (1631 kg/ha) and Groundnut-Tobacco-Summer soybean (1578 kg/ha) sequence cropping systems. Similar trend was followed in growth and yield parameters of tobacco, but did not differ significantly to each other. However, only plant height did vary significantly due to various tobacco based sequence cropping systems. The total cycle of various tobacco and non-tobacco based cropping systems under various mulches is not completed. As soon as the results of summer groundnut, summer soybean, maize, turmeric, banana, sugarcane, ratoon tobacco leaf yield and tobacco seed yield obtained, it will be submitted for your information and reference.

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	1470	114.93	16.60	47.89	16.56
M2- Trash mulch	1164	109.31	16.16	47.13	15.92
M3- Crop residue mulch	1761	126.83	16.74	48.88	16.49
M4- Soil mulch	1357	120.19	17.61	47.06	15.83
S.Em±	94	4.56	0.49	0.68	0.39
C.D. at 5%	287	NS	NS	NS	NS
Cropping system (S)					
S1-Tomato-Tobacco-Summer groundnut	1631	126.83	16.66	48.11	16.57
S2- Groundnut-Tobacco-Soybean	1578	121.71	17.50	48.79	16.29
S3- Soybean-Tobacco-Maize	1309	113.51	16.52	47.84	16.13
S4-Sunhemp-Tobacco-Sugarcane (Relay crop)	1159	105.66	16.63	47.88	16.31
S5- Soybean-Tobacco-Sugarcane (Relay crop)	1295	114.13	16.62	47.65	16.32
S6-Tobacco alone	1657	125.05	16.74	46.19	15.58
S.Em±	68	2.26	0.39	0.62	0.35
C.D. at 5%	191	6.36	NS	NS	NS
Interaction	NS	NS	NS	NS	NS

BDNAG 58: 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

Year of start : 2021-22 Replications : Three
Design :RBD Plot size : 10 × 5 m

Treatment details: 10(Ten)

S. No.	Name of the weedicide
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*

Results : Though the tobacco leaf yields are very low, there is a significant impact on the *Orobanche* incidence due to various treatments imposed. The treatment where tobacco was planted on fallow land applied with neem cake @ 30 DAP followed by post emergent application of Imazethapyr on *Orobanche* spikes recorded the tobacco leaf yield of 885 kg/ha and was significantly higher than the tobacco planted on fallow land followed by hand removal of *Orobanche* spikes (385 kg/ha) and non-removal of the *Orobanche* spikes (285 kg/ha). However, it was on par with the treatments where in tobacco was planted on fallow land applied with neem cake @30DAP followed by hand removal of *Orobanche* (635 kg/ha), post emergent application of neem oil (678 kg/ha), pongamea oil (761 kg/ha), paraquat (760 kg/ha), Glyphosate (770 kg/ha) to *Orobanche* spikes, green manuring of black sesamum (693 kg/ha) and sunhemp (652 kg/ha) before planting tobacco. Similar trend is seen in all the growth and yield parameters.

Table 1 BDNAG 58: Yield and morphological characters of *bidi* tobacco influenced by different treatments

S. No.	Treatments	Leaf yield 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*	635	77.27	10.20	23.56	12.40
2	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Neem oil on *Orobanche* spikes	678	78.40	11.87	26.31	12.44
3	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Pongamia oil on Orobanche spikes	761	85.50	11.73	26.39	12.88
4	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Paraquat on *Orobanche* spikes	760	83.74	11.23	26.42	12.92
5	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Imazethapyr on *Orobanche* spikes	885	86.88	15.67	29.64	13.15
6	Fallow-tobacco + Neem cake application at 30 DAP + Post emergence application of Glyphosate on *Orobanche* spikes	770	91.80	13.13	29.09	13.03
7	Green manuring of Black sesamum-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	693	86.80	12.53	28.33	12.52
8	Green manuring of Sunnhemp-tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	652	82.13	10.20	25.56	12.67
9	Fallow-tobacco + Hand removal of *Orobanche*	385	74.00	10.93	21.07	12.40
10	Fallow-tobacco + Non removal of *Orobanche*	285	66.27	9.33	19.88	11.99
	Mean	651	81.28	11.68	25.62	12.64
	S.Em±	114	4.68	1.40	2.58	0.46
	C.D. at 5%	339	13.92	NS	NS	NS

NANDYAL

BDNyAG 18: RESPONSE OF *BIDI* TOBACCO TO DIFFERENT DROUGHT MITIGATION MEASURES

Objectives

- To find out the effect of different drought management measures on growth and cured leaf of *bidi* tobacco.
- To find out the effect of different drought management measures on leaf chemical quality of *bidi* tobacco.

Year of start	:	2019-20	**Fertiliser**	:	RDF (110 N + 70 P_2O_5 + 50 K_2O)
Design	:	Split plot	**Plot size**	:	6.0×6.0 m
Replications	:	Three	**Variety**	:	NandyalPogaku-1

Treatments: 10 (Ten)

Main Plot: Plant density

P1: Normal planting - 75 ×75 cm (17,777/ha)
P2: High density planting - 60 × 60 cm (27,777/ha)

Subplot: Drought mitigation measures

D1: No foliar Spray
D2: Foliar spray with water during drought period
D3: Foliar spray with KNO_3 @ 2.5 % during drought period
D4: Foliar spray with Gibberellic acid @ 20 ppm during drought period
D5: Foliar spray with Triacontanol 0.1% EW @ 2ml /L during drought period

***Note**: Drought period is assessed based on climate parameters and available soil moisture*

Results indicated that higher leaf length (34.3 cm), leaf width (14.1 cm), RWC (64.9%), Dry weight/unit leaf area (12.6) were observed in high density planting method compared to normal planting method. There is no significant difference among the planting methods. Higher cured leaf yield was observed in high density planting (1859 kg/ha) compared to normal planting (1268 kg/ha).Among the drought mitigation measures application of foliar spray with Gibberellic acid @ 20 ppm during drought period has recorded higher leaf length (45.3 cm), leaf width (17.1 cm) and relative water content (75.5 %) at 90 DAP and Cured leaf yield (2136 kg/ha) which is on par with foliar spray with Triacontanol 0.1%EW @ 2ml /L (2015 kg/ha) during drought period

Conclusions: It is concluded that, during 2021-22 high density planting – 60 cm x 60 cm treatment recorded significantly higher cured leaf yield (1859 kg/ha), net returns and B:C ratio (3.1) compared with Normal planting –75 cm x 75 cm treatment (1268 kg/ha). Among drought mitigation measures Foliar spray with Gibberellic acid @ 20 ppm during drought period treatment recorded significantly higher cured leaf yield (2136 kg/ha), net returns and B:C ratio followed by Foliar spray with Triacontanol 0.1%EW @ 2ml /L during drought period (2015 kg/ha).

Table 1 BDNyAG 18: Growth and yield parameters as affected by different drought mitigation measures and plant density

Treatments	Plant height (cm)	Leaf length (cm)	Leaf Width (cm)	Relative water content (%)	Soil moisture (%)	Dry wt /unit leaf area (mg/cm2)	Cured Leaf Yield (kg/ha)	BCR
Main Plots: Plant density								
Normal planting – 75 × 75 cm (17,777/ha)	59.4	32.7	13.6	61.8	17.9	10.1	1268	2.8
High density planting – 60 × 60 cm (27,777/ha)	67.2	34.3	14.1	64.9	24.6	12.6	1859	3.1
S. Em+	3.7	1.4	0.9	1.8	0.6	0.2	71.0	
C.D. at 5%	NS	NS	3.1	NS	1.9	0.6	429.9	
Subplot: Drought mitigation measures								
No foliar Spray	58.7	27.3	12.4	50.4	17.2	9.6	1565	1.9
Foliar spray with water during drought period	60.8	29.5	14.2	67.6	25.1	12.9	1763	2.8
Foliar spray with KNO3 @ 2.5% during drought period	62.6	32.1	12.9	60.7	27.6	12.6	1857	3.1
Foliar spray with Gibberellic acid @ 20 ppm during drought period	72.7	45.3	17.1	75.5	28.9	13.7	2136	3.0
Foliar spray with Triacontanol 0.1% EW @ 2 ml/L during drought period	69.2	35.5	12.6	66.3	27.6	11.2	2015	2.9
S.Em±	2.9	1.6	0.9	4.2	1.0	0.9	87	
C.D. at 5%	8.5	4.8	2.8	12.5	3.2	2.7	245	
Interactions	NS	NS	NS	NS	NS	NS	NS	
C.V. (%)	10.2	12.7	14.2	16.5	10.6	10.4	11.5	

Table 2 BDNyAG 18: **Cost economics as influenced by methods of planting and drought mitigation measures**

Treatments	Cured Leaf Yield (kg/ha	Gross Returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Main Plots: Plant density					
P_1 – Normal planting – 75 cm x 75 cm	1268	120460	43021.4	77438.6	2.8
P_2 – High density planting – 60 x 60 cm	1859	176605	56969.4	119635.6	3.1
Subplot: Drought mitigation measures					
D_1 – No foliar Spray	1565	148675	78250.0	70425.0	1.9
D_2 – Foliar spray with water during drought period	1763	167485	62031.5	105453.5	2.7
D_3 – Foliar spray with KNO_3@ 2.5 % during drought period	1857	176415	63005.4	113409.6	2.8
D_4 – Foliar spray with Gibberellic acid @ 20 ppm during drought period	2136	202920	67640.0	135280.0	3.0
D_5 - Foliar spray with Triacontanol 0.1%EW @ 2ml /L during drought period	2015	191425	66008.6	125416.4	2.9

BDNyAG 17: MANAGEMENT OF BROOMRAPE (*OROBANCHE SPP*) IN *BIDI* TOBACCO

Objectives

- To study the effect of management practices on growth and 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

Year of start	:	2020-21	**Fertiliser**	:	RDF (110 N + 70 P_2O_5 + 50 K_2O)
Design	:	Split plot	**Plot size**	:	4.5 × 5.25 m
Replications	:	Three	**Variety**	:	A119 / Nandyal Pogaku 1
Spacing	:	75 × 75 cm	**Location**	:	RARS, Nandyal

Treatments: 15

Main Plots – Cropping systems

M1: Gingelly - *bidi* tobacco
M2: Sorghum - *bidi* tobacco
M3: Fallow - *bidi* tobacco

Sub Plots – *Orobanche* management methods

Trt. No.	Name of the Treatment	Time of application	Recommended dose	Dosage
T1	Neem cake @ 200 kg/ha fb Paraquat 24 % SL	PoE directed spray after emergence	0.6 kg a.i./ha	5.0 ml/ltr
T2	Neem cake @ 200 kg/ha fb Imazethapyr 10%SL	PoE directed spray after emergence	0.05 kg a.i./ha	1.0 ml/ltr
T3	Neem cake @ 200 kg/ha fb Ethoxysulfuron 15% WDG	PoE directed spray after emergence	25g/ha	0.33 g/ltr
T4	Hand weeding			
T5	Weedy Check			

***Note**: Neem cake @ 200 kg/ha applied as basal*
Post emergence directed spray of herbicide done after emergence of spikes

Results

Results indicated that higher plant height (60.2 cm), leaf length (35.5 cm), leaf width (14.7 cm), dry weight/unit leaf area (8.1 mg/cm^2), leaf yield (1703 kg/ha), net returns (Rs.64400 / ha) and B:C ratio (2.0) were observed in sorghum followed by *bidi* tobacco cropping system. There is no significant difference among the cropping systems. Lower weed count observed in sorghum followed by *bidi* tobacco cropping system.

Among *Orobanche* management methods Neem cake @ 200kg/ha application followed by Imazethapyr10% SL has recorded higher plant height (62.4 cm), leaf length (37.9 cm), leaf width (16.6 cm), dry weight/unit leaf area (9.5 mg/cm2) and cured leaf yield (1826 kg/ha) which is on par with hand weeding of whereas higher net returns and benefit cost ratio were observed in application of Neem cake @200kg/ha followed by Imazethapyr10% SL. Lower weed count was observed in hand weeding which is on par with application of Neem cake @200kg/ha followed by Imazethapyr 10% SL.

Conclusion: It is concluded that lower *Orobanche* population was observed in sorghum –*bidi* tobacco cropping system with application of Neemcake @200 kg/ha fb Imazethapyr10% SL

Table 1 BDNyAG 17: Growth and yield parameters as influenced by cropping systems and *Orobanche* management methods

Treatments	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Dry wt /unit leaf area (mg/cm^2)	Cured Leaf Yield (kg/ha)
Cropping systems					
M1: Gingelly - *bidi* tobacco	59.6	34.4	12.5	7.9	1337
M2: Sorghum - *bidi* tobacco	60.2	35.5	14.7	8.1	1679

Treatments	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Dry wt /unit leaf area (mg/cm^2)	Cured Leaf Yield (kg/ha)
M3: Fallow - *bidi* tobacco	57.4	30.2	12.9	6.7	1223
S. Em±	4.1	0.6	1.2	0.1	87
C.D. at 5%	NS	1.9	NS	0.3	261
***Orobanche* management methods**					
T1: Neem cake @ 200 kg/ha fb Paraquat 24% SL	59.1	32.3	13.9	6.8	1244
T2: Neem cake @ 200 kg/ha fb Imazethapyr10% SL	62.4	37.9	16.6	9.5	1826
T3: Neem cake @ 200 kg/ha fb Ethoxysulfuron 15% WDG	57.3	35.8	15.8	7.6	1673
T4: Hand weeding	60.5	36.1	17.2	8.1	1769
T5: Weedy check	64.1	26.6	10.7	6.2	1015
S. Em±	3.1	1.8	1.2	0.2	92
C.D. at 5%	NS	5.6	3.5	0.6	274
Interactions	NS	NS	NS	NS	NS
C.V. (%)	12.8	11.6	10.9	13.7	16.9

Table 2 BDNyAG 17: *Orobanche*count spike (no.) as influenced by cropping systems and *Orobanche management* methods(70 DAT)

Treatments	Before spraying	After spraying
Cropping systems		
M1: Gingelly – *bidi* tobacco	36.1	22.0
M2: Sorghum – *bidi* tobacco	31.8	21.9
M3: Fallow – *bidi* tobacco	41.3	26.7
***Orobanche* management methods**		
T1: Neem cake @ 200 kg/ha fb Paraquat 24% SL	36.1	2.4
T2: Neem cake @ 200 kg/ha fb Imazethapyr 10% SL	42.5	6.0
T3: Neem cake @ 200 kg/ha fb Ethoxysulfuron 15% WDG	39.5	6.1
T4: Hand weeding	44.2	0.0
T5: Weedy check	55.1	55.1

Table 3 BDNyAG 17: Seed yield as influenced by cropping systems and *Orobanche* management methods

Treatments	Sorghum (kg/ha)	Gingelly (kg/ha)
***Orobanche* management methods**		
T1: Neem cake @ 200 kg/ha fb Paraquat 24% SL	973.5	201
T2: Neem cake @ 200 kg/ha fb Imazethapyr 10% SL	410.4	209
T3: Neem cake @ 200 kg/ha fb Ethoxysulfuron 15% WDG	1040	152
T4: Hand weeding	1143	175
T5: Weedy check	782	196

Table 4 BDNyAG 17: Cost economics as influenced by cropping systems and *Orobanche* management methods

Treatments	Cured Leaf Yield (kg/ha)	Gross returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	B:C Ratio
Cropping systems					
M1: Gingelly – *bidi* tobacco	1337	100275	60235	40040	1: 1.7
M2: Sorghum – *bidi* tobacco	1679	125925	61525	64400	1: 2.0
M3: Fallow – *bidi* tobacco	1223	91725	55200	36525	1: 1.7
***Orobanche* management methods**					
T1: Neem cake @ 200 kg/ha fb Paraquat 24% SL	1244	93300	62400	30900	1:1.5
T2: Neem cake @ 200 kg/ha fb Imazethapyr 10% SL	1826	136950	60240	76710	1:2.3
T3: Neem cake @ 200 kg/ha fb Ethoxysulfuron 15% WDG	1673	125475	60560	64915	1:2.1
T4: Hand weeding	1769	132675	76700	55975	1: 1.7
T5: Weedy check	1015	76125	59500	16625	1:1.3

BDNyAG 19: ENHANCING THE PRODUCTIVITY OF *BIDI* TOBACCO BASEDCROPPING SYSTEMS

Objectives

- To evaluate different *bidi* tobacco based cropping systems for higher productivity and monetary returns.
- To find out the different *bidi* tobacco based cropping systems on quality of *bidi* tobacco.

