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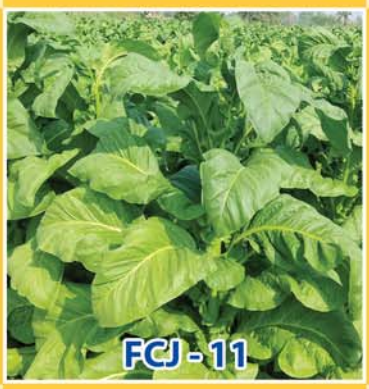

ALL INDIA NETWORK PROJECT ON TOBACCO

Annual Report 2018-19

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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Printed at
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1. INTRODUCTION

In India different tobacco types *viz.*, Flue Cured Virginia (FCV), *Bidi*, *Natu*, *Chewing* and *Rustica* are grown under diverse agro-climatic conditions prevailed. To cater the location specific needs of different tobacco types the All India Coordinated Project on Tobacco was established by Indian Council of Agricultural Research in the Fourth Five Year Plan during 1970-71 with the headquarters of the Coordinating unit at Anand (Gujarat). The headquarters was subsequently shifted to CTRI, Rajahmundry, A.P. 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, CTRI, Rajahmundry. A total of number 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, Anand and Pusa; 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 Central Tobacco Research Institute (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, Orissa University of Agriculture and Technology, Bhubaneswar and Chandra Sekhar Azad University of Agriculture and Technology, Kanpur, respectively. During the year 2018-19 multidisciplinary and multi-location trials were conducted for varietal development and also for the site specific agro-technologies.

As per the approved EFC the staff strength was rationalized and the revised Scientific, Technical and Administrative staff strength is reduced from 24, 26 and 4 to 16, 21 and 3, respectively. The expenditure incurred for the Network Project during 2018-19 was Rs. 386.66 lakhs.

Research Programmes

1. Evolving location specific superior varieties/hybrids of different tobaccos.
2. Breeding tobacco varieties tolerant for biotic and abiotic stresses Evaluation and development of best-bet site specific agro-techniques for enhancing the production efficiency and produce quality.
3. Development of location specific and cost-effective IPM modules for effective management of pest and diseases and to minimise the pesticide residues in tobacco.
4. Screening and identification of genotypes having suitable traits for non-conventional uses of tobacco.
5. Comparative evaluation of tobacco and non-tobacco based cropping systems that are remunerative and sustainable.

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.	Rajahmundry, ICAR-CTRI, (A.P.)	1970-71	FCV
2.	Shivamogga, UA & HS, (Karnataka)	1971	FCV
3.	BTRS, Anand, AAU,(Gujarat)	1970-71	Bidi, Chewing and *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 (A.P.)	1970-71	FCV
7.	RARS, Nandyal- 518 503 (A.P.)	1970-71	Bidi and Natu
8.	ARS, Nipani (Karnataka)	1970-71	Bidi
9.	Pulses Research Centre, Berhampur (Orissa)	1987-88	Pikka
10.	Araul, Kanpur Nagar district (U.P.)	1987-88	Bidi and *Rustica*
C.	**Voluntary centres**		
11.	Ladol, Sardar Krushinagar (Gujarat)	2001	*Rustica* (Lal *Choupadia*, Kala *Choupadia*)
12.	Kandukur, ICAR-CTRI RS, (A.P.)	2001	FCV
13.	Jeelugumilli, ICAR-CTRI RS, (A.P.)	2001	FCV, Irrigated *Natu*
14.	Vedasandur, ICAR-CTRI RS, (T.N)	2001	*Chewing*, Cheroot, Cigar filler and Cigar wrapper

The technical programme for all the AINPT centres is finalized during the Annual Group Meetings or Biennial Workshops and implemented by the concerned centres. The headquarters of the All India Network Project on Tobacco is located at ICAR-CTRI, Rajahmundry.

AINPT co-ordinates activities of all the centers and monitors the research programmes through four Project Investigators located at ICAR-CTRI, Rajahmundry. It also co-ordinates with ICAR on all the administrative and research issues related to the coordinating centres and ensure implementation of all the mandated programmes as per the guidelines of ICAR.

The **X Group** meeting of All India Network Project on Tobacco was held at ICAR-CTRI, Rajahmundry from 29th to 30th October, 2018. In the Group meeting the work done during 2017-18 was reviewed and the technical programme for the year 2018-19 was finalized.

Centre-wise distribution of approved experiments in the different disciplines was given below:

Centre	PB	AG	SS & AC	EN	PP & NE	Total
Rajahmundry	5		1			6
Jeelugumilli	6					6
Kandukur	5					5
Shivamogga	8	3			4	15
Anand	8	3		3	6	20
Ladol/Dharmaj	7					7
Guntur	5					5
Hunsur	3					3
Dinhata	1					1
Nipani	14	2				16
Nandyal	14	2		1		17
Berhampur	4	2				6
Araul	4	2				6
Vedasandur		1				1
Total	**84**	**15**	**1**	**4**	**10**	**114**

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

2. SEASONAL FEATURES

RAJAHMUNDRY

An amount of 881.7 mm rainfall was received in 68 rainy days during 2017-18 season (Table R). The maximum temperature varied from 30.4 to 38.7 ^{0}C and the minimum temperature between 17.0 to 27.0. Relative humidity varied between 86 to 93 early morning and 59 to 75 in the afternoon.

Table R: Meteorological data at Rajahmundry centre (2018-19)

Month	Tempe-rature °C		Relative Humidity		Rainfall (mm)	Rainy days	Sun Shine (hrs)	Evapo-ration (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2018								
Apr.	36.3	25.1	86	62	20.0	4.0		5.0
May	39.4	27.0	87	59	6.6	3.0	3.7	6.4
Jun.	37.0	26.7	86	59	107.3	11.0	0.5	4.7
Jul.	32.3	25.1	90	74	362.8	20.0	-	3.2
Aug.	31.8	24.4	91	75	155.2	17.0	1.0	3.0
Sept.	34.0	24.3	89	69	165.0	12.0	1.0	3.1
Oct.	34.2	23.2	90	62	2.0	2.0	1.4	3.4
Nov.	33.4	20.3	87	59	4.5	3.0	1.0	3.0
Dec.	30.0	18.7	90	63	73.2	5.0	1.0	3.0

Month	Tempe-rature °C		Relative Humidity		Rainfall (mm)	Rainy days	Sun Shine (hrs)	Evapo-ration (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2019								
Jan.	29.7	17.0	88	67	13.8	4.0	-	2.6
Feb.	32.1	19.2	93	69	3.0	3.0	-	3.1
Mar.	34.5	23.5	92	69	3.0	3.0	-	4.6
Apr.	37.0	24.0	89	62	50.4	6.0	-	5.8
Total					**966.8**	**93**		

JEELUGUMILLI

An amount of 795.8 mm rainfall was received in 78 rainy days during 2018-19 season (Table J). Maximum temperature varies between 27.7 to 38.1 and minimum temperature varied between 16.95 to 26.35°C.

Table J: Meteorological data at Jeelugumilli centre (2018-19).

Month	Temperature °C		Relative Humidity		Rainfall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2018								
Apr.	36.73	24.43	93.06	47.06	20.2	3	9.71	6.13
May	38.16	26.14	91.87	46.90	4.8	1	8.70	6.92
Jun.	35.41	26.35	91.1	56.70	103.4	9	5.26	5.11
Jul.	30.16	24.70	94.09	74.12	271.8	18	2.39	2.48
Aug.	29.72	24.30	96.00	76.54	145.2	29	3.09	1.96
Sept.	32.11	24.31	95.5	67.23	105.4	7	6.00	3.67
Oct.	32.69	22.66	94.19	57.48	42.2	3	7.76	4.40
Nov.	31.43	20.53	93.2	54.00	21.6	2	8.08	3.37
Dec.	27.77	18.58	96.54	60.29	40.4	3	5.81	2.09
2019								
Jan.	28.38	16.95	95.16	50.93	12.2	1	7.19	2.64
Feb.	31.83	19.58	91.35	47.14	-	-	7.68	3.13
Mar.	34.41	22.41	94.12	46.90	28.6	2	8.33	4.32
Total					**795.8**	**78**		

SHIVAMOGGA

Total rainfall of 923.4 mm was received during the year 2018 which is 50.9 mm higher than the normal rainfall (872.5 mm). Number of rainy days was also higher (80) as compared to normal (64). The maximum temperature was recorded during April (36.7^{0}C) and minimum was recorded during January (15.3^{0}C) month. Pre monsoon showers during March, April and May helped for the good summer crop growth and yield and also helped for preparatory tillage operations for *Kharif* sowing. The onset of monsoon was normal during the year and resulted good crop growth and yield. Irregular/poor distribution of rainfall was noticed during the North-East monsoon season resulting poor crop stand during the season.

Table S: Meteorological data at AINP (T), Shivamogga centre (2018-19)

Month	Temperature °C		Relative Humidity		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2018								
Apr.	36.7	22.7	78.2	49.7	62.4	4	7.84	5.46
May	34.3	22.1	81.0	58.3	154.0	12	6.95	4.85
Jun.	29.2	21.7	89.0	80.4	145.0	12	2.32	3.35
Jul.	28.0	21.5	89.8	83.6	154.2	21	2.09	3.69
Aug.	27.4	21.3	90.8	84.5	174.2	19	3.47	4.01
Sept.	31.1	20.5	84.1	66.1	82.4	5	7.45	5.76
Oct.	31.5	19.8	81.5	59.4	134.8	5	7.92	5.46
Nov.	31.4	17.7	77.8	51.1	5.2	1	8.07	5.48
Dec.	31.2	17.2	79.9	51.3	3.6	0	7.75	5.57
2019								
Jan.	31.5	13.2	67.1	39.0	0.0	0	9.0	5.40
Feb.	34.2	17.4	68.9	30.5	3.4	1	10.0	6.00
Mar.	36.6	18.9	70.4	27.3	2.2	0	5.7	6.50
Total / Mean	**31.9**	**19.5**	**79.8**	**56.7**	**921.4**	**80**	**6.54**	**5.12**

Special Occurrence of Pest and Diseases: The incidence of damping off was slightly higher than usual occurance during the nursery stage due to intermittent rains. Occurrence of Black shank disease in the main field was below ETL. Incidence of Spodoptera and budworm in the initial stages and aphids in the later stage was observed but the incidence and damage was below ETL. Proper plant protection measures were taken for the control of pests and diseases.

KANDUKUR

Table K: Monthly rainfall pattern at CTRI Research Station, Kandukur

Month	Temperature		Relative Humidity		Rain fall mm	Rainy days	Sun shine (hrs)
	Max	Min	7.25 hrs	14.25 hrs			
2018							
Apr.	40.1	29.9	68.5	65.6	0	0	9.2
May	39.7	32.9	87.4	76.3	0	0	9.1
Jun.	36.1	31.1	90.3	83.4	67.6	4	8.2
Jul.	36.9	26.9	89.2	73.1	5.8	2	7.3
Aug.	35.9	23.6	92.6	77	45.4	8	7.6
Sept.	34.3	22.1	91.7	74.1	24.4	4	8
Oct.	33.2	22.2	91.7	71.2	3.8	1	7.9
Nov.	30	20.3	90.9	72	180.6	6	5.48
Dec.	25.7	15.7	90.5	81.4	9.6	1	7.56
2019							
Jan.	33.46	24.3	88.7	68.3	0	0	8.3
Feb.	31.7	21.4	88.4	70.4	0	0	8.23
Mar.	29.19	19.3	91.74	73.4	0	0	8.8
Total	**33.85**	**24.1**	**90.13**	**73.85**	**37.46**	**3.71**	**7.9**

GUNTUR

An amount of 451.2 mm of rainfall was received during 2018-19 in 34 rainy days as against average rainfall of 991mm (Table G). The mean maximum temperature varied from 43.7°C to 27.2°C, whereas, the minimum temperature ranged from 17.6°C to 26.6°C. Relative humidity ranged from 57.9 to 66.9 in the morning hours and 50.2 to 53.6 in the afternoon.

Table G: Meteorological data at Guntur (2018-19)

Month	Mean Temp °C		Mean R.H %		Monthly Rainfall (mm)	Rainy Days	Mean Sunshine Hours	Mean Evaporation (mm)
	Max	Min	7.15 hrs	2.15 hrs				
2018								
Apr.	37.6	26.6	57.9	51.2	---	---	7.0	6.0
May	43.7	24.9	60.4	53.4	---	---	8.0	7.5
Jun.	39.6	22.0	62.0	52.8	38.9	5	6.0	8.5
Jul.	36.2	26.3	62.0	53.3	114.9	10	6.0	7.0
Aug.	33.8	24.5	62.3	53.6	165.6	9	7.5	6.0
Sept.	35.1	25.7	62.5	53.5	51.0	5	7.2	5.4
Oct.	33.3	24.8	63.5	53.3	25.0	2	7.5	4.5
Nov.	32.1	20.8	62.5	52.2	---	---	6.3	3.5
Dec.	31.8	20.0	61.9	50.2	46.8	2	7.5	7.0

Month	Mean Temp °C		Mean R.H %		Monthly Rainfall (mm)	Rainy Days	Mean Sunshine Hours	Mean Evaporation (mm)
	Max	Min	7.15 hrs	2.15 hrs				
2019								
Jan.	27.2	17.6	66.9	52.1	9.0	1	6.1	5.0
Feb.	27.7	19.6	59.8	50.8	---	---	7.5	5.7
Mar.	36.1	25.3	62.7	53.9	---	---	8.2	6.0
Total					**451.2**	**34**		

Decennial Averages:

- Average Rain fall : 991mm
- Average Rainy Days : 55 days
- Mean Max. Temp : 40° C (May with high day Temp. 47.5°C)
- Mean Min Temp. : 18°C (January)

HUNSUR

An amount of 854.4 mm rainfall was received in 78 days during 2018-19.

Table H: Meteorological data at Hunsur (April, 2018 to March, 2019).

Month	Temperature °C		Relative Humidity		Rinfall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2018								
Apr.	33.8	16.4	66	34	88.2 (88.5)	8	8.5	3.9
May	35.6	15.7	60	37	194.2 (126.6)	13	5.4	3.3
Jun.	27.5	14	52	35	79.0 (97.4)	12	5.9	3.1
Jul.	27.1	13.7	41	32	106.0 (97.5)	13	2.9	2.8
Aug.	27.2	14	39	26	118.2 (101.9)	14	3.7	3.2
Sept.	28.2	14.8	66	46	83.0 (115.1)	4	6.4	3.9
Oct.	27.1	14.3	85	30	161.4 (134.8)	7	7.2	4.5
Nov.	30.4	13	84	58	1.0 (72.5)	-	7.6	4.7
Dec.	28.7	12.8	71	52	- (3.2)	-	6.6	3.6
2019								
Jan.	29.3	8.75	92	38	- (3.0)	-	7.9	3.5
Feb.	32.5	13.8	87	46	- (4.0)	-	8.7	5.5
Mar.	35.3	18.6	89	38	- (28.0)	-	8.5	6.8
Total								

Figures in the parentheses indicate decennial mean

Special Occurrence of Pest and Diseases: Even though the vector borne viral incidence (leaf curl) was noticed in certain regions in the early season, timely corrective measures were taken. Severe incidence of stem borer was not noticed in the area.

ANAND

The Rainfall received during the year 2018-19 was 937.2 mm in 29 rainy days (Table A-1) which was more than the normal rainfall (862 mm) of the middle Gujarat Agro-Climatic Zone. Rainfall received during the pre nursery stage was useful for land preparation. Heavy rainfall (599.2 mm) within a short period of 15 days during nursery stage, (109.2, 102.0, 95.2 mm in 24 hrs on July 5, 17 and August 17 respectively), adversely affected the tiny germinating seeds and seedlings. During transplanting, 185.8 mm rainfall received within 9 days which helps in transplanting of tobacco seedlings.

Table A-1: Meteorological data at AINPT, BTRS, Anand during 2018-19.

Month	Temperature °C		Relative Humidity		Rain fall (mm)	Rainy days	Sun Shine (hrs)	Evaporation (mm)
	Max.	Min.	7.25 hrs	14.25 hrs				
2018								
Apr.	39.8	21.1	67.0	23.0	0.00	00	10.2	8.9
May	41.5	25.5	77.5	29.5	0.00	00	10.5	9.5
Jun.	38.7	27.5	78.1	44.3	95.0	03	7.0	8.9
Jul.	31.4	24.6	94.1	78.7	450.0	11	1.6	3.1
Aug.	31.6	24.2	93.0	75.3	332.2	13	2.7	3.2
Sept.	32.6	22.6	90.2	60.0	60.0	02	6.3	3.9
Oct.	37.0	19.4	87.1	33.5	0.00	00	9.3	4.5
Nov.	34.0	15.4	85.3	35.1	0.00	00	9.2	3.4
Dec.	28.4	10.5	83.5	37.0	0.00	00	8.6	2.9
2019								
Jan.	27.4	9.6	85.7	35.3	0.00	00	9.3	3.2
Feb.	29.7	12.7	84.7	35.8	0.00	00	9.1	4.2
Mar.	34.3	16.6	70.1	27.1	0.00	00	9.5	6.7
Total	**33.9 (av.)**	**19.1 (av.)**	**83.0 (av.)**	**42.9 (av.)**	**937.2**	**29.0**	**7.78 (av.)**	**62.4**

TableA-2: Meteorological data of different crop phases during 2018-19.

Crop phase		Rainfall (mm)	Rainy days	Temperature ^{0}C	
				Maximum	Minimum
Hot weather (2nd April to 3rd June)	(63)*	0.0	0.0	44.2	17.7
Pre-nursery (4th June to 1st July)	(28)*	95.0	3.0	42.2	22.0
Nursery (2nd July to 19th Aug.)	(49)*	599.2	15.0	36.0	19.5
Transplanting (20th Aug. to 16th Sept.)	(28)*	185.8	9.0	34.2	22.0
Growth (17th Sept to 31st Dec.)	(106)*	57.2	2.0	38.2	6.0
Harvesting (1st Jan. to 1st April)	(91)*	0.0	0	40.5	5.5
Total	**365**	**937.2**	**29.0**	---	---

* Figures in parentheses indicate number of days

ARAUL

A total rainfall of 1027.8 mm was received during the period from June 2018 to June 2019. Maximum rainfall (386 mm) was received during the month of July 2018 (Table Ar). More than 50% rainfall received in the months July and August.

Table Ar: Meteorological data at Araul from June 2018 to June 2019

Month	Temperature (^{0}C)		Rainfall (mm)	Relative Humidity (%)
	Min.	Max.		
2018				
Jun.	27.50	39.80	63.40	51.00
Jul.	26.30	34.20	386.00	77.50
Aug.	25.00	32.10.	365.30	82.00
Sept.	23.50	32.40	143.80	74.10
Oct.	17.20	34.30	0.00	54.50
Nov.	12.10	28.80	0.00	62.00
Dec.	7.35	23.85	0.00	78.64
2019				
Jan.	7.85	21.75	13.50	66.72
Feb.	10.98	23.41	5.00	70.73
Mar.	13.98	29.72	4.20	58.95
Apr.	19.28	39.32	2.80	42.32
May	24.20	41.30	3.80	34.60
Jun.	26.80	39.70	40.00	45.15
Total			**1027.8**	

LADOL

Rabi season was noticed normal and no severe damage was observed due to insect and pest. During month of December, January and February minimum temperature was recorded from 8.4 ^{0}C to 10.7 ^{0}C and maximum temperature was from 24.8 ^{0}C to 27.7 ^{0}C which was favorable for crop growth, cured leaf yield and quality parameters. No rainfall received during the crop growing period.

Table L: Meteorological data at Ladol Centre (2018-19)

Month	Temperature °C		Relative Humidity		Rainfall (mm)
	Max.	Min.	7.25 hrs	14.25 hrs	
2018					
Jun.	40.1	28.1	83.3	70.2	43.0
Jul.	32.0	25.9	87.4	83.4	119.0
Aug.	30.7	25.4	87.3	83.3	111.0
Sept.	32.2	22.3	84.1	81.6	97.0
Oct.	36.4	18.5	74.1	77.9	-
Nov.	32.5	14.6	70.9	75.7	-
Dec.	27.0	8.9	70.4	79.1	-

Month	Temperature °C		Relative Humidity		Rainfall (mm)
	Max.	Min.	7.25 hrs	14.25 hrs	
2019					
Jan.	27.7	8.4	67.7	73.6	-
Feb.	24.8	10.7	68.6	69.8	13.0
Mar.	33.8	14.4	70.0	74.2	-
Total					**3830**

NIPANI

Month wise rainfall and rainy days received during the year 2018 and average of last 26 years are presented in the Table N. The total rainfall of 846.5 mm was received during the year 2018 as compared to average rainfall of 894.3 mm. The total rainfall received was 5.34% lower than the average rainfall spread over 74 rainy days as compared to average rainy days of 62.9. Rainfall received during the pre-nursery stage was 180.9 mm spread over 10 rainy days helped for nursery and tobacco planting. Rainfall received during nursery (306.6 mm in 28 rainy days) was higher than average and enough for raising healthy seedlings both in the research station and farmer's fields. The rainfall received during transplanting (151 mm in 12 rainy days) was 21% higher than average rainfall. The higher and even distribution of rainfall favored the better establishment of seedlings in the main field. Further, the rainfall of 208 mm in 13 rainy days was 8.5% higher than average rainfall during growth stage. This helped for better growth of the plant, enlargement and proper filling of the leaves. No rainfall was received during harvesting stage resulted in the production of quality tobacco both in research station and farmers field. Overall situation of tobacco indicates that, rainfall received during various growth stages of tobacco was higher and evenly distributed, resulted in higher yield with better quality and remunerative price.

Table N: Meteorological data at Nipani centre (2018-19)

Month	Temperature °C		Relative Humidity		Rainfall (mm)	Rainy days
	Max.	Min.	7.25hrs	14.25 hrs		
2018						
Apr.	37.2	20.3	56.8	30.1	16.2	2
May	36.1	22.6	75.1	42.5	80.9	5
Jun.	36.3	21.5	81.4	65.7	110.4	11
Jul.	26.8	21.6	92.6	86.8	248.5	23
Aug.	25.7	20.3	91.5	83.5	175.9	22
Sept.	30.0	18.6	82.5	62.6	117.0	5
Oct.	30.5	18.3	75.7	48.0	55.4	2
Nov.	27.3	15.5	70.3	42.3	15.4	3
Dec.	24.5	13.1	71.2	46.3	26.8	1
2019						
Jan.	21.7	10.3	68.5	42.6	0.0	0
Feb.	31.7	13.5	61.5	37.4	0.0	0
Mar.	34.2	15.5	57.1	29.9	15.2	2
Total					**861.7**	**76**

Special Occurrence of Pest and Diseases: In the year 2018, ARS, Nipani received annual rainfall of 846.5 mm, which is below the normal rainfall of 894.3 mm (average of last 26 years) with same number of rainy days (63) compared to normal. Little excess rainfall was received during all the growth stages. The plant stand and crop condition was good and favorable for the crop with no rain during harvesting leading to normal quality produce. Moderate to low incidence of aphids, brown leaf spot and frog eye leaf spot and high incidence of leaf curl were noticed.

NANDYAL

Crop condition: During 2018, an amount of 354.4 mm rainfall was received in 26 rain days at Regional Agricultural Research Station, Nandyal. Tobacco nurseries were sown during last week of July 2018 and transplanting was done last week of September 2018 and crop was harvested second FN of February 2019. Due to deficit of rainfall, the experiment was sown with pre planting irrigation for establishment of the seedlings.

Table Ny: Meteorological data at RARS, Nandyal during 2018-19

Month	Temperature °c		Relative Humidity (%)		Rainfall in 24 hours	Rainy days	Sunshine (hours)	Evaporation (mm)
	Max.	Min.	07.25 hrs	14.25 hrs				
2018								
Apr.	39.9	26.8	63.0	27.7	0.0	0.0	8.9	9.2
May	40.6	27.6	62.8	34.5	16.2	1.0	8.4	8.8
Jun.	37.2	26.3	71.7	44.7	121.0	5.0	5.7	7.4
Jul.	35.1	25.7	73.8	46.1	38.4	5.0	2.0	7.2
Aug.	34.5	25.1	78.2	49.4	42.2	4.0	3.2	6.3
Sept.	34.5	24.9	77.3	47.6	103.4	6.0	6.2	5.5
Oct.	35.1	23.5	78.4	44.1	4.0	1.0	8.3	6.2
Nov.	33.1	21.3	80.6	49.3	8.2	1.0	8.0	5.8
Dec.	31.1	19.7	84.8	51.0	3.0	1.0	6.5	3.5
2019								
Jan.	31.4	16.5	83.7	37.7	18.0	2.0	8.2	3.1
Feb.	35.1	20.3	76.5	31.6	0.0	0.0	9.7	5.5
Mar.	39.1	23.3	74.4	26.3	0.0	0.0	8.9	7.9
Average/ Total	**35.6**	**23.4**	**75.4**	**40.8**	**354.4**	**26.0**	**7.0**	**6.4**
Remarks	mean	mean	mean	mean	total	total	mean	mean

Special Occurrence of Pest and Diseases: During the year 2018-19 stunted crop growth was observed due to prolonged dry spells, early withdrawal of monsoons and deficit of rainfall during crop growth period. Sucking pest incidence especially leaf hoppers and mealy bug was high at vegetative stage to maturity stage resulting in high leaf curl and phyllody disease incidence resulted in yield loss. Minor incidence of *S.litura* was recorded vegetative stage and aphid incidence was recorded throughout the season.

BERHAMPUR

The annual rainfall during 2018-19 was 1954 mm in 73 rainy days (Table B). Maximum rainfall was received in August, 2018 (601 mm) followed by July, 2018 (347 mm) and September, 2018 (326 mm). During 2018, April was the hottest month (37°C) and January, 2019 was the coolest month (13°C).

Table B: Meterological data (*kharif*) of CPR, Berhampur (2018 to 2019).

Month	Temperature °C		Rainfall (mm)	Rainy days
	Max.	Min.		
2018				
Apr.	37	24	55	6
May	35	25	257	8
Jun.	35	26	191	9
Jul.	32	26	347	18
Aug.	32	25	601	15
Sept.	32	25	326	13
Oct.	33	22	146	3
Nov.	32	19	0	0
Dec.	28	15	4	0
2019				
Jan.	29	13	0	0
Feb.	33	17	22	1
Mar.	36	23	5	0
Total			**1954**	**73**

DINHATA

A total amount of 2042 mm rainfall received during 2018-19 in 62 days. Maximum rainfall was received in May and June months.

Table D: Meteorological data, Dinhata, 2018-19.

Month	Temperature °C		Relative Humidity		Rain fall (mm)	Rainy days	Sun Shine (hrs)
	Max.	Min.	06.32 hrs	13.32 hrs			
2018							
Apr.	30.5	19.6	89	80	239	06	4.93
May	30.5	21.0	89	79	491.5	11	5.04
Jun.	31.6	23.4	91	79	442.5	09	2.71
Jul.	31.8	24.5	90	82	388.5	12	3.29
Aug.	32.9	24.4	90	76	140.1	08	5.03
Sept.	32.0	23.5	92	77	244.5	08	4.79
Oct.	30.3	19.0	92	78	52.2	02	6.75
Nov.	28.1	13.6	93	77	-	-	7.56
Dec.	23.6	9.0	96	70	0.2	01	6.70
2019							
Jan.	23.3	10.7	97	69	-	-	7.44
Feb.	23.7	13.4	98	79	14.5	02	5.56
Mar.	27.3	16.5	93	73	29.1	03	7.32
Total					**2042.1**	**62**	

VEDASANDUR

The annual rainfall received during 2018-19 season was 587.6 mm in 40 rainy days as against the decennial average of 685.5 mm, a deficit of 97.9 mm for the season. There is no rainfall in the month of August and about 197.4 mm of rainfall received during the month of September in 9 rainy days which was helpful to the nursery operations. Also, a rainfall of 120.2 mm was received in 9 rainy days during the month of October which was helpful to carry out main field operations. During the month of November, a rainfall of 136.4 mm was received in a 8 rainy days and it was insufficient to the transplanted tobacco seedlings. During the month of December only 5.6 mm of rainfall was received in a single day and with very hardship to carry out the intercultural operations in the tobacco crop. There is no rainfall during the month of January, February, March and continuously prevailed drought conditions. By and large, this season experienced insufficient rainfall, optimum temperature and relative humidity, moderate sunshine hours and wind velocity.

Table V: Meteorological data at RARS, Vedasandur during 2018-19

Month	Temperature °C		Relative Humidity		Rain fall (mm)	Rainy days	Sun Shine (hrs)
	Max.	Min.	0718hrs	1418hrs			
2018							
Apr.	38	25	82	40	0.0 (39.1)	0(2)	10
May	37	24	81	43	100.4 (98.0)	11(4)	7
Jun.	37	25	83	42	25.0 (31.3)	2(2)	7
Jul.	36	24	81	71	2.6 (9.9)	0(1)	5
Aug.	36	25	83	52	0.0 (82.3)	0(4)	5
Sept.	37	24	81	51	197.4 (57.7)	9(3)	7
Oct.	36	25	89	57	120.2(169.9)	9(9)	6
Nov.	35	23	82	72	136.4 (120.8)	8(7)	5
Dec.	34	22	84	61	5.6 (42.6)	1(3)	6
2019							
Jan.	33	20	80	47	0.0 (12.0)	0(1)	5
Feb.	35	22	85	45	0.0 (9.7)	0(1)	7
Mar.	39	25	87	51	0.0 (12.2)	0(2)	8
Total					**587.6(685.5)**	**40(39)**	

Figures in parentheses indicate decennial mean

3. AREA AND PRODUCTION TRENDS OF DIFFERENT TYPES OF TOBACCO IN INDIA OF DURING 2018-19

RAJAHMUNDRY

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

Year	Area (ha)	Production (M kg)	Productivity (kg/ha)
2001-02	87754	120	1368
2002-03	93209	128	1370
2003-04	109373	148	1353
2004-05	113334	153	1350
2005-06	117242	145	1240
2006-07	126889	172	1355
2007-08	126700	165	1305
2008-09	140875	204	1448
2009-10	150233	208	1382
2010-11	139240	173	1244
2011-12	112792	160	1422
2012-13	120105	177	1470
2013-14	123615	214	1731
2014-15	108737	190	1748
2015-16	70122	118	1686
2016-17	61821	105	1719

KARNATAKA FCV (HUNSUR & SHIVAMOGGA)

Table S: Year-wise area, production and productivity of FCV tobacco

Year	Area (ha)	Production (M kg)	Productivity (kg/ha)
2001	40011	57.08	1427
2002	47699	63.25	1326
2003	69495	73.68	1060
2004	69700	90.34	1296
2005	73980	82.91	1121
2006	78162	96.98	1241
2007	85755	87.65	1022
2008	90175	113.99	1264
2009	106000	115.68	1091
2010	117924	127.85	1084
2011	101843	104.29	1024
2012	93000	93.8	1009
2013	97760	102.01	1043
2014	85689	103.46	1207
2015	75837	71.63	945
2016	70588	68.28	967
2017	81083	106.68	1316
2018	83606	85.08	1018

ANAND

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

Year	Area ('00 hect.)	Production ('00 MT)	Productivity (Kg/ha)
2009-10	628	1015	1616
2010-11	1479	2805	1897
2011-12	1580	2784	1762
2012-13	1238	2124	1716
2013-14	1370	2400	1752
2014-15	1660	2360	1422
2015-16	1980	3260	1646
2016-17	1670	3750	2246
2017-18	1450	2740	1890
2018-19	1795	3780	2106
Average (2009-10 to 2018-19)	1485	2702	1820

NANDYAL

Table Ny: Year-wise area, production and productivity of *bidi* tobacco of Andhra Pradesh.

Year	Area (ha)	Production (tones)	Productivity (Kg/ha)
2007-08	5621	9747	1734
2008-09	9593	13411	1398
2009-10	15744	30228	1920
2010-11	12000	21156	1763
2011-12	8777	14482	1650
2012-13	6705	10403	1552
2013-14	7000	12509	1787
2014-15	7500	11608	1548
2015-16	9800	9776	998
2016-17	10250	15375	1500
2017-18	9250	11088	1199

NIPANI

Bidi tobacco is mainly grown in Chikodi, Hukkeri and Gokak talukas of Belgavi district. At present, it occupies an area of 11,675 hectares with the production of about 14,250 tonnes and producing of 1221 kg/ha. The *bidi* tobacco produce of this area is known for its quality throughout the country.

Table N: Year-wise area, production and productivity trends of *bidi* tobacco in Karnataka.

Year	Area (ha)	Production (T)	Productivity (kg/ha)
2003-04	21997	8379	381
2004-05	22000	18700	850
2005-06	21598	16771	777
2006-07	19826	7931	400
2007-08	25203	13162	522
2008-09	22104	13704	620
2009-10	20284	13793	680
2010-11	19680	12398	630
2011-12	18200	12922	710
2012-13	17680	11810	668
2013-14	11392	14240	1250
2014-15	15107	19770	1309
2015-16	13422	17449	1300
2016-17	10889	17422	1600
2017-18	11358	13750	1211
2018-19	11675	14250	1221

ARAUL

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

Year	Area (ha)	Production (mt)	Productivity(kg./ha)
2010-11	26332	35866	1362
2011-12	24045	33670	1400
2012-13	23788	34460	1449
2013-14	25435	37813	1487
2014-15	31245	35557	1138
2015-16	31638	37470	1184
2016-17	27352	32269	1180
2017-18	23112	28614	1238

Source: Statistical Department, Directorate of Agriculture, Lucknow (U.P.)

DINHATA

Table D: Year wise area, production and productivity of *Motihari* and *Jati* tobacco in West Bengal.

Year	Area (ha)	Production (M.T)	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	18,500	27750	1500
2017-18	18,500	27750	1500
2018-19	18,500	27750	1500

LADOL

Table L: Year wise, area, production and productivity of *rustica* tobacco in Gujarat.

Year	Area (00 ha)	Production (00 M.T)	Productivity (kg/ha)
2008-09	492	701	1425
2009-10	628	1015	1616
2010-11	880	1760	2000
2011-12	954	1609	1687
2012-13	578	980	1696
2013-14	980	1650	1684
2014-15	1260	1860	1476
2015-16	1465	2180	1488
2016-17	1320	2100	1591
2017-18	1040	2000	1923
2018-19	1163	2426	2086

BERHAMPUR

Table B: Year-wise area, production and productivity of tobacco in Odisha State.

Year	Area (thousand ha)	Production (thousand tonnes)	Productivity (kg/ha)
1987-88	14.00	5.00	357
1988-89	14.00	6.00	429
1989-90	15.00	9.00	600
1990-91	15.00	9.00	600
1991-92	15.00	11.00	733
1992-93	13.00	10.00	769
1993-94	10.00	6.00	600
1994-95	10.00	6.00	600
1995-96	9.00	7.00	778
1996-97	9.00	5.00	556
1997-98	9.00	4.00	444
1998=99	8.00	4.00	500
1999-2000	7.00	5.00	714
2000-2001	3.00	2.00	667
2001-2002	6.00	4.00	667
2002-2003	4.00	3.00	750
2003-2004	5.31	3.49	657
2004-2005	4.76	3.25	683
2005-2006	3.72	2.71	728
2006-2007	4.13	3.02	731
2007-2008	3.79	2.79	736
2008-2009	4.03	3.00	744
2009-2010	3.30	2.48	752

Year	Area (thousand ha)	Production (thousand tonnes)	Productivity (kg/ha)
2010-2011	2.16	1.86	861
2011-2012	1.82	1.52	835
2012-2013	2.03	1.15	567
2013-2014	1.69	1.01	598

District wise Tobacco Statistics of Odisha 2013-14

District	Area (thousand ha)	Production (thousand tonnes)	Productivity (kg /ha)
Koraput	1.02	0.55	539
Rayagada	0.65	0.45	692
Nayarangpur	0.02	0.01	500
Total	1.69	1.01	598

Source : Odisha Agriculture Statistics, 2013-14

VEDASANDUR

Table V: Year wise area, Production and productivity of tobacco in Tamil Nadu and progress of increase in productivity for the past 10 years.

Year	Chewing tobacco			Cheroot tobacco		
	Area (lakh ha)	Production (lakh tonnes)	Productivity (kg/ha)	Area (lakh ha)	Production (lakh tonnes)	Productivity (kg/ha)
2009-10	0.175	0.437	2497	0.02	0.032	1600
2010-11	0.17	0.433	2547	0.02	0.033	1650
2011-12	0.16	0.4	2500	0.018	0.028	1556
2012-13	0.15	0.375	2500	0.016	0.026	1625
2013-14	0.12	0.28	2333	0.012	0.018	1500
2014-15	0.11	0.275	2500	0.012	0.019	1583
2015-16	0.11	0.275	2500	0.012	0.019	1583
2016-17	0.11	0.275	2500	0.012	0.019	1583
2017-18	0.11	0.275	2500	0.012	0.019	1583
2018-19	0.11	0.275*	2500	0.012	0.019*	1583

* Expected yield

4. RECOMMENDATIONS TO FARMING COMMUNITY FROM THE CONCLUDED PROJECTS, IF ANY, FOR DISCUSSION AND APPROVAL

ANAND

- It is recommended that *Bidi* tobacco growing farmers are advised to apply poultry manure or tobacco dust as organic fertilizer to raise their nursery which increased number of healthy seedlings with reduced root-knot index

NANDYAL

- Bidi tobacco can be cultivated profitably without affecting yield and leaf quality by applying 100% RDN (110 kg) +PK (70 Kg P +50 Kg K once in two years or 100% RDN (110 kg) +P (70 kg) every year instead of applying 100% RDF (110KgN + 70 kg P +50 kg K) every year without affecting leaf quality

- *Bidi* tobacco can be grown profitably without affecting yield and leaf quality by topping upto 15 leaf at bud stage or early flowering stage without affecting leaf quality

5. SALIENT RESEARCH FINDINGS

RAJAHMUNDRY

- FCR-62 recorded significantly higher cured leaf yield (2316 kg/ha), bright grade leaf (1529 kg/ha) and grade index of 1827 compared to controls VT-1158 and Siri
- FCR-56 and FCJ-39 recorded significantly higher cured yields (2386 kg/ha and 2672 kg/ha) and bright leaf yields (1178 kg/ha and 1319 kg /ha) compared to better check, Siri
- FCR-42 recorded significantly higher bright leaf yields of 1482 kg /ha and grade index (1921) compared to better control Siri (1171 kg/ha and 1517) with an improvement of 26 percent
- Hybrids FCRH-3 and FCRH-4 are high yielders among the three entries tested in IHT with 2540 and 2572 kg/ha cured leaf yields, 1406 and 1423 kg/ha bright leaf yield and grade index of 1817 and 1843 respectively

JEELUGUMILLI

- FCR-64 showed higher cured leaf yield (2448 kg/ha) and grade out turn (1905) with an yield improvement of 14 percent over LT-Kanchan (2150 kg/ha, 1673)
- FCR-60 and FCJ-39 showed higher cured leaf yields with 2271 and 2278 kg/ha respectively over check variety LT-Kanchan 1929 kg/ha. FCR-60 and FCJ-39 recorded significantly higher yields over the checks Kanchan (1885 kg/ha) and CH-1 (1851 kg/ha)
- FCJ-60 and FCJ-39 also showed higher (non Significant) grade index with 1767 and 1772 respectively over check variety LT-Kanchan 1616, however significant over the checks Kanchan (1466) and CH-1 (1441).
- FCK-7 recorded significantly higher cured leaf yield (2392 kg/ha) and grade indeed 1847 compared all the three checks Kanchan (1696 kg/ha), LT-Kanchan (1699 kg/ha) and CH-1 (1865 Kg/ha)
- The hybrid CH-163 is the top yielder among the entries tested with 2240 kg/ha cured leaf yields and 1730 grade index compared to LT-Kanchan
- Hybrid FCRH-2 yielded high among the three entries tested with 2113 kg/ha cured leaf yield and 1525 grade index over control LT-Kanchan

SHIVAMOGGA

- In IVT the entries FCR-64 and FCR-66 have given numerically superior GLY, CLY and TGE over the checks.
- In AVT-II the entry FCJ-36 has recorded significantly higher GLY (12851 kg/ha), CLY (1741 kg/ha) and TGE (1345 kg/ha)
- In AVT-II (R) the entry FCS-4 recorded significantly higher GLY of 13855 kg/ha, 1870 kg/ha of CLY, 1590 kg/ha of TGE and laminar potassium (3.27%)

- In Station Trial the entries Tobios-6, FCS-4 and FCS-3 have recorded significantly higher GLY, CLY and TGE compared to checks Sahyadri and Kanchan.
- Application of 100% RDF with P mobilizer and P solubilizer recorded significantly higher green leaf yield, cured leaf yield and top grade equivalent
- Application of humic substances @ 1.25 kg /ha as soil application coupled with foliar spray @ 0.05 % at 30DAS and 45 DAS recorded maximum height , number of leaves, dry weight of seedling and low incidence of damping off
- Soil drenching with carbendazim 50% @ 0.1% and carbendazim 25% and mancozeb 50% @ 0.2% at planting and 30DAT recorded highest percent reduction of wilt incidence over control of 59.05 percent
- The treatment combination of *Purpureocillium lilacinum* 5kg/acre with FYM 1 t/ha found to be superior in reducing the root-knot index (1.33) and in increasing yield parameters.
- Combination of *Trichoderma harzianum* 5kg/acre with FYM 1 t/ha and carbofuran 3G 1.0 kg a.i./ha (RC) found effective in reducing the Root Knot Index and in increasing yield parameters.

KANDUKUR

- In IVT the entries FCR-63 with 13453 kg/ha green leaf, 1688 kg/ha cured leaf, 1063 kg/ha bright leaf and 1408 / ha grade index is the best entry with 39, 16, 18 and 17 per cent increase over Siri respectively. Two selections *viz*., FCR-63 and FCR-62 with significant superiority in cured, bright and grade index over better control, Siri were proposed for testing under AVT-1 during 2019-20
- In IHT the yield characters of all the three hybrids are lower compared to better control Siri, hence no further advancement of them.
- In AVT-I among the lines evaluated FCR-60 was better entry with 12319 kg/ha green leaf, 1895 kg/ha cured leaf, 1155 kg/ha bright leaf and 1583 /ha grade index with an increase of 15, 27, 25 and 29 per cent respectively over better check Siri during 2018-19.The same lines will be tested as AVT-2 during 2018-19.
- In AVT-II during 2018-19 FCR-47 and FCR-41were the better performers in cured, bright leaf yield and grade index. Based on the results of the combined analysis FCR-47 with 13766 kg/ha green leaf, 1982 kg/ha cured leaf, 1268 kg/ha bright leaf and 1669 /ha grade index with an increase of 26, 26, 28 and 27 per cent higher yield over better control, Siri respectively was the best entry. FCR-47 is proposed for testing in bulk trial along with checks in the farm.
- In Bulk Trial the entry FCR-39 is proposed for large scale testing in the farm. FCR-39 recorded 11551 kg/ha green leaf yield, 1475 kg/ha cured leaf yield, 929 kg/ha bright leaf yield and 1147 /ha grade index with an increase of 24, 11, 13 and 12 per cent respectively over better control Siri. FCR-39 is proposed for large scale testing in the farm.

GUNTUR

- In the initial varietal trial, three entries *viz*., FCR-64, FCR-65, and FCR-66 have performed well with significantly high green leaf, cured leaf and bright leaf yields and also grade index over other entries and two checks.

- In the initial hybrid trial, FCRH-2, FCRH-3 & FCRH-4 were evaluated for their yield and quality performance and found not suitable for black soil. The yields of hybrids were slightly high but, leaf quality was inferior to three local checks.

- In advanced varietal trial-I, FCR-56 out yielded all the entries including two checks i.e., Hemadri and Siri in respect of all yield characters *viz*., green leaf yield, cured leaf yield, bright leaf yield and grade index.

- In advanced varietal trial-II, FCR-44 and FCR-47 out yielded all the test entries including two checks i.e., Hemadri and Siri and will be further evaluated under bulk trial.

- Chemical quality parameters *viz*., nicotine, reducing sugars and chlorides were within the permissible limits in all the entries tested under AVT-I and AVT-II including checks.

HUNSUR

- Five entries were evaluated against checks in IVT and there were no significant differences among the entries.

- In IHT, three hybrids were evaluated against checks. There was no significant difference among the entries tested for all the yield parameters, however, the hybrids under testing had recorded higher yield than checks Kanchan and FCH 222. Entry FCRH 4 has yielded 14% higher cured leaf yield than Kanchan. Incidence of wilt was higher among the hybrids tested and Kanchan which could be the cause for lower yields.

- In AVT-1, six entries were evaluated against checks. Entry, FCJ40 was found to be promising in terms of yield with 10% improvement in green leaf yield and 21% improvement in cured, bright leaf yield and TGE over Kanchan followed by FCJ 41.

ANAND

- In bidi tobacco, ABD 190 showed significant superiority for cured leaf yield in IVT than respective checks. In advance hybrid trial, all the hybrids showed significant superiority for cured leaf yield over MR GTH 1.
- The entries ASO 20 and ASO 18 showed maximum oil yield and nicotine yield potentiality over A 145 respectively.
- In *rustica* tobacco, AR 145 and AR 148 showed significant superiority over better check GCT 2 in IVT.
- The results on "Assessment of alternate crop sequences for bidi tobacco growing area of middle Gujarat agro- climatic zone" indicated that significantly the highest tobacco equivalent yield (3565 kg/ha) was obtained from treatment (Tobacco + Pearl millet cropping system) compared to other treatments. Sesamum - Potato cropping system recorded significantly lower tobacco equivalent yield (1957 kg/ha) followed by Groundnut + potato cropping system. While, treatment Tobacco as sole crop gave maximum net profit of 85079 Rs/ha.
- "Production potential of *kharif* based cropping system for bidi tobacco in middle Gujarat" indicated that significantly higher tobacco equivalent yield (6121 kg/ha) and maximum net profit (1,72,178 Rs/ha) was obtained from Cow pea {Vegetable} – Bidi tobacco over Sesamum – Bidi tobacco and Cluster bean {Vegetable} – Bidi tobacco.
- Out of 73 entries screened for TMV under artificial inoculation these, 57 entries including segregation materials showed resistance to the disease and these materials are maintained by plant breeding section for further breeding work.
- Out of 47 genotypes screened, 25 genotypes were found free from root-knot disease in root-knot sick field and selected for further screening in the next year.
- Application of poultry manure significantly yielded maximum number of transplantable, total seedlings and reduced the root-knot disease than the rest of the treatments.
- Based on the agro-meteriological parameters, Frog eye spot can be predicted with accuracy 20 and 44% in nursery and main field of *bidi* tobacco.

ARAUL

- In IVT the entry ArR-77 and AR-148 showed significant superiority for cured leaf yield Azad Kanchan.
- In AVT II the entry ArR-58 showed significant superiority for cured leaf yield with 18.30% increase in yield over the check Azad Kanchan.
- In Preliminary Yield Evaluation Trial I entries ArR-89 and ArR-91 exhibited significant superiority with 24.53% and 21.77% increase in yield over the check Azad Kanchan
- Based on the evaluation in preliminary evaluation trail I entries, ArR-79 and ArR-83 showed significant superiority over Azad Kanchan with 17.22% and 19.18% increase in yield respectively over the check Azad Kanchan, and hence, nominated for testing in IVT during *Rabi* 2019-20

- 75% RDF+ 2.5 t vermicompost + PSB+ Azatobactor exhibited significant superiority for leaf length, leaf width, plant height, no. of curable leaves and cured leaf yield as compared to recommended fertilizer dose.
- Weeding 3 times significantly recorded highest cured leaf yield (2765 kg/ha) followed Polythene mulch with cured leaf yield of 2610 kg/ha.

LADOL

- In three state trials comprising one each of IET (ST-1), PYT (ST-2) and LSVT involving 29 genotypes including two checks were evaluated during 2018-19. On the basis of overall performance 5 genotypes viz, LR 17-1, LR 17-5, LR 18-1, LR 18-8 and LR 86 were found promising and gave significant differences among the cured leaf yield.
- Total eighteen genotypes along with two checks were evaluated in AVT I, AVT-II and IVT for cured leaf yield and agronomic characters, based on genotype LR 86 gave significant higher cured leaf yield.
- Results in AVT-II the line LR 86 showed numerical maximum leaf yield against both check *viz.*, GCT-3 and DCT-4 in pooled analysis (2017-19).
- During the year 2018-19, germplasm involving the 261 genotypes/varieties comprising both indigenous and exotic materials were raised. Using these materials, fifteen single and five multiple crosses were made. All single and multiple crosses were obtained.
- To develop high cured leaf yield, medium duration lines with resistance to Leaf mosaic virus and Leaf curl disease, total 76 no. of crosses involving 267 progenies were grown out of these 11 promising bulks and 237 single plants were selected in F1 to F5 generations for generation advancement.

NIPANI

- In AVT-I, two entries ABD 163 and ABD 145 were found superior over best check NBD 209.
- In IVT (V), none of the entries were superior for leaf yield over best check Vedaganga-1. Two entries *viz.*, NyBD-61 and NBD 316 were on par with best check and were significantly superior over NBD 209.
- In Station Varietal Trial, the genotypes NBD 321, NBD 323 and NBD 325) were numerical superiority over NBD 209.
- In Station Hybrid Trial, three hybrids viz., NBTH-1003, NBTH-1002, NBTH-1004 recorded numerically superior leaf yield compared to best check.
- In Preliminary Hybrid trials, NBTH-1021 and NBTH-101 recorded significantly superior leaf yield over best check NBD 209.
- A total of 230 germplasm lines, seven A lines and seven released varieties were maintained.
- Tobacco planted under various mulches gave higher yield. Among the different mulches, plastic mulches proved to be better in giving higher leaf yield.
- Tobacco stem ash gave higher leaf yield. Substitution of sulphate of potash can be done through other sources of potash available.

NANDYAL

- In IVT NBD 316, ABD189 & NyBD61 recorded significantly higher cured leaf yield with an yield improvement of 19.1 – 20.5%.
- In AHT BTH 315, NyBTH 124 & BTH 336 recorded significantly higher cured leaf yield with an yield improvement of 15.9 – 20.0%
- In AVT I ABD174 & NyBD 60 has recorded significantly higher cured leaf yield with an yield improvement of 13.8 –14.3%.
- In AVT II ABD 145 and ABD 163 has recorded significantly higher cured leaf yield with an yield improvement of 17.2%
- In bulk yield trial NBD 289 & NBD 290 recorded significantly higher cured leaf yield with an yield improvement of 16.1 – 24.2%
- In on farm trial ABD132 & NyBD 56 recorded significantly higher cured leaf yield with an yield improvement of 15.2 – 21.5%
- Significantly higher cured leaf yield (1915 kg/ha) was recorded with100% RDF (110 kgN + 70 kg P +50 Kg K) every year over control (989 kg/ha) and 100% RDN (1314 kg/ha) without affecting leaf quality.
- Topping at 15 leaf (early flowering stage) recoded 1938 kg/ha cured leaf yield and is at par with topping at 12 leaf early flowering stage (1747 kg/ha) and topping at 12 leaf button stage (1652 kg/ha) without affecting leaf quality.
- *S. litura* peak infestation was noticed during vegetative stage *i.e* 49th std week aphids scale 3 was recorded during 51st std week. Among the natural enemies, spiders and coccinellid beetles played a dominant role.

BERHAMPUR

- Ninety numbers genotype were being maintained for future breeding programme.
- In yield evaluation trial, during *Kharif* 2018, genotypes NF 4-10-2 (1500 kg/ha), NF 4-18-3 (1451 kg/ha), NF 4-20-2 (1449 kg/ha), and NF 4-27-3(1372 kg/ha) produced significantly higher cured leaf yield over check variety Gajapati (1201 kg/ha) with a yield improvement of 24.9, 20.8, 20.6 and 14.2% respectively.
- Three years average data showed genotypes NF 4-18-3 (1281 kg/ha), NF 4-27-3 (1243 kg/ha), NF 4-10-2 (1237 kg/ha) were found significantly superior reflecting 10.7, 7.4 and 6.9 % higher cured leaf yield over check variety Gajapati (1157 kg/ ha).
- During 2018-19, only two lines such as BPT 39 (1388 kg/ha) and BPT 7 (1381 kg ha) showed significantly superiority in cured leaf yield over check variety Gajapati (1116 kg /ha) with an improvement of 24.4 and23.7 percent respectively.
- Two years data revealed that only one genotype BPT 49 (1288 kg/ha) exhibited significant yield superiority (10.0%) over check variety Gajapati (1171 kg/ha).
- Pikka tobacco genotype Sel 47 produced 1356 kg/ha cured leaf yield in 2nd dates of planting (25.08.19) which was at par (1321 kg/ha)with 3rd dates of planting (10.09.2018) and significantly superior than first date of planting (10.08.2018).

- Pikka tobacco genotype Sel 47 produced higher cured leaf yield of 1699 kg/ha at F3 : N100:P50:K50 which was significantly superior than F2 :N80:P40:K40 (1419 kg/ha) and F1 :N60:P30:K30 (1127 kg/ha)

DINHATA

- Among seven lines evaluated in IVT AR-145, AR-148, AR-151, LR-90, LR-91, ArR-71 and ArR -77, none of them showed superior to local control DD-437 and Dharla.

6. IMPORTANT EVENTS DURING 2018-19

HUNSUR

- One day work shop was conducted on good agricultural practices for sustainable FCV tobacco production for field officers/field assistants at ICAR-CTRI RS, Hunsur on 15.06.2018
- One day work shop was conducted on PHPM and CPA issues on 12.10.2018 for farmers of Periyapatna region at ICAR-CTRI RS, Hunsur.
- Soil day programme was organized for selected farmers of Hunsur by State dept of agriculture /CTRI Hunsur at ICAR-CTRI RS, Hunsur on 6.12.2018 and distributed soil health cards to farmers

ANAND

- Scientists participated in the 15th meeting of AGRESCO, AAU, Anand.
- Dr. J. N. Patel attended Farmers Meet on Alternate to Tobacco at APMC, Sayajipur and Savli during Feb. 23, 2018 and March 10, 2018, respectively.
- Scientists of the project participated in "MERA GAO MERA GAURAV" activities during 2018-19.
- Dr. H. R. Patel, Unit Officer attended 14th Combined Joint AGRESCO Sub-committee Meeting of all SAUs & Kamdhenu University during March 21-23, 2018 at JAU, Junagadh.

ARAUL

- Dr. A.K. Srivastava attended Research Advisory Committee Meeting held on June 5-6, 2019 in the Department of Genetics and Plant Breeding, CSAUA&T, Kanpur.
- Dr. A.K. Srivastava & Dr.(Smt.) Achila Singh attended X Group Meet of All India Network Research Project on Tobacco held on October 29-30, 2018 at ICAR-CTRI, Rajahmundry (AP)-533105.

LADOL

- Dr. D. R. Chaudhari, Assistant Professor attended 15th AGRESCO Sub-committee Meeting of Crop Improvement, Plant Physiology and Bio-Technology on March 5-6, 2019 at SDAU, S.K.Nagar.

NIPANI

- Dr.G.M.Sajjanar, Dr.P.S.Matiwade, Dr.Prasanna P.M., Dr.G.H.Dandin, Mr.G.S.Prabhayyanavarmath, Mr.P.K.Murari, Mr.V.A.Hundekar, Mr.K.D.Yadav, Mr.D.S.Guled, and Mr.R.S.Patil participated in four days 'Annual Krishimela-2018' at University of Agricultural Scieces, Dharwad and exhibited the tobacco technologies from 22nd to 25th September, 2018.
- Dr.M.B.Chetti, H'able Vice-Chancellor, UAS, Dharwad visited the research station and discussed with scientists about activities, problems of station and labourers on 7th October, 2018.
- Dr.P.S.Matiwade participated in "World Farmers Day" organised by Department of Agriculture at ADA, Office Chikkodi on 22nd December, 2018.
- Dr.H.L.Nadaf, Director of Research, UAS, Dharwad visited the research station, discussed about the station and seed production activities on 16th March, 2019.

