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Influence of planting date and chemical desuckering on morpho-physiological parameters, yield and quality of bidi tobacco varieties (*Nicotiana Tabacum L.*)

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Abstract

A field experiment to study the influence of planting date and chemical desuckering on morpho-physiological parameters, yield and quality of *bidi* tobacco varieties (*Nicotiana tabacum L.*) was carried out at Bidi Tobacco Research Station, Anand Agricultural University, Anand during the year 2016-17. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications comprising twelve treatment combinations of two varieties (GT 7 and GABT 11), two suckericides treatments (hand desuckering and pendimethalin @ 0.45 % + 2 % urea) and three transplanting dates (3rd week of August, 1st week of September and 3rd week of September). Physiological parameters like LAI and LAR were significantly higher in the variety GABT 11 at harvesting. Variety GABT 11 also recorded higher NAR and RGR at 135 DAT – harvesting stage. Cured leaf yield, harvest index, chlorophyll content and reducing sugar were maximum in the variety GABT 11. While, variety GT 7 recorded significantly lowest nicotine content and higher spangle score.

Keywords: tobacco, pendimethalin, LAI, LAR, NAR, RGR, cured leaf yield, nicotine, reducing sugar, SPAD chlorophyll value

Introduction

Tobacco is a coarse, large-leaved perennial crop that grows in warm climates and rich, well-drained soils. Tobacco is a product prepared from the leaves of the tobacco plant by curing them. It is a low-volume and a high value commercial crop, providing livelihood to millions of people. Tobacco cultivation, processing and manufacture are a source of employment to about 36 million people in the country. India occupies second place in tobacco production & exports. Gujarat state ranks second in area (1.58 lakh hectares) with a production of 278 million kg (Anon., 2013). Tobacco's defining feature for people is its nicotine, which makes up 2 to 7 percent of the leaf. In concentrated form, nicotine is used as an insecticide & drug and in small doses, imparts feelings of alertness and pleasure.

The major thrust area of tobacco research is to improve the productivity and quality in context to demand at national and international market. Since the area is limited, yield level per unit area has to be increased. The study of the physiology and physiological parameters of the *bidi* tobacco can help to increase the production and productivity of *bidi* tobacco. Yield being a complex character involves a number of morpho-physiological characters. It can be predicted on the basis of performance of yield components that these characters are genetically correlated with yield. Correlation between various characters is of great value as it indicates the degree to which various characters of a plant are associated with the economic productivity.

The transplanting date and varieties had significant effect on the growth and the cured leaf yield in *bidi* tobacco crop due to favourable environment at different growth stages which may increase photosynthetic rate, assimilates the supply for growth of a plant. These variances affect plant growth, development, yield and quality of the tobacco produce.

Materials and Methods

The present investigation entitled "Effect of planting date and chemical desuckering on morpho-physiological parameters, yield and quality of *bidi* tobacco varieties (*Nicotiana tabacum L.*)" was carried out at *Bidi* Tobacco Research Station, Anand Agricultural

University, Anand (Gujarat) during the year 2016-17. The field trial was laid out in FRBD with three replications. Two

tobacco improved varieties were selected for the research experiment *viz.*, GT-7 and GABT-11.

Table 1: Treatment combinations

Sr. No.	Treatment combinations	Treatments
T ₁	GT 7 + hand desuckering + 3 rd week of August planting	(V ₁ S ₁ D ₁)
T ₂	GT 7 + hand desuckering + 1 st week of September planting	(V ₁ S ₁ D ₂)
T ₃	GT 7 + hand desuckering + 3 rd week of September planting	(V ₁ S ₁ D ₃)
T ₄	GT 7 + pendimethalin @ 0.45 % + 2 % urea + 3 rd week of August planting	(V ₁ S ₂ D ₁)
T ₅	GT 7 + pendimethalin @ 0.45 % + 2 % urea + 1 st week of September planting	(V ₁ S ₂ D ₂)
T ₆	GT 7 + pendimethalin @ 0.45 % + 2 % urea + 3 rd week of September planting	(V ₁ S ₂ D ₃)
T ₇	GABT 11 + hand desuckering + 3 rd week of August planting	(V ₂ S ₁ D ₁)
T ₈	GABT 11 + hand desuckering + 1 st week of September planting	(V ₂ S ₁ D ₂)
T ₉	GABT 11 + hand desuckering + 3 rd week of September planting	(V ₂ S ₁ D ₃)
T ₁₀	GABT 11 + pendimethalin @ 0.45 % + 2 % urea + 3 rd week of August planting	(V ₂ S ₂ D ₁)
T ₁₁	GABT 11 + pendimethalin @ 0.45 % + 2 % urea + 1 st week of September planting	(V ₂ S ₂ D ₂)
T ₁₂	GABT 11 + pendimethalin @ 0.45 % + 2 % urea + 3 rd week of September planting	(V ₂ S ₂ D ₃)

Suckericide treatments

The tobacco plants were topped when they reached the button stage. After topping the buds in the axils of the leaves become active and there after suckers emerged in the axils of the leaves. These active lateral branches/suckers were removed by hand or by chemical desuckering before they become large enough to retard the development of leaves. These sucker were removed periodically. The process of removing these suckers commence after 6-7 days of topping operation and continued for 5-6 times. (Singh 2010).

