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Effect of Topping Height and Timing on Quantity and Quality Influe-Cured Tobacco (Var.K326)

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Abstract

One of the most important practices in flue-cured tobacco farming is topping and sucker control at the right time. Topping cause's development and root growth, drought tolerance, reduce deployment pests, increased synthesis of nicotine .This study was conducted in randomized complete block design (RCBD) with 10 treatments in 3 replications over two years (2008-2009) at Tirtash research and education center. Treatments consisted of three phases(button stage, early flowering and full flowering) and three levels of leaf removal (18, 20 and 22) with the control treatment without topping and sucker control.The results of combined analysis showed that there were significant differences between treatments for fresh weight, cured leaf weight, total income, net income, mean price, sugar and nicotine percent (α = 1%). According to results the highest and lowest cured-leaf yield belongs to topping at button stage with 22 leaves with 4546 kg/ha and control with 3054 kg/ha respectively.

Key words: Tobacco, Flue-cured, Topping height, Quality and Quantity

Introduction

To maximize leaf production and encourage leaf-ripening, 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,Czubacka et al., 2012). Topping always refers to the removal of the tobacco flower before the leaves are systematically removed (Singh et al., 2000, Lin et al, 2004, Wang et al., 2012). Removing the flower switches the plant from a seed producing (reproductive) to a leaf producing (vegetative) phase (Pandeya et al., 2001, Wang et al., 2012). Topping increases the size and weight of leaves, increasing the overall yield per hectare (Singh et al., 2000, Hao and chao yang, 2001,Roton et al., 2005, Reed et al., 2012). Topping stimulates root growth, the source of nicotine, which improves drought tolerance. In addition, topping increases yield through increased growth, especially of the upper leaves. Topping stimulates theproduction of secondary plant products that accumulate in the leaves (Yi et al., 2006). These products give the cured leaf improved quality and smoking characteristics (Hu et al., 2000). Topping lowers the population of several insects that are attracted to the plant by the flowers. Topping is a turning point for nicotine formation and accumulation inside tobacco plant (Hu et al., 2000,Roton et al., 2005). However, before topping the quantity of nicotine formed is relatively small due to only about 2.5% of nitrogen absorbed by tobacco plant to be used for nicotine formation. While, after topping, the proportion of nitrogen absorbed by tobacco plant used for

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nicotine formation goes up drastically, reaching 16% or so, resulting in a significant increase of nicotine content in tobacco plant (Mizusaki et al., 1971, Page et al., 1982,Legget et al., 1977, Wang et al., 2012,Farrokh et al., 2012). Topping stage of tobacco is a key time for development of agricultural measures to promote the quality of leaves (Haoet al., 2001, Reed et al., 2012). Late topping increases the number of pretopping suckers that must be removed as well as the chance of plants blowing over in a windstorm. Topping height is another aspect of topping management. Topping height is mostly a matter of personal preference; there is not one correct topping height. However, burley tobacco should be topped at a height resulting in plants that are efficiently handled in the field and in the barn. Tall plants are difficult to handle, requiring extra labor, and make curing more difficult. Hao and Chao yang (2001) reported that yield did not continue to increase when plants were topped at more than 22 harvestable leaves. Legget et al (1977) found that an increase in topping height decreased total alkaloids and price, but increased yield and an increase in plant spacing tended to increase total alkaloids, but had little effect on sugars. Therefore, the objectives of this research were to understand the influence remove of leaf number and topping timing on quality and quantity characteristics in flue-cured tobacco(var. K326).

Material and Methods

The study was conducted under field conditions at the Tirtash Research and Education Center using acompletely block randomized design with three replications on flue-cured tobacco (var. K326)over two years (2008-2009). Treatments wereincluding leaf number removal and topping timing consisting: 1-control, without sucker control and topping2- Topping at button stage and removal of 18 leaves. 3-Topping at button stage and removal of 20 leaves. 4-Topping at button stage and removal of 22 leaves. 5-Topping at early flowering and removal of 18 leaves. 6-Topping at early flowering and removal of 20 leaves. 7- Topping at early flowering and removal of 22 leaves.8- Topping at full flowering and removal of 18 leaves. 9- Topping at full flowering and removal of 20 leaves. 10-Topping at full flowering and removal of 22 leaves.Plots measuring 8x5m, with 2m spacing between plots was demarcated after disc harrowing andridging by tractor. The fertilizers NPK at concentrations of 300, 100 and 100 kg ha-1 were applied in the formof ammonium nitrate, diammonium phosphate and muriatic of potash, respectively. All of PK and half of N(starter fertilizer) were mixed with the soil at the time of transplanting, while remaining N was applied at earlybutton stage. These fertilizers were applied over the surface of the soil and in order to assess the uniqueeffect. The seedlings were grown in a float system1 from mid-February to the beginning of May. Tobaccoseedlings were transplanting in six-leaf and one-shoot period; then, water was poured appropriately.Tobacco plants spaced 50 cm in rows 100 cm. Yield data were collected after barn curingas the tobacco was graded. Other factor s evaluated included total income, net income, mean price and nicotine percent. Data were subjected to ANOVA using the SAS statistical software packageand Duncan's multiple range tests were performed to compare the treatment means.