NANDYAL

- Dr. R. Veera Raghavaiah, University HOD, Department of Agronomy inspected experimental fields and basic records at RARS, Nandyal on 15/11/2018.
- Dr.B.Govinda Rao, University Head, Dept .of G & PBr. visited experimental plots & monitoring the technical programme and verified basic records at RARS, Nandyal on 16/11/2018.
- Dr. N. V. Naidu, Director of Research, ANGRAU has visited experimental plots and monitored the technical programme and verified basic records at RARS, Nandyal on 25/07/2018 & 12/12/2018.
- Dr. V. Damodar Naidu, Hon'ble Vice-chancellor and Dr. N. V. Naidu, Director of Research ANGRAU visited AINPT experimental plots at RARS, Nandyal on 12/12/2018 & 13/12/2018.
- Sri.Jaichandra Reddy, AGM, VST Company has visited our natu tobacco breeding material and fresh crosses RARS, Nandyal on 04/01/2019.
- Presented work done report for 2018-19 regarding AINPT Scheme during Station level discussions at RARS, Nandyal on 26/3/2019.
- Present brief results of work done during 2018-19 pertaining to AINPT scheme at RARS, Nandyal on 18/3/2019 to 20/3/2019.
- Presented work done for 2017-18 and tentative technical programme for 2018-19 at State Level Technical Programme meetings at RARS, Lam, Guntur during 8/5/19 to 10/5/19.

BERHAMPUR

- M. Prusti, Asst. Research Scientist (PBG) attended and participated in the ZREAC meeting at central farm, OUAT, Bhubaneswar on 17.04.2018.
- A. M. Prusti, Asst. Research Scientist (PBG) attended and participated in three days TRG meeting at OUAT, Bhubaneswar from 19.04.2018 to 21.04.2018.
- A. M. Prusti, Asst. Research Scientist (PBG) attended and participated in five days SLREC meeting at OUAT, Bhubaneswar from 08.05.2018 to 12.05.2018.
- Prof. L. M. Garnayak, Dean of Research, OUAT, visited CPR and AINP Tobacco trials and seed production plot on 22.02.2019.

7. STATUS OF GERMPLASM MAINTAINED

S.No.	Centre Name	Number of germplasm (2018-19)
1.	Rajahmundry	3380
2.	Shivamogga	164
3.	Kandukur	296
4.	Guntur	151
5.	Hunsur	635
6.	Anand	457
7.	Araul	390
8.	Ladol	261
9.	Nipani	230
10.	Nandyal	210
11.	Berhampur	115
12.	Dinhata	255
13.	Vedasandur	145

8. VARIETY RELEASE PROPOSALS

1. ABD – 132 from Nandyal Centre
2. FCJ – 11 from Jeelugumilli Centre
3. FCR – 15 from Kandukur Centre

9. EXTENSION ACTIVITIES

SHIVAMOGGA

On-farm trials/Field visits

Sl. No	Name of the Farmer	Place	Problem faced/Field visits	Date	Scientist
1	Radhakrishna	Hoskote Village, Hunsuru	Tobacco/ *Fusarium* wilt	14.06.18	Dr. H. Ravindra, Dr. T.M Soumya, Mr. Chethan K.G and Mr. Abhiram G J
2	Rajkumar	C.K Halli, Hunsuru	Tobacco/Fusarium wilt	14.06.18	
3	Tagadaiah	K.M Wadi Village, Hunsuru	Tobacco/farm trial	12.07.18	Dr. H. Ravindra, Dr. C.Malleshappa Mr. Chethan K.G and Mr. Abhiram G J
4	Vijayakumar	K.M Wadi Village, Hunsuru	Tobacco/farm trial	12.07.18	
5	Siddamma W/o Shekharappa	Jeenalli	FCV Tobacco/ Tobacco mosaic virus	29.08.18	Dr. C.Malleshappa Dr. T.M Soumya and Mr. Abhiram G J
6	H. Rajendrappa	Ballur, Shikaripura Taluk	FCV Tobacco/ Tobacco leaf curl		
7	Channesh	Kattige, Honnali Taluk	FCV Tobacco/ Farm trial		
8	Bharamagowda	Madenahalli Honnali Taluk	FCV Tobacco/Wilt		
9	Vasanth	Madenahalli Honnali Taluk	FCV Tobacco/ Tobacco leaf curl		
10	Kamalamma,	Kattige Honnali Taluk	FCV Tobacco/ Tobacco leaf curl		
11	Channeshappa,	Kattige Honnali Taluk	FCV Tobacco/ Tobacco mosaic virus		
12	Basavarajappa	Kattige, Honnali Taluk	FCV Tobacco/ Curing	11.10.18	Dr. U. Sreedhar Dr. K. Sarala Dr. H. Ravindra Mr. G.J Abhiram
13	Channesh	Kattige, Honnali Taluk			
14	Nagendrappa	Kattige, Honnali Taluk			
15	Rudrappa	Kattige, Honnali Taluk			

Training programmes / Guest lectures

S.No.	Date	Training programme / guest Lecture	Topic of Guest lecture	Scientists
1.	12.07.2018	Training program on varities, nutrient, pest and disease management in FCV Tobacco in Collaboration with Tobacco Board at Siddapura, Ramanathapura taluk, Hassan Dist	Use of varities Pest and disease management Nutrient management	Dr. C. Malleshappa Dr. H. Ravindra G. J Abhiram

Radio / T.V. Talk

- Dr. H. Ravindra delivered a TV talk on important nematode diseases of crops

Efforts on transfer of technology

- Technologies for getting high yield and good quality FCV tobacco is being transferred to farmers through Radio talks, News papers, Training programmes and Field visits in collaboration with Tobacco board, KVK's and ITC Ltd., extension workers.

Education and Training

- Attended farmer training programme on GAP in Model village, Korisapadu on 11th January, 2019 organized by Vellampalli Auction Plat Farm.

Visitors

- Former DGP, Sri Malakondaiah Visited CTRI Research Station, Guntur on 7th February, 2019.

- Union Commerce Minister , Sri Suresh Prabhu and Executive Director & i/c Chairman, Tobacco Board, Smt. K. Suneetha Visited CTRI Research Station, Guntur on 10th February, 2019.

HUNSUR

- Thirty eight training programmers were conducted on various aspects of tobacco cultivation (Nursery management, field crop management, Post Harvest product management, NTRM issues etc,) to the FCV tobacco growers covering all the auction platform areas of KLS.

- Four workshops were organized on Good Agricultural practices and PHPH Progarmme to tobacco board field officers/farmers of KLS

ANAND

No.	Name of Scientists	Place of visit	Purpose	Date
1	Dr. H. R. Patel, Dr. J. N. Patel	Sarsa,Khambholaj,Bhalej, Vaghasi and Jitodiya	FLD visit	July 3, 2018
2	Dr. K.Sarala, Dr. J. N. Patel, Dr.Y.M.Rojasara, Shri Delvadiya D.R.	Tharmal,Vanoda and Fagwel	To interact with tobacco farmer of Anand and Kheda district	December 28, 2018
3	Dr. Y.M. Rojasara. Dr. K.M.Gediya Shri N. A. Bhatt	Kinkhalod, Moxi and Sokhda	FLD visit	Jan.10, 2019
4	Dr. J. N. Patel, Dr.Y.M.Rojasara, Shri N. A. Bhatt	Dabhasar	FLD visit	Jan.24, 2019
5	Dr. J. N. Patel	Sarsa, Bhalej	FLD visit	Jan.29, 2019

Front Line Demonstration

Sr. No.	Components	No. of Trials	Place
1	Varietal (GABT 11) (High yielding)	3	Villages of Anand, Kheda and Vadodara districts

- Scientists of the project participated in Krushi Mahotsav every year and addressed farmers meet in different villages. Farmers are also advised looking to his fields and the plant and soil samples about their problems.

ARAUL

- Dr. A.K. Srivastava, in-charge AINRPT, Araul delivered lecture on scientific cultivation of tobacco to the T & V training programme organized by Department of Agriculture and ETV, UP on dated 03.03.2019.
- Kishan Gosthi was organized on January 27, 2019 at Araul with objective for awareness of farmers for scientific cultivation of tobacco.

- Farmers training programme was organized on January 27, 2019 at TRS Araul regarding awareness and scaling up of the farmers on remunerative scientific cultivation of tobacco.

LADOL

Field Visits

Sr. No.	Name of Scientists	Place of visit	Purpose	Date
1.	Dr. D. R. Chaudhari	Mandali, Rampur (Kot), Hirpura, Pundhara	Good Agril. Practices and plant disease & insect management in GCT-3 & DCT-4	28-12-2018 29-12-2018
2.	Shri. D. R. Patel			
3.	Dr. R. K. Sharma			
4.	Shri. M. M. Patel			
5.	Dr. Vikash Kumar			

Trainings

- During season, provided information about 300-350 farmers regarding agricultural practices in rustica tobacco and seed production techniques who visited our station.
- Attended farmer's training programme on "Bij Utpadan: Mulyvardhit Kheti" at SSK, SKnagar.
- A training programme was organized on 2nd November, 2018 at Agriculture Research Station, Ladol to demonstrate new simple and innovative intercropping system i.e. raising Rustica tobacco nursery between rows of castor for generating extra income vis-à-vis judicious use of dissipating land resources.

Transfer of technology

Front line Demonstrations:

- FLDs on *rustica* tobacco varieties GCT 3 & DCT 4 were conducted to 25 farmers in these villages.

NIPANI

Field visits

- Dr.P.S.Matiwade, Dr.Virupaksha Prabhu H., Dr.Geeta Dandin and Dr.B.N.Bhat visited the fields of bidi tobacco variety NBD-209 and promsing entry, NBD-277 of Mr. Ashish Patil of Khadaklat Tq: Chikodi on 18th December, 2018.

- Dr. P.S. Matiwade, Dr. S.B. Patil, Dr. Geeta Dandin and Mr.G.S.Prabhayyannavarmath visited the tobacco field of NBD-209 and promsing entry, NBD-277 of Mr.Ashok Katrali of Shirguppi Tq: Athani on 17th January, 2019.

Other extension activities

- Dr.P.S.Matiwade visited the fields in the villages of Chikodi, Raibag and Athani talukas for the incidence of pest and diseases as a part of Pest Surveillance and Advising Unit of JDA Belagavi on 12th July, 2018.
- Dr. P.S.Matiwade participated in steering committee meeting of ATMA (Agricutural Technologies Management Agency) chaired by CEO (ZP), Balagavi at JDA Office, Belagavi on 18th August, 2018.
- Dr.P.S.Matiwade participated in training programme on "Use of Soil Testing and Soil Health Card" organised by ATMA at ADA Chikkodi Office, on 10th October, 2018.
- Dr.Geeta Dandin, Ms.Nelamma R. Kolageri and Ms.Tanuja I. Ganagi Participated in "World Soil Health Day" conducted by Department of Agriculture at ADA, Office, Chikkodi on 5th December, 2018.
- Dr.P.S.Matiwade and Dr.B.N.Bhat participated in 'National Consultation on Tobacco Cultivation in India: Situational analysis Organised by Centre for Multi Disciplinary Development Research (CMDR), Dharwad on 25th February, 2019.

NANDYAL

Particulars of farmers training programme and field visits conducted by AINP on Tobacco scheme, RARS, Nandyal

Date	Venue	Title of the training programme	No of farmers Participated	Names of the Officers participated
20-12-18	Bukkapuram, Allinagaram and Nandipalle villages of Mahanandi mandal of Nandyal division in Kurnool Dist	Best management practices for tobacco cultivation	40	Dr. S.Jaffar Basha, Sr. Sci (Agro) P. Pulli Bai, Sci. (PB)
09-01-19	Tudumuladinne village of Uyyalawada mandal of Allagadda division in Kurnool Dist.	Good Agricultural practices for tobacco cultivation	50	Dr.S.Vasundhara, ADR, RARS, Nandyal Dr. S.Jaffar Basha, Sr. Sci(Agro) P. Pulli Bai, Sci. (PB)
24-01-19	Parumanchala village of Jupadu Bunglow of Nandikotkur division	Best management practices for tobacco cultivation	50	Dr. S.Jaffar Basha, Sr. Sci(Agro) P. Pulli Bai, Sci. (PB)

Radio talks:

S. No.	Name of the Scientist	Date	Venue	Topic
1.	Smt. P.Pulli Bai	26.09.2018	AIR, Kurnool	"Pogaku beedi thotallo Yajamanyam"

T & V Meetings

S. No.	Date	Place/ Institution conducted	Assignment (Role)	Topic of the lecture/Lab exercises etc.
Dr.S.Jaffar Basha, Senior Scientist (Agronomy)				
1	29.06.18	RARS, Nandyal	Resource person	Participated as a resource person and noted seasonal and tobacco crop condition reported by DOA, Kurnool District.
2	21.07.18	RARS, Nandyal	Resource person	
3	18.08.18	RARS, Nandyal	Resource person	
4	15.09.18	RARS, Nandyal	Resource person	
5	27.10.18	RARS, Nandyal	Resource person	
6	24.11.18	RARS, Nandyal	Resource person	
7	25.01.19	RARS, Nandyal	Resource person	
8	18.05.19	RARS, Nandyal	Resource person	
Smt.P.Pulli Bai, Scinetist (Breeding)				
1	29.06.18	RARS, Nandyal	Resource person	Participated as a resource person and noted seasonal and tobacco crop condition reported by DOA, Kurnool District.
2	21.07.18	RARS, Nandyal	Resource person	
3	18.08.18	RARS, Nandyal	Resource person	
4	15.09.18	RARS, Nandyal	Resource person	
5	27.10.18	RARS, Nandyal	Resource person	
6	24.11.18	RARS, Nandyal	Resource person	
7	25.01.19	RARS, Nandyal	Resource person	
8	18.05.19	RARS, Nandyal	Resource person	

BERHAMPUR

- Training programme on "Scientific method of pikka tobacco cultivation" was organised at village Jagadalpur on 28.02.2019 where 25 nos. farmers were participated

- Training programme on "Scientific method of pikka tobacco cultivation" was organised at village Padripalli on 08.03.2019 where 25 nos. farmers were participated

DINHATA

Training imparted

S. No.	Training	Date/Beneficiary
1.	Training to the Farmers son of the Assistant Director of Agriculture, Dinhata II Block, Sahebganj, Dinhata	06.09.2018
2.	Training to the Farmers at Block- O - Mahakuma Krishi Mela, Krishi Mandi ground (Krishi Mela), Dinhata	23.12.2018
3.	Training to the Farmers at Krishi Prajukti and Shilpa-Sanskritik Mela 2019 Kuchlibari, Dhaprahat, Cooch Behar	29.01.2019

VEDASANDUR

- One day farmers training programme was conducted on 27.07.2018 nursery raising and tray seedlings management.

- Dr. M.Kumaresan, Principal Scientist (Agronomy) & Head I/C, attended the AIR, Madurai recording programme on "varieties and its highlights" which was released by the ICAR-CTRI Research Station, Vedasandur" on 13th Aug.2018.

10. PUBLICATIONS /SYMPOSIA/ WORKSHOP/ SEMINARS

GUNTUR

- P. Venkateswarlu and M.V. Jayakrishna. 2018. Integrated management of tobacco aphid, Myzus nicotianae Blackman in central black soils of Andhra Pradesh. *Tobacco Research*, 43 (2): 69-75.
- K. Sarala, K. Prabhakara Rao, P. Venkateswarlu, Y. Subbaiah, T.G.K. Murthy, A.V.S.R. Swamy, D. Damodar Reddy and C. Chandrasekhar Rao. 2018. Tobios-6: A promising tobacco soma clone for northern light soils of Andhra Pradesh. *Tobacco Research*, 43(2): 93-99.

HUNSUR

Participation in symposia/ seminars/ workshops/ conferences etc.,

- Dr. M.Mahadevaswmy attended the National Agronomy congress 2018 at Pantnagar on 20-22 Feb., 2018 and presented the paper on influence of climate on FCV tobacco based cropping systems in KLS on 21.2.2018 in the technical session
- Dr. Nanda C participated in the 1st National Genetics Congress, held at Dr. B.P. Pal Auditorium, IARI, New Delhi on 14-16 December, 2018
- Dr.S.Ramakrishnan and Dr.M.Mahadevaswamy attended a farmers training progrmanme on water and soil resource management in tobacco growing Periyapatna region on 30.11.2018 at Kandegala organized by MYRIDA/ MYKAPS rural development programmes
- Dr. M.Mahadevaswmy participated in one day training programme as guest lecturer at Matkere village in HD kote taluk on 22.12.2018 organized by MYRIDA and ITC on soil conservation and soil health management for sustainable agriculture
- Dr.S.Ramakrishnan and Dr.M.Mahadevaswamy participated in the one day workshop on Sustainable Agriculture Practices (SAP) held at Nallur Pala, Hunsur on 12.06.2018

ANAND

Paper published in Reviewed Journal

i. International Journal :

- Hadiya R. G, and M. G. Makwana, P. J. Katba, N. D. Vyas, K. G. Kanjariya, D. R. Delvadia, Dr. D. J. Parmar. (2017) "Genetic analysis for seed yield and importance characters in tobacco (Nicotiana rustica L.)" *Journal of pharmacognosy and phytochemistry;* 6 (3):514-17.
- Panchal R. M. and Patel H.R. (2017). Impact of crop rotations/sequences in bidi tobacco based cropping pattern on crop yield, root-knot disease and nematodes. *Curr. Nem.* 28(1): 107-112.

Presentations at Seminar / Symposia etc. during 2018-19.

i. National Level :

- Patel, H. R., K. R. Joshi and Y. M. Rojasara. 2017. Effects of methods of application of fungicides in management of damping-off in bidi tobacco nursery. Special symposium on Microbial antagonists and their role in biological control of plant diseases held at AAU, Anand during Oct. 5-7, 2017.

NIPANI

A. Scientific Articles

- Chandrashekharagowda, P., Jones Nirmalnath, Shiney Ammanna, Matiwade P.S. and Jagadeesh K.S., 2018, Suppression of Orobanche spp. In Tobacco by Native Arbuscular Mycorrhizal Fungi, *Int. J. Curr. Microbiol.Spp.Sci.*, 7(4): 1890-1896.

B. Abstracts

- Sajjanar, G.M., Matiwade, P.S., Geeta Dandin and Shivalingappa Hotkar, Performance of bidi tobacco genotypes for seed yield under occurrence of erratic rainfall during crop growth, Paper published in National Conference on 'Enhancing productivity of oilseeds in changing climate scenario held at ICAR-DGR, Junagadh during April 7- 9, 2018. Pp:O-0044.

C. Extention Folders

- Sajjanar, G.M., Matiwade, P.S. and Geeta Dandin, 2018, 50 years of research accomplishments in bidi tobacco.

D. Popular Articles /Leaflets:

- G.M. Sajjanar and P.S. Matiwade, 2019, Tambakannu sada kettaddu ennalagadu. Eke gotte?? Krushi Munnade, pp: 4-7.

NANDYAL

S. No.	Authors	Title	Year	Name of the Journal with pages	NAAS rating
1.	Y.Bharathi S.Jaffar Basha and J.Manjunath	Variability, correlation and path analysis for seed yield and its component traits in bidi tobacco (*Nicotiana tabacum* L.)	2018	*The Journal of Research*, PJTSAU 46 (2&3):99-102	3.35
2.	S Jaffar Basha, P Pulli Bai, J Manjunath and C Chandrasekhara Rao	Relative performance of bidi tobacco (*Nicotiana tabacum* L.) varieties to different levels of nitrogen and topping under rainfed conditions in vertisols of Andhra Pradesh	2018	*International Journal of Pure and Applied Biosciences* 6(6):465-468	4.74

S. No.	Authors	Title	Year	Name of the Journal with pages	NAAS rating
3.	P.Pulli Bai, K.Prabhakar, S.Jaffar Basha, J.Manjunath and N.K.Gayatri	High yielding good quality bidi tobacco variety (*Nicotiana tabacum* L.) Nandyala Pogaku-1	2018	*Trends in Biosciences* 11(21), 3033-3034	3.94
4.	J.Manjunath and S. Jaffar Basha	Comparative efficacy of green labeled insecticides against Spodoptera litura on bidi tobacco (*Nicotiana tabacum* L.) at scarce rainfall zone of A.P	2018	Journal of Entomology and Zoology *Studies* 6(4): 1132-1134	5.53
5.	S Jaffar Basha, K.Prabhakar J Manjunath, P Pulli Bai and C Chandra Sekhara Rao	Production potential of bidi tobacco (*Nicotiana tabacum* l.) varieties to varied levels of nitrogen and topping under rainfed conditions in vertisols of Andhra Pradesh	2018	Accepted for *Tobacco Research*	3.35
6.	S Jaffar Basha, K.Prabhakar J Manjunath, P Pulli Bai and C Chandra Sekhara Rao	Response of bidi tobacco (*Nicotiana tabacum* l.) to planting methods and planting geometry under rainfed conditions in vertisols of Andhra Pradesh	2018	Accepted for *Tobacco Research*	3.35
7.	S Jaffar Basha, K.Prabhakar J Manjunath, P Pulli Bai and C Chandra Sekhara Rao	Foliar fertilization with nitrogen and potassium to bidi tobacco (*Nicotiana tabacum* L.) under rainfed conditions in vertisols of Andhra Pradesh	2018	Accepted for *Tobacco Research*	3.35
8.	S Jaffar Basha, J Manjunath, P Pulli Bai and C Chandra Sekhara Rao	Response of bidi tobacco (*Nicotiana tabacum* L.) to foliar nutrition with nitrogen and potassium under rainfed conditions	2019	*Journal of Pharmacognosy and Phytochemistry* 8(1): 205-207	5.21
9.	S Jaffar Basha, J Manjunath, P Pulli Bai and C Chandra Sekhara Rao	Assessment of Planting Methods in Bidi Tobacco (*Nicotiana tabacum* L.) to Minimize the Effect of Water Logging under Rainfed Conditions in Vertisols of Andhra Pradesh, India	2019	*International Journal of Current Microbiology and Applied Sciences.* 8(1): 846-852	5.38

BERHAMPUR

- A.M. Prusti, N. Senapati, P. M. Mohapatra, S. S. Bal, A. Kar, I. O. P. Mishra, R. K. Panigrahi And P.K.Panda (2019) Economic, women friendly power weeder use in tobacco cultivation. In Souvenir of Nationnal seminar on "Role of women in agricultural production and marketing" held on 8.1.2019 to 9 .1.2019 at OUAT page 45.

Symposium/ workshop/ seminar attended:

Name of the scientist	Symposium/ workshop/ seminar/	Date	Venue
A. M. Prusti	X Annual group meet of AINP on Tobacco research scientists.	29.10.2018 to 30.10.2018	ICAR-CTRI, Rajahmundry

DINHATA

- S. K. Dam and U Sreedhar 2019. Management of frog eye leaf spot (Cercospora nicotianae Ellis & Everh) in Flue cured Virginia tobacco. *J. Mycopathol. Res*. 57(1):13-16

VEDASANDUR

- Dr. M.Kumaresan, Principal Scientist (Agronomy) & Head I/C, attended the meeting on 30th May 2018 at SBI, Coimbatore, relating to organizing of "Kissan Mela".

11. 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

12. BUDGET AND EXPENDITURE -2018-19

ANAND

Rs. in Lakhs

Sr. No	Detail	Allocation (75 + 25)	Expenditure incurred
1	Pay & Allowances	174.67	94.21
2	T.A.	2.00	1.08
3	Recurring	21.27	17.17
4	Non-recurring	-	-
	Total :	**197.94**	**112.46**

SHIVAMOGGA

Rs. in Lakhs

Sl. No.	Particulars	Allocation	Expenditure incurred
1.	Pay & allowance	69.33	68.22
2.	ORC	13.37	13.20
3.	T.A	0.69	0.63
	Total	**83.40**	**82.05**

NIPANI

Rs. in Lakhs

Sl. No.	Particulars	Allocation	Expenditure incurred
1	Salary of Research Staff & Est.	51.66	34.58
2	Travelling allowance	0.84	0.71
3	Recurring contingencies	7.30	6.63
4	Non Recurring charges	-	-
	Total	**59.80**	**41.92**

NANDYAL

Rs. in Lakhs

Sl. No.	Head	Allocation	ICAR share (75%)	Total Expenditure 2017-18
1	Pay & Allowances	37.33	26.58	35.45
2	T.A.	1.12	0.26	0.34
3	Recurring Contigencies	6.80	5.05	6.73
4	Non Recurring charges	-	-	-
	Total	**45.25**	**31.89**	**42.52**

ARAUL

Rs. in Lakhs

Head of Account	Total Expenditure	ICAR Share (75%)
Pay & Allowances	25.81	19.35
T.A.	1,08	0.81
Recurring contingency	6.70	5.02
Total	**33.59**	**25.18**

BERHAMPUR

Rs. in Lakhs

Head	Allocation	Expenditure incurred
Salary	21.00	6.34
TA	0.56	0.11
ROC	5.10	4.22
NRC	0.00	0.00
Total	**26.66**	**10.67**

13. CO-ORDINATION UNIT, RAJAHMUNDRY

The X Group meeting of All India Network Project on Tobacco was conducted at ICAR–Central Tobacco Research Institute from 29th to 30th October, 2018. Scientists from various AINPT centres and other delegates from all over India participated and presented the research results of 2017-18 and after thorough discussions; the technical programme for 2018-19 was finalized.

- During the group meeting, varietal identification committee meeting was held wherein three variety proposals were discussed and identified one rustica tobacco variety ArR-27 (Nath)
- Compiled one publication entitled "INDIAN TOBACCO – The Compendium of Varieties: where in the varieties released were compiled alongwith their specific traits.
- Prepared and submitted budget proposals (Budget Estimates/ Revised Estimates), for the year 2018-19 and 2019-20 and statement on allocation of funds to SAU centres. The proposals were submitted to the Council as and when required.
- Regularly monitored weather conditions at all the AINPT centres and sent detailed report on status along with contingency measures proposed.
- 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 sent to all the concerned centres
- Revised EFC Memo for 2017-20 was prepared which was approved by ICAR
- Action taken report of AINPT on review committee recommendations of AINPT was prepared and attended the meeting for finalization of review committee recommendations
- Prepared the output-outcome outlay of the AINPT and submitted to ICAR
- Compiled seed production details of the different centres
- Compiled the information for outcome and outlay review meeting for which the information from the SAU centers as per proforma given by the ICAR was compiled.
- Compiled the list of publications of all the centers of AINPT along with citations.
- As per the suggestions in EFC meeting staff strength in different AINPT centers under state agricultural universities rationalized accordingly budget proposals were prepared and submitted to ICAR.
- Compiled the annual report of 2018-19.
- Compiled the Research Achievements and work plan 2018 of different AINPT centres and the proceedings of X Group meeting

Monitoring Visits: Monitoring team from CTRI, Rajahmundry Dr. K. Sarala, Head, Division of Crop Improvement and Dr. U. Sreedhar Head, Division of Crop Protection, CTRI, Rajahmundry visited University from 9th October to 11th October, 2018 as a part of monitoring the All India Network Project (Tobacco), Shivamogga.

CROP IMPROVEMENT

A. VFC TOBACCO

IVT ON VFC TOBACCO

VFRBRC/ VFJBRC/ VFKBRC/ VFGBRC/ VFHBRC/ VFSBRC 2: INITIAL VARIETAL TRIAL ON FCV TOBACCO

Year of start: 2018-19

Initial Varietal Trial (IVT) was conducted at six centres *viz*., Rajahmundry, Jeelugumilli, Kandukur, Guntur, Hunsur and Shivamogga, with 5 entries along with their respective check varieties.

Entries: 05 (Five)

1. FCR-62
2. FCR-63
3. FCR-64
4. FCR-65
5. FCR-66

Checks at different Centres:

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

Design : RBD
Total treatments : 05 + checks as given above
Replications : Four

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

Centre	Plot size	Spacing
Rajahmundry	3.2 x 5.4 m	0.7 x 0.7 m
Jeelugumilli	2.0 x 12.0 m	1.0 x 0.6 m
Guntur	2.8 x 4.0 m	0.7 x 0.7 m
Kandukur	2.6 x 5.85 m	0.65 x 0.65 m
Hunsur	2.0 x 6.6 m	1.0 x 0.55 m
Shivamogga	6.0 x 3.6 m	0.9 x 0.6 m

Results

Data on yield characteristics at different centres are presented in Tables IVT 1 to 4 VFC TOBACCO. The results are discussed centre-wise.

RAJAHMUNDRY

A replicated trial was conducted with five lines along with two control varieties *Viz.*, VT-1158 and Siri (Table 1 IVT VFC TOBACCO).

Significant differences observed for all the four characters among the entries tested *Viz.*, green leaf, cured leaf, bright leaf and grade index. Five lines *Viz.*, FCR-62, FCR-63, FCR-64, FCR-65, and FCR-66, recorded cured leaf yields of 1821-2316 kg/ha and FCR-62 recorded significantly higher yield with 2316 kg/ha compared to controls VT-1158 (1883 kg/ha) and Siri (1937 kg/ha).

Five lines *Viz.*, FCR-62, FCR-63, FCR-64, FCR-65, and FCR-66, recorded bright leaf yields of 1176-1529 kg/ha with grade index of 1406-1827 respectively, compared to control VT-1158 (1216 kg/ha and 1452) and Siri (1251 kg/ha and 1494). FCR-62 is significantly yielded high bright grade leaf (1529 kg/ha) and grade index of 1827.

Based on the overall performance three lines FCR-62, FCR-63 and FCR-65 were found better than checks and are proposed for further testing under advanced varietal trial-I during ensuing season.

JEELUGUMILLI

A replicated trial was conducted with five entries along with three control varieties *Viz.*, Kanchan, LT-Kanchan and CH-1 (Table 1 IVT VFC TOBACCO).

Significant differences observed among the entries tested for all the three characters Viz., Green Leaf, Cured leaf and grade index. Five lines *Viz.*, FCR-62, FCR-63, FCR-64, FCR-65, and FCR-66, recorded cured leaf yields of 1722-2448 kg/ha while checks LT-Kanchan 2150 kg/ha and Kanchan 2119 kg/ha, FCR-64 being the high yielder (2448 ka/ha) with an yield improvement of 14 percent over LT-Kanchan (2150).

Five lines *Viz.*, FCR-62, FCR-63, FCR-64, FCR-65, and FCR-66, recorded grade index of 1340-1905 while check LT-Kanchan 1673, among the entries tested FCR-64 yielded high grade out (1905) with an improvement up to 14 percent over LT- Kanchan (1673).

Since none of the lines are showing significant superiority over check and their performance is on par with checks the trial is proposed for drop for further testing.

GUNTUR

A Replicated trial was conducted at CTRI Research Station, Guntur with five FCV tobacco entries *viz.*, FCR-62, FCR-63, FCR-64, FCR-65 & FCR-66 and two local checks, Siri and Hemadri for their yield and quality performance (Table 1 to 4 IVT VFC TOBACCO).

The data revealed that treatments were significantly superior to the check, Hemadri but were on par with check, Siri. Maximum green leaf (14880 kg/ha), cured leaf (2441 kg/ha), bright leaf (1433 kg/ha) and grade index (2037 kg/ha) were recorded in FCR-65 followed by FCR-64 (14761, 2398, 1377 & 1964 Kg/ha) and FCR-66 (14226, 2375, 1369 & 1949 Kg/ha). There was an increase of 10.12, 5.72 and 5.74% in respect of cured leaf, bright leaf and grade index yields, respectively in FCR-65 over the check, Siri.

Pest and disease incidence recorded under natural conditions was below ETL in all the entries including checks. As none of the entries found superior over better control, Siri entries were not proposed for testing under AVT-1 (2019-20).

KANDUKUR

Five lines *viz.*, FCR-62, FCR-62, FCR-64, FCR-65 and FCR-66 were evaluated in a replicated trial along with three controls *viz.*, Siri, VT-1158 and N-98. The results revealed that the treatments differed significantly for all the four yield parameters (Table 1 IVT VFC TOBACCO).

Among the lines evaluated, FCR-63 recorded significantly superior green leaf yield (13453 kg/h) with an increase of 39 per cent over better control Siri (9689 kg/ha). FCR-62 and FCR-64 also recorded significantly superior green leaf yield. The increase in green leaf yield over Siri ranged from 12 to 39 per cent.

The cured leaf yield was significantly higher in FCR-63 (1688 kg/ha), followed by FCR-62 (1655 kg/ha) with an increase of 16 and 14 per cent over Siri (1456 kg/ha) respectively.

FCR-63 recorded significantly higher bright leaf of 1063 kg /ha with an increase of 18 per cent over Siri (902 kg /ha). FCR-62 also recorded significantly superior bright leaf yield of 1042 kg/ha with an increase of 15 per cent over Siri.

Grade index was significantly higher in FCR-63 (1408 /ha) with an increase of 17 per cent over Siri (1206 /ha). FCR-62 also recorded significantly higher grade index of 1384 /ha with an increase of 15 per cent over Siri.

Incidence of pest and diseases were recorded (Table 5 IVT VFC TOBACCO). During 2018-19 the incidence of pests and diseases was low. FCR-62 and FCR-63 are proposed to advance to AVT-1 in 2019-20.

HUNSUR

Five entries FCR 62, FCR 63, FCR 64, FCR 65, FCR 66 were evaluated against checks Kanchan (C) and FCH 222 (C) in the Initial varietal trial for their yield and quality. Data was analyzed and the results revealed that entries differed significantly with respect to green leaf yield while for cured leaf and bright leaf yield and TGE there was no significant difference among the entries (Table 1 IVT VFC TOBACCO).

Among the five entries tested, FCR 64 recorded higher green leaf (8663 kg/ha), cured leaf (1205 kg/ha), bright leaf yield (810 kg/ha) and TGE (877) which was on par with check Kanchan but less than FCH 222. Higher incidence of wilt was observed during the season (Table 6 IVT VFC TOBACCO) which ranged from 8% (FCH 222) to 50% (FCR 65).

SHIVAMOGGA

Five genotypes were tested along with three checks *viz*. Thrupthi, Kanchan and Sahyadri. None of the entries yielded significantly superior over the checks. However entries FCR-64 and FCR-66 have given numerically superior GLY, CLY and TGE over the checks Table 1 IVT VFC TOBACCO. Data presented in the Table 6 IVT VFC TOBACCO revealed that, FCR-62 has recorded lowest incidence of Black shank and FCR-64 recorded moderate incidence of Frog eye leaf spot. Significant variation is seen among IVT genotypes. Among the five IVTs entries, three entries *viz*., FCR-63, FCR-64 and FCR-65 were found moderately resistant with frog eye leaf spot disease severity of 43.75, 30.88 and 37.19 per cent respectively. Whereas, remaining two entries FCR-62 and FCR-66 (50.75% and 47.15%) were showed moderately susceptible reaction. FCR-65 recorded highest laminar potassium content in L position (2.86%) followed by FCR-66 (2.71 %).

Table 1 IVT VFC TOBACCO: Green leaf yield (kg/ha) in IVT at different centres (2018-19)

Entries	Rajah-mundry	Jeelu-gumilli	Guntur	Kandukur	Hunsur	Shivamogga
FCR-62	13896*	12979	12559	11990**	7075	10398
FCR-63	12289	11291	13601	13453**	6483	10879
FCR-64	11332	15635	14761*	10823*	8663	10703
FCR-65	12191	11416	14880*	10248	7769	10316
FCR-66	10924	11000	14226*	10577	6975	10538
Thrupthi (C)						8396
Kanchan (C)		13531			8658	10149
FCH 222 (C)					9439	
LT-Kanchan (C)		13729				

Entries	Rajah-mundry	Jeelu-gumilli	Guntur	Kandukur	Hunsur	Shivamogga
CH-1 (C)		12874				
Sahyadri (C)						10187
VT 1158 (C)	11293			9048		
Siri (C)	11619		14047	9689		
N-98				9312		
Hemadri (C)			10892			
G. Mean	11935	12807		10644		10196
S. Em±	589	954	758	326	581	639
C.D. at 5%	1751	2806	2327	958	1781	1939
C.V. (%)	10	12	9.68	6.12	13	10.86

*Significant at 5%

Table 2 IVT VFC TOBACCO: Cured leaf yield (kg/ha) in IVT at different centres (2018-19)

Entry	Rajah-mundry	Jeelu-gumilli	Guntur	Kandukur	Hunsur	Shivamogga
FCR-62	2316*	2032	2053	1655*	974	1409
FCR-63	2048	1768	2175	1688**	1051	1360
FCR-64	1889	2448	2398*	1586	1205	1445
FCR-65	2033	1787	2441*	1594	1065	1341
FCR-66	1821	1722	2375*	1487	935	1423
Thrupthi (C)						1138
Kanchan (C)		2119			1031	1355
FCH 222 (C)					1259	
LT-Kanchan (C)		2150				
CH-1 (C)		2016				
Sahyadri (C)						1341
VT 1158 (C)	1883			1420		
Siri (C)	1937		2194	1456		
N-98				1441		
Hemadri (C)			1584			
G. Mean	1989	2005		1541		1351
S. Em±	98	149	151	51	119	86
C.D. at 5%	292	440	465	151	NS	260
C.V. (%)	11	11	12.12	6.66	19.14	10.98

*Significant at 5%

Table 3 IVT VFC TOBACCO: Bright leaf yield (kg/ha) in IVT at different centres (2018-19)

Entry	Rajahmundry	Kandukur	Hunsur	Guntur
FCR-62	1529*	1042*	643	1315
FCR-63	1323	1063**	672	1325
FCR-64	1220	981	810	1377*
FCR-65	1313	988	694	1433*
FCR-66	1176	892	616	1369*
VT 1158 (C)	1216	863		
Siri (C)	1251	902		1351
N-98 (C)		879		
Hemadri (C)				906
Kanchan (C)			689	
FCH 222 (C)			853	
G. Mean	1290	951	711	1297
S. Em±	64	37	79	40
C.D. at 5%	191	110	NS	125
C.V. (%)	11	7.87	19.33	8.45

*Significant at 5%

Table 4 IVT VFC TOBACCO: Grade index/TGE (kg/ha) in IVT at different centres (2018-19)

Entry	Rajah-mundry	Jeelu-gumilli	Kandukur	Hunsur	Guntur	Shivamogga
FCR-62	1827*	1581	1384*	695	1733	1059
FCR-63	1581	1376	1408**	750	1854	1049
FCR-64	1459	1905	1303	877	1964*	1228
FCR-65	1568	1391	1313	767	2037*	1140
FCR-66	1406	1340	1191	677	1949*	1116
Thrupthi (C)						874
Kanchan (C)		1649		759		1073
FCH 222 (C)				916		
LT-Kanchan (C)		1673				
CH-1 (C)		1569				
Sahyadri (C)						995
VT 1158 (C)	1452		1114			
Siri (C)	1494		1206		1920	
N-98 (C)			1179			
Hemadri (C)					1220	
G. Mean	1541	1561	1262			1067
S. Em±	77	116	49	87	105	72
C.D. at 5%	228	341	145	NS	324	219
C.V. (%)	10	13	7.79	19.3	10.11	11.7

*Significant at 5%

Table 5 IVT VFC TOBACCO: Pests and disease incidence in IVT at Kandukur (2018-19)

(Out of 36 Plants)

Entries	TMV	Aphid	Caterpillar	CMV	LC A	LC B	LC C	LC D	LC X
FCR-62	-Nil-	-Nil-	-Nil-	-Nil-	Nil-	2	-Nil-	-Nil-	-Nil-
FCR-63	-Nil-	-Nil-	-Nil-	-Nil-	Nil-	1	1	-Nil-	-Nil-
FCR-64	-Nil-	-Nil-	1	-Nil-	-Nil-	1	-Nil-	-Nil-	-Nil-
FCR-65	-Nil-	-Nil-	-Nil-	-Nil-	Nil	-Nil-	1	-Nil-	-Nil-
FCR-66	-Nil-	-Nil-	-Nil-	-Nil-	2	-Nil-	-Nil-	-Nil-	-Nil-
Siri (C)	-Nil-	-Nil-	-Nil-	-Nil-	1	-Nil-	-Nil-	-Nil-	-Nil-
VT-1158 (C)	-Nil-	-Nil-	-Nil-	-Nil-	-Nil-	-Nil-	-Nil-	-Nil-	-Nil-
N-98 (C)	-Nil-	-Nil-	-Nil-	-Nil-	-Nil-	1	-Nil-	-Nil-	-Nil-

Leaf Curl scale A to X is low to high.

Table 6 IVT VFC TOBACCO: Incidence of pest and diseases in the entries of IVT at Hunsur (2018-19)

Entries	Wilt (% incidence)	RKI (Range)	TMV	LC
FCR-62	48	1-2	-	1
FCR-63	24	1	-	-
FCR-64	48	1	-	-
FCR-65	50	1-2	-	1
FCR-66	27	3-4	-	1
Kanchan (C)	13	1-2	-	-
FCH 222 (C)	8	1-2	-	-

Table 6 IVT VFC TOBACCO: Diseases reaction and laminar potassium content in the entries of IVT at Shivamogga (2018-19)

Entries	Frog eye leaf spot	Black shank	Root-knot Index	Laminar potassium content (%)	
				X	L
FCR-62	MR (50.75)	MR (4.00)	3.0 (MS)	2.18	1.97
FCR-63	MS (43.75)	MS (20.00)	2.0 (MR)	2.81	2.23
FCR-64	MR (30.88)	MS (16.00)	2.0 (MR)	2.33	2.12
FCR-65	MR (37.19)	MS (12.00)	3.0 (MS)	2.38	2.86
FCR-66	MS (47.15)	MR (8.00)	3.0 (MS)	2.85	2.71
Thrupthi (C)	S (62.00)	MS (24.00)		3.04	2.30
Kanchan (C)	S (73.75)	MS (28.00)		2.78	2.52
Sahyadri (C)	MS (49.50)	MS (24.00)		2.67	2.70
S. Em±				0.11	0.14
C.D. at 5%				0.37	0.38

IVT ON VFC TOBACCO-HYBRIDS

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

Year of start: 2018-19

Initial Hybrid Trial (IHT) was conducted at six centres viz., Rajahmundry, Jeelugumilli, Kandukur, Guntur, Hunsur and Shivamogga, with 3 entries (ITC Limited – ABD-ILTD, Rajahmundry) along with respective check varieties.

Entries: 3 (Three)

1. FCRH-2
2. FCRH-3
3. FCRH-4

Checks at different centres

Rajahmundry	:	1. VT 1158	2. Siri	3. Hema	
Jeelugumilli	:	1. Kanchan	2. LT-Kanchan	3. CH 1	
Guntur	:	1. Hemadri	2. Siri	3. VT 1158	
Kandukur	:	1. VT 1158	2. Hema	3. Siri	4. N-98
Hunsur	:	1. Kanchan	2. FCH-222	3. CH 3	
Shivamogga	:	1. Thrupthi	2. Kanchan	3. Sahyadri	

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

Results

Data on yield characteristics at different centres are presented in Tables IHT VFC TOBACCO 1 to 4. The results are discussed centre-wise.

RAJAHMUNDRY

Initial hybrid trial is conducted with three entries Viz. FCRH-2, FCRH-3 and FCRH-4 along with three checks. Significant differences were observed among the entries for all the characters. Hybrids FCRH-3 and FCRH-4 were the high yielders among the three entries tested with 2540 and 2572 kg/ha cured leaf yields respectively with1406 and 1423 kg/ha bright leaf yields and grade index of 1817 and 18 43 respectively. While, control Siri recorded 2432 kg/ha cured leaf yields and 1345 kg/ha bright leaf yield and grade out turn of 1742. However, Hybrids FCRH-3 and FCRH-4 recorded significant higher cured leaf, bright leaf and grade index over checks VT-1158 and Hema.

FCRH-3 and FCRH-4 are proposed for further testing in advanced hybrid trial -1 during ensuing season. The Chemical quality characters are presented in Table 5 IHT VFC TOBACCO.

JEELUGUMILLI

Initial hybrid trial was conducted with three entries along with three checks. Significant differences were observed among the entries tested for all the three characters Viz., Green Leaf Cured Leaf and Grade index. Hybrid FCRH-2 were yielded high among the three entries tested with 2113 kg/ha cured leaf yield with 1525 grade index. Control LT-Kanchan recorded 2010 kg/ha cured leaf yields and 1407 grade index.

FCRH-2 and FCRH-3 being high yielders compared to all the three checks Kanchan, LT- Kanchan and CH-1, are proposed for further evaluation in advance hybrid varietal trial-1.

Disease /Pest incidence: Low incidence of TMV and leaf curl was observed among the entries tested under natural conditions (Table 7 IHT VFC TOBACCO).

GUNTUR

A Replicated trial was conducted with three hybrids, FCRH-2, FCRH-3 & FCRH-4 for their yield and quality performance were compared with three local checks viz., Hemadri, Siri and VT-1158. All six treatments were replicated four times. The data presented in Table IHT-1 revealed that the performance of all three hybrids was superior to the check, Hemadri and on par with other two checks, Siri and VT-1158 in respect of total quantity of green leaf and cured leaf yields. But, the leaf quality of hybrids was significantly inferior to all three checks. Highest green leaf of 17790 kg/ha and cured leaf of 2404 kg/ha was recorded in hybrid, FCRH-2, whereas, highest bright leaf of 1422 kg/ha and grade index of 2125 kg/ha were recorded in check, Siri.

Although the check, Siri was slightly inferior to hybrids in respect of leaf quantity, but superior in respect of leaf quality. Based on the performance, it was confirmed that all three hybrids were not found suitable for black soils and hence not proposed for further testing under AHT-1.

KANDUKUR

Three CMS hybrids *viz.*, FCRH-2, FCRH-3 and FCRH-4 were evaluated in a replicated trial along with three controls viz., Siri, VT-1158 and N-98. The results on the yield parameters revealed that the green leaf, cured leaf, bright leaf and grade index yields are lower than the better control Siri. Based on the results it is proposed, not to advance any entries further.

HUNSUR

In IHT, three hybrids viz., FCRH-2, FCRH-3 and FCRH-4 were evaluated against checks Kanchan (C), FCH 222 (C) and CH 3(C). Data was recorded on yield parameters. Analysis of the data indicated that there was no significant difference among the entries tested for all the yield parameters (IHT VFC TOBACCO 1 to 4). However, all the three hybrids under testing had recorded higher green leaf, cured leaf, bright lead yield and TGE than checks, Kanchan and FCH 222. Yields were on par with the hybrid check CH3. Entry, FCRH-4 has recorded higher green leaf yield (9881 kg/ha) and cured leaf yield (1663 kg/ha) with 14% improvement over Kanchan.

Incidence of wilt was high among the hybrids tested and Kanchan which ranged between 21-24% (Table 8 IHT VFC TOBACCO) which could be the cause for lower yields. Incidence of wilt was least in CH3 and FCH 222 (5%).

The leaf chemical quality parameters (measured in terms of percent Nicotine, Reducing sugars and Chlorides) were estimated for the entries tested. All the parameters were well within the prescribed limits (Table VFHBR 3.2). The hybrids under testing have recorded low nicotine (<1% in 'X' position and <2% in 'L' position) during the current season.

SHIVAMOGGA

Among three hybrids tested in replicated trial against checks Thrupti, Sahyadri and Kanchan the entry FCRH-4 recorded significantly higher GLY (11964 kg/ha), CLY (1587 kg/ha) over all the three checks. Followed by FCRH-3 which has recorded 11360 kg/ha of GLY, 1505 kg/ha of CLY. FCRH-4 has recorded 11% increase in cured leaf yield over the best check Sahyadri. FCRH-4 has recorded significantly superior yield of 1229 kg/ha of TGE over all the checks. Among three IHT (Initial Hybrid trial) entries *viz*., FCRH-2, FCRH-3 and FCRH-4 were showed moderately resistant by recording 28.25, 24.75 and 21.50 PDI to frog eye leaf spot.

Table 1 IHT VFC TOBACCO: Green leaf yield (kg/ha) in IHT at different centres (2018-19)

Entry	Rajah-mundry	Jeelu-gumilli	Guntur	Kandu-kur	Hunsur	Shivamogga
FCRH-2	12825	13090	17790	8333*	9714	9329
FCRH-3	15242*	13194	16384	8950*	9612	11360*
FCRH-4	15431*	12402	15290	9550*	9881*	11964*
Thrupthi (C)						8788
Kanchan (C)		12527			8419	10173
Sahyadri (C)						10699
FCH 222 (C)					9174	

Entry	Rajah-mundry	Jeelu-gumilli	Guntur	Kandu-kur	Hunsur	Shivamogga
CH-3 (C)					9830	
Hemadri (C)			11030			
Siri (C)	14841		15602	9919		
VT 1158 (C)	12901		15066	9870		
N-98				9796		
Hema (C)	10886					
LT-Kanchan (C)		14277				
CH-1		11368				
G. Mean	13688	12809	15194	9403	7791	10385
S. Em±	539	467	671	335	633	454
C.D. at 5%	1624	1360	2023	1011	NS	1370
C.V. (%)	8	9.0	8.84	7.14	13.4	8.75

* Significantly superior to check Siri, VT-1158 and Hema

Table 2 IHT VFC TOBACCO: Cured leaf yield (kg/ha) in IHT at different centres (2018-19)

Entry	Rajah-mundry	Jeelu-gumilli	Guntur	Kandu-kur	Hunsur	Shiva-mogga
FCRH-2	2137	2113	2404	1356	1622	1213
FCRH-3	2540#	2031	2379	1453	1603	1505*
FCRH-4	2572#	1970	2338	1535	**1663**	1587*
Thrupthi (C)						1123
Kanchan (C)		1959			1425	1322
Sahyadri (C)						1418
FCH 222 (C)					1509	
CH-3 (C)					1653	
Hemadri (C)			1555			
Siri (C)	2432		2371	1558		
VT 1158 (C)	2150		2259	1520		
N-98				1455		
Hema (C)	1815					
LT-Kanchan (C)		2010				
CH-1		1836				
G. Mean	2274	1986	2218	1479		1361
S. Em±	93	73	118	56	67	66
C.D. at 5%	280	214	358	NS	NS	199
C.V. (%)	9	9.0	10.73	7.58	8.47	9.68

Table 3 IHT VFC TOBACCO: Bright leaf yield (kg/ha) in IHT at different centres (2018-19)

Entry	Rajahmundry	Kandukur	Guntur	Hunsur
FCRH-2	1183	815	1153	1099
FCRH-3	1406#	873	1118	1169
FCRH-4	1423#	919	1065	1123
Kanchan (C)				1013
FCH 222 (C)				1068
CH-3 (C)				1142
Hemadri (C)			918	
Siri (C)	1345	970	1422	
VT 1158 (C)	1190	929	1360	
N-98 (C)		888		
Hema (C)	1004			
G. Mean	1258	899	1173	1102
S. Em±	51	38	71	55
C.D. at 5%	155	NS	213	NS
C.V. (%)	10	8.51	10.12	9.92

significantly superior to check VT 1158 and Hema

Table 4 IHT VFC TOBACCO: Grade index/TGE (kg/ha) in IHT at different centres (2018-19)

Entry	Rajah-mundry	Jeelu-gumilli	Guntur	Kandu-kur	Hunsur	Shiva-mogga
FCRH-2	1631	1525	1703	1084	1186	910
FCRH-3	1817#	1466	1695	1171	1214	1133*
FCRH-4	1843#	1422	1710	1123	1225	1229*
Thrupthi (C)						842
Kanchan (C)		1414			1066	995
Sahyadri (C)						1100
FCH 222 (C)					1133	
CH-3 (C)					1233	
Hemadri (C)			1387			
Siri (C)	1742		2125	1292		
VT 1158 (C)	1541		2030	1229		
N-98 (C)				1190		
Hema (C)	1300					
LT-Kanchan (C)		1407				
CH-1 (C)		1221				
G. Mean	1646	1409	1775	1198	1176	1035
S. Em±	70	53	105	46	49	56
C.D. at 5%	212	154	316	NS	NS	168
C.V. (%)	9	9.0	8.16	7.77	8.33	10.78

Table 5 IHT VFC TOBACCO: Chemical quality characters in IHT at Rajahmundry (2018-19)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
FCRH-2	0.72	16.44	1.77
FCRH-3	0.56	19.86	1.42
FCRH-4	0.79	17.45	1.73
VT-1158 (C)	1.02	16.89	1.59
Siri (C)	0.74	16.65	1.84
Hema (C)	0.86	15.40	1.30

Table 6 IHT VFC TOBACCO: Pests and disease incidence in IHT at Jeelugumilli (2018-19)

Entries	Number of plants affected per 40 plants			
	TMV	CMV	Aphid	Leaf curl
FCRH-2	1	Nil	Nil	1
FCRH-3	0	Nil	Nil	0
FCRH-4	1	Nil	Nil	1
Kanchan (C)	0	Nil	Nil	0
LT-Kanchan (C)	1	Nil	Nil	0
CH-1 (C)	1	Nil	Nil	1

Table 7 IHT VFC TOBACCO: Pests and disease incidence in IVT at Kandukur (2018-19)

(Out of 36 plants)

Entries	TMV	Aphid	Caterpillar	CMV	LC A	LC B	LC C	LCD	LC X
FCRH-2	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCRH-3	Nil	Nil	Nil	Nil	Nil	1	Nil	Nil	Nil
FCRH-4	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Siri (C)	2	Nil	Nil	Nil	Nil	Nil	2	Nil	Nil
VT-1158 (C)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N-98 (C)	Nil	Nil	Nil	Nil	Nil	Nil	1	Nil	Nil

Table 8 IHT VFC TOBACCO: Pests and disease incidence in IVT at Hunsur (2018-19)

Entries	Wilt (% incidence)	RKI (Range)	TMV	LC
FCRH-2	21	1-3	-	-
FCRH-3	24	2	-	-
FCRH-4	21	1-2	-	-
Kanchan (C)	24	1	-	-
FCH 222 (C)	5	1	-	-
CH-3 (C)	5	1	-	-

Table 9 IHT VFC TOBACCO: Data on chemical quality parameters in IVT at Hunsur (2018-19)

Entries	Nicotine		Reducing Sugars		Chlorides	
	X	L	X	L	X	L
FCRH-2	0.55	1.49	18.71	10.69	0.61	0.38
FCRH-3	0.66	1.06	13.50	12.58	0.69	0.48
FCRH-4	0.53	1.01	16.96	13.56	0.43	0.51
Kanchan (C)	0.62	1.83	18.57	11.01	0.48	1.02
FCH 222 (C)	0.66	1.62	14.85	12.34	0.70	0.78
CH-3 (C)	0.75	1.40	12.20	12.04	0.74	0.96

RAJAHMUNDRY

VFRBR 1.1: ADVANCED VARIETAL TRIAL I

Year of start: 2018-19

Design : RBD
Replications : Three
Treatments : 3 Entries + 2 Checks

Results

Three lines were evaluated in a replicated trial against two checks *viz*., VT-1158 and Siri, during 2018-19. Results revealed that lines FCR-56 and FCJ-39 recorded significantly higher yields 2386 kg/ha and 2672 kg/ha respectively compared to better control Siri (2145 kg/ha) (Table 1 VFRBR 1.1).

FCR-56 and FCJ-39 recorded significantly higher bright leaf yields of 1178 kg/ha and 1319 kg /ha respectively compared to better control Siri (1059 kg/ha). FCR-56 and FCJ-39 also recorded high grade index 1408 and 1576 against best check, Siri 1065.

Incidence of pests and diseases: Observations on the pests and disease under natural incidence conditions were recorded and presented in Table 2 VFRBR 1.1. During 2018-19, TMV incidence was observed in very low (1-2). Leaf curl is observed 1-2 in all the entries studied. Aphid incidence is not observed in all treatments.