Hand desuckering

Axillary suckers as well as ground suckers were removed by hand from the axil/base of the leaves.

Chemical desuckering

To avoid time consuming, laborious and more expensive process of hand desuckering, chemical desuckering was done.

Chemical suckericide, Pendimethalin @ 0.45% + 2% Urea (75 ml stomp 30% EC + 100 g urea dissolved in water and made final volume as five litre) was applied in the leaf axils just after topping to suppress the emergence of suckers. Urea increases the efficiency of chemicals which could be attributed to better retention at the point of application as urea might help in increasing the succulence of cells, resulting in better contact action of chemical suckericides (Patel *et al.*, 2004) [9].

Physiological parameters like Relative Growth Rate (RGR), Leaf Area Index (LAI), Leaf Area Ratio (LAR), Net Assimilation Rate (NAR), quality parameters like Nicotine content, Reducing sugar content, Spangle score, Chlorophyll content (SPAD value) and yield parameters like Cured leaf yield and Harvest Index (HI) were recorded.

Results & Discussion

Table 2: Effect of planting date and chemical desuckering on Physiological parameters at harvesting stage of growth in *bidi* tobacco varieties.

Treatments	135 DAT – Harvesting		Harvesting	
	RGR × 100 (g/g/day)	NAR X 1000 (g/cm ² /day)	LAI	LAR (cm ² / mg)
Varieties (V)				
GT 7 (V ₁)	0.053	0.007	3.70	68.34
GABT 11 (V ₂)	0.256	0.037	4.51	79.58
S. Em. ±	0.003	0.001	0.087	1.893
C. D. (P = 0.05)	0.010	0.002	0.255	5.553
Suckericides (S)				
Hand desuckering (S ₁)	0.165	0.020	3.94	73.78
Chemical desuckering (S ₂)	0.144	0.023	4.26	74.13
S. Em. ±	0.003	0.001	0.071	1.545
C. D. (P = 0.05)	0.008	0.002	0.208	NS
Transplanting date (D)				
3 rd week of August (D ₁)	0.164	0.023	4.09	73.40
1 st week of September (D ₂)	0.168	0.023	4.22	74.06
3 rd week of September (D ₃)	0.132	0.018	4.00	74.21
S. Em. ±	0.003	0.001	0.087	1.893
C. D. (P = 0.05)	NS	NS	NS	NS
Sig. Interactions	-	-	-	-
CV %	8.2	13.7	7.3	8.8

The data on physiological parameters are presented in Table 1. The variety GABT 11 had significantly highest relative growth rate (0.256 g/100g/day) and net assimilation rate (0.037g/1000cm²/day) at 135 DAT – harvesting as compared to variety GT 7. RGR depends upon the rate of increase of dry weight to the already present dry weight per day. Differences in RGR and NAR among the genotypes might be due to the

genetic characters to produce photosynthates at different production rate and dependence of NAR on rate of increase in dry weight as well as leaf area per plant between two growth stages which depends upon the different genetic constitution of genotypes. Similar trends observed by Chavda (1998) [2] in *bidi* tobacco. The hand desuckering treatment showed significantly higher RGR (0.165 g/100g/day) as compared to

chemical desuckering. But NAR was significantly highest in chemical suckericide treatment (0.023 g/1000cm²/day). This results might be due to the increased in the accumulation of dry matter and leaf area by chemical suckericide treatments as compared to hand desuckering.

The variety GABT 11 recorded significantly highest LAI (4.51) and LAR (79.58 cm²mg⁻¹) at harvesting stage as compared to GT 7. LAI depend upon leaf area of the plant in different varieties. LAR is the leaf area per unit dry weight and is an indicator of photosynthetic capacity per unit of respiring and growing tissues. Similar trend of LAI was also reported by Dobhal and Monga (1993) [4], Chavda (1998) [2] and Singh *et al.* (1999). Pendimethalin @ 0.45% + 2% Urea recorded highest LAI (4.26) and LAR (74.13 cm²mg⁻¹) at harvesting as compared to hand desuckering. Chemical suckericide treatment divert the photosynthates to vegetative plant parts by suppressing the sucker growth and increased the leaf area of the plant, which resulted in the higher LAI. Transplanting dates had non-significant effect for RGR, NAR, LAI and LAR.

