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Effect of transplanting date and nitrogen levels on growth attributes, cured leaf yield and economics of Bidi Tobacco (*Nicotiana tabacum*)

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Abstract

A field experiment was conducted during *Kharif* season of the year 2020-21 at Bidi Tobacco Research Station, Anand Agricultural University, Anand (Gujarat). This experiment was carried out in randomized block design with factorial concept and nine treatments combinations comprising of three transplanting dates (25th August, 10th September and 25th September) and three levels of nitrogen (150 kg/ha, 200 kg/ha and 250 kg/ha) with four replications. The aim of this study is to evaluate the effect of transplanting date and nitrogen levels on growth, cured leaf yield and economics of bidi tobacco. The results revealed that the plant growth attributes *viz*., plant height, leaf length, leaf width, growth score, spangle score and cured leaf yield were found significantly higher with transplanting at D_2 (10th September) which remain statistically at par with transplanting at D_3 (25th September) whereas, early transplanting date D_1 (25th August) take more time to harvest. The highest gross realization and net realization was secured due to transplanting date D_2 (10th September) of bidi tobacco followed by transplanting date D_3 (25th September). Whereas, the highest value of BCR was recorded under transplanting date D_3 (25th September) followed by D_2 (10th September). Whereas nitrogen level, observed similarly plant height, Leaf length, leaf width, growth score, spangle score and yield were recorded significantly higher with nitrogen level N_3 (250 kg/ha) which were at par with nitrogen level N_2 (200 kg/ha). Gross realization, net realization and BCR were recorded the highest with nitrogen level N_3 (250 kg/ha). Dry weight per unit leaf area was significantly not affected by the transplanting date as well as nitrogen levels. Transplanting date and different nitrogen levels fail to exert their interaction effect on growth attributes and cured leaf yield.

Keywords: Bidi tobacco, cured leaf yield, growth score, Nitrogen levels, Spangle Score

Introduction

Tobacco is a member of the Tubiflorae order of the Solanaceae family, the most widely grown commercial non-food crop in the world. Tobacco is a self-pollinated, C_3 and short-day plant. Tobacco is grown under a wide range of climates, being a tropical crop but it is now grown from subtropical to temperate region of the world. *Nicotiana tabacum* L. and *Nicotiana rustica* L. are commercially important species of tobacco. It is believed to have been introduced in India from Central America by Portuguese in 1603. The name "Nicotiana" as well as "Nicotine" was given in the honour of Jean Nicot, French ambassador to Portugal who in 1559 sent it as a medicine to the court of Catherine de crops entering world trade entirely on the leaf basis and it is valued for its leaf containing nicotine. It is an important commercial crop in view of revenue generation, export earnings and employment potential. It is called the golden leaf of India.

Tobacco is an important commercial commodity in world trade since the beginning of the 17th century. It enters the foreign trade of all the countries either in the form of raw tobacco or as manufactured tobacco products. Tobacco is an agricultural product processed from the fresh leaves of plants of the genus Nicotiana. Tobacco smoking is the practice where tobacco is burned and the vapours either tasted or inhaled. At present industries based on some alternative uses of tobacco are coming up which include insecticide grade nicotine sulphate, pharmaceutical grade solanesol, leaf protein concentrate and tobacco seed oil for edible purpose (Singh and Jain, 2005) [18]. The area under tobacco in the world is 42.9 lakh hectares with a production of 7.49 million tonnes and productivity 1745 kg/ha. The major tobacco growing countries in the world are China, India, USA, Brazil, Turkey, Russia, Italy and Zimbabwe. Presently, India stands third in production (951 million kg) of tobacco in the world after China and Brazil (Anonymous, 2019) [3]. China and India produce together more than 50% of World's total.

The various crop production factors *viz.*, spacing, seed rate, transplanting time, amount of fertilizer, nutrient availability, method of fertilizer application, time of fertilizer application, method of irrigation, time of irrigation and adoption of high yielding variety etc. play an important role in increasing the production of tobacco per unit area. Among the various factors of production, proper time of transplanting and suitable variety play a pivotal role in increasing production. Among the various factors known to determine the crop yield, date of transplanting has been recognized as the most important non-monetary input affecting the yield and quality of tobacco. As early transplanting faces high temperature during the initial stage and late transplanting faces low temperature during initial stage in middle Gujarat, these adversely affect the growth, yield and quality. Therefore, determination of optimum time of transplanting is of paramount importance for increasing production without much expense. Along with transplanting date, selection of high yielding variety, nitrogen management, disease and pest resistant variety is also important. Among various crop production factor these two factors, proper transplanting date and suitable variety do not require any external input so that suitable transplanting date and variety play significant role in increasing farmer income.

