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CONTENTS

Studies on sucker control in natu tobacco (*Nicotiana tabacum* L.) under rainfed vertisols

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ABSTRACT: A field experiment was undertaken at Regional Agriculture Research Station, Nandyal, Andhra Pradesh for two consecutive years *viz*., 2018-19 and 2019-20 on rainfed vertisols to evaluate the suitable and economical method of sucker control in natu tobacco for higher cured leaf yield, leaf quality and net income. The treatments consisted of two topping stages as first factor and four sucker control methods as second factor in factorial randomized block design with three replications. The data pooled over two seasons revealed that topping stage did not significantly influence data on ground as well as auxillary suckers per plant. Significantly lower number of ground suckers per plant (1.7), fresh weight of ground suckers per plant (24.3 g), dry weight of ground suckers per plant (5.0 g), number of auxillary suckers per plant (2.5), fresh weight of ground suckers per plant (20.6 g), dry weight of ground suckers per plant (3.6 g), higher leaf length (53.7 cm), leaf width (18.3 cm), leaf area index (1.35), cured leaf yield (2213 kg ha^{-1}), net returns (Rs 90,717 ha^{-1}) with BCR of 2.70 were observed with application of fatty alcohol @ 5 %. Interaction of application of fatty alcohol @ 5 % at flowering stage recorded higher cured leaf yield (2282 kg ha^{-1}). Different treatments did not influence leaf chemical constituents (nicotine, reducing sugars and chlorides) and are in permissible limits.

Key words*:* Cured leaf yield, leaf quality, Natu tobacco, suckericide, topping stage

Natu tobacco (*Nicotiana tabacum* L.) seedlings (45-60 days old) were transplanted during late rainy season *i.e.,* September (2nd fortnight) under rainfed vertisols. Topping (removal of the flowering head and young leaves) is an essential cultivating measure for air-cured tobacco, which switches the plant from reproductive to vegetative phase (Gooden *et al.,* 2011). Topping increases the size and weight of leaves, increasing the overall yield per hectare (Reed *et al.,* 2012). Topping stage of tobacco is a key time for development of agricultural measures to promote the quality of leaves. Topping stimulates the production of secondary plant products that accumulate in the leaves. These products give the cured leaf improved quality and smoking characteristics. Topping is a turning point for nicotine formation and accumulation inside tobacco plant (Guo *et al.,* 2011). Topping of tobacco not only increases the yield but also improves the quality of cured leaf (Krishna *et al.,* 2012). Although tobacco plants are typically topped either by hand or mechanically, topping may be accomplished chemically before the emergence of the button and opening of any flowers. Chemical topping would appear to be the ideal method for eliminating the production of excess leaves and the top which will flower. Chemical topping of plants in the pre button stage eliminates the production of excess leaves and tops which are discarded and do not add to cured leaf yield of cured leaf. Leaf body can be increased by early chemical topping and redirection of these plant resources. There is need to find out suitable and economical method of sucker control in popularly grown natu tobacco variety. As well as sucker control in tobacco is important for increasing yield and improving quality of the produce. The proper methods for topping and de-suckering are such functions which help to improve production of tobacco crop. Topping is the path way for suckers because after topping the leaves in the axil which remains dormant becomes active and put forth shoots which known as suckers. The process of removal suckers from the leaf axil is called de-suckering. After topping suckers also compete for nutrients, light, moisture and space. Tobacco suckers not only influence plants essential nutrients but also provide shelter for insects, pests and disease. Suckers growth efficiency is higher than tobacco leaves. The intra-plant completion takes place which ultimately affect the yield of tobacco crop. The plant has the ability to produce three suckers in each axils of leaves. To get plant free from suckers during crop life span mostly 4-5 times de-suckering is required. Topping and de-suckering in tobacco crop enhance yield per hectare. Manually removal of suckers from tobacco plant is requiring considerable time and a lot of labor effort. Tobacco plants free of suckers would of economics importance. The sucker control in tobacco is must for increasing yield and improving quality of the produce. Suckers are developed from the leaf axil just after topping

