EVALUATION OF NEWLY DEVELOPED BIDI TOBACCO (*NICOTIANA TABACUM L.*) GENOTYPES FOR SEED OIL

ABSTRACT

Tobacco (*Nicotiana tabacum* L.) seed oil (TSO), a byproduct of tobacco leaf production, has been shown to be a substitute for a diesel fuel in a raw or chemically modified form. The oil content of the seed ranges from 36% to 41% of seed dry weight. In the present study the experiment was conducted with 8 genotypes ABD 132, ABD119, NyBD56, NBD290, NBD289, ABD146, A119(C) & Nandyal pogaku-1(C) in randomized block design from 2018-19 to 2020-21 at Regional Agricultural Research Station,Nandyal with an objective to evaluate the newly developed genotypes for seed yield and yield attributes and to find out oil yield and quality of tobacco seed oil. Results showed that the entries ABD132 (2199 kg/ha), NBD290 (2150kg/ha), ABD145 (2137 kg/ha) & NBD289 (2067kg/ha) has recorded significantly higher cured leaf yield and chemical quality parameters were recorded in its leaves of the genotypes under untopped condition, the lowest chloride content of 0.78 % in NBD 290 , higher nicotine content (2.82%) in ABD132 (Nandyal Pogaku 2) and higher reducing sugars (1.55%) in A119 , making it suitable for bidi smoking. Entries ABD 132(745 kg/ha) & A119 (738 kg/ha) recorded higher seed yield and oil yield potential (234 kg/ha) & (235 kg/ha) respectively .ABD 132 has recorded maximum nicotine yield potential (62.01).These genotypes used further breeding programmes to increase the oil yield and to use the by-products.

Keywords: Chemical quality, Cured leaf yield , Genotypes, Seed yield, Tobacco seed oil,

INTRODUCTION

Tobacco (Nicotiana tabacum L) is an economically important crop, widely cultivated all over the world, especially in India. Its leaves are generally processed into various tobacco products including cigars, bidis, snuffs, hookah, and gutka. However, tobacco seeds are wasted byproducts of commercial leaf production. Recently, tobacco seeds have been developed as biodiesel, animal feed, paint, soap, and seed oil (Rao 1994). A study showed that tobacco seeds have oil contents of about 30–40%, which is higher than that of some other oil crops, including soybean, cotton, and olive. Tobacco seed oil contains a variety of beneficial substances, such as triacylglycerols, phospholipids, tocopherols, sterols, and unsaturated fatty acids Gu, J *et al*., 2022. Recently bidi smoking is under decreasing trend either due to increased livelihood of Indians or due to creation of health awareness among smokers by government of India. Hence the research on tobacco has to be reoriented towards identifying bidi tobacco varieties suitable for multiple uses other than smoking like medicine, dye industry, edible oil, food from leaf protein etc. Tobacco seeds are rich in oil and free of nicotine. Oil in tobacco seed constitutes 33-40% of seed weight ,it is comparable to mustard, sunflower and safflower oil and according to literature could be used as an appropriate feedstock for biodiesel production (Tian *et al*., 2020) as well as raw material for the manufacture of soaps, paints, lubricants and fuels. The oil is also edible once refined (Sarala *et al.,* 2013). The objective of study is to assess the newly developed genotypes for their potential in seed yield, cured leaf yield, as well as leaf quality, oil, and nicotine yield. The present day tobacco cultivars, directed for leaf yield, may not be suitable for high seed yield. Hence, there is a need to develop specific varieties endowed with appropriate plant frame and ideotype for maximizing seed and oil yield. The present study is proposed to find out suitable genotypes in bidi tobacco for higher seed and oil yield.

MATERIALS AND METHODS

The experiment was conducted to evaluate the six newly developed genotypes viz., ABD132, NyBD56, NBD290, NBD289, ABD 146, ABD 119 along with two checks A119 & Nandyal pogaku-1 in a Randomized Block Design with three replications with spacing of 75 cm x 75 cm. Fertilisers were applied @ 110 kg N, 70 kg P2 O5 and 50 kg K2O/ha. In each genotype five randomly selected plants were harvested for important traits like days to 50 % flowering, plant height, number of leaves per plant, leaf length, leaf width, days to maturity, cured leaf yield, number of branches per plant, number of capsules per plant, seed yield, oil content in seed, nicotine, reducing sugars, chloride content in leaf, nicotine and oil yield potential. This trial was conducted at RARS,Nandyal during 2018-2020 .The seed oil estimation was carried out by BTRS,AAU,Gujarat. Cured leaf yield, seed yield and oil content of the entries were recorded. Analysis of variance (ANOVA) was performed using the software OPSTAT by online.

