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Influence Of Remove Leaf Number And Topping Timing On Quality In Air-Cured Tobacco By Priming And Stalk Cut

Yazdani, mohammad

PhD Student, Department of Agronomy, Tabriz Branch, Islamic Azad University, Tabriz, Iran

ABSTRACT

Nicotine biosynthesis can be induced through topping to tobacco plants. In order to investigating influence of remove leaf number and topping timing on quantity air-cured tobacco by priming and stalk cut an experimental was conducted at research farm of Tirtash Research and Education Center using a completely block randomized design with three replications during 2012. Treatments were including leaf number removed and topping timing consisting (1: control, sucker control and stalk cut method. 2: topping at early button and removal of 20 leaves. 3: topping at early button and removal of 23 leaves. 4: topping at early button and removal of 26 leaves. 5: topping at early flowering and removal of 20 leaves. 6: topping at early flowering and removal of 23 leaves. 7: topping at early flowering and removal of 26 leaves. 8: topping at flowering and removal of 20 leaves. 9: topping at flowering and removal of 23 leaves. 10: topping at flowering and removal of 26 leaves). Results showed that, effects remove of leaf number and topping timing was significant on quality air-cured tobacco. In addition, nicotine and potassium content increased at the topping in early button and early flowering, but at the flowering and removal of 26 leaves decreased the nicotine and potassium content. In experimental indicated that, topping stage is the important for chemicals characteristics, particularly the change of nicotine metabolism.

Key words: topping, air-cured, tobacco

Introduction

The physical and chemical properties of leaf tobacco are influenced by genetics, agricultural practices, soil type and nutrients, weather conditions, plant disease, stalk position, harvesting and curing procedures (Pandeya *et al*., 2001; Hao *et al*., 2001; Czubacka *et al*., 2012). A change in any of these factors can markedly alter the chemical composition of leaf and thus affect smoking quality (Tso, 1990; Reed *et al*., 2012). To maximize leaf production and encourage leaf-ripening, topping (removal of the flowering head and young leaves) is an essential cultivating measure for flue-cured tobacco, which switches the plant from reproductive to vegetative phase (Guo *et al*., 2011). Topping always refers to the removal of the tobacco flower before the leaves are systematically removed (Singh *et al*., 2000; Wang *et al*., 2012). To maximize leaf production and encourage leaf ripening, it is necessary to remove the flower. 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; 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 (provided suckers are controlled) through increased growth, especially of the upper leaves.

Topping stimulates the production of secondary plant products that accumulate in the leaves (Atkinson *et al*., 2002; Yi *et al*., 2006). These products give the cured leaf improved quality and smoking characteristics. Topping lowers the population of several insects that are attracted to the plant by the flowers. Topping also stimulates sucker growth (Singh *et al*., 2000; Qi *et al*., 2011; Guo *et al*., 2011). Therefore, a good sucker control program is necessary to ensure high yields of acceptable quality. Topping is a turning point for nicotine formation and accumulation inside tobacco plant (Roton *et al*., 2005; Guo *et al*., 2011). However, before topping the quantity of nicotine formed is relatively small due to only about 2.5% of nitrogen (N) absorbed by tobacco plant to be used for nicotine formation. While, after topping, the proportion of N absorbed by tobacco plant used for nicotine formation goes up drastically, reaching 16% or so, resulting in a significant increase of nicotine content in tobacco plant (Legget *et al*., 1977; Atkinson *et al*., 2002; Wang *et al*, 2012).

Topping stage of tobacco is a key time for development of agricultural measures to promote the quality of leaves (Hao *et al*., 2001; Reed *et al*., 2012). Topping height is another aspect of topping management. Topping

Corresponding Author: Yazdani, mohammad, PhD Student, Department of Agronomy, Tabriz Branch, Islamic Azad University, Tabriz, Iran
E-mail: Yazdanisavadkoohi@yahoo.com

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. In general, yield did not continue to increase when plants were topped at more than 22 harvestable leaves (Hao and Chao yang, 2001). Legget *et al* (1987) 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 in air-cured tobacco by priming and stalk cut.

