

Influence of Nitrogen and Topping Levels on Yield and Quality of Bidi Tobacco Hybrid Varieties

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ABSTRACT

A field experiment was undertaken at Bidi Tobacco Research Station, Anand Agricultural University, Anand for three consecutive years *viz.*, 2017-18 to 2019-20 to study influence of nitrogen and topping levels on yield and quality of bidi tobacco hybrid varieties. The experiment was laid out in factorial randomized block design assigning two hybrid varieties, *i.e.* MRGTH 1 and GABTH 2, three nitrogen levels *i.e.* 140, 180 and 220 kg/ha and three topping levels, *i.e.* 18, 21 and 24 leaf stages with three replications. The data pooled over three years revealed that tobacco variety GABTH 2 recorded significantly the highest tobacco cured leaf yield (3700 kg/ha) with maximum net realization of ₹117433/ha and BCR value 3.06. Both the upper levels of 180 and 220 kg nitrogen/ha, being at par with each other produced significantly higher cured leaf yield of 3388 and 3407 kg/ha, respectively as compared to lower level of 140 kg nitrogen/ha. Topping levels were failed to exert their significant effect on tobacco cured leaf yield. Application of nitrogen @ 180 kg/ha gave maximum net realization of ₹102741/ha and BCR value of 2.81 as compared to lower level of 140 kg/ha whereas, tobacco crop topped at 21 leaves gave maximum net income of ₹105898/ha with 2.86 BCR. Tobacco varieties and nitrogen as well as topping levels had non-significant effect on leaf chemical constituents *i.e.* nicotine, reducing sugar and chloride contents. Wherein, only nicotine content was significantly changed due to tobacco varieties and different topping levels. Tobacco variety MRGTH 1 and topping level at 18 leaves gave significantly the highest nicotine content compared to others.

Key words: Bidi tobacco hybrid varieties, Nitrogen, Topping, Yield, Nicotine, Reducing sugar, Chloride and Economics

Introduction

Tobacco is a leading commercial crop valued for its leaf containing several important phyto-chemicals including nicotine. It contributes significantly to National Exchequer by way of excise collection and export earnings. In Gujarat, tobacco crop is grown in 1.58 million hectares with average annual production of 295 million kg (Anonymous, 2021). In Charotar area of middle Gujarat, only one *bidi* tobacco hybrid variety being grown is MRGTH 1 and hence there is a need to release more hybrid varieties having high productivity and leaf quality so as to

improve economic returns to the farmers. *Bidi* tobacco variety GABTH 2 with higher genetic potential for sandy loam soil was developed and released as a result of research efforts from Bidi Tobacco Research Station, Anand Agricultural University. To determine the expression of a newly released tobacco hybrid GABTH 2 in a given environment, agronomic evaluation becomes necessary. Introduction of newly released varieties made it imperative to work out their specific cultural requirement under a given set of conditions. Mainly two factors are influencing the growth and yield of tobacco crop *i.e.* nitrogen requirements and topping levels. Nitrogen

is the most important element and has a more pronounced effect on the growth, development and quality of *bidi* tobacco than other essential elements. Excessive or improper applications of nitrogen may affect the yield and quality of tobacco. Topping is the practice of removing flower head and the arrest of subsequent growth of auxiliary buds in tobacco cultivation results in higher yield and quality. Topping increases the size and weight of leaves, increasing the overall yield per hectare (Reed *et al.*, 2012 and Singh *et al.*, 1999). For improving yield and quality, topping is an essential practice but the time and schedule has to be developed for maximizing the benefits of topping. Hence, the present study was conducted to study agronomic evaluation of promising *bidi* tobacco (*Nicotiana tabacum* L.) hybrid varieties in Gujarat.

