

THE EFFECTS OF TOPPING BURLEY TOBACCO

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Two cultivars (Polish – Bursan and American – Tennessee 90) were topped at beginning of flowering stage. 4 levels of topping were employed: high (inflorescence with 2 leaves removed); mean (topping, leaving 14 leaves on plants); low (leaving 12 leaves); very low (leaving 10 leaves). Control object – plants without topping. Suckers appearing on topped plants were removed successively by hand. The reaction of both cultivars on topping was similar: high and mean toppings resulted in slight increase of leaves yields, while low and very low toppings – decrease (significant in case of Tennessee cv). In all cases, topping modified quality of leaves, the most profound being when low and very low topping was applied. The modification referred to booth: physical features of leaves as well as their chemical composition. As regards physical properties – leaves were bigger, had higher weight of “leaf body” and were characterized by smaller contribution of midrib. In range of chemical composition, leaves of topped plants contained much more nicotine and lesser amount of ash..

Keywords: tobacco, chemical composition, yield cultivars.

Burley tobacco is gaining in an importance in Polish tobacco industry. At present it covers about 30 % of the total demand for tobacco leaves. There have been however only scarce experiments in Polish conditions on the effects of agricultural measures on the yields and quality of leaves this type of tobacco. In general, topping of tobacco plants has a great influence on the yield and chemical composition of leaves. Experiments with flue and air cured tobaccos resulted in an increase yield by 10 to 20 % and marked improvement of leaves quality. As regards quality, the topping brought about significant increment of leaves area and their “body” as well as nicotine content (Elliot 1976, Parsikova 1976, Cousins 1988, Berbeć and Wiśniewski 1991, and others).

The effect of topping commonly is considered to be resultant of prevention plants from seed formation. Nevertheless, experiments with sterile form of tobacco (Berbeć 1975) gave identical effects, thus author comes to conclusion that it must be other reason positive effects of topping. In pot experiment he found out that topped plants produced much more roots (by 35-55 %) and this author maintains, that increase of roots mass is the reason of higher yields and stimulation of nicotine synthesis. Effects of topping are conditioned by several factors, such as time of topping (stage of inflorescence development), level of topping, state of plants nutrition and others. In case of burley tobacco, in average conditions the bests

results gives middle level of topping at early stage of flowering, leaving 16-18 leaves per plant for harvest (Swetnam and Walton, 1998).

The aim of the field experiment was to examine effects of topping two cultivars of burley tobacco commonly cultivated in Poland.

MATERIAL AND METHODS

Three year field experiment was carried out on brown soil (loess origin) in Zamość (Lublin region) in 2000-2002. Soil, slightly acid in reaction was rich in nutrients and contained 1,6 % of organic matter. Mineral fertilization was supplied according to recommendation for this type of tobacco. The experiment comprised two factors:

- 2 cultivars (Polish – Bursan and American – Tennessee);
- 4 levels of topping: high (along with inflorescence removed 2 top leaves); middle (leaving 14 leaves for harvest); low (leaving 12 leaves per plant); very low (leaving 10 leaves). The control object – plants without topping.

Experimental design was randomized blocks (with sub-blocks) in 4 replication. Plot area – 40,5 m², plant – to plant distance – 90x45 cm. Seedlings were produced in greenhouse with the use of multicellular trays and sterilized substrate. They were transplanted in the field in second decade of May. During field growth standard crop management was practiced. Toppings (by hand) were performed at beginning of flowering stage. Later on, suckering (by hand) was accomplished as the needs arose. Leaves were harvested according to their technological maturity (3 or 4 times) and were air dried in barn supplied with device for air-flow regulation. Afterward they were classified (according to external features) in 4 grades. Samples of middle leaves (first grade) were subjected to laboratory evaluation in respect of physical features (area, weight of 1 dm² and percentage of midrib) as well as chemical composition (content of nicotine, total nitrogen, carbohydrates and ash).

RESULTS

Polish cultivar (Bursan) characterized more intensive growth, and in result, terminal height of plants was significantly greater. Non – topped plants were taller (on average) by 40 cm, while topped (depending of level of topping) by 16-50 cm in comparison to Tennessee cv. Number of leaves (limited by level of topping) in Bursan cv. was greater only if plants were not topped and at high topping (by 1,7 and 0,7 respectively). The area of middle leaves both cultivars, in general, was similar. Topping of plants at 3 levels (high, middle and low) did not affect area of middle leaves. The only marked increase (in both cultivars) revealed at very low topping (Table 1). Total area of leaves (per plant), irrespectively of treatments examined, was greater in Bursan cultivar due to greater number of leaves. Topping of plants in all cases resulted in decrease of leaves area per plant, the most profound being, when low and very low toppings were applied.