of tobacco plants. These unwanted suckers compete for food, light, moisture and space. These suckers should be removed by hand or by chemical de-suckering before they become large enough to retard the development of the leaves. To reap maximum benefit, suckers should be removed periodically. Patel *et al.* (2004) observed that leaf chemical constituents *viz.,* nicotine and reducing sugar contents were not significantly changed by different concentration of pendimethalin in *bidi* tobacco. Hussain and Nanjappa (2007) conducted an experiment on *bidi* tobacco and reported that plants having higher leaf area index, leaf dry weight, stem dry weight and total dry weight resulted in higher cured leaf yield. The process of removal of suckers commences after 6-7 days of topping operation and it will continue for 2-3 times for effective results (Singh, 2010). The widely used practice of hand desuckering shares about 6 to 8 per cent of the cost of natu tobacco production. At present manual desuckering is in vogue which is tedious and time consuming due to non-availability of labour. Results of previous researches indicate that good numbers of suckericides, both systemic and contact types *viz.,* pendimethalin, decanol, royalten, neem oil and khudaband are effective for the management of suckers. Fugen *et al*. (2012) studied the effect of different suckericides on economic characteristics and intrinsic quality of tobacco. They concluded that tobacco botany characters *i.e.,* plant height and whole plant leaf area after application of suckericides were better than control. Proper sucker control is necessary to reap the benefit of topping (Srinivasulu *et al.,* 2013). Samin *et al*., (2015) concluded that pendimethalin alone or in combined with other suckericides increased leaf area, fresh weight of leafs, cured weight of leaves and also leaf yield. Therefore, the objective of this research is to understand the influence of topping stage and chemical suckericide concentration on quality in tobacco by stalk cut under rainfed condition.

MATERIALS AND METHODS

The present investigation was undertaken at Regional Agriculture Research Station, Nandyal, Andhra Pradesh for two consecutive years *viz.,* 2018-19 and 2019-20 on under rainfed vertisols to evaluate the suitable and economical method of sucker control in natu tobacco for higher cured leaf yield, quality and net income. The treatments consisted of two topping stages (button stage and flowering stage) as first factor and four sucker control methods (manual, fatty alcohol 4%, 5% and 6%) as second factor in factorial randomized block design with three replications. The soil of experimental site was medium deep black, moderately alkaline (pH-8.2), non saline (EC-0.11 ds m^{-1}), low in nitrogen (152.3 kg ha^{-1}), medium in available P_2O_5 (32.5 kg ha^{-1}) and high in available K_2O (350.9 kg ha^{-1}). 40 N + 50 P_2O_5 + 50 K_2O were applied through ammonium sulphate for nitrogen, single superphosphate for phosphorus and sulphate of potash for potassium. Half of the nitrogen, total phosphorus and total potassium were applied as basal and remaining half was applied as top dressing within 30-40 days after planting. An amount of 217.2 mm rainfall was received in 20 rainy days with 65.8 % deficit compared to normal during 2018 whereas 856.0 mm rainfall was received in 39 rain days with 45.1% excess rainfall during 2019. Crop management practices like land preparation, weed control, intercultivation, need based plant protection and sun curing were followed as recommended for local area. The data were recorded on ground and auxillary suckers number, fresh and dry weight, plant height, leaf length, leaf width, cured leaf yield. The leaf samples were used for estimating chemical quality constituents *viz.,* nicotine, reducing sugars (Harvey *et al*., 1969) and chlorides (Hanumantha *et al*., 1980). The data gathered in each observation were statistically evaluated critical difference for at 5% level of probability to assess the significance of treatment means using analysis of variance technique (Panse and Sukhatme, 1985).

RESULTS AND DISCUSSION

Topping stage did not significantly influence data on ground as well as auxillary suckers per plant (Table 1). The stage of topping did not show significant variations on yield and yield attributes (Chavda *et al.,* 2007). Significantly lower number of ground suckers per plant (1.7), fresh weight of ground suckers per plant (24.3 g), dry weight of ground suckers per plant (5.0 g), number of auxillary suckers/plant (2.5), fresh weight of ground suckers per plant (20.6 g), dry weight of ground suckers per plant (3.6 g), higher leaf length (53.7 cm), leaf width (18.3 cm), leaf area index (1.35), cured leaf yield (2213 kg ha^{-1}), net returns (Rs 90,717 ha^{-1}) with BCR of 2.70 were observed with application of fatty alcohol @ 5 % (Table 1 and 3). Manual suckering recorded higher number of ground suckers per plant (4.0), fresh weight of ground suckers per plant (54.3 g), dry weight of ground suckers per plant (12.2 g), number of auxillary suckers/plant (6.9), fresh weight of ground suckers per plant (63.4 g), dry weight of ground suckers per plant (10.7 g), lower leaf length (49.0 cm), leaf width (16.7 cm), leaf area index (1.12), cured leaf yield (1832 kg ha^{-1}), net returns (Rs 64,005 ha^{-1}) with BCR of 2.16. Different treatments did not influence leaf chemical constituents (nicotine, reducing sugars and chlorides) and are in permissible limits. In general natu tobacco leaf has nicotine of 2.2 – 3.7 %, reducing sugars of 2.5 – 3.9% and chlorides of 0.9 – 1.6

Table 1: Effect of topping stage and suckericide on sucker control, growth parameters and cured leaf yield of natu tobacco