Cured leaf yield of tobacco is influenced by various biotic and abiotic factors, among these transplanting at very early in the season faces high temperature and higher relative humidity during the initial stage which is favourable for some biotic stress e.g. pest, disease while very late transplanting faces low temperature during initial stage which leads to development of abiotic stress for example low temperature in initial crop growth stage in middle Gujarat. These adversely affect the growth, yield and quality.

Appropriate levels of the nutrient are needed to produce a high-yielding, quality leaf with appropriate smoke flavor and aroma which is needed in all parts of plant life. Nitrogen is the most important macronutrient in tobacco production. Farmers are increasingly persuaded to use more nitrogen fertilizer in order to improve crop yield (Farrokh *et al.*, 2012) [6]. Nitrogen deficiency generally results in stunted growth and chlorotic leaves caused by poor assimilate formation that leads to premature flowering and shortening of the growth cycle. The presence of N in excess promotes development of the above ground organs with abundant dark green (high chlorophyll) tissues of soft consistency and relatively poor root growth. This increases the risk of lodging and reduces the plants resistance to harsh climatic conditions and to foliar diseases. Nitrogen fertilizer use has played a significant role in increasing the yield of tobacco.

Nitrogen in tobacco cultivation is considered as a key element that can affect the quantity more than any other nutrients. With regards to obtaining results from the experiment, increasing in nitrogen fertilizer amount positively increased studied traits of tobacco. Increasing the amount of nitrogen increases the number of leaves, plant height, stem diameter and wet leaf weight (Castelli *et al*., 1990) [5]. Application of nitrogen increases leaf dimensions (length and width of leaf) that is causing the yield rise (Rachman *et al*., 1990) [15].

Materials and Method

A field experiment was conducted during the *Kharif* season of the year 2020-21 at Bidi Tobacco Research Station, Anand Agricultural University, Anand (Gujarat). Geographically, Anand is situated at 22°35′ North latitude and 72°56′ East longitude at an elevation of about 45.1 meters above the mean sea level. Anand is situated about 70 km away from the Arabian Sea coast and hence this region enjoys a typical sub-tropical climate with dry and hot summer, fairly cold and dry winter and moderately humid monsoon. Generally, the monsoon starts from the third week of June and retreats by middle of September with an average annual rainfall of 864.5 mm, which is released entirely from south-west monsoon currents soil of the experimental site is loamy sand and locally known as "*Goradu*" soil. The soil is alluvial by nature of origin, very deep, well drained and fairly moisture retentive. Soil responds well to fertilizers, manures and irrigation. Soil is suitable for range of crops of tropical and sub-tropical regions.

This experiment was carried out in randomized block design with a factorial concept and nine treatments combinations comprising of three transplanting dates (25th August, 10th September and 25th September) and three levels of nitrogen (150 kg/ha, 200 kg/ha, and 250 kg/ha) with four replications. Nitrogen was applied in four equal splits; 1st as basal through Ammonium sulphate and remaining three equal splits through Urea each at 30 days interval after transplanting. Bidi tobacco varieties GABT 11 was selected for the present experiment. This variety GABT 11 was released in 2012 by BTRS, AAU, Anand. Average yield of GABT 11 is 4170 kg/ha.

