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RESEARCH ARTICLE

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EFFECTS OF HEIGHT OF TOPPING ON THE YIELD AND QUALITY OF K-110 TOBACCO VARIETY

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ABSTRACT

Field experiment was conducted using tobacco cultivar K-110 in June, 2014 and October, 2014 cropping season at Bilatte leaf development farm, southern Ethiopia. The aim of study was to identify the optimum number of leaves per plant, higher leaves yield and quality that promote green leaves production in tobacco. The treatments consisted of six toping height levels; topping at 14, 16, 18, 20, 22 leaves and control (no plants without topping).The results revealed that the tobacco yield and plant height more than topped at 20, 22, 24 and untopped tobacco. Leaf length and width tended to increase with lower topping 14- 20 leaves. Increased nicotine content in leaves topping at 24 leaves and untopped than any topped tobacco. The reducing sugar and nitrogen for the combined samples tended to give the highest for lower and mid topped tobacco 14- 18 leaves. Nitrogen/nicotine ratio tended to increase with lower and mid topped at 16- 18 leaves. Lower and mid topped (14- 20) leaves topped resulted in desirable chemical characteristic an acceptable range.

Keywords: Flue cured tobacco, Green leaves, Tobacco height, Yields

INTRODUCTION

A large-scale tobacco production in the country has solely owned by the National Tobacco Enterprises (Ethiopia) S.C has been operational in the country for more than 50 years. It has been producing tobacco around ShewaRobit, Bilatte, Hawassa and Wolaita to supply its leaf processing plants and furnishes the cigarette making factory in Addis Ababa. The production and productivity of tobacco has never been improved since the tobacco production began. This was attributed to the heavy reliance on traditional production practices required production technologies. This lack of access for improved current production technologies from domestic sources has been forcing the enterprise to depend on foreign generated technologies [1, 2]

When the flower buds of tobacco begin to appear, these flower heads should be removed or "topped" to stop seed formation, the plant to focus on leaf production only. This topping is preformed, to produce mature, uniform, larger, thicker, darker leaves and contain more nicotine. Topping of plants also stimulates the growth of secondary stems from the base and/or leaf axils [3]. Topping may be done by hand or with special machines and requires two or three trips over the field to cover all the plants.

The correct time for tobacco topping is when; the plants reach about 40 to 50 percent of the elongated button stage of flowering or soon after the flowers begin to appear, will maximize yield and quality. The topped plants can be left un- topped or can be topped will exert more energy into flower and seed production rather than leaf production and substantial yield losses can occur. Early topping reduces the populations of insects such as aphids and budworms that are attracted to the terminal bud and flower. Besides this, early topping is much easier than later topping as stalk tissue is softer and much easier to break. Experiment conducted on the height of marked topped flue-cured tobacco which resulted in early improvement of leaves quality, significant increment of leaf area and their " body" as well as nicotine content [4]. At Bilatte tobacco farm, the effect of different topped height on growth; yield and quality of tobacco, no work has been done or remains undefined. Keeping in view this consideration a field experiment was done with the objective to assess the effectiveness of various topping stages for desirable chemical and physical characteristics of K-110 tobacco variety.

MATERIALS AND METHODS

Experimental description

The trial was set up in June and October, the wet and dry cropping season to determine effect of topped height on the yield and quality of K-110 tobacco variety at Bilatte leaf development research site. The experiment was laid out in complete block design (RCBD) in triplicates, spacing between plants and rows of 55×110cm respectively with plot size of 18.15 m2(10 plants /row). Six topping levels: 14, 16, 18, 20, 22, 24 and control were tested for their effect on growth characteristic, yield and quality of FCV K-110 tobacco.

Physical determination

Green leaves yield per plot (kg/plot) was estimated by determining the weighting of all collected green leaves from each plot. The leaf length, width and stem diameter, were measured from lower, middle and top leaves with help of measuring tape from the selected five plants . Numbers of leaves were determined by counting the leaves per plant, in selected five samples

Quality analysis

For quality analysis on leaves composite samples taken from each topping height and control plot cured leaves sent to National Tobacco Enterprise Sahre Company at Addis Ababa quality laboratory to determine nicotine percent, soluble sugars percent, overall nitrogen percent and overall nitrogen/nicotine. The obtained data were analyzed using SAS statistical package program [5]. Means were compared by least significant differences (LSD test).

RESULTS AND DISCUSSION

Physical characteristic

The maximum yield in green leaves topping tobacco K-110 variety for late topped plants was observed at 20, 22, 24 leaves and in control whereas the minimum was recorded at early and mid-14, 16 and 18 leaves (Table 1). Significance ($p<0.05$) difference were observed among topping and control on the fresh green leaves yield of tobacco (kg/plot).

A general trend of increasing green leaves yield together with increase topping height and un-topped plants was observed. Some similar findings [6, 7] confirmed that there is significant increase in leaves yield when high level toppings and un-topped tobacco yielded more than tobacco topped.