Year of start	:	2020-21	**Plot size**	:	6.0 × 6.0 m
Design	:	RBD	**Location**	:	RARS, Nandyal
Replications	:	Three			

Treatments: 9

T1: Foxtailmillet -*Bidi* tobacco
T2: Greengram -*Bidi* tobacco
T3: Blackgram -*Bidi* tobacco
T4: Sweet corn -*Bidi* tobacco
T5: Cluster bean -*Bidi* tobacco
T6: Cowpea -*Bidi* tobacco
T7: Bajra -*Bidi* tobacco
T8: Onion -*Bidi* tobacco
T9: Fallow -*Bidi* tobacco (C)

Results

Results indicated that Onion followed by *bidi* tobacco cropping system has recorded higher plant height (65.5 cm), leaf length (42.6 cm), leaf width (19.5 cm) and *bidi* tobacco equivalent yield (2624 kg/ha) which is on par with sweet corn followed by *bidi* tobacco cropping system whereas higher net returns (Rs 87308/ha) and benefit cost ratio (2.28) was observed in sweet corn followed by *bidi* tobacco cropping system.

Conclusion: *Bidi* tobacco equivalent yields were higher with Onion-*Bidi* tobacco cropping system 2624 kg/ha followed by sweet corn-*Bidi* tobacco Cropping system 2543 kg/ha.

Table 1 BDNyAG 19: Growth parameters as influenced by different cropping systems

Treatments	Plant height (cm)	Leaf Length (cm)	Leaf Width (cm)	Cured Leaf Yield (kg/ha)
T1: Foxtail millet - *Bidi* tobacco	55.3	37.1	15.0	1261
T2: Greengram - *Bidi* tobacco	57.1	40.3	18.1	1855
T3: Blackgram - *Bidi* tobacco	59.6	36.5	14.3	1127
T4: Sweet corn - *Bidi* tobacco	60.3	38.9	17.2	1513
T5: Clusterbean - *Bidi* tobacco	56.8	38.3	18.6	1628
T6: Cowpea - *Bidi* tobacco	60.7	37.8	15.3	1257
T7: Bajra - *Bidi* tobacco	56.9	34.2	13.0	1169
T8: Onion - *Bidi* tobacco	65.5	42.6	19.5	2017
T9: Fallow - *Bidi* tobacco (C)	62.6	38.1	14.2	1425
S. Em±	4.2	2.2	0.6	122
C.D. at 5%	NS	7.4	1.9	358
C.V. (%)	12.5	13.2	14.5	12.9

Table 2 BDNyAG 19: *Bidi* tobacco equivalent yield of different crops as influenced by cropping systems

Treatments	*Bidi* tobacco yield(kg/ha)	Crop yield (kg/ha)	*Bidi* tobacco equivalent yield (kg/ha)
T1: Foxtail millet - *Bidi* tobacco	1261	1140	1634
T2: Greengram - *Bidi* tobacco	1855	525	2371
T3: Blackgram - *Bidi* tobacco	1127	612	1849
T4: Sweet corn - *Bidi* tobacco	1513	21048 (cob no)	2548
T5: Cluster bean - *Bidi* tobacco	1628	425	1837
T6: Cowpea - *Bidi* tobacco	1257	530	1613
T7: Bajra - *Bidi* tobacco	1169	751	1476
T8: Onion - *Bidi* tobacco	2017	2471	2624
T9: Fallow - *Bidi* tobacco (C)	1425	-	1425
S. Em±			78
C.D. at 5%			226
C.V. (%)			13.6

Table 3 BDNyAG 19: Cost economics of different crops as influenced by cropping systems

Treatments	*Bidi* tobacco equivalent yield (kg/ha)	Gross Returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net returns (Rs/ha)	B:C ratio
T1: Foxtail millet - *Bidi* tobacco	1634	99674	66645	33029	1:1.49
T2: Greengram - *Bidi* tobacco	2371	144631	68214	76417	1:2.12
T3: Blackgram - *Bidi* tobacco	1849	112789	69116	43673	1:1.63
T4: Sweet corn - *Bidi* tobacco	2548	155428	68120	87308	1:2.28
T5: Cluster bean - *Bidi* tobacco	1837	112057	60120	51937	1:1.86
T6: Cowpea - *Bidi* tobacco	1613	98393	68512	29881	1:1.43
T7: Bajra - *Bidi* tobacco	1476	90036	67230	22806	1:1.33
T8: Onion - *Bidi* tobacco	2624	160064	76215	83849	1:2.15
T9: Fallow - *Bidi* tobacco (C)	1425	86925	41255	45670	1:2.10

C. RUSTICA TOBACCO

ARAUL

RUArAG 30 : STUDIES ON THE ECONOMICS OF TOBACCO - POTATO INTERCROPPING SYSTEM (BULK PLOT TRIAL)

Objective: To assess the best ratio of Potato to be grown with tobacco for high remuneration.

Experiment Details

Design	:	Bulk Plot	**Year of Start**	:	2020-21
Plot size	:	9.0 × 8.0 m	**Year of Completion**	:	2021-22
Variety	:	*Hookah* Tobacco - Azad Kanchan Potato - Chipsona-I			
Harvesting	:	Stalk cut method			
Curing	:	Sun Curing			

Treatment Details : 03 (Three)

T1: Tobacco + Potato (2:4)
T2: Tobacco as sole crop
T3: Potato as sole crop

Results

Yield data (Table RuArAG-30) confirmed that higher tobacco equivalent yield was recorded in Treatment-3 (Potato as sole crop) i.e. 2468 Kg/ha followed by Treatment-1 [Tobacco + Potato (2:4)] *i.e.* 2168 kg/ha with 13.84% yield increase. The treatments also reflecting positive co-relation regarding morphological characters in comparison of treatment-2.

Economics of the treatments (Table RuArAG-30-2) revealed that highest monetary return of Rs. 51060.00/ha was recorded by Treatment-1 with B.C. Ratio of 1.09 and it will go as remunerative recommendation to the farming community.

Pooled Analysis

In order to work out economics of tobacco-potato inter cropping system, an experiment was conducted during 2020-21 and 2021-22 at Tobacco Research Station, Araul, Kanpur, U.P. The soil of experiment site was Sandy loam. The experiments consist of three treatments. The pooled analysis indicated that tobacco equivalent yield was significantly affected under various treatments. The higher tobacco equivalent yield recorded under the Treatment-3 (Potato as sole crop) i.e. 2401 kg/ha followed by Treatment-1 [Tobacco + Potato (2:4)] *i.e.* 2062 kg/ha.

Economics of the treatment revealed that highest net return of Rs. 47540.00 was recorded by Treatment-1 with benefit cost ratio of 1.05 and it will go as remunerated recommendation to farming community.

Table 1 RUArAG 30 : Data on Tobacco- Potato equivalent yield with morphological characters (2021-22)

Treatments	Tobacco equivalent yield (kg/ha)	Plant Height (cm)	Leaf Length (cm)	Leaf Width (cm)	No. Curable Levels
T1: Tobacco + Potato (2:4)	2168	64.81	41.38	37.12	12
T2: Tobacco as sole crop	1895	62.44	37.95	32.81	10
T3: Potato as sole crop	2468	-	-	-	-

Table 2 RUArAG 30: Economics of the system - Bulk Plot Trial (2021-22)

Treatments	Cured leaf yield/Potato (kg/ha)	Gross Return (Rs./ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B.C. Ratio
T1: Tobacco + Potato (2:4)	2168	97560.00	46500.00	51060.00	1.09
T2: Tobacco as sole crop	1895	85275.00	44350.00	40925.00	0.92
T3: Potato as sole crop	2468	11060.00	68600.00	42460.00	0.62

Tobacco Price: Rs. 45.00/kg   Potato Price: Rs. 6.00/kg.

Table 3 RUArAG 30: Pooled Analysis (2020-21 and 2021-22)

Treatments	Tobacco equivalent yield (kg/ha)	Gross Return (Rs./ha)	Cost of cultivation (Rs./ha)	Net Return (Rs./ha)	B.C. Ratio
T4: Tobacco + Potato (2:4)	2062	92790.00	45250.00	47540.00	1.05
T5: Tobacco as sole crop	1838	82710.00	42925.00	39785.00	0.93
T6: Potato as sole crop	2401	108045.00	69300.00	38745.00	0.56

Tobacco Price: Rs. 45.00/kg   Potato Price: Rs. 6.00/kg.

D. CHEWING TOBACCO

VEDASANDUR

CHVsAG 7: EFFECT OF NATURAL SWEETENERS AND ASTRINGENT TASTENERS ON THE CHEWING QUALITY OF *CHEWING* TOBACCO

Objective: To find out a suitable natural sweetener and astringent tasteners for improving the chewing quality.

Year of start	:	2020-21	**Year of completion**	:	2021-22
Design	:	CRBD	**Replications**	:	Three

Treatments: 12 (Twelve)

T1: White sugar 10% solution + Coconut mesocarp 5% solution
T2: White sugar 10% solution + Banana peducle 5% solution
T3: White sugar 10% solution + Banana pseudo stem 5% solution
T4: Coconut palm jaggery 10% solution + Coconut mesocarp 5% solution
T5: Coconut palm jaggery 10% solution + Banana peducle 5% solution
T6: Coconut palm jaggery 10% solution + Banana pseudo stem 5% solution
T7: Sugar cane jaggery 10% solution + Coconut mesocarp 5% solution
T8: Sugar cane jaggery 10% solution + Banana peducle 5% solution
T9: Sugar cane jaggery 10% solution + Banana pseudo stem 5% solution
T10: Palmyra jaggery 10% solution +Coconut mesocarp 5% solution
T11: Palmyra jaggery 10% solution + Banana peducle 5% solution
T12: Palmyra jaggery 10% solution + Banana pseudo stem 5% solution
T13: Control (Without sweetener or astringent tastners)

Results

The results of the year 2020-2021 revealed that the cured leaf of chewing tobacco treated with palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp or banana peduncle or banana pseudostem improved the chewing quality. The chewability scores for the chewing characters *viz.*, body, aroma, whitish encrustation, taste, pungency, saliva secretion, duration of pungency, stiffness in the mouth were higher with the palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp or banana peduncle or banana pseudostem. The expenditure was higher (Table 2) for the treatment 10% solution of Coconut palm jaggery and with different astringent tasteners (Rs. 406.6/33 kg) followed by Palmyrah jaggery 10% solution with different astringent tasteners (Rs. 393.3 /33 kg). The net return was higher (13 to 15%) for the treatment palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp as compared to the control.

The results of the year 2021-2022 revealed that the cured leaf of chewing tobacco treated with palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp or banana peduncle or banana pseudostem improved the chewing quality. The chewability scores for the chewing characters *viz.*, body, aroma, whitish encrustation, taste, pungency, saliva secretion, duration of pungency, stiffness in the mouth were higher with the palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp or banana peduncle or banana pseudostem (Table 3). The expenditure was higher (Table 4) for the treatment 10% solution of coconut palm jaggery with different astringent tasteners (Rs.426.93/33 kg) followed by Palmyrah jaggery 10% solution with different astringent tasteners (Rs. 412.97/33 kg). The net return was higher (11 to 12%) for the treatment palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp as compared to the control.

Pooled Results

The pooled result of chewability scores revealed that the sweetener Palmyrah jaggery at 10% solution with 5% solution of different astringent tasteners increased the chewability scores *viz.*, body, aroma, whitish encrustation, taste, pungency, saliva secretion, duration of pungency, stiffness in the mouth (Table 5), there by improved the chewing quality. The expenditure was higher (Table 6) for the sweetener coconut palm jaggery 10% in combination with 5% astringent tasteners (Rs. 416.77/33 kg) followed by Palmyrah jaggery 10% in combination with 5% solution of different astringent tasteners (Rs.403.14 /33kg). The net return was higher (12 to 13%) for the treatment palmyrah jaggery treatment 10% in combination with 5% solution of coconut mesocarp as compared to the control.

Conclusion

Palmyrah jaggery 10% solution with 5% solution of coconut mesocarp or banana pseudo stem or banana peduncle improved the chewability scores *viz.*, body, aroma, whitish encrustation, taste, pungency, saliva secretion, duration of pungency, stiffness in the mouth. By treating the cured leaves with palmyrahjaggery 10% solution in combination with 5% solution of astringent tasteners the net returns increased to the tune of 13% as compared to control.