Yields of leaves (dried) Bursan cv. were markedly higher almost in all treatments compared (the only exception was when high topping was applied). The differences (in favour of Bursan) grew bigger along with lowering level of topping. The effect of topping was not alike in both cultivars: in case of Bursan, irrespectively of level of topping, there were no marked differences in yields (there

were however noted tendency to decrease along with the level of topping). Tennessee cv. instead, reacted with significant decrease of leaves yields when low and very low toppings were carried out (Table 2).

Table 1

Characteristics of plants depending on the level of topping (average for 3 years)

Level of topping	Height of plants (cm)		Number of leaves		Area of middle leaves (cm ²)		Total area of leaves per plant (m ²)	
	B	TN	B	TN	B	TN	B	TN
Control	157	117	25,0	23,3	1428	1403	2,71	2,25
	137		24,1		1415		2,48	
High	140	90	22,6	21,9	1348	1264	2,51	2,15
	115		22,2		1306		2,33	
Middle	95	64	14,0	14,0	1391	1384	1,74	1,60
	80		14,0		1387		1,67	
Low	78	57	12,0	12,0	1419	1383	1,48	1,30
	68		12,0		1401		1,39	
Very low	64	48	10	10	1722	1509	1,48	1,16
	56		10		1616		1,32	
Average (cultivars)	107	75	16,7	16,2	1462	1388	1,98	1,69

LSD:

topping:	0,1	55	0,06
cultivars:	0,1	25	0,03
topping x cultivars:	0,2	91	0,10

Table 2

Yields and characteristics of leaves (air-dried) depending on the level of topping (average for 3 years)

Level of topping	Yield (t ha ⁻¹)		I + II grade (%)		Midrib in leaf (%)		Weight of 1 dm ² (g)	
	B	TN	B	TN	B	TN	B	TN
Control	2,50	2,31	62	52	29,1	31,4	0,369	0,463
	2,40		57		30,3		0,416	
High	2,53	2,60	52	58	28,6	30,5	0,451	0,505
	2,56		55		29,5		0,478	
Middle	2,64	2,15	64	62	28,5	29,7	0,485	0,580
	2,39		63		28,8		0,533	
Low	2,35	1,98	66	61	28,8	29,9	0,453	0,605
	2,17		63		29,4		0,529	
Very low	2,30	1,70	67	58	28,1	28,8	0,486	0,658
	2,00		62		28,5		0,572	
Average (cultivars)	2,46	2,15	62	58	28,6	29,9	0,449	0,562

LSD:

topping:	0,19	4,1	1,70	0,046
cultivars:	0,09	1,9	0,72	0,021
topping x cultivars:	0,32	6,8	2,70	0,076

Quality of leaves evaluated by their external features (especially color) in all experimental objects was rather high (over 50 % leaves was qualified to I and II

grade). Topping of Bursan cv. did not affect markedly contribution of I and II grade in total yield, while in case of Tennessee cv. discussed contribution was higher when middle and low toppings were applied.

Midrib contribution in leaf, high in general (28,1-31,4 %), on average was higher in leaves of Tennessee cv. Irrespectively of level of topping, both cultivars reacted by decrease of midrib contribution (the smallest at very low topping). From physical features examined, topping had the greatest effect on weight of 1 dm² of leaf blade (so called "body"). In both cultivars, irrespectively of level of topping, it positively affected "body" of the leaves, the most influential being very low topping.

In respect of chemical composition of leaves, topping had a substantial effect, too. First of all it resulted in a great increase of nicotine content (especially at low and very low level of topping, where the increase surpassed over twice those in leaves not topped plants). There were others positive changes in chemical composition of leaves recorded, too: decrease of total nitrogen content, slight increase of carbohydrates (only in Bursan cv.) and decrease of ash (in leaves of both cultivars) (Table 3).