Similar result observed on number of leaves per plant as number of leaves depend on level of topping. The not topped and late topped plants at 20, 22 and 24 leaves stages showed more number of leaves. The result reveals that topping height effects leaves length and width. The early topped 14 and 16 plant's leaf showed highest leaf length and width as compared to un-topped, mid and late topped plants. Our result in line with of Elliot (1976) stated that topping increase leaf size. Stem diameter showed significant difference among treatments (Table 1). The late and un-topped plants showed less stem diameter then early topped plant. The early topped at 14 and late topped at 22 leaves stage recorded equal stem diameter of 4.30cm2 followed by 16 topped leaves of 4.14 cm2

Chemical characteristics

Nicotine

The results indicated that maximum nicotine content (4.26%) was recorded when plant not topped while the lowest nicotine content of 2.37% was recorded in plots with a plant topping at 18 leaves stages with significant ($P \leq 0.05$) effect topping height on nicotine content of tobacco (Table 2). Nicotine percentage content were obtained from plants topped at 14,16 and 18 leaf levels respectively. The nicotine content is in an acceptable range (2.37-2.89) because it is considered that a nicotine level of 0.7 - 3.0% in FCV tobacco is most satisfactory. Our result line with other works [8] also found that as topping height was increased from 12 to 20 leave total nicotine decreased while reducing sugars increased.

Reducing sugar

Levels of reducing sugars were markedly affected by height of topping. The lowest topping height at 14 leaves recorded higher reducing sugar (17.73) while for plants not topped with lowest reducing sugar (12.58) in the combined samples (Table 2).While, from our study we observed that for all topped and

Table 1. Characteristics of plants depending on the level of topping (average 2 seasons)

Level of topping	Yield (per kg plot)	Leaf length per plant (cm)	Leaf width per plant (cm)	Stem diameter per plant (cm)	Leaf number per plant
Control	35.15	65.7	27.92	3.53	24.1
Topping at 14	33 .01	72.64	31.44	4.3	14
Topping at 16	33.84	72.5	31.75	4.14	16
Topping at 18	24.17	71.8	30.69	4.09	18
Topping at 20	39.87	71.17	30.28	4.09	20.1
Topping at 22	40.7	71.14	30.22	4.3	22.2
Topping at 24	36.07	69.5	29.64	3.98	24.1
Mean	34.69	70.55	30.28	4.06	19.8
CV. (%)	15.76	7.67	7.4	9.02	19.79
$LSD_{0.05}$	15.36	NS	NS	0.64	1

NS= not significant at the 0.05 probability level according to Duncan's multiple range test

un-topped tobacco leaves in Bilatte we achieved the range of desirable quality of reducing sugar (8- 24%). Other studies also revealed that the reducing sugars decreased with lower topping height and lower topping increased nicotine content resulting in decrease sugar content [8, 9, 10] but their differences were more pronounced than in this study.

Total Nitrogen

Maximum total nitrogen at 16 leaves for un-topped and topped plant was recorded at 3.04 % and 2.72 % respectively. While the total nitrogen for late topped plants at 20 and 24 leaves were 1.96% and 1.97% respectively (Table 2). Except un- topped and all topping height in trial total nitrogen gives the most satisfying smoke of about 0.7 to 3.0%. Our study with comparison to other studies [10] found that Nitrogen was negatively related to leaf number per acre whether due to topping height and also reported that low total nitrogen for delay topping.

Nitrogen/Nicotine Ratio

The ratio of nitrogen to nicotine is assumed to give some chemical balance within the leaf. In some studies it is observed that the total nitrogen to nicotine ratio ranges from 0.7 to 1 [11] and is also confirmed that from 0.8 to 1.1 [12] it marks substantial and rounded flue-cured tobaccos for smoking. The ratio exceeding 1.0 has the less desirable the tobacco because it tends to be light bodied. On the other hand, lesser the value (below 0.5), frequent considered undesirable because the tobacco is heavy bodied and associated with high nicotine content and low level of reducing sugars. Result of our trial indicated that, the maximum total nitrogen/nicotine ratio was found in leaves of tobacco topped to 16 and 18 leaves was 1.0 and 1.1 respectively. Significantly minimum total nitrogen/nicotine ratio was found 0.7 for un-topped, 0.8 for topped plants at 14 and 20, and 0.9 for 22 and 24 leaves level composition (Table 2). Hence, the quality of tobacco decreases with higher ratio value 1.0 or 1.1. The topped leaves from Bilatte samples lack predominating nitrogen matters in its composition.

CONCLUSION

From our study, the data indicates that tobacco green leaf weight and plant leaf number recorded maximum

Table 2. Chemical composition of topping trial leaf samples depending on the level of topping

Treatments	Nicotine (%)	Reducing sugar (%)	Nitrogen (%)	Nitrogen/Nicotine ratio (%)
Topping at 14	2.89	17.73	2.5	0.8
Topping at 16	2.68	15.14	2.72	1
Topping at 18	2.37	15.72	2.63	1.1
Topping at 20	3.34	13.62	1.96	0.8
Topping at 22	3.11	13.4	2.12	0.9
Topping at 24	3.79	10.89	1.97	0.9
No topping	4.26	12.58	3.04	0.7
Mean	3.17	14.49	2.48	0.9
CV (%)	20.74	14.39	15.92	15.4

NS= not significant at the 0.05 probability level according to Duncan's multiple range test

for late topped plants and un- topped. While, for early and mid topped leaves level in producing leaves desirable chemical characteristic an acceptable range and significant increase leaf size and stem diameter. Therefore, to enhancing quality of FCV tobacco production early and mid topping (14-20) leaves recommended.

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CONFLICT OF INTEREST

The authors have declared that there is no conflict of interest.

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