Table 1.Effect of different treatments on Chewability Test- (2020-2021)

S. No.	Quality Characteristics	Body (10)	Aroma (10)	Incrus tation (10)	Taste (10)	Pun-gency (10)	Saliva secret ion (10)	Duratio n of pungen cy (10)	Stiffnes s in the mouth (10)	Total score out of 80
T1	White sugar 10% solution + coconut mesocarp 5% solution	7.66	7.33	7.66	7.0	7.0	5.66	5.66	7.0	54.92
T2	White sugar 10% solution + banana peduncle 5 % solution	7.66	7.33	7.66	7.0	7.0	5.33	5.33	7.0	54.24
T3	White sugar 10% solution + banana pseudo stem 5% solution	7.66	7.33	7.00	7.0	7.0	5.33	5.33	6.66	53.28
T4	Coconut palm jaggery 10% solution + coconut mesocarp 5 % solution	8.0	7.0	7.33	7.0	7.66	5.33	5.66	7.33	55.28
T5	Coconut palm jaggery 10% solution + banana peduncle 5% solution	8.0	7.66	7.66	7.0	7.0	5.66	5.66	7.0	55.60
T6	Coconut palm jaggery 10% solution + banana pseudostem 5% solution	8.0	7.66	7.33	6.66	7.0	5.66	5.33	7.33	54.96
T7	Sugar cane jaggery 10% solution + coconut mesocarp 5 % solution	8.0	7.66	7.66	6.0	6.66	6.0	5.66	7.33	54.96
T8	Sugar cane jaggery 10% solution + banana peduncle 5 % solution	8.0	8.0	6.66	6.66	7.0	6.0	6.0	7.0	55.36
T9	Sugar cane jaggery 10% solution + banana pseudostem 5% solution	8.0	8.0	7.33	6.66	7.0	6.33	5.66	7.33	56.24
T10	Palmyrah jaggery 10% solution + coconut mesocarp 5% solution	8.0	8.0	8.00	8.0	8.0	6.33	6.66	8.0	60.96
T11	Palmyrah jaggery 10% solution + banana peduncle 5% solution	8.0	8.0	8.00	7.66	7.33	6.00	6.66	8.0	59.60
T12	Palmyrah jaggery 10% solution + banana pseudostem 5% solution	8.0	8.0	8.00	8.0	7.66	6.33	7.0	7.66	60.64
T13	Control	7.0	6.33	3.33	5.33	5.68	6.33	5.0	6.0	42.96

Table 2 CHVsAG7: Economics of different treatments (2020-2021)

SL. No.	Quality Characteristics	Cured leaf before treatment (kg)	Cured leaf after treatment (kg)	Price/kg	Expenditure (Rs)	Goss Return (Rs)	Net Return (Rs)
T1	White sugar 10% solution + coconut mesocarp 5% solution	33	34.4	82	123.3	2821	2698
T2	White sugar 10% solution + banana peduncle 5 % solution	33	34.8	82	123.3	2854	2730
T3	White sugar 10% solution + banana pseudo stem 5% solution	33	34	82	123.3	2788	2665
T4	Coconut palm jaggery 10% solution + coconut mesocarp 5 % solution	33	34.4	84	406.6	2890	2483
T5	Coconut palm jaggery 10% solution + banana peduncle 5% solution	33	34.4	84	406.6	2890	2483
T6	Coconut palm jaggery 10% solution + banana pseudostem 5% solution	33	34	84	406.6	2856	2449
T7	Sugar cane jaggery 10% solution + coconut mesocarp 5 % solution	33	34.4	82	151.3	2821	2670
T8	Sugar cane jaggery 10% solution + banana peduncle 5 % solution	33	34.2	82	151.3	2804	2653
T9	Sugar cane jaggery 10% solution + banana pseudostem 5% solution	33	36.4	82	151.3	2985	2834
T10	Palmyrah jaggery 10% solution + coconut mesocarp 5% solution	33	37	90	393.3	3330	2937
T11	Palmyrah jaggery 10% solution + banana peduncle 5 % solution	33	36.4	90	393.3	3276	2883
T12	Palmyrah jaggery 10% solution + banana pseudostem 5% solution	33	36.4	90	393.3	3276	2883
T13	Control	33	33	80	0	2560	2560

Table 3 CHVsAG7: Effect of different treatments on Chewability Test (2021-2022)

SL. No.	Quality Characteristics	Body (10)	Aroma (10)	Incrustation (10)	Taste (10)	Pungency (10)	Saliva secretion (10)	Duration of pungency (10)	Stiffness in the mouth (10)	Total score out of 80
T1	White sugar 10% solution + coconut mesocarp 5% solution	7.66	7.16	7.83	7.16	7.0	6	5.5	7.16	55.44
T2	White sugar 10% solution + banana peduncle 5 % solution	7.66	6.83	7.5	6.83	7.16	5.83	5.66	7.33	54.80
T3	White sugar 10% solution + banana pseudo stem 5% solution	7.83	7.16	7.33	6.83	6.83	5.33	5.66	7.33	54.24
T4	Coconut palm jaggery 10% solution + coconut mesocarp 5 % solution	8.0.	6.83	7.0	7.16	7.5	5.33	5.83	6.66	54.24
T5	Coconut palm jaggery 10% solution + banana peduncle 5% solution	8.0	7.33	7.83	7.33	7.16	5.5	5.66	7.33	56.08
T6	Coconut palm jaggery 10% solution + banana pseudostem 5% solution	8.0	7.33	7.5	7.16	7.33	5.66	5.83	7.33	56.08
T7	Sugar cane jaggery 10% solution + coconut mesocarp 5 % solution	8.0	7.0	7.33	6.66	6.5	5.33	5.33	7.16	53.28
T8	Sugar cane jaggery 10% solution + banana peduncle 5 % solution	8.0	7.33	7.16	6.66	6.83	5.33	5.66	7.33	54.24
T9	Sugar cane jaggery 10% solution + banana pseudostem 5% solution	7.83	7.0	7.5	7.0	7.0	5.16	6.33	7.0	54.80
T10	Palmyrah jaggery 10% solution + coconut mesocarp 5% solution	8.0	8.0	8.0	7.66	7.66	6.5	6.5	8.0	60.32
T11	Palmyrah jaggery 10% solution + banana peduncle 5 % solution	8.0	7.83	7.8	7.66	8.0	6.5	7.0	7.5	60.24
T12	Palmyrah jaggery 10% solution + banana pseudostem 5% solution	8.0	8.0	8	7.83	7.66	6.5	6.66	8.0	60.64
T13	Control	7.0	6.33	4.66	5.33	5.66	4.33	4.83	6.0	44.08

Table 4 CHVsAG 7: Economics of different treatments (2021-2022)

SL. No.	Quality Characteristics	Cured leaf before treatment (kg)	Cured leaf after treatment (kg)	Price/kg	Expenditure (Rs)	Gross return (Rs)	Net retrurn (Rs)
T1	White sugar 10% solution + coconut mesocarp 5% solution	33	34	82	129.47	2788	2659
T2	White sugar 10% solution + banana peduncle 5 % solution	33	34.8	82	129.47	2854	2724
T3	White sugar 10% solution + banana pseudo stem 5% solution	33	34.5	83	129.47	2864	2734
T4	Coconut palm jaggery 10% solution + coconut mesocarp 5 % solution	33	34.2	84	426.93	2873	2446
T5	Coconut palm jaggery 10% solution + banana peduncle 5% solution	33	34.5	84	426.93	2898	2471
T6	Coconut palm jaggery 10% solution + banana pseudostem 5% solution	33	34	84	426.93	2856	2429
T7	Sugar cane jaggery 10% solution + coconut mesocarp 5 % solution	33	34.2	82	158.7	2804	2646
T8	Sugar cane jaggery 10% solution + banana peduncle 5 % solution	33	34.5	82	158.7	2829	2670
T9	Sugar cane jaggery 10% solution + banana pseudostem 5% solution	33	34.1	82	158.7	2796	2638
T10	Palmyrah jaggery 10% solution + coconut mesocarp 5% solution	33	36	90	412.97	3240	2827
T11	Palmyrah jaggery 10% solution + banana peduncle 5 % solution	33	36.5	90	412.97	3285	2872
T12	Palmyrah jaggery 10% solution + banana pseudostem 5% solution	33	36.2	90	412.97	3258	2845
T13	Control	33	32	80	0	2560	2560

Table 5 CHVsAG7: Effect of different treatments in Chewability Test (Pooled -2020-2022)

S. No.	Quality Characteristics	Body (10)	Aroma (10)	Incrustation (10)	Taste (10)	Pungency (10)	Saliva secretion (10)	Duration of pungency (10)	Stiffness in the mouth (10)	Total score out of 80
T1	White sugar 10% solution + coconut mesocarp 5% solution	7.66	7.23	7.75	7.08	7.0	5.83	5.5	7.08	55.21
T2	White sugar 10% solution + banana peduncle 5 % solution	7.66	7.08	7.58	6.92	7.08	5.58	5.5	7.17	54.52
T3	White sugar 10% solution + banana pseudo stem 5% solution	7.75	7.16	7.33	6.92	6.92	5.33	5.5	7.0	53.76
T4	Coconut palm jaggery 10% solution + coconut mesocarp 5 % solution	8.0	7.23	7.17	7.08	7.46	5.33	5.75	7.0	54.76
T5	Coconut palm jaggery 10% solution + banana peduncle 5% solution	8.0	7.50	7.75	7.17	7.08	5.58	5.66	7.17	55.92
T6	Coconut palm jaggery 10% solution + banana pseudostem 5% solution	8.0	7.50	7.42	6.91	7.17	5.66	5.58	7.33	55.52
T7	Sugar cane jaggery 10% solution + coconut mesocarp 5 % solution	8.0	7.33	7.5	6.33	6.58	5.67	5.5	7.25	54.12
T8	Sugar cane jaggery 10% solution + banana peduncle 5 % solution	8.0	7.67	6.91	6.66	6.92	5.67	5.83	7.17	54.80
T9	Sugar cane jaggery 10% solution + banana pseudostem 5% solution	7.92	7.5	7.42	6.83	7.0	5.75	6.0	7.17	55.52
T10	Palmyrah jaggery 10% solution + coconut mesocarp 5% solution	8.0	8.0	8.0	7.83	7.83	6.42	6.58	8.0	60.61
T11	Palmyrah jaggery 10% solution + banana peduncle 5 % solution	8.0	7.92	7.9	7.66	7.67	6.25	6.83	7.83	59.92
T12	Palmyrah jaggery 10% solution + banana pseudostem 5% solution	8.0	8.0	8	7.92	7.66	6.42	6.83	7.83	60.64
T13	Control	7.0	6.33	4.0	5.33	5.66	5.33	4.92	6.0	43.52

Table 5 CHVsAG 7: Economics of different treatments (Pooled data of 2020-2022)

S. No.	Quality Characteristics	Cured leaf before treatment (kg)	Cured leaf after treatment (kg)	Price/kg of leaf	Expenditure (Rs)	Gross return (Rs)	Net return (Rs)
T1	White sugar 10% solution + coconut mesocarp 5% solution	33	34.2	82	126.39	2804	2678
T2	White sugar 10% solution + banana peduncle 5 % solution	33	34.8	82	126.39	2854	2727
T3	White sugar 10% solution + banana pseudo stem 5% solution	33	34.25	82.5	126.39	2826	2699
T4	Coconut palm jaggery 10% solution + coconut mesocarp 5 % solution	33	34.3	84	416.77	2881	2464
T5	Coconut palm jaggery 10% solution + banana peduncle 5% solution	33	34.45	84	416.77	2894	2477
T6	Coconut palm jaggery 10% solution + banana pseudostem 5% solution	33	34	84	416.77	2856	2439
T7	Sugar cane jaggery 10% solution + coconut mesocarp 5 % solution	33	34.3	82	155	2813	2657
T8	Sugar cane jaggery 10% solution + banana peduncle 5 % solution	33	34.35	82	155	2817	2661
T9	Sugar cane jaggery 10% solution + banana pseudostem 5% solution	33	35.25	82	155	2891	2735
T10	Palmyrah jaggery 10% solution + coconut mesocarp 5% solution	33	36.5	90	403.14	3285	2881
T11	Palmyrah jaggery 10% solution + banana peduncle 5 % solution	33	36.45	90	403.14	3281	2877
T12	Palmyrah jaggery 10% solution + banana pseudostem 5% solution	33	36.3	90	403.14	3267	2863
T13	Control	33	32	80	0	2560	2560

CHVsAG 8: INTEGRATED MANAGEMENT OF *OROBANCHE* IN CHEWING TOBACCO

Objective:

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 Chewing tobacco yield and quality

Year of start : 2021-22

Year of completion:2022-23

Design : RBD

Replications : Three

Treatments: 9 (Nine)

T1:	Fallow – tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*
T2:	Fallow – tobacco + Neem cake application at 30 DAP + Post emergence application of neem oil on *Orobanche* Spikes
T3:	Fallow – tobacco + Neem cake application at 30 DAP + Post emergence application of pongamia oil on *Orobanche* Spikes
T4:	Fallow – tobacco + Neem cake application at 30 DAP + Post emergence application Paraquat on *Orobanche* Spikes
T5:	Fallow – tobacco + Neem cake application at 30 DAP + Post emergence application of Imazethapyr on *Orobanche* Spikes
T6:	Sesamum – tobacco
T7:	Sesamum – tobacco + Neem cake application at 30 DAP + Hand removal
T8:	Fallow – tobacco + Hand removal of *Orobanche*
T9:	Fallow – tobacco + Non removal of *Orobanche*

Results

Results revealed that the different integrated *Orobanche* management practices did not influence the number of spikes/plant. Theper plant *Orobanche* weight significantly increased with fallow-Tobacco+ non removal of *Orobanche* (26.06 g/plant). Fallow- tobacco + Hand removal of *Orobanche* recorded the lowest dry weight of *Orobanche*/plant (3.12 g/plant). Sesame in *kharif*, chewing tobacco in *rabi* or tobacco in *rabi* + neem cake application at 30 DAP + hand removal of *Orobanche* at 65 days recorded a lower *Orobanche* dry weight (5.0 to 9.58 g/plant). Sesamum-Tobacco+ Neem cake application at 30 DAP+ Hand removal of Orobanche at 65 days and fallow-tobacco + hand removal of *Orobanche* (*Orobanche* free) recorded a lower dry weight of *Orobanche*/plot (5.02 to 32.17 g/plot) as compared to the control. Application of pongamia oil, Paraquat and Imazethapyr on *Orobanche* spikes reduced the *Orobanche* dry weight /plot (38.0 to 142.73 g) as compared to the control (360.33 g). *Orobanche* infestation percentage was lower with the treatments, sesame- tobacco+ neem cake application at 30 DAP + hand removal *Orobanche* at 65 days (1.1 %) as compared to the control (Table 1). The FGLY significantly increased by 22% with fallow- Tobacco+ hand removal of *Orobanche* (*Orobanche* free) as compared to the control.

Total cured leaf yield significantly increased by 39 % with fallow- Tobacco+ hand removal of *Orobanche (Orobanche* free) as compared to the control. TCLY recorded with fallow-tobacco + hand removal of *Orobanche* (*Orobanche* free) was comparable with sesame-tobacco, sesame-tobacco+neem cake application at 30DAP + hand removal of *Orobanche* at 65 days and fallow tobacco+ neem cake application at 30 DAP + post emergence of neem oil at 65 days. Higher net returns of Rs. 171836/ha was recorded with Fallow-Tobacco+hand removal of *Orobanche* (*Orobanche*free) treatment as compared the control.