Table 1 VFRBR 1.1: Yield characters of AVT-I entries at Rajahmundry (2018-19)

Entries	Yield in kg/ha			Grade Index
	Green leaf	Cured leaf	Bright leaf	
FCR-51	13239	2212	1092	1305
FCR-56	14285	2386*	1178*	1408*
FCJ-39	15996*	2672*	1319*	1576*
VT-1158 (C)	12841	2084	1029	1229
Siri (C)	12474	2145	1059	1265
Grand mean	13767	2300	1135	1357
S.Em. ±	417	69	34	41
C.D. at 5%	1253	209	103	123
C.V. %	7	9	10	7

*Significant at 5%

Table 2 VFRBR 1.1: Pest and disease incidence in AVT-I entries at Rajahmundry (2018-19)

(Over 36 plants)

Entry	Number of plants affected			
	TMV	CMV	Aphid	Leaf curl
FCR-51	1	Nil	Nil	2
FCR-56	2	Nil	Nil	1
FCJ-39	1	Nil	Nil	2
VT-1158 (C)	1	Nil	Nil	1
Siri (C)	1	Nil	Nil	2

Table 3 VFRBR 1.1: Chemical quality characters in AVT-I entries at Rajahmundry (2018-19)

Entry	Nicotine (%)	Reducing Sugars (%)
FCR-51	1.37	11.43
FCR-56	1.06	10.67
FCJ-39	0.56	18.91
VT-1158 (C)	0.88	16.30
Siri (C)	0.89	17.39

VFRBR 1.2: ADVANCED VARIETAL TRIAL II

Year of start: 2018-19

Design: RBD
Replications : Three
Treatments : 7 Entries + 2 Checks

Results

Seven lines were evaluated in a replicated trial against two checks V*iz*., VT-1158 and Siri, during 2018-19. Significant differences were observed among the entries for all the four characters studied *Viz*. Green leaf, Cured leaf, Bright leaf and grade index. Among the entries tested FCR-42 recorded significantly higher cured leaf yields 2610 kg/ha compared to better control Siri (2059 kg/ha) with an improvement of 27 per cent (Table 1 VFRBR 1.1).

FCR-42 recorded significantly higher bright leaf yields of 1482 kg /ha compared to better control Siri (1171 kg/ha) with an improvement of 26 percent. FCR-42 also recorded significantly higher grade index of 1921 compared to better control Siri (1517) with an improvement of 26 percent.

Incidence of pests and diseases: Observations on the pests and disease under natural incidence conditions were recorded and presented in table 3 VFRBR 1.2. During 2018-19 TMV incidence observed was very low (1-3). Leaf curl observed 1-2 in all the entries studied. Aphid incidence is not observed in all treatments.

Chemical quality: Nicotine and reducing sugars in cured leaf were within the acceptable standards (Table 3 VFRBR 1.2).

Table 1 VFRBR 1.2: Yield characters of AVT-II entries at Rajahmundry (2018-19)

Entries	Yield in kg/ha			Grade Index
	Green leaf	Cured leaf	Bright leaf	
FCR-37	13129	2032	1154	1498
FCR-42	16853*	2610*	1482*	1921*
FCJ-28	12967	2001	1139	1472
FCS-3	12831	1991	1134	1467
FCS-4	12950	1886	1074	1391
FCK-6	14625	2335	1328	1719
FCK-7	11488	1884	1071	1387
VT-1158 (C)	12636	1914	1090	1409
Siri (C)	13112	2059	1171	1517
Grand mean	13399	2079	1183	1531
S.Em. ±	909	138	79	102
C.D. at 5%	2727	414	235	305
C.V. %	11	11	11	11

* significantly superior to check Siri

Table 2 VFRBR 1.2: Pest and disease incidence in AVT-II entries at Rajahmundry (2018-19)

(Over 36 plants)

Entry	Number of plants affected			
	TMV	CMV	Aphid	Leaf curl
FCR-37	1	Nil	Nil	2
FCR-42	1	Nil	Nil	1
FCJ-28	1	Nil	Nil	1
FCS-3	3	Nil	Nil	1
FCS-4	1	Nil	Nil	1
FCK-6	1	Nil	Nil	1
FCK-7	1	Nil	Nil	1
VT-1158 (C)	2	Nil	Nil	2
Siri (C)	1	Nil	NIL	1

Table 3 VFRBR 1.2: Chemical quality characters in AVT-II entries at Rajahmundry (2018-19)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
FCR-37	1.36	13.59	1.92
FCR-42	1.10	17.71	2.74
FCJ-28	0.45	16.47	1.83
FCS-3	0.81	15.70	1.31
FCS-4	1.15	17.81	1.88
FCK-6	1.24	12.25	2.09
FCK-7	0.67	17.36	1.88
VT-1158 (C)	0.93	17.73	1.62
Siri (C)	0.93	15.41	1.72

Pooled analysis

The pooled analysis of the two years data revealed that FCR-42 and FCK-6 were high yielders with cured leaf yields of 2261 and 2176 kg/ha respectively with a grade index of 1445 and 1361. The differences were non significant and performance was similar to checks. Hence, dropped for further evaluation.

Table 4 VFRBR 1.2: Performance of advanced breeding lines in AVT II (Pooled analysis, 2017-18 & 2018-19)

Treatments	Yield in kg/ha		
	Green leaf	Cured leaf	Bright leaf
FCR-37	11701	2049	1258
FCR-42	13248	2261	1445
FCJ-28	10005	1717	1096
FCS-3	9782	1666	1071
FCS-4	9047	1496	943
FCK-6	12382	2176	1361
FCK-7	10713	1938	1190
VT-1158 (C)	10858	1879	1292
Siri (C)	11466	2015	1318
Mean	11028	1911	1219
S.Em. ±	1801	145	94
C.D. at 5%	3242	NS	370
C.V. %	28	39	40
Seasons			
2017-18	8663	1742	908
2018-19	13393	2080	1530
S.Em. ±	1273	181	85
C.D. at 5%	NS	NS	234
C.V. %	38	23	17
Seasons X Treatments			
S.Em. ±	1801	257	120
C.D. at 5%	NS	NS	NS
C.D. at 1%			

Bulk Trial

Bulk trial was conducted with five entries and control, Siri. FCR-17 and FCR-4 recorded higher green leaf (15918 and 15306 kg/ha, respectively) cured leaf (2408 and 2388 kg/ha) yields and grade index (1327 and 1296) than Siri and other lines.

Table 1 BT: Performance of entries in Bulk Yield Trial (2018-19)

Entries	Yield in kg/ha		
	Green leaf	Cured leaf	Grade Index
FCR-4	**15,306**	**2,388**	**1,296**
FCR-17	**15,918**	**2,408**	**1,327**
FCR-26	13,877	2,204	1,198
FCR-29	12,694	2,090	1,131
FCR-30	12,510	2,069	1,076
Siri (C)	12,122	2,250	1,069

JEELUGUMILLI

VFJBR 1.1: ADVANCED VARIETAL TRIAL I

Year of start: 2018-19

Design : RBD
Plot size : 2.0 m x 12.0 m
Treatments : 9 Entries + 3 checks
Replications : Four
Spacing : 1.0 m x 0.6 m

Results

Nine entries are tested in replicated yield trial for first year; significant differences were observed among the entries for the characters green Leaf, cured leaf yield and grade index. FCR-60 and FCJ-39 showed higher cured leaf yields with 2271 and 2278 kg/ha respectively over check variety LT-Kanchan 1929 kg/ha. FCR-60 and FCJ-39 recorded significantly higher yields over the checks Kanchan (1885 kg/ha) and CH-1 (1851 kg/ha) (Table 1 VFJBR 1.1).

FCJ-60 and FCJ-39 also showed higher (non Significant) grade index with 1767 and 1772 respectively over check variety LT-Kanchan 1616, however significant over the checks Kanchan (1466) and CH-1 (1441) (Table 1 VFRJBR 1.1).

Disease /Pest incidence: low incidence of TMV and leaf curl was observed among the entries tested under natural conditions (Table 2 VFJBR 1.1).

Table 1 VFJBR 1.1: Yield characters of AVT-I entries at Jeelugumilli (2018-19)

Entries	Yield in kg/ha		Grade Index
	Green leaf	Cured leaf	
FCR-51	13097	2083	1621
FCR-52	10611	1688	1313
FCR-53	11027	1754	1365
FCR-59	13652	2172	1690
FCR-60	14277	2271#	1767#
FCJ-38	12333	1962	1527
FCJ-39	14402	2278#	1772#
FCJ-40	12597	2004	1559
FCJ-41	12430	1977	1539
Kanchan (C)	11847	1885	1466
LT Kanchan (C)	12125	1929	1501
CH-1 (C)	11638	1851	1441
Grand mean	12503	1988	1547
S.Em. ±	775	122	95
C.D. at 5%	2273	360	280
C.V. %	11	11	10

Significantly superior to checks Kanchan and CH-1

Table 2 VFRBR 1.1: Pest and disease incidence in AVT-I entries at Jeelugumilli (2018-19)

(Over 40 plants)

Entry	Number of plants affected			
	TMV	CMV	Aphid	Leaf curl
FCR-51	1	Nil	Nil	1
FCR-52	1	Nil	Nil	2
FCR-53	1	Nil	Nil	1
FCR-59	2	Nil	Nil	1
FCR-60	1	Nil	Nil	2
FCJ-38	2	Nil	Nil	1
FCJ-39	3	Nil	Nil	2
FCJ-40	1	Nil	Nil	2
FCJ-41	1	Nil	Nil	1
Kanchan (C)	2	Nil	Nil	2
LT Kanchan (C)	1	Nil	Nil	1
CH-1 (C)	1	Nil	Nil	2

* Observed under natural conditions (out of 40 plants)

VFJBR 1.2: ADVANCED VARIETAL TRIAL II

Year of start: 2018-19

Design : RBD
Replications : Four
Plot size : 2.0 m x 12.0 m
Spacing : 1.0 m x 0.6 m
Treatments : 9 Entries + 3 checks

Results

Nine entries were tested in replicated yield trial for second season (2018-19), significant differences were observed among the entries for the characters cured leaf yield and grade index. FCK-7 recorded significantly higher cured leaf yield with 2392 kg/ha compared all the three checks Kanchan (1696 kg/ha), LT-Kanchan (1699 kg/ha) and CH-1 (1865 Kg/ha) and FCR-48 recorded significantly higher cured leaf yield 2147 kg/ha over check variety LT-Kanchan1699 kg/ha and Kanchan 1696 kg/ha respectively.(Table 1.1VFJBR 1.2).

FCK-7 also showed significantly higher grade index with 1847 with check variety LT-Kanchan (1302) while the entry FCR-43 recorded significantly higher grade index of 1558 compared to checks Kanchan (1250) and CH-1 (1277) (Table 1.1 VFJBR 1.2).

Disease /Pest incidence: low incidence of TMV and leaf curl is observed among the entries tested under natural conditions (Table 2 VFRJBR 1.2).

Table 1 VFJBR 1.2: Yield characters of AVT-II entries at Jeelugumilli (2018-19)

Entries	Yield in kg/ha		Grade Index
	Green leaf	Cured leaf	
FCR-42	12069	1948	1278
FCR-43	12500	2017	1558#
FCR-45	11750	1896	1359
FCR -47	10625	1715	1324
FCR -48	13305	2147#	1267
FCJ-33	11624	1876	1107
FCJ-35	11986	1934	1141
FCJ-36	10902	1759	1038
FCK-7	14819*	2392*	1847*
Kanchan (C)	11847	1696	1250
LT Kanchan (C)	11527	1699	1302
CH-1 (C)	12416	1865	1277
Grand mean	12114	1912	1312
S.Em. ±	781	126	87
C.D. at 5%	1880	369	257
C.V. %	11	10	12

* Significantly superior over better check CH-1# significantly superior over other checks Kanchan Na d LT- Kanchan

Table 2 VFRBR 1.2: Pest and disease incidence in AVT-II entries at Jeelugumilli (2018-19)

(Over 40 plants)

Entry	Number of plants affected			
	TMV	CMV	Aphid	Leaf curl
FCR-42	1	Nil	Nil	2
FCR-43	2	Nil	Nil	1
FCR-45	2	Nil	Nil	2
FCR -47	1	Nil	Nil	1
FCR -48	1	Nil	Nil	2
FCJ-33	2	Nil	Nil	1
FCJ-35	1	Nil	Nil	1
FCJ-36	1	Nil	Nil	2
FCK-7	1	Nil	Nil	1
Kanchan (C)	2	Nil	Nil	1
LT Kanchan (C)	1	Nil	Nil	2
CH-1 (C)	2	Nil	Nil	1

Results of Pooled analysis

Pooled analysis of two years data revealed that significant differences were observed among the entries for all the three characters *Viz.*, Green Leaf, Cured Leaf and Grade index. FCK-7, FCR-42 and FCR-43, recorded higher cured leaf yields 2849, 2847 and 2816 kg/ha respectively with high grade out turn of 1875, 1666 and 1675 grade index compared to the checks Kanchan (2493 kg/ha and 1644), LT-Kanchan (2500 kg/ha and 1677) and CH-1 (2488 kg/ha and 1597). FCK-7 being high yielder among the entries with an yield improvement of 14 percent over best check LT- Kanchan and is more towards NLS tobacco type is proposed for further testing in station bulk trials.

Table 3 VFJBR 1.2: Performance of advanced breeding lines in AVT II (Pooled analysis, 2017-18 & 2018-19)

Treatments	Yield in kg/ha		
	Green leaf	Cured leaf	Bright leaf
FCR-42	16250	2847	1666
FCR-43	16544	2816	1675
FCR-45	13750	2500	1597
FCR -47	14027	2430	1597
FCR -48	14791	2500	1527
FCJ-33	15416	2777	1666
FCJ-35	13888	2430	1458
FCJ-36	14722	2638	1527
FCK-7	16875	2849	1875
Kanchan (C)	14680	2493	1644
LT Kanchan (C)	14597	2500	1677
CH-1 (C)	13583	2488	1597
Mean	14926	2605	1625
S.Em. ±	985	159	104
C.D. at 5%	2240	424	295
C.V. %	9	8	11
Seasons			
2017-18	17858	3310	1990
2018-19	12395	2002	1319
S.Em. ±	324	47	54
C.D. at 5%	899	131	149
C.V. %	5	4	8
Seasons X Treatments			
S.Em. ±	459	67	76
C.D. at 5%	1271	185	210

VFJBR 3.2: ADVANCED HYBRID TRIAL ON FCV TOBACCO (AHT II)

Year of start: 2018-19

Design : RBD Treatments : 3 Entries + 4 checks

Results

Hybrid trial is conducted with three entries along with four checks for the second season. Significant differences were observed among the entries tested for all the three characters *Viz.*, Green Leaf Cured Leaf and Grade index. The hybrid CH-163 was the top yielder among the entries tested with 2240 kg/ha cured leaf yields with 1730 grade index. Control LT-Kanchan recorded 2054 kg/ha cured leaf yields and 1586 grade index. Compared to check Kanchan the yield improvement is 30 percent and compared the check CH-1 the yield improvement is 4 percent and check LT Kanchan is 9 percent.

Disease /Pest incidence: low incidence of TMV and leaf curl is observed among the entries tested under natural conditions.

Table 1 VFRJBR 3.2: Performance of advanced hybrids in AHT II (2018-19)

S. No.	Entries	(Yield in kg/ha)		Grade index
		Green leaf	Cured leaf	
1.	CH-99	12479	2050	1584
2.	CH-163	13635*	2240	1730
3.	CH-228	10979	1804	1392
4.	Kanchan (C)	10479	1722	1330
5.	LT-Kanchan (C)	12500	2054	1586
6.	CH-1 (C)	13020	2139	1651
7.	CH-3 (C)	10947	1799	1388
	Mean	12005	1973	1523
	S.Em ±	646	106	81
	C.D. at 5%	1919	315	242
	C.V. (%)	11	12	11

Table 2 VFRBR 3.2: Pest and disease incidence in AHT-II entries at Jeelugumilli (2018-19)

Entry	Number of plants affected per 40 plants			
	TMV	CMV	Aphid	Leaf Curl
CH-99	1	Nil	Nil	1
CH-163	1	Nil	Nil	1
CH-228	1	Nil	Nil	2
Kanchan (C)	2	Nil	Nil	1
LT Kanchan (C)	1	Nil	Nil	1
CH-1 (C)	1	Nil	Nil	1
CH-3 (C)	2	Nil	Nil	1

Results of Pooled analysis

Pooled analysis of the data revealed that among the entries significant differences were observed for the characters green leaf, cured leaf and grade index. The hybrid CH-163 was the higher yielder among the three hybrids with 2319 kg/ha cured leaf yields (lower than better control LT-Kanchan 2366 kg/ha) with 1671 grade index. Compared to the control Kanchan (2007 kg/ha) the hybrid CH-163 is significantly superior.

Table 3 VFJBR 3.2: Performance of advanced breeding lines in AVT II (Pooled analysis, 2017-18 & 2018-19)

Treatments	Yield in kg/ha		
	Green leaf	Cured leaf	Bright leaf
CH-99	10895	2168	1535
CH-163	11557	2319#	1671#
CH-228	10182	2131	1566
Kanchan (C)	10223	2007	1358
LT-Kanchan (C)	11536	2366	1622
CH-1 (C)	10166	1998	1389
CH-3 (C)	9781	2082	1453
Mean	10620	2153	1513
S.Em. ±	797	110	86
C.D. at 5%	2759	295	240
C.V. %	39	27	30
Seasons			
2017-18	9235	2333	1503
2018-19	12006	1973	1523
S.Em. ±	204	164	1230
C.D. at 5%	565	NS	NS
C.V. %	5	22	23
Seasons X Treatments			
S.Em. ±	288	232	171
C.D. at 5%	799	NS	NS

BULK TRIAL

Three entries were assessed in bulk trial for assessing yield and quality. FCJ-11 (3317 kg/ha) out yielded with superior quality medium bodied lemon to orange colored cured leaf. Checks Kanchan and LT- Kanchan yielded cured leaf of 2400 and 2525 kg/ha and grade index of 1260 and 1708 (Table BT).

Table 1 BT: Performance of advanced breeding lines in bulk trial (2018-19)

Entry	Yield in kg/ha		Grade index
	Green leaf	Cured leaf	
FCJ-11	18791	3317	2350
Kanchan (C)	11850	2400	1260
LT-Kanchan (C)	12350	2525	1708

ON FARM TRIAL

In the on-farm trial conducted with FCJ-11 and control, Kanchan at seven locations at NLS area, FCJ-11 recorded 30% increase in mean cured leaf yield (2507 kg/ha) over Kanchan (1933 kg/ha). In general the crop was affected with heavy rains in the early part of the crop growth under NLS. Under such situations, FCJ-11 found to withstand the rains with less crop damage and gave higher yields compared to Kanchan. Bright leaf percent was equal (80%) in both the lines.

Table OFT: Performance of advanced breeding lines in on farm trial (2018-19)

Name of the Farmer	Village Name	Cured leaf yield in kg/ha	
		FCJ-11	Kanchan
Achanta Balakrishna	Sangayagudem	2500	1850
Gidda Venkateswarao	Sangayagudem	2500	1890
Bondala Reddayya	Acchayapalem	2450	1950
Alla Subbarao	Jeelugumilli	2500	1940
K.Hemanth Prasad	Jeelugumilli	2550	1900
Putatta Mahesh	Yernagudem	2250	1800
Pampana Srinivas	Buttayagudem	2800	2200
		2507 (30)	1933

Note: Figures in the parenthesis are percent increase over Kanchan

GUNTUR

VFGBR 1.1: ADVANCED VARIETAL TRIAL I

Year of start: 2018-19

Design : RBD
Replications : Four
Plot size : 2.8 x 4.0 m
Spacing : 70 x 70 cm
Treatments : 4 entries + 2 checks

Results

Four improved lines *viz.*, FCR-55, FCR-56, FCR-57 and FCR-58 were evaluated in replicated trial for yield and quality. Among these, the performance of FCR-56 was significantly superior to other three lines and also two controls (Hemadri & Siri). All other treatments including two checks were on par with each other. Maximum green leaf of 13527 kg/ha, cured leaf of 2551 kg/ha, bright leaf of 1382 kg/ha and grade index of 2091 kg/ha was recorded in FCR-56 (Table-VFGBR-1.1). There was an increase of 21.91, 19.39 and 20.34% in respect of cured leaf, bright leaf and grade index, respectively due to FCR-56 entry over the check, Siri.

The same trial will be conducted as AVT-II during 2019-20.

Table 1 VFGBR 1.1: Yield parameters (kg/ha) (2018-19)

S. No	Treatment	Green Leaf	Cured Leaf	Bright Leaf	Grade Index
1	FCR-55	10803	1860	1095	1651
2	FCR-56	13527*	2551*	1382*	2091*
3	FCR-57	10357	1802	1053	1555
4	FCR-58	12120	2184	1122	1764
5	Hemadri (C)	10000	1763	991	1503
6	Siri (C)	11161	1992	1114	1665
	S.Em ±	757	134	85	110
	C.D. at 5%	2281	406	247	332
	C.V. (%)	13.37	13.32	15.11	12.88

*Significantly superior over Siri (C)

VFGBR 1.2: ADVANCED VARIETAL TRIAL II

Year of start: 2018-19

Design : RBD
Replications : Four
Plot size : 2.8 x 4.0 m
Spacing : 70 x 70 cm
Treatments : 4 entries + 2 checks

Results

In AVT-2, four lines *viz.*, FCR-41, FCR-44, FCR-46, & FCR-47 were evaluated in RBD with four replications along with two checks (Siri and Hemadri) for their yield and quality. The trial was conducted in two consecutive years i.e. 2017-18 and 2018-19 and the data recorded on yield parameters of second year trial were presented in Table 1 VFGBR 1.2. The data revealed that 2 test lines *viz.*, FCR-44 & FCR-47 were significantly superior to both checks. Maximum yields of 16790, 2868, 1613 & 2455 kg/ha of green leaf, cured leaf, bright leaf and grade index, respectively were recorded in FCR-47 followed by FCR-44 with 15941, 2701, 1495, 2394 kg/ha, respectively. An extent of 14.43, 22.19 and 19.47% increase of cured leaf, bright leaf and grade index, respectively were recorded in FCR-47 over the check, Siri.

The data on chemical quality parameters were presented in the Table 2 VFGBR 1.2. Nicotine, reducing sugars and chlorides were within the acceptable limits in all the entries including checks. Nicotine ranged from 2.53 to 3.40%, reducing sugars ranged from 13.31 to 21.58% and chlorides ranged from 0.85 to 1.51% in test entries and checks.

Table 1 VFGBR 1.2: Yield parameters (kg/ha) (2018-19)

S. No	Treatment	Green Leaf	Cured Leaf	Bright Leaf	Grade Index
1	FCR-41	12924	2353	1245	1947
2	FCR-44	15941*	2701*	1495*	2394*
3	FCR-46	14651	2511	1381	2157
4	FCR-47	16790*	2868*	1613*	2455*
5	Hemadri (C)	12589	2318	1206	1888
6	Siri (C)	14063	2454	1255	1977
	S.Em ±	364	72	63	60
	C.D. at 5%	1099	219	192	183
	C.V. (%)	9.81	8.49	8.86	9.42

*Significantly superior over Siri (C)

Table 2 VFGBR 1.2: Chemical quality parameters (2018-19)

S. No	Treatment	Nicotine %	Reducing Sugars %	Chlorides %
1	FCR-41	2.53	17.17	1.48
2	FCR-44	2.61	19.09	1.50
3	FCR-46	3.37	17.62	1.35
4	FCR-47	3.40	21.58	0.85
5	Hemadri (C)	2.59	13.31	1.51
6	Siri (C)	2.74	18.28	1.10

Pooled analysis

Treatments: The results of combined analysis over two years revealed that similar trend was observed where, FCR-44 & FCR-47 were significantly superior to both checks (Table 3 VFGBR-1.2). FCR-44 produced more green leaf (17758 kg/ha), cured leaf (2681 kg/ha), bright leaf (1585 kg/ha) and grade index (2260 kg/ha) followed by FCR-47 (17680, 2702, 1570 and 2236 kg/ha) when compared to the better check, Siri (14771, 2392, 1300 and 1906 kg/ha).

Seasons: Seasons not differed significantly for all the yield characters studied. However, the best season was 2017-18 in respect of quantity of leaf obtained with average green leaf of 16712, cured leaf of 2334, bright leaf of 1419 and grade index of 1882 Kg/ha. Both the entries namely, FCR-44 and FCR-47 out yielded in both the seasons. Overall, there was an increase of 10.78, 17.98 and 15.66% of cured leaf, bright leaf and grade index, respectively due to FCR-44 over the standard check, Siri.

Seasons X Treatments: The interaction between seasons and treatments was significant for all the yield characters studied. Maximum green leaf, cured leaf, bright leaf and grade index were recorded in FCR-44 during 2017-18. Based on the overall performance of the entries, it was concluded that both FCR-44 and FCR-47 performed better when compared with other two entries and checks. Hence, FCR-44 and FCR-47 will be further evaluated under bulk trial during 2019-20.

Table 3 VFGBR 1.2: Yield parameters (kg/ha) in different AVT II entries – Pooled analysis (2017-18 and 2018-19)

Treatment	Green Leaf	Cured Leaf	Bright Leaf	Grade Index
FCR-41	13864	2224	1254	1825
FCR-44	17758*	2681*	1585*	2260*
FCR-46	16324	2522	1453	2103
FCR-47	17680*	2702*	1570*	2236*
Hemadri (C)	13217	2086	194	1727
Siri (C)	14771	2392	1300	1906

Treatment	Green Leaf	Cured Leaf	Bright Leaf	Grade Index
Treatments				
S.Em ±	620	90	67	77
C.D at 5%	1868	273	203	232
C.V (%)	11.40	9.22	10.0	10.63
Seasons				
2017-18	16712	2334	1419	1882
2018-19	14660	2251	1363	1845
S.Em ±	1020	317	24	363
C.D at 5%	NS	NS	NS	NS
C.V (%)	16.17	11.24	9.72	14.23
Seasons X Treatments				
S.Em ±	395	192	101	150
C.D at 5%	1183	575	304	451

*Significantly superior over Siri (C)

BULK TRIAL

The entry, FCR-38 identified as superior in AVT-2 during 2017-18 was further evaluated in bulk trial along with better check, Siri. Each variety was planted separately in about 0.05 ha (1000 plants each). The yield data revealed that green leaf of 16467 kg/ha, cured leaf of 2498 kg/ha, bright leaf of 1551 kg/ha and grade index of 2156 kg/ha was recorded in FCR-38 with an increase of 4.85, 5.01, 5.15 and 5.18%, respectively over the standard check, Siri (Table BT).

Table 1 BT: Performance of advanced breeding lines in bulk trial (2018-19)

Entry	Yield in kg/ha			
	Green leaf	Cured leaf	Bright leaf	Grade index
FCR-38	16467	2498	1551	2156
Siri (C)	15705	2380	1475	2050
% increase	4.85	5.01	5.15	5.18

KANDUKUR

VFKBR 1.1: ADVANCED VARIETAL TRIAL- I

Year of start: 2018-19

Design : RBD
Plot size : 2.6 x 5.85 m
Treatments : 6 entries + 3 checks
Replications : Four
Spacing : 0.65 x 0.65 m

Results

Six lines *viz*., FCR-51, FCR-53, FCR-55 FCR-58 FCR-59 and FCR-60 were evaluated along with three checks viz., Siri, VT-1158 and N-98 in a replicated trial. Among the lines evaluated, FCR-60 recorded significantly superior green leaf yield (12319 kg/ha) with an increase of 15 per cent over better control, Siri (10675 kg/ha). FCR-60 recorded significantly superior cured leaf yield (1895 kg/ha) with an increase of 27 per cent over Siri (1491 kg/ha) (Table 1 VFRKBR 1.1). FCR-60 recorded significantly superior bright leaf yield of 1155 kg/ha with an increase of 25 per cent over Siri (922 kg/ha). FCR-60 also recorded significantly superior grade index of 1583/ha with an increase of 29 per cent over Siri (1224/ha) respectively.

Incidence of pests and diseases (Table 2 VFRKBR 1.1) was low during 2018-19. FCR-60 was the better performer during 2018-19. The same trial will be conducted during 2019-20 as AVT-2.

Table 1 VFRKBR 1.1: Yield characters in kg/ha (2018-19)

Treatment	Green leaf	Cured leaf	Bright leaf	Grade index
FCR-51	10856	1548	914	1236
FCR-53	10453	1553	978	1306
FCR-55	9895	1556	981	1308
FCR-58	10026	1548	975	1297
FCR-59	9336	1527	945	1269
FCR-60	12319**	1895**	1155**	1583**
Siri (C)	10675	1491	922	1224
VT-1158 (C)	10207	1458	889	1196
N-98 (C)	10478	1474	899	1209
Grand Mean	10472	1561	962	1293
S.Em ±	357	58	36	46
C.D. at 5%	1042	169	105	135
C.V. (%)	6.82	7.42	7.50	7.16

*Significant at 5% and **Significant at 1%

Table 2 VFRKBR 1.1: Incidence of pests and diseases (2018-19)

Entries	Out of 36 plants								
	TMV	Aphid	Caterpillar	CMV	LCA	LCB	LCC	LCD	LCX
FCR-51	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-53	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-55	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-58	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-59	Nil	Nil	Nil	Nil	Nil	1	Nil	Nil	Nil
FCR-60	Nil	Nil	Nil	Nil	Nil	1	Nil	Nil	Nil
Siri (C)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
VT-1158 (C)	Nil	Nil	Nil	Nil	2	1	Nil	Nil	Nil
N-98 (C)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

VFRKBR 1.2: ADVANCED VARIETAL TRIAL II

Year of start: 2018-19

Design : RBD
Plot size : 2.6 x 5.85 m
Treatments : 4 entries + 3 checks
Replications : Four
Spacing : 0.65 x 0.65 m

Results

Four lines viz., FCR-41, FCR-47, FCR-49 and FCR-50 were evaluated along with three checks viz., Siri, VT-1158 and N-98 in a replicated trial for the second year. Results revealed that treatments differed significantly for all the four yield characters studied. Green leaf yield was significantly higher in FCR-47 (12944 kg/ha), FCR-41 (11884 kg/ha) and FCR-49 (11662 kg/ha) over Siri (10125 kg/.ha). The yield increase over better control Siri was 28, 17 and 15 per cent respectively over Siri. FCR-47 also recorded significantly higher cured leaf yield of 1819 kg /ha and increase over Siri (1484 kg/ha) was 22 per cent. Other better performers were FCR-41 (1755 kg/ha) and FCR-49 (1655 kg/ha) with an increase of 18 and 12 per cent over Siri. Bright leaf yield was significant in FCR-47 (1164 kg/ha) with an increase of 26 per cent over better check Siri (920 kg/ha). FCR-41 and FCR-49 also recorded significantly higher bright grade leaf of 1104 kg/ha and 1024 kg/ha respectively with an increase of 20 and 11 per cent over Siri (Table 1 VFKBR1.2).

FCR-47 also recorded significantly higher grade index (1546 /ha) over better check Siri (1233/ha) and its increase over Siri was 25 per cent followed by FCR-41(1485 /ha) and FCR-49 (1391 /ha). FCR-47 was the better entry during 2018-19. Pest and disease incidence in general was low (Table 2 VFKBR 1.2).

Table 1 VFRKBRC 1.2: Yield parameters (2018-19)

Entries	Yield in kg/ha			Grade index
	Green leaf	Cured leaf	Bright leaf	
FCR-41	11884**	1755**	1104**	1486**
FCR-47	12944**	1819**	1164**	1546**
FCR-49	11662**	1665*	1024*	1391*
FCR-50	7783	1266	792	1051
Siri (C)	10125	1484	920	1233
VT-1158 (C)	9582	1428	858	1165
N-98 (C)	9862	1473	897	1221
Grand mean	10549	1556	966	1299
SEM ±	345	66	35	47
CD at 5%	1025	165	103	141
CD at 1%	1404	226	141	193
CV (%)	6.54	7.15	7.20	7.32

Table 2 VFRKBR1.2: Incidence of pests and diseases (2018-19)

Entries	Out of 36 plants								
	TMV	Aphid	Caterpillar	CMV	LCA	LCB	LCC	LCD	LCX
FCR-41	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-47	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-49	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
FCR-50	Nil	Nil	Nil	Nil	Nil	1	Nil	Nil	Nil
Siri (C)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
VT-1158 (C)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
N-98 (C)	Nil	Nil	Nil	Nil	Nil	Nil	1	Nil	Nil

Pooled analysis: Combined analysis of the data pertaining to 2017-18 and 2018-19 revealed that seasons and treatments variation was significant for all the four yield parameters. Green leaf yield was significantly superior in FCR-47 (13766 kg/ha) and FCR-41 (12480 kg/ha) with an increase of 26 and 15 per cent respectively over Siri (10883 kg/ha). Cured leaf yield was significantly superior in FCR-47 (1982kg/ha), FCR-41 (1846 kg/ha) and FCR-49 (1681kg/ha) and increase over Siri (1574kg/ha) was 26, 17 and 7 per cent respectively. FCR-47 (1268 kg/ha) and FCR-41 (1173 kg/ha) recorded significantly superior bright leaf yield over Siri (993 kg/ha) with an increase of 28 and 18 per cent respectively. Grade index was significantly superior in FCR-47 (1669 /ha) and FCR-41 (1549 /ha) with an increase of 27 and 17 per cent over better control, Siri (1318 /ha). Seasons differed significantly and the best season is 2017-18 with 11856 kg/ha green leaf, 1727 kg/ha cured leaf, 1092 kg/ha bright leaf and 1439 /ha grade index. Interaction of seasons X treatments was not significant for all the four yield characters. FCR-47 was the better performer among the entries evaluated. Data presented in Table 3 VFKBR 1.2.

Hence, FCR-47 with 13766 kg/ha green leaf, 1982 kg/ha cured leaf, 1268 kg/ha bright leaf and 1669 /ha grade index with an increase of 26, 26, 28 and 27 per cent higher yield over better control, Siri respectively was the best entry and proposed for testing in bulk trial during 2019-20.

Table 3 VFKBR 1.2: Combined analysis of yield, seasons x treatments (2017-18 and 2018-19)

Treatments	Yield in kg/ha			Grade Index
	Green leaf	Cured Leaf	Bright Leaf	
FCR-41	12480**	1847**	1173**	1549**
FCR-47	13766**	1982**	1268**	1669**
FCR-49	11519	1681*	1038	1398
FCR-50	8802	1327	827	1094
Siri(C)	10883	1574	998	1318
VT-1158(C)	10353	1520	937	1256
N-98 (C)	10615	1560	967	1298
G. Mean	11202	1642	1029	1369
SEM ±	253	38	24	32
CD at 5%	702	106	67	90
CD at 1%	923	139	88	118
CV%	6.40	6.58	6.65	6.72
Seasons				
2017-18	11856	1727	1092	1439
2018-19	10549	1556	966	1299
SEm ±	208	42	26	34
C.D. at 5%	721	147	90	118
C.D. at 1%	1093	NS	NS	NS
C.V. %	9.85	13.67	13.32	13.22
Seasons X Treatments				
SEm ±	358	54	34	46
CD at 5%	NS	NS	NS	NS
CD at 1%	NS	NS	NS	NS

BULK TRAIL

Bulk trial was conducted with FCR-34, FCR-39, Siri, VT-1158 and N-98. FCR-39 recorded higher yield over better control Siri (Table1 Bulk Trial). FCR-39 recorded 11551 kg/ha green leaf yield, 1475 kg/ha cured leaf yield, 929 kg/ha bright leaf yield and 1147 /ha grade index with an increase of 24, 11, 13 and 12 per cent respectively over better control Siri. FCR-39 is proposed for large scale testing in the farm.

Table 1 BULK TRIAL: Yield parameters in kg/ ha

S. No.	Entries	Green Leaf	Cured Leaf	Bright Leaf	Grade Index
1.	FCR-34	9467	1369	847	1055
2.	FCR-39	11551	1475	929	1147
3.	Siri (C)	9291	1324	821	1020
4.	VT-1158 (C)	9021	1276	796	985
5.	N-98(C)	9130	1297	805	1002

HUNSUR

VFHBR 1.1: ADVANCED VARIETAL TRIAL ON FCV TOBACCO (AVT I)

Year of start : 2018-19
Design : RBD
Replications : Three
Plot size : 2.0 x 6.6 m
Treatments : 16 entries + 2 checks

Results

In AVT-1, six entries *viz*., FCJ 33, FCJ 34, FCJ 35, FCJ 37, FCJ 40 and FCJ 41 were further evaluated against checks (Kanchan and FCH 222) for their yield performance. Data recorded in terms of yield was analyzed and the results revealed significant differences among the entries tested for all the yield parameters (Table 1 VFHBR 1.1). Entry, FCJ 40 was found to be promising in terms of yield with 10% improvement in green leaf yield (11120 kg/ha) and 21% improvement in cured leaf yield (1530 kg/ha), bright leaf yield (1009 kg/ha)) and TGE (1108) over Kanchan followed by FCJ 41 though not statistically significantly superior over checks. Among the lines identified as TMV resistant in IVT of previous year, line FCJ 35 has yielded on par with Kanchan.

Incidence of wilt was high among the entries tested (Table 2 VFHBR 1.1) which ranged from 7% (FCH 222) to 35% (FCJ 33 and Kanchan).

Leaf chemical quality was estimated in terms of percent nicotine, reducing sugars and chlorides. Nicotine and reducing sugars were well within the prescribed limit while chlorides were on little higher side (Table 3 VFHBR 1.1).

Table 1 VFHBR 1.1: Yield parameters (2018-19)

Entries	Yield in kg/ha			Top Grade Equivalent
	Green leaf	Cured leaf	Bright leaf	
FCJ-33	5458	825	554	599
FCJ-34	8391	1174	783	847
FCJ-35	9905	1319	878	960
FCJ-37	9449	1228	817	886
FCJ-40	11120	1530	1009	1108
FCJ-41	11137	1418	941	1033
Kanchan (C)	9181	1200	798	873
FCH 222 (C)	9960	1375	932	1011
S.Em ±	911	112	76	85
C.D. at 5%	2762	340	231	257
C.V. (%)	16.91	15.41	15.72	16.03

Table 2 VFHBR 1.1: Incidence of pest and disease (2018-19)

Entries	Wilt (% incidence)	RKI (Range)	TMV	LC
FCJ-33	35	2	-	-
FCJ-34	28	1-2	-	-
FCJ-35	28	1	-	-
FCJ-37	14	2-3	-	-
FCJ-40	22	2-3	-	-
FCJ-41	31	2-3	-	-
Kanchan (C)	35	1-2		
FCH 222 (C)	7	1-2		

Table 3 VFHBR 1.1: Chemical quality (%) parameters (2018-19)

Entries	Nicotine		Reducing Sugars		Chlorides	
	X	L	X	L	X	L
FCJ-33	1.16	2.14	12.51	12.82	1.04	0.55
FCJ-34	0.83	2.66	11.48	5.11	0.94	0.72
FCJ-35	1.04	1.88	8.06	11.27	1.05	0.77
FCJ-37	0.70	2.28	12.37	12.16	0.82	0.66
FCJ-40	0.98	2.44	12.66	9.95	1.02	0.76
FCJ-41	1.16	1.80	15.27	12.44	0.89	0.77
Kanchan (C)	0.88	2.26	15.60	12.19	0.93	0.64
FCH 222 (C)	0.84	1.65	13.02	12.83	0.99	0.93

SHIVAMOGGA

VFSBR 1.1: ADVANCED VARIETAL TRIAL I

Year of start: 2018-19

Design : RBD
Treatments : 4 Entries + 3 Checks
Gross plot size: 6.0 X 2.7 m
Net plot size : 6.0 X 2.7 m
Replications : Three
Fertilizer dose: 40:30:80 NPK

Results

Among the four genotypes tested, one entry FCJ-38 has recorded significantly higher GLY (12916 kg/ha), CLY (1669 kg/ha) and TGE (1168 kg/ha) over the best check Kanchan.

Table 1 VFSBR 1.1: Yield characters and Root-knot index of AVT-I entries (2018-19)

Entries	Yield in kg/ha		TGE	Root-knot index
	Green leaf	Cured leaf		
FCR-53	11227	1494	1046	3.0 (MS)
FCR-55	10980	1409	983	3.0 (MS)
FCR-60	11043	1491	1042	4.0 (S)
FCJ-38	12916*	1669*	1168*	4.0 (S)
Thrupti (C)	10295	986	709	
Kanchan (C)	10040	1002	795	
Sahyadri (C)	10972	1024	812	
Grand mean	11177	1357	944	
C.D. at 5%	992	187	126	
C.V. %	2860	582	357	
S.Em. ±	14.46%	15.73%	16.58%	

VFSBR 1.2: ADVANCED VARIETAL TRIAL II

Year of start: 2018-19

Design : RBD
Treatments : 7 Entries + 1 Check
Net plot size : 6.0 X 2.7 m
Replications : Three
Gross plot size: 6.0 X 2.7 m
Fertilizer dose: 40:30:80 NPK

Results

Seven genotypes were tested in replicated trial against a check Kanchan. The entry FCJ-36 has recorded significantly higher GLY (12851 kg/ha) and CLY (1741 kg/ha). It has given numerically higher TGE of 1345 kg/ha over the check Kanchan. Followed by FCR-49 which has recorded GLY of 12381 kg/ha, CLY of 1610 kg/ha and TGE of 1268 kg/ha. Under AVT- 2 genotypes, FCR-49 recorded highest laminar potassium content at X (2.75%) and L position (3.17%). Among the five AVT-I and seven AVT-II entries, except FCJ-33 (AVT-II) all were showed moderately resistant reaction to frog eye leaf spot with the disease severity of ranges from 20.63 to 39.65 per cent. FCJ- 33 found moderately susceptible reaction with the disease severity of 43.83% respectively (Table 2 FVSBR 1.2).

Table 1 VFSBR 1.2: Yield characters of AVT-II (2018-19)

Entries	Yield in kg/ha		
	Green leaf	Cured leaf	TGE
FCK-7	11418	1541	1202
FCR-43	12068	1569	1179
FCJ-36	12851*	1741*	1345
FCR-49	12381	1610	1268
FCJ-33	10804	1459	1138
FCJ-35	9356	1268	953
FCR-50	8448	1056	811
Kanchan (C)	9528	1286	1093
Grand mean	10857	1441	1136
S.Em. ±	873	117	86
C.D. at 5%	2649	354	262
C.V. %	13.93	14.02	13.18

Table 2 VFSBR 1.2: Incidence of disease reaction and laminar potassium content (%) of AVT-II (2018-19)

Entries	Disease reaction (%)		Root-knot index	Laminar potassium content (%)	
	Frog-eye-leaf spot	Black shank		X	L
FCK-7	MR (22.25)	MR (4.00)	3.0 (MS)	2.67	2.40
FCR-43	MR (25.50)	MR (4.00)	3.0 (MS)	2.33	2.69
FCJ-36	MR (24.50)	MS (12.00)	4.0 (S)	2.16	2.88
FCR-49	MR (20.63)	MS (16.00)	4.0 (S)	2.75	3.17
FCJ-33	MS (43.83)	MS (12.00)	3.0 (MS)	2.42	2.75
FCJ-35	MR (39.65)	MR (8.00)	3.0 (MS)	2.20	3.07
FCR-50	MR (23.18)	MS (12.00)	3.0 (MS)	2.39	2.82
Kanchan (C)	MR (20.60)	MS (28.00)		2.72	2.97
S.Em. ±				0.11	0.15
C.D. at 5%				0.39	0.47

Pooled analysis

Seven genotypes were tested in replicated trial against the check Kanchan. The entry FCR-49 has given significantly higher GLY of 15526 kg/ha and TGE of 1493 kg/ha while the entry FCJ-36 has given the highest CLY of 1997 kg/ha over the years.

Table 3 VFSBR 1.2: Pooled analysis of Yield characters of AVT-II (2017-19)

Entries	Yield in kg/ha		
	Green leaf	Cured leaf	TGE
FCK-7	14555*	1844*	1386
FCR-43	14217	1785	1310
FCJ-36	15271*	1997*	1447*
FCR-49	15526*	1957*	1493*
FCJ-33	12255	1597	1178
FCJ-35	10445	1330	993
FCR-50	13477	1700	1232
Kanchan (C)	12655	1638	1234
Grand mean	13550	1731	1284
S.Em. ±	543	66	56
C.D. at 5%	1647	201	169
C.V. %	6.94	6.63	7.53

VFSBR 1.2: ADVANCED VARIETAL TRIAL II (REPEAT)

Year of start: 2018-19

Design : RBD
Treatments : 5 Entries + 3 Checks
Fertilizer dose: 40:30:80 NPK
Replications : Three
Gross plot size: 6.0 X 2.7 m
Net plot size : 6.0 X 2.7 m

Results

Five genotypes were tested in replicated trial along with three checks *viz*., Thrupti, Sahyadri and Kanchan during 2018-19. Results revealed that the entry FCS-4 recorded significantly higher GLY of 13855 kg/ha, 1870 kg/ha of CLY and 1590 kg/ha of TGE over all the three checks. Lesser incidence Black shank was observed in FCS-4 and FCS-3. Aphid incidence was observed in low frequency. Laminar potassium content varied significantly in AVT-1 genotypes. FCS-4 recorded highest laminar potassium content in L position (3.27%) followed by FCJ-30 (3.19%).

Table 1 VFSBR 1.1: Yield characters of AVT-II (R) entries (2018-19)

Entries	Yield in kg/ha		
	Green leaf	Cured leaf	TGE
FCJ-27	12840	1715	1318
FCS-4	13855*	1870*	1590*
FCJ-28	11813	1601	1231
FCS-03	7342	954	811
FCJ-30	9605	1297	1040
Thrupti (C)	10876	1474	1108
Kanchan (C)	11405	1426	1100
Sahyadri (C)	11142	1468	1131
Grand mean	11110	1476	1166
S.Em. ±	668	95	86
C.D. at 5%	2025	289	262
C.V. %	10.4	11.2	12.8

Table 2 VFSBR 1.2: Incidence of disease reaction (%) of AVT-II (R) (2018-19)

Entries	Disease reaction (%)		Laminar potassium content (%)	
	Frog-eye-leaf spot	Black shank	X	L
FCJ-27	MR (26.00)	MR(6.65)	2.72	2.61
FCS-4	MR (24.63)	MR(4.8)	2.63	3.27
FCJ-28	MR (25.50)	MS (16.00)	2.96	2.54
FCS-03	MR (22.65)	MR (4.00)	2.28	2.78
FCJ-30	MR (28.50)	MR (8.00)	2.46	3.19
Thrupti (C)			2.90	2.72
Kanchan (C)			3.05	2.96
Sahyadri (C)			2.78	2.86
S.Em. ±			0.08	0.16
C.D. at 5%			0.25	0.47

Pooled analysis

Five genotypes were tested over two years along with three checks viz., Thrupti, Sahyadri and Kanchan during 2017-18 and 2018-19. Results revealed that the entry FCS-4 recorded significantly higher GLY of 14407 kg/ha, 1932 kg/ha of CLY and 1368 kg/ha of TGE over all the three checks. Followed by FCJ-27 which has given significantly higher GLY and CLY over all the three checks.

Table 3 VFSBR 1.2: Pooled analysis of yield characters of AVT-II (R)(2017-19)

Entries	Yield in kg/ha		
	Green leaf	Cured leaf	TGE
FCJ-27	13808*	1788*	1309
FCS-4	14407*	1932*	1368*
FCJ-28	12845	1671	1225
FCS-03	9699	1255	981
FCJ-30	12852	1665	1287
Thrupti (C)	10101	1293	866
Kanchan (C)	11608	1487	1113
Sahyadri (C)	11571	1437	1136
Grand mean	12111	1566	1161
S.Em. ±	637	91	65
C.D. at 5%	1932	277	198
C.V. %	9.11	10.10	9.76

VFSBR 3: STATION SELECTION TRIAL

Objectives:

1. To identify high yielding and good quality FCV tobacco varieties for zone 7
2. To develop/identify varieties for abiotic stress especially for moisture stress

Design : RBD
Treatments : 5 entries + 3 checks
Fertilizer dose: 40:30:80 N:P:K (kg/ha)
Replications : Three
Gross plot size: 6.0 x 5.4 m
Net plot size : 4.8 x 3.6 m

Results

Among the six genotypes tested, the entries Tobios-6, FCS-4 and FCS-3 have recorded significantly higher GLY, CLY and TGE compare to checks Sahyadri and Kanchan. Among these entries Tobios-6 has recorded highest cured leaf yield of 1502 kg/ha with an increase of 26% over the best check Kanchan followed by FCS-4 which has recorded 1395 kg/ha of cured leaf. Five SSTs entries *viz.*, FCR-53, FCR-54, FCR-55, FCS-4, FCS-3 and Tobios-6 screened against frog eye leaf spot were showed moderately resistant reaction with disease severity of 20.65, 25.38, 23.13, 20.00, 27.00 and 25.38 per cent, respectively.

Table 1 VFSBR 3: Leaf yield characterization in FCV genotypes (2017-18)

Genotypes	Yield (kg/ha)			Disease Reaction (%)	
	Green leaf	Cured leaf	TGE	Frog eye leaf spot	Black shank
FCR-53	8993	1214	950	MR (20.65)	MR (8.00)
FCR-54	8416	1094	930	MR (25.38)	MS (12.00)
FCR-55	7968	1080	811	MR (23.13)	MS (16.00)
FCS-4	10731*	1395*	1049*	MR (20.00)	MR (8.00)
FCS-3	10315*	1393*	1090*	MR (27.00)	MR (4.00)
Tobios-6	10823*	1502*	1133*	MR (25.38)	MR (8.00)
Kanchan (C)	9465	1183	911	S (73.75)	MS (28.00)
Sahyadri (C)	8169	1103	937	MS (49.50)	MS (24.00)
Mean	9485	1258	989		
S.Em. ±	16	16	15		
C.D. at 5%	873	114	88		
C.V. %	15.94	15.75	15.47		

SEGREGATING POPULATIONS

Objective: To develop/ Identify high yielding good quality FCV tobacco varieties

Results: Phenotypically superior genotypes are selected from early generations and carried forward to next generation. Five F_3, F_4 populations and eight F_5 populations were raised and selections were made based on the phenotypic characters.

F_3 - GENERATION	F_4 - GENERATION	F_5 - GENERATION
1. TB-100 X TB-102	Tobios-6 x Sahyadri	V-4283 x SL-24
2. Tobios-6 x Sahyadri	Tobios-6 x Thrupthi	V-4238 x SL-24
3. Tobios-6 x Kanchan	Tobios-5 x Thrupthi	CY-139 x Sahyadri
4. NLST-2 x FCH-221	Tobios-5 x Thrupthi	Bhavya x Tobios-5
5. Tobios-6 x Thrupthi	NLSH-1 x Kanchan	V-4267 x Bhavya
		CY-139 x Sahyadri
		Bhavya x Tobios-5
		V-4267 x Bhavya

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

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

Design : RBD
Replications : Two
Net plot size : 6.0 x 2.7 m
Gross plot size: 6.0 x 2.7 m
Treatments : One hundred & three
Fertilizer dose: 40:30:80 N:P:K (kg/ha)

Results

Hundred entries including 3 checks were evaluated. The top five genotypes REAMS-158, RHOMAS-7, REAMS-134, SILK LEAF and VIRGINIACI, which were significantly superior to local checks in respect of GLY, CLY and TGE.

Table 1 VFSBR 5: Leaf yield characterization in FCV tobacco genotypes during 2018-19

S. No.	Genotypes	Yield (kg/ha)		
		Green leaf	Cured leaf	TGE
1.	T-1-448	6510	846	635
2.	T-1-163	8526	1108	831
3.	T-165	7902	1027	770
4.	TANTA	6606	859	644

S. No.	Genotypes	Yield (kg/ha)		
		Green leaf	Cured leaf	TGE
5.	TB-22	8388	1090	818
6.	TRC-1-96	5628	732	549
7.	VA-21	9960	1295	971
8.	VA-45	8823	1147	860
9.	VA-259	12951	1684	1263
10.	VA-309	12171	1582	1187
11.	VA-310	9786	1272	954
12.	VA-405	9906	1288	966
13.	VA-509	14493	1884	1413
14.	VA770	12669	1647	1235
15.	AUREA	10512	1367	1025
16.	VIRGINIA	13614	1770	1327
17.	VIRGINIACI	16032	2084	1563
18.	V-373(SER)	11970	1556	1167
19.	WHITE MAMMOTH	5208	677	508
20.	WARME- V-92	5526	718	539
21.	NC11271	7671	997	748
22.	NC-2326	12537	1630	1222
23.	NC-3150	7836	1019	764
24.	NIS NICTINOVY-1122	6297	819	614
25.	NC-401	7281	947	710
26.	NCPY-10	5211	677	508
27.	NLS-1	13503	1755	1317
28.	NLS-2	13563	1763	1322
29.	NLS-5	10209	1327	995
30.	NOO-90	7467	971	728
31.	OXFORD-1	6612	860	645
32.	PULAWASAKA-13	6735	876	657
33.	PYKY-171	11595	1507	1131
34.	Q-46	11301	1469	1102
35.	REAM -51-NO-1	7515	977	733
36.	RHOMAS-7	17364	2257	1693
37.	RIWAKA-3	8913	1159	869
38.	RK-70	5196	675	507
39.	SALTE IMPROVED GOLDEN LEAF	6462	840	630
40.	SILVER DONAR	8121	1056	792
41.	SILK LEAF	16128	2097	1572
42.	SUPER GOLD	15042	1955	1467
43.	SPEIGHT G -7	10500	1365	1024
44.	SPEIGHT G -23	10113	1315	986
45.	SPEIGHT G -28	15570	2024	1518
46.	SPEIGHT G -36	9030	1174	880
47.	SPEIGHT G -41	6171	802	602
48.	SPEIGHT G -58	6165	801	601
49.	SPEIGHT G -70	10971	1426	1070

S. No.	Genotypes	Yield (kg/ha)		
		Green leaf	Cured leaf	TGE
50.	SPEIGHT G -103	14835	1929	1446
51.	SPEIGHT G -168	9063	1178	884
52.	SPEIGHT G -179	10095	1312	984
53.	T-117	10989	1429	1071
54.	NC-810	12792	1663	1247
55.	NC-940	13077	1700	1275
56.	OXOFORD 414 NA	9960	1295	971
57.	REAMS -126	10113	1315	986
58.	REAMS-134	16674	2168	1626
59.	REAMS-158	19155	2490	1868
60.	REAMS-744	10557	1372	1029
61.	REAMS-M-1	12972	1686	1265
62.	RG-8	12513	1627	1220
63.	RG-11	14388	1870	1403
64.	RG-13	11859	1542	1156
65.	RG-17	9792	1273	955
66.	RG-22	9417	1224	918
67.	RG-81	10035	1305	978
68.	RG-89	9225	1199	899
69.	SPEIGHT G -80	14187	1844	1383
70.	SPEIGHT G -102	8775	1141	856
71.	SPEIGHT G -108	13293	1728	1296
72.	SPEIGHT G -111	5514	717	538
73.	SPEIGHT G -120	15549	2021	1516
74.	SPEIGHT G -152	13485	1753	1315
75.	SPEIGHT G -172	11766	1530	1147
76.	SPEIGHT G -178	11631	1512	1134
77.	SPEIGHT NF -3	14295	1858	1394
78.	VA 119	14334	1863	1398
79.	KRK-26 R	12678	1648	1236
80.	V -76	14079	1830	1373
81.	YELLOW SPECIAL	9531	1239	929
82.	YELLOW SPECIAL A	12279	1596	1197
83.	YELLOW GOLD	11295	1468	1101
84.	T 1 -832	3021	393	295
85.	EC-554926	14343	1865	1398
86.	EC-55429	3771	490	368
87.	EC-554930	11277	1466	1100
88.	COKER-176	7455	969	727
89.	CU-387	6855	891	668
90.	GL-939	11643	1514	1135
91.	GK-149	11442	1487	1116
92.	K-317	2991	389	292
93.	K-358	11568	1504	1128
94.	K-399	7905	1028	771
95.	NC-37 NF	13491	1754	1315

S. No.	Genotypes	Yield (kg/ha)		
		Green leaf	Cured leaf	TGE
96.	NC-60	14262	1854	1391
97.	NC-207	12540	1630	1223
98.	NC-567	10128	1317	987
99.	NC-606	11508	1496	1122
100.	Kanchan (C)	11722	1403	1097
101.	Thrupti (C)	10777	1215	781
102.	Sahyadri (C)	10647	1284	897
	Mean	10564	1369	1026
	S.Em. ±	2028	276	185
	C.D. at 5%	5868	734	613
	C.V. %	22.1	20.8	22.42

VFSBR 6: BACK CROSS BREEDING PROGRAMME: CONVERSION OF THRUPTHI, SAHYADRI, TOBIOS-6, BHAVYA & FCH-222 IN TO MALE STERILE LINES (BC-4)

Objective: Conversion of Thrupthi, Sahyadri, Tobios-6, Bhavya & FCH-222 into male sterile lines

Results : The proposed varieties have been crossed with the male sterile lines supplied by CTRI, Rajahmundry. Male sterile plants in each population are crossed with respective recurrent parent.