The topping was done at 24 leaves stage of crop growth and desuckring was carried out as per requirements. The main purposes behind topping and desuckering is to reduce intra-plant competition and divert energy flow into leaves. The plant height, leaf length and leaf width were measured at 30 DAT, 60 DAT and at harvest. The growth score (0-10) and Spangle score (0-5) were recorded at the time of leaf maturity based on visualization and skills of the evaluator. Cured leaf yield (kg/ha) was recorded by weighing of cured leaves after harvesting and sun curing in each treatment plot from each gross plot area

The collected data for various parameters were statistically analyzed using Fishers analysis of variance (ANOVA) technique and the treatments were compared at 5% levels of significance. In order to evaluate the most effective remunerative treatment, relative economics of each treatment was calculated. The gross realization in terms of rupees per hectare was worked out for each treatment considering prevailing market price of transplantable bidi tobacco plants. Likewise, cost of cultivation was also worked out considering expenses incurred for cultural operations and materials used for respective treatments. Net realization under each treatment was worked out by subtracting cost of cultivation from gross realization. The Benefit: Cost ratio (BCR) was calculated on the basis of formula given below:

Results and Discussion

Effect on Growth attributes

Effect of transplanting date

Mean data on plant height, leaf length and leaf width were recorded at 30, 60 DATP and at harvest as influenced by different transplanting dates. The results indicated that plant height was not significantly affected by the different dates of transplanting at 30 DATP and at harvest. Whereas the transplanting date was significantly affected at 60 DATP. The plant height was significantly higher under treatment D_2 (10th September) (33.35 cm) at 60 DATP which was at par with treatment D_3 (25th September) (32.73 cm). While lowest plant height was recorded from treatment D_1 (25th August) (30.63 cm). The increase in plant height might be due to favorable climatic conditions during growth stages as compared to the rest of the transplanting dates. These findings are in the line with those reported by Garasiya (2018) [7].

Leaf length increased with the advancement of plant growth. The leaf length was significantly higher in treatment D_2 (10th September) at 60 DATP and at Harvest (44.14 cm and 61.56 cm, respectively), but it was at par with D_3 (25th September) (42.31 cm and 59.65 cm respectively). While treatment D_1 (25th August) recorded significantly the lowest leaf length at 60 DATP (40.12) and at harvest (55.31 cm). A similar trend was also observed for the leaf width. The leaf width was significantly higher in treatment D_2 (10th September) at 60 DATP and harvest (22.13 cm and 29.57 cm, respectively) compared to treatment D_1 (25th August) (19.58 cm and 26.70 cm, respectively), but it was statistically at par with treatment D_3 (25th September) at 60 DATP (21.41 cm) and harvest (29.29 cm) respectively. Higher leaf length and width might be due to Favourable climatic conditions during growth stages of crop. Early and late transplanting reduce the growth of plant. These results are in agreement with those obtained by Anon. (2003-04) and Garasiya (2017).

The mean data of the growth score and spangle score of bidi tobacco were significantly influenced by various dates of transplanting. Among the different transplanting dates, treatment D_2 (10th September) recorded significantly higher growth score (6.74) and spangle score (3.87) compared with D_1 (25th August) (6.08 and 3.650, respectively), but it was at par with treatment D_3 (25th September) (6.51 and 3.82, respectively). higher growth score and spangle score under the 2nd transplanting date D_2 (10th September) might be due to good climatic conditions to promote the physiological activities of the plant which increase the growth attributes as well as growth score and spangle score.

The statistical data of days to maturity revealed that the number of days required to maturity by bidi tobacco was significantly influenced by various transplanting dates. Results revealed that early transplanting date D_1 (25th August) takes more time (207 days) but it was at par with treatment D_2 (10th September) (202 days). Late transplanting at D_3 (25th September) (196 days) takes fewer days to maturity compared to remaining treatments. Transplanting of tobacco during an early date takes more time to maturity might be due to the prolonged early vegetative phase. The effect of transplanting dates on dry weight per unit area of the leaf (mg/cm^2) was found non-significant (Table 1).

Effect of Nitrogen

As per an experiment, the results revealed that plant height was not significantly affected by different levels of nitrogen at 30 DATP and at harvest. Further, the results revealed that plant height was significantly affected due to different nitrogen levels at 60 DATP. Both the extreme levels of nitrogen (150 and 250 kg/ha) significantly affected to the plant height (31.27 cm and 33.30 cm, respectively). However, both these levels were at par with an optimum level of nitrogen (200 kg/ha) (32.13 cm). Higher plant height might be due to a higher dose of nitrogen which might increase the growth of plant resulting into an increase in plant height.