Table 1 CHVsAG 8: Effect of Integrated *Orobanch*e management practices on the *Orobanche* and cured leaf yield

Treatments	No. of spikes /plant	Weight of *Orobanche*/ plant (g)	Weight of *Ororbanche*/plot (g/ 40.5 m^2)	Orobanche percent of infestation	FGLY (kg/ha)	TCLY (kg/ha)
Fallow: Tobacco + Neem cake application at 30 DAP+ Hand removal of *Orobanche* at 65 days	6.97	15.39	242.33	15.56	2256	2634
Fallow: Tobacco + Neem cake application at 30DAP + Post emergence application of neem oil on *Orobanche*	6.03	23.50	138.77	19.43	2617	3111
Fallow: Tobacco + Neem cake application at 30DAP Post emergence application of pongamia oil on *Orobanche* spikes	5.01	11.54	97.00	8.89	2320	2814
Fallow: Tobacco+ Neem cake application 30 at DAP + Post emergence application of paraquat on *Orobanche* spikes	5.77	10.15	38.00	3.89	2320	2748
Fallow: Tobacco+ Neem cake application at 30 DAP + Post emergence application of Imazethapyr on *Orobanche* spikes	6.64	9.20	142.33	17.23	2419	2781
Sesamum: Tobacco	6.0	9.58	32.17	3.89	2600	3094
Sesamum: Tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	5.56	5.0	5.00	1.11	2633	3111
Fallow: Tobacco + Hand removal of *Orobanche*	6.36	3.12	9.53	8.96	2666	3256
Fallow: Tobacco + Non removal of *Orobanche*	9.25	26.06	360.33	32.0	2186	2412
S. Em±	0.22	3.82	20.0	3.6	94.3	140.1
C.D. at 5%	NS	11.5	60.6	13.1	260.0	442.8

Table 2 CHVsAG 8: Effect of Integrated *Orobanche* management practices on Economics

Treatments	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)
Fallow: Tobacco + Neem cake application at 30 DAP+ Hand removal of *Orobanche* at 65 days	126276	242328	116052
Fallow: Tobacco + Neem cake application at 30DAP + Post emergence application of neem oil on *Orobanche*	122576	286212	163636
Fallow: Tobacco + Neem cake application at 30DAP Post emergence application of pongamia oil on *Orobanche* spikes	122576	258888	136312
Fallow: Tobacco+ Neem cake application 30 at DAP + Post emergence application of paraquat on *Orobanche* spikes	123186	252816	129630
Fallow: Tobacco+ Neem cake application at 30 DAP + Post emergence application of Imazethapyr on *Orobanche* spikes	123256	255852	132596
Sesamum: Tobacco	119316	284648	163636
Sesamum: Tobacco + Neem cake application at 30 DAP + Hand removal of *Orobanche*	123876	286212	129630
Fallow: Tobacco + Hand removal of *Orobanche*	127716	299552	171836
Fallow: Tobacco + Non removal of *Orobanche*	119316	222088	102772

CROP CHEMISTRY AND SOIL SCIENCE

CROP CHEMISTRY AND SOIL SCIENCE

I. SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

RAJAHMUNDRY

VFRCHC 1: LEAF QUALITY EVALUATION

A total no. of 549 (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 were appended.

A. **FCV TOBACCO:** A total of 272 FCV tobacco leaf samples received from different centres and were analysed for chemical quality parameters. The centre wise results are presented below:

- **ICAR-CTRI RS, Hunsur**: FCV tobacco leaf samples (42) pertaining to AINP-T (on-farm trials), AVT-1, AVT-2, IHT, IVT experiments were analysed. The leaf nicotine varied from 1.00 to 1.69% in 'X' position, 0.91 to 2.06 % in 'L' position, while the per cent reducing sugars varied from 10.06 to 19.10 % in 'X' position, 9.25 to 18.10 % in 'L' position and the chlorides ranged from 0.11 to 0.51 % in 'X' position and 0.17 to 0.73 % in 'L' position

- **ICAR-CTRI RS, Kandukur**: FCV tobacco leaf samples (48) pertaining to IVT, IHT were analysed. The nicotine content varied from 0.54 to 1.85 % while the reducing sugars varied from 9.15 to 18.08 % and the chloride content varied from 0.12 to 0.24 %

- **ICAR-CTRI RS, Jeelugumilli**: FCV tobacco leaf samples (20) pertaining to AHT-1, AHT-2 were analysed. The leaf nicotine varied from 1.58 to 2.72% while the percent reducing sugars varied from 5.62 to 15.18% and the chlorides ranged from 1.25 to 1.92%

- **AINPT Centre, Shivamogga**: FCV tobacco leaf samples (162) pertaining to Crop Improvement and Crop Production experiments were analysed. Leaf nicotine varied from 0.53 to 2.76%, reducing sugars varied from 3.69 to 18.99% and the chlorides ranged from 0.10 to 0.41%

Table 1 VFRCHC 1: Summary of Chemical Quality Parameters (%) of FCV tobacco in different tobacco centres (2021-22)

Centre / Zone	Nicotine	Reducing Sugars	Chlorides
ICAR-CTRI RS, Kandukur (48)	0.54-1.85	9.15-18.08	0.12-0.24
ICAR-CTRI RS, Hunsur (42)	1.00-1.69(X) 0.91- 2.06 (L)	10.06-19.10(X) 9.25- 18.10 (L)	0.11-0.51(X) 0.17- 0.73 (L)
ICAR-CTRI RS, Jeelugumilli(20)	1.58-2.72	5.62-15.18	1.25-1.92
AINPT centre, Shivamogga (162)	0.53-2.76	3.69-18.99	0.10-0.39

**Figures in parentheses represent the total number of samples analysed*

B. **NON-FCV TOBACCO**: A total No. of **277** leaf samples of non-FCV tobacco were analysed for quality parameters. Centre wise results are presented below:

- **AINPT Centre, Nandyal**: A total number of (30) *bidi* tobacco samples pertaining to Agronomy experiment BDNyAg18 of RARS, Nandyal were analysed during the year 2021-22. Leaf nicotine varied from 0.71 to 4.63%, reducing sugars from 2.25 to 4.61%

- **AINPT Centre, Nipani**: *Bidi* tobacco leaf samples (57) pertaining to Farmers field and AVT-II experiments of ARS, Nipani were analysed. Leaf nicotine content varied from 0.56 to 3.96% while the reducing sugars varied from 0.96 to 9.80 % and the chloride content varied from 0.71 to 2.66 %

- **AINPT Centre, Ladol**: A total number of (62) *Rustica* tobacco leaf samples pertaining to IVT, IET, PYT, LSVT and one agronomy experiments were analysed. The leaf nicotine, reducing sugars and chlorides varied from 1.69 to 3.79 %, 1.76 to 6.77 % and 0.35 to 1.64%, respectively

❖ **AINPT Centre, Berhampur**: Tobacco leaf smaples (44) pertaining to DTGE and leaf samples (20) pertaining to MLT experiments (20) of CPR, (QUAT) Berhampur conducted during the year 2021-22 were analysed. The leaf nicotine content varied from 0.11 to 2.95% while the reducing sugars varied from 0.38 to 2.85% and the chloride content varied from 0.45 to 2.83%

Table 2 VFRCHC 1: Summary of Chemical Quality Parameters (%) in non-FCV tobacco in different centres (2021-22)

Centre / Type of Tobacco	Nicotine	Reducing Sugars	Chlorides
Nandyal (*Bidi*-212)	0.71-4.63	2.25-4.61	1.32-3.48
Nipani (*Bidi* -38)	0.56-3.96	0.96-9.80	0.71-2.66
Ladol (*Rustica*-49)	1.69-3.79	1.76-6.77	0.35-1.64
Berhampur (*Pikka*-64)	0.11-2.95	0.38-2.85	0.45-2.83

**Figures in parentheses represent the total number of samples analysed*

ORGANIC CHEMISTRY

SMOKE ANALYSIS

NANDYAL: *Bidi* samples (10) received from NANDYAL centre were analysed for Smoke Parameters *viz.,* NFDPM, Nicotine and Carbonmonoxide during 2021-22. Tar value is low (19.37 mg/*bidi*) in the entry Nandyal Pogaku 1 (C) of BYT and it is high (51.28 mg/*bidi*) in the entry ABD-163 of OFT. Nicotine value is low (0.95 mg/*bidi*) in the entry Nandya Pogaku 1 (C) of BYT and it is high (2.02 mg/*bidi*) in the entry ABD- 163 of OFT. The value of Carbonmonoxide is low (11.96 mg/*bidi*) in the entry Nandyal Pogaku 1 (C) of BYT and it is slightly high (23.90 mg/*bidi*) in the entry ABD- 189 of BYT.

S.No	Sample details	Av.Wt of Bidi (g)	Av. Length of Bidi (mm)	Tar (mg/Bidi)	Nicotine (mg/Bidi)	Carbondioxide (mg/Bidi)
Bulk Yield Trial						
1	ABD- 169	0.5400	76	37.58	1.14	23.90
2	NYBD- 61	0.5247	78	40.40	1.30	23.78
3	NBD- 316	0.4940	78	42.91	1.47	21.93
4	ABD- 169	0.4937	76	35.20	1.06	22.96
5	ABD- 174	0.5426	77	30.62	0.99	20.91
6	A- 119 (C)	0.5291	77	27.61	1.46	16.00
7	Nandyal Pogaku- 1(C)	0.5258	79	19.37	0.95	11.96
On Farm Trial						
8	NBD- 289	0.5068	77	42.86	1.51	23.00
9	ABD- 145	0.5250	77	30.31	1.37	20.73
10	ABD- 163	0.5268	78	51.28	2.02	21.66

CROP PROTECTION

CROP PROTECTION

I. ENTOMOLOGY

A. FCV TOBACCO

SHIVAMOGGA

VFSEN 34: TO STUDY THE POPULATION DYNAMICS OF INSECT PEST COMPLEX IN TOBACCO CROP ECOSYSTEM

Objective: To record the insect pests occurring in tobacco ecosystem

Experimental Details
Year of start : 2021
Cultivar : Sahyadri Season: *Kharif* 2021

Observations
- Number of aphids and white flies per leaf, number of lepidopterans per plant
- Correlation of weather parameters with the incidence of insect pests

Table 1 VFSEN 34: Insect pests observed in tobacco ecosystem during the Kharif 2021

Weeks	Month	MSW	White-flies	Aphids	S. litura	H.armigera	Semi-looper
1st week	July	29	0.00	0.0	0.00	0.00	0.00
2nd week		30	0.67	0.0	0.00	0.00	0.00
3rd week		31	5.00	0.0	3.90	0.00	1.80
4th week	August	32	5.33	17.3	3.30	0.00	2.00
5th week		33	5.00	25.0	3.50	0.00	2.00
6th week		34	6.33	32.0	3.10	0.00	1.90
7th week		35	6.67	28.0	4.10	0.00	2.20
8th week	Sept.	36	6.33	29.0	4.10	0.00	2.50
9th week		37	7.33	30.0	3.60	0.00	3.00
10th week		38	7.67	31.0	4.40	0.00	2.80
11th week		39	6.67	29.0	3.70	0.00	2.90
12th week	October	40	7.33	27.0	3.50	0.00	2.50
13th week		41	7.67	35.0	3.40	0.00	2.70
14th week		42	7.67	25.0	3.60	0.50	2.90
15th week		43	8.00	25.0	3.80	0.80	2.60
16th week		44	6.33	31.0	3.90	0.80	2.50
17th week	Nov.	45	6.67	29.0	4.00	0.60	1.80

MSW-Mean Standard Week

Results

- Totally five insect pests *viz.*, Aphids, Whiteflies, *Spodoptera litura, Helicoverpa armigera* and Semi looper were observed in tobacco ecosystem
- Whiteflies and aphids had significantly negative correlation with rainfall and significantly positive correlation with maximum temperature whereas, it was negatively non significant with minimum temperature and negatively significant with morning relative humidity. Whiteflies were negatively significant with evening relative humidity and aphids were negatively non significant with evening relative humidity
- *S. litura* and *H. armigera* were negatively significant and negatively non significant with rainfall, whereas positively significant and positively non significant with maximum temperature, respectively. Minimum temperature, morning and evening relative humidity were negatively correlated
- Semi looper had negatively significant association with rainfall and positively significant with maximum temperature whereas positively non significant with minimum temperature and negatively significant with morning and evening relative humidity

Table 2 VFSEN 34: Correlation between incidence of insect pests of tobacco and weather parameters

Insects	Correlation coefficient (r)				
	Meteorological parameters				
	RF	Max. temp.	Min. temp.	RH-1	RH-2
Whiteflies	-0.521*	0.728**	-0.137NS	-0.675**	-0.607**
Aphids	-0.621**	0.637**	-0.068NS	-0.530*	-0.470NS
Spodoptera litura	-0.605*	0.561*	-0.215NS	-0.494*	-0.425NS
Helicoverpa armigera	-0.208NS	0.292NS	-0.513*	-0.218NS	-0.571*
Semi looper	-0.491*	0.612**	0.012NS	-0.603*	-0.508*

**Significant at 5% level of significance;*
***Significant at 1% level of significance;*
NS-Non significant

VFSEN 35: SCREENING OF TOBACCO CULTIVARS AGAINST LEAF CURL VIRUS TRANSMITTED BY WHITEFLY, Bemisia tabaci

Objective: To identify the resistant cultivar for the management of Tobacco Leaf Curl Virus

Experimental Details

Design : RBD
Cultivars : 16
Season : *Kharif* 2021
Replications: Three

Observations

- White fly population, per cent leaf curl disease incidence at 30, 60, 90 and 120 days after transplanting
- Plant morphological characters *viz.*, leaf length, width, thickness and number of leaves per plant

Table 1 VFSEN 35: Number of Whitefly B. tabaci on different cultivars of tobacco during 2021

S. No	Varieties	Number of whiteflies per leaf				
		30 DAT	60 DAT	90 DAT	120 DAT	Over all mean
1	Aurea	0.20 (0.84)^{i}	1.50 (1.50)^{e}	1.25 (1.32)^{g}	0.20 (0.84)^{f}	0.79
2	Sahyadri	0.50 (0.99)^{h}	1.60 (1.44)^{de}	1.67 (1.46)^{fg}	0.30 (0.89)^{ef}	1.02
3	VA – 770	1.96 (1.57)^{a}	3.87 (2.09)^{a}	4.23 (2.18)^{a}	3.00 (1.87)^{a}	3.26
4	VA- 310	1.86 (1.54)^{a}	3.73 (2.05)^{a}	4.07 (2.14)^{ab}	2.67 (1.78)^{ab}	3.08
5	Kanchan	0.60 (1.04)^{gh}	1.87 (1.53)^{cde}	1.90 (1.54)^{ef}	0.50 (0.99)^{def}	1.22
6	FCS- 4	0.82 (1.15)^{fg}	2.03 (1.59)^{cd}	2.03 (1.58)^{ef}	0.67 (1.06)^{def}	1.39
7	VA- 509	1.87 (1.54)^{a}	3.67 (2.04)^{a}	4.03 (2.13)^{ab}	2.57 (1.74)^{ab}	3.04
8	TANTA	1.77 (1.51)^{ab}	3.47 (1.99)^{a}	3.87 (2.09)^{ab}	2.43 (1.70)^{abc}	2.89
9	REAM-151	1.50 (1.41)^{bc}	3.73 (2.06)^{a}	3.80 (2.07)^{abc}	2.37 (1.69)^{abc}	2.85
10	Thrupti	0.70 (1.09)^{gh}	2.00 (1.57)^{cde}	2.00 (1.58)^{ef}	0.63 (1.05)^{def}	1.33
11	VA- 21	1.87 (1.54)^{a}	3.53 (2.00)^{a}	4.10 (2.14)^{ab}	2.70 (1.78)^{ab}	3.05
12	Rhomas-7	1.50	3.67	3.67	2.33	2.79