Table 1 VFSBR 6: Data on backcross generation with male sterile lines (BC4 Generation) (2018-19)

S. No.	BACKCROSS GENERATION WITH MALE STERILE LINES (BC4 GENERATION)
1	MSVT X FCH 222
2	MSVT X BHAVYA
3	MSVT X SAHYADRI
4	MSVT X TOBIOS -6
5	MSVT X THRUPTI
6	C1 MS KANCHAN X FCH 222
7	C1 MS KANCHAN X BHAVYA
8	C1 MS KANCHAN X SAHYADRI
9	C1 MS KANCHAN X TOBIOS -6
10	C1 MS KANCHAN X THRUPTI
11	C4 MS KANCHAN X FCH 222
12	C4 MS KANCHAN X BHAVYA
13	C4 MS KANCHAN X SAHYADRI
14	C4 MS KANCHAN X TOBIOS -6
15	C4 MS KANCHAN X THRUPTI

B. *BIDI* TOBACCO

IVT ON *BIDI* TOBACCO

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

Year of start: 2018-19

Initial Varietal Trial on *bidi* tobacco was conducted with four entries and recommended checks at three centres *viz*. Anand, Nipani and Nandyal. Data was presented in the Table IVT *Bidi* Tobacco 1 to 5.

Entries: 04 (Four)

1. ABD 189
2. ABD 190
3. NBD 316
4. NyBD 61

Design : RBD
Replications : Four

Checks at different centres

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

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

Centre	Plot size	Spacing
Anand	1.8 x 7.5 m	90 x 75cm
Nipani	Gross: 4 m x 9 m Net: 2 m x 7.5 m	-
Nandyal	6.75 X 1.5 m	75 x75 cm

Results

Yield data and morphological characters at different centres are presented in Tables IVT *Bidi* Tobacco 1 - 4. The results are presented centre-wise.

ANAND: The results revealed significant yield differences among the entries tested. ABD 190 showed significant superiority for cured leaf yield over better check. None of the lines under testing was free from leaf curl and root knot (except ABT 10) diseases.

NANDYAL: Initial varietal trial (2018-19) on *bidi* tobacco was conducted with four entries along with two checks. The entries NBD 316 (1808 kg/ha), ABD189 (1797 kg/ha) & NyBD61 (1787) have recorded significantly higher cured leaf yield when compared to the checks Nandyal Pogaku 1(1500 kg/ha) & A 119 (1340 kg/ha).

NIPANI: Four test entries were evaluated along with four checks. None of the entries were superior for leaf yield over best check Vedagana-1 (2575 kg/ha). Two varieties viz., NyBD-61 (2596 kg/ha) and NBD 316 (2383 kg/ha) were on par with best check and were significantly superior over NBD 209 (1033 kg/ha).

Table IVT *Bidi* Tobacco 1: Cured leaf yield and number of leaves per plant in IVT entries at different centres (2018-19)

Entry	Yield (kg/ha)			No. of leaves/ plant	
	Anand	Nipani	Nandyal	Anand	Nipani
ABD 189	3785	1404	1797*	35	17
ABD 190	4144	1261	1529	38	19
NBD 316	2439	2383	1808*	19	16
NyBD 61	2302	2596	1787*	18	13
GT 7 (C)	3441			27	
ABT 10 (C)	2193			22	
MRGTH 1 (C)	2738			21	
Vedaganga-1 (C)		2575			18
A 119 (C)		1561	1340		13
Bhavyashree (C)		1356	1627		13
NBD 209 (C)		1033			17
Nandyal Pogaku-1 (C)			1500		
SEm ±	154		60.3	1.16	
CD at 5%	457	404	181.8	3.43	19.92
CV (%)	10.3	13.04	12.0	9.00	5.52

Table IVT *Bidi* Tobacco 2: Morphological characters of IVT entries at different centres (2018-19)

Entry	Plant height (cm)			Leaf length (cm)			Leaf width (cm)		
	A	N	Ny	A	N	Ny	A	N	Ny
ABD 189	135.8	103	63.8	47.2	40	41.8	23.7	16	18.2
ABD 190	150.1	115	59.5	51.4	43	37.8	25.9	17	20.6
NBD 316	113.4	100	67.2	53.4	41	45.4	29.1	16	19.9
NyBD 61	94.3	95	71.3	57.9	42	45.2	24.7	15	19.7
GT 7 (C)	97.3			50.9			21.4		
ABT 10 (C)	99.9			54.2			20.8		
MRGTH 1 (C)	86.8			54.2			22.7		

Entry	Plant height (cm)			Leaf length (cm)			Leaf width (cm)		
	A	N	Ny	A	N	Ny	A	N	Ny
Vedaganga-1 (C)		122			44			17	
Bhavyashree (C)		89			39			15	
NBD 209 (C)		107			44			16	
Nandyal Pogaku-1 (C)			68.1			39.2			17.6
A 119 (C)		85	61.1		40	34.6		15	14.2
Grand Mean			65.1			40.6			18.3
SEm ±	4.40		1.9	1.75		1.9	0.96		1.1
CD at 5%	13.1	13.28	5.9	5.21	4.65	5.7	2.84	6.60	3.3
CV (%)	7.92	23.73	8.0	6.66	3.38	10.0	7.95	1.84	12.0

A: Anand **N: Nipani** **Ny: Nandyal**

Table IVT *Bidi* Tobacco -3: Some morphological & quality traits of IVT entries at Nandyal & Anand centres (2018-19)

Entry	Nandyal			Anand	
	Days to 50% flowering	Leaf thickness (mm)	Spangle score	Days to flower	Days to maturity
ABD 189	148.8	56	5	82	173
ABD 190	144.5	59	5	95	171
NBD 316	127.0	68	7	67	175
NyBD 61	124.3	66	7	61	175
GT 7 (C)	130.0	59.7	5.7	70	175
ABT 10 (C)	2.9	3.2	0.4	80	171
MRGTH 1 (C)	8.9	9.6	1.4	62	176
Nandyala Pogaku-1(C)	118.5	57	6		
A119(C)	117.5	53	6		
GM	130.0	59.7	5.7		
SEM±	2.9	3.2	0.4	3.21	1.40
C.D. at 5%	8.9	9.6	1.4	9.55	**NS**
C.V. %	5.0	11.0	16.6	8.69	1.62

Table IVT *Bidi* Tobacco -4: percentage increase over control among IVT entries at Anand & Nandyal centres (2018-19)

Treatments	Anand		Nandyal
	GT 7	MRGTH 1	Nandyal Pogaku-1
ABD 189	10.0	38.2	19.8
ABD 190	20.4	51.3	
NBD 316			20.5
NyBD 61			19.1

Table IVT *Bidi* Tobacco -5: Pest & Disease incidence and nicotine content among IVT entries at Anand centre (2018-19)

Treatment	Mosaic (%)		Leaf curl (%)		RKI (0-5)*		Nicotine (%)
	√x+1	Retra	√x+1	Retra	Normal field	Sick plot	
					Mean	Mean	
ABD 189	4.79	22.9	2.52	5.35	00	2.6	5.57
ABD 190	3.69	13.6	2.30	4.29	00	4.6	6.07
NBD 316	4.13	17.1	1.94	2.76	00	2.8	6.07
NyBD 61	3.06	9.4	2.30	4.29	00	5.0	6.78
GT 7 (C)	4.26	18.1	2.52	5.35	00	4.7	5.87
ABT 10 (C)	2.37	5.6	1.73	1.99	00	00	7.60
MRGTH 1 (C)	1.00	00	2.30	4.29	00	4.4	5.77
SEM±	0.68	-	0.53	-	-	-	-
C.D. at 5%	2.02	-	NS	-	-	-	-
C.V. %	42.7	-	47.5	-	-	-	-

*****LSI data were not analyzed. ******Root-Knot Nematode was not observed in experimental area. *0=Free; 5= Maximum disease intensity

ANAND

BDABRC 3: ADVANCE HYBRID TRIAL I ON *BIDI* TOBACCO

Year of start: 2018-19

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

Results

The cured leaf yield differences were significant among hybrids tested. All the hybrids showed significant superiority for cured leaf yield over MR GTH 1 and BTH 318 gave highest cured leaf yield. None of the entry / hybrid was free from tobacco mosaic (except MR GTH 1), root knot nematode and leaf curl diseases.

Table BDABRC 3.1: Yield, morphological characters and disease incidence in AHT I (2018-19)

Treat-ments	Yield	% increase over MRGTH 1	No. of leaves/ plant	Days to flower	Days to maturity	Plant height	Leaf		Mosaic (%)		Leaf curl (%)	RKI** (0-5)*		Spangle score (1-9)	Nicotine (%)	Thick-ness (mg/cm^2)
							length	width				Normal field	Sick plot			
						----- cm -----			Arc	Retra	Mean	Mean	Mean			
BTH 318	4101	29.3	29	75	178	98.0	60.7	29.4	36.7	35.7	3.33	0.12	4.6	8.4	6.38	13.52
BTH 336	3877	22.2	27	72	174	113.3	55.9	25.6	33.0	29.7	2.50	0.03	3.2	7.9	6.58	12.50
BTH 339	3857	21.6	31	80	183	113.6	55.8	24.5	38.5	38.7	3.33	0.13	3.0	7.5	7.08	12.41
MRGTH 1 (C)	3172	-	21	60	174	92.2	57.4	26.0	00	00	1.66	00	4.7	8.2	6.68	12.69
SEM±	78.3	-	0.46	1.28	5.21	12.1	1.33	1.09	2.54	-	-	-	-	-	-	-
C.D. at 5%	235.9	-	1.39	3.86	NS	NS	NS	NS	7.66	-	-	-	-	-	-	-
C.V. %	5.1	-	4.15	4.37	7.21	28.3	5.67	12.13	23.0	-	-	-	-	-	-	-

@ spangle score :- 0= No spangle, 9 = full spangle

** **LC & RKI** data was not analyzed, Leaf Spot was not noticed in experimental area * 0=Free; 5= Maximum disease intensity

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., *Meloidogyne incognita* 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 47 genotypes screened, 25 genotypes were found free from root-knot index in root-knot sick field and selected for further screening in the next year.

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

Year of start: 1970-71

During the year 2018-19, 46 entries of advanced breeding materials /crosses of *bidi* tobacco and 7 entries of *rustica* tobacco were examined for leaf curl and *Cercospora* leaf spot diseases. Observations revealed that out of them, 5 in *bidi* and 4 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 73 (including twenty four mosaic resistant cultures) entries grown in different generations were artificially inoculated with tobacco mosaic virus and evaluated for resistance to mosaic. Out of these, 53 entries including segregation materials showed resistance to the disease and these materials are maintained by plant breeding section for further breeding work.

BDABR 45: BREEDING *BIDI* TOBACCO FOR NON CONVENTIONAL USES

Year of start: 2018-19

Design : RBD
Replications : Three
Plot size : 1.8 x 7.5 m
Spacing : 90 x 75 m
Treatments : 7 entries + 1 check

Results

The seed and *khakhri* yield differences was significant among the genotypes tested. ASO 20 showed significant superiority for seed yield and *khakhri* yield over A 145. ASO 20 and ASO 18 showed maximum oil yield and nicotine yield potentiality over A 145, respectively.

Table BDABR 45.1: Yield, morphological characters, nicotine, seed oil and yield potential

Treatment	Seed Yield	*Khakhri* yield	No. of leaves/ plant	No. of capsules	Days to flower	Days to maturity	Nicotine (%)	Seed Oil (%)	Yield potential (kg/ha)	
	(kg/ha)						*Khakhri*		Nicotine	Oil
ASO 18	614	1007	16	458	48	165	4.35	33.43	43.80	205
ASO 19	608	881	20	519	61	174	4.05	35.65	35.68	217
ASO 20	1086	1380	20	593	57	170	2.83	35.58	39.10	386
ASO 21	578	947	17	580	47	155	2.29	32.94	21.68	190
ASO 22	521	841	13	509	36	153	2.02	32.94	16.98	172
ASO 23	806	1012	23	603	57	182	1.92	37.67	19.43	303
ASO 24	520	865	17	623	52	160	2.13	35.96	18.42	187
A 145 (C)	912	1225	16	604	47	162	2.13	37.55	26.10	342
S.Em ±	38.1	41.0	0.70	29.1	1.40	1.69	-	-	-	-
C.D. at 5%	115.5	124.3	2.12	88.3	4.25	5.12	-	-	-	-
C.V (%)	9.35	6.96	6.89	8.98	4.78	1.77	-	-	-	-

Table BDABR 45.2: Pooled seed yield performance of non-conventional uses of genotypes in *bidi* tobacco over the years (2017-19)

Treatment	Seed Yield (kg/ha)		Pooled mean	% increase over A 145
	2017-18	2018-19		
ASO 18	614	642	628	-
ASO 19	608	562	585	-
ASO 20	1086	1037	**1062**	23.5
ASO 21	578	781	680	-
ASO 22	521	494	507	-
ASO 23	806	1003	905	-
ASO 24	520	1026	773	-
A 145 (C)	912	808	**860**	-
S.Em ±	38.07	56.37	101.67	
C.D. at 5%	115.48	170.96	340.1	
Year S.Em ±	-	-	50.8	
Year C.D. at 5%	-	-	NS	
C.V (%)	9.35	12.30	11.11	

Table BDABR 45.3: Pooled *Khakhri* yield performance of non-conventional uses of genotypes in *bidi* tobacco over the years (2017-19)

Treatment	*Khakhri* yield (kg/ha)		Pooled mean	% increase over A 145
	2017-18	2018-19		
ASO 18	1035	1007	1021	-
ASO 19	1681	881	1281	-
ASO 20	1827	1380	1604	17.3
ASO 21	1249	947	1098	-
ASO 22	946	841	893	-
ASO 23	1499	1012	1256	-
ASO 24	1464	865	1165	-
A 145 (C)	1511	1225	1368	-
S.Em ±	70.44	40.96	127.47	-
C.D. at 5%	213.70	124.30	426.34	-
Year S.Em ±	-	-	63.7	-
Year C.D. at 5%	-	-	213.2	-
C.V (%)	8.70	6.96	8.24	-

Pooled analysis: The pooled analysis of cured leaf yield showed significant differences among lines tested. None of the entries showed significant superiority for seed yield over better check, in pooled.

BULK TRIAL ON *BIDI* TOBACCO

Year of start: 2018-19

Design : RBD
Plot size : 7.2 x 26.25 m
Treatments : 3 entries + 1 check
Replications : Three
Spacing : 90 x 75 m

Results: The results revealed non-significant yield differences among the entries tested. ABD 152 did not show any significant superiority for cured leaf yield over checks GT 7 and GABT 11.

Table BULK TRIAL: Yield, morphological characters and disease incidence

Treatments	Yield kg/ha			No. of leaves/ plant	Days to flower	Plant height	Leaf		Days to maturity	Nicotine (%)	Thick-ness (mg/cm^2)
	Yield	% increase over				----- cm -----	length	width			
		GT 7	MRGTH 1								
ABD 152	2861	-	-	23.7	69.0	148.6	47.3	28.1	166	4.76	10.50
A 119 (C)	2357	-	-	23.1	63.2	80.4	54.6	23.9	151	5.57	12.64
GT 7 (C)	2871	-	-	27.8	70.0	106.3	54.0	21.0	160	4.55	12.34
GABT11(C)	3214	-	-	32.7	94.4	89.0	61.7	27.8	174	5.57	11.86
SEM+	61.2	-	-	-	-	-	-	-	-	-	-
C.D. at 5%	NS	-	-	-	-	-	-	-	-	-	-
C.V. %	14.4	-	-	-	-	-	-	-	-	-	-

BDAEN 68: SCREENING OF BIDI TOBACCO GENOTYPES AGAINST LEAF EATING CATERPILLAR (*SPODOPTERA LITURA* FAB.)

Screening of different 691 bidi tobacco cultures/ genotypes raised under nursery conditions by Plant Breeding section was carried out in the year 2018 under natural population of leaf eating caterpillar, *S. litura*. Observations revealed that out of 691 cultures/ genotypes, none of the genotypes was found free from infestation due to *S. litura* under natural infestation.

NANDYAL

BDNyBR 1.1: - ADVANCED VARIETAL TRIAL –I ON *BIDI* TOBACCO

Design: R.B.D
Plot size: 6.75 x 1.5 m
Entries: 5 entries + 2 Checks

Replications: Three
Spacing: 0.75 x 0.75 m

Results

In advanced varietal trial I (2018-19) of *bidi* tobacco, 5 entries along with two checks were evaluated. The entries ABD174 (1893 kg/ha) & NyBD60 (1886 kg/ha) have recorded significantly higher cured leaf yield when compared to the checks Nandyal Pogaku 1 (1656 kg/ha) & A 119 (1528 kg/ha).

Table BDNyBR 1.1: ADVANCED VARIETAL TRIAL- I ON *BIDI* TOBACCO 2018-19

Entry	Days to 50% flowering	Pl. height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thick-ness (mm)	Spangle score	Cured leaf yield (kg/ ha)	% IOC
NyBD60	125	66.3	44.6	18	65.3	7.7	1886*	13.8
ABD166	141	60.9	40.3	18	56.0	6.0	1770	6.8
ABD169	137	62.4	41.6	17	58.0	7.0	1754	5.9
ABD173	135	72.0	34.8	16	58.9	7.3	1509	
ABD174	130	74.5	44.0	18	66.1	6.7	1893*	14.3
Nandyala Pogaku-1(C)	118	62.8	42.5	17	55.3	4.7	1656	
A-119(C)	120	65.8	32.1	16	52.7	4.3	1528	
GM	129.4	66.39	39.99	16.97	58.88	6.24	1713	
SEM±	4.4	2.5	1.9	0.4	2.6	0.6	53.0	
C.D. at 5%	13.7	7.9	6.0	1.3	8.0	1.8	163.0	
C.V. %	5.9	6.7	9.0	5.0	8.0	16.0	14.0	

BDNyBR 1.2: - ADVANCED VARIETAL TRIAL –II ON *BIDI* TOBACCO

Design: R.B.D
Plot size: 6.75 x 1.5 m
Spacing: 0.75 x 0.75 m

Replications: Five
Entries: 2 entries + 2 Checks

Results

In advanced varietal trial II (2018-19) of *bidi* tobacco, 2 entries along with two checks were evaluated. The entry ABD163 (1744 kg/ha) has recorded significantly higher cured leaf yield when compared to the checks Nandyal Pogaku 1 (1539 kg/ha) & A 119 (1375 kg/ha) (Table 1 BDNyBR 1.2). Chemical quality parameters viz., nicotine, reducing sugars and chlorides were within the acceptable standards (Table 2 BDNyBR 1.2).

Table 1 BDNyBR 1.2: ADVANCED VARIETAL TRIAL- II (2018-19)

Entry	Days to 50% flowering	Pl. height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thickness (mm)	Spangle score
ABD163	129.2	68.2	39.2	18.3	44.0	6
ABD 145	138.4	74.4	41.2	17.1	42.0	5
ABD 167						
Nandyala Pogaku-1(C)	119.0	77.6	35.1	15.3	39.0	4
A-119(C)	118.8	63.1	27.9	13.8	38.0	5
GM	126.4	70.82	35.85	16.12	40.75	5.0
SEM±	4.2	3.3	3.0	0.7	1.0	0.4
C.D. at 5%	13.1	10.4	9.4	2.4	3.2	1.4
C.V. %	8.0	11.0	18.0	11.0	6.0	18.0

Table 2 BDNyBR 1.2: Yield and Chemical quality parameters (2018-19)

Entry	Cured leaf yield (kg/ha)	% increase over control	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
ABD163	1744*	13.3	3.85	2.49	1.57
ABD 145	1650	7.2	4.29	3.31	1.72
ABD 167					
Nandyala Pogaku-1 (C)	1539		3.42	3.22	1.57
A-119(C)	1375		3.18	3.36	1.45
GM	1577				
SEM±	43.8				
C.D. at 5%	136.4				
C.V. %	10.0				

Pooled Results: Pooled cured leaf yield of advanced varietal trial II (2017-18 & 2018-19) of *bidi* tobacco, 2 entries along with two checks were evaluated. The entries ABD 145 (1891 kg/ha) and ABD 163(1888 kg/ha) have recorded significantly higher cured leaf yield when compared to the check Nandyal pogaku-1 (1613 kg/ha)

Table 3 BDNyBR 1.2: Pooled analysis of cured leaf yield of AVT II entries during (2017-18 and 2018-19)

Entries	Cured leaf yield kg/ha		Mean	% increase over control
	2017-18	2018-19		
ABD163	2132	1650	1891*	17.2
ABD 145	2031	1744	1888*	17.0
ABD 167				
Nandyala Pogaku-1 (C)	1687	1539	1613	
A-119(C)	1501	1375	1438	
GM	1838	1577	1707	
	Years	Entries	Years x Entries	
SEM±	41.0	58.0	82.0	
C.D.@5%	118.0	167.0	180.0	
C.V%	15.0	11.0	13.0	

BYT: BULK YIELD TRIAL ON *BIDI* TOBACCO 2018-19

Replications : Non-replicated
Spacing : 0.75 x 0.75 m
Plot size : 300 m^2
Entries : 2 entries +2 Checks
Fertilizer : 110N + 70P_2O_5 + 50 K_2O kg/ha

Results: In Bulk Yield Trial (2018-19) of *bidi* tobacco, the entries NBD 289 (2205 kg/ha) & NBD 290 (2061 kg/ha) recorded higher cured leaf yield when compared to the checks Nandyal Pogaku1 (1774 kg/ha) & A119 (1658 kg/ha). Chemical and smoke quality parameters are within the permissible limits (Table BDNyBR).

Table 1 BYT: Bulk yield trial on *bidi* tobacco 2018-19

Entry	Days to 50% flowering	Pl. ht (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thickness (mm)	Spangle score
NBD 289	129.2	79.8	47.0	17.6	62.1	5
NBD 290	128.4	67.2	44.3	18.6	57.7	5
Ndl.Pogaku 1 (C)	119.0	61.6	38.0	16.6	57.5	4
A119(C)	117.8	71.4	35.0	13.6	63.2	5
GM	123.6	70.0	41.0	16.6	60.1	5

Table 2 BYT: Yield and Chemical quality parameters (2018-19)

Entry	Cured leaf yield (kg/ha)	% increase over control	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
NBD 289	2205	24.2	5.31	3.88	1.67
NBD 290	2061	16.1	3.96	3.89	1.55
Nandyala Pogaku-1 (C)	1774		3.48	3.20	1.57
A119 (C)	1658		3.09	3.06	2.08
GM	1925				

Table 3 BYT: Smoke analysis report of Bulk yield trial on *bidi* tobacco (2018-19)

Entry	Av. wt of *bidi* (g)	Av. length of *bidi* (mm)	Tar NFDPM (mg/*bidi*)	Nicotine (mg/*bidi*)	Carbon monoxide (mg/*bidi*)
NBD 289	0.4454	73	35.50	2.38	21.24
NBD 290	0.4126	73	37.98	2.57	21.07
Nandyala Pogaku-1 (C)	0.5200	73	35.28	1.03	22.98
A-119 (C)	0.4872	73	44.38	2.38	26.91

OFT: ON FARM TRIAL ON *BIDI* TOBACCO 2017-18

Entries: 3 Entries +2 Checks
Plot size: 1000 m^2
Spacing: 0.75 m x 0.75 m
Fertilizer: 110 N+70 P_2O_5+ 50 K_2O kg/ha

Results

In On-farm Trial (2018-19) of *bidi* tobacco, the entries ABD 132 (2170 kg/ha) & NyBD 56 (2057 kg/ha) recorded higher cured leaf yield when compared to the checks, Nandyal Pogaku 1 (1785 kg/ha) & A 119 (1579 kg/ha) (Table 1 OFT). Chemical and smoke quality parameters are within the permissible limits (Table 3 OFT).

Table 1 OFT: On-farm trial on *bidi* tobacco 2018-19

Entry	Days to 50% flowering	Pl. ht (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thickness (mm)	Spangle score
ABD132	141	86.2	43.5	19.0	65.6	6
NyBD56	126	68.0	46.0	17.7	64.5	5
ABD146	133	68.0	45.8	19.2	63.7	5
Nandyala Pogaku-1 (C)	121	67.0	39.5	16.1	65.2	4
A-119(C)	120	62.6	34.3	13.0	64.0	5
GM	128.2	70.36	41.82	17.0	64.6	5

Table 2 OFT: Yield and Chemical quality parameters (2018-19)

Entry	Cured leaf yield (kg/ha)	% increase over control	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
ABD132	2170	21.5	3.13	3.38	1.41
NyBD56	2057	15.2	4.07	3.46	1.62
ABD146	1798		4.85	3.43	1.21
Nandyala Pogaku-1 (C)	1785		2.67	3.06	1.98
A119 (C)	1579		3.35	2.84	1.68
GM	1878				

Table 3 OFT: Smoke analysis report of Bulk yield trial on *bidi* tobacco (2018-19)

Entry	Av. wt of *bidi* (g)	Av. length of *bidi* (mm)	Tar NFDPM (mg/*bidi*)	Nicotine (mg/*bidi*)	Carbon monoxide (mg/*bidi*)
ABD132	0.4413	72	34.09	1.84	19.42
NyBD56	0.4662	73	44.34	2.48	22.65
ABD146	0.4605	72	49.79	2.62	26.47
Nandyala Pogaku-1 (C)	0.4942	73	41.84	1.14	22.05
A-119(C)	0.4783	73	48.62	2.07	27.10

PHYSIOLOGICAL TRAITS IN ADVANCED CULTIVARS OF *BIDI* TOBACCO IN BYT AND OFT

Results

Physiological traits in advanced cultivars of *bidi* tobacco, 5 entries along with two checks were evaluated for drought, the lower specific leaf area were recorded in Nandyal Pogaku-1 1(8.5 cm^2/gm), NyBD 56 (9.6 cm^2/gm) and ABD 132(9.8 cm^2/gm) and higher leaf area index were recorded in ABD 132 (2.93) and NyBD 56 (2.87), higher leaf area ratio were recorded in ABD 132(161.2 cm^2/gm) and NyBD 56 (158.6 cm^2/gm), higher net assimilation rate were recorded in NyBD 56 (3.45 g/cm^2/day) and Nandyal pogaku-1 (3.32 g/cm^2/day) and higher relative growth rate were recorded in NyBD 56 (0.1216 g/g/day) followed by ABD 132 (0.1191 g/g/day) at 45-90 days after transplanting.

Table 1: Physiological traits in advanced cultivars of *Bidi* tobacco in BYT and OFT

Entries	Leaf area cm2	SLA cm^2/ gm	LAI@ 45DAT	LAI @ 90 DAT	LAI@ 135DAT	LAR@45 DAT cm^2/gm	LAR@90 DAT cm^2/gm	LAR@135 DAT cm^2/gm
ABD 132	890	9.8	2.93	3.83	5.06	161.2	64.5	58.6
ABD 146	721	10.4	2.14	3.12	4.13	152.4	66.2	61.2
NBD 290	861	10.2	1.98	3.25	4.21	143.2	58.4	49.5
NBD 289	901	10.6	2.01	3.41	4.11	148.5	56.2	47.5
Nandyal pogaku1 (C)	598	8.5	2.56	3.68	4.73	156.3	64.7	52.3
A 119(C)	630	10.3	1.72	3.23	4.15	146.2	61.2	57.2
NyBD 56	722	9.6	2.87	4.01	5.35	158.6	68.2	62.3

Table 2: Growth rates in advanced cultivars of *Bidi* tobacco

Entries	RGR @ 45-90 DAT (g/g/day)	RGR @ 90-135 DAT (g/g/day)	NAR @ 45-90 DAT (g/cm^2/day)	NAR @ 90 - 135 DAT (g/cm^2/day)
ABD 132	0.1191	0.0308	3.20	0.89
ABD 146	0.1052	0.0298	3.08	0.43
NBD 290	0.1034	0.0296	3.01	0.69
NBD 289	0.1036	0.0255	2.98	0.73
Nandyal pogaku1 (C)	0.1104	0.0325	3.32	0.98
A 119(C)	0.1112	0.0248	3.02	0.65
NyBD 56	0.1216	0.0358	3.45	0.99

BDNyBR 3.1: ADVANCED HYBRID TRIAL –I ON *BIDI* TOBACCO

Year of start : 2018-19
Design : R.B.D
Plot size : 6.75 x 1.5 m
Treatments : 4 entries + 3 Checks

Replications: Three
Spacing: 0.75 x 0.75 m

Results

In advanced hybrid trial (2018-19) of *bidi* tobacco, 4 entries along with three checks were evaluated. The entries BTH 315 (1711 kg/ha), NyBTH 124 (1653 kg/ha) & BTH 336 (1649 kg/ha) have recorded significantly higher cured leaf yield when compared to the checks MRGTH1 (1391 kg/ha), A 119 (1416 kg/ha) & Nandyal Pogaku 1 (1422 kg/ha). Chemical quality parameters viz., nicotine, reducing sugars and chlorides were within the acceptable standards.

Table 1 BDNyBR 3.1: Morphological characters in AHT- I (2018-19)

Entry	Days to 50% flowering	Pl. height	Leaf length	Leaf width	Leaf thickness	Spangle score
		(cm)				
BTH 315	128	64.5	45.6	19.7	55.8	8
BTH 318	129	60.7	37.4	15.8	49.3	6
BTH 336	126	62.5	43.6	19.2	52.8	7
NyBTH 124	126	72.3	38.5	16.6	54.9	8
Nandyala Pogaku-1(C)	119	70.0	36.1	14.2	48.4	4
A-119(C)	120	60.3	33.4	13.3	45.6	5
MRGTH-1 (C)	128	69.1	35.0	13.2	45.4	5
GM	125.0	65.62	38.52	16.00	50.3	6.10
SEM±	1.8	1.1	2.0	1.1	2.5	0.49
C.D.@5%	5.6	3.6	6.2	3.4	7.8	1.5
C.V%	6.0	8.0	10.0	12.0	9.0	14.0

Table 2 BDNyBR 3.1: Yield and Chemical quality parameters in AHT-I during 2018-19

Entry	Cured leaf yield (kg/ha)	% increase over control	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
BTH 315	1711*	20.0	3.67	3.21	1.42
BTH318	1542		2.02	2.96	1.27
BTH336	1649*	15.9	4.06	3.40	1.33
NyBTH124	1653*	16.0	3.09	3.13	1.68
Nandyala Pogaku-1(C)	1422		2.92	3.33	1.13
A-119(C)	1416		3.46	3.34	1.58
MRGTH-1 (C)	1391		2.69	3.52	1.73
GM	1540.7				
SEM±	60.79				
C.D.@5%	187.3				
C.V%	13.0				

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

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

Design : R.B.D
Replications : Three
Spacing : 0.75 x 0.75 m
Entries: 6 + 3 (C)
Plot size: 6.75 x 1.5 m
Fertilizer:110N + 70 P_2O_5 + 50 K_2O kg/ha

Results

In Station hybrid trial- I (2018-19) of *bidi* tobacco, 6 entries along with three checks were evaluated. The entries NyBTH-171 (CmsGT7 X ABD 167) (1735 kg/ha), NyBTH-170 (CmsGT7 X ABD 163) (1705 kg/ha) & NyBTH-173 (CmsGT4 X ABD 163) (1703 kg/ha) recorded significantly higher cured leaf yield when compared to the checks MRGTH-1(1456 kg/ha), Nandyal Pogaku 1 (1528 kg/ha) & A 119 (1463 kg/ha) (Table BDNyBR 3.2).

Table BDNyBR 4.1: Station Hybrid trial –I on *bidi* tobacco 2018-19

Entry	Days to 50% flowering	Pl. height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf Thickness (mm)	Spangle score	Cured leaf yield kg/ha
NyBTH-169	118.0	73.5	46.3	15.4	58.48	4.0	1689 (10.5)
NyBTH-170	119.3	75.5	43.2	15.6	63.10	5.0	1705* (11.5)
NyBTH-171	115.7	70.5	44.2	17.4	63.94	6.0	1735* (13.5)
NyBTH-172	116.3	78.3	47.5	16.8	62.11	6.0	1675 (9.6)
NyBTH-173	116.3	67.0	42.8	17.7	62.84	6.0	1703* (11.4)
NyBTH-174	115.0	71.7	45.0	15.6	56.42	4.0	1624 (6.2)
Nandyala Pogaku-1 (C)	112.0	72.0	37.1	14.4	69.78	4.0	1528
A-119 (C)	114.0	65.1	36.0	13.6	63.57	5.0	1463
MRGTH-1 (C)	127.7	64.1	34.8	12.9	58.20	4.0	1456
GM	116.38	71.65	43.58	16.02	62.00	5.0	1656
SEM±	1.53	2.61	1.33	0.72	2.71	0.52	56.7
C.D.@5%	5.0	8.0	4.0	2.1	8.5	1.5	170.1
C.V%	4.0	6.0	5.0	8.0	9.0	11.0	15.0

Figures in parenthesis represent the % increase over control

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

Design: R.B.D
Replications: Three
Fertilizer: 110 N+70 P_2O_5+50 K_2O kg/ha
Entries: 6 +3 (C)
Plot size: 6.75 m x 1.5 m
Spacing: 0.75 m x 0.75 m

Results

In Station hybrid trial -II (2018-19) of *bidi* tobacco, 6 entries along with three checks were evaluated. The entries NyBTH-163 (CmsGT5 X ABD 65) (1725 kg/ha), NyBTH-168 (CmsGT4 X ABD 138) (1694 kg/ha) & NyBTH-166 (CmsGT4 X ABD 132) (1614 kg/ha) recorded significantly higher cured leaf yield when compared to the checks MRGTH-1 (1434 kg/ha), Nandyal Pogaku1 (1418 kg/ha) & A 119 (1383 kg/ha) (Table 1 & 2 BDNyBR 4.2).

Table 1 BDNyBR 4.2: Station Hybrid trial –II on *bidi* tobacco 2018-19

Entries	Days to 50% flowering	Pl.ht (cm)	Leaf length (cm)	Leaf width (cm)	Leaf thickness (mm)	Spangle score	Cured leaf yield (kg/ha)
NyBTH-163	120.7	66.3	41.4	18.0	61.16	6.0	1725* (20.2)
NyBTH-168	111.3	62.4	44.8	20.3	61.93	7.0	1694* (18.1)
NyBTH-166	112.7	69.5	38.9	16.2	52.16	4.0	1614* (12.5)
NyBTH-148	112.7	65.9	40.0	16.8	63.50	5.0	1558 (8.6)
NyBTH-147	117.0	63.4	44.5	17.5	64.68	5.0	1514 (5.5)
NyBTH-167	112.3	73.7	42.1	18.5	60.08	7.0	1496
MRGTH-1 (C)	129.0	66.1	39.0	15.4	50.85	8.0	1434
Nandyala Pogaku-1 (C)	117.7	72.5	38.5	16.5	60.33	5.0	1418
A-119 (C)	118.0	62.4	35.8	14.9	65.16	6.0	1383
GM	116.5	66.76	41.53	17.52	59.98	6.0	1576
SEM+	1.85	2.30	1.72	0.99	2.42	0.7	41.2
C.D.@5%	5.5	6.9	5.16	2.97	7.5	2.0	124.0
C.V. (%)	5.0	7.0	7.1	10.0	12.0	10.0	14.0

Figures in parenthesis represent the % increase over control

Pooled results

Pooled cured leaf yield of station hybrid trial -II (2017-18 & 2018-19) of *bidi* tobacco, 6 entries along with three checks were evaluated. The entries NyBTH-148 (CmsA119 X ABD 124) (1975 kg/ha), NyBTH-168 (CmsGT4 X ABD 138) (1932 kg/ha), NyBTH-147 (CmsA119 X ABD 120) (1921 kg/ha), NyBTH-163 (CmsGT5 X ABD 65) (1911 kg/ha), NyBTH-166 (CmsGT4 X ABD 132) (1815 kg/ha) and NyBTH-167 (CmsGT5 X NBD 289) (1781 kg/ha) have recorded significantly higher cured leaf yield when compared to the checks MRGTH-1(1542 kg/ha), Nandyal Pogaku1 (1532 kg/ha) & A 119 (1469 kg/ha).

Table 2 BDNyBR 4.2: Pooled data on cured leaf yield performance of Station Hybrid Trial II during (2017-18 and 2018-19)

Entries	Cured leaf yield (kg/ha)		Mean cured leaf yield (kg/ha)	% increase over control
	2017-18	2018-19		
NyBTH-148	2391	1558	1975*	28.0
NyBTH-168	2170	1694	1932*	25.0
NyBTH-147	2328	1514	1921*	24.5
NyBTH-163	2096	1725	1911*	24.0
NyBTH-166	2015	1614	1815*	17.7
NyBTH-167	2067	1496	1781*	15.4
MRGTH-1 (C)	1649	1434	1542	
Nandyala Pogaku-1 (C)	1646	1418	1532	
A-119 (C)	1555	1383	1469	
GM	1991	1537	1764	
	Years	Entries	Years x Entries	
SEM±	41.0	58.0	82.0	
C.D.@5%	118.0	167.0	180.0	
C.V. (%)	15.0	11.0	13.0	

BDNyBR 4.3: OBSERVATIONAL VARIETAL TRIAL ON *BIDI*/NATU TOBACCO

Design: R.B.D
Entries: 4 + 3 (C)
Replications: Three
Plot size: 6.75 x 1.5 m
Spacing: 0.75 x 0.75 m
Fertilizer: 110 N + 70 P_2O_5 + 50 K_2O kg/ha

Results

In Observational varietal trial (2018-19) of *bidi* tobacco, four entries along with three checks were evaluated and the entries *i.e* NyNT65 (1922 kg/ha), NyBD 62 (1858 kg/ha) & NyBD63 (1835 kg/ha) recorded significantly higher cured leaf yield when compared to the checks Bhairavi (1664 kg/ha), Nandyal Pogaku 1 (1590 kg/ha) & A 119 (1436kg/ha) (Table 1 BDNyBR 4.3).

Table 1 BDNyBR 4.3: Observational varietal trial on *bidi* tobacco 2017-18

Entry	Days to 50% flowering	Pl. height (cm)	Leaf length (cm)	Leaf width (cm)	Leaf Thickness (mm)	Spangle score	Cured leaf yield (kg/ha)
NyBD 62	119	67	44	19	78.73	6.0	1858* (11.6)
NyBD 63	120	72	46	18	67.03	6.0	1835* (10.2)
NyNT 64	127	80	47	16	70.99	4.0	1752 (5.2)
NyNT 65	119	54	45	16	85.28	5.0	1922* (15.5)
Nandyala Pogaku-1 (C)	118	64	40	18	56.18	5.0	1590
A-119 (C)	119	61	35	14	67.90	5.0	1436
Bhairavi (C)	127	74	43	16	62.45	4.0	1664
GM	121.29	67.54	42.99	16.87	69.79	5.0	1722
SEM±	2.0	3.3	1.14	0.55	3.1	0.8	44.1
C.D. at 5%	6.3	10.4	3.5	1.69	9.3	2.4	132.0
C.V. (%)	3.0	9.0	5.0	6.0	10.0	14.0	13.0

Figures in parenthesis represent the % increase over control

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

Results:

New crosses made: A total of 12 crosses were made out of 6 crosses under varietal improvement for specific traits (leaf quality, drought tolerant, high yielding etc.,) and six crosses for hybrid development.

$F_1 \rightarrow F_2$: 18 F_1 crosses were evaluated for leaf yield and other traits; these will be evaluated under F_2 generation during 2019-20
$F_2 \rightarrow F_3$: 2 F_2 crosses were evaluated. In these, 75 single plants are selected and these will be advanced to F_3

$F_3 \rightarrow F_4$: 7 *bidi* F_3s were evaluated 31 single progenies were studied out of this 21 superior single plant selections were made, these will be advanced to F_4 generation during 2019-20

$F_4 \rightarrow F_5$: 10 *bidi* F_4s were evaluated and 52 single progenies were studied out of this 35 superior single plant selections were made ,these will be advanced to F_5 generation during 2019-20

$F_5 \rightarrow F_6$: 21 progenies from 8 *bidi* crosses were evaluated and 13 superior single plant selections were made under F_5s these will be advanced to F_6 generation during 2019-20.

$F_6 \rightarrow$ OVT: 6 *bidi* F6s were evaluated and 12 single progenies were studied out of this 9 superior uniform bulks were selected; these will be evaluated under OVT during 2019-20.

B. Hybridization and study of segregating generations in *bidi* tobacco

During 2018-19, the following new crosses were made

i) For development of *bidi* tobacco hybrids

S. No.	Crosses proposed	Objective
1	CMS GT7 X ABD174	Drought tolerant higher cure leaf yield with less smoke toxicants
2	CMS GT7 X ABD166	
3	CMS GT7 X NyBD60	
4	CMS GT4 X ABD174	
5	CMS GT4 X ABD166	
6	CMS GT4 X NyBD60	

ii) For improvement of *bidi* tobacco varieties.

S. No.	Crosses	Objective
1.	GT4XABD174	Drought tolerant high yielding with good leaf quality
2.	GT4XABD166	
3.	GT7XABD174	
4.	GT7XABD166	
5.	A119XABD174	
6.	A119XABD166	

Evaluation of F_1 generation

S. No.	Cross Combination	Cured leaf yield/ 5pl.(gm)	S. No.	Cross Combination	Cured leaf yield/ 5pl.(gm)
1.	GT4 X ABD145	395.0	10.	GT7 X ABD119	611.0
2.	GT4 X ABD163	512.0	11.	GT4 X ABD132	482.0
3.	GT4XABD167	544.0	12.	GT4 X NBD289	555.0
4.	A119XABD145	422.0	13.	GT4 X NBD260	474.0
5.	A119XABD163	618.0	14.	GT4 X ABD119	595.0
6.	A119XABD167	440.0	15.	A119 X ABD132	694.0
7.	GT7 X ABD132	651.5	16.	A119 X NBD289	566.0
8.	GT7 X NBD289	427.0	17.	A119 X NBD260	642.0
9.	GT7 X NBD260	441.0	18.	A119 X ABD119	488.0

During *Kharif* 2018-19, 18 *bidi* crosses were evaluated under F_1 generation. Based on cured leaf yield superior crosses will be evaluated under F_2 generation during 2019-20.

Evaluation of F_2 generation

S. No.	Cross Combination	Objective	Cured leaf yield/ 5pl.(gm)	No. of single plants selected
1.	ABD132 X ABD65	Drought tolerant, low suckering habit, higher yield	516.0	35
2.	NBD289 X ABD138		556.0	40
			Total	**75**

During *Kharif* 2018-19, 4 F_2 *bidi* crosses were evaluated .Based on cured leaf yield only 2 superior crosses were retained, 75 single superior plants were made and promoted to F3 generation during 2019-20.

Evaluation of F_3 Generation (For development of varieties)

7 F_{3S} evaluated during 2018-19

F_3 crosses	Objectives	Cured leaf yield/ 5pl.(gm)	No. of Progenies studied	No. of SPS
ABD 146 x ArBD 32	Drought tolerant, higher cure leaf yield better smoking quality with profuse	460.0	4	2
ABD 146 x NyBD 56		540.0	8	6
ABD 146 x ArBD 33		653.0	4	4
NyBD 56 x ArBD 32		637.0	3	3

F_3 crosses	Objectives	Cured leaf yield/ 5pl.(gm)	No. of Progenies studied	No. of SPS
ArBD 32 x ArBD 33	spangling.	588.0	1	1
NyBD 56x ABD 146		494.0	9	4
ArBD 32 x ABD 146		473.0	2	1
		Total	**31**	**21**

In F_3 generation from 31 progenies of 7 crosses, 21 single plant selections were made and promoted to F_4 generation during 2019-20.

Evaluation of F_4 generation: 10 F4s were evaluated during 2018-19 **(for development of varieties)**

F_4 crosses	Objectives	Cured leaf yield/ 5pl.(gm)	No. of Progenies studied	No. of SPS
1.ABD120XABD124	Drought tolerant, high cure leaf yield better smoking quality with profuse spangling.	432	7	5
2.ABD124XABD131		457	6	3
3.ABD120XABD119		520	5	4
4.ABD124XABD132		430	7	4
5.ABD120XABD131		360	3	2
6.ABD119XABD131		447	8	6
7.ABD120XABD132		439	2	2
8.ABD119XABD132		480	4	2
9.ABD124XABD119		485	7	4
10.ABD131XABD132		550	3	3
	Total		**52**	**35**

In F_4 generation from 52 progenies of 10 crosses, 35 single plant selections were made and promoted to F_5 generation during 2019-20.

Evaluation of F_5 generation : 8 F_{5S} evaluated during 2018-19

No. of F_5 crosses	Objectives	Cured leaf yield/ 5pl.(gm)	No. of Progenies studied	No. of SPS
1)GT4 x Bhavyasree	1. Drought tolerant high leaf potential, high cured leaf yield than A 119.	392	2	2
2)GT4 x ABD 87		422	3	3
3) GT4 x ABD62		270	2	-
4)A119xBhavyasree		410	1	1
5)A119 x ABD102		505	4	4
6) A119 x ABD 87		260	4	-
7) A119 x ABD62		380	3	1
	2. Drought	435	2	2

8) A119 x NBD154.	tolerant, better smoking quality with profuse spangling. 3. Tolerant to leaf burn disease, lodging with excellent leaf thickness and good spangling.			
		Total	**21**	**13**

During *Kharif* 2018-19, 8 bidi F_4s were evaluated and 21 single progenies were studied out of this 13 superior single plant selections were made, these will be evaluated under F_6 generation during 2019-20.

F_6 Generation : 6 F_6 s evaluated during 2018-19

No of F_6 crosses	**Objectives**	**CLY/5Pl. (gm)**	**No. of Progenies studied**	**Uniform bulks**
1.A119XABD119	1. Tolerant to leaf burn disease, lodging with excellent leaf thickness and good spangling. 2. Drought tolerant, better smoking quality with profuse spangling. 3. High cured leaf yielding with excellent leaf quality for chemical and smoke parameters	389	3	1
2.A119XABD115		510	2	2
3.GT7XABD119		405	1	1
4.GT4XNBD119		452	2	2
5.GT4XNBD154		456	-	-
6.A119XABD120		300	4	3
	Total		**12**	**9**

In F_6 generation from 12 progenies of 6 bidi crosses, 9 uniform bulks were promoted to OVT during 2019-20.

NTNyBR: STUDY AND GENERATION OF BREEDING MATERIAL IN NATU TOBACCO

New crosses made: Two crosses were made under varietal improvement for specific traits (leaf quality, drought tolerant, high yielding etc.)

$F_1 \rightarrow F_2$: 2 F_1 crosses were evaluated for leaf yield and other traits; these will be evaluated under F_2 generation during 2019-20.

$F_2 \rightarrow F_3$: 2 F_2 crosses were evaluated. In these, 25 single plants are selected and these will be advanced to F_3.

$F_3 \rightarrow F_4$: 10 natu F_3s were evaluated 32 single progenies were studied out of this 23superior single plant selections were made, these will be advanced to F_4 generation during 2019-20.

$F_4 \rightarrow F_5$: 6 natu F_4s were evaluated and 25 single progenies were studied out of this 15 superior single plant selections were made, these will be advanced to F_5 generation during 2019-20.

During 2018-19, the following new crosses were made for improvement of natu tobacco varieties.

S.No.	Cross	Objective
1	Bhairavi x WAF	Drought tolerant high yielding varieties
2	Bhairavi x Natu Special	

F_1 Generation

S.No.	Crosses	Objective
1	Bhairavi x KFC	Drought tolerant high yielder
2	Bhairavi x Talmari aku	

F_2 Generation

S.No.	Cross combination	Objective	CLY/5Pl.(gm)	No. of SPS
1	NGP89 X Ongole	Drought tolerant ,high yielder	353	15
2	Talmari aku X KFC		319	10
	Total			**25**

Evaluation of F_3 generation

F_3 Crosses	Objective	CLY/5Pl. (gm)	No. of progenies studied	No. of SPs
Natu kavali x Kommipadu vithanam	High yielding and good physical & chemical leaf quality attributes.	676	2	2
II1068 x Bhairavi		610	2	2
II 1873 xBhairavi		469	2	2
Bhairavi x Kommipadu vithanam		578	3	3
NG-64 X NG-61		632	3	2
NGP-87 X Line-61		696	4	4
Royal narasaraopeta x NGP 89		508	3	2
Kawali x natu parchuru		625	5	3
Chebrolu x Yelamanchali		509	4	1
Narasarao peta x Tokaaku farm		410	4	2
Total			**32**	**23**

In F_3 generation from 32 progenies of 10 crosses, 23 single plant selections were made and promoted to F_4 generation during 2019-20.

Evaluation of F_4 generation

Cross combination	Objective	CLY/5Pl. (gm)	No. of progenies studied	No. of SPs
Commipaduvittanam X Peddavittanam	Higher cured leaf yield potential, good leaf quality & within the range of chemical parameters.	398	2	2
Commipadu vittanam XPotti vittanam		323	2	2
Commipadu vittanam X Natunoonepalli		275	4	2
PeddavittanamX Pottivittanam		285	5	2
PeddavittanamXNatunoonepalli		418	7	4
PottivittanamXNatunoonepalli		354	5	3
	Total		**25**	**15**

During *Kharif* 2018-19, 6 natu F_4s were evaluated 25 single progenies were studied out of this 15 superior single plant selections were made, these will be evaluated under F_5 generation during 2019-20.

BDNyBR 1: COLLECTION, EVALUATION AND MAINTENANCE OF *BIDI* TOBACCO GERMPLASM

Techniques to be adopted: New germplasm lines received from different centers will be evaluated and already existing germplasm lines were maintained once in 2 years. (During *kharif* 2018-19, *bidi* tobacco lines were evaluated)

Design: Non replicated rows

Plot size: Each entry in one row of 9 m length.

Spacing: 75 cm x 75 cm

Fertilizer: 110 N + 70P_2O_5 + 50 K_2O kg/ha

Results

Data pertaining to the characters *i.e*; plant habit, plant height (A119, ABD190 (60.0 cm) to ABD132, NBD 289 (92-100 cm)), ,internodal length, leaf length (cm) A119 (34.0 cm) to NBD289 & NyBD56 (47.0 cm), leaf width (cm) A119(14.2 cm) to ABD190 (20.6 cm), stem colour, leaf characters, total leaf number, economic leaf number, no. of cured leaf, suckering habit, spangling ABD190 & NyBTH 174(4) to NBD 316, NyBD 61 & NyBTH 124(7), no. of days taking for flowering A119 & Nandyal pogaku 1(117) to ABD132&ABD189(150), inflorescence, flower colour, corolla shape , capsule shape and cured leaf yield/plant(g) A119 (90g) to ABD 132 & NBD 289 (154 g) were recorded (Table BDNyBR-1).

Table BDNyBR-1: Germplasm evaluation ranges given below in *bidi* tobacco 2018-19

Parameters	**Range (*bidi* tobacco)**
Days to 50% flowering	A119 & Nandyal pogaku 1(117) to ABD 132 & ABD 189 (150)
Plant height (cm)	A119, ABD190 (60.0 cm) to ABD132, NBD289 (92-100 cm)
Leaf length (cm)	A119 (34.0 cm) to NBD289 & NyBD56 (47.0 cm)
Leaf width (cm)	A119 (14.2 cm) to ABD190 (20.6 cm)
Spangle score	ABD190 & NyBTH 174(4) to NBD316, NyBD 61 & NyBTH 124(7)
Leaf thickness (mm)	A119(53) toNBD316 &NyBD62 (68)
Cured leaf yield/ plant (g)	A119(90g) to ABD132 & NBD289 (154g)

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

Year of start: 2018-19
Seed oil trial on bidi tobacco was conducted with six entries and recommended checks at Nandyal.

Design: RBD

Replications: Three

Treatments: Entries 6 + 2 checks

Plot size: 6.75 X 1.5 m

Spacing: 75 x75 cm

Results

Yield data and morphological characters are presented in Table BDNYBR 6. In seed oil yield trial (2018-19) of bidi tobacco, 6 entries along with two checks were evaluated. The entries ABD132 (2012 kg/ha) & NBD290 (1802 kg/ha) have recorded significantly higher cured leaf yield when compared to the checks Nandyal Pogaku 1 (1629 kg/ha) & A 119 (1340 kg/ha). Checks A 119 (566 kg/ha) & Nandyal Pogaku 1 (527 kg/ha) were recorded numerically higher seed yield and oil yield potential and ABD 132 recorded maximum nicotine yield potential (Table BDNyBR-6).

Table BDNyBR 6: Evaluation of newly developed bidi tobacco genotypes for seed oil

Entry	Days to 50% flow.	Pl.ht (cm)	No. of Lea. /pl.	Leaf length (cm)	Leaf width (cm)	Days to Maturity	No. of Bran. /pl.	No. of cap. /Pl.	Seed yield (kg/ha)	Cured leaf yield (kg/ha)	Nicotine (%)	Oil (%)	Yield potential (kg/ha)		Cured leaf yield % IOC
													Nicotine	Oil	
ABD132	142	91.7	25.0	44.9	18.8	181	22	357	430	2012*	3.51	31.15	70.62	133.94	23.5
NBD290	128	72.4	29.0	41.8	16.4	149	19	352	457	1802*	1.99	29.85	35.85	136.41	10.6
NBD289	129	87.0	28.0	45.3	16.5	148	21	385	437	1702	2.44	30.90	41.52	135.03	
NyBD56	140	89.7	21.3	42.1	16.0	168	20	370	487	1667	2.79	30.85	46.50	150.23	
ABD146	134	80.8	25.7	38.1	14.1	154	19	339	417	1633	2.19	30.29	35.76	126.30	
Nandyala Pogaku 1(C)	119	84.8	21.0	38.5	14.9	138	23	396	527	1629	1.89	29.29	30.78	154.35	
ABD119	127	86.6	22.0	41.6	16.4	148	29	642	338	1604	2.41	29.84	38.65	100.85	
A119(C)	120	80.3	21.3	36.7	13.5	136	24	401	566	1340	2.01	31.08	26.93	175.91	
GM	131.43	84.07	24.6	41.52	15.96	154.8	22.0	405.0	447.5	1680					
SEM±	2.1	4.4	0.9	1.1	0.5	3.1	2.66	28.6	24.3	44.8					
C.D.@5%	6.4	13.5	2.9	3.4	1.7	9.4	NS	NS	NS	136.0					
C.V%	5.0	9.0	7.0	6.0	7.0	5.0	16.0	14.0	12.0	11.0					

NIPANI

BDNBR 1.1: ADVANCED VARIETAL TRIAL I

Objective: Breeding for high yield with quality coupled with disease resistance.

Year of start : 2018-19
Design : RBD
Replications : 3
Plot Size: Gross: 4 x 9 m Net: 2 x 7.5 m
Entries : 6 + 4 (C)

Results

Out of six test entries tested, three *viz.*, ABD-173 (3648 kg/ha), ABD 164 (3296 kg/ha) and ABD 174 (3278 kg/ha) were on par with best check Vedaganga-1 (3293 kg/ha). However for inter nodal length, leaf length, leaf width and no. of leaves per plant; the test entries are comparable with the best check Vedaganga-1 (Table 1 BDNBR 1.1).