Table 3

**Chemical composition (in %) of dried leaves depending on the level of topping
(average for 3 years)**

Level of topping	Nicotine		N (total)		Carbohydrates		Crude ash	
	B	TN	B	TN	B	TN	B	TN
Control	0,57	0,58	3,32	3,57	0,86	0,53	22,3	22,2
	0,57		3,44		0,70		22,2	
High	0,96	1,02	3,48	3,74	0,85	0,45	21,9	22,0
	0,99		3,61		0,65		22,0	
Middle	1,06	1,45	3,56	4,10	0,98	0,51	21,6	21,2
	1,26		3,83		0,74		21,4	
Low	1,24	1,23	3,66	4,10	0,89	0,49	21,9	21,3
	1,24		3,88		0,69		21,6	
Very low	1,10	1,45	3,54	4,21	0,88	0,44	28,1	21,4
	1,28		3,88		0,66		21,8	
Average (cultivars)	0,99	1,15	3,51	3,94	0,89	0,48	22,0	21,6

LSD:

topping:	0,12	0,13	0,11	0,45
cultivars:	0,05	0,06	0,05	0,20
topping x cultivars:	0,19	0,21	0,18	0,74

DISCUSSION

Publications concerning topping of tobacco unanimously indicate positive effects on both: yield of leaves as well as their quality (Elliot 1970, Parsikova 1970, Alquiza and Zamora 1987, Wiśniewski 1990, Berbeć and Wiśniewski 1991). The range of influence of the treatment depends however on many factors, the most influential being biology of plants. In general, more sensitive are tobaccos characterized by late flowering and long vegetative period (Elliot 1966, Donev and Pamukov 1970, Parsikova 1970, Gupton 1975). In all cases however, positive

effects are conditioned by removal of suckers, that intensively grew when inflorescence had been stripped off (Chaplin 1967, Cousins 1988, Palmer and Calvert 1993). In our experiment with two cultivars of burley tobacco, topping improved qualitative features of leaves (both physical characteristics as well as chemical composition). As concerns yields – reaction of cultivars was different: Polish cultivar - Bursan (that has shorter vegetative period) did not show significant reaction for topping, while American (Tennessee) gave markedly lesser yields when low and very low toppings were applied.

CONCLUSIONS

1. Topping of burley tobacco did not bring about positive effects as regards yields of leaves. Low and very low toppings (12 and 10 leaves harvested) in both cultivars compared, resulted even decrease of yields (significant in case of Tennessee cv.).

2. Topping positively affected qualitative features of leaves (irrespective of cultivar and level of topping). Leaves of topped plants characterized heavier “body”, smaller contribution of midrib and much more nicotine.

3. As concerns level of topping, in case of burley tobacco, high or middle topping is worth to be recommended for practice. They enable fairly good yields and improvement quality of leaves.

REFERENCES

1. Aquiza P.C., Zamora O.B. 1987. Yield and quality of three flue-cured tobacco cultivars at different toppings time and nitrogen fertilization. *J.Tob. Sci. Technology*, 1-4.
2. Berbeć S. 1975. Comparison effects of topping male sterile and fertile tobaccos at different moisture conditions of soil. *Biul. IHAR*, 3-4.
3. Berbeć S., Wiśniewski J. 1970. Comparison of morphological features and nicotine content in leaves of some tobacco cultivars of *Nicotiana* genus. *Annales UMCS s.E*, vol.XLVI,9.
4. Chaplin J.F. 1967: Influence of various degrees of sucker control on flue-cured tobacco. *Tob.Sci.*, 11.
5. Cousins L.T. 1988. The effect of sucker control on yield and quality of flue-cured tobacco in Zimbabwe. *Tobacco Inf. Bull. Special Issue*.
6. Donev N., Pamukov I. 1970. Vlijanie na karseneto varchu dobiva i kachestvoto na tjutjun Viržinija. *Blg. Tjutjun*, 8.
7. Elliot J.M. 1976. Effects of height of topping and plant spacing of flue-cured tobacco on certain properties of flue –cured leaves and smoke characteristics of cigarettes. *Can J.. Plant Sci.*, 56.
8. Gupton C.L. 1975. Varietal response of burley tobacco to stage of physiological development when topped. *Agron. J.* t.67,6.
9. Palmer G., Calvert J.R. 1993. Topping, sucker and harvest management for burley tobacco. *Kentucky Extension Service*, ID-73.
10. Parsikova A. 1970. Vlijanie dălbokoto karsene varchu razmerite na tjutjunevite lista, suchoto vestestvo i chimičeskija im sastaw. *Blg. Tjutjun*, 8.
11. Swetnam L.D., Walton L.R. 1998. Mechanically topping Burley tobacco. *Tob. Sci.* vol.42.
12. Wiśniewski J. 1990. The effects of topping and sucker control on yield and quality of leaves of different plant spacing. *R.N.R. seria A*, t.108, z.3.