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Influence of Topping Stages and Levels on Chemical Characteristics of Flue-cured Virginia Tobacco

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Abstract

Topping stages and levels had a significant effect on the chemical composition of flue-cured virginia. Plants topped at button stage produced desirable chemical characteristics as indicated by their moderately high total nitrogen (2.06%), highest nicotine (2.07%) and potash (2.70%) contents and lowest chloride (2.71%) and reducing sugar (11.72%) contents. Plants topped at 16 leaves level also produced desirable chemical characteristics, having lowest total nitrogen (1.95%), chloride (2.73%) and reducing sugar (11.72%) contents and highest nicotine (1.98%) and potash (2.67%) contents respectively. Topping beyond button stage and above 16 leaves level resulted in undesirable chemical characteristics.

Introduction

Tobacco is a major cash crop of Pakistan. In addition to providing employment opportunities to farmers, laborers and traders, it earns over Rs. 14158 million as Central Excise Duty (Anonymous, 1996).

More than 90 percent of Flue-cured virginia (FCV) tobacco is grown in N.W.F.P. (Shah and Hussain, 1991) where among many factors topping at inappropriate stage and level is responsible for undesirable chemical characteristics of tobacco leaf. Marshal and Heinz (1969) observed reduced percent total alkaloids and total nitrogen for delayed topping. Foliar nicotine content increased for reduced leaves per plant (Gomez and Borov, 1982). Lamarre and Kozumplik (1983) documented improved quality by reducing topping height from 19 to 16 leaves. Higher topping reduced nicotine and increased sugar content (Chen and Chen, 1985).

Keeping in view these considerations a field experiment was run with the objectives to assess the effectiveness of various topping stages and levels against chemical characteristics of FCV tobacco and identify an optimum topping stage and level for desirable chemical characteristics.

Materials and Methods

Three topping stages i.e. button, 50 percent flowering and 100 percent flowering and levels viz; 16, 20 and 24 leaves left on plant, were tested for their effect on chemical characteristics of FCV tobacco at Malahadher Research Farm, N.W.F.P. Agricultural University Peshawar. The cultivar used was Speight G-117. The field was thoroughly prepared and recommended doses of fertilizer were applied at the time of ridge making. Transplantation was done in March, 1998 in plots measuring 3.1 x 7.8 m² in randomized complete block design with split plot arrangement and three replications. Topping stages were allotted to main plots whereas, topping levels were randomized in subplots. Normal practice for interculture and insect-pest control was

followed. The physico-chemical characteristics of the soil and meteorological data of experimental site are shown in Table 1.

Table 1: Physico-chemical Characteristics of Soil and Meteorological Data of Experimental Site

Characteristics	Values
Nitrogen %	0.09
Potash ppm	170.00
Available Phosphorus ppm	15.00
Soil pH	7.40
Texture	Silty Clay Loam
Mean annual min. temp. °C	13.00
Mean annual max. temp. °C	31.00
Av. annual ppt. mm	745.00

All mature leaves from ten randomly selected plants were picked in five subsequent pickings from each treatment, cured separately, sundried, ground and subjected to chemical analysis. All the analysis were made in triplicate. The percentage of chemical constituents were calculated on moisture free basis. The samples were analyzed for total nitrogen, nicotine, chloride, potash and reducing sugar. Total nitrogen was determined by the micro-kjeldahl method according to AOAC (1970). Nicotine was determined by nicotesta using perchloric acid solution in glacial acetic acid. Chloride analysis was carried by the wet washing method of Chapman and Prett (1961). Potash was determined in accordance with the method described in AOAC (1970). Reducing sugar was estimated by Lane and Eynon method as described in Chemistry and Technology of tobacco by Shmuk (1953). The data were statistically analyzed and means were compared by using Least Significant Difference Test (LSD).

Results and Discussion

Total Nitrogen: Topping stages significantly affected nitrogen content (Table 2). Maximum (2.06%) total nitrogen

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was recorded for plants topped at button stage, while lowest value of 1.91 percent total nitrogen was recorded for plants topped at 100 percent flowering stage. Delay in topping accelerated nitrogen utilization by flower formation resulting in decreased leaf nitrogen. Marshal and Heinz (1969) also reported low total nitrogen for delayed topping.

Topping levels also significantly affected total nitrogen. Plants topped at 24 leaves level had maximum (2.01%) total nitrogen while minimum (1.95%) total nitrogen was recorded for plants topped at 16 leaves level. Topping forced nitrogen materials to fewer leaves for further growth and nourishment resulting in increased total leaf nitrogen. Identical results were reported by Hanmer *et al.* (1940).