Table 1 BDNBR 1.1: Yield data and morphological characters AVT II - 2018 *Kharif*

Entry name	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
ABD-164	3296	130	19	6	52	26
ABD-166	2056	122	15	8	48	23
ABD-169	1833	117	14	8	46	23
ABD-173	3648	140	20	6	55	27
ABD-174	3278	137	19	6	54	26
NyBD-60	2463	109	16	7	44	22
Vedaganga-1 (C)	3293	151	20	7	59	29
A-119 (C)	1389	110	12	8	43	21
Bhavyashree (C)	2204	139	15	8	54	26
NBD-209 (C)	3389	141	19	6	56	27
C.D. at 5%	444	12	2.94	0.91	6.81	4.03
C.V. (%)	12.80	5.57	10.10	7.61	6.79	9.28

BDNBR 1.2: ADVANCED VARIETAL TRIAL II

Objective: Breeding for high yield with quality coupled with disease resistance.

Year of start: 2018-19
Design : RBD
Plot Size : Gross: 4 x 9 m
Entries : 3 + 4 (C)
Replications : 3
Net : 2 x 7.5 m

Results: Out of three varieties none of the test entries were superior for leaf yield over best check NBD 209 (2778 kg/ha). The test entry ABD 145 (2500 kg/ha) was on par with NBD 209 and was significantly superior over popular variety A 119 (1352 kg/ha). In pooled analysis, ABD-145 and ABD-163 out yielded for leaf yields (2271 kg and 2162 kg/ha respectively). Among the entries, ABD-145 produced highest reducing sugars (7%) than the best check NBD 209 (6.32) where as other parameters like nicotine and chlorides per cent, none of the test entries were superior than the best check NBD 209 (Table 1 & 3 BDNBR 1.2).

Table 1 BDNBR 1.2: Advanced Varietal Trial -II 2018 *Kharif* Season

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
ABD-145	2500	103	16	5	41	21
ABD-163	2259	105	15	5	42	21
ABD-167	1778	110	14	5	43	20
Vedaganga-1 (C)	2241	109	15	5	43	21
A-119 (C)	1352	86	12	5	34	17
Bhavyashree (C)	1130	112	11	6	43	20
NBD-209 (C)	2778	116	17	4	46	22
C.D. at 5%	328.08	16.12	18.16	0.70	5.75	2.61
C.V. (%)	9.10	8.56	9.69	8.07	7.56	8.61

Table 2 BDNBR 1.2: Pooled analysis of Advanced Varietal Trial II (2017-18 and 2018-19)

Entries	Leaf yield (kg/ha)		
	2017-18	2018-19	Pooled
ABD-163	2065	2259	2162
ABD-145	2041	2500	2271
ABD-167	1100	1778	1439
NBD-209	1713	2778	2246
Vedaganga-1 (C)	1354	2241	1798
Bhavyashree (C)	1320	1130	1225
A-119 (C)	915	1352	1134
C.D. at 5%	512.89	328.08	732.69
C.V. (%)	19.21	9.1	17.08

Table 3 BDNBR 1.2: Data on chemical parameters in AVT-II - 2018 (*Kharif)*

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
ABD-145	2.81	7.00	2.34
ABD-163	2.51	5.25	3.04
ABD-167	1.59	5.94	2.84
Vedaganga-1 (C)	2.67	6.31	2.54
A-119 (C)	2.65	5.46	2.85
Bhavyashree (C)	2.23	6.17	2.99
NBD-209 (C)	2.87	6.32	3.01

BDNBR 2.1: STATION VARIETAL TRIAL I (SVT)

Year of start: 2018-19

Design : RBD Replications : 3
Plot Size : Gross: 4 x 9 m Net: 2 x 7.5 m
Entries : 12 + 4 (C)

Results: Seven entries along with four checks were evaluated. None of the entries were shown superiority for leaf yield over best checks NBD 209 (2192 kg/ha) & Vedaganga-1 (2047 kg/ha). All test entries except NBD 320 (1076 kg/ha) were on par compared best check for that yield. The genotypes NBD 321 (2414 kg/ha), NBD 323 (2256 kg/ha) and NBD 325 (2211 kg/ha) were numerically superiority over NBD 209. NBD 325 recorded highest leaf length and leaf width 64 cm and 30 cm respectively compared to the best check A-119 (60 cm and 26 cm respectively).

Table BDNBR 2.1: Data on yield and morphological characters SVT - 2018 *Kharif*

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD-320	1706	154	19	7	55	24
NBD-321	2414	149	22	6	58	23
NBD-322	2175	144	18	8	63	27
NBD-323	2256	119	19	6	60	21
NBD-324	2064	127	15	8	64	27
NBD-325	2211	152	17	8	64	30
NBD-326	2086	142	17	8	61	28
Vedaganga-1 (C)	2047	143	19	8	61	27
Bhavyashree (C)	1703	143	17	8	58	24
A-119 (C)	1644	118	14	8	60	26
NBD-209 (C)	2192	147	20	6	57	23
C.D. at 5%	444	35	3	2	5	4
C.V. (%)	9.75	11.35	7.76	14.16	3.40	7.43

BDNBR: PRELIMINARY VARIETAL TRIAL (PVT)

Year of start: 2018-19

Design : RBD
Replications : Two
Plot Size: Gross: 2 x 9 m Net: 2 x 9 m
Entries : 10 + 4 (C)

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

Results: Ten advanced lines were evaluated along with four checks. All the test entries were on par with best check, NBD 209 (2211 kg/ha), of which NBD 334 (2544 kg/ha) was numerically superior in leaf yield. Leaf morphological traits were on par with best check Vedaganga-1 (Table BDNBR).

Table BDNBR: Data on yield and morphological characters PVT - 2018 *Kharif*

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD - 327	1944	145	20	7	57	25
NBD - 328	1683	135	19	6	55	24
NBD - 329	2028	141	15	8	61	30
NBD - 330	1528	134	18	7	59	25
NBD - 331	1856	130	15	7	56	24
NBD - 332	2078	140	36	7	59	27
NBD - 333	1933	136	15	7	56	26
NBD - 334	2544	139	18	7	59	30
NBD - 335	1964	143	16	7	58	28
NBD - 336	1933	151	18	7	58	29
Vedaganga-1 (C)	2028	138	18	8	62	28
Bhavyashree (C)	1622	145	16	7	56	25
A-119 (C)	1956	116	15	8	56	25
NBD-209 (C)	2211	140	20	7	57	25
C.D. at 5%	583.60	13.12	3.90	1.41	6.29	5.38
C.V. (%)	13.85	4.40	10.37	9.12	5.03	9.33

BDNBR: PRELIMINARY HYBRID TRIAL

Objective: Breeding hybrids for high yield with quality coupled with disease resistance.

Year of start: 2018-19
Design : RBD
Replications : Two
Plot Size : Gross: 2 x 9 m Net: 2 x 9 m
Entries : 16 + 4 (C)

Results

Sixteen hybrids and four parents were tested in replicated yield trial along with the four checks viz., Vedaganga-1, A-119, Bhavyashree and NBD 209. Significant differences were found among the test hybrids for leaf yield. Hybrids tested, *viz*., NBTH-1021 (2739 kg/ha) and NBTH-1011 (2667 kg/ha) recorded significantly superior leaf yield over best check NBD 209 (2144 kg/ha).None of the test hybrids were superior for leaf length and leaf width over the best check A-119 (64 cm and 28 cm respectively).However two test hybrids viz., NBTH -1013 (23 no.) and NBTH -1017 (22 no.) recorded highest leaves per plant compared to the best check NBD 209 (19 no.) leaves per plant.

Table BDNBR: Data on yield and morphological characters - 2018 *Kharif*

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH-1009	2189	131	19	7	58	24
NBTH-1010	1606	107	13	8	60	25
NBTH-1011	2667	134	16	8	63	27
NBTH-1012	2506	142	15	9	61	27
NBTH-1013	2278	145	23	5	58	23
NBTH-1014	2261	124	18	7	60	24
NBTH-1015	2117	134	20	6	58	24
NBTH-1016	2539	149	20	8	60	26
NBTH-1017	2089	155	22	6	59	24
NBTH-1018	1689	124	13	8	59	25
NBTH-1019	2000	145	17	7	57	24
NBTH-1020	2261	154	16	8	61	27
NBTH-1021	2739	144	21	7	54	21
NBTH-1022	2072	133	18	7	56	23
NBTH-1023	2567	133	16	7	63	27
NBTH-1024	2283	158	19	7	62	28
ABD-138	1572	111	12	7	57	24
ABD-151	2483	111	21	6	56	24
ABD-174	1839	140	20	7	54	24
NBD-316	2156	159	17	8	59	27
A-119 (C)	1400	110	14	7	64	28

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBD-209 (C)	2144	139	19	7	58	24
Bhavyashree (C)	1511	133	15	7	58	24
Vedaganga-1 (C)	1894	138	18	7	59	25
C.D. at 5%	510.94	11.77	3.34	1.10	5.22	2.99
C.V. (%)	11.94	4.16	9.21	7.59	4.29	5.80

BDNBR: STATION HYBRID TRIAL I (SHT)

Objective: Breeding hybrids for high yield with quality coupled with disease resistance.

Year of start: 2018-19
Design : RBD
Replications : Three
Plot Size : Gross: 2 x 9 m Net: 2 x 9 m
Entries : 8 + 4 (C)

Results

Eight hybrids were tested in replicated yield trial along with four checks viz., Vedaganga-1, A-119, Bhavyashree and NBD 209. Among the test hybrids only three hybrids *viz.*, NBTH-1003 (2111kg/kg), NBTH-1002 (1917 kg/ha), NBTH-1004 (1811 kg/ha) recorded numerically higher leaf yield compared to best check A-119 (1494 kg/ha). NBTH 1003 325 recorded highest leaf length (58 cm) and leaf width (25 cm) compared to best check Vedaganga-1 (56 and 23 cm respectively).

Table BDNBR: Data on yield and morphological characters - 2018 *Kharif*

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
NBTH - 1001	1450	114	15	7	53	24
NBTH - 1002	1917	127	27	7	55	24
NBTH - 1003	2111	132	27	8	58	25
NBTH - 1004	1811	118	23	6	54	20
NBTH - 1005	1619	146	15	7	57	25
NBTH - 1006	1550	131	15	7	56	24
NBTH - 1007	800	111	15	6	50	21
NBTH - 1008	1611	134	15	7	56	23
Vedaganga-1	1117	125	17	7	56	23

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
(C)						
Bhavyashree (C)	844	122	17	6	50	20
A-119 (C)	1494	103	15	7	54	23
NBD-209 (C)	1028	115	18	6	51	20
C.D. at 5%	685.81	7.57	13.34	12.04	6.17	8.35
C.V. (%)	21.49	109	20	5	52	20

BDNBR : STATION VARIETAL TRIAL (SVT SEED)

Objective: To develop varieties for higher seed yield.

Year of start : 2018-19

Design : RBD
Replications : Three
Plot Size : Gross: 4 x 7.5 m Net: : 4 x 7.5 m
Entries : 10 + 3 (C)

Results

A total of ten genotypes were evaluated along with checks A 119 (for leaf) and A-145 (for seed) during 2018. With respect to seed yield, five genotypes viz., ABD-69 (439 kg/ha), ABD-119 (351 kg/ha), NBD 259 (346 kg/ha), 783-51 (342 kg/ha) and ArBD-7 (340 kg/ha) were recorded significantly higher seed yield over check variety A-145 (220 kg/ha). Regarding leaf yield, ABD-119 (1740 kg/ha) was shown significant superiority over A-119 (1220 kg/ha). The check varieties A-119 and A-145 were on par with each other for both seed and leaf yield. The popular variety A-119 showed numerical superiority over A-145 for both seed and leaf yield.

Table BDNBR: Data on seed, yield and morphological characters - 2018 *Kharif*

Entries	Seed leaf yield (kg/ha)	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
783-51	342	1060	70	7	6	48	18
Gundsurti	183	1010	87	9	6	50	18
Smyrna	233	937	93	7	7	49	18
Sanand local	301	1123	97	10	6	53	20
ABD-119	351	1740	125	13	6	56	26
NBD-259	346	1503	94	9	7	59	27
NBD-122	210	1320	111	10	7	55	22
ABD-69	439	1400	84	11	6	56	22

Entries	Seed leaf yield (kg/ha)	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves/ plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
ArBD-7	340	1413	107	10	7	55	24
Line 1-1	263	1177	100	12	6	47	19
A-119 (C)	325	1220	78	10	6	52	21
Bhagyashree (C)	220	870	41	6	5	36	14
A-145 (C)	117	430	27	4	1	7	6
C.D. at 5%	17.97	15.86	13.34	17.68	9.18	6.26	13.93

Performance of varieties for seed yield across years: Evaluation of ten varieties across two years revealed that five entries viz., ABD 69, NBD 259, ArBD 7, A-119 and NBD 122 showed yield superiority of 39.1%, 30.2%, 29.5%, 20.8% and 20%, respectively. For leaf yield, yield superiority over A 119 was recorded by ABD-119 (30.4), NBD 122 (26.0%), NBD 259 (23.7%), ArBD-7 (14.6%) and ABD 69 (9.1%).

Table BDNBR: Data on Seed Yield (kg/ha)

Entries	Seed Yield (kg/ha)				Leaf yield (kg/ha)			
	2017	2018	Mean	% increase over A-145	2017	2018	Mean	% increase over A 119
783-51	124	342*	233	12.5	462	1060	761	
Gundsurti	180	183	181		652	1010	831	
Smyrna	189	233	211	3.2	623	937	780	
Sanand local	185	301	243	16.1	764	1123	944	
ABD-119	150	351*	250	18.5	902	1740*	1321	30.4
NBD-259	239*	346*	292	30.2	905	1503	1204	23.7
NBD-122	300*	210	255	20.0	1162*	1320	1241	26.0
ABD-69	231*	439*	335	39.1	622	1400	1011	9.1
ArBD-7	239*	340*	289	29.5	739	1413	1076	14.6
Line 1-1	128	263	195		563	1177	870	
A-119 (C)	191	325	258	20.8	617	1220	919	-
A-145 (C)	187	220	204		504	870	687	
C.D. at 5%	48.57	117.00			318.41	429.86		
C.V. (%)	11.49	17.97			20.21	15.86		

GENERATION OF BREEDING MATERIAL

BDNBR 5: GENERATION OF BREEDING MATERIAL (GENERATION OF NEW CROSSES)

Objective: Breeding for high yielding varieties and quality coupled with disease resistance

Year of start : 2018-19

A total of 13 new inter-varietal crosses for leaf yield and quality were produced. The lists of crosses are given in Table BDNBR 5.

Table BDNBR 5: List of crosses generated during 2018-19

S.No.	Crosses	Purpose
1.	NBD 209 X ABD 173	High leaf yield and resistance to major diseases
2.	NBD 209 X ABD 151	High leaf yield and resistance to major diseases and pests
3.	A-119 X ABD 173	High leaf yield and quality coupled with resistance to major diseases
4.	A-119 X ABD 164	High leaf yield and quality coupled with resistance to major diseases
5.	A-119 X ABD 151	High leaf yield and quality coupled with resistance to major diseases and pests
6.	NBD 209 X ABD 166	High leaf yield and resistance to major diseases
7.	NBD 209 X ABD 174	High leaf yield and resistance to major diseases
8.	NBD 209 X ABD 164	High leaf yield and resistance to major diseases
9.	Bhavyashree X ABD 151	High leaf yield and quality coupled with resistance to major diseases and pests
10.	NBD 209 X ABD 189	High leaf yield
11.	NBD 209 X ABD 167	High leaf yield and resistance to major diseases
12.	A-119 X ABD 189	High leaf yield and quality
13.	A-119 X ABD 167	High leaf yield and good quality coupled with resistance to major diseases

BDNBR 5.1: GENERATION BREEDING MATERIAL (F_1 evaluation)

Objective: Breeding for high yielding varieties and quality coupled with disease resistance.

Year of start : 2018-19
Design : RBD
Replications : Two
Plot Size: Gross: 2 x 9 m Net: 2 x 9 m
Entries : 21 + 7 (C)

Results

Twenty eight inter-varietal F_1s were evaluated for leaf yield and other traits, four F_1s were chosen and advanced to F_2 (Table 1 & 2 BDNBR 5.1).

Table 1 BDNBR 5.1: Data on yield and morphological characters - 2018 *Kharif*

Entries	Leaf yield (kg/ha)	Plant height (cm)	No. of leaves / plant	Internodal length (cm)	Leaf length (cm)	Leaf width (cm)
A-119 x NBD 209	1227	79	17	5	54	23
A-119 x Bhavyashree	727	82	17	6	54	23
A-119 x Vedaganga	620	61	16	5	51	22
A-119 x Bhagyashree	633	70	18	4	51	20
A-119 x PL-5	347	69	17	5	62	29
NBD 209 x Bhavyashree	400	101	17	7	57	25
NBD 209 x Vedaganga	1000	99	20	7	55	23
NBD 209 x A-2	1193	99	20	6	54	22
NBD 209 x PL-5	827	84	21	4	36	13
Bhavyashree x Vedaganga	1133	77	19	4	35	16
Vedaganga x Bhagyashree	613	97	126	5	49	19
Vedaganga x A-2	747	84	110	5	51	23
Vedaganga x PL-5	573	62	92	5	45	16
Bhagyashree x PL-5	413	53	9	2	51	18
A-2 x PL-5	587	86	12	7	58	24
A 119 (C)	533	86	16	7	53	23
NBD 209 (C)	1507	100	18	6	50	23
Bhavyashree (C)	1280	100	15	7	59	29
Bhagyashree (C)	880	107	16	7	55	25
Vedaganga-1 (C)	1207	91	18	6	57	25
A-2	990	89	13	7	52	22
PL-5	607	105	16	7	51	22
C.D. at 5%		44.26	23.97	4.51		
C.V. (%)		23.60	49.94	9.88		

Table 2 BDNBR 5.1: Selected F_1s for advancement of F_2

S.No	Entries
1	A-119 X NBD 209
8	NBD 209 X Vedaganga
10	NBD 209 X A-2
12	Bhavyashree X Vedaganga

BDNBR 5.2: GENERATION BREEDING MATERIAL (F_2 population)

Objective: Breeding for high yielding varieties with quality coupled with disease resistance

Year of start : 2018-19
Design : RBD
Replications : Two
Plot Size : 42 x 7.5 m
Entries : 3 + 2 (C)

Results

A total of three F_2 populations were grown. In these, a total of 29 plants (7 to 14 plants in each F_2) were selected (Table BDNBR 5.2).

F_2 populations planted during *kharif* 2018-19 (Plot size 42 m X 9 m, 504 plants each)

Table BDNBR 5.2: Data on F_2 families selection- 2018 *Kharif* Season

Entries	Selection (No. of plants)
GT-4 X ABD 115	8
ABD 151 X NBD 289	14
ABD 146 X NBD 277	7
Total	**29**

BDNBR 5.3: GENERATION OF BREEDING MATERIAL (F_3 population)

Objective: Breeding for high yielding varieties with quality coupled with disease resistance

Year of start: 2018-19
Plot Size : 3 x 18 m
Entries : 3 + 2 (C)

Results

Sixteen F_3 families were grown along with checks. In these, a total of 52 plants (1 to 11 plants in each F_3) were selected.

Table BDNBR 5.3: F_3 Families evaluated during *kharif* 2018-19

Entry code	Pedigree	No. of plants selected
2017-1-1	Bhavyashree × ABD -146	2
2017-1-3	Bhavyashree × ABD -146	5
2017-2-2	A- 119 × ABD – 146	11
2017-2-5	A- 119 × ABD – 146	4
2017-3-1	Bhavyashree × ABD -151	1
2017-3-3	Bhavyashree × ABD -152	4
2017-3-4	Bhavyashree × ABD -153	3
2017-3-5	Bhavyashree × ABD -154	2
2017-3-6	Bhavyashree × ABD -155	6
2017-3-10	Bhavyashree × ABD -156	3
2017-4-3	Vedaganga X NBD-261	3
2017-4-7	Vedaganga X NBD-261	2
2017-5-6	ABD-32 X Bhavyashree	1
2017-5-6	ABD-32 X Bhavyashree	1
2017-6-6	NBD-209 X GPM-68	3
2017-6-7	NBD-209 X GPM-68	1

BDNBR 5.4: INDUCED MUTAION (M2) STUDIES IN *BIDI* TOBACCO

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

Year of start : 2018-19
Entries : 2 varieties (10 Gamma irradiation dosages)

Varieties	:	A 119 & NBD 209
Dosages	:	250, 300, 350, 400, 450 Gy
LD_{50}	:	A 119: 300 Gy & NBD 209: 400 Gy
Lethal dosages	:	450 Gy & 500 Gy

Results

Two varieties NBD 209 and A 119 were subjected for gamma irradiation with 5 treatments ranging from 250 to 450 Gy at an interval of 50 Gy. A total of 46 and 32 mutants were advanced to M3 derived from A 119 and NBD 209, respectively.

Table BDNBR 5.4: M_1 plants advanced to M_2

Variety	Dosages	Total no. of plants advanced to M2
A 119	250 Gy	12
LD_{50}	300 Gy	25
	350 Gy	9
	Total	**46**
NBD 209	350 Gy	7
LD_{50}	400 Gy	17
	450 Gy	8
	Total	**32**

BDNBR 5.5: INDUCED MUTAION (M1) STUDIES IN *BIDI* TOBACCO

Objective: Creating new genetic variability for quality, yield (leef and seed) and resistance to biotic stresses to create new genetic variability for seed yield through induced mutation

Year of start : 2018-19

Entries : Four entries and one variety (5 Gamma irradiation dosages)

Entries & Varieties : NBD 122, NBD 259, ArBD-7, ArBD-4 & ABD 119
Dosages : 250, 300, 350, 400, 450 Gy

Results

To create new genetic variability for seed yield through induced mutation, four entries and one variety *viz.*, NBD 122, NBD 259, ArBD-7, ArBD-4 & ABD 119 were subjected for gamma irradiation with five dosage treatments ranging from 250 to 500 Gy at an interval of 50 Gy. A total of 59 M1 plants were advanced to M2.

Table BDNBR 5.4: M_1 plants advanced to M_2

Variety	Dosages	Total no. of plants advanced to M2
NBD 259	250	6
	300	4
	350	6
	400	6
	450	5
	Total	**27**
ArBD 7	250	2
	300	1
	350	2
	400	2
	450	2
	Total	**9**

Variety	Dosages	Total no. of plants advanced to M2
NBD 122	250	3
	300	1
	350	2
	400	1
	450	1
	Total	**8**
ABD 119	250	2
	300	1
	350	2
	400	3
	450	1
	Total	**9**
ArBD 4	250	1
	300	2
	350	1
	400	1
	450	1
	Total	**6**
	Total no. of Plants	**59**

BDNBR: 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 12 plants each
Entries : 230
Plot Size : 1 X 9 m

Results

A total of 230 germplasm lines were grown and maintained. Distinct germplasm were identified

Table BDNBR: No. of germplasm lines maintained

S. No.	Entries
1.	Keliu-20
2.	Anand-23
3.	Anand-119
4.	Anand-2
5.	GT-4
6.	Kukumarthi

S. No.	Entries
7.	103-9-101
8.	783-51
9.	114-4 (RPK type)
10.	Peschtere 28
11.	S-20
12.	S-12

S. No.	Entries
13.	S-112
14.	Akol
15.	Gundsurti
16.	Kodani
17.	V-54
18.	Dumbara
19.	Smyrna
20.	Sanand local
21.	Subhelav selection
22.	Red Russion
23.	Bankete A-1
24.	V-58
25.	Keliu- 49
26.	Pilliu- 19
27.	BL 4-2
28.	103-9-101-28-31 (A-2 X Olor)
29.	ABD – 7
30.	ABD – 15
31.	ABD – 119
32.	ABD – 24
33.	ABD – 30
34.	ABD – 36
35.	GT -9
36.	TI -421
37.	TI -525
38.	KDH – 959
39.	Abirami
40.	Jayalaksmi
41.	575-28-110
42.	GT – 5
43.	GT – 7
44.	NBD -119
45.	NBD - 239 – 2
46.	NBD – 257
47.	NBD – 259
48.	NBD – 260
49.	NBD - 239 -4
50.	NBD – 209
51.	NBD – 122
52.	NBD – 261
53.	K - 20 - Plule leaves
54.	RPK - 1 – 2
55.	NBD - 48 – 1
56.	22 - 10 - 1 (11 - 47 - Sokha)
57.	35 - 19 - 39 – 24
58.	169 - 19 -16 (88 - 47 - Sokha)

S. No.	Entries
59.	SB -154
60.	169 - 19 - 6 (88 - 47 - Sokha)
61.	A -1 -11 – 65
62.	169 - 2 (N & L)
63.	Jhakhari Rampur
64.	AKBT - 03 – 02
65.	ABT – 10
66.	Bhavyashree
67.	NBD – 43
68.	NBD – 53
69.	NBD - 57 – 1
70.	NBD – 71
71.	NBD - 80 – 1
72.	NBD - 80 – 2
73.	NBD – 85
74.	NBD – 95
75.	NBD – 111
76.	NBD -115
77.	NBD – 136
78.	NBD – 154
79.	NBD – 155
80.	NBD – 159
81.	NBD – 164
82.	NBD – 236
83.	NBD – 271
84.	NBD – 276
85.	NBD – 277
86.	ABD – 43
87.	ABD – 46
88.	ABD – 50
89.	ABD – 51
90.	ABD – 52
91.	ABD – 54
92.	ABD – 60
93.	ABD – 61
94.	ABD – 62
95.	ABD – 67
96.	ABD – 68
97.	ABD – 69
98.	ABD - 70
99.	ABD -71
100.	ABD – 72
101.	ABD – 73
102.	ABD – 77
103.	ABD – 78
104.	ABD -79
105.	ABD – 84
106.	ABD – 87

S. No.	Entries
107.	ABD – 90
108.	ABD – 91
109.	ABD – 92
110.	ABD – 94
111.	ABD – 95
112.	ABD – 96
113.	ABD – 99
114.	ABD – 100
115.	ABD – 101
116.	ABD – 102
117.	ABD – 103
118.	ABD – 104
119.	ABD – 107
120.	ABD – 109
121.	ABD – 110
122.	ABD – 111
123.	ABD – 112
124.	ABD – 113
125.	ABD – 115
126.	ABD – 116
127.	ABD - 117
128.	ABD – 118
129.	ABD – 120
130.	ABD – 121
131.	ABD – 123
132.	ABD - 124
133.	ABD – 125
134.	ABD – 127
135.	ABD – 128
136.	ABD – 130
137.	ABD -131
138.	ABD – 132
139.	ABD – 146
140.	ABD – 152
141.	ArBD – 4
142.	ArBD - 5
143.	ArBD – 7
144.	ArBD – 8
145.	ArBD – 9
146.	ArBD – 32
147.	ArBD – 33
148.	NyBD – 3
149.	NyBD – 4
150.	NyBD – 5
151.	NyBD – 56
152.	NyBD – 59
153.	G. M. Koyali
154.	Line {34 - 30 X (A - 119)^2} 103 - 6 - 1 -40 - 22 -34 -26 -35 - 22 - 25 – 2
155.	Line 543 - 41 - 12 - 14 (RPK type)
156.	Line - 1 – 1
157.	Pilliu – 37
158.	Line - 169 - 119 (Upper leaves long internode)
159.	B.S.P (Black Spangle Parent)
160.	N.C.D (Necrotic Crinkle Dwarf)
161.	Line 93 - 103 - 93 (88-47 X Sokh)
162.	Line 114 - 16 (Female parent of GT - 4)
163.	Line 181 -83 - 1 (S -20 X K - 20)
164.	Line 134 - 2 - 2 {K - 20 X Sokh} X K – 20
165.	Line 543 - 37 - 38 - 24 (A -119 X Olor)
166.	Line 121 - 13 -27 - 29 (108 - 15 X Olar)
167.	ABD -10
168.	ABD – 65
169.	ABD - 66
170.	ABD – 67
171.	ABD - 101 (GABT -11)
172.	ABD -118
173.	C -11
174.	KL
175.	Oriental
176.	Xanthi
177.	Samsan
178.	Trabizonal
179.	Viswanath
180.	Sender Patti Special
181.	Bhagyalakshmi
182.	HDBRG -LP – 2
183.	F-7 - 127
184.	Margadhan
185.	Bhagya
186.	320-2-30-28-18-I
187.	Jati Patti
188.	320-2-30-28-20-12
189.	16-12-21-106-4-26
190.	DWFC

S. No.	Entries
191.	Thangam
192.	320-2-80-25-84-10-I
193.	Jati
194.	Kunkumarthi
195.	GT-5
196.	Vairam
197.	F-7-124
198.	NPN – 63
199.	NPN – 64
200.	NPN – 65
201.	NPN – 66
202.	NPN – 73
203.	NPN – 75
204.	NPN – 81
205.	NPN – 30
206.	A-428
207.	NBD-289
208.	NBD-290
209.	NyBD-55
210.	ABD-138

S. No.	Entries
211.	ABD-151
212.	ArBD-39
213.	ArBD-40
214.	NBD-309
215.	NBD-312
216.	NBD-314
217.	NBD-300
218.	NBD-292
219.	NBD-302
220.	NBD-297
221.	NBD-315
222.	NBD-316
223.	NBD-317
224.	NBD-318
225.	NBD-319
226.	NBD-307
227.	NBD-308
228.	NBD-310
229.	NBD-311
230.	NBD-313

MAINTENANCE OF A LINES AND RELEASED VARIETIES

Objective: To maintain A lines & released varieties
Design : Non replicated, two lines of 10 plants each
Entries : 7 + 7 (C) Plot Size : 4 X 9 m

Results: Seven A lines and seven varieties were maintained

Table: MAINTENANCE OF A LINES AND RELEASED VARIETIES

S. No.	Entry Name
1.	MS A-119
2.	MS NBD-209
3.	MS Bhavyashree
4.	MS Bhagyashree
5.	MS Vedagandga
6.	MS A-2
7.	MS PL-5
8.	A-119
9.	NBD-209
10.	Bhavyashree
11.	Bhagyashree
12.	Vedaganga
13.	A-2
14.	PL-5

C. NATU TOBACCO

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 fifteen numbers of genotype were maintained for future breeding programme. No new germplasm was collected/ received for characterization and evaluation.

PBBR 8: YIELD EVALUATION TRIAL OF ADVANCED BREEDING LINES IN *PIKKA* TOBACCO

Objective: To develop a suitable high yielding *Pikka* tobacco variety for the State

Year of start : 2015-16
Year of completion: 2018-19

Treatment : 7+1 (c)
Design : RBD
Replications : Three
Plot size : 4.5 x 3.0 M
Spacing : 75 x 50 cm
Manurial schedule : a) Fertilizer dose N:P:K :: 80:40:40 kg/ha.

Observations

1. Plant stand, 2 .Topped plant height (cm),
3. No. of leaves/plant, 4 .Leaf length (cm),
5 Leaf breadth (cm) 6. Cured leaf yield (kg/ha)

Results

Seven lines of *Pikka* tobacco along with one check variety, Gajapati were evaluated during *kharif* 2015, 2016, 2017 and 2018 in RCBD with three replications for cured leaf yield and ancillary characters. Since the performance of the trial was very poor in 2016, it was not considered for analysis. Therefore, trial data of *kharif* 2015, 2017 and 2018 considered for statistical analysis. Data on cured leaf yield and ancillary characters of *Pikka* tobacco genotypes tested in YET 2015, 2017 and 2018 *kharif* seasons and pooled over years are given in Table 1 to 4 PBBR 8.

Table 1 PBBR 8: Data on morphological characters and curd leaf yield (kg/ha) in YET, 2015 *kharif*

Entries	Plant population/ ha	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF4-2-3	25679	65.4	11	50.4	20.4	1370	5.7
NF4-10-2	25185	63.5	11	50.3	23.3	1185	
NF4-17-2	24444	54.0	11	51.7	21.1	1111	
NF4-18-3	25185	62.9	11	51.5	17.6	1333	2.9
NF4-20-2	23704	61.6	11	42.2	15.1	1037	
NF4-27-3	26173	60.8	11	51.0	17.8	1444	11.4
NF4-31-1	24444	61.8	11	48.5	19.2	1259	
Gajapati (C)	25185	61.7	11	50.6	20.0	1296	
Mean	25000	61.5	11	49.5	19.3	1254	
SEm ±	372	2.0	0.6	1.6	0.5	39	
C.D. at 5%	1128	5.9	NS	4.8	1.6	117	
C.V. (%)	2.6	5.5	9.5	5.5	4.7	5.3	

Table 2 PBBR 8: Data on morphological characters and curd leaf yield (kg/ha) in YET, 2017 *kharif*

Entries	Plant population/ ha	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF 4-2-3	21728	101.5	16	37.9	13.2	1035	6.0
NF 4-10-2	22222	110.9	16	35.1	13.3	1026	5.1
NF 4-17-2	24444	83.7	14	37.0	11.7	952	
NF 4-18-3	24197	115.4	18	40.6	13.5	1058	8.4
NF 4-20-2	20000	108.7	14	41.6	14.5	987	1.1
NF 4-27-3	23210	122.7	17	37.1	13.0	913	
NF 4-31-1	22963	105.3	17	38.7	15.1	945	
Gajapati (C)	25432	108.3	13	39.7	14.9	976	
Mean	23025	107.1	16	38.5	13.6	987	
SEm ±	486	2.5	0.9	1.2	0.6	31	
C.D. at 5%	1474	7.6	2.8	3.7	1.9	95	
C.V. (%)	3.7	4.1	10.3	5.5	8.0	5.5	

Table 3 PBBR 8: Data on morphological characters and curd leaf yield (kg/ha) in YET, 2018 *kharif*

Entries	Plant population/ ha	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF 4-2-3	26667	81.7	14	47.7	14.3	1193	
NF 4-10-2	26667	92.7	16	52.7	16.0	1500	24.9
NF 4-17-2	26667	54.7	12	48.3	13.0	1076	
NF 4-18-3	25185	100.7	16	52.7	17.3	1451	20.8
NF 4-20-2	25926	101.0	15	47.3	15.7	1449	20.6
NF 4-27-3	26667	75.7	15	48.3	15.7	1372	14.2
NF 4-31-1	25926	85.3	12	39.3	11.0	874	
Gajapati (C)	26667	77.7	14	49.3	14.0	1201	
Mean	26297	83.7	14	48.2	14.6	1264	
SEm ±	475	2.8	0.9	1.8	0.8	47	
C.D. at 5%	NS	8.4	2.7	5.4	2.3	142	
C.V. (%)	3.1	5.8	10.6	6.4	9.0	6.4	

Table 4 PBBR 8: Data on pooled analysis of morphological characters and curd leaf yield (kg/ha) in YET, 2015, 2017 & 2018 *kharif*

Entries	Plant population/ ha	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF 4-2-3	24691	82.9	14	45.3	16.0	1199	3.6
NF 4-10-2	24691	89.0	14	46.0	17.5	1237	6.9
NF 4-17-2	25185	64.1	12	45.7	15.3	1046	
NF 4-18-3	24856	93.0	15	48.3	16.1	1281	10.7
NF 4-20-2	23210	90.4	13	43.7	15.1	1158	0.1
NF 4-27-3	25350	86.4	14	45.5	15.5	1243	7.4
NF 4-31-1	24445	84.2	13	42.2	15.1	1026	
Gajapati (C)	25761	82.6	13	46.5	16.3	1157	
Mean	24774	84.1	14	45.4	15.9	1168	
SEm ±	258	1.4	0.5	.9	0.4	23	
C.D. at 5%	737	4.0	1.3	2.5	1.1	65	
C.V. (%)	3.1	5.0	10.3	5.9	7.0	5.9	

Pooled results:

Significant differences were observed for cured leaf yield and other morphological characters every year except number of leaves per plant in 2015 plant population /ha in 2018.

During 2015 *kharif*, only one genotype NF 4-27-3 (1444kg/ha) produced significantly higher cured leaf yield over check variety Gajapati (1296 kg/ha). Genotypes NF 4-27-3 (1444 kg/ha), NF 4-2-3(1370 kg/ha) and NF 4-18-3(1333 kg/ha) gave 11.4,5.7 and 2.9% higher cured leaf yield over check variety Gajapati (1296 kg/ha).

During *kharif*, 2017 none of the test entries were found significantly superior to check variety Gajapati (976 kg/ha) in cured leaf yield . However entries like NF 4-18-3 (1058 kg/ha) , NF 4-2-3 (1035 kg/ha) , NF 4-10-2 (1026 kg/ha)and NF 4-20-2 (987 kg/ha) exhibited 8.4%, 6.0%, 5.1% and 1.1% higher cured leaf yield over check variety Gajapati.

Significantly higher cured leaf yield was recorded in NF 4-10-2 (1500 kg/ha), followed by NF 4-18-3 (1451kg/ha), NF 4-20-2 (1449 kg/ha), and NF 4-27-3 (1372 kg/ha) over check variety Gajapati (1201 kg/ha) during *Kharif* 2018. The range of yield improvement over Gajapati (Check var.) was 24.9% (NF 4-10-2), 20.8% (NF 4-18-3), 20.6%(NF 4-20-2) and 14.2% (NF 4-27-3).

Pooled analysis over years showed significant differences among seven test entries for cured leaf yield and other ancillary characters. Among seven test entries, genotypes NF 4-18-3 (1281 kg/ha), NF 4-27-3 (1243 kg/ha), NF 4-10-2 (1237 kg/ha) were found significantly superior reflecting 10.7, 7.4 and 6.9 % higher cured leaf yield over check variety Gajapati (1157 kg/ ha). Other genotypes NF 4-2-3 (1199 kg/ha) and NF 4-20.2 (1158 kg/ha) also produced numerically higher cured leaf yield over check variety, Gajapati.

Conclusion: Considering cured leaf yield and other attributes, *Pikka* tobacco genotypes NF 4-18-3, NF 4-27-3, NF 4-10-2, NF 4-2-3 and NF 4-20-2 may be promoted to Replicated Yield Trial 2019

PBBR 5 : BULK EVALUATION TRIAL 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	: 2016-17	Year of completion	: 2018-19
Treatment	: 3+1 (C)	Plot size	: 9.0 x 4.0 m
Spacing	: 75 x 50 cm		
Manurial schedule	: Fertilizer dose N:P:K :: 80:40:40 kg/ha.		

Observations recorded:

1. Plant stand
2. Topped plant height (cm)
3. No. of leaves/ plant
4. Leaf length(cm)
5. Leaf breadth(cm)
6. Cured leaf yield (kg/ha)

Results

Three lines of pikka tobacco along with one check variety Gajapati were evaluated during *kharif* 2016, 2017 and 2018 in bulk for cured leaf yield and ancillary characters. Data on cured leaf yield and ancillary characters of pikka tobacco genotypes tested in YET 2016, 2017 and 2018 *kharif* seasons and pooled over years are given in Table PBBR 5.1, PBBR 5.2, PBBR 5.3 and PBBR 5.4.

Table 1 PBBR 5.1: Data on morphological characters and curd leaf yield (kg/ha) in BET, 2016 *kharif*

Entries	No. of plants/ plot	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF3-6-2	53	90	20.4	44.6	17.6	619	
NF3-15-1	90	124.6	25.0	37.8	15.0	595	
PVM-14-1	112	123.4	23.6	34.4	11.1	726	3.42
GAJAPATI (C)	115	114.4	22.6	30.6	11.2	702	

Table 2 PBBR 5.2: Data on morphological characters and curd leaf yield (kg/ha) in BET, 2017 *kharif*

Entries	No. of plants/ plot	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF3-6-2	114	95.9	13.6	39.2	16.6	1059	
NF3-15-1	118	107.0	15.2	41.1	17.3	1191	5.49
PVM-14-1	81	106.8	12.5	36.4	15.3	984	
GAJAPATI (C)	102	124.9	12.1	42.2	19.1	1129	

Table 3 PBBR 5.0: Data on morphological characters and curd leaf yield (kg/ha) in BET, 2018 *kharif*

Entries	Plant population/ ha	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
NF3-6-2	26222	92	13	51	17	1118	
NF3-15-1	26222	144	15	51	16	1207	
PVM-14-1	26222	83	12	43	16	1041	
Gajapati (C)	26667	70	16	54	19	1311	

Table 4 PBBR 5.4: Data on pooled analysis and cured leaf yield of pikka tobacco genotypes in BET 2016, 2017 & 2018 *kharif* season

Genotype	Cured Leaf Weight (kg/ha)				% increase over check
	2016	2017	2018	Pooled	
NF 3-6-2	619	1059	1118	932	
NF 3-15-1	595	1191	1207	998	
PVM 14-1	726	984	1041	917	
Gajapati (C)	702	1129	1311	1047	

Pooled Analysis

Three lines of pikka tobacco along with one check variety Gajapati were evaluated in larger plots during *kharif* 2016, 2017 and 2018 for cured leaf yield and ancillary characters. During 2016 *kharif* season, genotype PVM 14-1 (726 kg/ha) ranked first in cured leaf yield and gave 3.42 % higher yield than check variety Gajapati(702 kg/ ha). Out of four entries tested under bulk evaluation trial during 2017 *kharif* season, genotype NF3-15-1 recorded maximum cured leaf yield (1191 kg/ha) reflecting 5.49 % higher yield over check variety Gajapati (1129 kg ha). No entry was found superior to check variety Gajapati (1311 kg/ha) with respect to cured leaf yield during *kharif* 2018. Similar result was also noticed in pooled data over three years.

Pooled analysis of three years data revealed that No entry was found superior to check variety Gajapati and none was found suitable for on farm testing.

PBBR 9: REPLICATED YIELD TRIAL OF ADVANCED BREEDING LINES 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	: 2017-18	Design	: RBD
Year of completion	: 2018-19	Replications	: Three
Treatment	: 10+1 (C)	Plot size	: 4.0 x 3.0 m
		Spacing	: 75 x 50 cm

Manurial schedule : Fertilizer dose N:P:K :: 80:40:40 kg/ha.

Observation recorded:

1. Plant stand
2. Topped plant height (cm)
3. No. of leaves/plant
4. Leaf length (cm)
5. Leaf width (cm)
6. Cured leaf yield (kg/ha)

Results

Ten lines of pikka tobacco along with one check variety Gajapati were evaluated during *kharif* 2017 and 2018 in RCBD with three replications for cured leaf yield and ancillary characters. Data on cured leaf yield and ancillary characters of pikka tobacco genotypes tested in RYT 2017, 2018 *kharif* seasons and pooled over years are given in Table 1 to 3 PBBR 9.

Table 1 PBBR 9: Data on morphological characters and cured leaf yield (kg/ha) in RYT 2017 *kharif*

Entries	No. of plants/ plot	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
BPT-4	20000	85.0	14	29.2	11.4	1181	
BPT-7	19753	77.1	15	30.3	12.9	1052	
BPT-16	19259	39.7	8	22.0	9.5	818	
BPT-18	19753	83.3	14	32.4	13.0	960	
BPT-23	21234	76.6	16	30.3	13.7	1077	
BPT-33	18765	95.0	15	30.6	14.8	1069	
BPT-35	20247	106.2	16	28.5	14.9	905	
BPT-39	21481	87.9	13	28.5	13.1	948	
BPT-49	19259	99.3	17	29.8	14.4	1356	10.6
BPT-50	21728	81.7	13	28.0	11.1	856	
Mean	25432	108.3	13	39.7	14.9	1226	
Gajapati (C)	20628	85.5	14	29.9	13.1	1041	
SEm ±	1219	4.7	1	1.2	0.7	50	
C.D. at 5%	NS	14.0	2	3.4	2.0	147	
C.V. (%)	10.2	9.6	6.6	6.7	9.1	8	

Table 2 PBBR 9: Data on morphological characters and cured leaf yield (kg/ha) in RYT 2018 *kharif*

Entries	No. of plants/ plot	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
BPT-4	22963	49.7	12	41.3	44.0	899	
BPT-7	24444	81.0	14	49.3	65.0	1381	23.7
BPT-16	23704	63.3	13	36.7	57.0	1026	
BPT-18	22963	57.7	13	43.0	40.0	869	
BPT-23	24444	44.7	12	41.7	38.0	862	
BPT-33	24444	73.0	15	38.0	50.0	871	
BPT-35	23704	27.7	11	35.3	42.0	855	
BPT-39	24444	66.0	14	47.0	67.0	1388	24.4
BPT-49	23703	67.7	13	44.7	62.0	1221	9.4
BPT-50	22963	90.0	14	48.7	69.0	1186	6.3
Mean	25185	65.0	13	48.3	56.0	1116	
Gajapati (C)	23906	62.3	13	43.1	17.9	1061	
SEm ±	958	3.4	1	1.6	0.9	49	
C.D. at 5%	NS	9.9	2	4.6	2.6	144	
C.V. (%)	6.9	9.3	9.1	6.3	8.4	8.0	

Table 3 PBBR 9: Data on pooled analysis of morphological characters and cured leaf yield (kg/ha) in RYT 2017 and 2018 *kharif*

Entries	No. of plants/ plot	Topped Plant Height	No. of leaves/ plant	leaf length (cm)	leaf width (cm)	Cured leaf (kg/ha)	% increase over check
BPT-4	21481	67.3	13	35.3	13.0	1040	
BPT-7	22099	79.0	15	39.8	17.3	1217	3.9
BPT-16	21482	51.5	10	29.3	14.2	922	
BPT-18	21358	70.5	13	37.7	13.2	915	
BPT-23	22839	60.6	14	36.0	13.2	970	
BPT-33	21605	84.0	15	34.3	15.7	970	
BPT-35	21975	66.9	13	31.9	14.5	880	
BPT-39	22963	76.9	13	37.8	17.7	1168	
BPT-49	21481	83.5	15	37.2	17.5	1288	10.0
BPT-50	22346	85.8	13	38.3	17.1	1021	
Mean	25309	86.7	13	44.0	16.8	1171	
Gajapati(C)	22267	73.9	13	36.5	15.5	1051	
SEm ±	775	2.9	0.4	1.0	0.6	35	
C.D. at 5%	2215	8.3	1.2	2.8	1.6	100	
C.V. (%)	8.5	9.6	7.9	6.5	8.7	8.1	

Pooled Analysis

Test entries differed significantly for cured leaf yield and yield attributing characters (Table PBBR 9.1) during *kharif*,2017, among 11 entries tested under Replicated Yield Trial, genotype BPT-49 recorded highest cured leaf yield (1356 kg/ha) and gave 10.60 % higher yield over check variety Gajapati (1226 kg/ha) , followed by BPT-4 (1181 kg/ha). No entry was significantly superior to check variety Gajapati in cured leaf yield.

Significant differences for cured leaf yield and other ancillary characters were found among test materials except for no. of plants/ha during *kharif* 2018. (Table PBBR 9.2). Only two lines *Viz*., BPT 39 (1388 kg/ha) and BPT 7 (1381 kg ha) showed significantly superiority in cured leaf yield over check variety Gajapati (1116 kg /ha). Test entries BPT 39 (1388 kg/ha), BPT 7 (1381 kg/ha), BPT49 (1221 kg/ha) and BPT 50 (1186 kg/ha) out yielded check variety Gajapati (1116 kg/ha) by 24.4, 23.7, 9.4 and 6.3 percent respectively

Pooled analysis of cured leaf yield and ancillary characters of pikka tobacco genotypes in RYT during 2017 & 2018 *kharif* seasons was presented in Table PBBR 9.3. Significant differences among test entries were observed for cured leaf yield and yield attributing characters. Only one genotype BPT 49 (1288 kg/ha) exhibited significant yield superiority (10.0%) over check, variety Gajapati (1171 kg/ha). Another genotype BPT 7 (1217 kg/ha) though gave 3.9 % higher cured leaf yield over check variety Gajapati but found at par with Gajapati.

Considering two years data on leaf yield and ancillary characters, pikka tobacco genotypes BPT 49 and BPT 7 may be promoted to Bulk Evaluation Trial (BET), 2019. Further, genotypes BPT 39 and BPT 50 performed better than check variety, Gajapati during *kharif*, 2018 and gave 24.4 and 6.3 percent higher cured leaf yield than Gajapati.

D. *RUSTICA* TOBACCO

IVT

RUABRC/ RULdBRC/ RUDBRC/ RUArBRC 2:

INITIAL VARIETAL TRIAL ON *RUSTICA* TOBACCO

Initial varietal trial on *Rustica* tobacco with seven entries was conducted at four centres (Anand, Ladol, Araul and Dinhata) during 2018-19. The details of the trial are given below.

Year of start: 2018-19

Layout : RBD
Treatments : 7 entries + checks
Replications : Three

Entries: 7 (Seven)

1. AR 145
2. AR 148
3. AR 151
4. ArR 71
5. ArR 77
6. LR 90
7. LR 91

Checks at different centres :

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

Results

Morphological characters, yield data and Percent increase over best check at different centres are consolidated and given respectively in Tables RUBRC 2-1 to Table RUBRC 2-5. The results are discussed centre-wise.

ARAUL

On the basis of cured leaf yield, entry ArR-77 (3550 kg/ha) followed by entry AR-148 (2980 kg/ha) found significantly superior over the best check Azad Kanchan (2680 kg/ha).

ANAND

The yield differences were significant among the entries tested. Line AR 145 and AR 148 showed significant superiority over better check GCT 2. None of the entries was free from tobacco mosaic disease. Screening of different *rustica* tobacco cultures / genotypes raised under nursery conditions by Plant breeding section was carried out in the year 2018 under natural population of leaf eating caterpillar, *S. litura*. The population of the pest *S. litura* was not sufficiently building up under natural conditions hence nursery remained free from infestation of *S. litura*.

DINHATA

In IVT 7 lines *i.e*. AR-145, Ar-148, AR-151, LR–90, LR–91, ArR–71 and ArR-77 were tested with two local varieties i.e. DD-437 and Dharla for their cured leaves and first grade leaf yields. Among seven lines none of them recorded significantly higher yield than local control Dharla and DD-437 except ArR-77. However, line ArR-77 recorded cured leaf yield at par with Dharla and DD-437. Though the line ArR-77 recorded more cured yield but first grade leaf yield was inferior in former line than control. The LR-91 showed highest quality outturn (35.71 %) followed by LR-90 (33.80%).

LADOL

The result revealed significant yield differences among the entries tested in IVT. None of the entry showed significant superiority for cured leaf yield over best check DCT 4 (5093 kg/ha). However, entry AR 145 showed numerical maximum cured leaf yield (5494 kg/ha) against both checks *viz*., GCT-3 and DCT-4.

Table RUBRC 2-1: Morphological characters of IVT entries of *rustica* tobacco at different centres (2018-19)

Entry	No. of leaves/ plant				Plant height (cm)				Leaf length (cm)				Leaf breadth (cm)			
	A	L	Ar	D	A	L	Ar	D	A	L	Ar	D	A	L	Ar	D
AR 145	15	14	10	9	51.2	57.8	60.84	31.5	41.6	41.1	34.82	26.2	29.9	35.7	27.58	26.6
AR 148	16	12	11	10	50.9	53.3	57.83	33.6	47.7	40.7	31.25	30.3	36.8	35.5	25.42	28.5
AR 151	17	13	10	10	48.1	60.7	60.16	31.6	40.4	38.2	30.83	24.4	29.8	33.1	26.42	25.0
LR 90	12	12	8	7	44.9	59.8	58.10	42.7	39.4	40.0	34.17	33.5	30.6	38.7	26.08	31.5
LR 91	14	11	8	8	50.3	51.6	53.28	40.2	38.1	36.5	32.14	28.2	31.7	35.8	27.47	25.4
ArR 71	15	12	9	8	49.6	49.0	61.11	31.3	42.3	39.9	374.46	28.2	30.0	34.7	30.02	22.5
ArR 77	14	11	11	8	54.1	57.6	64.91	45.0	45.0	42.3	35.742	28.1	35.8	37.7	27.30	28.5
GC1 (C)	14				38.3				40.9	39.9			36.0			
GCT 2 (C)	13				53.8				41.0	40.2			33.6			
GCT 3 (C)	14	12			48.3	66.8			48.3				33.4	36.0		
DCT 4 (C)		13				61.3								36.9		
DD 437 (C)				8				36.6				23.6				23.9
Dharla (C)				9				33.2				26.8				24.4
Azad Kanchan(C)			10				59.12				32.92				26.25	
SK 417 (C)			9				60.61				34.28				29.88	
SEm ±	0.58	0.41		0.45	2.54	2.15		1.269	1.95	0.99		1.71	1.65	0.85		1.02
C.D. at 5%	1.73	1.23		1.36	7.53	6.44		3.80	5.80	3.00		5.10	4.92	2.55		3.07
C.V. (%)	7.11	5.89		9.01	8.97	6.47		6.07	7.96	4.28		10.7	8.75	4.09		6.75

A: ANAND **L: LADOL** **Ar: ARAUL** **D:DINHATA**

Table RUBRC 2-2: Yield data of IVT *rustica* entries at different centres (2018-19)

Entries	Cured leaf yield at different centres (kg/ha)			
	ANAND	LADOL	DINHATA	ARAUL
AR 145	4014	5494	2052	2740
AR 148	4681	5032	1951	**2980**
AR 151	3676	4946	2351	2350
ArR 71	3340	4616	1992	2900
ArR 77	3574	4426	2385	**3550**
LR 90	2549	4730	1775	2450
LR 91	2660	4410	2279	2670
GC1 (C)	2894			
GCT2 (C)	3473			
GCT3 (C)	3095	4752		
DCT 4 (C)		5093		
DD 437 (C)			2438	
Dharla (C)			2646	
Azad Kanchan (C)				2680
SK 417 (C)				2475
Grand Mean		4833		
SEm ±	213	184	94	102
C.D. at 5%	634	552	283	265
C.V. (%)	10.9	6.59	7.40	10.48

Table RUBRC 2-3: Days to maturity and per cent increase over best check in IVT *rustica* entries at different centres (2018-19)

Entries	Days to maturity		Increase over best check (%)		
	ANAND	ARAUL	ANAND		ARAUL
			GCT2 (C)	GCT 3 (C)	Azad Kanchan
AR 145	141	110	9.34	29.7	
AR 148	143	110	27.5	51.2	11.19
AR 151	141	108			
ArR 71	138	106			
ArR 77	142	109			32.46
LR 90	139	111			
LR 91	135	108			
GC1 (C)	137				
GCT2 (C)	142				
GCT3 (C)	140				
Azad Kanchan (C)		110			
SK 417 (C)		110			
SEm ±	2.47				
C.D. at 5%	NS				
C.V. (%)	3.06				

Table RUBRC 2-4: Disease incidence and quality parameters (%) in IVT *rustica* entries at Anand Centre (2018-19)

Entries	TMV (%)	Leaf curl (%) Mean	Nicotine (%)	Chlorides (%)
AR 145	3.6	00	3.95	0.9585
AR 148	3.3	1.66	4.55	1.1710
AR 151	1.2	00	4.55	1.3840
LR 90	21.3	00	5.57	0.9941
LR 91	27.9	1.66	6.07	1.0650
ArR 71	2.3	00	5.57	1.0650
ArR 77	34.7	3.3	5.06	1.3600
GC1 (C)	13.2	6.66	5.57	1.0300
GCT2 (C)	21.8	00	5.57	1.0300
GCT3 (C)	13.9	1.66	4.55	1.4240

Table RUBRC 2-5: Disease in IVT *rustica* entries at Ladol Centre (2018-19)

Entries	Disease	
	LCV (%)	LMV (%)
AR 145	1.75	0.88
AR 148	1.80	0.90
AR 151	0.93	1.85
ArR 71	0.91	1.82
ArR 77	1.85	0.93
LR 90	0.91	0.91
LR 91	1.89	0.94
GCT3 (C)	1.80	1.80
DCT 4 (C)	1.72	1.72

Table RUBRC 2-6: First grade leaf yields and quality leaf outturn at Dinhata Centre (2018-19)

Treatments	First grade leaf (kg/ha)	Quality leaf (%)
AR-145	530	25.82
AR-148	466	23.88
AR-151	630	26.79
LR-90	600	33.80
LR-91	814	35.71
ArR-71	543	27.25
ArR-77	605	25.36
DD-437(C)	682	27.97
Dharla (C)	800	30.23
SEm ±	40.82	
C.D. at 5%	122.38	
C.V. (%)	10.87	

ARAUL

RUArBR 1.2: ADVANCED VARIETAL TRIAL II ON *RUSTICA* TOBACCO

Year of start: 2018-19

Layout : RBD
Replications : Six
Plot size : 4.5 m x 2.25 m
Treatments : 2 entries + 2 checks

Results: On the basis of cure leaf yield in AVT-II, entry ArR-58 (3380 kg/ha) found to be significantly and superior over the best check Azad Kanchan (2730 kg/ha) during 2018-19. On the basis of pooled analysis entry ArR-58 (3270 kg/ha) showed superiority for cured leaf yield over the best check variety Azad Kanchan (2764 kg/ha) with 18.30% increase. Seasonal influence and also information between seasons and treatments is not significant. Therefore, this entry may be approved for bulk trial to be conducted during *rabi* 2019-20. The data is presented in Table 1 & 2 RUArBRC-1.2.