Materials and Methods

A field experiment was conducted at Bidi Tobacco Research Station, Anand Agricultural Research Station, Anand during 2017-18 to 2019-20 to study agronomic evaluation of promising *bidi* tobacco (*Nicotiana tabacum* L.) hybrid varieties in Gujarat. The total rainfall of 726.8, 937.2 and 1305 mm were recorded for the years 2017-18, 2018-19 and 2019-20, respectively compared to the region's normal rainfall of 862 mm. The experimental site falls in middle Gujarat agro-climatic zone III characterized by maximum temperature ranges from 26.0 to 40.6 °C and minimum temperature ranges from 10.3 to 28.4 °C. The soil of the experiment was loamy sand in texture and slightly alkaline in reaction (pH 7.48) with 0.51 % organic carbon, 68.78 kg/ha available phosphorus and 263.3 kg/ha available potassium. Treatments consisted of two tobacco hybrid varieties viz. MRGTH 1 and GABTH 2, three nitrogen levels viz. 140, 180 and 220 kg/ha and three topping levels 18, 21 and 24 leaf stage were tested in a factorial randomized block design with three replications. Forty five days old seedlings were planted at planting geometry of 90 x 75 cm during first fortnight of September during crop seasons in all three years. The crop was raised with assured irrigation using furrow method with recommended package of practices apart from the inputs applied as treatments. Nitrogen was applied in four equal splits as per treatments *i.e.* first split at time of planting through ammonium sulphate and remaining three splits through urea each at 30 days interval after

planting. The data were recorded for plant height, leaf length, leaf width and cured leaf yield at harvest. The leaf samples were used for estimating chemical quality constituents *viz.*, nicotine and reducing sugar contents (Harvey *et al.*, 1969) and chloride content (Murthy *et al.*, 1962). The data was statistically analyzed and results were pooled.

Results and Discussion

Varieties

The varieties failed to exert their significant effect on growth parameters *i.e.* leaf length, leaf width, plant height, leaf thickness as well as leaf quality parameters *i.e.* reducing sugar and chloride contents (Table 1). Similar genetic constitutions of the varieties might have contributed for uniformity in growth parameters and reducing sugar and chloride contents. Similar results were also reported by Gupta *et al.* (2014) and Jaffar Basha *et al.* (2018). There was a significant difference between the varieties with regard to cured leaf yield and nicotine content. Variety GABTH 2 increased cured leaf yield by 20% over variety MRGTH 1 and recorded significantly the highest tobacco cured leaf yield (3700 kg/ha) with net returns (₹117433/ha) and BCR value of 3.06 (Table 2). Whereas, significantly the highest nicotine content of 6.19% was observed in variety MRGTH 1.

Nitrogen levels

There were non - significant differences in growth parameters due to different nitrogen levels except leaf width. Application of 180 kg nitrogen/ha gave significantly higher leaf width closely followed by 220 kg nitrogen/ha. Cured leaf yield was signifi-



Overview of Experiment

cantly increased with increasing nitrogen levels from 140 to 220 kg/ha (Table 1). Both the upper levels 180 and 220 kg nitrogen/ha, being at par with each other produced significantly higher cured leaf yield of 3388 and 3407 kg/ha, respectively as compared to lower level of 140 kg nitrogen/ha. It might be due to greater availability of nitrogen and metabolites for growth and yield of the crop. These results collaborate with findings of earlier workers (Jaffar Basha *et al.*, 2020, Krishna Reddy *et al.*, 2016 and Gediya *et al.*, 2008). Quality parameters *viz.* nicotine, reducing sugar and chloride contents were not influenced significantly due to nitrogen levels. Similar results regards to nicotine content were also reported by Patel *et al.* (2003). However, maximum nicotine and minimum reducing sugar contents were observed with higher level of 220 kg nitrogen/ha. These results are also in conformity with the findings of Amanullah *et al.* (2008) and Kasturi Krishna *et al.* (2016). Application of 180 kg nitrogen/ha gave maximum net realization of ₹102741/ha and BCR value of 2.81 as compared to lower level of 140 kg/ha (Table 2).

Topping levels

Topping at 24 leaves gave significantly the tallest plants (94.71 cm) as compared to topping at 18 and 21 leaves, *i.e.* 77.49 and 88.44 cm height, respectively. These results are in agreement with the findings of Jaffar Basha *et al.*, 2020. Different topping levels failed to exert their significant effect on leaf size and dry weight per unit leaf (Table 1). Cured leaf yield did not differ due to different levels of topping. However, maximum cured leaf yield (3455 kg/ha) was recorded with topping at 21 leaf stage

Table 1.1 Interaction effect of tobacco hybrids and nitrogen levels on leaf length of *bidi* tobacco at harvest

Varieties Nitrogen levels	Leaf length (cm)		
	N ₁	N ₂	N ₃
V ₁	51.88	55.06	53.00
V ₂	54.84	55.51	56.33
S.Em. ±	0.54		
C.D.0.05	1.52		
C.V. %	5.2		

Table 1. Response of variety, nitrogen and topping levels on yield and growth parameters of *bidi* tobacco varieties (Pooled over 2017-18 to 2019-20)