S. No	Varieties	Number of whiteflies per leaf				
		30 DAT	**60 DAT**	**90 DAT**	**120 DAT**	**Over all mean**
		(1.41)bc	(2.04)a	(2.04)abc	(1.68)abc	
13	RG -13	1.37 (1.36)cd	3.37 (1.96)a	3.37 (1.97)bc	1.93 (1.55)bc	2.51
14	NC_37_NF	1.04 (1.24)ef	2.13 (1.62)cd	2.07 (1.60)ef	0.77 (1.12)de	1.50
15	SPEIGTT-G-28	1.13 (1.27)de	2.45 (1.71)bc	2.45 (1.71)de	1.03 (1.24)d	1.77
16	DELCRAST- 66	1.23 (1.31)j	3.07 (1.89)ab	3.07 (1.89)cd	1.70 (1.48)c	2.27
	F value	*	*	*	*	-
	C.D. at 5%	0.11	0.23	0.19	0.24	-
	C.V. (%)	5.87	7.90	6.39	10.52	-

Numbers in the parenthesis are square root transformed value
** -Significant at (P≤0.05); DAT- Days after transplanting*

Table 2 VFSEN 35: Screening of tobacco cultivars against Leaf Curl Virus disease

S. No	Varieties	Percent Disease Incidence (%)				
		30 DAT	60 DAT	90 DAT	120 DAT	Resistance category based on PDI at 120 DAT
1	Aurea	0.35 (3.34)h	1.60 (7.25)k	3.20 (10.30)k	3.83 (11.23)k	R*
2	Sahyadri	0.80 (5.10)g	1.68 (7.45)k	3.73 (11.05)jk	4.37 (11.79)jk	R
3	VA – 770	2.80 (9.56)a	6.88 (15.18)a	11.75 (20.13)a	18.93 (25.74)a	R
4	VA- 310	2.60 (9.28)ab	5.70 (13.80)bc	9.20 (17.66)bc	15.97 (23.54)ab	R
5	Kanchan	0.83 (5.23)g	1.88 (7.88)jk	3.85 (11.23)ijk	4.97 (12.82)ijk	R
6	FCS- 4	1.23 (6.37)fg	2.40 (8.91)hij	4.18 (11.79)ijk	5.85 (13.94)hij	R
7	VA- 509	2.28 (8.59)abc	4.86 (12.74)cd	8.08 (16.50)cd	14.40 (22.30)bc	R
8	TANTA	2.26 (8.64)abc	4.50 (12.25)de	7.78 (16.17)cd	12.73 (20.82)cd	R
9	REAM-151	2.13 (8.39)abcd	3.73 (11.06)ef	7.13 (15.49)de	10.87 (19.25)de	R
10	Thrupti	1.10 (6.00)fg	2.12 (8.36)ijk	3.93 (11.44)ijk	5.26 (13.25)ijk	R
11	VA- 21	2.63 (9.26)ab	6.17 (14.38)ab	10.60 (18.99)ab	17.23 (24.53)ab	R

S. No	Varieties	Percent Disease Incidence (%)				
		30 DAT	60 DAT	90 DAT	120 DAT	Resistance category based on PDI at 120 DAT
12	Rhomas-7	2.00 (8.13)^{bcd}	3.50 (10.77)^{fg}	6.67 (14.93)^{def}	10.00 (18.43)^{def}	R
13	RG -13	1.83 (7.78)^{cde}	3.02 (10.01)^{fgh}	6.00 (14.17)^{efg}	8.79 (17.06)^{efg}	R
14	NC_37_NF	1.40 (6.78)^{ef}	2.45 (9.00)^{hij}	4.46 (12.00)^{hij}	6.23 (14.45)^{ghij}	R
15	SPEIGTT-G-28	1.55 (7.14)^{def}	2.73 (9.51)^{ghi}	4.90 (12.79)^{ghi}	6.81 (15.10)^{ghi}	R
16	DELCRAST- 66	1.63 (7.32)^{cdef}	2.80 (9.54)^{ghi}	5.55 (13.56)^{fgh}	7.83 (16.09)^{fgh}	R
	F value	*	*	*	*	-
	C.D. at 5%	1.34	1.27	1.57	2.60	-
	C.V. (%)	11.01	7.29	6.64	9.16	-

Numbers in the parenthesis are arcsine transformed values

** -Significant at ($P \leq 0.05$); DAT- Days after transplanting, R-Resistant*

Table 3 VFSEN 35: Morphological characters of tobacco cultivars

S. No.	Varieties	Leaf length (cm)	Leaf width (cm)	No. of leaves /plant	Leaf thickness (mm)	Trichome density (mm^2)
1	Aurea	40.94	24.27^{cd}	11.34	0.38	1.43^{a}
2	Sahyadri	41.93	24.74^{cd}	11.17	0.42	1.30^{b}
3	VA – 770	41.23	22.88^{d}	12.19	0.42	0.78^{f}
4	VA- 310	43.02	24.28^{cd}	12.59	0.47	0.80^{f}
5	Kanchan	42.94	23.71^{cd}	13.08	0.53	1.25^{bc}
6	FCS- 4	40.88	23.72^{cd}	12.08	0.49	1.23^{bc}
7	VA- 509	40.09	25.70^{bc}	13.59	0.43	1.01^{e}
8	TANTA	44.61	23.06^{d}	13.51	0.44	1.07^{de}
9	REAM-151	41.24	23.88^{cd}	11.87	0.35	1.03^{e}
10	Thrupti	41.78	24.44^{cd}	14.21	0.49	1.23^{bc}
11	VA- 21	39.94	24.96^{bcd}	11.59	0.42	1.02^{e}
12	Rhomas-7	38.72	22.72^{d}	11.81	0.39	1.12^{cde}
13	RG -13	38.55	27.25^{ab}	12.89	0.45	1.14^{cde}
14	NC_37_NF	41.21	25.61^{bc}	13.48	0.43	1.20^{bc}
15	SPEIGTT-G-28	41.08	28.55^{a}	13.04	0.32	1.17^{cd}
16	DELCRAST- 66	40.31	23.12^{d}	11.97	0.38	1.16^{cd}
	C.D. at 5%	6.47	5.91	9.35	14.16	7.11
	C.V. (%)	NS	2.42	NS	NS	0.13

DAT- Days after transplanting, NS- Non significant

Results

- Among the different cultivars evaluated, lowest mean number of whiteflies were recorded in the cultivar Aurea (0.79/leaf), followed by Sahyadri (1.02/leaf), Kanchan (1.22/leaf) and Thrupti (1.33/leaf). Whereas, highest numbers of whiteflies were recorded in VA-770 (3.26/leaf), followed by VA-310(3.08/leaf), VA-21 (3.05/leaf) and VA-509 (3.04/leaf)
- Among the different cultivars evaluated against TLCV, lowest per cent disease incidence was recorded in the cultivar Aurea (3.8 per cent) at 120 days after transplanting, followed by Sahyadri (4.4 %) and Kanchan (4.9 %). Whereas, highest per cent disease incidence was recorded in VA-770 (18.9 %), followed by VA-21 (17.2 %) and VA-310 (16.0 %)
- Among the different cultivars, there was no significant difference for leaf length, thickness and number of leaves per plant was recorded.
- Highest leaf width was recorded in SPEIGHT-G-28 (28.6 mm) followed by RG-13 (27.2 mm), NC-37-NF (25.6 mm) and lowest leaf width was recorded in Rhomas-7 (22.7 mm) followed by VA-770 (22.9 mm)
- Trichome density was maximum in cultivar, Aurea (1.4/mm^2) followed by Sahyadri (1.3 / mm^2) and Kanchan (1.3/ mm^2). Whereas, lowest density was observed in VA-770 (0.7/ mm^2) and VA-310 (0.8/ mm^2)
- Trichome density had significantly negative correlation with per cent disease incidence and leaf width having negatively non-significant with PDI

Table 4 VFSEN 35: Correlation between percent disease incidence of tobacco cultivars and morphological characters

	Correlation coefficient (r)	
	Morphological characters	
Percent disease incidence at 120 days after transplanting	**Leaf width**	**Trichome density**
	-0.825^{NS}	-0.925**

**Significant at 5% level of significance; **Significant at 1% level of significance; NS-Non significant*

VFSEN 36: MANAGEMENT OF TOBACCO LEAF CURL VIRUS TRANSMITTED BY WHITEFLY, *Bemisia tabaci*

Objective: To identify the resistant cultivar for the management of Tobacco Leaf Curl Virus

Design: RBD
Season: *Kharif* 2021
Replications: Five
Treatments: Four
Variety: Sahyadri

Observations

- Whitefly population and per cent disease incidence at 30, 60, 90 and 120 days after transplanting
- Different natural enemies in each treatments
- Green and cured leaf yield (kg/ha)

Table 1 VFSEN 36: Population of whitefly, B. tabaci in IPM modules of tobacco during 2021

Modules		No. of whiteflies per leaf					Percent reduction over control
		30 DAT	60 DAT	90 DAT	120 DAT	Overall mean	
Module-1 (Integrated)	Foliar spray of seedlings with Imidacloprid 0.3 ml/liter one day before planting + Maize as a barrier crop + two sprays of Neem oil 10,000 ppm @ 2ml/liter at 20 and 30 DAT + one spray of Imidacloprid 17.8 SL @ 0.3 ml/liter at 40 DAT.	0.65 (1.05)c	1.08 (1.25)b	1.24 (1.32)c	1.8 (1.51)b	1.19	62.90
Module-2 (Chemical)	Two sprays of Imidacloprid 17.8 SL @ 0.3 ml/liter at 10 and 40 DAT+ Two sprays Thiamethoxam 25 WG @ 0.3 g/liter at 25 and 55 DAT.	0.96 (1.20)bc	1.21 (1.31)b	2.06 (1.59)b	1.9 (1.54)b	1.53	52.41
Module-3 (Bio-intensive)	Maize as a barrier crop + yellow sticky traps @ 10/acre +one spray of neem oil 10,000 ppm @ 2ml/liter at 10 and 20 DAT + one spray of Lecanicilium lecanii @ 5.0 g/liter at 30 DAT + Metarhizium rileyi @ 3.0 g/ liter at 40 DAT.	1.34 (1.35)ab	1.88 (1.54)a	2.28 (1.66)ab	2.02 (1.59)b	1.88	41.61
Module-4	Untreated control	1.56 (1.43)a	2.92 (1.84)a	3.84 (2.08)a	4.54 (2.24)a	3.22	0.0
	F value	*	*	*	*	-	-
	C.D. at 5%	0.22	0.13	0.20	0.15	-	-
	C.V. (%)	12.96	6.96	9.21	7.03	-	-

Numbers in the parenthesis are arcsine transformed values

** -Significant at ($P \leq 0.05$); DAT- Days After Transplanting*

Table 2 VFSEN 36: Evaluation of IPM modules against Tobacco Leaf Curl virus transmitted by *Bemisia tabaci*

Modules		Percent of Disease incidence (%)					Percent reduction over control
		30 DAT	60 DAT	90 DAT	120 DAT	Overall mean	
Module-1 (Integrated)	Foliar spray of seedlings with Imidacloprid 0.3 ml/liter one day before planting + Maize as a barrier crop + two sprays of Neem oil 10,000 ppm @ 2ml/liter at 20 and 30 DAT + one spray of Imidacloprid 17.8 SL @ 0.3 ml/literat 40 DAT.	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)	Two sprays of Imidacloprid 17.8 SL @ 0.3 ml/liter at 10 and 40 DAT+Two sprays Thiamethoxam 25 WG @ 0.3 g/liter at 25 and 55 DAT.	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)	Maize as a barrier crop + yellow sticky traps @ 10/acre +one spray of neem oil 10,000 ppm @ 2ml/liter at 10 and 20 DAT + one spray of Lecaniciliumlecanii @ 5.0 g/liter at 30 DAT + Metarhiziumrileyi @ 3.0 g/ liter at 40 DAT.	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)	Untreated	3.8 (11.26)a	7.34 (15.70)a	10.63 (19.01)a	16.30 (23.78)a	9.52	0.0
	F value	*	*	*	*		
	C.D. at 5%	1.04	1.18	0.99	1.92	-	-
	C.V. (%)	9.20	8.42	5.85	9.47	-	--

Numbers in the parenthesis are arcsine transformed values
**-Significant at (P≤ 0.05); DAT- Days after Transplanting*

Table 3 VFSEN 36: Effect of IPM modules on natural enemies in FCV tobacco

Modules	Natural enemies on Border crop/ plant			Mean/ plant	Natural enemies on tobacco crop/plant				Mean/ plant	Overall Mean/ plant
	LBB	Spiders	Wasps		LBB	Spiders	Wasps	Bugs		
Module-1 (Integrated)	2.10	1.12	0.80	1.34	2.51	1.34	0.95	4.70	2.37	1.93
Module-2 (Chemical)	-	-	-	-	1.03	1.23	0.82	2.20	1.32	1.32
Module-3 (Bio-intensive)	2.80	1.43	0.95	1.72	2.64	1.74	1.02	5.40	2.7	2.28
Module-4 (Unt-reated control)	-	-	-	-	2.92	2.23	1.92	5.20	3.06	3.07

Table 4 VFSEN 36: Impact of IPM modules on yield of FCV tobacco during *kharif*

Modules	Green leaf yield (kg/ha)	Percent increase in green leaf yield over control	Cured leaf yield (kg/ ha)	% increase in cured leaf yield over check
Module-1 (Integrated)	13,028	41.01	1899	37.75
Module-2 (Chemical)	12,214	37.08	1762	32.91
Module-3 (Bio-intensive)	11978	35.84	1663	28.92
Module-4 (Untreated C)	7,685	0.00	1182	0.00

Results

- Among the different modules evaluated against whitefly, *B. tabaci*, module-1 (IPM module) found to be superior with 62.90 per cent reduction in whitefly population over control, followed by module-2 (52.41 %) and module-3 (41.61 %)
- Among the different treatments evaluated against TLCV, module-1 (IPM module) found to be superior with highest per cent reduction of TLCV (76.6) over control, followed by module-2 (73.4 %) and module-3 (52.4 %)
- The maximum number of natural enemies were recorded in untreated control plot (3.1/plant), followed by module-3 (2.3/plant) and module-1 (1.9/plant). Whereas, lowest number of natural enemies (1.3/plant) were recorded in modue-2 (Chemical module)
- The highest cured leaf yield was recorded in module-1 (1899 kg/ha) with a per cent increase of (37.75) followed by module-1I (1762 kg/ha) with per cent increase of 32.91. Lowest cured leaf yield was recorded in untreated control (1182 kg/ha).

B. *BIDI* TOBACCO

ANAND

BDAEN 86: ESTABLISHMENT OF ENTOMOPHAGE BIO-DIVERSITY PARK

Objective: To restore and conservation of natural enemies for tobacco insect pest

Year of start: 2007-2008 Date of planting: 27-08-2021

Entomophage Biodiversity Park was raised to establish, conserve and increase the population of natural enemies in tobacco based agro ecosystem during the crop season at *bidi* tobacco research farm. Five lines 5 m. length and 0.90 m. apart from each other were sown/ transplanted with seven different crops *viz.,* tobacco, marigold, sena, cotton, kuvadio (*Cassia* sp.), maize and lucerne in a following sequence.