Treatments	Ground suckers plant^{-1}			Auxillary suckers plant^{-1}			Plant height (cm)	Leaf length (cm)	Leaf width (cm)	LAI	Cured leaf yield (kg ha^{-1})
	Number	Fresh wt (gm)	Dry wt (gm)	Number	Fresh wt (gm)	Dry wt (gm)					
Topping Stage											
Button stage	2.7	36.8	7.3	4.3	36.0	6.2	53.7	51.5	17.2	1.21	1993
Flowering Stage	2.6	35.9	7.7	3.9	34.9	6.0	56.0	51.2	17.3	1.21	2069
S.Em±	0.2	3.2	0.6	0.2	1.9	0.3	1.14	0.67	0.28	0.02	52
CD @ 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Suckericide											
Manual	4.0	54.3	12.2	6.9	63.4	10.7	54.5	49.0	16.7	1.12	1832
Fatty alcohol 4%	2.1	29.3	5.9	3.1	26.4	4.5	55.5	52.5	17.7	1.27	2102
Fatty alcohol 5%	1.7	24.3	5.0	2.5	20.6	3.6	54.6	53.7	18.3	1.35	2213
Fatty alcohol 6%	2.6	37.8	7.2	3.9	31.6	5.5	54.7	50.3	16.3	1.12	1977
S.Em±	0.3	4.6	0.8	0.3	2.6	0.4	1.65	0.91	0.38	0.03	72.9
CD @ 5%	1.0	14.0	2.4	0.8	8.1	1.3	NS	2.8	1.1	0.09	222
Interactions	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	8.7	8.7	9.3	8.9	10.5	11.1	7.7	7.9	8.0	8.3	12.3

%. The reason for higher growth and yield parameters could be the full utilization of plant nutrients by the leaves in chemical de-suckering. The chemical de-suckering controls suckers effectively when compared to manual de-suckering. Increasing suckericide content resulted in better cover of plant and reducing new suckers growth. Maximum leaf area and leaf yield were obtained from the plots treated with suckericides in comparison with manual desuckering. Qahar *et al.* (2006) observed that application of suckericides increased leaf area of tobacco. Bakht *et al.* (2007) concluded that suckericides reduced sucker weight per plant as compared with manual desuckering as chemical desuckering effectively increased yield and yield contributing traits in tobacco. The application of suckercides control suckers better than manual control (Bakht *et al.,* 2007). Topping stage of tobacco is a key time for development of agricultural measures to promote the quality of leaves (Reed *et al.,* 2012). Topping- without suckering treatment reduced the yields by 8.2% in cured leaf and 10.3% in bright leaf. This is due to increased production of suckers with topping and no suckering. Topping at early growth stage and controlling sucker

Table 2: Interaction effect of topping stage and suckericide on cured leaf yield (kg ha^{-1}) of natu tobacco

Topping stage	Suckericide				Mean
	Manual	Fatty alcohol 4 %	Fatty alcohol 5 %	Fatty alcohol 6 %	
Button stage	1798	2058	2143	1975	1993
Flowering stage	1867	2147	2282	1978	2069
Mean	1832	2102	2213	1977	
	S.Em±	CD @ 5%			
Topping stage	51.6	NS			
Suckericide	72.9	222			
Interaction	103.1	NS			

Table 3: Effect of topping stage and suckericide on leaf chemical constituents and economics of natu tobacco

Treatments	Nicotine (%)	Reducing Sugars (%)	Chlorides (%)	Gross returns (Rs ha^{-1})	Net Returns (Rs ha^{-1})	BCR
Topping Stage						
Button stage	2.82	3.21	1.18	129552	75414	2.39
Flowering Stage	2.66	3.31	1.08	134454	80316	2.48
S.Em±	0.28	0.16	0.09			
CD @ 5%	NS	NS	NS			
Suckericide						
Manual	3.09	2.95	1.06	119080	64005	2.16
Fatty alcohol 4%	2.56	3.66	1.08	136631	84056	2.60
Fatty alcohol 5%	2.57	3.12	1.09	143842	90717	2.70
Fatty alcohol 6%	2.74	3.31	1.31	128457	74782	2.39
S.Em±	0.41	0.22	0.13			
CD @ 5%	NS	NS	NS			
Interactions	NS	NS	NS			
CV (%)	9.2	9.7	10.2			

growth with using suckericide enhanced tobacco leaf quality (Shahram and Hamid, 2014). Suckericides gave higher values for all yield contributing traits (Aaqil *et al.,* 2017). Interaction of application of fatty alcohol @ 5 % at flowering stage recorded higher cured leaf yield (2282 kg ha^{-1}) (Table 2). Significantly lower cured leaf yield (1798 kg ha^{-1}) was recorded with topping at button stage with manual de-suckering.

CONCLUSION

It may be concluded from the results that, suckers could be profitably controlled with application of fatty alcohol @ 5 % either at button or flowering stage for higher cured leaf yield without affecting the leaf quality in natu tobacco.

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