Nicotine: Nicotine percentage was significantly influenced by topping stages (Table 2). Maximum nicotine percentage of 2.07 was produced by plants topped at button stage whereas, minimum (1.82) nicotine percentage was produced by plants topped at 100 percent flowering stage. Nicotine is produced in root tips and early topping enlarged root system which ultimately raised nicotine content. The results are in line with those of Donev (1963).

The response of nicotine percentage to topping levels, was also significant. Maximum (1.98) nicotine percentage was obtained from plants topped at 16 leaves level while minimum (1.92) nicotine percentage was documented for plants topped at 24 leaves level. Reducing number of leaves probably enlarged root system thus enhanced nicotine production. Similar results were reported by Gomez and Borov (1982) who claimed increasing nicotine content with reducing number of leaves per plant.

Chloride: The data given in Table 2 illustrate that topping stages significantly influenced chloride percentage. Highest chloride percentage of 2.79 was recorded in plants topped at 100 percent flowering stage while lowest chloride percentage of 2.71 was observed in plants topped at button stage. Chloride content of leaves decreased with an increase in nitrogen, phosphorus and potassium (NPK) absorption resulting from early topping. Ali *et al.* (1977) also reported identical findings.

Topping levels also significantly influenced chloride percentage. Highest (2.77) chloride percentage was noted in plants topped at 24 leaves level whereas, lowest (2.73) chloride percentage was documented for plants topped at 16 leaves level. Lesser leaves enhanced rapid NPK uptake by roots and as chloride content was inversely proportional to NPK contents its percentage decreased. The results agree with those of Ali *et al.* (1977).

Potash: The data in Table 2 revealed that percent potash varied significantly for topping stages from as high as 2.70 percent for topping at button stage to as low as 2.58 percent for topping at 100 percent flowering. Early topping promoted higher nutrient uptake by roots and as soil

Potassium was high so its percentage increased. Ali *et al.* (1977) also observed increased percent leaf potash with higher dose of potassium application.

Table 2: Total Nitrogen, Nicotine, Chloride, Potash and Reducing Sugar. Contents as Affected by Various Topping Stages and Levels in FCV Tobacco

Topping Stage	Topping levels			
	16	20	24	Mean

	Per cent Nitrogen			
Button Stage	1.99	2.06	2.12	0.06a
50% Flowering Stage	1.98	1.99	1.98	1.98b
100% Flowering Stage	1.89	1.90	1.97	1.91c
Mean	1.95b	1.98ab	2.01a	
	Per cent Nicotine			
Button Stage	2.12	2.08	2.02	2.07a
50% Flowering Stage	1.97	1.96	1.94	1.96b
100% Flowering Stage	1.84	1.82	1.80	1.82c
Mean	1.98a	1.95ab	1.92b	
	Per cent Chloride			
Button Stage	2.69	2.71	2.73	2.71c
50% Flowering Stage	2.74	2.75	2.77	2.75b
100% Flowering Stage	2.77	2.78	2.81	2.79a
Mean	2.73c	2.75b	2.77a	
	Per cent Potash			
Button Stage	2.77	2.73	2.65	2.70a
50% Flowering Stage	2.72	2.69	2.66	2.69a
100% Flowering Stage	2.53	2.57	2.64	2.58b
Mean	2.76a	2.66a	2.64b	
	Per cent Reducing Sugar			
Button Stage	11.33	11.45	12.39	11.72b
50% Flowering Stage	12.91	13.16	13.36	13.14a
100% Flowering Stage	12.90	13.22	13.44	13.19a
Mean	12.38 b	12.61ab	13.06a	

Means followed by different letters differ significantly at 5% level of probability using LSD Test

Per cent potash also varied significantly for topping levels. Highest (2.67) percent potash was documented for plants topped at 16 leaves level while lowest (2.64) percent potash was observed for plants topped at 24 leaves level. Potash percentage decreased from bottom to top and since, most of the upper leaves were removed for 16 leaves level, the remaining leaves showed high potash percentage. Akehurst (1968) also observed decreasing potassium from bottom to top.

Reducing Sugar: The response of percent reducing sugar to topping stages was significant. Maximum (13.19) percent reducing sugar was produced by plants topped at 100 percent flowering stage, while minimum

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(11.72) percent reducing sugar was produced by plants topped at button stage. Decrease in percent reducing sugar occurred simultaneously with increased NPK uptake resulting from early topping. The results are in harmony with that of Breland *et al.* (1959).

Topping levels also significantly affected percent reducing sugar. It varied from highest (13.06%) for plants topped at 24 leaves level to lowest (12.38%) for plants topped at 16 leaves level. Low topping increased nicotine content resulting in decreased sugar content. These results agree with those of Chen and Chen (1985).

These results led to the conclusion that plants topped at button stage and 16 leaves level proved their superiority to others in producing leaves of desirable chemical characteristics. Therefore they are recommended to enhance quality FCV tobacco production.

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