Table 1 RUArBR 1.2: Pooled analysis of AVT II entries yield data at Araul (2017-2019)

Treatments	Yield (kg/ha)			% Increase Over	
	2017-18	2018-19	Mean	Azad Kanchan	SK-417
LR-86	2486	2775	2331		
ArR-58	3160	3380	3270	18.30	18.01
Azad Kanchan (C)	2798	2730	2764		
SK-417 (LC)	2782	2640	2711		
Grand Mean	**2807**	**2881**	**2844**		
S. Em. ±	79.87	105.33	91.98		
C.D. at 5%	233.14	309.10	268.28		
C.V. (%)	11.93	9.95	9.10		

Table 2 RUArBR 1.2: Chemical parameters in AVT II during *rabi* 2018-19

Treatment	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
LR-86	3.38	0.65	0.68
ArR-58	2.09	0.07	0.36
Azad Kanchan (C)	2.22	0.14	0.43
SK-417 (LC)	2.71	0.18	0.45

RUArBR 5A: PRELIMINARY YIELD EVALUATION TRIAL OF *RUSTICA* TOBACCO (II YEAR)

Objective: To identify the high yielding promising genotypes of *Hookah* tobacco.

Year of start: Rabi 2017-18

Design : R B D
Replication : Three
Plot size : 4.5 X 1.35 m
Treatments : 8 Entries + 2 checks

Results

On the basis of pooled analysis, the entry ArR-79 (3294 kg/ha) followed by entry ArR-83 (3349 kg/ha) were found significantly superior with 17.22% and 19.18% increase in yield respectively over the best yielding check variety Azad Kanchan (2810 kg/ha) and these two line proposed for IVT to be conducted during 2019-20. The data is given in table 1&2 RUArBR 5A.

Table 1 RUArBR 5A: Pooled results of *Hookah* tobacco in PYET II during *rabi* 2017-18 & 2018-19

Treatment	Cured leaf yield (kg/ha)			% increase over Azad Kanchan
	2017-18	2018-19	Mean	
ArR-79	3178	3410	3294	17.22
ArR-80	2125	3050	2588	
ArR-81	2448	2715	2582	
ArR-82	2950	2600	2775	
ArR-83	3248	3450	3349	19.18
ArR-84	2675	2890	2783	
ArR-85	2915	2890	2903	
ArR-86	2133	2250	2192	
Azad Kanchan (C)	2809	2810	2810	
SK-417 (C)	2760	2780	2770	
Mean	2724	2885	2805	
S. Em. ±	118.40	105.35	109.90	
C.D. at 5%	342.20	285.65	298.20	
C.V. (%)	10.63	10.15	9.98	

Table 2 RUArBR 1.2: Chemical parameters in PYET II during *rabi* 2018-19

Treatment	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
ArR-79	4.24	0.28	0.51
ArR-80	2.82	0.40	0.61
ArR-81	2.78	0.08	0.50
ArR-82	3.36	0.15	0.40
ArR-83	4.17	0.87	0.37
ArR-84	2.54	0.10	0.49
ArR-85	3.45	1.87	0.35
ArR-86	4.25	2.31	0.25
Azad Kanchan (C)	2.59	1.05	0.41
SK-417 (LC)	2.14	0.56	0.25

RUArBR 5: PRELIMINARY YIELD EVALUATION TRIAL OF *RUSTICA* TOBACCO (I YEAR)

Year of start: *Rabi* 2018-19 Plot size : 4.5 X 1.35 m
Treatments : 8 Entries + 2 checks

Results: On the basis of cured leaf yield entry, ArR-89 (3375 Kg/ha) followed by entry ArR-91 (3300 Kg/ha) found significantly superior with increase in yield 24.53% and 21.77% respectively over better check variety Azad Kanchan (2710 Kg/ha). The data is given in table RUArBR 5.

Table RUArBR 5: Performance of *Hookah* tobacco lines in PYET during *rabi* 2018-19

Treatment	Days to Matu-rity	Av. Curable leaves/ plant	Plant Height (cm)	Leaf (cm)		Yield (kg/ha)	% Increase Over
				Length	Width		Azad Kanchan
ArR-87	108	11	70.00	31.00	31.32	2679	
ArR-88	109	12	67.32	29.00	27.10	2610	
ArR-89	107	12	65.40	29.00	31.40	3375	24.53
ArR-90	111	11	72.30	30.00	33.68	2350	
ArR-91	108	10	72.28	31.10	33.55	3300	21.77
ArR-92	108	08	65.65	31.15	29.00	2130	
ArR-93	109	09	62.85	29.30	29.00	2580	
ArR-94	109	10	68.55	29.28	27.32	2345	
Azad Kanchan (C)	109	10	62.36	29.28	28.32	2710	
SK-417 (LC)	108	09	61.32	27.70	30.52	2630	
S. Em. ±						101	
C.D. at 5%						241	
C.V. (%)						9.73	

LADOL

RULdBR 1.1: ADVANCED VARIETAL TRIAL I ON *RUSTICA* TOBACCO

Year of start: 2018-19

Design : RBD
Replications : Six
Plot size : 2.4 x 4.5 m
Spacing : 60 x 45 cm
Treatments : 2 Entries + 2 checks
Irrigated/ rainfed : Irrigated

Results

In AVT-I trial, yield difference was found significant among all the entries tested. None of the entry showed significant superiority for cured leaf yield over best check DCT 4 (4958 kg/ha). Significant difference for plant height, no. of leaves, leaf length and leaf width were found for all the entries in AVT-I trial (Tables RULdBR 1.1-1 & 1.1-2)

Table RULdBR 1.1-1: Morphological characters of entries in AVT I (2018-19)

Entries	Plant Stand	Plant Height (cm)	Leaf (cm)		No. of leaves/plant
			Length	Width	
LR 87	38	47.8	39.7	36.6	11
LR 88	36	45.8	38.6	33.5	10
GCT 3 (C)	37	53.6	37.8	33.8	12
DCT 4 (C)	38	50.3	38.1	34.1	12
S. Em. ±	0.57	1.28	0.46	0.73	0.30
C.D. at 5%	NS	3.87	1.40	2.21	0.89
C.V. (%)	3.76	6.37	2.95	5.22	6.51

Table RULdBR 1.1-2: Yield (kg/ha) & disease incidence in AVT I (2018-19)

Entries	Yield	Disease (%)	
		LCV	LMV
LR 87	4953	0.44	1.33
LR 88	4475	1.84	1.38
GCT 3 (C)	4705	1.82	1.82
DCT 4 (C)	4958	1.33	1.78
Grand Mean	4773		
S. Em. ±	127		
C.D. at 5%	382		
C.V. (%)	6.51		

RULdBR 1.2: ADVANCED VARIETAL TRIAL II ON *RUSTICA* TOBACCO

Year of start : 2018-19

Design : RBD
Replications : Five
Plot size : 2.4 x 4.5 m
Spacing : 60 x 45 cm
Treatments : 3 Entries + 2 checks
Irrigated/ rainfed : Irrigated

Results:

In AVT-II trial, Yield difference was found significant in which accession LR 86 out yielded (5166 kg/ha) cured leaf yield reflecting 8.90 percent higher cured leaf yield over the best check DCT 4 (4744 kg/ha). Significant difference for plant height, no. of leaves, leaf length and leaf width were found for all the entries in AVT-II trial (Tables RULdBR 1.2-1 & 1.2-2).

Table RULdBR 1.2-1: Morphological characters of entries in AVT II (2018-19)

Entries	Plant Stand	Plant Height (cm)	Leaf (cm)		No. of leaves/plant
			Length	Width	
ArR 57	37	47.3	37.1	34.9	11
AR 125	38	53.4	36.5	34.7	11
LR 86	37	42.5	40.5	39.3	12
GCT 3 (C)	38	55.8	37.4	33.9	11
DCT 4 (C)	38	50.5	37.7	35.0	12
S. Em. +	0.68	1.36	0.75	0.76	0.33
C.D. at 5%	NS	4.09	2.25	2.27	1.00
C.V. (%)	4.05	6.11	4.43	4.75	6.53

Table RULdBR 1.2-2: Yield (kg/ha) & disease incidence in AVT II (2018-19)

Entries	Yield	Rank	% increase Over better check	Disease (%)	
				LCV	LMV
ArR 57	4660			1.64	1.09
AR 125	4589			2.12	1.59
LR 86	**5166**	**1**	**8.90**	0.54	1.09
GCT 3 (C)	4452			1.06	2.13
DCT 4 (C)	4744			2.12	2.12
Grand Mean	4722				
S. Em. ±	133				
C.D. at 5%	399				
C.V. (%)	6.30				

Table RULdBR 1.2-3: Yield (kg/ha) & disease incidence in AVT II (2018-19)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
ArR 57	1.98	8.62	1.76
AR 125	2.76	6.39	1.98
LR 86	1.79	6.60	1.57
GCT 3 (C)	1.75	6.81	1.38
DCT 4 (C)	2.02	7.61	1.98

Pooled Analysis:

The pooled analysis of cured leaf yield (2017-19) revealed significant differences among all the entries tested. Entry LR 86 (4837 kg/ha) showed highest cured leaf yield which reflecting 9.04 percent higher over best check DCT 4 (4436 kg/ha). The interaction between season and treatments is not significant. (Table RULdBR 1.2.-4).

Table RULdBR 1.2-4: Pooled yield Performance of AVT of *rustica* tobacco 2017-18 and 2018-19

Treatment	Yield (kg/ha)		Pooled Mean	% Increase over	
	2017-18	2018-19		GCT 3	DCT 4
ArR 57	4612	4660	4636		
AR 125	4227	4589	4408		
LR 86	4508	5166	**4837**	18.50	9.04
GCT 3 (C)	3712	4452	4082		
DCT 4(C)	4128	4744	4436		
S.Em. ±	115	133	70		
C.D. at 5%	345	399	200		

BULK TRAIL

Year of start : 2018-19
Spacing : 60 x 45 cm

Treatments : 1 Entries + 2 (C)
Irrigated /Rainfed : Irrigated

Results

In bulk trial (2018-19) of *rustica* tobacco, none of the entries recorded higher cured leaf yield when compared to the best check DCT 4 (4890 kg/ha).

Table BT 1-1: Yield and morphological characters

Treatment	Yield kg/ha	Plant height (cm)	Leaf (cm)		No. of leaves/ plant	Disease		Leaf thickness (mm)
			Length	Width		LCV (%)	LMV (%)	
AR 121	4735	70.7	35.4	34.7	14	2.83	2.36	0.80
GCT 3 (C)	4648	65.3	35.6	34.2	12	1.85	1.39	1.08
DCT 4 (C)	4890	56.0	36.3	35.3	13	1.86	0.93	1.16

Table BT 1-2: Chemical characters

Treatment	Nicotine (%)	Reducing sugar (%)	Chlorides (%)
AR 121	3.57	1.85	1.88
GCT 3 (C)	3.63	2.45	2.42
DCT 4 (C)	3.50	2.14	2.60

STATION TRIALS

RULdBRS 1: INITIAL EVALUATION TRIAL (*RUSTICA*) (ST-1)

Year of start: 2018-19

Design : RBD
Plot size : 2.4 x 4.5 m
Treatments : 7 Entries + 2 checks
Replications : Three
Spacing : 60 x 45 cm
Irrigated/ rainfed : Irrigated

Results: In IET (ST-1) trial, nine entries were included in which Entry No. 1 and 2 were significantly superior and gave 11.45 and 9.96 percent higher cured leaf yield than best check DCT 4 (4741 kg/ha). These two entries, LR 17-1 and LR 17-5 will be promoted for further testing in coordinated trials on the basis of their performance for consecutive two years in station trials (Table RULdBRS 1-1 & 2).

Table RULdBRS 1-1: Morphological characters of entries in IET (2018-19)

Entries	Plant Stand	Plant Height (cm)	Leaf (cm)		No. of leaves/ plant
			Length	Width	
LR 17-1	37	43.2	38.3	35.3	12
LR 17-5	37	56.1	36.8	35.0	12
LR 17-9	36	40.0	39.3	37.5	11
LR 17-4	35	43.6	37.6	33.9	11
LR 17-10	36	47.1	37.7	37.7	10
LR 17-7	35	40.9	30.9	34.2	10
LR 17-6	36	43.6	32.8	28.6	11
GCT 3 (C)	38	56.2	38.3	32.8	12
DCT 4 (C)	37	52.7	37.6	34.2	12
S. Em. $\pm$	0.67	1.76	0.73	1.02	0.42
C.D. at 5%	NS	5.29	2.18	3.05	1.25
C.V. (%)	3.22	6.49	3.44	5.12	6.49

Table RULdBRS 1-2: Yield (kg /ha) & Disease incidence in IET (2018-19)

Entries	Yield (kg /ha)	Rank	% increase Over better check	Disease	
				LCV (%)	LMV (%)
LR 17-1	5284	1	11.45	0.91	1.82
LR 17-5	5213	2	9.96	0.90	1.80
LR 17-9	4759			1.85	2.78
LR 17-4	4441			0.95	1.90
LR 17-10	4272			1.85	2.78
LR 17-7	3892			0.96	1.92
LR 17-6	4256			0.93	2.80
GCT 3 (C)	4534			1.77	2.65
DCT 4 (C)	4741			0.89	1.79
Grand Mean	4599				
S. Em. ±	153				
C.D. at 5%	459				
C.V. (%)	5.76				

RULdBRS 2: PRELIMINARY YIELD TRIAL (ST-2)

Year of start: 2018-19

Design : RBD
Replications : Three
Plot size : Gross: 2.4 x 4.5 m
Spacing : 60 cm x 45 cm
Treatments : 11 Entries + 2 checks
Irrigated/ rainfed : Irrigated

Results

In PYT (ST-2) trial, Out of thirteen entries, two entries were significantly superior and gave better performance than best check DCT 4. Entry No. 1 and 8 were gave 14.07 and 11.05 percent respectively higher cured leaf yield than best check DCT 4 (4804 kg/ha). These two entries will be promoted for testing in station trial-1 (Table RULdBRS 2-1 & 2).

Table RULdBRS 2-1: Morphological characters of entries in PYT (2018-19)

Entries	Plant Stand	Plant Height (cm)	Leaf (cm)		No. of leaves /plant
			Length	Width	
LR 18-1	39	68.4	36.2	34.4	14
LR 18-2	36	42.4	38.6	34.6	10
LR 18-3	38	42.4	35.9	33.3	11
LR 18-4	37	65.1	34.3	31.9	14
LR 18-5	36	47.0	34.8	34.7	11
LR 18-6	37	45.8	39.7	37.3	10
LR 18-7	38	44.2	35.2	35.4	10
LR 18-8	36	48.4	37.8	35.0	13
LR 18-9	35	50.1	36.8	32.1	12
LR 18-10	36	50.3	36.8	35.8	11
LR 18-11	37	43.7	37.9	34.7	11
GCT 3(C)	39	60.0	37.4	35.8	13
DCT 4 (C)	38	51.6	38.5	35.6	13
S. Em. ±	0.94	1.87	1.07	0.98	0.45
C.D. at 5%	NS	5.47	3.13	2.86	1.30
C.V. (%)	4.37	6.40	5.03	4.90	6.61

Table RULdBRS 2-2: Yield (kg/ha) & Disease incidence (2018-19)

Entries	Yield (kg/ha)	Rank	% increase Over better check	Disease (%)	
				LCV	LMV
LR 18-1	5480	1	14.07	0.85	0.85
LR 18-2	3889			1.85	2.78
LR 18-3	4495			1.74	2.61
LR 18-4	5173			0.90	1.80
LR 18-5	4611			1.83	2.75
LR 18-6	4594			0.90	2.70
LR 18-7	4395			0.88	2.65
LR 18-8	5335	2	11.05	0.92	1.83
LR 18-9	3983			0.94	1.89
LR 18-10	3650			2.80	2.80
LR 18-11	4083			1.82	0.91
GCT 3(C)	4580			2.54	0.88
DCT 4 (C)	4804				
Grand Mean	4544				
S. Em. ±	174				
C.D. at 5%	509				
C.V. (%)	6.65				

RULdBRS 3: LARGE SCALE VARIETAL TRAIL

Year of start : 2018-19

Design : RBD
Replications : Four
Plot size : 2.4 x 4.5 m
Spacing : 60 x 45 cm
Treatments : 5 Entries + 2 checks
Irrigated/ rainfed : Irrigated

Results: In LSVT trial, seven entries were included in which significant differences among all the entries were noticed for cured leaf yield. Entry LR 86 (5381 kg/ha) recorded highest cured leaf yield which reflecting 9.95 percent respectively high cured leaf yield over best check DCT 4 (4894 kg/ha). Significant difference was found in plant height, no. of leaves and leaf length and leaf width (Table RULdBRS 3-1 & 2).

Table RULdBRS 3-1: Morphological characters of entries in LSVT (2018-19)

Entries	Yield (kg /ha)	Rank	% increase Over better check	Plant Stand	Plant Height (cm)	Leaf (cm)		No. of leaves /plant
						Length	Width	
LR 90	4811			38	54.1	39.8	39.2	12
LR 91	4591			36	51.3	35.8	36.3	11
LR 87	4880			38	46.4	38.2	37.6	11
LR 88	4369			36	42.6	38.3	34.5	10
LR 86	5381	1	9.95	39	47.4	40.9	39.3	12
GCT 3 (C)	4604			37	57.4	36.6	36.3	12
DCT 4 (C)	4894			38	50.8	39.9	37.7	12
Grand Mean	4790							
S. Em. ±	150			0.73	1.61	0.88	0.98	0.37
C.D. at 5%	446			NS	4.79	2.63	2.92	1.10
C.V. (%)	6.27			3.92	6.45	4.60	5.27	6.59

Table RULdBRS 3-2: Yield (kg/ha) & Disease incidence (2017-18)

Entries	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)	Disease	
				LCV (%)	LMV (%)
LR 90	1.59	7.24	1.50	0.66	1.32
LR 91	2.49	6.65	1.89	0.69	1.38
LR 87	2.34	8.47	1.74	1.32	1.32
LR 88	1.88	9.53	1.15	0.70	1.40
LR 86	1.84	6.59	1.56	0.64	0.64
GCT 3 (C)	2.54	6.47	1.90	0.68	2.05
DCT 4 (C)	3.32	5.29	1.95	1.32	1.32

BREEDING WORK IN *RUSTICA* TOBACCO

A. Crosses made: During the year 2018-19 germplasm involving the 261 genotypes/varieties comprising both indigenous and exotic materials were raised. Using these materials, fifteen single and five multiple crosses were made. All single and multiple crosses were obtained.

B. Generation advancement and evaluating segregating materials:

To develop lines with high cured leaf yield, medium duration 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**.**

Sr. No.	Generation	No of crosses grown	Number of progenies		
			Grown	Selected	
			No. of progenies	No. of progenies	Bulk
1	F1	17	17	16	
2	F2	13	13	101	
3	F3	10	126	62	
4	F4	8	48	34	
5	F5	15	42	24	
6	Promising bulk	13	21	-	
Total		**76**	**267**	**237**	**11**

C. MAINTENANCE AND EVALUATION *RUSTICA* GERMPLASM

Two hundred sixty one accessions of *rustica* germplasm were maintained for next season during 2018-19 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 varieties in next crop season 1798.0 kg, labeled seed of two varieties was produced and will be allotted to farmers during 2019-20.

Seed Production (kilograms)

Crop	*Rustica* Tobacco		
Variety	GCT 3	DCT 4	Total
Production	724	1074	1798

CROP PRODUCTION

A.VFC TOBACCO

SHIVAMOGGA

FEELER TRIAL 2: EFFECT OF P SOLUBILIZER AND P MOBILIZERS ON THE AVAILABILITY OF P IN THE RHIZOSPHERE OF TOBIOS-6 VARIETY OF FCV TOBACCO

Experiment details

Year of start: 2017-18
Year of completion: 2018-19

Design	:	RBD	Location	:	ZAHRS, Navile
Replications	:	Three	Date of sowing	:	28-05-2018
Treatments	:	Seven	Date of planting	:	13-07-2017
Gross plot size	:	6.3 m X 4.2 m	Net Plot size	:	4.5 m X 3.0 m
Fert. dose (kg/ha)	:	40:30:80 NPK	Variety	:	Tobios-6

Results

The experiment was conducted at ZAHRS, Navile, Shivamogga during *Kharif* 2017 and 2018 with seven treatments replicated thrice under Randomized Complete Block Design. The observations on growth parameters at 30 DAP and green leaf and cured leaf yields were recorded. The results of the experiment are as follows.

Plant height (cm) : The treatment receiving RDF with P solubilizer and P mobilizer recorded higher plant height (12.6 cm) and which was followed by 75% of Rec. P with P solubilizer and P mobilizer (11.8 cm). The lowest plant height was recorded in the treatment receiving RDF alone (10.5 cm).

Number of leaves per plant: Application of RDF with P solubilizer and P mobilizer recorded highest number of leaves per plant (9.9). It was followed by 75% of Rec. P with P solubilizer and P mobilizer (9.6). Both the treatments were on par with each other and superior over RDF. Lowest number of leaves per plant was recorded in treatment supplied with RDF (7.3).

Leaf area (cm^2): Application of RDF with P solubilizer and P mobilizer significantly increased the leaf area/plant (617.2 cm^2) at 30 days after planting and it was on par with the treatment 75% of plant Rec. P with P solubilizer and P mobilizer (602.8 cm^2). Lowest leaf area was observed with application of RDF (445.8 cm^2).

Green leaf yield (kg ha^{-1}): Results of 2017-18 revealed that application of P solubilizer and P mobilizer had significantly increased the green leaf yield. The data revealed that maximum green leaf was observed with the application of RDF along with P solubilizer and P mobilizer (10594 kg ha^{-1}) which was on par with the treatment supplied with RDF and P mobilizer (10544 kg ha^{-1}), RDF and P solubilizer (10523 kg ha^{-1}). Lowest green leaf yield was recorded in the treatment 75% Rec. P and P solubilizer (8417 kg ha^{-1}).

The results pertaining to 2018-19 revealed that highest green leaf yield was observed in the treatment RDF along with P solubilizer and P mobilizer (10995 kg ha^{-1}) which was significantly superior over 75% Rec. P with P solubilizer (8928 kg ha^{-1}) and 75% Rec. P with P mobilizer (9286 kg ha^{-1}).

Pooled data of 2017 and 2018 revealed that significantly higher green leaf yield was recorded in application of RDF with P solubilizer and P mobilizer (10795 kg ha^{-1}) and it was followed by RDF with P solubilizer (10303 kg ha^{-1}). Lowest green leaf yield was recorded with 75% Rec. P and P solubilizer (8672 kg ha^{-1}).

Cured leaf yield (kg ha^{-1}): Experimental results of 2017-18, revealed that the cured leaf yield varied significantly and the highest yield (1078 kg ha^{-1}) was observed with the application of RDF with P solubilizer and P mobilizer. It was followed by RDF and P mobilizer (1000 kg ha^{-1}). Lowest cured leaf yield was recorded in the treatment 75% Rec. P and P solubilizer (862 kg ha^{-1}).

During 2018-19, highest cured leaf yield was revealed with RDF along with P solubilizer and P mobilizer (1041 kg ha^{-1}) which followed by 75% Rec. P with P solubilizer and P mobilizer (989 kg ha^{-1}). Both the treatments were on par with each other. Lowest cured leaf yield was recorded in the treatment 75% Rec. P and P mobilizer (857 kg ha^{-1}).

Pooled data on cured leaf yield for the years 2017 and 2018 revealed that significantly higher cured leaf yield was recorded with application of RDF with P solubilizer and P mobilizer (1060 kg ha^{-1}) and it was followed by 75% Rec. P with P solubilizer and P mobilizer (972 kg ha^{-1}). Lowest cured leaf yield was observed with RDF (907 kg ha^{-1}).

Top grade equivalent: Pooled data of 2017 and 2018 revealed that significantly higher TGE was recorded with application of 75% Rec. P with P solubilizer and P mobilizer (564 kg ha^{-1}) and it was followed by 75% Rec. P with P mobilizer (546 kg ha^{-1}). Lowest TGE was observed with 75% Rec. P with P solubilizer (380 kg ha^{-1}).

Nutrient content and uptake: Application of P mobilizer and P solubilizer didn't show significant difference among the treatments on nitrogen content in leaf and stem. The phosphorus content in leaf varied from 0.33 to 0.42 per cent and in stem 0.13 to 0.19 per cent. The highest total uptake of phosphorus (11.86 kg/ha) was recorded in RDF with P solubilizer and P mobilizer. The highest potassium content in leaf (4.23 %) and stem (1.27 %) was recorded in RDF with P solubilizer and P mobilizer. Highest total uptake of potassium 92.71

kg ha^{-1} was recorded in the treatment RDF with P solubilizer and P mobilizer and lowest was observed in 75% Rec. P with P solubilizer (58.18 kg ha^{-1}).

Chemical properties and nutrient status: Results of the experiment indicated that there was no significant difference among the treatments with respect to pH and electrical conductivity of soil due to application of P solubilizer and P mobilizer. The organic carbon content varied from 3.85 g kg^{-1} to 4.78 g kg^{-1}.

Significantly higher available nitrogen content in soil was recorded in 75% Rec. P with P mobilizer (141.87 kg ha^{-1}) after harvest and it was followed by 75% Rec. P with P solubilizer (134.40 kg ha^{-1}) and lowest was recorded in RDF with P solubilizer and P mobilizer (108.27 kg ha^{-1}). Available phosphorus at non-rhizosphere soil didn't show any significant difference. Available phosphorus at rhizosphere soil (165.70 kg ha^{-1}) was high in the treatment supplied with RDF with P solubilizer and P mobilizer. Available potassium (217.73 kg ha^{-1}) was highest in the treatment supplied with 75% Rec. P with P mobilizer.

B:C ratio : The highest benefit cost ratio of 1.27 was recorded in RDF with P solubilizer and P mobilizer and it was followed by 1.16 in the treatment supplied with 75% Rec. P and 100% Rec. N and K with P mobilizer and P solubilizer. Lowest was recorded in the treatment 75% Rec. P and 100% Rec. N and K with P solubilizer (1.08).

Table 1 FEELER TRIAL-2: Effect of rate of P, P mobilizer and P solubilizer on growth parameters of FCV tobacco

Treatment	Plant height (cm) at 30 DAP	No. of leaves $plant^{-1}$ at 30 DAP	Leaf area (cm^2) $plant^{-1}$ at 30 DAP
T_1:Recommended NPK	10.5	7.3	445.8
T_2:Rec. NPK + P mobilizer	12.2	9.5	574.3
T_3:Rec. NPK + P solubilizer	10.6	9.2	496.7
T_4:Rec. NPK + P mobilizer + P solubilizer	12.6	9.9	617.2
T_5:75% Rec. P + Rec. N and K + P mobilizer	10.8	8.8	502.0
T_6: 75% Rec. P + Rec. N and K + P solubilizer	10.2	9.3	532.4
T_7: 75% Rec. P + Rec. N and K + P mobilize + P. solubilizer	11.8	9.6	602.8
S. Em±	**0.50**	**0.40**	**30.76**
C.D. at 5%	**1.55**	**1.24**	**94.79**

Table 2 FEELER TRIAL-2: Effect of application of different rates of P, P mobilizer and P solubilizer on yield parameters of FCV tobacco

Treatment	Green leaf yield (kg/ha)			Cured leaf yield (kg/ha)			Top grade equivalent (kg/ha)		
	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled	2017-18	2018-19	Pooled
T_1: Recommended NPK	10080	9708	9894	875	938	907	570	493	532
T_2: Rec. NPK + P mobilizer	10544	10018	10281	1000	924	962	549	481	515
T_3: Rec. NPK + P solubilizer	10523	10082	10303	971	933	952	454	488	471
T_4: Rec. NPK + P mobilizer + P solubilizer	10594	10995	10795	1078	1041	1060	485	574	529
T_5:75% Rec. P + Rec. N and K + P mobilizer	9659	9286	9472	990	857	924	558	535	546
T_6: 75% Rec. P + Rec. N and K + P solubilizer	8417	8928	8672	862	947	904	392	369	380
T_7: 75% Rec. P + Rec. N and K + P mobilize + P. solubilizer	9779	10012	9896	956	989	972	555	573	564
S. Em$\pm$	344	343	284	40.0	33.0	29.0	31.0	31.0	29.0
C.D. at 5%	1059	1057	874	123	101	90	96	96	88

Table 3 FEELER TRIAL-3: Effect of application of different rates of P, P mobilizer and P solubilizer on nutrient content and uptake of FCV tobacco

Treatment	Nutrient content in leaf (%)			Nutrient content in stem (%)			Total uptake (kg/ha)		
	N	P	K	N	P	K	N	P	K
T_1: Recommended NPK	1.64	0.33	3.35	0.32	0.13	1.04	24.17	6.69	59.90
T_2: Rec. NPK + P mobilizer	1.72	0.42	4.21	0.41	0.17	1.18	27.59	8.78	72.98
T_3: Rec. NPK + P solubilizer	1.61	0.37	4.02	0.37	0.15	1.05	27.38	8.43	72.37
T_4: Rec. NPK + P mobilizer + P solubilizer	1.90	0.42	4.23	0.45	0.19	1.27	36.98	11.86	92.71
T_5:75% Rec. P + Rec. N and K + P mobilizer	1.53	0.37	3.75	0.37	0.16	1.12	25.21	8.37	67.86
T_6: 75% Rec. P + Rec. N and K + P solubilizer	1.57	0.36	3.69	0.34	0.15	1.02	22.45	6.91	58.18
T_7: 75% Rec. P + Rec. N and K + P mobilize + P. solubilizer	1.68	0.39	3.86	0.41	0.17	1.14	30.46	9.61	76.48
S. Em±	0.12	0.02	0.18	0.03	0.01	0.05	1.38	0.56	3.61
C.D. at 5%	NS	0.05	0.55	NS	0.02	0.16	4.27	1.72	11.12

Table 4 FEELER TRIAL-2: Effect P mobilizer and P solubilizer on soil chemical properties after harvest

Treatment	pH	EC (dSm^{-1})	Organic carbon ($g\ kg^{-1}$)
Recommended NPK	6.70	0.18	4.78
Rec. NPK + P mobilizer	6.72	0.15	4.47
Rec. NPK + P solubilizer	6.64	0.15	4.68
Rec. NPK + P mobilizer + P solubilizer	6.49	0.16	3.95
75% Rec. P + Rec. N and K + P mobilizer	6.37	0.15	4.68
75% Rec. P + Rec. N and K + P solubilizer	6.46	0.17	4.58
75% Rec. P + Rec. N and K + P mobilize + P. solubilizer	6.48	0.16	3.85
S. Em±	**0.24**	**0.01**	**0.19**
C.D. at 5%	**NS**	**NS**	**0.60**

Table 5 FEELER TRIAL-2: Effect P mobilizer and P solubilizer on available NPK ($kg\ ha^{-1}$) content after harvest in soil

Treatment	N ($kg\ ha^{-1}$)	P_2O_5 Non-rhizosphere ($kg\ ha^{-1}$)	P_2O_5 Rhizosphere ($kg\ ha^{-1}$)	K_2O ($kg\ ha^{-1}$)
Recommended NPK	126.93	173.83	116.01	181.80
Rec. NPK + P mobilizer	115.73	149.64	120.54	169.93
Rec. NPK + P solubilizer	130.67	150.02	143.97	176.60
Rec. NPK + P mobilizer + P solubilizer	108.27	170.80	165.70	157.38
75% Rec. P + Rec. N and K + P mobilizer	141.87	147.56	132.64	217.73
75% Rec. P + Rec. N and K + P solubilizer	134.40	140.76	124.32	209.26
75% Rec. P + Rec. N and K + P mobilize + P. solubilizer	119.47	145.67	140.57	207.47
S. Em±	**6.36**	**8.11**	**7.29**	**10.79**
C.D. at 5%	**19.61**	**NS**	**22.45**	**33.26**

Inference: Treatment receiving 100 % RDF along with P mobilizer and P solubilizer had recorded significantly higher green leaf yield, cured leaf yield and top grade equivalence. Nutrient content of P and K both in leaf and stem showed significant difference among different treatments and uptake followed the trend of content.

FEELER TRIAL 3: PERFORMANCE OF TOBACCO SEEDLINGS WITH THE APPLICATION OF HUMIC ACID SUBSTANCES AS BIO STIMULANTS

Year of start: 2018

Duration : One year
Design : RCBD
Replications : Four
Treatments : Five
Gross plot size: 1m X 1 m
Variety : Sahyadri
Date of sowing: 28-05-2018
Date of reset : 06-07-2018
Date of spraying: 06.07.2018/16.07.2018/22.07.2018

Treatments

T_1	Soil application of humic substances @ 1.25 kg /ha
T_2	Soil application of humic substances @1.25 kg /ha + foliar spray @ 0.05 % at 30 DAS
T_3	Soil application of humic substances @1.25 kg /ha + foliar spray @ 0.05 % at 30 DAS and 45 DAS
T_4	Soil application of humic substances @1.25 kg /ha + foliar spray @ 0.05 % 10 days after reset to portray
T_5	Package of practices

Results: Method and rate of application of humic substance to FCV tobacco seedlings showed significant effect on plant height, number of leaves and dry weight of seedling. The treatment combination receiving humic substances @ 1.25 kg ha^{-1} for soil application coupled with foliar spray @ 0.05 % at 30DAS and 45 DAS recorded the maximum height (7.46 cm), number of leaves (4.7) and dry weight of seedling (34.00 g 10 pl^{-1}). It was followed by the treatment supplied with humic substances @ 1.25 kg ha^{-1} and foliar spray @ 0.05% at 30DAS recorded plant height (7.25 cm), number of leaves (3.9) and dry weight of seedling (32.50 g 10 pl^{-1}). Lowest plant height (5.89 cm), number of leaves (3.7) and dry weight of seedling (24.75 g 10 pl^{-1}) was recorded in recommended package of practices.

Table Feeler Trial 3: Germination count and Morphological characters (2018-19)

Treatments	Germination count (No.)		Plant height (cm)	No. of leaves /plant	Dry wt. of seedlings (g)	Damping off incidence (%)
	15 DAS	30 DAS				
T_1	25.0	48.0	6.35	3.8	27.50	14.5
T_2	24.0	51.0	7.25	3.9	32.50	15.0
T_3	24.0	49.0	7.46	4.7	34.00	17.5
T_4	27.0	50.0	6.55	4.1	30.00	15.5
T_5	23.0	43.0	5.89	3.7	24.75	18.0
S. Em±	0.97	2.16	0.24	0.20	1.62	-
C.D. at 5%	NS	NS	0.74	0.61	5.00	-

VFSAG 64: STUDIES ON FUEL USE EFFICIENCY IN TOBACCO BARN WITH MODIFIED HEAT CONVEYANCE SYSTEM

CONCLUDING RESULTS

Fuel wood consumption in modified and conventional barn of AINP (T), ZAHRS, Shivamogga were assessed in consultation with Hunsur centre. Also observations on fuel wood consumption were recorded for both the barns at ZAHRS, Shivamogga during 2019-20. The data collected during the year depicted that the modified barn consumed 6.77 kg fuel wood per kg of cured leaf as against 8.62 kg in conventional barn when mixed species of on farm available fuel wood was used. The mixed fuel wood includes logs, twigs and branches of Pongamia, Rain tree, Sesbania, Subabul, Neem, Gulmohar, and Silver oak. Naturally damaged trees and their parts were collected from the farm for curing.

Further, when the wood logs of Eucalyptus alone were fed to both conventional and modified barns the fuel wood consumption was 4.83 kg per kg cured leaf in conventional barn as against 3.70 kg fuel wood per kg cured leaf in modified barn.

To workout the economics of barn modification the average cured leaf yield of 1,200 kg ha^{-1} and fuel wood cost of Rs. 3,500 ton^{-1} was used. As the fuel wood consumption is low in modified barn, an amount of Rs. 7,770 ha^{-1} per year could be saved over conventional barn. However, an initial investment of Rs. 25,000-30,000 is required for barn modification.

As per the data provided by the Hunsur centre fuel wood consumption in conventional barn is 5 kg per kg cured leaf. This could be attributed to the use of uniform sized wood logs (cut woods) of Eucalyptus species only for curing, which is purchased from the wood Depot @ Rs. 3800 per ton.

Further, there are only two barns of same size (13'X13'X13') at ZAHRS, Shivamogga. Between 2012-2015 the data of 9.0 kg fuel wood per kg cured leaf in conventional barn was obtained by taking average of previous years as one barn of 13'X13'X13' was utilized to modify its furnace to hopper type to conduct experiment

Table VFSAG 64-1: Fuel wood consumption for curing of FCV tobacco leaf in conventional and modified barn

Year	Conventional barn			Modified barn			CTRI, Hunsur (Conventional) Wood consumed per kg cured leaf
	Weight of cured leaf (kg)	Qty. of wood used (kg)	Wood consumed / kg cured leaf	Weight of cured leaf (kg)	Qty. of wood used (kg)	Wood consumed per kg cured leaf	
2012-13 to 2016-17	121	1026	8.94	110	596	5.46	5.00*
Wood saved: 3.48 kg per kg cured leaf (38.92 %)							
2019-20							
Run – 1	82.68	900	10.89	117.72	765	6.50	
Run – 2	119.44	794	6.64	149.44	996	6.66	
Run – 3	92.40	770	8.33	77.08	550	7.14	
Average (1-3)	**97.84**	**821**	**8.62**	**114.70**	**770.3**	**6.77**	
Wood saved: 1.85 kg per kg cured leaf (21.46 %)							
Run – 4 *	155.36	717	4.62	131.40	500	3.81	
Run – 5 *	148.51	750	5.05	124.88	450	3.60	
Average (4-5)	**151.94**	**734**	**4.83**	**128.14**	**475**	**3.70**	

Note: * Eucalyptus wood logs were fed during curing

$$\text{Wood saved (\%)} = \frac{\text{(Wood consumed per kg cured leaf in conventional) - (Wood consumed per kg cured leaf in modified)}}{\text{Wood consumed per kg cured leaf in conventional}} \times 100$$

Table VFSAG 64-2: Economics of fuel wood consumption in modified barn over conventional for the year 2019-20

Average yield of cured leaf (kg ha^{-1})	Fuel wood consumption (t ha^{-1})		Fuel wood saved (t ha^{-1})	Cost of fuel wood (Rs ha^{-1})		Amount saved (Rs ha^{-1})	Per cent saving
	Conventional	Modified		Conventional	Modified		
1200	10.34	8.12	2.22	36,190	28,420	7770	21.47

Note: Cost of wood @ 3500 per ton

B. *BIDI* TOBACCO

ANAND

BDAAG 158C: ASSESSMENT OF ALTERNATIVE CROP SEQUENCES FOR *BIDI* TOBACCO GROWING AREA OF MIDDLE GUJARAT AGRO - CLIMATIC ZONE

Year of start : 2015-16 (*Kharif –rabi*)
Year of completion: 2017-18

Treatments

T1 : Tobacco (*Kharif-Rabi*) alone
T2 : Ground nut (*Kharif*) – Potato (*Rabi*)
T3 : Maize (*Kharif*) – Potato *(Rabi)*
T4 : Pigeon pea + Pearlmillet (*Kharif-Rabi*) – Clusterbean (Summer)
T5 : Sesamum *(Kharif*) – Potato (*Rabi*)
T6 : Tobacco (*Kharif-Rabi*) + Pearlmillet (*Summer*)

Design : RBD
Replications : Four
Spacing : As per treatment
Plot size : Gross : 5.4 x 7.5 m
Varieties : As per treatment
Fertilizer kg/ha : As per treatment
Other practices : As per recommendations

Crop details:

No.	Crop	Variety	Spacing (cm)	Fertilizer (NPK, kg/ha)	Season
C1	Tobacco	MRGTH 1	90 x 75	220 – 0- 0	*Kharif*
C2	Ground nut	GG 2	45 x 15	25 – 50 – 0	*Kharif*
C3	Potato	Kufri Badshah	45 x 25	180 – 80- 40	*Rabi*
C4	Maize	HQPM 1	45 x 30	100 – 50 – 40	*Kharif*
C5	Pigeon pea	GT 1	90 x 30	25 – 50 – 0	*Kharif*
C6	Pearl millet	GHB 558	45 x 15	80 – 40 – 0	*Kharif*
C7	Sesamum	Guj Till 1	45 x 15	37.5 – 25 – 0	*Kharif*
C8	Clusterbean	Guj Guar 1	30 x 15	25 – 50 - 0	Summer

Results: Statistical analysis presented in Table BDAAG 158c-1 indicated that significantly the highest tobacco equivalent yield (3565 kg/ha**)** was obtained from treatment T_6 (Tobacco + Pearl millet cropping system) compared to other treatments. Treatment T_5 (Sesamum - Potato cropping system) recorded significantly lower tobacco equivalent yield (1957 kg/ha) followed by treatment

T_2 (Groundnut + potato cropping system). While, treatment T_1 (Tobacco as sole crop) gave maximum net profit (85079 Rs/ha).

Table BDAAG 158c-1: Tobacco equivalent yield and economics (2017-18) as effected by different cropping sequences

Trt.	Treatment Details	Tobacco equivalent yield (kg/ha)	Economics (Rs/ha)		
			Total income	Total Cost	Net Profit
T_1	Tobacco (*Kharif-Rabi*) alone	3013	123388	38308	85079
T_2	Ground nut (*Kharif*) – Potato (*Rabi*)	**2255**	92362	76818	40886
T_3	Maize (*Kharif*) – Potato *(Rabi)*	2748	112526	77709	52015
T_4	Pigeon pea + Pearl millet (*Kharif-Rabi*) – Cluster bean (Summer)	2546	104241	61506	50338
T_5	Sesamum *(Kharif*) – Potato (*Rabi*)	**1957**	80119	67542	34270
T_6	Tobacco (*Kharif-Rabi*) + Pearl millet (*Summer*)	**3565**	146007	67455	78553
	S. Em+	115	---	---	---
	C.D. at 5%	**347**	---	---	---
	C.V. (%)	8.6	---	---	---

Selling price (Rs./kg):

Tobacco: 40.95, G. Nut: 32.0, Sesame: 40.0, P. Pea: 25.0, Maize: 10.0, P. millet: 14.0 (*Kharif*) and 10.0 (Summer), Potato: 4.0, Cluster bean: 25.0

Pooled results

The data presented in Table BDAAG 158c-2 revealed that treatment T_6 (Tobacco + Pearl millet cropping system) produced significantly higher tobacco equivalent yield during 2015-16 and 2016-17 years and significantly the highest tobacco equivalent yield during 2017-18 and in pooled analysis.

With regard to pooled analysis, data presented in Table BDAAG 158c-5 showed that treatment T_6 (Tobacco + Pearl millet cropping system) recorded higher values of tobacco equivalent yield, gross returns as well as net profit. Treatment T_1 (Tobacco alone) stood second by net return as well as higher BCR value as 3.0.

Table BDAAG 158c-2: Effect of different cropping systems on tobacco equivalent yield

Trt	Crop	Tobacco equivalent yield (kg/ha)			
		2015-16	2016-17	2017-18	Pooled
T_1	Tobacco (*Kharif-Rabi*) alone	**2069**	**3531**	3013	2871
T_2	Ground nut (*Kharif*) – Potato (*Rabi*)	2683	**2482**	**2255**	**2473**
T_3	Maize (*Kharif*) – Potato *(Rabi)*	**3423**	3476	2748	3216
T_4	Pigeon pea + Pearl millet (*Kharif-Rabi*) – Cluster bean (Summer)	**3380**	2777	2546	2901
T_5	Sesamum *(Kharif*) – Potato (*Rabi*)	3197	**2090**	**1957**	**2414**
T_6	Tobacco (*Kharif-Rabi*) + Pearl millet (*Summer*)	**3610**	**3902**	**3565**	**3692**
	S. Em±	126.9	131.3	115.3	64.5
	C.D. at 5%	**382.5**	**395.7**	**347.4**	**194.4**
	C.V. (%)	8.3	8.6	8.6	4.4

Table BDAAG 158c-3: Effect of different cropping systems on total Income

Trt	Crop	Total Income (Rs/ha)			
		2015-16	2016-17	2017-18	Pooled
T_1	Tobacco (*Kharif-Rabi*) alone	83811	141646	123388	116281
T_2	Ground nut (*Kharif*) – Potato (*Rabi*)	108691	99547	92362	100200
T_3	Maize (*Kharif*) – Potato *(Rabi)*	138666	139442	112526	130211
T_4	Pigeon pea + Pearl millet (*Kharif-Rabi*) – Cluster bean (Summer)	136920	111366	104241	117509
T_5	Sesamum *(Kharif*) – Potato (*Rabi*)	129492	83834	80119	97815
T_6	Tobacco (*Kharif-Rabi*) + Pearl millet (*Summer*)	146221	156507	146007	149579

Table BDAAG 158c-4: Effect of different cropping systems on total cost of cultivation

Trt	Crop	Total cost (Rs/ha)			
		2015-16	2016-17	2017-18	Pooled
T_1	Tobacco (*Kharif-Rabi*) alone	38057	41779	38308	39381
T_2	Ground nut (*Kharif*) – Potato (*Rabi*)	62443	78269	76818	72510
T_3	Maize (*Kharif*) – Potato *(Rabi)*	61973	85471	77709	75051
T_4	Pigeon pea + Pearl millet (*Kharif-Rabi*) – Cluster bean (Summer)	59161	60639	61506	60435
T_5	Sesamum *(Kharif*) – Potato (*Rabi*)	52456	67470	67542	62489
T_6	Tobacco (*Kharif-Rabi*) + Pearl millet (*Summer*)	67186	70374	67455	68338

Table BDAAG 158c-5: Effect of different cropping systems on net income

Trt	Crop	Net income (Rs/ha)			
		2015-16	2016-17	2017-18	Pooled
T_1	Tobacco (*Kharif-Rabi*) alone	45754	99867	85079	76900
T_2	Ground nut (*Kharif*) – Potato (*Rabi*)	46249	21277	40886	27690
T_3	Maize (*Kharif*) – Potato *(Rabi)*	76693	53971	52015	55160
T_4	Pigeon pea + Pearl millet (*Kharif-Rabi*) – Cluster bean (Summer)	77759	50727	50338	57074
T_5	Sesamum *(Kharif*) – Potato (*Rabi*)	77037	16365	34270	35326
T_6	Tobacco (*Kharif-Rabi*) + Pearl millet (*Summer*)	79036	86133	78553	81240

Table BDAAG 158c-6: Tobacco equivalent yield and economics of different cropping systems (Pooled, 2015-16 to 2017-18)

Trt	Crop	Tobacco equivalent yield (kg/ha)	Economics (Rs./ha)			
			Gross returns	Total cost	Net returns	BCR
T_1	Tobacco (*Kharif-Rabi*) alone	2871	116281	39381	76900	**3.0**
T_2	Groundnut (*Kharif*) – Potato (*Rabi*)	**2473**	100200	72510	27690	1.4
T_3	Maize (*Kharif*) – Potato *(Rabi)*	3216	130211	75051	55160	1.7
T_4	Pigeon pea + Pearl millet (*Kharif-Rabi*) – Cluster bean (Summer)	2901	117509	60435	57074	1.9
T_5	Sesamum *(Kharif*) – Potato (*Rabi*)	**2414**	97815	62489	35326	1.6
T_6	Tobacco (*Kharif-Rabi*) + Pearl millet (*Summer*)	**3692**	149579	68338	**81240**	2.2
	S. Em±	64.5	---	---	---	---
	C.D. at 5%	**194.4**	---	---	---	---
	C.V. (%)	4.4	---	---	---	---

Table BDAAG 158c-7: Selling price of different crop yield (Rs./kg)

No.	Crop	2015-16	2016-17	2017-18	Average
C_1	Tobacco	40.51	40.11	40.95	40.52
C_2	Ground nut	35.00	35.00	32.00	34.00
C_3	Sesame	45.00	35.00	40.00	40.00
C_4	Pigeon pea	30.00	30.00	25.00	28.33
C_5	Maize	12.50	13.50	10.00	12.00
C_6	P.M (*kharif*)	12.50	11.00	14.00	12.50
C_7	Clusterbean	27.50	20.00	25.00	24.17
C_8	Potato	10.00	4.00	4.00	6.00
C_9	P.M(Summer)	15.70	10.00	10.00	11.90

BDAAG 160 : PRODUCTION POTENTIAL OF *KHARIF* BASED CROPPING SYSTEM FOR BIDI TOBACCO IN MIDDLE GUJARAT (JOINT STUDY BY AGRONOMY AND AGRIL. CHEMISTRY)

Year of start : 2016-17 (*Kharif –rabi*)
Design : RBD
Replications : Four
Plot size : Gross : 4.5 x 6.3 m

Treatments

T1 : Sorghum Fodder (*Kharif*) - Bidi tobacco
T2 : Green gram (*Kharif*) – Bidi tobacco
T3 : Black gram (*Kharif*) – Bidi tobacco
T4 : Sesamum (*Kharif*) – Bidi tobacco
T5 : Cow pea (Vegetable, *Kharif*) – Bidi tobacco
T6 : Cluster bean (Vegetable, *Kharif*) – Bidi tobacco

Crop details:

No.	Crop	Variety	Spacing (cm)	Fertilizer (NPK, kg/ha)	Season
C1	Jowar Fodder	S 1049	Broadcasting	80-40-0	*Kharif*
C2	Green gram	GAM 5	45 x 15	20 – 40 – 0	*Kharif*
C3	Black gram	Guj. Udad 2	45 x 15	20 – 40 – 0	*Kharif*
C4	Sesamum	Guj. Til. 1	45 x 15	37.5 – 50 - 0	*Kharif*
C5	Cowpea	AVC 1	45 x 15	20 – 40 – 0	*Kharif*
C6	Cluster bean	PNB	45 x 15	20 – 40 – 0	*Kharif*
C7	Tobacco	GABT 11	90 x 90	200 – 0 - 0	*Kharif-Rabi*

Results

The results presented in Table BDAAG 160.1 revealed that significantly higher tobacco equivalent yield (6121 kg/ha) and maximum net profit (172178 Rs/ha) was obtained from T5 (Cow pea {Vegetable} – Bidi tobacco) over treatments T4 (Sesamum – Bidi tobacco) and T6 (Cluster bean {Vegetable} – Bidi tobacco). Second best treatment was T1 (Sorghum Fodder - Bidi tobacco cropping system) which also recorded significantly higher tobacco equivalent yield (5835 kg/ha) with net profit (159137 Rs/ha). Sesamum – Bidi tobacco cropping system recorded significantly lower tobacco equivalent yield (4946 kg/ha) which was at par with treatments T6, T2 and T3.

Further, the data illustrated in Table BDAAG 160.2 and 160.3 indicated that yield, morphological characters, dry weight per unit leaf area and root knot index of bidi tobacco grown after short duration *kharif* crops were not changed due to different treatments.

With regard to quality parameters (nicotine, reducing sugar and chloride) the results presented in BDAAG 160.4 revealed that quality parameters were significantly affected due to different treatments. Treatments T_5 (Cowpea – Potato) and T_6 (Clusterbean – Tobacco), being at par with each other recorded significantly higher nicotine and chloride contents as compared to T_1 (Sorghum - Tobacco) and T_2 (Green gram – Tobacco) treatments. However, treatment T_2 (Green gram - Tobacco) produced higher reducing sugar content as compared to all other treatments except, treatment T_4 (Sesamum – Tobacco).

Table BDAAG 160.1: Tobacco equivalent yield and economics (2018-19) as affected by tobacco based cropping sequences

Trt.	Treatment Details	Tobacco equivalent yield (kg/ha)	Economics (Rs./ha)		
			Total income	Total Cost	Net Profit
T_1	Sorghum Fodder (*Kharif*) - *bidi* tobacco	5835	233408	74241	159167
T_2	Green gram (*Kharif*) – *bidi* tobacco	5477	219083	75687	143396
T_3	Black gram (*Kharif*) – *bidi* tobacco	5370	214802	75526	139277
T_4	Sesamum (*Kharif*) – *bidi* tobacco	4946	197831	66605	131226
T_5	Cow pea (Vegetable, *Kharif*) – *bidi* tobacco	6121	244824	72647	172178
T_6	Cluster bean (Vegetable, *Kharif*) – *bidi* tobacco	5105	204219	72301	131917
	S.Em. ±	256.07	--	--	--
	C.D. at 5%	**772**	--	--	--
	C. V. %	9.35	--	--	--

Selling price (Rs./kg): Sorghum green fodder = 2.0, Green gram = 40.0, Black gram = 40.0, Cow pea veg. = 12.0, Cluster bean veg. = 12.0, Tobacco = 40.0

Table BDAAG 160.2: Yield and morphological characters of tobacco as affected by different (2018-19) tobacco based cropping sequences

Trt	Crop	Tobacco yield (kg/ha)	Leaf size (cm)		Plant height (cm)
			Length	Width	
T_1	Sorghum-Tobacco	4712	49.28	21.75	95.59
T_2	Green gram-Tobacco	4888	50.17	21.20	88.20
T_3	Black gram-Tobacco	5095	50.72	21.13	94.80
T_4	Sesamum-Tobacco	4946	52.03	22.98	96.52
T_5	Cow pea-Tobacco	5097	52.02	20.88	91.35
T_6	Cluster bean -Tobacco	4887	53.63	22.98	95.05
S. Em. ±		265.44	1.08	0.87	3.21
C. D. at 5%		**NS**	NS	NS	NS
C. V. %		10.75	4.21	7.96	6.85

Table BDAAG 160.3: Leaf thickness and root knot index of tobacco as affected by different (2018-19) tobacco based cropping sequences

Trt.	Crop	Dry weight per unit leaf area (mg/cm^2)	RKI (0-5) *	
			√(x+1)	Original
T_1	Sorghum-Tobacco	9.03	1.97	2.90
T_2	Green gram-Tobacco	8.41	2.04	3.18
T_3	Black gram-Tobacco	8.22	1.94	2.78
T_4	Sesamum-Tobacco	9.45	2.08	3.35
T_5	Cow pea-Tobacco	9.23	2.01	3.08
T_6	Cluster bean -Tobacco	8.92	2.07	3.30
S. Em. ±		0.49	0.07	--
C. D. at 5%		**NS**	**NS**	**--**
C. V. %		10.96	7.39	--

*0=Free; 5= Maximum disease intensity

Table BDAAG 160.4: Quality parameters of tobacco as affected by different (2018-19) tobacco based cropping sequences

Tr.	Treatment Details	Nicotine (%)	Reducing Sugar (%)	Chloride (%)
T_1	Sorghum-Tobacco	4.55	3.20	1.03
T_2	Green gram-Tobacco	3.54	3.80	1.14
T_3	Black gram-Tobacco	4.86	2.60	1.46
T_4	Sesamum-Tobacco	5.46	3.54	1.35
T_5	Cow pea-Tobacco	5.86	3.07	1.38
T_6	Cluster bean -Tobacco	5.56	2.87	1.53
S.Em.±		0.17	0.12	0.10
C.D. at 5%		**0.51**	0.36	0.29
C.V. %		6.77	7.55	14.60

BDAAG 161: POSSIBILITIES FOR UTILIZATION OF TOBACCO WASTE WITH INTEGRATED NUTRIENT MANAGEMENT ON YIELD AND ITS QUALITY AS WELL AS ON SOIL STATUS IN BIDI TOBACCO UNDER MIDDLE GUJARAT CONDITIONS.