Material and Methods

The study was conducted under field conditions at the Tirtash Research and Education Center using a completely block randomized design with three replications during 2012 growing season. Treatments were including leaf number removed and topping timing consisting (1: control, sucker control and stalk cut method. 2: topping at early button and removal of 20 leaves. 3: topping at early button and removal of 23 leaves. 4: topping at early button and removal of 26 leaves. 5: topping at early flowering and removal of 20 leaves. 6: topping at early flowering and removal of 23 leaves. 7: topping at early flowering and removal of 26 leaves. 8: topping at flowering and removal of 20 leaves. 9: topping at flowering and removal of 23 leaves. 10: topping at flowering and removal of 26 leaves).

Plots measuring 5*4.5m, with 1m spacing between plots was demarcated after disc harrowing and ridging by tractor. The fertilizers NPK at concentrations of 300, 120 and 100 kg ha^{-1} were applied in the form of ammonium nitrate, diammonium phosphate and muriate 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 early button stage. These fertilizers were applied over the surface of the soil and in order to assess the unique effect. Tobacco seedlings were transplanting in six-leaf and one-shoot period; then, water was poured appropriately. Tobacco plants spaced 45 cm in rows 90 cm. For chemical analysis, plant samples were oven dried at 70 ^{0}C for 48h and ground to a powder (2 mm). Total nitrogen of leaf was determined by Kjeldhal technique (Tecator Kjeltec Auto 1030 analyzer) and phosphorus was determined by using a spectrophotometer and total potassium by flame photometer. Data were subjected to ANOVA using the SAS statistical software package using GLM and Duncan's multiple range tests was performed to compare the treatment means.

Result And Discussion

Analysis of variance of the topping experiment on quality in air-cured tobacco by priming and stalk cut showed that differences were significant for some characters measured (potassium and nicotine) and not significant for sugar, nitrogen, phosphorus, ash and burn (table1).

Table 1: The effects of leaf number and topping timing on some characteristics in air-cured tobacco

Source of variation	Nitrogen	Phosphorus	Potassium	Sugar	Nicotine	Ash	Burn
block	71/74	2179/4	0/16	0/007	1/75	5/04	0/68
Treatment	19/11 ^{ns}	17960/0 ^{ns}	0/31*	0/01 ^{ns}	1/62**	1/54 ^{ns}	2/45 ^{ns}
Error	17/56	8517/4	0/12	0/006	0/25	0/90	2/43
Total	631/7	3493/2	5/38	0/25	26/66	40/30	67/30
CV	14/78	8/20	9/28	12/52	13/46	3/75	62/35

Levels of significant:* P< %5, ** P<%1, ns = not significant

Results in this study shown that, leaf number and topping timing flue-cured tobacco has significant influence on nicotine formation (figure1). Nicotine content increased at the topping in early button and early flowering but at the flowering and removal of 26 leaves decreased the nicotine content. Nicotine, a secondary metabolite synthesized in tobacco roots, acts as a unique alkaloid in tobacco and is an important quality factor for tobacco. The increase in nicotine synthesis after topping is one of the typical responses of flue-cured tobacco to topping, therefore, the optimal plant material can be provided for studying nicotine synthesis by topping. Wang *et al* (2012) reported that P and K nutrition control the formation of nicotine via regulating the activity of nicotine and nutrient accumulation during the topping stage. 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. It gives a uniform quality of product and prevents excessive coarseness in the leaves (Wang *et al*, 2012).

Potassium content increased at the all topping but at the flowering and removal of 26 leaves decreased. The role of K in determining the chemical composition of tobacco leaf is now well established (Farrokh *et al*., 2012). Topping stimulates the production of secondary plant products that accumulate in the leaves and consequence timely topping is an important for control sucker. Topping at flowering and removal of 23 leaves has highest nicotine content. Delayed topping beyond this early button to first flowering stage can adversely affect burley.

Brown and Terrill (1973) found that as topping height was increased from 12 to 20 leaves, total N and nicotine decreased while reducing sugars increased. Height of topping and topping timing has been shown to affect yield, subjective quality, and physical and chemical characteristics (Brown and Terrill, 1973). 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).Topping also stimulates root growth, which increases nicotine production in the roots and translocation to the leaves. Secondary plant products that accumulate in the leaves and improve quality and smoking characteristics also increase at topping.