RESULTS AND DISCUSSION

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 (527kg/ha) were recorded numerically higher seed yield and oil yield potential (175.91 kg/ha & 154.35 kg/ha) respectively and ABD 132(Nandyal Pogaku 2) (70.62 kg/ha) has recorded maximum nicotine yield potential. Patel *et al*. (1998), Abbas *et al*. (2008), Swamy *et al*. (2010), Mohammad and Nawroz (2014) and Sivakanthan *et al.* (2018) reported that seed oil percentage in different types of tobacco varied between 35 and 39 %. In the present study, it is observed that higher oil percentage was recorded in ABD 132 (Nandyal Pogaku 2) (31.15 %) and A119 (31.08 %) under rainfed conditions of vertisols in Kurnool and Nandyal districts. (Table 1).

The entries ABD132(Nandyal Pogaku 2) (2199 kg/ha) , NBD290 (2150kg/ha), ABD145 (2137 kg/ha) & NBD289 (2067kg/ha) have recorded significantly higher cured leaf yield with an improvement of 31.59 %,28.66 %,27.88 % & 23.69 % when compared to the checks Nandyal Pogaku 1 (1671 kg/ha) & A 119 (1513 kg/ha). None of the entries were found significant superiority for seed yield over checks. Chemical quality parameters were recorded in its leaves of the genotypes under untopped condition, the lowest chloride content of 0.78 % in NBD 290 , higher nicotine content (2.82%) in ABD132 (Nandyal Pogaku 2) and higher reducing sugars (1.55%) in A119 , making it suitable for bidi smoking. (Table 2)

Based on two years (2018-19 & 2019-20) seed yield performance, it is concluded that the varieties A119 (652.1 kg/ha) and Nandyal Pogaku 1(648.7 kg/ha) can be used as one of the parents in hybridization programme for achieving higher production of seed and oil yield potential. The variety ABD 132(Nandyal Pogaku 2) has recorded significantly higher cured leaf yield (2106 kg/ha) and maximum nicotine yield potential (70.62 kg/ha) .Hence it is suitable for dual purpose from which either higher cured leaf yield or highest seed oil % or higher nicotine yield potential (Table 1 & 3). Similar results were reported by Sivaraju *et al*., 2015, Michele *et al*., 2016 & Jaffar Basha *et al*., 2020.

CONCLUSIONS: In the present study, results showed that the entries ABD132 (2199 kg/ha), NBD290 (2150kg/ha), ABD145 (2137 kg/ha) & NBD289 (2067kg/ha) has recorded significantly higher cured leaf yield and chemical quality parameters were recorded in its leaves of the genotypes under untopped condition, the lowest chloride content of 0.78 % in NBD 290 , higher nicotine content (2.82%) in ABD132 (Nandyal Pogaku 2) and higher reducing sugars (1.55%) in A119 , making it suitable for bidi smoking. Entries ABD 132(745 kg/ha) & A119 (738 kg/ha) recorded higher seed yield and oil yield potential (234 kg/ha) & (235 kg/ha) respectively .ABD 132 has recorded maximum nicotine yield potential (62.01).

Table 1: Evaluation of newly developed bidi tobacco genotypes for seed oil during (2018-19)

S.N	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	
1	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
2	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
3	NBD289	129	87.0	28.0	45.3	16.5	148	21	385	437	1702	2.44	30.90	41.52	135.03	
4	NyBD56	140	89.7	21.3	42.1	16.0	168	20	370	487	1667	2.79	30.85	46.50	150.23	
5	ABD146	134	80.8	25.7	38.1	14.1	154	19	339	417	1633	2.19	30.29	35.76	126.30	
6	Ndl.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	
7	ABD119	127	86.6	22.0	41.6	16.4	148	29	642	338	1604	2.41	29.84	38.65	100.85	
8	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	**131.4**	**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**					

Table 2: Evaluation of newly developed bidi tobacco genotypes for seed oil during (2019-20)

S.N	Entry	Days to 50% flowering	Pl.ht (cm)	Leaf length (cm)	Leaf width (cm)	No. of Days to Maturity	No. of Leaves /pl.	No. of capsules /pl.	Nicotine %	Reducing sugars%	Chlorides %	Seed yield (kg/ha)	Cured leaf yield (kg/ha)	%IOC
1	ABD 132	152	194.7	39.8	17.4	175	33	539	2.82	1.27	1.58	745.32	2199*	31.59
2	NBD 290	130	174.3	37.3	15.0	168	27	540	1.46	1.28	0.78	717.39	2150*	28.66
3	ABD 146	141	154.3	38.3	16.0	169	29	541	1.59	1.36	0.78	699.6	2137*	27.88
4	NBD 289	133	170.1	44.5	18.8	165	27	532	1.62	1.51	1.00	735.17	2067*	23.69
5	ABD 119	140	139.3	39.9	16.7	167	27	578	1.53	1.34	1.05	711.91	2045	22.38
6	NyBD 56	129	123.7	38.5	16.3	157	20	639	1.55	1.37	0.97	750.38	2028	21.36
7	Nandyal pogaku-1(C)	125	187.3	42.2	17.2	161	26	610	1.93	1.54	1.35	770.39	1671	
8	A119(C)	127	154.0	31.5	13.0	151	22	582	1.99	1.55	0.92	738.27	1513	
	GM	**134.62**	**162.21**	**39.0**	**16.30**	**164.0**	**26.0**	**570**	**1.81**	**1.40**	**1.05**	**733.5**	**1976**	
	SEM±	**2.96**	**6.45**	**2.29**	**1.28**	**7.18**	**0.78**	**38.56**				**45.96**	**125.18**	
	C.D.@5%	**9.07**	**19.77**	**7.02**	**NS**	**NS**	**2.39**	**NS**				**NS**	**383.38**	
	C.V%	**3.81**	**6.89**	**10.18**	**13.70**	**7.58**	**5.12**	**11.71**				**10.85**	**10.97**	