Leaf length and leaf width were significantly influenced by different Nitrogen levels at 60 DATP and at harvest except for 30 DATP. Observed data of this experiment indicated that significantly higher leaf length was observed in treatment N_3 (250 kg/ha) at 60 DATP (44.07 cm) and at harvest (61.57 cm), but, it was at par with treatment N_2 (200 kg/ha) at 60 DATP (43.21 cm) and at harvest (58.96 cm), respectively. While, treatment N_1 (150 kg/ha) recorded significantly the lowest leaf length at 60 DATP and at harvest (39.30 cm and 55.99 cm, respectively). Leaf width was increased with an increase in levels of nitrogen. Results indicated that significantly higher leaf width was observed due to treatment N_3 (250 kg/ha) at 60 DATP and at harvest (22.30 cm and 29.96 cm, respectively) which was at par with treatment N_2 (200 kg/ha) (21.38 cm and 28.64 cm, respectively), while treatment N_1 (150 kg/ha) recorded significantly the lowest leaf width at 60 DATP and at harvest (19.43 cm and 26.95 cm, respectively). Thus, higher leaf width might be due to a higher dose of nitrogen resulting in an increase in the vegetative growth of plant which seems to be an increase in the leaf width. This finding is also in collaboration with those reported by Ling and Wang (1975) [10], Patel (1991) [13], Haghighi *et al.* (2011) [9] and Basha *et al.* (2020) [4].

The data on growth score (0-10) and spangle score (0-5) recorded at harvest presented in Table 1 revealed that growth score and spangle score were differed due to various levels of nitrogen. Treatment N_3 (250 kg/ha) recorded significantly higher growth score and spangle score (6.91 and 3.96, respectively), but, it was at par with treatment N_2 (200 kg/ha) (6.54) and (3.80). The lowest growth score and spangle score were observed under treatment N_1 (150 kg/ha) (8.57 and 3.44, respectively). A similar result was observed by Patel (1994) [12]. Different levels of nitrogen did not manifest any significant effect on dry weight per unit area of the leaf (mg/cm^2) at harvest.

Results of this experiment concluded that the days to maturity of bidi tobacco were not significantly affected by different nitrogen levels (period from transplanting to harvest). But, numerically more days were required under a higher nitrogen level N_3 (250 kg/kg) (203 days) followed by treatment N_2 (200 kg/ha) (202) (Table 1). The results might be due to the application of higher levels of nitrogen which promotes the vegetative growth of plant and delayed the maturity of crop. These results are in agreement with those obtained by

Effect on cured leaf yield

Effect of transplanting date

The mean data on cured leaf yield (kg/ha) as influenced by the transplanting date are presented in Table 1. Results revealed that significantly higher cured leaf yield was observed under transplanting date D_2 (10th September) (4673 kg/ha) and was at par with D_3 (25th September) (4541). While, the lowest cured leaf yield was observed in D_1 (25th August) (4109 kg/ha). The increased in cured leaf yield in transplanting date D_2 (10th September) may be attributed to higher growth and development of the crop due to a more favourable environment during the crop growth period as compared to early and late transplanting dates D_1 (25thAugust) and D_3 (25th September). Higher cured leaf yield might be due to optimum mean temperature and higher bright sunshine hours during the growth phase of crop. The results are in accordance with the results reported by Sanibabu *et al*. (1986) [17], Prasadrao *et al.* (2002), Anon. (2002-03), Tadvi *et al.* (2018) [7] and Garasiya (2018) [7].

Table 1: Effect of transplanting date and nitrogen levels on growth attributes and cured leaf yield of bidi tobacco.