Table 1. Analysis of variance of the effect of topping on fresh leaf weight, cured leaf weight, tobacco price average, total income, net income and nicotine percent in 2008-2009 years.

S. O. V.	D. F.	Fresh leaf weight	Cured leaf weight	Tobacco price average	Total income	Net income	Nicotine
Block	2	3195174	185080	2401608	112740673	112740673	0.07
Treatment	9	73833797**	21787605**	577027879**	181837020**	2059595989**	4.6**
year	1	529206481**	21787605**	577027879**	743341606**	1935971206**	4.6*
AB	9	14938090**	283411**	4054893**	228227751**	232771154**	0.16*
Error	36	4558078	81621	698055	53120193	53120193	.041
Coefficient of variation (%)		11.05	10.4	14.58	14.73	11.7	13.44

* and ** : significant at 5% and 1% of probability levels, respectively.

Results and Discussion

Analysis of variance of the topping experiment on quality flue-cured tobacco showed thatdifferences were significant for characters measured fresh and cured leaf yield, total income, net income, mean price and nicotine percent. Results in this study shown that, leaf number removal and topping timing flue-cured tobacco has significant influence on fresh and cured yields (Table 2).

Table2: Comparison mean of fresh leaf yield and cured leaf yield of flue-cured tobacco in different treatments (two years mean)

treatments	fresh leaf yield (kg/ha)	cured leaf yield (kg/ha)
Control	24120 ef	3054 f
topping at button stage and removal of 18 leaves	24610 def	3850 d
topping at button stage and removal of 20 leaves	27820 bc	4155 bcd
topping at button stage and removal of 22 leaves	30530 a	4645 a
topping at early flowering and removal of 18 leaves	23870 f	3406 e
topping at early flowering and removal of 20 leaves	27120bcd	3945 cd
topping at early flowering and removal of 22 leaves	29250 ab	4398 ab
topping at full flowering and removal of 18 leaves	23830 ef	3384 ef
topping at full flowering and removal of 20 leaves	25380 cde	4099 bcd

topping at full flowering and removal of 22 leaves	28400 ab	4233 bc

In our experimental, fresh and cured leaf yields increased at topping in button and early flowering of 22 leaves but at all topping time of 18 leaves and control treatment decreased. Low performance control and treatments with 18 leaves indicate that more number of leaves harvested in control could not affect the usefulness of topping treatments. The object of topping is to divert the nutrients of the plant to the leaves instead of flowers and seeds with the result gaining in the size and body of the leaf (Qi et al., 2011). It gives a uniform quality of product and prevents excessive coarseness in the leaves (Zhou et al., 1996; Wang et al, 2012).Lowest tobacco price average achieves at control treatment and topping at full flowering and removal of 18 leaves(figure 1).Topping in the button stage of plant development is the cultural practice that gives tobacco its desired physical characteristics that lead to high texture and elasticity of leaf and achieves high price average (Singh et al., 2000).