Field Layout

Tobacco	Marigold	Sena	Cotton	Kuvadio	Maize	Lucern	Maize	Kuvadio	Cotton	Sena	Marigold	Tobacco

Results

The Table 1 BDAEN 86 revealed that activity of various natural enemies like spider, coccinellids, *Nesidiocoris tenuis*, *Geocoris ochropeterus* and *Rhinocoris* sp, were found on different crops raised under Entomophage Park. Out of various bio agents, maximum activity of *N. tenuis* was found in tobacco. The activity of spider was found in all the crops raised under entomophage biodiversity park *i.e.*, tobacco, marigold, sena, cotton, kuvadio, maize and lucern.

Population of natural enemies and insect pests on tobacco grown nearby Entomophage Biodiversity Park and away from it (Table 2 BDAEN 86) revealed more or less similar trend throughout the crop season. The infestation of whitefly, leaf eating caterpillar, capsule borer, spiders and predatory bugs does not differ from each other and remain statistically at par in a tobacco raised near and away from entomophage biodiversity park (Table 3 BDAEN 86).

Table 4 BDAEN 86 revealed that spider recorded positive significant correlation with MinT, Mean T, RH2, Mean RH VP1, VP2 and Mean VP. *Coccinellids* established negative significant correlation with WS. Bug, *Rhinocoris* sp failed to establish significant correlation with any abiotic factors. A significant negative association establish between *Nesidiocoris tenius* and abiotic factors like MaxT, Min T, Mean T, RH2, VP1, VP2 and Mean VP.

Table 1 BDAEN 86: Population of natural enemies in Entomophage Park

St.	Tobacco /m^2					Lucerne / m^2					Marigold / m^2					Sena / m^2					Cassia / m^2					Maize / m^2					Cotton / m^2				
We	Sp	Lb	Ge	Ne	Rh	Sp	Lb	Ge	Ne	Rh	Sp	Lb	Ge	Ne	Rh	Sp	Lb	Ge	Ne	Rh	Sp	Lb	Ge	Ne	Rh	Sp	Lb	Ge	Ne	Rh	Sp	Lb	Ge	Ne	Rh
35	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	3	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	3	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
38	0	0	1	2	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
39	0	0	1	2	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
40	0	0	1	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	0
41	1	0	0	4	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0
42	0	0	0	4	0	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
43	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0
44	0	0	0	4	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
45	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
46	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0
47	0	0	0	6	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1
48	0	0	0	7	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1
49	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	1	0	1	1	0	0
50	0	0	0	6	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
51	0	0	0	8	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	2	1	0	0
52	0	0	0	8	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
1	0	0	0	7	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
2	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0
3	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0
4	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
5	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
6	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

SMW: Standard Meteorological Week, Sp: Spider, LB: Lady Bird Beetle, Ge: Geocorisochropeterus,
Ne: Nesidiocoris tenuis, Rh: Rhinocoris sp.

Table 2 BDAEN 86: Studies on insect pests of tobacco, its natural enemies near & away from Entomophage Park (2021-22)

SMW	Tobacco /M^2 (Near)						Tobacco /M^2 (Away)					
	Natural enemies			Insect pests			Natural enemies			Insect pests		
	Spi-der	Predatory bug	Total	White fly	Leaf eating caterpillar	Capsule borer	Spider	Predatory bug	Total	White fly	Leaf eating caterpillar	Capsule borer
35	2	1	3	0	0	0	0	2	2	0	0	0
36	1	1	2	1	0	0	2	0	2	1	1	0
37	0	1	1	2	0	0	0	0	0	2	0	0
38	1	1	2	0	1	0	1	1	2	2	0	0
39	0	2	2	3	0	0	0	2	2	0	1	0
40	1	1	2	0	0	0	1	2	3	2	0	0
41	1	3	4	2	0	0	0	3	3	0	1	0
42	0	2	2	2	0	0	0	3	3	0	0	0
43	0	1	1	0	0	0	0	1	1	3	0	0
44	1	6	7	2	1	1	2	6	8	2	0	0
45	0	4	4	3	0	0	0	3	3	2	0	1
46	0	3	3	2	0	1	0	4	4	3	0	1
47	0	2	2	2	0	2	0	2	2	1	0	2
48	0	3	3	3	0	3	0	2	2	3	0	2
49	0	3	3	3	0	2	0	4	4	2	0	3
50	0	5	5	1	0	1	0	4	4	1	0	1
51	0	4	4	2	0	2	0	5	5	2	0	1
52	0	4	4	1	0	1	0	3	3	1	0	2
1	0	3	3	3	0	1	0	3	3	2	0	2
2	0	1	1	2	0	2	0	2	2	1	0	1
3	0	3	3	2	0	1	2	2	4	2	0	1
4	0	1	1	2	0	1	0	1	1	1	0	1
5	2	2	4	1	0	0	0	0	0	2	0	1
6	1	1	2	2	0	1	0	1	1	2	0	1
Total	10	58	68	41	2	18	8	57	65	37	3	20

Table 3 BDAEN 86: Summary on population of natural enemies and insect pest appear near and away from Entomophage Biodiversity Park

Entomophage Biodiversity park	Population of natural enemies/m²		Population of insect pest/m²		
	Spider	Predatory bug	Whitefly	Leaf eating caterpillar	Capsule borer
Near	0.170	2.500	1.708	0.000	0.792
Away	0.170	2.330	1.542	0.042	0.750
't' value	1.000	0.940	0.609	-1.000	0.327

Table 't' value @ 0.05% = 2.013, Table 't' value @ 0.01 % = 2.687

Table 4 BDAEN 86: Correlation coefficient between abiotic factors and different bio agents in Entomophage Biodiversity Park

Weather parameter	Spider	Coccinellids	*Geocoris ochropeterus*	*Nesidiocoris tenuis*	*Rhinocoris* sp.
EP	-0.048	0.027	-0.356	0.201	0.278
WS	0.103	-0.423*	0.201	-0.283	0.027
Max T	0.316	0.212	-0.114	-0.634**	0.349
Min T	0.482*	0.046	0.192	-0.820**	0.318
Mean T	0.448*	0.116	0.082	-0.800**	-0.352
RH_1	-0.291	-0.219	0.413*	-0.366	-0.228
RH_2	0.407*	-0.295	0.450*	-0.591**	-0.111
Mean RH	0.315	-0.287	0.456*	-0.551**	-0.158
VP_1	0.480*	-0.022	0.244	-0.809**	-0.354
VP_2	0.429*	-0.133	0.325	-0.752**	-0.245
Mean VP	0.458*	0.078	0.287	-0.786**	-0.152

**Significant ** highly significant*

EP	Evaporation
BSS	Bright Sunshine hours
WS	Wind speed
Max T	Maximum temperature
Min T	Minimum temperature
Mean T	Mean temperature
RH_1 & RH_2	Relative humidity (morning and afternoon)
Mean RH	Mean relative humidity
VP_1 & VP_2	Vapor pressure (morning and afternoon)
Mean VP	Mean vapor pressure

BDAEN 88: STUDY OF POPULATION DYNAMICS OF IMPORTANT PESTS OF TOBACCO

Objective: The major pests of tobacco are whiteflies, *Bemisia tabaci* (Gen.), leaf eating caterpillar, *Spodoptera litura* (F) and capsule borer, *Helicoverpa armigera* (Hub.). The above mentioned insect pests show population fluctuations during the crop season. Therefore, regular monitoring on the status of insect pests was carried out to forewarn the farmers of the region.

Year of start : 2007-2008
Date of planting
Nursery : 20-07-2021 Seed crop : 27-08-2021

Results
The weekly observations on insect pest status were recorded during the year 2021-22 and summarized in Table 1 BDAEN 88 (nursery conditions) and Table 2 BDAEN 88 (field conditions).

Nursery

(1) **Rove beetle, Bledius latiusculus (K):** The data presented in Table 1 BDAEN 88 revealed that occurrence of rove beetle was started from 30th week (third week of July) and continued up to 33rd (Second week of August) meteorological standard week.

(2) **Whitefly, Bemisia tabaci (G):** The whitefly population was not noticed during nursery period.

(3) **Leaf eating caterpillar, Spodoptera litura (F):** The observations on leaf eating caterpillar was recorded from 32nd and 33rd standard meteorological week (first week and second week of August). The attempt was made to correlate the different weather parameters with insect pest of tobacco in nursery and found non-significant.

Field crop

(A) **Whitefly, *Bemisia tabaci* (G):** The population of whiteflies commenced from the 34th standard week (first week of August) and continued throughout the crop season. The maximum population (24/50 plants) of whiteflies was recorded in 50th (second week of December) standard meteorological week. Correlation worked out for whitefly with abiotic factors revealed that weather parameters like EP, BSS, WS, Max T, Min T, Mean T, RH_1, RH_2, Mean RH, VP_1, VP_2 and Mean VP failed to establish statistically significant correlation.

(B) **Leaf eating caterpillar, *Spodoptera litura* (F):** The incidence of leaf eating caterpillar was found from 34th standard meteorological week (third week of August) and continued up to 42nd standard meteorological week (third week of October). The maximum population 7 larvae / 50 plants were registered in 36th standard meteorological week (first week of September).

An attempt was made to correlate weather parameters with population of *S. litura*. The results indicated that WS Max T Min T, Mean T, RH_1, RH_2, VP_1, VP_2 and Mean VP had positive significant correlation with *S. litura* while it was negative significant with BSS.

(C) **Capsule borer, *Helicoverpa armigera* (Hub.):** The infestation of capsule borer was started in 45th standard meteorological week (first week of November) and continued up to 5th standard meteorological week (fourth week of January). The highest larval population was registered in 51st and 52nd standard meteorological week (11/3 twigs/ 50 plants).
An attempt was made to correlate the capsule borer with weather parameters and found that, Max T, Min T, Mean T, , Mean RH, VP_1, VP_2 and Mean VP had established highly significant negative correlation.

Table 1 BDAEN 88: Population dynamics of the major pests infesting *bidi* tobacco under nursery conditions.

Std. week	Rove beetle burrows/holes /25 cm^2	Leaf eating caterpillar damaged seedlings/ sq.feet
29	0	0
30	1	0
31	1	0
32	1	1
33	1	1

Table 2 BDAEN 88: Population dynamics of the major pests infesting *bidi* tobacco under field conditions

SMW	Whitefly / 50 plants	Leaf eating caterpillar		Capsule borer(*Helicoverpa armigera* Hub.) / 3 twigs/ 50 plants
		No. of egg masses/ 50 plants	No. of larvae/ 50 plants	
34	12	2	5	0
35	16	1	6	0
36	17	1	7	0
37	17	0	6	0
38	18	0	5	0
39	18	0	4	0
40	19	0	3	0
41	19	0	2	0
42	18	0	1	0
43	18	0	0	0
44	21	0	0	0
45	22	0	0	6
46	22	0	0	6
47	22	0	0	7
48	23	0	0	8

SMW	Whitefly / 50 plants	Leaf eating caterpillar		Capsule borer(*Helicoverpa armigera* Hub.) / 3 twigs/ 50 plants
		No. of egg masses/ 50 plants	No. of larvae/ 50 plants	
49	23	0	0	10
50	24	0	0	10
51	22	0	0	11
52	17	0	0	11
1	10	0	0	10
2	10	0	0	15
3	8	0	0	12
4	7	0	0	8
5	10	0	0	5
6	12	2	5	0

Table 3 BDAEN 88: Correlation coefficient between weather parameters with insect pest of tobacco in field

Weather parameter	Whitefly	Leaf eating caterpillar Egg mass	Leaf eating caterpillar Larvae	Capsule borer
EP	0.115	-0.046	0.083	-0.332
BSS	-0.094	-0.461*	-0.763**	0.329
WS	0.128	0.135	0.722**	-0.293
Max T	0.391	0.219	0.398*	-0.819**
Min T	0.318	0.0.436*	0.850**	-0.785**
Mean T	0.369	0.381	0.700**	-0.853**
RH_1	-0.411*	0.355	0.592**	-0.282
RH_2	0.031	0.409*	0.848**	-0.378
Mean RH	-0.117	0.381	0.812**	-0.777**
VP_1	0.140	0.453*	0.871**	-0.656**
VP_2	0.153	0.441*	0.881**	-0.656**
Mean VP	0.148	0.450*	0.883**	-0.722**

**Significant **Highly significant*

EP	Evaporation
BSS	Bright Sunshine hours
WS	Wind speed
Max T	Maximum temperature
Min T	Minimum temperature
Mean T	Mean temperature
RH_1	Relative humidity (morning)
RH_2	Relative humidity (afternoon)
Mean RH	Mean relative humidity
VP_1	Vapor pressure (morning)
VP_2	Vapor pressure (afternoon)
Mean VP	Mean vapor pressure

II. PLANT PATHOLOGY

A. *BIDI* TOBACCO

ANAND

BDAPP 126: MONITORING OF RESISTANCE DEVELOPMENT IN *PYTHIUM APHANIDERMATUM* TO FUNGICIDES

Damping-off caused by *Pythium aphanidermatum* is a most dreadful disease of *bidi* tobacco in nursery. Bordeaux mixture at 0.6% gives reasonable control of the disease. Metalaxyl MZ 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.

(A) RESISTANCE DEVELOPMENT IN PYTHIUM APHANIDERMATUM TO METALAXYL MZ

Year of start: 2001-2002

Treatments

1. Metalaxyl MZ @ 2.16 kg/ha (*i.e.,* 68 WP @ 3.17 kg/ha); 2-3 drenching as and when required starting from disease development (RDMZ)
2. Bordeaux mixture 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 1 BDAPP 126 (A)] revealed that in nursery conditions 13% damping-off disease incidence in comparison with control was recorded in the treatment of metalaxyl MZ applied @ 2.16 kg/ha.