Treatment	Plant height (cm)			Leaf length (cm)			Leaf width (cm)			Growth Score	Spangle score	Dry weight per unit leaf area (mg/cm²)	Cured leaf yield kg/ha
	At 30 DATP	At 60 DATP	At harvest	At 30 DATP	At 60 DATP	At harvest	At 30 DATP	At 60 DATP	At harvest				
Transplanting date													
D_1: 25th August	10.21	30.63	62.50	23.25	40.12	55.31	15.35	19.58	26.70	6.08	3.50	9.21	4109
D_2: 10th September	10.44	33.35	64.83	24.40	44.14	61.56	15.88	22.13	29.57	6.74	3.87	8.96	4673
D_3: 25th September	10.25	32.73	62.67	23.63	42.31	59.65	15.75	21.41	29.29	6.51	3.82	8.98	4541
S.Em.±	0.17	0.52	1.13	0.42	0.69	1.01	0.29	0.36	0.47	0.14	0.08	0.11	156
CD at 5%	NS	1.52	NS	NS	2.01	2.94	NS	1.06	1.38	0.41	0.23	NS	455
Nitrogen													
N_1: (150kg N/ha)	10.19	31.27	61.75	23.08	39.30	55.99	15.16	19.43	26.95	5.87	3.44	9.02	4040
N_2: (200 kg N/ha)	10.31	32.13	63.58	23.61	43.21	58.96	15.76	21.38	28.64	6.54	3.80	8.95	4498
N_3: (250 kg N/ha)	10.39	33.30	64.67	24.60	44.07	61.57	16.07	22.30	29.96	6.91	3.96	9.18	4786
S.Em.±	0.17	0.52	1.13	0.42	0.69	1.01	0.29	0.36	0.47	0.14	0.08	0.11	156
CD at 5%	NS	1.52	NS	NS	2.01	2.94	NS	1.06	1.38	0.41	0.23	NS	455
Interaction (D x N)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV%	5.88	5.61	6.17	6.18	5.66	5.93	6.31	5.98	5.73	7.64	7.38	4.40	12.17

Effect of Nitrogen
The mean data on cured leaf yield (kg/ha) recorded at harvest as influenced by different levels of nitrogen are presented in Table 2 revealing a significant increase in cured leaf yield of tobacco with an increase in nitrogen levels. The higher level of nitrogen N_3 (250 kg/ha) produced significantly higher cured leaf yield (4786 kg/ha) than the lower level of nitrogen N_1 (150 kg N/ha) (4040 kg/ha) but it was at par with an optimum level of nitrogen N_2 (200 kg/ha) (4498 kg/ha). Thus, the increase in cured leaf yield might be due to the application of a higher dose of nitrogen which might help the vegetative growth of the crop. The result was in close agreement with that of Patel (1991) [13], Gediya (2005) [8], Marchetti *et al.* (2006) [11], Rathbone (2008) [16], Haghighi *et al.* (2011) [9] and Basha *et al.* (2020) [4].

Economics
Effect of transplanting date: The highest net returns of 2,69,579 ₹/ha were secured due to transplanting date D_2 (10th September) of bidi tobacco followed by transplanting date D_3 (25th September) (2,62,779 ₹/ha). While, the minimum net returns were obtained from D_1 (25th August). In the case of BCR, the highest value of 5.44 was recorded under transplanting date D_3 (25th September) followed by D_2 (10th September). It might be due to less cost of cultivation incurred and more net returns obtained under the D_3 transplanting date as compared to other transplanting dates.

Effect of Nitrogen
There was an appreciable increase in net realization due to application of various levels of nitrogen. The highest net returns of 2,75,674 ₹/ha was obtained with application of 250 kg N/ha (N_3) followed by treatment N_2 (200 kg N/ha) (257594 ₹/ha). While the lowest value of net return 2,27,862 ₹/ha was obtained from nitrogen level N_1 (150 kg N/ha) (Table 2).

Table 2: Economics as influenced by various transplanting dates and nitrogen levels in bidi tobacco

Treatment	Gross realization (₹/ha)	Cost of cultivation (₹/ha)	Net Realization (₹/ha)	BCR
Transplanting date				
D_1	281467	52764	228703	4.33
D_2	320101	50521	269579	5.34
D_3	311059	48279	262779	5.44
Nitrogen				
N_1	276740	48878	227862	4.66
N_2	308113	50519	257594	5.10
N_3	327841	52167	275674	5.28

Interaction effect
There was no significant interaction found between the different date of transplanting and nitrogen levels in any growth attribute, cured leaf yield and economics.

Conclusion
In light of results obtained from the present investigation, it could be concluded that plant height, leaf length, leaf width, growth score, spangle score, cured leaf yield, gross realization, and net realization were found superior with transplanting date D_2 (10th September). In the case of nitrogen levels above all the parameters observed superior with nitrogen level N_3 (250 kg/ha). Therefore, Bidi tobacco should be transplanted from 10th September to 25th September and the crop should be fertilized with 250 kg N/ha (Nitrogen was applied in four equal splits; 1st as basal through Ammonium sulphate and the remaining three equal splits through Urea each at 30 days interval after transplanting).