Table 3: Pooled seed & cured leaf yield performance of bidi tobacco genotypes during (2018-19 and 2019-20)

S.no	Name of the entries	Seed Yield (kg/ha)		Mean	Cured leaf yield (kg/ha)		Mean
		2018-19	2019-20		2018-19	2019-20	
1	ABD132	430	745.32	587.7	2012	2199	2106*
2	NBD290	457	717.39	587.2	1802	2150	1976*
3	NBD289	437	735.1	586.1	1702	2067	1885
4	NyBD56	487	750.3	618.7	1667	2028	1848
5	ABD146	417	700	558.5	1633	2137	1885
6	Ndl.Pogaku 1 (C)	527	770.3	648.7	1629	1671	1650
7	ABD119	338	711.9	525.0	1604	2045	1825
8	A119 (C)	566	738.2	652.1	1340	1513	1427
	Grand Mean	**457.4**	**733.6**	**595.5**	**1674**	**1976**	**1825**
		Years	**Entries**	**Years x Entries**	**Years**	**Entries**	**Years x Entries**
	S.Em±	24.3	45.96	47.28	44.8	125.1	107.3
	C.D.at 5%	NS	NS	NS	136.0	383.3	327.6
	C.V%	12.0	11.0	11.5	11.0	10.9	11.0

REFERENCES

1. Abbas, A.M., Sayeed, A.M. and Rajesh, K.R. (2008). Comparative study on characteristics of seed oils and nutritional composition of seeds from different varieties of tobacco (Nicotiana tabacum L.) cultivated in Bangladesh. Asian Journal of Biochemistry, 3: 203-12.
2. Gu, J.; Zhang, X.; Song, B.; Zhou, D.; Niu, Y.; Cheng, G.; Zheng, Y.; Wang, Y.2022. Chemical Composition of Tobacco Seed Oils and Their Antioxidant, Anti-Inflammatory, and Whitening Activities. Molecules. 27, 8516. https://doi.org/10.3390/molecules27238516.
3. Michele, B., Simone, G., Rachele, P., Pasquale, Raiola, Stefano, C., Flaminia, V., Francesco, D., Massimo, Zuin, Sergio, T., Renato, M., Francesco, D. and Fulvio, P. (2016). Alternative use of tobacco as a sustainable crop for seed oil, biofuel and biomass. Agronomy for Sustainable Development, 36: 55.
4. Mohammad Tofiq Mohammad and Nawroz Abdul-razzak Tahir. 2014. Evaluation of Chemical Compositions of Tobacco (Nicotiana tabacum L) Genotypes Seeds. Annual Research & Review in Biology 4(9): 1480-1489.

5. Patel, J.A., B.K. Patel and M.K.Chakraborthy.1998. Production potential and quality aspects of tobacco seed oil. ***Tobacco. Research*.** 24: 44-49.
6. Rao, P.U. Nutrient composition of some less-familiar oil seeds. Food Chem. 1994, 50, 379–382.
7. Sarala, K., Murthy, T. G. K., Prabhakara Rao, K and Ravisankar, H. 2013. Tobacco research in India: trends and developments***. Agrotechnology***, *2*(3): 113.
8. Sivaraju, K., Damodar Reddy, D. and Narasimha Rao, C.V. (2015). Comparative study on characteristics of seed oil and nutritional composition of seed cake in different tobacco types cultivated in India. Tobacco Research, 41(1): 6-14.
9. Swamy, A.V.S.R., Krishnamurthy, V., Palanichamy, K., Narasimha rao C.V and Mohan M.2010. Evaluation of tobacco hybrids for production of high seed and oil yield under Tamil Nadu conditions. ***Tobacco. Research*.** 36 (1 & 2): 115-116.
10. Sivakanthan, S.; Jayasooriya, A.P.; Madhujith, T. Optimization of the production of structured lipid by enzymatic interesterification from coconut (Cocos nucifera) oil and sesame (Sesamum indicum) oil using response surface methodology. LWT-Food Sci. Technol. 2018, 101, 723–730.
11. Tian, Y., Chen, K., Li, X., Zheng, Y and Chen, F. 2020. Design of high-oleic tobacco (*Nicotiana tabacum L.)* seed oil by CRISPR-Cas9-mediated knockout of NtFAD2–2. ***BMC Plant Biology***. *20*:1-12.