The variety GABT 11 had significantly highest nicotine content (5.68 %), reducing sugar (3.77 %) and SPAD value (54.49) as compared to variety GT 7. The varietal differences in nicotine content might be due to genetically efficient and the dilution effect of the alkaloid in higher cured leaf yield. Similar results were observed by Patel (1987) [13], Chavda (1998) [2], Patel and Kingaonkar (2006) [8], Hussain and Nanjappa (2007) [5] and Patel (2013) [12] in *bidi* tobacco. Syed *et al.* (2008) [17] found that plant varieties of tobacco having higher yield contained low nicotine and high reducing sugar as compared to low yielding varieties. Suckericide treatments had non-significant effect on the nicotine content and SPAD value. But significantly higher reducing sugar (3.81%) was recorded in pendimethalin @ 0.45 % + 2 % urea. Similar trend of results were also reported by Patel *et al.* (1992) [10], PullaRao *et al.* (1993) [14] and Patel *et al.* (2004) [9] in *Nicotiana tabacum*. The variation in chlorophyll content due

to chemical suckericide treatments may be attributed to decreased chlorophyll degradation and increased chlorophyll synthesis. The delay in leaf senescence could also be attributed to higher chlorophyll content. These results are in the accordance with Interlandi *et al.* (2002) [6] and Tremola *et al.* (2002) [6] in Italian style burley tobacco. The transplanting date D₂ recorded significantly highest chlorophyll content (51.91). The variety GT 7 had significantly the highest spangle score (3.53) as compared to variety GABT 11 (2.72). Similar trend was also noted by Patel (1987) [13] and Chavda (1998) [2] in different *bidi* tobacco varieties. The higher spangle score (3.25) was recorded in pendimethalin @ 0.45 % + 2 % urea.

The variety GABT 11 had the highest harvest index (53.52%). Harvest index represent the efficient translocation of photosynthates to economical plant parts as compared to other plant parts. Chavda (1998) [2] found that harvest index was varied different cultivars of *bidi* tobacco. The harvest index was not significantly influenced by suckericidal treatments and transplanting date.

The variety GABT 11 gave significantly highest cured leaf yield (2880 kg/ha) as compared to GT 7 (2011 kg/ha). These results are in the accordance with Syed *et al.* (2008) [17], Syed *et al.* (2009) [16] and Patel (2013) [12] in *Nicotiana tabacum* varieties. Chemical suckericide treatment pendimethalin @ 0.45% + 2% urea significantly increased the cured leaf yield (2605 kg/ha). Due to suppression of axillary and ground suckers by chemical suckericide, produced photosynthates transferred to vegetative plant parts mostly in the leaves. Another reason for increased leaf dry matter due to chemical suckericide treatments may be ascribed to higher leaf length and breadth and thereby leaf area as well as thickness of leaves. These results are in accordance with the results obtained by Patel *et al.* (2004) [9], Chavda *et al.* (2007) [3] and Jehan *et al.* (2007) [7] in *Nicotiana tabacum*. The transplanting date D₂ (1st week of September) recorded significantly highest cured leaf yield (2540 kg/ha).

Table 3: Effect of planting date and chemical desuckering on quality and yield parameters at harvesting stage of growth in *bidi* tobacco varieties.

Treatments	Nicotine content (%)	Reducing sugars (%)	Spangle score (0-5)	Chlorophyll content (SPAD value)	Harvest index (%)	Cured leaf yield (kg/ha)
Varieties (V)						
GT 7 (V ₁)	5.27	3.61	3.53	46.62	52.40	2011
GABT11 (V ₂)	5.68	3.77	2.72	54.49	53.52	2880
S. Em. ±	0.077	0.051	0.068	0.789	1.934	63.0
C. D. (P = 0.05)	0.225	0.151	0.200	2.315	NS	184.60
Suckericides (S)						
Hand desuckering (S ₁)	5.39	3.57	3.01	49.77	52.38	2286
Chemical desuckering (S ₂)	5.56	3.81	3.25	51.33	53.54	2605
S. Em. ±	0.062	0.042	0.055	0.644	1.529	51.44
C. D. (P = 0.05)	NS	0.123	0.163	NS	NS	150.93
Transplanting date (D)						
3 rd week of August (D ₁)	5.34	3.73	3.16	48.3	52.91	2513
1 st week of September (D ₂)	5.62	3.74	3.20	51.91	53.28	2540
3 rd week of September (D ₃)	5.46	3.60	3.01	51.45	52.68	2282
S. Em. ±	0.077	0.051	0.068	0.789	1.934	63.03
C. D. (P = 0.05)	NS	NS	NS	2.315	NS	184.86
Sig. Interactions	-	-	-	-	-	V × D
CV %	4.9	4.8	7.5	5.4	12.6	8.9

Conclusion

The results indicated that the varieties, suckericide treatments and transplanting dates played an effective role in vegetative growth, development and yield attributing characters as well as quality of *bidi* tobacco. Variety GABT 11 was found

superior for most of the growth and physiological parameters and there by cured leaf yield as compared to variety GT 7. The application of chemical suckericide pendimethalin @ 0.45 % + urea 2 % was found most efficient for improving the morpho- physiological parameters and thereby, increased the

cured leaf yield without impairing the quality of the produce. On the basis of research finding, it can be concluded that variety GABT 11 should be transplanted in 1st week of September and chemically desuckered with pendimethalin @ 0.45 % + urea 2 % for obtaining higher yield over hand desuckering in *bidi* tobacco crop.

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