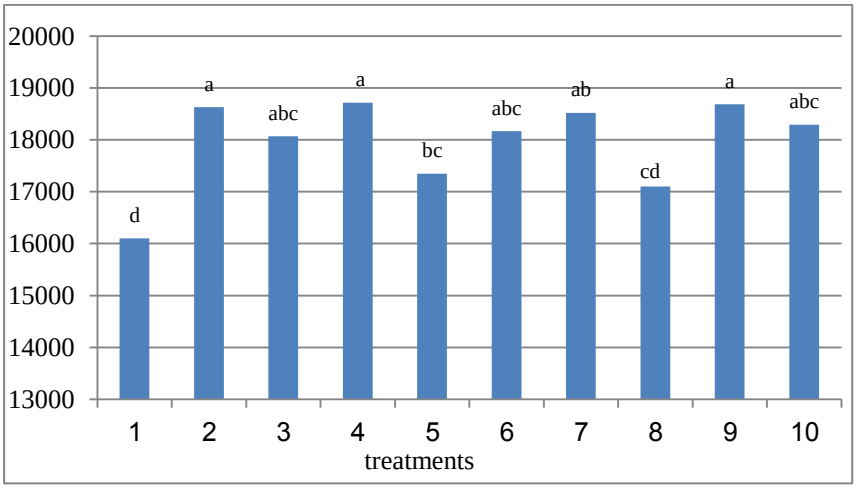

Figure 1. Effect of topping height and timing on **tobacco price average** (rials/kg). 1: Control (without topping and sucker control). 2: topping at button stage and removal of 18 leaves. 3: topping at button stage and removal of 20 leaves. 4: topping at button stage and removal of 22 leaves. 5: topping at early flowering and removal of 18 leaves. 6: topping at early flowering and removal of 20 leaves. 7: topping at early flowering and removal of 22 leaves. 8: topping at full flowering and removal of 18 leaves. 9: topping at full flowering and removal of 20 leaves. 10: topping at full flowering and removal of 22 leaves.

Topping atbutton and early flowering stages of22 leaves has highest total and net income in our experimental (Table 3). Research results indicate that waiting beyond these stages to top results in decreased yields and increased labor requirements for topping, since stalks are tougher and suckers must be removed. Also, suckers are usually easier to control when tobacco is topped on time. The labor requirement for making two to three "on time" toppings is not significantly greater than for making one topping when many plants are in full flower. Topping height is mostly a matter of personal preference; there is not one correct topping height (Zuo and Zhun, 1993).

Table 3: Comparison mean of total income and net income of flue-cured tobacco in different treatments (two years mean)

treatments	Total income (1000 rials/ha)	Net income (1000 rials/ha)
Control	49210 e	49210e
topping at button stage and removal of 18 leaves	71840 c	69940 bc
topping at button stage and removal of 20 leaves	75880 bc	70220 bc
topping at button stage and removal of 22 leaves	87990 a	81120 a
topping at early flowering and removal of 18 leaves	59400 d	57500 de
topping at early flowering and removal of 20 leaves	71700 c	66220cd
topping at early flowering and removal of 22 leaves	81910 ab	75280 ab
topping at full flowering and removal of 18 leaves	58300 d	56330 e
topping at full flowering and removal of 20 leaves	77080 bc	71870 bc
topping at full flowering and removal of 22 leaves	78090bc	72000 bc

Height of topping and topping timing has been shown to affect yield, subjective quality, and physical and chemical characteristics (Brown and Terrill, 1973; Tso, 1990). Topping in the early button stage of plant development is the cultural practice that gives tobacco its desired chemical and physical characteristics that lead to high yields of high quality leaf (Singh et al., 2000).Lowest tobacco nicotine percentwas in control treatment.Results in this study shown that, leaf number and topping timing flue-cured tobacco has significantinfluence on nicotine formation (fig. 2).Many research results show that nicotine increases by topping on right time.The increase in nicotine synthesis after topping is one of the typicalresponses of flue-cured tobacco to topping(Wang et al., 2012; Farrokh et al., 2012).

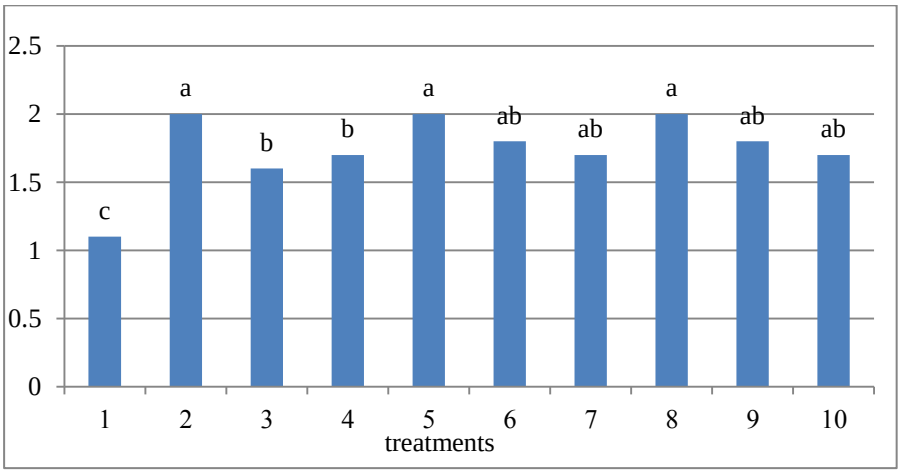

Figure2. Effect of topping height and timing on **nicotine percent**. 1: Control (without topping and sucker control). 2: topping at button stage and removal of 18 leaves. 3: topping at button stage and removal of 20 leaves. 4: topping at button stage and removal of 22 leaves. 5: topping at early flowering and removal of 18 leaves. 6: topping at early flowering and removal of 20 leaves. 7: topping at early flowering and removal of 22 leaves. 8: topping at full flowering and removal of 18 leaves. 9: topping at full flowering and removal of 20 leaves. 10: topping at full flowering and removal of 22 leaves

Conclusion

In experimental indicated that, topping stage is the essential for cured leaf yield production in flue-cured tobacco. Topping in tobacco is one of the most important operations to improve leaves growth, development and quality. In our experimental, topping at button or early flowering stages with 22 leaves has highest yield, net income and nicotine percent. Control treatment has the lowest quantity and quality characteristics.