Treatment	Cured Leaf Yield (kg/ha)	Leaf length (cm)	Leaf width (cm)	Plant height (cm)	Leaf thickness (mg/cm ²)	Nicotine Content (%)	Reducing sugar Content (%)	Chloride Content (%)
<i>A. Variety (V)</i>								
V ₁ : MRGTH 1	2977	53.31	23.31	89.61	12.54	6.19	5.21	1.04
V ₂ : GABTH 2	3700	55.56	24.38	84.15	12.90	5.98	5.31	1.02
S. Em. ±	47	0.68	0.71	1.12	0.36	0.04	0.05	0.02
C.D.0.05	131	NS	NS	NS	NS	0.11	NS	NS
<i>B. Nitrogen levels (N)</i>								
N ₁ : 140	3219	53.36	23.05	85.85	12.63	5.76	5.32	1.00
N ₂ : 180	3388	55.28	24.34	87.06	12.70	6.19	5.25	1.05
N ₃ : 220	3407	54.67	24.15	87.73	12.83	6.32	5.22	1.04
S. Em. ±	57	0.97	0.22	0.62	0.17	0.16	0.05	0.02
C.D.0.05	161	NS	0.61	NS	NS	NS	NS	NS
<i>C. Topping levels (T): Leaf stage</i>								
T ₁ : 18	3217	55.31	24.23	77.49	12.83	6.19	5.27	1.02
T ₂ : 21	3455	53.97	23.54	88.44	12.62	6.04	5.36	1.04
T ₃ : 24	3342	54.03	23.75	94.71	12.71	6.02	5.16	1.02
S. Em. ±	122	0.67	0.22	1.56	0.17	0.05	0.07	0.02
C.D.0.05	NS	NS	NS	6.13	NS	0.14	NS	NS
Int. (V x N)	NS	Sig.	NS	NS	NS	NS	NS	NS
V x T	NS	NS	NS	NS	NS	NS	NS	NS
N x T	NS	NS	NS	NS	NS	NS	NS	NS
V x N x T	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	12.6	5.2	6.7	5.2	9.9	5.9	3.9	7.1



Treatments comparison: $V_2N_2T_1$ v/s $V_2N_2T_3$



Treatments comparison: $V_2N_1T_3$ v/s $V_2N_3T_3$



Treatments comparison: $V_2N_3T_2$ v/s $V_1N_3T_1$

with maximum net realization of ₹105898 BCR value of 2.86 (Table 2). Nageswara Rao *et al.* (2003) showed results that topping at 18 and 16 leaves gave

higher cured leaf yield as compared to 14 leaves topping and no topping. Nicotine content differed significantly due to different topping levels. Topping at 18 leaves gave the highest nicotine content (6.19%) compared to 21 (6.04%) and 24 (6.02%) leaves topping. Earlier findings by Shahram and Hamid (2014) who investigated that topping at early growth stage enhanced tobacco leaf quality.

Interaction effect

Interaction effect of variety and nitrogen was found significant with respect to leaf length. Significantly maximum leaf length was recorded in treatment combination V_2N_3 (56.33 cm) compared to V_1N_1 (51.88 cm) and V_1N_3 (53.0 cm) treatment combinations (Table 1.1). Whereas, interaction effect between variety and topping, nitrogen and topping as well as variety, nitrogen and topping could not exert their significant effect on cured leaf yield, growth parameters and quality parameters of tobacco.

Conclusion

With respect to tobacco hybrids, it can be concluded that tobacco hybrid variety GABTH 2 topped at 21 leaves produced higher tobacco yield as compared to MRGTH 1. Application of 180 and 220 kg nitrogen/ha being at par with each other recorded higher tobacco yield as compared to 140 kg/ha.

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Table 2. Economics of different treatments (Pooled over 2017-18 to 2019-20)

Treatment	Gross income (₹/ha)	Cost of cultivation (₹/ha)	Net income (₹/ha)	BCR
A. Variety (V)				
V_1 : MRGTH 1	140263	56900	83363	2.46
V_2 : GABTH 2	174334	56900	117433	3.06
B. Nitrogen levels (N)				
N_1 : 140	151702	55740	95962	2.72
N_2 : 180	159642	56900	102741	2.81
N_3 : 220	160551	58060	102491	2.77
C. Topping levels (T): Leaf stage				
T_1 : 18	151605	56900	94705	2.67
T_2 : 21	162799	56900	105898	2.86
T_3 : 24	157491	56900	100590	2.77

Tobacco Price: 47.12 /kg

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