Year of start: 2017-18 (*Kharif –rabi*)
Treatments: Nine

T1	Control (RDN 140 kg N/ha; 25 % N from FYM + 25 % N from AS + 50 % N form Urea)
T2	25 % N (*Bidi* Tobacco stem - Leaf crop) + 25 % N (AS) + 50 % N (Urea)
T3	25 % N (*Bidi* Tobacco stem - Seed crop) + 25 % N (AS) + 50 % N (Urea)
T4	25 % N (*Bidi* Tobacco seed husk) + 25 % N (AS) + 50 % N (Urea)
T5	25 % N (*Bidi* Tobacco seed stover) + 25 % N (AS) + 50 % N (Urea)
T6	25 % N (*Rustica* Tobacco stem- Leaf crop) + 25 % N (AS) + 50 % N (Urea)
T_7	25 % N (*Rustica* Tobacco stem - Seed crop) + 25 % N (AS) + 50 % N (Urea)
T_8	25 % N (*Rustica* Tobacco seed husk) + 25 % N (AS) + 50 % N (Urea)
T_9	25 % N (Rustica Tobacco seed stover) + 25 % N (AS) + 50 % N (Urea)

Design : RBD
Replications : Three
Plot size : Gross : 4.5 x 6.0 m
Spacing : 90 x 75 cm

Results: The results depicted in Table BDAAG 161.1 to 161.3 showed that different treatments failed to exert their significant effect on yield, different morphological characters (leaf length, leaf width, plant height, days to maturity, growth score and spangle score), leaf thickness and root knot index of Bidi tobacco variety GT 7. Though significant differences were not observed and T6 recorded higher yield followed by T9

Table BDAAG 161.1: Effect of different treatments on yield and morphological characters of *Bidi* variety GT 7 (2018-19)

Trt.	Treatment Details	Yield kg/ha	Leaf length	Leaf width	Plant height
			---------- cm ----------		
T_1	Control (N140) = FYM25 + AS25 + Urea50	3132	54.49	20.69	93.20
T_2	N140 = BTS25 + AS25 + Urea50	3409	57.24	22.13	87.27
T_3	N140 = BSSt25 + AS25 + Urea50	3165	58.11	21.71	94.60
T_4	N140 = BSH25 + AS25 + Urea50	3519	57.60	22.62	94.13
T_5	N140 = BSSr25 + AS25 + Urea50	3188	55.82	22.76	89.00
T_6	N140 = RTS25 + AS25 + Urea50	3628	56.40	23.64	91.07
T_7	N140 = RSSt25 + AS25 + Urea50	3119	59.04	24.31	89.53
T_8	N140 = RSH25 + AS25 + Urea50	3189	60.09	23.31	98.13
T_9	N140 = RSSr25 + AS25 + Urea50	3357	56.40	23.07	88.53
S.Em.±		144.4	1.67	1.18	3.19
C.D. at 5%		**NS**	**NS**	**NS**	**NS**
C.V. %		7.58	5.05	9.02	6.03

Table BDAAG 161.2: Effect of different treatments on morphological characters of *bidi* tobacco variety GT 7 (2018-19)

Trt.	Treatment Details	Days to maturity	Growth score (1-10)	Spangle score (1-5)
T_1	Control (N140) = FYM 25 + AS 25 + Urea 50	164	6.73	3.17
T_2	N140 = BTS25 + AS25 + Urea50	168	7.53	3.57
T_3	N140 = BSSt25 + AS25 + Urea50	165	6.83	3.80
T_4	N140 = BSH25 + AS25 + Urea50	168	7.67	4.23
T_5	N140 = BSSr25 + AS25 + Urea50	170	7.57	3.73
T_6	N140 = RTS25 + AS25 + Urea50	166	7.53	3.87
T_7	N140 = RSSt25 + AS25 + Urea50	167	6.90	3.50
T_8	N140 = RSH25 + AS25 + Urea50	168	7.53	4.23
T_9	N140 = RSSr25 + AS25 + Urea50	168	6.93	4.13
S.Em.±		1.85	0.37	0.23
C.D. at 5%		**NS**	**NS**	**NS**
C.V. %		1.92	8.96	10.43

Table BDAAG 161.3:Effect of different treatments leaf thickness and root knot index of *bidi* tobacco variety GT 7 (2018-19)

Trt.	Treatment Details	Dry weight per unit leaf area (mg/cm^2)	RKI (0-5) *	
			$\sqrt{(x+1)}$	Original
T_1	Control (N140) = FYM25 + AS25 + Urea50	10.41	1.21	0.57
T_2	N140 = BTS25 + AS25 + Urea50	9.62	1.23	0.63
T_3	N140 = BSSt25 + AS25 + Urea50	9.44	1.18	0.47
T_4	N140 = BSH25 + AS25 + Urea50	10.06	1.00	0.00
T_5	N140 = BSSr25 + AS25 + Urea50	10.82	1.00	0.00
T_6	N140 = RTS25 + AS25 + Urea50	9.65	1.34	0.83
T_7	N140 = RSSt25 + AS25 + Urea50	9.74	1.00	0.00
T_8	N140 = RSH25 + AS25 + Urea50	10.11	1.00	0.00
T_9	N140 = RSSr25 + AS25 + Urea50	10.07	1.29	0.83
S.Em.±		0.48	0.13	--
C.D. at 5%		**NS**	**NS**	--
C.V. %		8.25	19.13	--

*0=Free; 5= Maximum disease intensity

Table BDAAG 161.4: Effect of different treatments on quality parameters of Bidi tobacco variety GT 7 (2018-19)

Trt.	Treatment Details	Nicotine (%)	Reducing Sugar (%)	Chloride (%)
T_1	Control (N140) = FYM25 + AS25 + Urea50	8.19	4.53	1.172
T_2	N140 = BTS25 + AS25 + Urea50	8.50	4.00	1.278
T_3	N140 = BSSt25 + AS25 + Urea50	6.78	5.00	1.065
T_4	N140 = BSH25 + AS25 + Urea50	6.98	4.86	1.101
T_5	N140 = BSSr25 + AS25 + Urea50	6.17	4.17	1.172
T_6	N140 = RTS25 + AS25 + Urea50	7.18	4.47	1.349
T_7	N140 = RSSt25 + AS25 + Urea50	6.57	4.40	1.136
T_8	N140 = RSH25 + AS25 + Urea50	7.28	4.27	1.030
T_9	N140 = RSSr25 + AS25 + Urea50	7.69	4.93	1.030
S.Em.±		0.17	0.17	0.035
C.D. at 5%		0.51	0.50	0.105
C.V. %		4.08	6.43	5.26

The results depicted in Table BDAAG 161.4 showed that different treatments altered quality parameters of bidi tobacco variety. Treatment T_2 [N140 = BTS25 + AS25 + Urea50] recorded significantly the highest nicotine content (8.50). With regards to reducing sugar, treatment T_3 [25 % N (Bidi Tobacco stem - Seed crop) + 25 % N (AS) + 50 % N (Urea)] registered significantly higher reducing content (5.00) but it was at par with T_4 and T_9 treatments. Further, the data revealed that chloride content of bidi tobacco variety GT 7 also changed due to different treatment wherein, treatment T_6 [25 % N (Bidi Tobacco seed stover) + 25 % N (AS) + 50 % N (Urea)] recorded significantly higher chloride content (1.349) but it was at par with T_2 treatment.

NANDYAL

BDNyAG 15: ECONOMIZATION AND MANAGEMENT OF P & K FERTILIZERS FOR *BIDI* TOBACCO

Year of start: 2015-16

Objective: To find out the optimum fertilizer dose for bidi tobacco for scare rainfall zone

Design: RBD
Replications: Three
Plot size : 4.5 X 3.75 m
Spacing (cm): 75 X 75 cm
Variety: Nandyal Pogaku-1

Treatments: 8 (given in table)

Results: During 2018-19 significantly higher SPAD readings were recorded at 30 DAP (51.7), 60 DAP (54.6) and 90 DAP (46.6) when bidi tobacco was applied with100% RDF every year. Significantly higher cured leaf yield (1915 kg/ha) was recorded when bidi was tobacco applied with 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O) every year and on par with other treatments except control (989 kg /ha) and 100 % RDN (1314 kg/ha). Higher plant height (83.3 cm), Leaf length (41.3 cm) and leaf width (17.3 cm) was observed when bidi tobacco applied 100% RDF every year. Higher net returns (Rs 87,125/ha) recorded with when bidi tobacco applied 100% RDF every year. Leaf chemical characters did not differ significantly due to different treatments and are in permissible limit. Post harvest soil analysis indicated that Soil N, P_2O_5 and K_2O differed significantly due to different treatments.

Table BDNyAG 15-1: Economization and management of P and K fertilisers on SPAD readings of *bidi* tobacco-2018-19

Treatment	SPAD readings		
	30 DAP	60 DAP	90 DAP
T_1- Control	37.8	41.2	33.2
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	51.7	54.6	46.6
T_3- 100% RDN+P every year	46.9	51.2	43.2
T_4-100%RDN +P once in two year	42.6	47.1	39.1
T_5- 100% RDN +K every year	47.4	51.4	43.5
T_6- 100% RDN +K once in two years	45.3	49.2	41.3
T_7 -100 %RDN +P K once in two years	49.0	52.0	44.1
T_8- 100%RDN	40.5	44.4	36.4
S.Em.±	2.7	2.4	2.4
C.D. at 5%	7.5	6.6	6.6
C.V. %	10.2	8.4	10.0

Table BDNyAG 15-2: Economization and management of P and K fertilisers on growth and yield of *bidi* tobacco 2018-19

Treatment	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
T_1- Control	62.1	29.9	12.0	989
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	83.3	41.3	17.3	1915
T_3- 100% RDN+P every year	77.5	37.7	16.9	1689
T_4-100%RDN +P once in two year	73.3	36.8	17.7	1621
T_5- 100% RDN +K every year	79.8	38.3	17.2	1774
T_6- 100% RDN +K once in two years	77.9	37.9	16.7	1757
T_7 -100 %RDN +P K once in two years	81.0	40.2	17.0	1843
T_8- 100%RDN	72.0	35.1	14.6	1314
S.Em.±	3.8	2.1	0.9	106
C.D. at 5%	10.7	5.8	2.5	298
C.V. %	8.8	9.6	10.8	11.4

Table BDNyAG 15-3: Economization and management of P and K fertilizers on leaf chemical quality of *bidi* tobacco (2018-19)

Treatment	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
T_1- Control	5.79	3.48	1.59
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	4.51	3.90	1.89
T_3- 100% RDN+ P every year	5.11	3.59	1.75
T_4-100% RDN + P once in two year	5.48	3.20	1.75
T_5- 100% RDN + K every year	5.47	3.42	1.64
T_6- 100% RDN +K once in two years	5.53	3.66	1.51
T_7 -100 % RDN +P K once in two years	5.49	3.50	1.40
T_8- 100% RDN	5.11	3.13	1.67
S.Em.±	0.31	0.26	0.20
C.D. at 5%	NS	NS	NS
C.V. %	10.1	13.1	20.6

Table BDNyAG 15-4: Economization and management of P and K fertilisers on economics (Rs) of *bidi* tobacco-2018-19

Treatment	Gross returns	Cost of cultivation	Net returns	BCR
T_1- Control	74175	37000	37175	2.00
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	143625	56500	87125	2.54
T_3- 100% RDN+P every year	126675	48500	78175	2.61
T_4-100% RDN +P once in two year	121575	48500	73075	2.51
T_5- 100% RDN +K every year	133050	52000	81050	2.56
T_6- 100% RDN +K once in two years	131775	52000	79775	2.53
T_7 -100 % RDN +P K once in two years	138225	56500	81725	2.45
T_8- 100% RDN	98550	44000	54550	2.24

Table BDNyAG 15-5: Economization and management of P and K fertilizers for Bidi tobacco on Post harvest soil chemical properties 2018-19

Treatment	pH	Ec (ds/m)	Available nutrients (kg/ha)		
			N	P_2O_5	K_2O
T_1- Control	8.1	0.21	87.8	31.7	370.1
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	8.1	0.23	133.8	52.9	508.0
T_3- 100% RDN+P every year	8.2	0.18	146.3	56.3	410.1
T_4-100%RDN +P once in two year	8.2	0.22	150.5	43.1	391.9
T_5- 100% RDN +K every year	8.1	0.18	158.9	32.9	537.1
T_6- 100% RDN +K once in two years	8.3	0.22	158.9	35.9	446.3
T_7 -100 %RDN +P K once in two years	8.2	0.19	154.7	42.3	435.5
T_8- 100%RDN	8.3	0.22	150.5	36.3	384.7
S.Em.±	0.34	0.01	8.00	2.54	23.09
C.D. at 5%	NS	NS	24.27	7.71	70.03
C.V. %	7.1	11.6	9.7	10.6	9.2
Soil initial properties	**8.3**	**0.22**	**122.4**	**50.6**	**520.6**

Pooled results

Pooled data results showed that significantly higher cured leaf yield (1551 kg/ha) and net returns (Rs 63,375/ha) was recorded when bidi tobacco applied 100% RDF every year and on par with 100% RDN+PK once in two years (1408 kg/ha and net returns of Rs 59,275/ha) and 100% RDN+P every year (1391 kg/ha and net returns of Rs 59,375/ha). Significantly lower yield (773 kg/ha) and net returns of Rs 24,600/ha was recorded with control. Higher Leaf length (42.8 cm) and leaf width (17.3 cm) was observed when bidi tobacco applied 100% RDF every year. Leaf chemical characters did not differed significantly due to different treatments and are in permissible limit. Post harvest soil analysis indicated that Soil N, P_2O_5 and K_2O differed significantly due to different treatments.

Bidi tobacco yields will be reduced to 50 % when no fertilizers applied. Bidi tobacco can be cultivated profitably without affecting yield and leaf quality by applying 100% RDN (110 kg) +PK (70 Kg P +50 Kg K once in two years or 100% RDN (110 kg) +P (70 kg) every year instead of applying 100% RDF (110KgN + 70 Kg P +50 Kg K) every year without affecting leaf quality

Table BDNyAG 15-6: Economization and management of P and K fertilisers on growth and yield of *bidi* tobacco (Pooled data)

Treatment	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
T_1- Control	53.2	30.1	12.4	773
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	74.4	42.8	17.3	1551
T_3- 100% RDN+P every year	71.4	39.9	16.2	1391
T_4-100%RDN +P once in two year	66.8	39.6	16.2	1293
T_5- 100% RDN +K every year	70.7	40.1	16.5	1253
T_6- 100% RDN +K once in two years	68.8	40.5	16.3	1275
T_7 -100 %RDN +P K once in two years	76.3	42.3	17.0	1408
T_8- 100%RDN	70.0	38.3	16.0	1058
S.Em.±	3.5	1.8	0.8	83
C.D. at 5%	10.2	5.3	2.3	249
C.V. %	9.5	9.0	10.2	12.3

Table BDNyAG 15-7: Economization and management of P and K fertilizers on leaf chemical quality of *bidi* tobacco (Pooled data)

Treatment	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
T_1- Control	5.32	3.39	1.24
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	5.13	3.45	1.49
T_3- 100% RDN+ P every year	5.27	3.15	1.45
T_4-100% RDN + P once in two year	5.17	3.12	1.22
T_5- 100% RDN + K every year	5.15	3.15	1.26
T_6- 100% RDN +K once in two years	5.25	3.26	1.27
T_7 -100 % RDN +P K once in two years	5.35	3.19	1.22
T_8- 100% RDN	5.07	2.94	1.38
S.Em.±	0.35	0.25	0.14
C.D. at 5%	NS	NS	NS
C.V. %	11.7	13.2	17.2

Table BDNyAG 15-8: Economization and management of P and K fertilisers on economics (Rs) of *bidi* tobacco (Pooled data)

Treatment	Gross returns	Cost of cultivation	Net returns	BCR
T_1- Control	58050	33450	24600	1.74
T_2- 100% RDF (110 kg N; 70 kg P_2O_5; 50 kg K_2O)	116325	52950	63375	2.20
T_3- 100% RDN+P every year	104325	44950	59375	2.32
T_4-100% RDN +P once in two year	96975	42700	54275	2.27
T_5- 100% RDN +K every year	93975	48450	45525	1.94
T_6- 100% RDN +K once in two years	95625	44450	51175	2.15
T_7 -100 % RDN +P K once in two years	105975	46700	59275	2.27
T_8- 100% RDN	79350	40450	38900	1.96

BDNyAG 16: EFFECT OF TOPPING CROP PERIOD AND NUMBER OF LEAVES ON GROWTH, YIELD AND QUALITY OF BIDI TOBACCO

Year of start: 2016-17

Objective:

1. To find out the optimum leaf number for topping in *bidi* tobacco.
2. To identify optimum crop stage for topping in *bidi* tobacco for higher yield and quality

Design : RBD Replications : Three
Plot size : 4.5 X 3.75 m Spacing (cm): 75 X 75 cm

Treatments : 11

T_1- Control (15 leaf stage at early flowering stage)
T_2- 8 leaf at button stage
T_3- 8 leaf at early flowering stage
T_4- 9 leaf at button stage
T_5- 9 leaf at early flowering stage
T_6- 10 leaf at button stage
T_7- 10 leaf at early flowering stage
T_8- 11 leaf at button stage
T_9- 11 leaf at early flowering stage
T_{10}- 12 leaf at button stage
T_{11}- 12 leaf at early flowering stage

Results

SPAD readings recorded did not show significant effect due to different treatments except variation in readings at different intervals. Topping at 15 leaf early flowering stage recoded 1938 kg /ha cured leaf yield and is at par with topping at 12 leaf early flowering stage (1747 kg/ha) and topping at 12 leaf button stage (1652 kg/ha). Higher net returns (Rs 88,850/ha) and BCR (2.57) was observed with topping at 15 leaf early flowering stage. Significantly lower cured leaf yield (1153 kg/ha), net returns (Rs 29,975/ha) and BCR (1.53) was recorded with treatment topping at 8 leaf button stage. Leaf thickness, spangle score did not differed significantly due to different treatments. Leaf chemical characters did not differ significantly due to different treatments and are in permissible limit.

Table BDNyAG 16-1: Effect of topping time and number of leaves on SPAD of *bidi* tobacco-2018-19

Treatment	SPAD		
	30 DAP	60 DAP	90 DAP
T_1- control (15 leaf stage at early flowering stage)	43.0	47.9	41.5
T_2- 8 leaf at Button stage	43.6	48.7	42.1
T_3- 8 leaf at early flowering stage	44.7	50.1	43.7
T_4- 9 leaf at Button stage	42.2	47.2	40.8
T_5- 9 leaf at early flowering stage	43.8	48.6	42.4
T_6- 10 leaf at Button stage	41.9	46.0	39.5
T_7-10 leaf at early flowering stage	43.9	48.9	43.1
T_8- 11 leaf at Button stage	42.3	47.3	40.7
T_9- 11 leaf at early flowering stage	44.7	50.2	43.0
T_{10}- 12 leaf at Button stage	42.0	45.3	38.8
T_{11}- 12 leaf at early flowering stage	43.8	48.1	42.3
S.Em.±	2.9	3.1	2.9
C.D. at 5%	NS	NS	NS
C.V. %	11.5	11.2	12.1

Table BDNyAG 16-2: Effect of topping time and number of leaves on growth, yield and quality of bidi tobacco - 2018-19

Treatment	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
T_1- control (15 leaf stage at early flowering stage)	75.1	36.2	14.4	1938
T_2- 8 leaf at Button stage	50.7	49.2	21.4	1153
T_3- 8 leaf at early flowering stage	53.9	48.8	20.9	1248
T_4- 9 leaf at Button stage	51.0	48.6	20.4	1333
T_5- 9 leaf at early flowering stage	54.6	48.2	19.6	1371
T_6- 10 leaf at Button stage	57.2	47.5	19.2	1417
T_7-10 leaf at early flowering stage	59.9	46.8	18.8	1475
T_8- 11 leaf at Button stage	61.9	46.9	18.8	1515
T_9- 11 leaf at early flowering stage	62.9	45.4	17.6	1524
T_{10}- 12 leaf at Button stage	64.6	43.6	17.4	1652
T_{11}- 12 leaf at early flowering stage	67.8	41.8	17.5	1747
S.Em.±	3.6	2.5	1.1	113
C.D. at 5%	10.6	7.4	3.3	333
C.V. %	10.4	9.5	10.4	13.2

Table BDNyAG 16-3: Effect of topping time and number of leaves on growth, yield and quality of bidi tobacco (2018-19)

Treatment	Dry wt/ unit leaf area (mg/cm^2)	Spangle score	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
T_1- control (15 leaf stage at early flowering stage)	12.5	8.0	6.71	3.54	1.51
T_2- 8 leaf at Button stage	15.1	6.7	5.21	3.89	1.66
T_3- 8 leaf at early flowering stage	14.3	6.3	5.16	3.61	1.51
T_4- 9 leaf at Button stage	14.1	7.0	5.57	3.69	1.46
T_5- 9 leaf at early flowering stage	13.7	7.0	5.98	3.14	1.47
T_6- 10 leaf at Button stage	13.3	7.0	6.11	3.53	1.52
T_7-10 leaf at early flowering stage	13.3	6.7	5.76	3.70	1.47
T_8- 11 leaf at Button stage	13.1	7.3	5.93	3.82	1.74
T_9- 11 leaf at early flowering stage	13.3	6.7	5.87	3.49	1.44
T_{10}- 12 leaf at Button stage	13.5	7.0	6.08	3.32	1.48
T_{11}- 12 leaf at early flowering stage	13.8	7.3	6.10	3.42	1.60
S.Em.±	1.13	0.4	0.32	0.33	0.09
C.D. at 5%	NS	NS	NS	NS	NS
C.V. %	14.4	9.2	9.4	15.9	9.8

Table BDNyAG 16-4: Effect of topping time and number of leaves on economics of *bidi* tobacco (2018-19)

Treatment	Gross returns	Cost of cultivation	Net returns	BCR
T_1- control (15 leaf stage at early flowering stage)	145350	56500	88850	2.57
T_2- 8 leaf at Button stage	86475	56500	29975	1.53
T_3- 8 leaf at early flowering stage	93600	56500	37100	1.66
T_4- 9 leaf at Button stage	99975	56500	43475	1.77
T_5- 9 leaf at early flowering stage	102825	56500	46325	1.82
T_6- 10 leaf at Button stage	106275	56500	49775	1.88
T_7-10 leaf at early flowering stage	110625	56500	54125	1.96
T_8- 11 leaf at Button stage	113625	56500	57125	2.01
T_9- 11 leaf at early flowering stage	114300	56500	57800	2.02
T_{10}- 12 leaf at Button stage	123900	56500	67400	2.19
T_{11}- 12 leaf at early flowering stage	131025	56500	74525	2.32

Pooled Results

Pooled data results showed that topping at 15 leaf early flowering stage recoded 1660 kg /ha cured leaf yield, net returns (Rs 71,550/ha) and BCR (2.35) and is on par with topping at 12 leaf at early flowering stage (1628 kg/ha, net returns of Rs 69,150/ha and BCR of 2.31) and topping at 12 leaf at Button stage (1587 kg/ha, net returns of Rs 66,075/ha and BCR of 2.25). Significantly lower cured leaf yield (1159 kg/ha.) with net returns of Rs 33,975/ha and BCR of 1.64 was recorded with treatment topping at 8 leaf button stage. Leaf chemical characters did not differed significantly due to different treatments and are in permissible limit.

Bidi tobacco can be grown profitably without affecting yield and leaf quality by topping upto 12 leaf at bud stage or early flowering stage without affecting leaf quality.

Table BDNyAG 16-5: Effect of topping time and number of leaves on growth, yield of bidi tobacco (Pooled data)

Treatment	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Cured leaf yield (kg/ha)
T_1- control (15 leaf stage at early flowering stage)	57.6	34.9	14.0	1660
T_2- 8 leaf at Button stage	40.3	42.9	18.3	1159
T_3- 8 leaf at early flowering stage	42.7	41.9	18.0	1304
T_{4-} 9 leaf at Button stage	43.1	41.7	17.9	1364
T_5- 9 leaf at early flowering stage	46.6	41.5	17.3	1370
T_6- 10 leaf at Button stage	49.1	42.2	17.6	1437
T_7-10 leaf at early flowering stage	48.9	40.4	17.2	1337
T_8- 11 leaf at Button stage	50.1	41.1	18.3	1427
T_9- 11 leaf at early flowering stage	50.8	40.9	17.2	1451
T_{10}- 12 leaf at Button stage	51.8	40.0	17.7	1587
T_{11}- 12 leaf at early flowering stage	51.3	37.6	16.9	1628
S.Em.$\pm$	2.7	2.3	1.0	64
C.D. at 5%	7.9	6.7	3.0	193
C.V. %	9.5	9.9	10.4	10.5

Table BDNyAG 16-6: Effect of topping time and number of leaves on leaf chemical quality of *bidi* tobacco (Pooled data)

Treatment	Nicotine (%)	Reducing sugars (%)	Chlorides (%)
T_1- control (15 leaf stage at early flowering stage)	5.64	3.14	1.24
T_2- 8 leaf at Button stage	5.48	3.32	1.33
T_3- 8 leaf at early flowering stage	5.48	3.19	1.46
T_4- 9 leaf at Button stage	5.67	3.28	1.38
T_5- 9 leaf at early flowering stage	5.51	2.97	1.27
T_6- 10 leaf at Button stage	5.30	3.17	1.50
T_7-10 leaf at early flowering stage	5.50	3.13	1.31
T_8- 11 leaf at Button stage	5.44	3.30	1.75
T_9- 11 leaf at early flowering stage	5.61	3.23	1.41
T_{10}- 12 leaf at Button stage	5.35	3.28	1.26
T_{11}- 12 leaf at early flowering stage	5.80	2.91	1.39
S.Em.±	0.35	0.23	0.10
C.D. at 5%	NS	NS	NS
C.V. %	9.65	12.54	17.02

Table BDNyAG 16-7: Effect of topping time and number of leaves on economics of *bidi* tobacco (2018-19)

Treatment	Gross returns	Cost of cultivation	Net returns	BCR
T_1- control (15 leaf stage at early flowering stage)	124500	52950	71550	2.35
T_2- 8 leaf at Button stage	86925	52950	33975	1.64
T_3- 8 leaf at early flowering stage	97800	52950	44850	1.85
T_4- 9 leaf at Button stage	102300	52950	49350	1.93
T_5- 9 leaf at early flowering stage	102750	52950	49800	1.94
T_6- 10 leaf at Button stage	107775	52950	54825	2.04
T_7-10 leaf at early flowering stage	100275	52950	47325	1.89
T_8- 11 leaf at Button stage	109500	52950	56550	2.07
T_9- 11 leaf at early flowering stage	108825	52950	55875	2.06
T_{10}- 12 leaf at Button stage	119025	52950	66075	2.25
T_{11}- 12 leaf at early flowering stage	122100	52950	69150	2.31

NIPANI

BDNAG 54: STUDY ON USE OF DIFFERENT MULCHES AND CONSERVATION PRACTICES IN BIDI TOBACCO

Objective: To study the performance of *bidi* tobacco under different mulches with regard to leaf yield and quality

Year of start: 2017-18

Design : RBD
Replications: 8
Treatments :5 (given in table)

Results

Results of *bidi* tobacco planted under different mulches and conservation practices revealed that, tobacco planted under black plastic mulch (2154 kg/ha) and white plastic mulch (2082 kg/ha) found encouraging and gave significantly higher yield as compared to crop residue mulch (1650 kg/ha), trash mulch (1404 kg/ha) and soil mulch (1354 kg/ha). Further, root length in both the plastic mulches is higher than other treatments. With regard to the quality parameters, tobacco grown under black plastic mulch realized significantly higher nicotine (2.3%) whereas maximum reducing sugars (5.6 %) and chlorides (2.1%) was recorded in tobacco grown on crop residue mulch. However, the nicotine in all the treatments was low.

Table BDNAG 54-1: Growth, yield and yield components of *bidi* tobacco as influenced by different mulches and conservation practices (2018-19)

Types of Mulches	Yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Leaf Length	Leaf Breadth	Root length
				(cm)		
Black Plastic Mulch	2154	93.70	22	60.24	23.27	45.2
White Plastic Mulch	2082	98.88	21	58.38	22.87	42.9
Trash Mulch	1404	89.13	20	53.94	20.72	30.1
Crop Residue Mulch	1650	90.85	22	56.89	21.94	39.8
Soil Mulch	1354	82.70	21	52.22	20.52	32.1
S.Em±	156	4.50	0.72	1.71	0.66	
C.D. at 5%	458	NS	NS	4.91	1.92	

Table BDNAG 54-2: Chemical quality parameters

Types of Mulches	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
Black Plastic Mulch	2.3	5.1	1.7
White Plastic Mulch	2.0	5.5	2.0
Trash Mulch	1.4	5.3	1.8
Crop Residue Mulch	1.7	5.6	2.1
Soil Mulch	1.8	5.0	1.8
S.Em±	0.17	0.17	0.06
C.D. at 5%	0.48	0.50	0.17

BDNAG 55: EVALUATION OF VARIOUS SOURCES OF POTASH FOR QUALITY PRODUCTION OF BIDI TOBACCO

Objective: To study the impact of various sources of potash on quality of *bidi* tobacco

Year of start: 2016-17

Design : RBD
Plot size : 6 x 20 m

Treatment details

1. Tobacco stems ash
2. Pressmud
3. Pressmud + Factory ash
4. Sugarcane trash ash
5. Maize rind ash
6. Sulphate of potash (C)

Results

In a study on evaluation of various sources of potash to substitute sulphate of potash, a recommended source of potash for quality production of bidi tobacco revealed that, though the impact of various sources of potash is non-significant, the trend of results showed, the substitution of sulphate of potash can be done through other sources of potash available. As far Nicotine was maximum in tobacco receiving sulphate of potash (5.5%) and followed by tobacco stem ash (5.4%). Reducing sugars (7.3%) and Chlorides (1.5%) were maximum in sugarcane trash ash and pressmud + factory ash respectively (Table BDNAG 55-1 & 2).

Table BDNAG 55-1: Growth, yield and yield components as influenced by various sources of potash

Types of Mulches	Yield (kg/ha)	Plant Height (cm)	No. of leaves/ plant	Leaf Length	Leaf Breadth
				(cm)	
Tobacco stem ash	983.33	117	15	63.35	27.39
Pressmud	925.33	117	13	65.76	27.19
Pressmud + Factory ash	948.00	121	14	62.66	27.41
Sugarcane trash ash	961.33	113	13	65.99	28.09
Maize rind ash	800.00	119	14	65.23	25.87
Sulphate of potash	973.33	121	13	65.63	28.56
S.Em±	0.74	4.82	2.95	1.84	1.20
C.D. at 5%	NS	NS	NS	NS	NS

Table BDNAG 55-2: Chemical quality parameters

Types of Mulches	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
Tobacco stem ash	5.4	6.2	1.4
Pressmud	5.3	6.7	1.4
Pressmud + Factory ash	5.1	6.9	1.5
Sugarcane trash ash	4.7	7.3	1.0
Maize rind ash	4.9	6.6	1.0
Sulphate of potash	5.5	5.9	1.1
S.Em±	0.27	0.56	0.05
C.D. at 5%	0.78	1.61	0.16

C. *NATU* TOBACCO

BERHAMPUR

PBAG 25: RESPONSE OF *PIKKA* TOBACCO GENETYPES TO DIFFERENT DATES OF PLANTING

Objective: To determine the response of pre-released *pikka* tobacco genotype Sel-47 to different planting time

Year of start: 2018-19
Year of completion: 2019-20

Design: Split plot
Replications: Three
Plot size: 6.75 x 5.5 m
Spacing: 75 cm x 50 cm
Manorial schedule: RDF: NPK: 80:40:40 kg/ha

Treatments: 12

Main plot : 3 planting dates	**Sub Plot: 4 Genotypes**
D_1: 10th August, 2018	Sel-47
D_2 : 25th August, 2018	62-90
D_3 :10th September, 2018	Gajapati
	JP local

Observations recorded

1. Plant stand
2. Topped plant height (cm)
3. No. of leaves/plant
4. Leaf length (cm)
5. Leaf breadth (cm)
6. Cured leaf yield (kg/ha)

Results

Two genotypes of *pikka* tobacco along with two check varieties Gajapati and JP local were evaluated during kharif 2018 in split plot design with three replications for cured leaf yield and ancillary characters. Three planting dates were assigned to three main plots and four genotypes were assigned to sub plots. Analysis of variance of cured leaf yield and ancillary characters of *pikka* tobacco genotypes are presented in Table PBAG 25-1, significant differences existed among three planting dates and four *pikka* tobacco genotypes for cured leaf yield and ancillary characters except plant population per hectare.

Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes are presented in Table PBAG 25-2, It was observed that planting dates affect the performance of all *pikka* tobacco genotypes. Planting on 2nd fort night of August (25.8.2018) recorded higher cured leaf yield followed by first fortnight of September,(10.09.2018) and first fortnight of August (10.08.2018). Cured leaf yield performance of 2nd date of planting (1098 kg/ha) was at par with 3rd date of planting (1068kg /ha) but significantly different form 1st date of planting (918 kg/ha). Similar observation were also noticed in all ancillary characters except plant population /ha. Among four genotypes Sel-47 (1278 kg/ha) produced significantly higher cured leaf yield than other genotypes. Sel-47 was followed by Variety Gajapati (1055 kg/ha), JP local (927 kg/ha) and 62-90 (841 kg/ha). Genotype Sel-47 produced 21.1% higher cured leaf yield over check var Gajapati. Cured leaf yield ranged from 739 kg/ha (D_1V_2) to 1356 kg/ha (D_2V_1) with an average yield of 1025 kg/ha (Table PBAG 25-3).

Table PBAG 25-1: ANOVA of cured leaf yield and ancillary characters in *pikka* tobacco

Source	df	MSS					
		Cured leaf yield (kg/ha)	Population / ha	Topped Plant height (cm)	No of leaves / plant	Leaf length (cm)	Leaf width (cm)
Replication	2	8650.763	21904113.6	592.694	3.583	70.583*	65.528*
Main plot (Planting dates)	2	104506.2*	19992434.3	978.4*	14.6*	329.3**	66.7*
Error a	4	**7499.6**	**6353692.5**	**113.0**	**1.7**	**7.6**	**6.7**
Sub plot (Genotypes)	3	326445.5**	2461202.7	309.6*	9.1**	98.7**	5.7**
Interaction	6	432.6	3204450.4	15.5	0.2	12.0**	1.3
Error b	18	**5090.493**	**3275220.3**	**78.287**	**1.157**	**3.991**	**0.981**
Total	**35**						

*, ** significant at 5% and 1% levels respectively

Table PBAG 25-2: Response of *pikka* tobacco genotypes to different dates of planting

Treatments	Cured Leaf yield (kg /ha)	Population /ha	Topped Plant height (cm)	No of leaves /plant	Leaf length (cm)	Leaf width (cm)
Main factor: Fertility levels						
D_1(10.8.18)	918	20917	70.9	11	36.3	14.6
D_2(25.8.18)	1089	23280	88.8	13	46.5	19.3
D_3(10.9.18)	1068	21199	81.8	12	43.3	17.5
Mean	1025	21799	80.5	12	42.0	17.1
S.Em±	25	728	3.1	0	0.8	0.7
C.D. at 5%	98	2856	12.0	1	3.1	2.9
C.V. (%)	8.4	11.6	13.2	11.0	6.6	15.1
Sub factor						
V 1 (Sel-47)	1278	22434	87.6	13	46.9	16.6
V 2 (62-90)	841	21211	80.2	11	40.7	17.6
V 3 (Gajapati)	**1055**	**21963**	**81.1**	**12**	**40.9**	**18.0**
V 4 (JP Local)	927	21587	73.2	12	39.6	16.3
Mean	1025	21799	80.5	12	42.0	17.1
S.Em±	24	603	2.9	0	0.7	0.3
C.D. at 5%	71	1792	8.8	1	2.0	1.0
C.V. (%)	7.0	8.3	11.0	9.2	4.8	5.8
C.D. at 5% D within V	165	4486	20.4	2	4.9	3.8
C.D. at 5% V within D	122	3104	15.2	2	3.4	1.7

Table PBAG 25-3: Cured leaf yield (kg/ha) of *pikka* tobacco genotypes under different dates of planting

Fertility levels	Genotypes				
	V_1 (Sel 47)	V_2 (62-90)	V_3 (Gajapati)	V_4 (JP Local)	Mean
D_1(10.8.18)	1159	739	951	824	918
D_2(25.8.18)	1356	887	1121	993	1089
D_3(10.9.18)	1321	895	1094	964	1068
Mean	1278	841	1055	927	1025
C.D. at 5% D within V					165
C.D. at 5% V within D					122

Conclusion: First year study showed 2nd fort night of August is optimum planting time for *pikka* tobacco genotype Sel-47 giving higher cured leaf yield than 1st fort night of August and September.

PBAG 26: RESPONSE OF *PIKKA* TOBACCO GENETYPES TO DIFFERENT FERTILITY LEVELS

Objective: To study the response of pre-released *pikka* tobacco genotype Sel-47 to different fertility levels

Year of start: 2018-19
Year of completion: 2019-20

Design: Split plot
Replications: Three
Plot size: 6.75 x 5.5 m
Spacing: 75 cm x 50 cm
Manorial schedule: RDF: NPK: 80:40:40 kg/ha

Treatments: 12

Main plot : 3 Fertility levels	**Sub Plot: 4 Genotypes**
F_1 :N_{60}:P_{30}:K_{30} kg/ha	Sel-47
F_2 :N_{80}:P_{40}:K_{40} kg/ha	62-90
F_3 : N_{100}:P_{50}:K_{50} kg/ha	Gajapati
	JP local

Observations recorded

1. Plant stand
2. Topped plant height (cm)
3. No. of leaves/plant
4. Leaf length (cm)
5. Leaf breadth (cm)
6. Cured leaf yield (kg/ha)

Results

Two genotypes of *pikka* tobacco along with two check varieties Gajapati and JP local were evaluated during kharif 2018 in split plot design with three replications for cured leaf yield and ancillary characters. Three fertility doses were assigned to three main plots and four genotypes were assigned to sub plots. Analysis of variance of cured leaf yield and ancillary characters of *pikka* tobacco genotypes are presented in Table PBAG 26-1. Highly significant differences existed among three fertility doses and four *pikka* tobacco genotypes for cured leaf yield and ancillary characters except plant population per hectare. The interaction of fertility levels and genotypes found significant for cured leaf yield only.

Data on cured leaf yield and ancillary characters of *pikka* tobacco genotypes are presented in Table PBAG 26-2, It was observed that fertility levels had strong effect on the performance of all *pikka* tobacco genotypes. Higher cured leaf yield obtained from increasing fertility levels. Similar observation were also noticed in all ancillary characters except plant population / ha. Among fertility doses F_3 (N_{100}:P_{50}:K_{50}) recorded significantly higher cured leaf yield (1367 kg/ha) with a magnitude of superiority of 13.7% and 38.6% over F_2 (N_{80}:P_{40}:K_{40}) and F_1 (N_{60}:P_{30}:K_{30}) respectively. Similarly F_2 (N_{80}:P_{40}:K_{40}) produced significantly higher cured leaf yield (1202 kg/ha) than F_1 (N_{60}:P_{30}:K_{30}) with yield increase of 21.9%. Among four genotypes Sel-47 (1404 kg/ha) produced significantly higher cured leaf yield than other genotypes. Sel-47 was followed by Variety Gajapati (1232 kg/ha), JP local (1078 kg/ha) and 62-90 (1026 kg/ha). Genotype Sel-47 produced 13.96% higher cured leaf yield over check var Gajapati. Cured leaf yield ranged from 916 kg/ha (F_1 V_4) to 1666 kg/ha (F_3 V_1) with an average yield of 1185 kg/ha (Table PBAG 26-3).

Table PBAG 26-1: ANOVA of cured leaf yield and ancillary characters in *pikka* tobacco

Source	df	MSS					
		Cured leaf yield (kg/ha)	Population /ha	Topped Plant height (cm)	No of leaves /plant	Leaf length (cm)	Leaf width (cm)
Replication	2	55233.148*	7695662.25	12.861	8.333	98.778*	4.194
Main plot (Fertility levels)	2	439787.859**	1026936.75	893.7*	37.0**	153.0**	115.9*
Error a	4	**4261.468**	**3575149.75**	**92.2**	**2.1**	**8.4**	**9.8**
Sub plot (Genotypes)	3	259551.176**	4444565.07	643.2**	12.5**	179.7**	40.1**
Interaction	6	11117.614*	2359324.27	4.0	0.1	1.5	3.4
Error b	18	**3058.311**	**2221151.84**	**89.454**	**0.981**	**4.667**	**1.648**
Total	**35**						

*, ** significant at 5% and 1% levels respectively

Table PBAG 26-2: Response of *pikka* tobacco genotypes to different fertility levels

Treatments	Cured Leaf yield (kg/ha)	Population /ha	Topped Plant height (cm)	No of leaves /plant	Leaf length (cm)	Leaf width (cm)
Main factor: Fertility levels						
F_1 (N_{60}:P_{30}:K_{30})	986	23683	66.3	11	38.0	12.5
F_2 (N_{80}:P_{40}:K_{40})	1202	23228	77.4	13	42.3	16.3
F_3 (N_{100}:P_{50}:K_{50})	1367	23138	83.3	15	45.1	18.7
Mean	1185	23350	75.7	13	41.8	15.8
S.Em±	19	546	2.8	0	0.8	0.9
C.D. at 5%	74	NS	10.9	2	3.3	3.6
C.V. (%)	5.5	8.1	12.7	11.2	7.0	19.8
Sub factor: Genotypes						
V_1 (Sel- 47)	1404	24243	86.4	14	47.8	16.2
V_2 (62-90)	1026	22748	65.8	12	37.1	12.8
V_3 (Gajapati)	1232	22830	75.0	13	42.0	16.6
V_4 (JP Local)	1078	23578	75.6	11	40.3	17.7
Mean	1185	23350	75.7	13	41.8	15.8
S.Em±	18	497	3.2	0	0.7	0.4
C.D. at 5%	55	1476	9.4	1	2.1	1.3
C.V. (%)	4.7	6.4	12.5	7.7	5.2	8.1

Table PBAG 26-3: Cured leaf yield (kg/ha) of *pikka* tobacco genotypes under different fertility levels

Fertility levels	Genotypes				
	V_1 (Sel 47)	**V_2 (62-90)**	**V_3 (Gajapati)**	**V_4 (JP Local)**	**Mean**
F_1 (N_{60}:P_{30}:K_{30})	1127	884	1016	916	986
F_2 (N_{80}:P_{40}:K_{40})	1419	1046	1252	1092	1202
F_3 (N_{100}:P_{50}:K_{50})	1666	1149	1427	1227	1367
Mean	1404	1026	1232	1232	1185
C.D. at 5% F within V					126
C.D. at 5% V within F					95

Conclusion: First year study showed *Pikka* tobacco genotype Sel-47 produced 1666 kg/ha cured leaf with application of fertilizer dose of N_{100}:P_{50}:K_{50} kg/ha which was 17.4 and 47.8 percent higher when compared to fertilizer dose of N_{80}:P_{40}:K_{40} kg/ha N_{60}:P_{30}:K_{30}.

D. *CHEWING* TOBACCO

VEDASANDUR

CHVsAG 6: EFFECT OF DIFFERENT ORGANIC MANURES ON THE TRAY SEEDLING PRODUCTION AND ITS RESULTANT EFFECT ON THE PRODUCTIVITY OF CHEWING TOBACCO

Objective

- To find out a suitable organic manure for the tray seedlings production
- To find out the resultant effect of organic manures on the productivity of the crop
- To work out the economics of the different treatments

Year of Start: 2016-17

Results

Different organic manures *viz.*, FYM, Cocopeat, sheep manure, vermicompost etc., at different ratios were tested for raising tray seedlings in comparison with traditional nursery seedlings. The experiment was conducted in a RBD with 3 replications. The resultant effect of the seedlings was tested in the main field in RBD with 3 replications. Fresh shoot/root weight recorded with the seedlings raised in trays with different organic manures in combination with cocopeat was high compare to fresh root weight of the seedlings, when organic manures were applied alone and in traditional nursery seedlings (Table.1). Higher root dry weight of seedlings was recorded with different organic manures + cocopeat. Higher root volume was recorded with FYM and sheep manure in combination with cocopeat. Organic manures applied alone and traditional nursery seedlings recorded a lower root volume.

The performance of the seedlings was evaluated in the main field. Tray seedlings raised with different organic manures in combination with cocopeat, recorded a higher leaf length and width at topping as well as harvest stages (Table CHVsAG 6-1). The First grade leaf yield (FGLY) was significantly higher with different organic manures in combination with cocopeat as compared to the traditional nursery seedlings. Similar trend was also observed with Total cured leaf yield (TCLY). The traditional nursery seedlings recorded a lower FGLY and TCLY.

The cost of cultivation was higher for the plastic tray seedlings with different organic manures used as compared to traditional nursery seedlings. The net return was higher with the tray seedlings when sheep manure 50%+cocopeat was used (Rs.1,32,823/ha.) as compared to traditional nursery treatment (Rs. 76,733/ha.). The highest B: C also recorded with this treatment.

FYM, Sheep manure, vermicompost in combination with cocopeat improved the tray seedling shoot/root weight, root volume thereby seedling growth.
The seedlings raised in trays with FYM, Sheep manure, Vermicompost in combination with cocopeat increased the FGLY and TCLY of chewing tobacco

Table CHVsAG 6-1: Effect of different organic manures on the production of tray seedlings

Treatments	Fresh weight in grams		Dry weight in grams		Root volume cc
	Shoot	Root	Shoot	Root	
FYM50%+Cocopeat50%	11.10	6.00	1.81	0.84	4.33
FYM25%+Cocopeat75%	12.00	7.60	1.86	0.88	6.00
Sheep manure 50% +Cocopeat50%	13.00	7.70	1.92	0.96	6.00
Sheep manure25 %+Cocopeat75%	15.70	7.90	2.00	1.08	4.00
Vermicompost 50 %+Cocopeat50%	11.50	6.50	1.80	0.82	3.5
Vermicompost 25 %+Cocopeat75%	12.50	6.90	1.84	0.92	4.0
FYM 100%	5.50	2.60	1.10	0.32	3.0
Sheep manure100 %	7.30	2.90	1.14	0.33	3.0
Vermicompost 100 %	10.90	4.30	1.60	0.50	3.0
Cocopeat 100%	12.40	5.40	1.90	0.42	5.0
Traditional nursery	6.50	3.20	0.86	0.22	2.5
S.Em ±	0.64	0.69	0.17	0.08	0.66
C.D. at 5%	1.92	2.05	0.51	0.24	1.95

Table CHVsAG 6-2: Resultant effect of seedling production through different organic manures on the growth and yield of chewing tobacco

Treatments	At topping		At Harvest		FGLY (kg/ha)	TCLY (kg/ha)
	Leaf length	Leaf width	Leaf length	Leaf width		
FYM50%+Cocopeat 50%	65.2	35.7	76.0	45.5	3386	4027
FYM25%+Cocopeat 75%	65.7	35.7	77.5	45.7	3072	3990
Sheep manure 50 % + Cocopeat 50%	64.8	34.0	76.5	43.8	3258	4182
Sheep manure 25 % + Cocopeat 75%	63.3	34.8	75.2	41.3	3450	3864
Vermicompost 50 % + Cocopeat 50%	65.2	35.8	74.7	43.5	3301	3744
Vermicompost 25 % + Cocopeat 75%	63.7	34.8	73.8	42.0	3080	3723
FYM 100%	60.5	34.7	72.0	42.0	2803	3545
Sheep manure100 %	65.7	35.7	73.9	45.0	2826	3744
Vermicompost 100 %	64.8	34.3	73.7	43.2	2922	3853
Cocopeat 100%	61.5	33.5	72.8	44.7	2434	3283
Traditional nursery	61.8	32.5	71.0	41.8	2475	3236
S.Em ±	1.72	1.02	1.23	0.70	136.5	178.3
C.D. at 5%	2.44	NS	3.65	2.01	405.5	529.8

E. *RUSTICA* TOBACCO

ARAUL

RUArAG-28: INTEGRATED NUTRIENT MANAGEMENT IN *HOOKAH* TOBACCO (INM).

Objective: To study the effect of different levels of integrated nutrient management on yield and yield attributing characters of *Hookah* Tobacco.

Year of Start : 2018-19
Design : RBD
Replications : 04
Variety : Azad Kanchan
Treatments : Six

T_1 : RDF (180 kg/ha N :50 kg/ha P : 50 kg/ha K)

T_2 : RDF + PSB+ Azatobactor

T_3 : 75% RDF + 5t FYM + PSB + Azatobactor

T_4 : 50% RDF+ 10t FYM + PSB+ Azatobactor

T_5 : 75% RDF+ 2.5t vermicompost + PSB+ Azatobactor

T_6 : 50% RDF+ 5.0t vermicompost + PSB+Azatobactor

Results

It is obvious from the result's that significantly higher leaf length (28.60 cm), leaf width (34.65 cm), plant height (74.20 cm), number of curable leaves (12.00) and cured leaf yield (3515 Kg/ha) was recorded under the Treatment-5 (75% RDF+ 2.5t vermicompost + PSB+ Azatobactor) followed by Treatment-2 (RDF + PSB+ Azatobactor) and Treatment-4 (50% RDF+ 10t FYM + PSB + Azotobator) as compared to control Treatment-1 (RDF) with cured leaf yield of 2849 Kg/ha.

Table: RUArAG 28-1: Growth Parameters and cured leaf yield of Hookah tobacco as influenced by different treatments during 2018-19

Treatments	Cured leaf yield (Kg/ha)	Plant Height (Cm)	Leaf Length (cm)	Leaf width (Cm)	Number of leaves/ plant
RDF (180 kg/ha N :50 kg/ha P : 50 kg/ha K)	2849	60.15	23.20	28.10	10
RDF + PSB+ Azatobactor	3376	71.27	27.45	33.25	11
75% RDF + 5t FYM + PSB + Azatobactor	3005	63.44	24.45	29.60	11
50% RDF+ 10t FYM + PSB+ Azatobactor	3282	69.28	26.70	32.35	11
75% RDF+ 2.5t vermicompost + PSB+ Azatobactor	3515	74.20	28.60	34.65	12
50% RDF+ 5.0t vermicompost + PSB+Azatobactor	2985	63.10	24.30	29.45	10
S.Em ±	94.73	2.48	1.04	1.25	0.35
C.D. at 5%	201.86	5.28	2.21	2.66	0.75
C.V. (%)	4.23	4.53	5.69	5.66	8.19

Table RuArAG 28-2: Quality parameters (2018-19)

Treatments	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
RDF (180 kg/ha N :50 kg/ha P : 50 kg/ha K)	3.2	0.90	097
RDF + PSB+ Azatobactor	2.14	0.81	1.84
75% RDF + 5t FYM + PSB + Azatobactor	3.38	1.24	1.45
50% RDF+ 10t FYM + PSB+ Azatobactor	3.31	1.84	1.02
75% RDF+ 2.5t vermicompost + PSB+ Azatobactor	2.72	0.84	1.29
50% RDF+ 5.0t vermicompost + PSB+Azatobactor	2.57	1.23	0.44

INITIAL SOIL ANALYSIS

pH	EC (ds/m)	0-15 Cm		
		N	P	K
		kg/ha		
7.50	0.21	145	112	194

RUArAG 29: WEED MANAGEMENT IN *HOOKAH* TOBACCO

Objective: To study the effect of various weed control methods for yield and yield attributing characters of *Hookah* Tobacco.

Year of Start: 2018-19
Design: RBD **Replication:** 05
Variety: *Hookah* Tobacco

Treatments: Four (given in table)

T_1 : Weed check
T_2 : Weeding two times
T_3 : Weeding three times
T_4 : Polythene Mulch

Results: It is clear from the results that various weeds control levels significantly influence the yield attributing characters *viz.*, Plant height, leaf length, leaf width, no. of curable leaves and cured leaf yield. Weeding 3 times significantly highest cured leaf yield (2765 kg/ha) recorded followed Polythene Mulch (2610 Kg/ha).

Table RUArAG 29-1: Effect of weed management on cured leaf yield and yield attributing characters of *Hookah* tobacco

Treatments	Cured leaf yield (kg/ha)	Plant Height (cm)	Leaf Length (cm)	Leaf Width (cm)	Curable Levels
Weed check	1635	55.65	20.25	23.15	8
Weeding two times	2404	69.15	25.20	28.65	11
Weeding three times	2765	72.75	26.50	29.95	12
Polythene Mulch	2610	70.35	25.60	28.80	12
S.Em ±	192..04	3.24	1.54	1.741	0.65
C.D. at 5%	418.34	7.16	3.36	3.72	1.41
C.V. (%)	11.92	6.83	8.94	8.77	8.73

Table RUArAG 29-2: Quality parameters

Treatments	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)
Weed check	3.79	1.27	0.37
Weeding two times	3.55	2.07	0.51
Weeding three times	2.88	2.40	0.45
Polythene Mulch	2.45	1.25	0.43

CROP CHEMISTRY AND SOIL SCIENCE

SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

A. VFC TOBACCO

RAJAHMUNDRY

VFRCHC 1: LEAF QUALITY EVALUATION

Analysis of chemical quality parameters *viz.*, nicotine, reducing sugars and chlorides of FCV and Non-FCV tobacco leaf samples related to different experiments of AINPT Centres.

A. FCV TOBACCO: A total 244 samples were analysed from different centres conducting FCV tobacco experiments. Results are presented below.

CTRI RS Guntur: FCV tobacco leaf samples (18) pertaining to AVT-1 and AVT-2 were analysed. The nicotine content varied from 2.04 to 4.24 % while the reducing sugars varied from 1.61 to 9.40% and the chloride content varied from 1.10 to 3.73 %.

CTRI Rajahmundry: FCV tobacco leaf samples (26) pertaining to AVT-I, AVT-II, IHT and Bulk trials were analysed, the nicotine, reducing sugars and chlorides varied from 0.56 to 1.37%, 10.67 to 19.86% and 1.31 to 2.74%, respectively.

CTRI RS Hunsur: FCV tobacco samples (72) pertaining to crop improvement and crop production experiments were analysed. The leaf nicotine varied from 0.83 to 1.16 % in 'X' position , 0.77 to 2.66 % in 'L' position and while the per cent reducing sugars varied from 8.06 to 23.77 % in 'X' position, 5.11 to 18.11 % in 'L' position and the chlorides ranged from 0.25 to 1.34 % in 'X' position and 0.25 to 1.60 % in 'L' position.

CTRI RS Kandukur: FCV tobacco leaf samples (16) pertaining to AVT-1 and AVT-2 were analysed, the nicotine, reducing sugars and chlorides varied from 2.76 to 3.81 %, 6.45 to 9.18 % and 0.63 to 0.83 %, respectively.

CTRI RS Jeelugumilli: FCV tobacco leaf samples (112) pertaining to AVT-1, AVT-2, IHT, AHT-II, and Bulk trial were analysed. The leaf nicotine varied from 1.85 to 5.34% in 'X' position , 1.68 to 5.66% in 'L' position and while the per cent reducing sugars varied from 2.18 to 7.61% in 'X' position, 2.15 to 7.62% in 'L' position and the chlorides ranged from 0.42 to 2.66% in 'X' position and 0.74 to 2.81 % in 'L' position.