References

Brown GW and Terrill TR.(1973). Effects of method of harvest on flue-cured tobacco. Part II. Chemical components. Agronomy Journal. 65: 268-273.

Czubacka A, Doroszewska T, and Trojak-Goluch A.(2012). Agronomic characteristics of transgenic tobaccodoubled haploids resistant to Potato virus Y Journal of Food, Agriculture and Environment. 10 (4):374-378.

Farrokh AR, Azizov I, Farrokh A, Esfahani M, Rar avoosi R.(2012). The effect of nitrogen andpotassium fertilizer on yield and mineral accum cured tobacco. Journal of Agricultural Science. 4: 167-178.Intl. J. Agron. Plant. Prod. Vol., 4 (8), 2081-2085

Gooden DT, Brown AB, Ellington G, Fortnum BA, Marshall MW, Reay-Jones F.(2011). South Carolina tobacco growers' guide. Pp: 90Guo H, Kan Y, and Liu W, 2011. Differential expression of miRNAs in response to topping in flue-curedtobacco (*Nicotianatabacum*) roots. Plos one. 6 (12): 1-15.

Hao J, and Chao yang C.(2001). Effects of topping and leaves remained on the yield and quality of flue-curedtobacco variety K326. Journal of Fujian Agricultural University. 2001-2003.

Hu GS, Li ZY, Mu L and Han JF.(2000). Studies on characteristics of nicotine accumulation in *Nicotiana tabacum*L. China Tobacco Journal. 6(2): 6-9.

Leggett JL, Sims JL, Gossett DR, Pal UR and Benner JF. (1977). Potassium and magnesium nutrition effectson yield and chemical composition of burley tobacco leaves and smoke. Journal of Plant Science. 57:159-166.

Lin GH, Zhou JH, Fan QF, Yang HQ and Cao YX.(2004). Effects of topping technology on leaf yield, qualityand alkaloid content of flue-cured tobacco. ActaBotanicaBoreali-OccidentaliaSinica. 7: 1362-1366.

Mizusaki S, Tanabe Y, Noguchi M and Tamaki E.(1971). Phytochemical studies on tobacco alkaloids. XIV.The occurrence and properties of putrescine N-methyltransferase in tobacco roots. Plant Cell Physiology. 12(4):633-640.

Page AL, Miller RH and Keeney DR.(1982). Methods of Soil the shoot apex increase the nicotine Concentration and nitrogen contents in tobacco plants. Annals of Botany. 96:793-797.

Pandeya RS, Rosa N, Wite FH, and Elliot JM.(2001). Rapid estimation, of some flue-cured tobacco chemicalcharacteristics by infrared–reflectance spectroscopy. Tobacco science. 22:27-31.

Qi YC, Ma L, Wang FF, and Liu, WQ.(2011). Construction and analysis of roots suppression subtraction hybridization cDNA library after tobacco topping. ScientiaAgriculturaSinica. 44(7): 1331-1337.

Reed TD, Johnson CS, Semtner PJ, and Wilkinson CA.(2012). Flue-cured tobacco production guide. Incooperation with the Virginia Bright Flue-Cured Tobacco Board. Pp: 140.

Roton C, Wiernik A, Wahlberg I, and Vidal B.(2005). Factors influencing the formation of tobacco-specificnitrosamines in french air-cured tobaccos in trials and at the farm level. BeitragezurbakforschungInternational/Contributions to Tobacco Research. 21: 305-320.

Singh KD, Tripathi SN, and Pandey AK. (2000). Influence of topping on yield, physical leaf quality parametersand economic return in chewing tobacco. Tobacco Research. 1999. P: 61.

Wang T, Wang S, Kang X, Tang J, Wei X, Peng W, and Guan G.(2012). Effect of phosphorus and potassiumnutrition on nicotine and nutrient accumulation during topping stage of *Nicotianatabacum*L. Journalof Food, Agriculture and Environment.10(2): 732-740.

Yi JH, Jia ZH and Sun ZJ.(2006). Effect of the topping time on the root growth and the content of nicotine ofFlue-cured tobacco. Journal of Anhui Agriculture Science. 34(12): 2762- 2777.

Zuo TJ and Zhun ZQ.(1993).Production, Physiology and Biochemistryof Tobacco. Shanghai Yuandong Press, Shanghai. pp. 35-186.