Reference

1. Anonymous Annual Report, All India Network Project on Tobacco, CTRI, Rajahmundary; c2002-03. p. 38.
2. Anonymous. Annual Report, All India Network Project on Tobacco, CTRI, Rajahmundary; c2003-04. p. 165-166.
3. Anonymous Annual Report, Department of Agriculture, Cooperation and Farmer's Welfare, Gov. of India, 2019. Retrieved from http://eands. dacnet. nic.in.
4. Basha SJ, Bai PP, Krishna SK, Rao CC. Effect of nitrogen and topping on performance of bidi tobacco (*Nicotiana tabacum* L.) varieties under rainfed conditions. Annals of Plant and Soil Research.

2020;22(4):415-419.
5. Castelli F, Miceli F, Piro F. Effects of harvesting and curing method on tobacco (*Nicotiana tabacum* L.) Burley at different nitrogen fertilizer rates and plant population densities. *Rivista di Agronomia*. 1990;24(4):308-316.
6. Farrokh AR, Azizov I, Farrokh A, Esfahani M, Choubeh MR, Kavoosi M. Effect of nitrogen and potassium fertilizer on yield, quality and some quantitative parameters of flue-cured tobacco cv. K326. African Journal of Agricultural Research. 2012;7(17):2601-2608.
7. Garasiya VB, Tadvi SN, Bhadane RS, Chavda JC. Effect of planting date and chemical desuckring on sucker growth, yield and yield attributes of *bidi* tobacco (*Nicotina tabacum*). International journal of chemical studies. 2018;6(2):115-118.
8. Gediya KM. Effect of Spacing, Nitrogen and Phosphorus Levels on Seed and Oil Yield of Bidi Tobacco Variety A-119 (Doctoral dissertation, Anand Agricultural University; Anand); c2005.
9. Haghighi H, Daliri HS, Mobaser HR, Moosavi AA. Effect of different nitrogen and potassium fertilizer levels on quality and quantity yield of flue-cured tobacco (Coker 347). World applied sciences journal. 2011;15(7):941-946.
10. Ling KC, Wang CT. Use of plant growth regulators to improve the yield and quality of seed and leaf of flue-cured tobacco. Bulletin-of-theTaiwan-scarch-Institllte. 1975;2:1-8.
11. Marchetti R, Castelli F, Contillo R. Nitrogen requirements for flue Cured tobacco. Agronomy journal. 2006;98(3):666-674.
12. Patel JM. Effect of spacing and nitrogen levels on yield and quality of bidi tobacco varieties under rainfed condition (Doctoral dissertation, AAU, Anand); c1994.
13. Patel MR. Comparative performance of different varieties of bidi (*Nicotiana tabacum* L.) and rustica (*Nicotiana rustica* L.) Tobaccos at varying levels of nitrogen (Doctoral dissertation, AAU, Anand); c1991.
14. Prasadarao E, Rao DS, Anjaneyulu C, Sumathi V, Ravi V. Yield and quality of oriental tobacco as affected by time and patterns of planting. Tobacco research. 2002;28(2):152-5.
15. Rachman A. Effect of nitrogen rates on growth, yield and quality of Boyolali smoke-cured tobacco. Industrial Crops Research Journal. 1990;2(2):5-8.
16. Rathbone DK. Effect of nitrogen rate and cultivar on burley tobacco (*Nicotiana Tabacum* L.) yield and leaf quality (Doctoral dissertation, university of Tennessee at martin), 2008.
17. Sannibabu M, Krishnamurthy S, Rao MS. Studies on time of planting in FCV tobacco under northern light soil condition of Andhra Pradesh. Tobacco Research. 1986;12(1):68-71.
18. Singh DK, Jain KC. Alternative uses of tobacco. Alternative uses of tobacco; *c*2005.
19. Tadvi SN, Garasiya VB, Malek MZ, Chavda JC. Effect of planting date and chemical desuckring on morpho-physiological parameters and yield of *rustica* tobacco (*Nicotina rustica*). International journal of chemical studies. 2018;6(3):2451-2454.