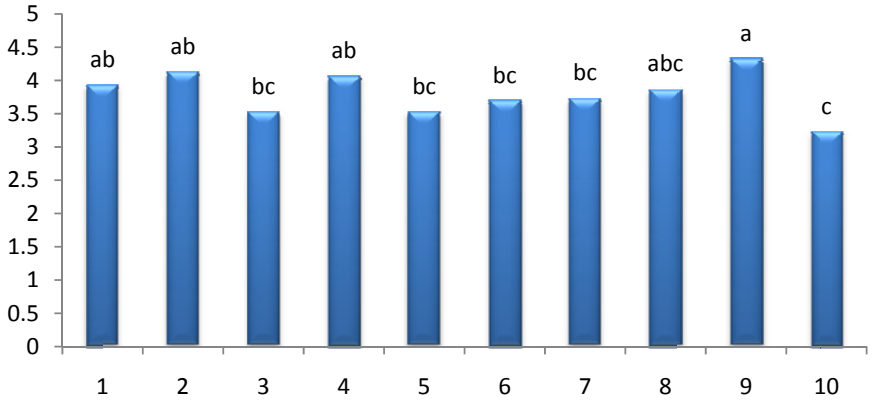

Fig. 1: Effect of leaf number and topping timing on nicotine (%) in air-cured tobacco. 1: control, sucker control and stalk cut method. 2: topping at early button and removal of 20 leaves. 3: topping at early button and removal of 23 leaves. 4: topping at early button and removal of 26 leaves. 5: topping at early flowering and removal of 20 leaves. 6: topping at early flowering and removal of 23 leaves. 7: topping at early flowering and removal of 26 leaves. 8: topping at flowering and removal of 20 leaves. 9: topping at flowering and removal of 23 leaves. 10: topping at flowering and removal of 26 leaves

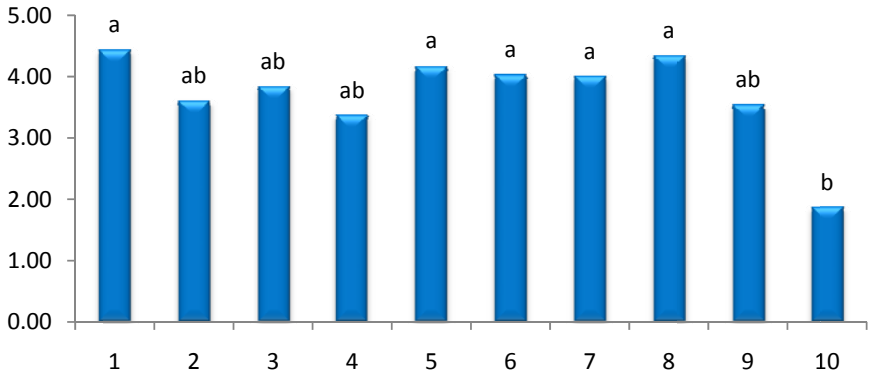

Fig. 2: Effect of leaf number and topping timing on potassium (ppm) in air-cured tobacco. 1: control, sucker control and stalk cut method. 2: topping at early button and removal of 20 leaves. 3: topping at early button and removal of 23 leaves. 4: topping at early button and removal of 26 leaves. 5: topping at early flowering and removal of 20 leaves. 6: topping at early flowering and removal of 23 leaves. 7: topping at early flowering and removal of 26 leaves. 8: topping at flowering and removal of 20 leaves. 9: topping at flowering and removal of 23 leaves. 10: topping at flowering and removal of 26 leaves

Conclusion:

In experimental indicated that, topping stage is the important for chemicals characteristics, particularly the change of nicotine metabolism. Moreover, may be that there were many responses of flue-cured tobacco to topping. Nicotine and potassium content increased at the topping in early button and early flowering, but at the flowering and removal of 26 leaves decreased the nicotine and potassium content. The increase in nicotine synthesis after topping is one of the typical responses of flue-cured tobacco to topping in all treatment.

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