The pathogen, which survived in metalaxyl MZ treated beds, was further screened in laboratory against the fungicide with three different concentrations [Table 2 BDAPP 126 (A)] 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 1 BDAPP 126 (A):

Treatments	No. of damped-off seedlings/ m^2	Per cent disease incidence in comparison with control	Transplantable seedlings/m^2
RDMZ	10	13	762
BM	21	26	567
CON	80		465

Table 2 BDAPP 126 (A):

S. 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 MZ 75 ppm	00	00	00	100
02	Metalaxyl MZ 150 ppm	00	00	00	100
03	Metalaxyl MZ 300 ppm	00	00	00	100
04	Control (Without Fungicide)	55	90	90	00

(B) RESISTANCE DEVELOPMENT IN PYTHIUM APHANIDERMATUM TO AZOXYSTROBIN

Year of start: 2015-16

Treatments

1. Azoxystrobin 23 SC @ 0.023% (230g a.i./ha *i.e.,* 10 ml/10 l water / $100m^2$) 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/$100m^2$) 2-3 spray drenching (AZO+DIF)
3. Control - No fungicide treatment (CON)

Methodology: As above in metalaxyl MZ

Results

Results [Table 1 BDAPP 126 (B)] revealed that in nursery conditions 40 and 36% 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 2 BDAPP 126 (B)] 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 1 BDAPP 126 (B):

Sr. No.	Treatment	No. of damped-off seedlings/m²	Percent disease incidence in comparison with control	Transplantable seedlings/m²
01	Azoxystrobin	50	40	658
02	Azoxystrobin +Difenoconazole	45	36	645
03	Control - No fungicide	125		430

Table 2 BDAPP 126 (B):

Sr. No.	Treatment / Concentration	Mycelial growth in mm (Average of 06 Plates)			Percent 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	Azo.+Difen. 650 ppm	00	00	00	100
05	Azo.+Difen. 1300 ppm	00	00	00	100
06	Azo.+Difen. 2600 ppm	00	00	00	100
07	Control(Without Fungicide)	55	90	90	00

**based on fungicide product*

BDAPP 128: SCREENING FOR RESISTANCE TO DAMPING-OFF AND ROOT-KNOT IN TOBACCO (JOINT STUDY BY PLANT PATHOLOGY AND PLANT BREEDING SECTIONS)

Damping-off of tobacco caused by *Pythium aphanidermatum* is a very serious problem for successful nursery raising. The severity of pre and post emergence damping-off leads to very poor seedlings emergence and stand even with the seeds of high germination ability. Under most congenial environmental conditions, the nurseries get completely destroyed. Due to relative ease in management of the disease by metalaxyl MZ, 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 *Meloidogyne incognita* and *M. Javanica* is another dreadful disease both in nursery and field. Losses due to root-knot to the tune of 50% have been reported in *bidi* tobacco. Although effective technologies of Root-knot 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. Resistance in cultivars however would be a most appropriate proposition. In view of the above, it is imperative to evaluate tobacco genotypes for their reaction to these two dreadful diseases with ultimate objective of breeding for resistance to them.

Year of start: 2002-2003

Methodology: Fourteen and sixteen tobacco genotypes/lines including check were evaluated separately for damping-off and Root-knot diseases, respectively employing standard procedures in nursery and controlled conditions.

Results revealed that out of 14 genotypes/lines, eleventh and third line showed moderately susceptible and susceptible reaction, respectively to damping-off disease in the nursery conditions. Out of 16 lines/varieties (Table 2 BDAPP 128), five line showed resistant reaction including ABT-10 (Check) while two, six and three lines showed moderately resistant, moderately susceptible reaction respectively to root-knot disease in pots (Table 1 BDAPP 128).

Table 1 BDAPP 128: Reaction to damping-off disease in the nursery conditions

Culture/ variety / line	Per cent damped-off seedlings	Reaction
ABD- 247	31	MS
ABD -249	31	MS
ABD- 251	44	MS
ABD- 252	44	MS
ABD- 253	47	MS
ABD- 255	47	MS
ABD- 256	59	S
ABD- 257	52	S
ABD- 258	59	S
ABD- 259	44	MS
GT- 7 (C)	37	MS
ABT- 10 (C)	29	MS
GABT- 11 (C)	45	MS
GABTH- 2 (C)	36	MS

Table 2 BDAPP 128: Reaction to root-knot disease

S. No.	Culture/ variety/ line	Root-knot index (0-5)*			Index range	Reaction on maximum index
		Nursery	Sick field	Pot		
1.	ABD- 247	0.60	2.2	4.2	3-5	S
2.	ABD- 249	0.48	2.6	3.0	3-4	MS
3.	ABD- 251	0.40	2.4	2.2	1-4	MR
4.	ABD- 252	1.28	2.6	4.2	3-5	S
5.	ABD- 253	0.60	3.0	2.6	0-4	MR
6.	ABD- 255	0.96	3.0	3.8	3-5	MS
7.	ABD- 256	0.20	1.3	1.4	0-2	R
8.	ABD- 257	0.72	2.6	3.0	2-4	MS
9.	ABD- 258	0.36	1.0	0.8	0-2	R
10.	ABD- 259	0.72	4.4	3.2	1-4	MS
11.	ABD- 200	-	-	1.2	0-3	R
12.	ABD- 201	-	-	1.4	0-3	R
13.	GT- 7 (C)	0.48	2.6	3.8	2-5	MS
14.	ABT- 10 (C)	0.00	0.0	0.0	0-0	HR
15.	GABT- 11 (C)	0.88	2.8	3.0	1-4	MS
16.	GABTH- 2 (C)	0.96	3.0	4.6	4-5	S

**0=Free, 5=Maximum disease intensity, HR= Highly Resistant; R= Resistant; MR= Moderately Resistant; MS= Moderately Susceptible; S= Susceptible; HS= Highly Susceptible.*

BDAPP 135: EFFICACY OF READY MIX FUNGICIDES FOR THE MANAGEMENT OF DAMPING-OFF DISEASE IN BIDI TOBACCO NURSERY

Damping-off caused by *Pythium aphanidermatum* is a most dreadful disease of *bidi* tobacco in nursery. Bordeaux mixture at 0.6% gives reasonable control of the disease. Metalaxyl MZ is found to be effective against the disease and is recommended @ 2.16 kg/ha (2-3 drenching) for its effective and economical management in the nursery in Gujarat. Now a days, new ready-mix fungicides are available to control phycomycetes. To know the efficacy of the same against damping-off disease in *bidi* tobacco nursery, present experiment is planned.

Objective: To evaluate the efficacy of ready mix fungicides for effective management of damping-off disease in *bidi* tobacco nursery

Year of start	:	2020-21	Net plot size	:	1.0 × 1.0 m
Design	:	RBD	Gross plot size	:	1.2 × 1.2 m
Replications	:	4 (Four)	Location	:	BTRS Farm
Variety	:	GT-7			

Treatment Details

Sr. no	Treatments	g a.i. /ha	Conc. (%)	Quantity of formulation required (g/10 litre water)
1	Cymoxanil 8% + Mancozeb 64% WP	810	0.081	11.50
2	Cymoxanil 8% + Mancozeb 64% WP	1080	0.108	15.00
3	Cymoxanil 8% + Mancozeb 64% WP	1350	0.135	19.00
4	Metiram 55% + Pyraclostrobin 5% WG	788	0.079	13.00
5	Metiram 55% + Pyraclostrobin 5% WG	1050	0.105	17.50
6	Metiram 55% + Pyraclostrobin 5% WG	1313	0.131	22.00
7	Dimethomorph 50% WP	375	0.038	7.50
8	Dimethomorph 50% WP	500	0.050	10.00
9	Dimethomorph 50% WP	625	0.063	12.50
10	Metalaxyl MZ 72 WP	3600	0.072	1.8
11	Bordeaux mixture at 0.6 %			
12	Control			

Note: *Fungicides (serial no.1 to 9) were spray drenched using 500 litre solution per ha, while metalaxyl MZ and Bordeaux mixture (serial no. 10 and 11) were drenched @ 2 litre/m² at the initiation of the disease and as and when required.*

Observations recorded

1. Germination count/ 25 cm^2
2. Damped-off seedlings/ m^2
3. Fresh weight of 100 seedlings (g)
4. Frog-eye leaf spot index (0-5)
5. Transplantable and Total surviving seedlings/ m^2

Results

The data on efficacy of ready-mix fungicides for the management of damping-off disease in *bidi* tobacco nursery presented in (Table 1 BDAPP 135) and (Table 2 BDAPP 135). The results indicated that germination counts were uniform before impose of the treatment as statistical difference was non-significant. The fresh weight of 100 seedlings was also non-significant (Table 1 BDAPP 135). The significantly minimum damped-off seedlings was registered in Metiram 55% + Pyraclostrobin 5% WG (0.105 %) (53/m^2) and it was at par with Metalaxyl MZ 72 WP (59/m^2) followed by Metiram 55% + Pyraclostrobin 5% WG (0.131%) (69/m2) and Metiram 55% + Pyraclostrobin 5% WG (0.079%) (75/m^2) (Table2 BDAPP 135). The maximum transplantable seedling was recorded in treatment of Metalaxyl MZ 72 WP (553/m^2) and it was at par with Metiram 55% + Pyraclostrobin 5% WG (0.131%) (507/m2) and Metiram 55% + Pyraclostrobin 5% WG (0.105%)(447/m^2). Similar trend was observed in total transplantable seedlings.

Table 1 BDAPP 135: Effect of fungicides on germination and fresh weight

S. No	Treatment	Conc. (%)	Germination count/ 25 cm^2	Fresh weight (g)
1	Cymoxanil 8% + Mancozeb 64% WP	0.081	5.73	533
2	Cymoxanil 8% + Mancozeb 64% WP	0.108	6.20	700
3	Cymoxanil 8% + Mancozeb 64% WP	0.135	6.00	683
4	Metiram 55% + Pyraclostrobin 5% WG	0.079	5.00	700
5	Metiram 55% + Pyraclostrobin 5% WG	0.105	7.10	750
6	Metiram 55% + Pyraclostrobin 5% WG	0.131	5.50	600
7	Dimethomorph 50% WP	0.038	6.60	617
8	Dimethomorph 50% WP	0.050	6.03	700
9	Dimethomorph 50% WP	0.063	7.17	667
10	Metalaxyl MZ 68 WP		4.77	650
11	Bordeaux mixture at 0.6 %	0.6	8.00	517
12	Control		4.93	567
	S. Em$\pm$		0.77	111.62
	C.D. at 5%		NS	NS
	C.V. (%)		21.83	30.20

Table 2 BDAPP 135: Effect of fungicides on damping-off and transplantable seedlings

S. No	Treatment	Conc. (%)	Damped-off seedlings /m^2	Seedling/m^2	
				Trans-plantable	Total surviving
1	Cymoxanil 8% + Mancozeb 64% WP	0.081	141	253	317
2	Cymoxanil 8% + Mancozeb 64% WP	0.108	125	273	323
3	Cymoxanil 8% + Mancozeb 64% WP	0.135	134	267	315
4	Metiram 55% + Pyraclostrobin 5% WG	0.079	75	313	393
5	Metiram 55% + Pyraclostrobin 5% WG	0.105	53	447	535
6	Metiram 55% + Pyraclostrobin 5% WG	0.131	69	507	592
7	Dimethomorph 50% WP	0.038	187	243	303
8	Dimethomorph 50% WP	0.050	174	227	315
9	Dimethomorph 50% WP	0.063	148	287	343
10	Metalaxyl MZ 68 WP		59	553	637
11	Bordeaux mixture at 0.6%	0.6	115	353	427
12	Control		196	213	270
	S. Em$\pm$		23.90	62.89	71.08
	C.D. at 5%		70.10	184.46	208.47
	C.V. (%)		33.64	33.20	30.97

BDAPP 811: VALIDATION OF PREDICTION MODEL FOR FROG-EYE SPOT DISEASE

Background

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 an outcome models were developed to predict the disease.

Year of start: 2016-17

Methodology

Six beds each of 1.2 x 1.2 m size in nursery and 250 m^2 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 to the tune of 80 % and 52.63 % in nursery and field, respectively.

Table 1 BDAPP 811: Validation of prediction model for FES 2021-2022

Std. week	Average value of preceding standard week						Value recorded and calculated for prediction				
	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
Nursery											
31	-	0.0	-	30.5	22.4	-	0	0	1.0	1	No
32	-	0.0	-	26.6	22.6	-	0	0	1.0	1	No
33	-	1.0	-	26.1	22.9	-	0.16	1	1.0	1	Yes
34	-	0.0	-	26.0	23.3	-	0.27	1	1.0	1	Yes
35	-	3.0	-	25.2	23.3	-	0.37	1	1.0	1	Yes
36	-	3.0	-	26.3	23.9	-	1.06	1	1.0	1	Yes
37	-	4.0	-	25.8	23.8	-	1.26	1	1.0	1	Yes
38	-	5.0	-	25.7	24.0	-	1.55	1	1.0	1	Yes
39	-	4.0	-	25.5	23.8	-	1.16	1	1.0	1	Yes
40	-	2.0	-	25.9	23.8	-	0.9	1	1.0	1	Yes
Main Field											
38	0.6	-	29.8	25.7	-	707.5	0.16	1	0.5	1	Yes
39	3.1	-	31.7	25.5	-	779.5	0.20	1	0.5	1	Yes
40	6.6	-	33.6	25.9	-	797.5	0.20	1	0.7	1	Yes
41	6.6	-	35.0	25.8	-	797.9	0.35	1	0.5	1	Yes
42	8.3	-	34.7	21.6	-	797.9	0.50	1	0.5	1	Yes
43	9.3	-	33.1	21.2	-	797.9	0.72	1	0.7	1	Yes
44	9.7	-	33.1	16.7	-	797.9	0.70	1	0.4	1	Yes
45	8.2	-	32.8	17.0	-	797.9	0.60	1	0.3	0	No
46	7.2	-	31.2	18.0	-	797.9	0.86	1	0.5	1	Yes
47	6.0	-	31.7	20.7	-	797.9	0.90	1	0.5	1	Yes
48	7.0	-	30.6	16.4	-	809.1	0.00	1	0.4	0	Yes

Std. week	Average value of preceding standard week						Value recorded and calculated for prediction				
	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
49	4.4	-	26.1	17.6	-	811.3	0.00	0	0.7	1	No
50	6.5	-	28.1	16.5	-	811.3	0.00	0	0.7	1	No
51	8.3	-	26.6	11.2	-	811.3	0.00	0	0.7	1	No
52	5.6	-	23.3	12.5	-	811.9	0.00	0	0.8	1	No
01	5.0	-	27.6	16.7	-	811.9	0.00	0	0.6	1	No
02	8.7	-	23.9	11.1	-	811.9	0.00	0	0.9	1	No
03	8.7	-	26.7	12.9	-	811.9	0.00	0	0.8	1	No
04	7.6	-	24.5	10.4	-	811.9	0.00	0	0.8	1	No

Yes= Validation confirmed; No= Validation deferred.

III. NEMATOLOGY

A. *BIDI* TOBACCO

ANAND

BDAPP 684: ROTATIONAL STUDY WITH RESISTANT BIDI TOBACCO TO MANAGE ROOT-KNOT DISEASE IN BIDI TOBACCO

Background

Highly resistant *bidi* tobacco ABT-10 is released in 2008 and grown in Root-knot infested fields by the farmers. Planting of Root-knot resistant ABT-10 for six consecutive years in severely infested field (RKI>4.00) at BTRS farm drastically reduced Root-knot disease (<1.00 RKI) on field tolerant MRGTH 1 in seventh year (*Ebhad*, 2016). However, no information is available about the minimum effective duration of rotation with resistant variety. Therefore, present experiment was planned to find out minimum effective duration of rotation with resistant variety to minimize the soil borne root-knot disease.