B. Non-FCV Tobacco: A total No. of 317 leaf samples were analysed for quality parameters. Details were presented below:

Nandyal: A total of 237 Bidi tobacco samples pertaining to Breeding and Agronomy experiments of RARS, Nandyal were analysed. The leaf nicotine, reducing sugars and chlorides varied from 0.73 to 6.81, 1.87 to 5.49 % and 1.56 to 5.38 %, respectively.

Ladol: Rustica tobacco leaf samples (16) of AVT-II, LSVT, Bulk Trial pertaining to ARS, Ladol centre were analysed. The leaf nicotine, reducing sugars and chlorides varied from 1.59 to 3.63 %, 1.85 to 8.62 % and 1.38 to 2.60 %, respectively.

Nipani: Bidi tobacco (40) samples received from ARS, Nipani were analyzed. The leaf nicotine reducing sugars and chlorides ranged from 1.10 to 5.08 %, 4.31 to 8.95 % and 0.91 to 3.46 %, respectively.

Araul: Rustica tobacco leaf samples (24) of AVT-II, PYT-II, INM pertaining to Tobacco Research Station, Araul were analysed. The leaf nicotine, reducing sugars and chlorides varied from 2.14 to 4.25 %, 0.08 to 2.40 % and 0.25 to 1.84 %, respectively.

Table 1: Summary of Chemical Quality Parameters of FCV tobacco in different tobacco centres (2018-19)

Centre / Zone	Nicotine (%)	Red. Sugars (%)	Chlorides (%)
CTRI RS, Kandukur(16)	2.76 - 3.81	6.45 - 9.18	0.63 - 0.83
CTRI RS, Guntur (18)	2.04 - 4.24	1.61 - 9.40	1.10 - 3.73
CTRI RS, Hunsur (72)	0.83 - 1.16 (X) 0.77 - 2.66 (L)	8.06 - 23.77 (X) 5.11 - 18.11 (L)	0.25 - 1.34 (X) 0.25 - 1.60 (L)
CTRI RJY (26)	0.56 - 1.37	10.67 - 19.86	1.31 - 2.74
CTRI RS (112) Jeelugumilli	1.85 - 5.34 (X) 1.68 - 5.66 (L)	2.18 - 7.61 (X) 2.15 - 7.62 (L)	0.42 - 2.66 (X) 0.74 - 2.81 (L)

*Figures in parentheses represent the total number of samples analysed

Table 2: Summary of Chemical Quality Parameters in Non-FCV tobacco centres (2018-19)

Centre / Type of Tobacco	Nicotine (%)	Red. Sugars (%)	Chlorides (%)
Nandyal (*Bidi*-237)	0.73 -6.81	1.87 – 5.49	1.56 - 5.38
Ladol (*Rustica*-16)	1.59 - 3.63	1.85 - 8.62	1.38 - 2.60
Nipani (*Bidi*-40)	1.10 - 5.08	4.31 - 8.95	0.91 - 3.46
Araul (*Rustica*-24)	2.14 - 4.25	0.08 - 2.40	0.25 - 1.84

ORGANIC CHEMISTRY

Bidi samples received from Nandyal center were analysed for Smoke Quality Parameters viz., NFDPM, Nicotine and Carbonmonoxide during the season 2018-19.

NANDYAL

Four entries NBD 290, NBD 289, A119 (c) and Nandyal Pogaku-1 (c) of *Bidi* samples pertaining to the Breeding Experiment, Bulk Yield Trial were analysed for Smoke Quality Parameters. The values of NFDPM and CO are slightly high in A-119 (c) and the value of Nicotine is slightly low in the entry Nandyal Pogaku-1 (c) when compared with other entries.

Five entries ABD 132, NyBD-56, ABD146, Nandyal Pogaku-1 (c) and A-119 (c) of *Bidi* samples pertaining to the Breeding Experiment, On-farm Trial were analysed for Smoke Quality Parameters. The values of NFDPM and CO are slightly high in ABD-146 and A-119 (c). The value of nicotine is slightly low in the entry Nandyal Pogaku-1 (c) when compared with other entries.

Table: Smoke Quality Parameters pertaining to Nandyal Centre (*Bidi* samples)

S.No	Sample Details	NFDPM (mg/Bidi)	Nicotine (mg/Bidi)	CO (mg/Bidi)
BULK TRIAL				
1	NBD 290	37.98	2.57	21.07
2	NDB 289	35.50	2.38	21.24
3	A 119 (c)	44.38	2.38	26.91
4	Nandyal Pogaku-1 (c)	35.28	1.03	22.98
ON-FARM TRIAL				
5	ABD 132	34.09	1.84	19.42
6	NyBD 56	44.34	2.48	22.65
7	ABD-146	49.79	2.62	26.47
8	Nandyal Pogaku-1 (c)	41.84	1.14	22.05
9	A 119 (c)	48.62	2.07	27.10

CROP PROTECTION

I. ENTOMOLOGY

A. *BIDI* TOBACCO

ANAND

BDAENC 86: ESTABLISHMENT OF ENTOMOPHAGE BIO-DIVERSITY PARK

Objective: To restore and conserve natural enemies of tobacco insect pests

Year of start: 2007-2008 Date of Planting: 17-08-2018

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 revealed that activity of various natural enemies like spiders, coccinellids, *Nesidiocoris tenuis*, *Geocoris ochropeterus* and *Rhinocoris* sp, were found on different crops raised under entomophage park (Table BDAENC 86-1). Out of various bio agents maximum activity of *N. tenuis* was found in tobacco. The activity of spider was found in tobacco, marigold, sena, cotton, kuvadio, maize and lucern. Population of natural enemies and insect pests on tobacco grown nearby entmophage biodiversity park and away from it (BDAEN 86.2) revealed more or less similar trend throughout the crop season. The infestation of whitefly, leaf eating caterpillar, capsule borer, spiders and predatory bugs remain statistically at par in a tobacco raised near and away from entomophage biodiversity park (BDAEN 86-3). Spiders failed to establish significant co relation with any abiotic factors. Coccinellids had highly significant negative correlation with BSS, WS, Min T, Mean T, RH_1, RH_2, Mean RH, VP_1, VP_2 and Mean VP. Among the predatory bugs, *Geocoris ochropeterus* showed significant negative correlation with WS, RH_2 and Mean RH_2., while *Nesidiocoris tenius* established highly significant negative correlation with BSS, Min T, Mean T, RH_1, RH_2, Mean RH, VP_1, VP_2 and Mean VP (BDAENC 86-4).

Table BDAENC 86-1 : Population of natural enemies in Entomophage park

St. We	Tobacco /m^2					Lucerne / m^2					Marigold / m^2					Sena / m^2					Cassia / m^2					Maize / m^2					Cotton / m^2				
	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
33	0	0	0	2	0	0	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
34	1	0	0	2	0	0	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
35	0	0	0	2	0	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
36	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	0	0	0
37	0	0	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
38	0	0	0	2	0	0	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
39	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	1	0	0	0	0
40	0	0	0	3	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	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	1	0	0	0	1	1	2	0	0
42	0	0	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	0
43	0	0	0	5	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	0
44	0	0	0	6	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	2	2	0	0
45	1	0	0	3	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	3	0	0
46	0	0	1	4	1	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	2	1	0	0
47	0	0	2	4	1	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	3	1	0	0
48	1	0	1	3	1	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	1	0	0
49	0	0	0	4	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	1	2	0	0	0
50	0	0	0	4	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0	3	0	0	0
51	0	0	0	5	1	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0
52	0	0	2	6	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	3	0	0	0
1	0	0	0	6	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	2	0	0	0
2	0	0	0	6	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0
3	0	0	0	6	1	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	2	0	0	0
4	0	0	0	5	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0
5	0	0	0	5	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
6	0	0	0	6	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	1	0	0
7	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	1	0	0

SMW: Standard Meteorological Week, Sp: Spider, LB: Lady Bird Beetle, Ge: *Geocoris ochropeterus*, Ne: *Nesidiocoris tenuis*, Rh: *Rhinocoris* sp.

Table BDAENC 86-2: Studies on insect pests of tobacco, its natural enemies near & away from Entomophage park (2018-19)

SMW	Tobacco /M^2 (Near)						Tobacco /M^2 (Away)					
	Natural enemies			Insect pests			Natural enemies			Insect pests		
	Spider	Predatory Bug	Total	White fly	Leaf eating caterpillar	Capsule borer	Spider	Predatory bug	Total	White fly	Leaf eating caterpillar	Capsule Borer
33	0	1	1	0	1	0	0	1	1	0	1	0
34	0	1	1	0	1	0	0	1	1	0	1	0
35	1	1	2	2	1	0	1	1	2	2	1	0
36	0	2	2	1	0	0	0	2	2	1	0	0
37	1	3	4	2	1	0	1	3	4	2	1	0
38	0	2	2	2	1	0	0	2	2	2	1	0
39	1	2	3	2	1	0	0	1	1	2	1	0
40	0	1	1	1	0	0	1	2	3	2	0	0
41	1	2	3	2	0	0	1	2	3	1	0	0
42	1	6	7	2	0	0	1	5	6	2	0	0
43	0	5	5	3	0	0	0	6	6	3	0	0
44	0	5	5	3	0	0	0	5	5	3	0	0
45	0	3	3	3	0	1	0	3	3	3	0	1
46	1	3	4	2	0	2	1	3	4	3	0	1
47	0	4	4	3	0	1	0	4	4	2	0	2
48	0	3	3	3	0	2	0	3	3	3	0	2
49	0	3	3	4	0	1	0	3	3	3	0	2
50	0	2	2	3	0	2	0	3	3	4	0	1
51	0	4	4	4	0	3	0	5	5	4	0	3
52	0	4	4	3	0	3	0	4	4	3	0	4
1	0	5	5	4	0	4	0	4	4	5	0	3
2	0	6	6	4	0	4	0	6	6	3	0	4
3	1	5	6	4	0	3	0	7	7	4	0	3
4	0	7	7	3	0	2	0	7	7	3	0	3
5	0	4	4	3	0	2	0	5	5	2	0	4
6	0	5	5	4	0	1	0	4	4	4	0	2
7	0	6	6	3	0	1	0	7	7	3	0	1
Total	7	95	102	70	6	32	6	98	104	69	6	36

Table BDAENC 86-3: Summary on population of natural enemies and insect pest appear near and away from Entomophage Biodiversity Park

Entomophage Biodiversity park	Population of natural enemies/m^2		Population of insect pest/m^2		
	Spider	Predatory bug	Whitefly	Leaf eating caterpillar	Capsule borer
Near	0.222	3.519	2.593	0.222	1.185
Away	0.259	3.407	2.556	0.222	1.333
't' value	-0.313	0.222	0.116	0.000	-0.389

Table 't' value @ 0.05% = 2.007, Table 't' value @ 0.01 % = 2.674

Table BDAENC 86-4: Correlation coefficient between abiotic factors and different bio agents in Entomophage Biodiversity Park

Weather parameter	Spider	*Coccinellids*	*Geocoris ochropeterus*	*Nesidiocoris tenuis*	*Rhinocoris* sp.
EP	-0.051	-0.294	0.275	-0.049	-0.167
BSS	0.164	0.608**	0.452*	0.664**	0.311
WS	-0.332	-0.545**	-0.538**	-0.416*	-0.437*
Max T	0.358	-0.259	0.339	-0.429*	0.239
Min T	0.087	-0.773**	-0.179	-0.835**	-0.162
Mean T	0.216	-0.623**	0.033	-0.739**	-0.001
RH_1	0.053	-0.550**	-0.410*	-0.605**	-0.077
RH_2	-0.102	-0.713**	-0.564**	-0.753**	-0.288
Mean RH	-0.065	-0.717**	-0.559**	-0.764**	-0.249
VP_1	0.052	-0.758**	-0.215	-0.838**	-0.216
VP_2	0.038	-0.771**	-0.343	-0.875**	-0.181
Mean VP	0.046	-0.772**	-0.280	-0.865**	-0.201

*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 ON POPULATION DYNAMICS OF IMPORTANT PESTS OF TOBACCO

Objective: The major pests of tobacco are whiteflies (*Bemisia tabaci* Gen.), leaf eating caterpillar (*Spodoptera litura* Fab.) 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: 2007-08
Date of planting:
Nursery : 23-07-2018
Seed crop : 29-09-2018

Results

The weekly observations on insect pest status were recorded during the year 2017-18 and summarized in Table 88-1 (nursery conditions) and 88-2 (field conditions).

Nursery conditions

1) Rove beetle, *Bledius latiusculus* (K): The data presented in BDAE 88.1 revealed that occurrence of rove beetle was started from 31th week (fourth week of July) and continued up to 34th (fouth week of August) meteorological standard week.
2) Whitefly, *Bemisia tabaci* (G): The whitefly population was not observed during nursery period.
3) Leaf eating caterpillar, *Spodoptera litura* (F): The observations on leaf eating caterpillar was recorded from 33rd and 34th standard meteorological week (second and third week of August) Maximum damaged seedlings per square feet were found during 34th standard meteorological week (third of August). The attempt was made to correlate the different weather parameters with insect pest of tobacco in nursery and found non-significant.

Table BDAEN 88-1: 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
30	0	0
31	1	0
32	1	0
33	3	1
34	3	1

Field crop:

(A) **Whitefly, *Bemisia tabaci* (G):** The population of whiteflies commenced from the 35th standard week (fourth week of August) and continued throughout the crop season. The maximum population (18/50 plants) of whiteflies was found on 46th (third week of November) standard meteorological week.

Correlation worked out for whitefly with weather parameters revealed that WS, RH_2 and Mean RH, exerted highly negative significant correlation while BSS had highly positive significant correlation.

(B) **Leaf eating caterpillar, *Spodoptera litura* (F):** The incidence of leaf eating caterpillar was found from 35th standard meteorological week (fourth of August) and continued up to 39th standard meteorological week (fourth week of September). The maximum population 9 larvae / 50 plants were registered in 38th standard meteorological week (second week of September).

Attempt was made to correlate abiotic factors with population of *S. litura*. Results indicated that Max T, Min T, Mean T, RH_2, Mean RH, 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.):** Infestation of capsule borer started in 46th standard meteorological week (third week of November) and continued up to 6th standard meteorological week (second week of February). The highest larval population was registered in 6th standard meteorological week (17/3 twigs/ 50 plants).

The attempt was made to correlate the capsule borer with weather parameters and found that, MaxT, Min T, Mean T, VP_1, VP_2 and Mean VP had highly negative significant correlation.

Table BDAEN 88-2: Population dynamics of the major pests infesting *bidi* tobacco under field conditions

SMW	Whitefly (*Bemisia tabaci* Gen.)/ 50 plants	Leaf eating caterpillar (*Spodoptera litura* Fab.)		Capsule borer (*Helicoverpa armigera* Hub.) /3 twigs/ 50 plants
		No. of egg masses/ 50 plants	No. of larvae/ 50 plants	
36	5	1	10	0
37	8	3	9	0
38	8	1	8	0
39	7	1	8	0
40	8	0	0	0
41	8	0	0	0
42	8	0	0	0
43	10	0	0	2

SMW	Whitefly (*Bemisia tabaci* Gen.)/ 50 plants	Leaf eating caterpillar (*Spodoptera litura* Fab.)		Capsule borer (*Helicoverpa armigera* Hub.) /3 twigs/ 50 plants
		No. of egg masses/ 50 plants	No. of larvae/ 50 plants	
35	2	2	3	0
36	6	2	3	0
37	8	0	4	0
38	9	0	9	0
39	9	0	7	0
40	10	0	0	0
41	12	0	0	0
42	15	0	0	0
43	14	0	0	0
44	14	0	0	0
45	16	0	0	0
46	18	0	0	2
47	13	0	0	3
48	15	0	0	3
49	14	0	0	4
50	11	0	0	5
51	14	0	0	7
52	11	0	0	8
1	13	0	0	9
2	12	0	0	11
3	10	0	0	10
4	11	0	0	12
5	6	0	0	14
6	4	0	0	17

BDAEN 88-3: Correlation coefficient between weather parameters with insect pests of tobacco in field

Weather parameter	Whitefly	Leaf eating caterpillar Egg mass	Leaf eating caterpillar Larvae	Capsule borer
EP	-0.046	-0.252	0.297	-0.293
BSS	0.649**	-0.825**	0-.496*	0.273
WS	-0.732**	0.556**	0.444*	0.187
Max T	0.323	-0.067	0.182	-0.792**
Min T	-0.269	0.436*	0.617**	-0.799**
Mean T	-0.019	0.239	0.466*	-0.858**
RH_1	-0.179	0.394	0.372	-0.382
RH_2	-0.637**	0.758**	0.662**	-0.351
Mean RH	-0.558**	0.724**	0.641**	-0.400
VP_1	-0.269	0.437*	0.634**	-0.805**
VP_2	-0.046	-0.252	0.297	-0.293
Mean VP	0.649**	-0.825**	0-.496*	0.273

** Highly significant

NANDYAL

BDNyEN 1: SEASONAL INCIDENCE OF INSECT PESTS AND NATURAL ENEMIES OF TOBACCO

Objectives:

- To identify the biotic and abiotic factors responsible for the mortality of important pests of tobacco.
- To find out the seasonal occurrence and intensity of different pests and their bio-agents on tobacco crop.

Year of start: 2008

Design : Observational Plot

Plot size : 500 m^2

Spacing : 75 X 75 cm

Replications : Unreplicated block

Date of sowing: 23-07-2018

Date of transplanting: 25-09-2018

Results

The results of seasonal incidence for insect pest of *bidi* tobacco indicated that high incidence of *S.litura* (4.8 larvae per plant) was recorded in 49 std week. Leaf hopper population was high in 44^{th} std week (3.4 / adults per plant). Mealy bug incidence was initiated from 44^{th} std week (2 no per plant) and increased at 28 no per plant at 48^{th} std week. Aphid score was recorded throughout the season. High aphid score of "3" was recorded at 52 std week. Correlation revealed that *S.litura* was negatively correlated with max temperature (-0.71), sunshine hours (-0.56) & evaporation (-0.75) and positively correlated with morning and evening relative humidity (0.78 & 0.52). Mealy bug incidence also negatively correlated with max and min temperature (-0.74&-0.68) and evaporation (-0.61)

Table 1 BDNyEN 1: Seasonal incidence of insect pests and natural enemies of tobacco

STD Wk	Age of the crop	*Spodoptera litura* (No. of larvae)	leaf hoppers/ plant	Mealy bug (Mean No of nymphs and adults)	Aphids (Score)
Oct-40	2 WAT	0	0	0	0
41	3 WAT	0	0.6	0	0
42	4 WAT	1.95	1	0	0
43	5 WAT	1.3	1	0	0
Nov 44	6 WAT	0.5	**3.4**	2	0
45	7 WAT	1.75	**2.6**	11	0
46	8 WAT	0.65	**3**	14	1
47	9 WAT	0.4	1.6	22	1
48	10 WAT	2	1	**28**	1
Dec 49	11 WAT	**4.8**	2.5	20	1
50	12 WAT	**4**	2.4	14	2
51	13 WAT	2.8	2	12	2
52	14 WAT	1.4	2	14	**3**
Jan-01	15 WAT	3.8	1.2	20	2
2	16 WAT	2	0.2	20	2
3	17 WAT	1	0	20	2

Table BDNyEN 1-2: Correlation of pest incidence with weather parameters

	Max Temp	Min Temp	RH Mor	RH Eve	Wind speed km hr	*Sun-shine Hrs*	*Rain-fall mm*	*Evapo ration*
Spodoptera litura	-0.71*	-0.49	0.78*	0.52*	-0.21	-0.56*	0.02	-0.75*
leaf hoppers /plant	-0.40	-0.46	-0.02	0.28	-0.11	-0.14	0.36	-0.21
Mealy bug	-0.74*	-0.68*	0.49	0.42	-0.41	-0.33	0.03	-0.61
Aphids	-0.79*	-0.75*	0.49	0.22	-0.33	-0.40	-0.09	-0.87*

II. PLANT PATHOLOGY AND NEMATOLOGY

A. VFC TOBACCO

SHIVAMOGGA

FEELER TRIAL: INTEGRATED MANAGEMENT OF FUSARIUM WILT IN FCV TOBACCO IN KLS CONDITIONS

Design : RCBD Replications : Four
Plot size : Gross - 12 x 2 = (6.05 x 2 m) Net – 10 x 2 =20 (5.5 x 2 m)
Location : ICAR-CTRI, Hunsur Variety : Kanchan

Treatments : Eight

1. Seedlings dip with carbendazim 50% @ 0.1% + application of *Trichoderma viride* @ 10g/plant at planting.
2. Seedlings dip with carbendazim50% @ 0.1%.
3. Application of *Trichoderma viride* @ 10g/plant at planting.
4. Seedlings dip with metiram 55% + pyraclostrobin 50% @ 0.5% and spray at 30 DAT.
5. Seedlings dip with azoxystrobin 23% SC @ 0.1% and spray at 30 DAT.
6. Soil drenching with carbendazim 25% + mancozeb 50% @ 0.2% at planting and 30DAT.
7. Soil drenching with carbendazim 50% @ 0.1% at planting and 30DAT.
8. Untreated control

Results: Results revealed that all the trial conducted *kharif* 2018, T_7 and T_6 recorded highest percent reduction of wilt incidence over control of 59.05 and 58.86% respectively. These treatments were found superior to other treatments. Maximum yield was recorded in T_7 and T_6. All treatments recorded better green and cured leaf yield compared to control plot.

Table FEELER TRIAL: Integrated Management of *Fusarium* wilt in FCV tobacco under field conditions (*kharif* 2018)

Treatment No.	Wilt incidence (%)		% disease reduction over control	Green leaf yield (kg/ha)	Cured leaf yield (kg/ha)
	45 DAT	55 DAT			
T_1	39.27 (38.82)*	42.07 (40.46)	39.90	6939	724
T_2	39.47 (38.94)	44.53 (41.88)	36.38	7030	693
T_3	46.17 (42.82)	50.50 (45.31)	27.86	7182	685
T_4	35.17 (36.39)	37.17 (37.58)	46.90	7484	673
T_5	30.83 (33.75)	34.17 (35.79)	51.19	7364	703
T_6	27.47 (31.62)	28.80 (32.47)	58.86	7485	687
T_7	25.33 (30.24)	28.67 (32.39)	59.05	7697	765
T_8	65.17 (53.86)	70.00 (56.82)	-	4818	474
S.Em±	1.92	1.78	-	603	86
C.D. at 5%	5.83	5.40	-	1831	263

B. *BIDI* TOBACCO

ANAND

BDAPP 126: MONITORING OF RESISTANCE DEVELOMENT 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 P*ythium 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.

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

Table BDAPP 126 A_1 revealed that in nursery conditions 23 per cent 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 BDAPP 126 A_2) and 100 per cent inhibition of the pathogen was observed after 72 hrs. This showed that resistance has not been developed in the pathogen.

Table BDAPP 126 A_1: Data on damping-off and root-knot

Treatment	No. of damped-off seedlings/m^2	Per cent disease incidence in comparison with control	Transplantable seedlings/m^2
RDMZ	84	23	403
BM	142	39	395
CON	360		213

Table BDAPP 126 A_2:

Sr. No.	Treatments Concentrations	Mycelial growth in mm (Average of 06 Plates)			Per cent inhibition of pathogen isolated from diseased seedlings after 72 hrs.
		24 hours	48 hours	72 hours	
01	Metalaxyl 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)	53	90	90	00

(B) RESISTANCE DEVELOPMENT IN *Pythium aphanidermatum* TO AZOXYSTROBIN

Year of start: 2015-16

Treatments:

Azoxystrobin 23 SC @ 0.023% (230g a.i./ha *i.e.* 10 ml/10 l water / 100m^2) 2 -3 spray drenching	(AZO)
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)
Control - No fungicide treatment	(CON)

Methodology: As above in metalaxyl MZ

Results: Results revealed that in nursery conditions 26 and 19% damping-off disease incidence in comparison with control were recorded in the treatment of azoxystrobin and azoxystrobin + difenoconazole, respectively (Table BDAPP 126 B_1).

The pathogen, which survived in azoxystrobin and azoxystrobin + difenoconazole treated beds, were further screened in laboratory against the fungicides with three different concentrations (Table BDAPP 126 B_2) and 100 per cent inhibition of the pathogen were observed in both the fungicides after 72 hrs. This showed that resistance has not been developed in the pathogen.

Table BDAPP 126 B_1: Data on damping-off and root-knot

Treatment	No. of damped-off seedlings/m^2	Per cent disease incidence in comparison with control	Transplantable seedlings/m^2
Azoxystrobin	90	26	619
Azoxystrobin Difenoconazole	67	19	608
Control - No fungicide	350		253

Table BDAPP 126 B_2 :

Sr. No.	Treatment / Concentration	Mycelial growth in mm (Average of 06 Plates)			Per cent inhibition of pathogen isolated from diseased seedlings after 72 hrs.
		24 hours	48 hours	72 hours	
01	Azoxystrobin 500 ppm*	00	00	00	100
02	Azoxystrobin 1000 ppm	00	00	00	100
03	Azoxystrobin 2000 ppm	00	00	00	100
04	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)	53	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)

Year of start: 2002-2003

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.

Methodology: Fourteen and twenty 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

Results (Table BDAPP128-1) revealed that out of 14 genotypes/lines, all the line showed moderately susceptible reaction to damping-off disease in the nursery conditions. Out of 20 lines/varieties, none was resistant except ABT 10 (Check) to root-knot disease in pots.

Table BDAPP 128-1: Reaction to damping-off disease in the nursery conditions

Culture/ variety / line	Per cent damped-off seedlings	Reaction
ABD 205	33 (-)	MS (-)
ABD 206	41 (-)	MS (-)
ABD 207	50 (-)	MS (-)
ABD 208	39 (-)	MS (-)
ABD 209	34 (-)	MS (-)
ABD 210	40 (-)	MS (-)
ABD 211	44 (-)	MS (-)
ABD 212	41 (-)	MS (-)
ABD 213	30 (-)	MS (-)
ABD 214	34 (-)	MS (-)
ABD 215	44 (-)	MS (-)
ABD 217	41 (-)	MS (-)
A 119 (C)	33 (-)	MS (-)
ABT 10 (C)	36 (-)	MS (-)

*Figure in parenthesis is of previous year.

BDAPP 128-2: Reaction to root-knot disease

Culture/ variety / line	Root-knot index (0-5)*			Index range	Reaction on maximum index
	Nursery	Sick field	Pot		
ABD 205	0.40	3.2	3.0	3 – 3	MS
ABD 206	0.80	3.8	3.6	3 – 4	S
ABD 207	0.60	4.2	4.0	4 – 4	S
ABD 208	0.60	4.6	4.4	4 – 5	HS
ABD 209	1.00	4.6	3.6	3 – 4	S
ABD 210	1.04	2.6	4.6	4 – 5	HS
ABD 211	0.48	4.6	4.4	4 – 5	HS
ABD 212	0.80	4.4	4.6	4 – 5	HS
ABD 213	0.48	1.4	2.6	2 – 3	MS
ABD 214	0.60	1.8	2.4	2 – 3	MS
ABD 215	0.88	4.6	4.4	4 – 5	HS
ABD 217	0.80	3.4	4.2	3 – 5	HS
ABD 200	--	0.27	2.6	2 – 3	MS
ABD 201	--	0.37	2.6	2 – 3	MS
ABD 202	--	0.83	3.0	3 – 3	MS
ABD 203	--	0.23	3.0	3 – 3	MS
ABD 204	--	0.47	2.4	2 – 3	MS
A 119 (C)	0.72	4.5	4.6	4 – 5	HS
GT 7 (C)	--	4.5	4.6	4 – 5	HS
ABT 10 (C)	0.00	0.0	0.0	0	HR

*0=Free, 5=Maximum disease intensity,
HR = Highly Resistant; R= Resistant; MR= Moderately Resistant;
MS =Moderately Susceptible; S= Susceptible; HS = Highly Susceptible.

BDAPP 511: SCREENING OF ADVANCED BREEDING MATERIALS / INTRODUCTIONS/ GENOTYPES FOR MAJOR DISEASES OF TOBACCO UNDER FIELD AND CONTROL CONDITIONS

Year of start : 2018-19

During the year 2018-19, fourty six entries of advanced breeding materials /crosses of *bidi* tobacco and seven entries of *rustica* tobacco (Table BDAPP 511-1) were examined for leaf curl and *Cercospora* leaf spot diseases. Observations revealed that out of fourty six *bidi* tobacco entries, five entries were found free from leaf curl infection during 2018-19 but they were found infected in past years. Among the *rustica* tobacco entries, four entries were found free from leaf curl. During the year leaf spot disease was not noticed.

Table: BDAPP 511-1: Leaf curl and mosaic in natural condition (2018-19)

S. No	Name of trial	No. of entries screened (Check)	No. of entries				
			Mosaic free		Leaf curl free		Leaf spot free**
			Natural condi-tions	Control condi-tions	Natural conditions *	Control conditions	
***Bidi* Tobacco**							
1	IVT	4+3	0	0	0	-	-
2	AHT	3+1	0+1	0	0	-	-
3	RKN-R	5+3	0+0	-	5 (2017-18)	-	-
4	TMV -R	24+1	-	24+1	-	-	-
5	ms Lines	10	-	10	-	-	-
	Total	**46**			5		
***Rustica* Tobacco**							
1	IVT	7+3	0	-	4	-	-
	Total	**7**			**4**		

*They were infected in previous years as mentioned in respective brackets.

**very low/ no incidence of FES disease was appeared, therefore considered as free from the disease.

Table BDAPP 511-2: Artificial inoculation of TMV (2018-19)

S. No.	Name of trial	No. of entries inoculated with TMV	Mosaic free entry	
			No.	Details of entry
1	IVT	4	0	
2	AHT	3+1	0	
3	TMV R-	24 + (1)	24 + (1)	All were found resistant to TMV
	Generation-RKN			
4	F_7	4	1	F_7 line 3-5-2
5	F_{10}	1	1	F_{10} line 126-32-3
	CROSSES/ CULTURE			
6	F_6	12	12	F_6 line 109-14-30-2
				F_6 line 193-13-7-23
				F_6 line 193-13-9-27
				F_6 line 2-7-12-15
				F_6 line 2-7-17-12
				F_6 line 53-24-12-3
				F_6 line 53-24-12-26
				F_6 line 5-25-8-9
				F_6 line 22-4-19-11
				F_6 line 61-14-1-21
				F_6 line 61-14-24-29
				F_6 line 61-14-30-29

S. No.	Name of trial	No. of entries inoculated with TMV	Mosaic free entry	
			No.	Details of entry
7	F_7	11	6	F_7 line 51-25-16-38-24
				F_7 line 74-1-6-18-27
				F_7 line 74-1-6-28-36
				F_7 line 74-1-13-33-13
				F_7 line 81-6-5-12-37
				F_7 line 43-11-6-11-10
8	F_8	2	2	F_8 line 183-2-5-17-9-12
				F_8 line 181-1-28-6-31-11
9	F_9	2	1	F_9 line 168-20-4-39-25-34-8
	MALE STERILE			
10	M s m	10	10	TMVR A 2
				BC_4ms (und) TMVR A 2
				TMVR A 119/ 7-----26
				ms (und) TMVR A 119
				TMVR GT 4/9-8-14-15-15
				ms (meg) TMVR GT 4
				TMVR GT 5 /99---31
				ms (und) TMVR GT 5
				TMVR GT 7/53-11-6-10
				ms (und) TMVR GT 7 x TMVR GT 7/53-11-6-10
	TOTAL	**73**	**57**	

During the year under report, total 73 (including twenty four mosaic resistant cultures) entries (Table BDAPP 511-2) grown in different generations were artificially inoculated with tobacco mosaic virus and evaluated for resistance to mosaic. Out of these, 57 entries including segregation materials showed resistance to the disease and these materials are maintained by plant breeding section for further breeding work.

Screening of tobacco cultures for resistance to tobacco leaf curl virus (TLCV) in glass house conditions revealed that during the year 2017-18 none of the entry was found free from the disease in field conditions.

Table BDAPP 511-3: Screening of root-knot in natural and sick field conditions (2018-19)

Sr. No.	Name of Trial	Natural field conditions		Sick plot	
		No. of entries observed (ck)	No. of RK free entries	No. of RK free entries	Details of entry
1	IVT	4 + (3)	4+(3)	0	-
5	AHT	3 + (1)	0+1	-	-
9	RKN Experiment	5 + (3)	-	5 +(1)	ABD 200
					ABD 201
					ABD 202
					ABD 203
					ABD 204
11	Crosses row trial	11 + (2)	-	8 +(1)	F_6 line-62-6-16-4
					F_6 line -49-15-12-8
					F_6 line } ..8
					F_6 line **..**10
					F_6 line -129-22-…-1
					F_7 line 164-37-23-6-7-15
					F_7 line 28-19-7-9-5-18
					F_7 line 288-7-24]147-12-32-12-14-10
12	F_7 generation	4	-	4	F_7 line 3-8-3
					F_7 line 2-6-1
					F_7 line 1-4-1
					F_7 line 3-5-2
13	F_{10} generation	8	-	8	F_{10} line 158-16-2
					F_{10} line 28-12-3-5
					F_{10} line 164-37-3
					F_{10} line 126-32-3
					F_{10} line 38-2-1
					F_{10} line 226-39-8
					F_{10} line 176-38-3
					F_{10} line 245-24-4
14	BDAPP 128 genotypes	12 + (2)	-	0	-
	Total	**47+3**		**25+1**	

Out of 47 genotypes screened (Table BDAPP 511-3), 25 genotypes were found free from root-knot disease in root-knot sick field and selected for further screening in the next year.

BDAPP 683: EFFECT OF MANURES IN MANAGEMENT OF NEMATODES IN *BIDI* TOBACCO NURSERY

Introduction: Nematodes are great menace in successful raising of *bidi* tobacco nursery and field crop. To find out easily available cheap source(s) of manures for effective management of nematodes at recommended dose and thereby get healthy seedlings of *bidi* tobacco present investigation was planned.

Objective: To find out easily available cheap source(s) of manures for effective management of nematodes and thereby to raise healthy seedlings of *bidi* tobacco.

Year of start: 2016-17
Design : RCBD
Variety : A119
Bed Size : Gross: 1.2 x 1.2 m
Location : BTRS Farm
Replication : 3
Fertilizer : As per treatments
Net : 1.0 x 1.0 m

Treatments

1) FYM @ 45 kg N + Poultry manure @ 90 kg N+ AS - Urea @ 45 kg N (PM)
2) FYM @ 45 kg N + Neem cake @ 90 kg N+ AS - Urea @ 45 kg N (NC)
3) FYM @ 45 kg N + Tobacco dust @ 90 kg N+ AS - Urea @ 45 kg N (TD)
4) FYM @ 45 kg N + Castor cake @ 90 kg N+ AS - Urea @ 45 kg N (CC)
5) FYM @ 45 kg N + Castor cake @ 90 kg N+ Carbosulfan + AS - Urea @ 45 kg N (CC+CAR)
6) FYM @ 45 kg N + AS- Urea @ 135 kg N+ Carbosulfan @2.5 l/ha before and 15 DAS (CAR)
7) FYM @ 45 kg N + AS- Urea @ 135 kg – Control

Note: All the bulky manures will be applied a month prior to seeding. Carbosulfan and fertilizers will be applied as per the treatments/ recommendation.

Results

The results **(**Table BDAPP 683-1**)** revealed that all the treatments significantly reduced root-knot disease compared to control at 85 DAS. Application of poultry manure significantly yielded maximum number of transplant seedlings and was at par with tobacco dust.

Year wise cultural details:

Particulars	2016-17	2017-18	2018-19
Manuring	14/6/2016	13/6/2017	5/6/18
Date of seeding	15-7-16	14/7/17	10/7/18
Fungicides applied	28/7/16 5/8/16 8/8/16	2/8/17 10/8/17	30/7/18 8/8/18 13/8/18

Year wise general conditions:

Particulars	2016-17	2017-18	2018-19
Pest & disease	Normal	Normal	Normal
Plant stand	Normal	Optimum	Normal
Seasonal condition	Normal	Normal	Normal
Rain distribution	Uneven	Uneven	Uneven

Table BDAPP 683-1: Germination count and Seedlings/m^2 (2018-19)

Treatment	Germination count/25cm^2	Fresh weight (g)	Seedlings/m^2			
			Transplantable		Total surviving	
			$\sqrt{x}$	Original	$\sqrt{x}$	Original
Poultry Manure	11.78	369	28.06	788	28.97	840
Neem cake	12.05	300	26.40	698	27.61	763
Tobacco dust	11.03	325	27.68	767	28.88	835
Castor cake	12.00	393	26.74	715	27.81	774
Castor cake + Carbosulfan	10.10	313	26.34	694	27.63	764
Carbosulfan	11.30	300	25.57	655	26.87	722
Control	13.65	306	24.46	599	25.95	674
S. Em±	1.05	26.24	0.30	15.74	0.42	23.44
C.D. at 5%	NS	NS	0.90	46.76	1.26	69.66
C.V. (%)	17.88	16.66	2.28	4.48	3.07	6.11

Table BDAPP 683-2: Root-knot index (0-5)* (2018-19)

Treatment	Root-knot index (0-5)*					
	I Pulling, 46 DAS		II Pulling, 63 DAS		III Pulling, 85 DAS	
	$\sqrt{x+1}$	Original	$\sqrt{x+1}$	Original	$\sqrt{x+1}$	Original
Poultry Manure	1.08	0.17	1.49	1.22	1.80	2.25
Neem cake	1.07	0.14	1.45	1.11	1.83	2.35
Tobacco dust	1.07	0.15	1.47	1.15	1.79	2.20
Castor cake	1.09	0.18	1.47	1.16	1.83	2.34
Castor cake + Carbosulfan	1.08	0.17	1.47	1.15	1.79	2.20
Carbosulfan	1.08	0.16	1.43	1.05	1.82	2.32
Control	1.09	0.19	1.48	1.19	2.08	3.33
S. Em±	0.01		0.03		0.01	
C.D. at 5%	NS		NS		0.03	
C.V. (%)	1.00		4.33		1.04	

Table BDAPP 683-3: Nematode population /100 ml soil (2018-19)

Treatment	Nematode population /100 ml soil							
	Initial				Final			
	Root-knot	Reni form	Stunt	Total	Root-knot	Reni form	Stunt	Total
Poultry manure	25	80	78	183	1885	1058	153	3096
Neem cake	63	15	46	124	1643	1005	130	2778
Tobacco dust	0	78	8	86	1915	1003	170	3088
Castor cake	131	68	76	275	2140	1153	160	3453
Castor cake + Carbosulfan	31	53	90	174	1840	965	165	2970
Carbosulfan	45	68	107	220	1668	980	160	2808
Control	42	34	48	124	1603	848	113	2564

Pooled Results

Pooled results (Table BDAPP 683-4) revealed that germination count and fresh weight were non-significant among the different manuring treatments. Application of poultry manure significantly yielded maximum number of transplantable and total seedlings than the rest of the treatments. Tobacco dust was at par in this regards compared to other treatments. Root-knot disease (BDAPP 683-5) was significantly reduced in all the treatments compared to control.

Table BDAPP 683-4: Pooled data for Germi. count/ 25 cm^2 and Seedlings/m^2 (2016-17 to 2018-19)

Sr. No.	Treatment	Germi. count/ 25 cm^2	Fresh weight (g)	Seedlings/m^2			
				Transplantable		Total surviving	
				$\sqrt{x}$	Orig.	$\sqrt{x}$	Orig.
1	Poultry Manure	10.30	365	26.55	708	28.82	833
2	Neem cake	10.36	344	23.31	551	25.55	660
3	Tobacco dust	9.72	373	25.50	655	27.69	768
4	Castor cake	10.20	377	24.32	597	26.47	704
5	Castor cake+ Carbosulfan	9.94	346	23.20	546	25.34	648
6	Carbosulfan	10.13	325	21.51	475	23.76	577
7	Control	10.60	340	22.41	506	24.72	613
	S. Em±	0.40	23.70	0.66	28.27	0.65	29.99
	C.D. at 5%	NS	NS	2.04	87.12	2.00	92.40
	C.V. (%)	13.46	23.89	5.77	10.46	5.68	10.30

Table BDAPP 683-5: Pooled data for Root-knot index (0-5)* (2016-17 to 2018-19)

Treatment	Root-knot index (0-5)*					
	I Pulling,		II Pulling,		III Pulling,	
	$\sqrt{x+1}$	Original	$\sqrt{x+1}$	Original	$\sqrt{x+1}$	Original
Poultry Manure	1.08	0.16	1.47	1.18	1.78	2.18
Neem cake	1.07	0.15	1.46	1.13	1.78	2.17
Tobacco dust	1.08	0.16	1.46	1.14	1.81	2.27
Castor cake	1.07	0.15	1.47	1.15	1.82	2.32
Castor cake + Carbosulfan	1.07	0.14	1.46	1.14	1.77	2.15
Carbosulfan	1.06	0.14	1.44	1.08	1.81	2.28
Control	1.11	0.25	1.50	1.27	2.06	3.25
S. Em±	0.009		0.014		0.01	
C.D. at 5%	0.024		NS		0.027	
C.V. (%)	3.45		3.47		1.75	

*0=Free, 5=Maximum disease intensity.

Table BDAPP 683-6: Pooled data for Nematode population /100 ml soil (2016-17 to 2018-19)

Treatment	Nematode population /100 ml soil							
	Initial				Final			
	Root-knot	Reni form	Stunt	Total	Root-knot	Reni form	Stunt	Total
Poultry manure	8	27	29	65	1035	367	207	1609
Neem cake	24	8	16	48	612	370	129	1111
Tobacco dust	9	27	3	39	811	343	273	1427
Castor cake	49	29	26	104	1024	414	198	1636
Castor cake + Carbosulfan	16	24	31	70	693	337	157	1186
Carbosulfan	15	23	36	74	860	345	164	1369
Control	33	20	17	71	697	302	165	1164

Table BDAPP 683-7: Year X Treatment interaction for transplantable seedlings

Treatment	2016-17		2017-18		2018-19		Pooled	
	$\sqrt{x}$	Original value	$\sqrt{x}$	Original value	$\sqrt{x}$	Original value	$\sqrt{x}$	Original value
Poultry Manure	27	712	25	623	28	788	27	708
Neem cake	22	486	22	469	26	698	23	551
Tobacco dust	26	685	23	513	228	767	25	655
Castor cake	24	603	22	473	27	715	24	597
Castor cake + Carbosulfan	22	513	21	432	26	694	23	546
Carbosulfan	19	352	20	418	26	655	22	475
Control	22	493	21	426	24	599	22	506
S. Em±	1.04		0.49		0.30		0.66	
C.D. at 5%	3.10		1.45		0.90		2.05	
C.V. (%)	9.01		4.46		2.28		5.77	
Y x T								
S. Em±	0.69							
C.D. at 5%	1.95							

Table BDAPP 683-8: Year X Treatment interaction for total survival seedlings

Sr. No	Treatment	2016-17		2017-18		2018-19		Pooled	
		$\sqrt{x}$	Original value	$\sqrt{x}$	Original value	$\sqrt{x}$	Original value	$\sqrt{x}$	Original value
1	Poultry Manure	28	761	30	898	29	840	29	833
2	Neem cake	23	541	26	676	28	763	26	660
3	Tobacco dust	27	730	27	739	29	835	28	768
4	Castor cake	26	658	26	679	28	774	26	704
5	Castor cake + Carbosulfan	23	556	25	623	28	764	25	648
6	Carbosulfan	20	406	25	603	27	722	24	577
7	Control	24	554	25	613	26	674	25	613
	S. Em±	1.06		0.58		0.42		0.65	
	C.D. at 5%	3.15		1.72		1.26		2.00	
	C.V. (%)	8.74		4.43		3.07		5.68	
	Y x T								
	S. Em±	0.74							
	C.D. at 5%	2.10							

Table: BDAPP 683-9: Economics of effective treatments

S. No.	Treat-ments	No. of TP	Gross income Rs/ha	Cost of prod., Rs/ha	Net realiz, Rs/ha	Additional over control		ICBR
		7000 m^2 ('000)				Income Rs/ha	Expendi-ture, Rs/ha	
1	Poultry Manure	4956	991200	203570	787630	282800	3570	1:79.22
2	Tobacco dust	4585	917000	206338	710662	208600	6338	1:32.91
3	Castor cake	4179	835800	214616	621184	127400	14616	1:8.72
4	Control	3542	708400	200000	508400	-	-	-

Recommendation:

Looking to the above results, it is recommended that poultry manure and tobacco dust was found superior which increased number of healthy seedlings with reduced root-knot index. The economics worked out for poultry manure and tobacco dust treatments revealed an ICBR of 1:79.22 and 1:32.91 respectively.

Recommendation for the farmers:

Thus, it is recommended that *Bidi* tobacco growing farmers are advised to apply poultry manure or tobacco dust as organic fertilizer to raise their nursery which increased number of healthy seedlings with reduced root-knot index.

BDAPP 684: ROTATIONAL STUDY WITH RESISTANT *BIDI* TOBACCO TO MANAGE SOIL BORN ROOT-KNOT DISEASE IN *BIDI* TOBACCO

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.

Year of start: 2017-18

Design : RBD **Variety** : ABT 10 & A 119
Replications : 4 (Four)
Bed Size : **Gross:** 4.5 x 6.0 m **Net** : 1.8 x 4.8 m

Results

The results revealed significant differences among the treatments for yield and root-knot index. The one year rotation with susceptible variety A 119 found significantly low yield as compared to resistant variety ABT 10 with root-knot index 1.3. One year rotation with resistant variety has no impact to reduce root-knot disease and increase yield. Final population of root-knot nematodes was found reduced in ABT 10 compared to A 119.

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

Table: BDAPP 684-1: Yield (kg/ha) for the two years (2017-18 & 2018-19)

Rotation Treatment	2017-18		2018-19		
	Yield, kg/ha	RKI (0-5)	Yield, kg/ha	RKI (0-5)	
				$\sqrt{x+1}$	Orig.
1 year with ABT 10	2030	0.00	1548	1.51	1.3
2 year with ABT 10	2098	0.00	2168	1.00	0
3 year with ABT 10	2115	0.00	2392	1.00	0
4 year with ABT 10	2089	0.00	2474	1.00	0
Susceptible A 119	1997	2.75	1487	1.88	2.6
S.Em±			148.18	0.08	
C.D. at 5%			456.63	0.24	
C.V. (%)			14.72	12.08	

Table: BDAPP 684-2: Nematode population /100 ml soil

Sr. No.	Treatment	Nematode population /100 ml soil							
		Initial				Final			
		Root-knot	Reni form	Stunt	Total	Root-knot	Reni form	Stunt	Total
1	1st year	100	100	90	290	780	160	93	1033
2	2nd year	140	105	73	318	835	158	93	1086
3	3rd year	45	105	55	205	785	165	110	1060
4	4th year	115	123	70	308	670	198	78	946
5	Control	145	155	93	393	963	150	75	1188

BDAPP 811: VALIDATION OF PREDICTION MODEL FOR FROG-EYE SPOT DISEASE

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 1.2m size in nursery and two hundred fifty square meter area in field of *bidi* tobacco *cv.* Anand 119 were earmarked and kept unprotected for this investigation. Weekly observations of frog-eye spot disease, using 0-5 scale, were recorded starting from the disease in nursery till the end of the disease in field crop. For recording observations, three blocks each in nursery and field were made and observations of 10 randomly selected seedlings/plants from each block were recorded in every standard week. Weather parameters such as daily temperature, relative humidity, rainfall etc. were correlated with the incidence and occurrence of the disease.

Results

The results on prediction of FES disease in nursery and field revealed that according to the model it was true to the tune of 20% and 47.36% in nursery and field, respectively.

Table BDAPP 811: Validation of prediction model for FES (2018-19)

Nursery											
	Average value of preceding standard week						Value recorded and calculated for prediction				
Std. week	BSS (hr)	RDAY (no.)	MAX T (^{0}C)	MIN T (^{0}C)	VP_1	Total RF (mm)	FES index observed	Actual FES COD	Calculated value	Validation value	Prediction for FES occurrence
31	-	1.0	-	25.0	22.9	-	0.00	0	0.8	1	No
32	-	0.0	-	25.0	30.2	-	0.00	0	0.0	0	Yes
33	-	1.0	-	24.8	25.7	-	0.00	0	0.0	0	Yes
34	-	3.0	-	24.3	26.0	-	0.23	1	0.0	0	No
35	-	6.0	-	23.4	25.7	-	0.30	1	0.0	0	No
36	-	3.0	-	23.7	25.1	-	0.60	1	0.0	0	No
37	-	0.0	-	22.7	23.1	-	0.45	1	0.0	0	No
38	-	0.0	-	23.0	23.5	-	0.32	1	0.0	0	No
39	-	1.0	-	23.3	24.1	-	0.15	1	0.0	0	No
40	-	1.0	-	21.3	23.2	-	0.40	1	0.0	0	No
Field											
38	6.4	-	32.1	23.0	-	880	0.00	0	0.6	1	No
39	6.9	-	34.2	23.3	-	919.2	0.00	0	0.4	0	Yes
40	8.4	-	34.2	21.3	-	937.2	0.00	0	0.4	0	Yes
41	9.0	-	37.3	22.3	-	937.2	0.00	0	0.2	0	Yes
42	9.0	-	37.2	20.4	-	937.2	0.10	1	0.1	0	No
43	9.0	-	37.2	19.8	-	937.2	0.22	1	0.1	0	No
44	9.8	-	36.8	16.7	-	937.2	0.28	1	0.1	0	No
45	9.9	-	35.5	17.4	-	937.2	0.20	1	0.2	0	No
46	9.6	-	34.3	14.6	-	937.2	0.00	0	0.1	0	Yes
47	9.3	-	34.5	14.4	-	937.2	0.00	0	0.1	0	Yes
48	9.2	-	34.4	16.1	-	937.2	0.35	1	0.1	0	No
49	8.1	-	30.9	13.9	-	937.2	0.18	1	0.2	0	No
50	7.1	-	30.1	13.6	-	937.2	0.10	1	0.2	0	No
51	8.6	-	28.1	11.1	-	937.2	0.05	1	0.4	1	Yes
52	9.3	-	27.7	9.1	-	937.2	0.00	0	0.4	0	Yes
01	8.3	-	24.0	7.1	-	937.2	0.00	0	0.6	1	No
02	9.3	-	28.7	8.2	-	937.2	0.00	0	0.2	0	Yes
03	9.1	-	26.5	9.4	-	937.2	0.00	0	0.5	1	No
04	9.5	-	29.7	10.7	-	937.2	0.00	0	0.3	0	Yes

Yes= Validation confirmed; No= Validation deferred

III. NEMATOLOGY

SHIVAMOGGA

VFSNM 634: BIO-MANAGEMENT OF ROOT-KNOT NEMATODE IN FCV TOBACCO UNDER FIELD CONDITIONS

Objective: To evaluate the efficacy of bio agents in Integration with organic amendments for the disease management under field conditions

Year of Start	: 2018		
Design	: RCBD	Replications	: Three
Entries	: 20	Variety	: Sahyadri
Plot size	: Gross - 5.4 x 6.0 m,	Net - 3.6 x 4.8 m	
Treatments	: Nine	Date of planting	: 27.07.2018

T1. Farmyard manure 1 t/ha
T2. Purpureocillium lilacinum (2x108 cfu/g) 5kg/acre with FYM 1 t/ha
T3. Trichoderma harzianum (2x108 cfu/g) 5kg/acre with FYM 1 t/ha
T4. Pseudomonas fluorescens (2x108 cfu/g) 5kg/acre with FYM 1 t/ha
T5. Bacillus pumilus (2x108 cfu/g) 5kg/acre with FYM 1 t/ha
T6. Bacillus hametus (2x108cfu/g) 5kg/acre with FYM 1 t/ha
T7. Bacillus subtilis (2x108cfu/g) 5kg/acre with FYM 1 t/ha
T8. Carbofuran (RC) 3G at 1.0 kg a.i./ha
T9. Untreated Check

Results: Results revealed that all the treatments were significantly superior over the untreated check in reducing the RKI and increasing the yield parameters. The treatment combination of T3, *P. lilacinum* 5 kg/acre with FYM 1 t/ha found to be superior in reducing the RKI (1.33) and in increasing yield parameters - 8303 kg green leaf, 831 kg cured followed by combination of T4, *T. harzianum* 5 kg/acre with FYM 1 t/ha and Carbofuran 3G 1.0 kg a.i./ha (RC) over untreated control.

Table VFSNM 634: Bio-management of root-knot nematode in FCV tobacco under field conditions (*kharif* 2018)

Treatments		RKI	Nematode Population (200/cc)	Green leaf (kg/ha)	Cured leaf (kg/ha)
T1	Farm yard manure	4.67	458	5945	636
T2	*P. lilacinum* + FYM	1.33	175	8303	831
T3	*T. harzianum* + FYM	2.13	222	7149	716
T4	*P. fluorescens* + FYM	2.67	268	6669	667
T5	*B. pumilus* + FYM	3.00	310	6540	656
T6	*B.hametus* + FYM	3.67	337	6099	612
T7	*B. subtilis* + FYM	3.00	311	6494	651
T8	Carbofuran	2.07	228	7098	713
T9	Untreated Check	5.00	609.33	5373	540
	S.Em±	0.29	11.51	167	22
	C.D. at 5%	0.84	33.45	486	65
	C.V. (%)	16.32	6.14	4.37	5.88

HUNSUR

VFHN 3: EFFECT OF *RABI* CROPS ON ROOT KNOT NEMATODE INFECTION IN *KHARIF* TOBACCO GROWN IN KLS

Year of Start: 2016-17 **Year of Completion:** 2018-19

Results: Experimental results revealed that, commonly grown rabi crop in KLS, the Field bean when taken up as preceding crop to FCV tobacco increased the soil root knot nematode population by 71.1% and also increased the root knot disease incidence in *Kharif* FCV tobacco with RKI of 3.80. Whereas Radish and Sun hemp as preceding rabi crop reduced the final soil nematode population to the tune of 40.7% and 38.9% respectively and subsequently lowered the RKI in *Kharif* FCV tobacco to 2.00 and 2.40 respectively. Cow pea and Cabbage as preceding rabi crop too increased the soil nematode population and nematode disease incidence in *Kharif* FCV tobacco. But the preceding crops Ragi and Horse gram was found to be safe by recording only marginal increase in the soil nematode population.

Table VFHN 3: Effect of commonly grown *rabi* crops on root knot nematode population in soil (2018-19)

Treatments/ RABI CROPS	Mean Initial Soil Nematode Population (/ 100g. soil)	Mean Soil Nematode Population after Rabi crops (/100g. soil)	Per cent Increase / Decrease in Population	Mean Initial Soil Nematode Population (/ 100g. soil) (Before *Kharif* tobacco)	Mean Final Soil Nematode Population (/100g. soil) (After *Kharif* tobacco)	Per cent Increase / Decrease in Nematode Population	Root Knot Index (RKI) (0 - 5 Scale)
T1. Field bean	156	230	(+) 47.4%	207	267	(+) 71.1%	3.8
T2. Ragi	150	135	(-) 10%	122	171	(+) 14.0%	3.2
T3. Cow pea	174	243	(+) 39.6%	222	284	(+) 63.2%	3.8
T4. Horse gram	165	132	(-) 20%	119	165	0%	2.4
T5. Sun hemp	172	81	(-) 52.9%	74	105	(-) 38.9%	2.4
T6. Radish	162	72	(-) 55.5%	66	96	(-) 40.7%	2.0
T7. Knol Khol	154	141	(-) 8.4%	129	174	(+) 12.9%	3.3
T8. Cabbage	153	194	(+) 26.7%	176	228	(+) 49.1%	3.8
T9. Control (Fallow)	165	145	(-) 12.1%	132	183	(+) 10.9%	3.3