Experiment Details

Year of start	:	2017-18	Replications	:	Four
Design	:	R.B.D.	Variety	:	ABT-10 & A-119
Gross Plot size	:	4.5 × 6.0 m	Fertilizer	:	As per recommendation
Net Plot size	:	1.8 × 4.8 m	Location	:	BTRS Farm

Treatments details

Rotation Treatment	Year					
	I	II	III	IV	V	VI
1 year with ABT-10	ABT-10	A-119	ABT-10	A-119	ABT-10	A-119
2 year with ABT-10	ABT-10	ABT-10	A-119	ABT-10	ABT-10	A-119
3 year with ABT-10	ABT-10	ABT-10	ABT-10	A-119	A-119	A-119
4 year with ABT-10	ABT-10	ABT-10	ABT-10	ABT-10	A-119	A-119
Susceptible A-119	A-119	A-119	A-119	A-119	A-119	A-119

Results

The results revealed that a significant difference among the treatments for yield and root-knot index was observed (Table 1 BDAPP 684 and Table 2 BDAPP 684). Four years of rotation in which first, second, third and fourth year were transplanted with a resistant variety (ABT-10) followed by susceptible variety A-119 registered 1604 kg/ha cured leaf yield while a susceptible variety (A-119) transplanted continuously, which yielded significantly lower cured leaf yield (1032 kg/ha) with root-knot index 0.90. Four year rotation with resistant variety (ABT-10) reduced root-knot index and increase yield compare to continuous planting of susceptible variety (A-119). Final population of root-knot nematodes was found minimum in ABT-10 compared to A-119.

It can be concluded that nematode infected field transplanted with variety ABT-10 (root-knot resistant) for three to four years, effectively manage population of Root-knot nematode with significant increase in cured leaf yield of A-119 (Root-knot susceptible).

Table 1 BDAPP 684: Yield (kg/ha) for the years 2017-18, 2018-19, 2019-20, 2020-21 and 2020-21

Rotation Treatment	2017-18	2018-19	2019-2020	2020-21	2021- 22
1st year with ABT-10	2030	1548	2206	1721	2048
2nd year with ABT-10	2098	2168	1790	2352	2091
3rd year with ABT-10	2115	2392	2234	1825	1506
4th year with ABT-10	2089	2474	2346	2355	1604
Susceptible A -119	1997	1487	1445	1556	1032
S.Em ±					67.67
C.D. at 5%					208.53
C.V. (%)					8.17

Table 2 BDAPP 684: Root-knot Index (0-5) (2017-22)

Rotation Treatment	2017-18	2018-19	2019-20	2020-21	2021-2022	
					Orig.	$\sqrt{x+1}$
1st year with ABT-10	0.00	1.30	0.00	2.93	0.00	1.00
2nd year with ABT-10	0.00	0.00	1.53	0.00	0.00	1.00
3rd year with ABT-10	0.00	0.00	0.00	1.78	2.60	1.88
4th year with ABT-10	0.00	0.00	0.00	0.00	0.90	1.37
Susceptible A-119	2.75	2.60	4.55	4.38	4.63	2.37
S.Em ±						0.08
C.D. at 5%						0.237
C.V. (%)						10.08

Table 3 BDAPP 684: Nematode population /200 cc soil

Sr. No.	Treatment	Nematode population /200 cc soil							
		Initial				Final			
		Root-knot	Reni form	Stunt	Total	Root-knot	Reni form	Stunt	Total
1	1st year	385	304	342	1031	824	514	642	1980
2	2nd year	280	254	310	844	590	425	492	1507
3	3rd year	493	342	326	1161	1035	610	563	2208
4	4th year	315	295	270	880	716	530	687	1933
5	Control	623	436	394	1453	1734	732	757	3223

BDAPP 685: EFFECTS OF ANTAGONISTIC CROP FOR MANAGEMENT OF ROOT-KNOT NEMATODE IN BIDI TOBACCO NURSERY

Background: Root knot nematodes (*Meloidogyne* spp.) are economically damaging nematodes in *bidi* tobacco nursery and act as primary inoculum which transfers into the field. For control, chemical nematicides can be used, but the range of available compounds is limited. The compounds are expensive and their uses have negative impacts on the environment and on public health. As a result, there is growing interest in alternative methods of management that are economically viable and non-polluting. (*Fourie, et al.*, 2016). It has been demonstrated by various researchers that bio-fumigation leads to the significant reduction of various economically important nematode pest populations and the symptoms they cause to crops, with subsequent increases in yield/quality of such crops. Bio-fumigation is defined as the action of volatile substances from the biodegradation of organic matter as fumigants to control plant pathogens Its efficiency is maintained in time through its introduction into an integrated crop management (ICM) system. It has been demonstrated by various researchers that bio-fumigation leads to the significant reduction of various economically important nematode pest populations and the symptoms they cause to crops, with subsequent increases in yield/quality of such crops

Objective: To manage root-knot nematode through antagonistic crop

Year of start	:	2020-21	Replications	:	Four
Design	:	R.B.D.	Crop	:	Tobacco
Gross Plot size	:	1.2 × 1.2 m	Variety	:	GT 7
Net Plot size	:	1.0 × 1.0 m	Location	:	BTRS Nursery, AAU, Anand

Treatment Details: 6 (Six)

Crop	Seed rate (kg/ha)
1. Mustard	25
2. French Marigold	2
3. Sunnhemp	100
4. Clusterbean	50
5. Sesamum	5
6. Fallow	-

Each beds of 1.44 m^2 size for each of the above six treatments were grown according to season and after flowering the respective crop were chopped and incorporated into the soil by making furrow. After incorporation in furrow immediately cover with soil and saturated through watering. Frequent watering allows the retention of gases by maintaining a thin impermeable layer on the surface. For recording the RKI observations, twenty five seedlings were randomly uprooted from each net plot area and number of galls on seedlings was recorded as per (0-5) scale. The observations on RKI were recorded at each pulling.

Observations recorded

1. Germination count/ 25 cm^2
2. Rove beetle count/ 25cm^2
3. Fresh weight of 100 seedlings at 1^{st} pulling
4. No. of transplantable seedlings/m^2
5. No. of surviving seedlings/m^2
6. Root-knot index (RKI)
7. Initial and final nematode population from soil

Results

The data on effect of antagonistic crop on Root-knot nematode in *bidi* tobacco under nursery condition is presented (Table 2 BDAPP 685). The results revealed that germination count was uniform in all the treatments. The rove beetle count in treatments do not differ significantly with each other. The fresh weight remain at par with each other as treatment difference is non-significant. The maximum healthy transplantable seedlings was registered in a plot with Sun hemp (609/m^2) followed by mustard (509/m^2) as source of bio fumigant. The treatment of mustard as green manure significantly reduced root-knot disease compared to other treatments at 90 DAS (Table 3 BDAPP 685). While sunhemp as green manure yielded maximum number of transplantable seedlings than the rest of the treatments. Mustard remain next best treatment.

Pooled

The pooled data (Table 6 BDAPP 685) on effect of different antagonistic crop on germination count revealed non-significant results among treatments in individual years (2020-21, 2021-22) and pooled. The rove beetle counts remain at par with each other indicated that different bio fumigant crop does not have any impact on its population. The fresh weight per 100 seedlings was registered in mustard (793 g) which numerically followed by Sun hemp (788 g) and Marigold (678 g).

Table 1 BDAPP 685: Effect of different antagonistic crop in *bidi* tobacco nursery

Treatment	Germination count/ 25cm^2	Rove beetle	Fresh weight (g)	Seedlings/m^2	
				Transplantable	Total surviving
Mustard	5.05	1.03 (0.85)*	780	509	557
Sesamum	4.30	0.88 (0.78)	665	360	404
Clusterbean	3.83	0.93 (0.88)	610	456	521
Sun hemp	5.70	0.95 (0.90)	775	609	676
Marigold	6.25	0.91 (0.83)	680	405	462
Fallow	5.00	0.91 (0.83)	650	321	384
S.Em ±	0.59	0.05	61.60	29.81	31.33
C.D. at 5%	NS	NS	NS	89.83	94.42
C.V. (%)	23.66	11.49	17.77	13.46	12.51

* *Figure in parenthesis is original value, while outside is* $\sqrt{x+1}$ *transformation*

Table 2 BDAPP 685: Effect of different antagonistic crop on root-knot index in *bidi* tobacco nursery

Treatment	Root-knot index (0-5)*		
	I Pulling, 50 DAS	II Pulling, 66 DAS	III Pulling, 90 DAS
Mustard	1.05 (0.10)**	1.39 (0.95)	1.65 (1.74)
Sesamum	1.09 (0.18)	1.47 (1.17)	1.76 (2.09)
Clusterbean	1.08 (0.16)	1.48 (1.18)	1.78 (2.18)
Sun hemp	1.09 (0.19)	1.48 (1.18)	1.79 (2.20)
Marigold	1.08 (0.16)	1.47 (1.16)	1.77 (2.15)
Fallow	1.07 (0.15)	1.50 (1.24)	1.98 (2.92)
S.Em ±	0.01	0.03	0.02
C.D. at 5%	NS	NS	0.06
C.V. (%)	1.63	3.61	2.10

** 0= free; 5= maximum disease intensity*

***Figure in parenthesis is original value, while outside is* $\sqrt{x+1}$ *transformation*

Table 3 BDAPP 685: Effect of different antagonistic crop on nematode population

Treatment	Nematode population /100 cc soil							
	Initial				Final			
	Root-knot	Reni form	Stunt	Total	Root-knot	Reni form	Stunt	Total
Mustard	20	23	25	68	251	230	224	706
Sesamum	32	28	34	95	411	274	421	1107
Clusterbean	24	30	38	92	267	303	441	1010
Sunnhemp	29	26	26	81	328	275	352	954
Marigold	25	20	30	74	299	316	296	911
Fallow	14	21	33	68	313	240	259	812

Table 4 BDAPP 685: Effect of different antagonistic crop on germination and Rove beetle

Treatment	Germination count/25cm^2			Rove beetle count/ 25cm^2		
	2020-21	2021-22	Pooled	2020-21	2021-2022	Pooled
Mustard	4.75	5.05	4.90	1.05 (0.88)*	1.03 (0.85)*	1.04 (0.86)*
Sesamum	5.38	4.30	4.84	0.96 (0.93)	0.88 (0.78)	0.92 (0.85)
Clusterbean	4.90	3.83	4.36	0.96 (0.93)	0.93 (0.88)	0.95 (0.90)
Sunnhemp	4.68	5.70	5.19	0.91 (0.83)	0.95 (0.90)	0.93 (0.86)
Marigold	5.38	6.25	5.81	0.93 (0.88)	0.91 (0.83)	0.92 (0.85)
Fallow	5.38	5.00	5.19	0.93 (0.88)	0.91 (0.83)	0.92 (0.85)
S.Em ±	0.52	0.59	0.41	0.05	0.05	0.03
C.D. at 5%	NS	NS	NS	NS	NS	NS
C.V. (%)	20.36	23.66	22.06	9.65	11.49	10.50

**Figure in parenthesis is original value, while outside is* $\sqrt{x+1}$ *transformation*

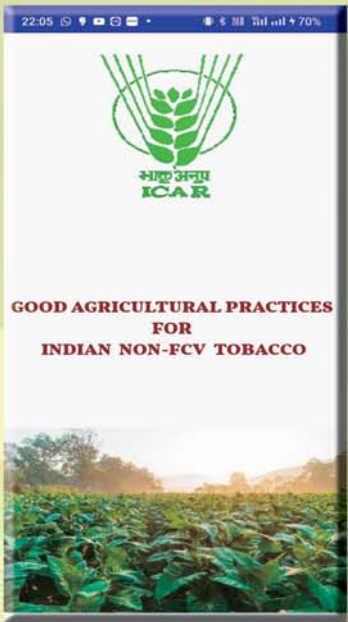
Table 5 BDAPP 685: Effect of different antagonistic crop on seedlings

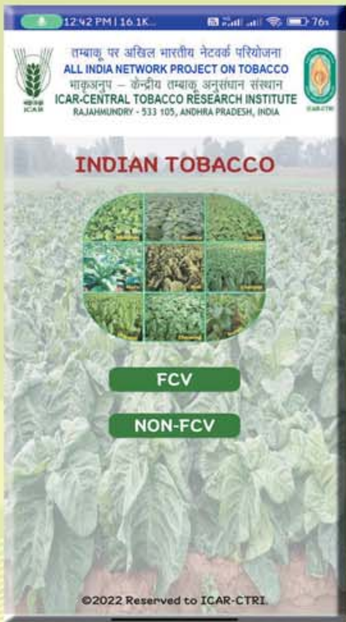
Treatment	Fresh weight of seedlings (g)			Total transplantable seedlings			Total surviving seedlings		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Mustard	805	780	793	477	509	493	520	557	538
Sesamum	575	665	620	369	360	364	391	404	397
Clusterbean	575	610	593	360	456	408	395	521	458
Sunnhemp	800	775	788	502	609	556	560	676	618
Marigold	675	680	678	366	405	385	412	462	437
Fallow	600	650	625	346	321	333	392	384	388
S.Em ±	73.67	61.60	45.27	31.43	29.81	22.46	31.21	31.33	22.90
C.D. at 5%	NS	NS	130.07	94.71	89.83	64.53	94.05	94.42	65.79
C.V. (%)	21.94	17.77	19.90	15.59	13.46	14.48	14.04	12.51	13.23
Y x T									
S.Em ±	30.63			30.63			31.27		
C.D. at 5%	NS			NS			NS		

Table 6 BDAPP 685: Effect of different anatagonistic crop on Root-knot index (Pooled)

Treatment	RKI (0-5) *, I Pulling			RKI (0-5) *, II Pulling			RKI (0-5) *, III Pulling		
	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled	2020-21	2021-22	Pooled
Mustard	1.05 (0.11)**	1.05 (0.10)	1.051 (0.11)	1.38 (0.90)	1.39 (0.95)	1.385 (0.93)	1.59 (1.54)	1.65 (1.74)	1.623 (1.64)
Sesamum	1.09 (0.18)	1.09 (0.18)	1.086 (0.18)	1.46 (1.13)	1.47 (1.17)	1.466 (1.15)	1.73 (1.98)	1.76 (2.09)	1.741 (2.04)
Clusterbean	1.08 (0.16)	1.08 (0.16)	1.077 (0.16)	1.46 (1.12)	1.48 (1.18)	1.466 (1.15)	1.75(2.07)	1.78 (2.18)	1.767 (2.13)
Sunnhemp	1.08 (0.17)	1.09 (0.19)	1.086 (0.18)	1.44 (1.08)	1.48 (1.18)	1.459 (1.13)	1.78 (2.17)	1.79 (2.20)	1.785 (2.19)
Marigold	1.07 (0.14)	1.08 (0.16)	1.072 (0.15)	1.46 (1.14)	1.47 (1.16)	1.466 (1.15)	1.76 (2.11)	1.77 (2.15)	1.769 (2.13)
Fallow	1.08 (0.16)	1.07 (0.15)	1.074 (0.16)	1.48 (1.19)	1.50 (1.24)	1.488 (1.22)	1.94 (2.77)	1.98 (2.92)	1.959 (2.84)
S.Em ±	0.01	0.01	0.006	0.02	0.03	0.016	0.03	0.02	0.017
C.D. at 5%	NS	NS	0.016	NS	NS	0.046	0.09	0.06	0.048
C.V. (%)	1.45	1.63	1.54	3.08	3.61	3.35	3.40	2.10	2.82
Y x T									
S.Em.	0.008			0.024			0.025		
C.D. at 5%	NS			NS			NS		

**0= free; 5= maximum disease intensity* ***Figure in parenthesis is original value, while outside is $\sqrt{x+1}$ transformation*





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