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Technological Indexes of Oriental Tobacco Treated with Glyphosate for the Control of Broomrape

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Abstract

The technological quality of oriental tobacco variety Plovdiv 7 treated with glyphosate (Glyphogan 480 SL) for the control of broomrape was studied. The product was applied acropetally, basipetally, one-time and twice in two doses.The nicotine content of first class oriental tobacco has optimal values in industrial controls and in the variants with single treatment with Glyphogan 480 SL acropetally, dosed at 30 ml/dka, and single treatment with Glyphogan 480 SL basipetally, dosed at 50 ml/dka.The amount of sugars and total nitrogen in tobacco batches of the first and second class for all variants were within the reference values.The ashes in all variants, except for the control and the second class variant with a single application of Glyphogan 480 SL dosed at 50 ml/dka basipetally, were within the reference values.For first-class oriental tobacco of the Plovdiv 7 variety treated with glyphosate (Glyphogan 480 SL), in the control and all variants with treatment basipetally, the tobacco smoke when smoking had a well expressed fullness, harmony and smoothness to the taste.

Key words: Tobacco, glyphosate, nicotine, sugars, total nitrogen, ashes, technological quality

Introduction

The chemical composition of tobacco leaves exerts a many-sided influence on smokers and on the taste qualities of tobacco.

Nicotine is the main alkaloid in tobacco and its quantitative content is of crucial importance for the strength of the physiological impact and the smoking and taste qualities of the culture (Veselinov, M., 1964).

Sugar content is essential for the accumulation of proteins, alkaloids and organic acids in tobacco and, thus, for the quality and taste properties of the latter as well.

In the case of tobacco nitrogen, as in other cultures, is a very important element for the normal growth and development of the culture and for the technological processing of the leaves.

Tobacco ashes are catalysts of physico-chemical processes and determine its greater or lesser ability to burn.

One of the main pests which worsen the quality of tobacco is broomrape (Orobanche spp.). Broomrape contamination changes the standard chemical indicators for culture quality in different degrees and directions (Hristeva, Ts. and D. Drachev, 2008).

A large number of anti-broomrape chemical substances have been studied and are used with varying results. Kasasian (1973) first demonstrated the ability of glyphosate to combat broomrape in broad beans. In the case of tobacco, the high efficiency of this herbicide was established by Jacobsohn and Kelman (1980), Langston et al. (1983), Lolas (1986), and a number of other researchers. Bozukov (2009) proved a reduction of the degree of broomrape contamination by means of a single or two treatments on the 40th and 60th day after planting tobacco by spraying glyphosate on the lower layer of leaves.

Knowledge of the conditions, processes, and factors determining the various properties of tobacco is essential. This allows cultivating it under suitable conditions and streamlining the manufacturing and technological processes, so as to obtain a raw material of the highest quality.

The purpose of the present study is to determine the change in the technological quality of oriental tobacco treated with glyphosate for the control of broomrape. The data from this study could provide

useful information on the possible changes of basic chemical compounds in tobacco leaves after applying glyphosate.

Materials and Methods

The study was conducted in the experimental field of the Tobacco and Tobacco Products Institute – Plovdiv in 2012 and 2013. The subject of study was the oriental variety Plovdiv 7 grown on humus carbonate soils with a humus content of 3.350% and a pH of 8.16.

The culture was treated with the product Glyphogan 480 SL containing 360 g/l of glyphosate.

The variants of the experiment were as follows:

1. Control – tobacco untreated with Glyphogan 480 SL
2. Treated acropetally on the 40th day after planting the tobacco, dosed at 30 ml/dka
3. Treated basipetally on the 40th day after planting the tobacco, dosed at 30 ml/dka
4. Treated acropetally on the 40th day after planting the tobacco, dosed at 50 ml/dka
5. Treated basipetally on the 40th day after planting the tobacco, dosed at 50 ml/dka
6. Treated acropetally on the 40th and 55th day after planting the tobacco, dosed at 30+30 ml/dka
7. Treated basipetally on the 40th and 55th day after planting the tobacco, dosed at 30+30 ml/dka
8. Treated acropetally on the 40th and 55th day after planting the tobacco, dosed at 50+50 ml/dka
9. Treated basipetally on the 40th and 55th day after planting the tobacco, dosed at 50+50 ml/dka

Spraying the herbicide acropetally targets the top leaves of the plants, whereas spraying basipetally targets the base of the stem.

The nicotine, sugar, total nitrogen and ash content was determined for all variants of the experiment, as well as for the untreated control. Nicotine was determined as a %, in accordance with ISO 15152; reducing sugars as a %, in accordance with ISO 15154; total nitrogen as a %, in accordance with BDS 15836-88, ash as a %, in accordance with ISO 2817.

The analyses were performed on first and second class tobacco batches.

Results and Discussion

The results of the chemical analyses for the content of nicotine, sugars, total nitrogen and ash in the samples of first and second-class tobacco, Plovdiv 7 variety, by variant, are presented in Table 1 and Table 2, respectively.

In first-class tobacco, the chemical indicators varied as follows: nicotine had the lowest content - 1.80% in the industrial control, and the highest content - 2.27% in the variants with two applications of glyphosate acropetally and basipetally. Sugars ranged from 11.20% in the variant with a single application of a low dose of Glyphogan 480 SL acropetally up to 15.50% in the industrial control. The total nitrogen was 1.93% in the industrial control and 2.41% for the variant with two applications of low doses of the substance acropetally. The ashes had the lowest percentage - 11.38% in variant 4 and the highest percentage of 12.91% in variant 7 (Table 1).

The optimal levels of nicotine in tobacco of the Plovdiv 7 variety, according to the Bulgarian Variety List catalogs (BVL), are from 0.9% to 2.0%. The fist class tobacco batches within this range were the industrial control and two of the experimental variants – 2 and 5. According to N. Donev et al. (1981) breaking and feeding with nitrogen during vegetation assist in the development of a more powerful root system and, indirectly, increase the resistance of the plant to the parasite. In addition, they also cause an increase in the nicotine content of the tobacco plant . That could explain the relatively high nicotine content in the experimental variants and in the control for first class tobacco.

The recommended percentage content of sugars in tobacco leaves of the Plovdiv 7 variety, according to BVL, ranges from 6.5% to 19.5%. It is worth noting that all first class variants fell within this range.

The optimum amount of total nitrogen in the oriental tobacco variety Plovdiv 7, according to BVL, is from 1.57% to 2.5% and the results for the first class variants were within this range.

According to Gyuzelev (1983), oriental tobaccos with the highest quality leaves have ash in the range from 9% to 14%. From the results obtained, it is clear that all first class variants had optimal ash content.

Table 1. Chemical composition of oriental tobacco, Plovdiv 7 variety, treated with glyphosate to control broomrape – first class

Variant	Nicotine, %	Sugars, %	Total nitrogen,%	Ashes, %
1. Control	1,80	15,50	1,93	12,24
2. Acropetally 40 day – 30 ml/dka	1,88	11,20	2,02	12,00
3. Basipetally 40 day – 30 ml/dka	2,04	13,30	2,25	12,40
4. Acropetally 40 day – 50 ml/dka	2,18	12,90	2,13	11,38
5. Basipetally 40 day – 50 ml/dka	2,00	14,40	2,07	12,21
6. Acropetally 40 + 55 day – 30+30 ml/dka	2,24	11,70	2,41	12,89
7. Basipetally 40 + 55 day – 30+30 ml/dka	2,25	13,90	2,15	12,91
8. Acropetally 40 + 55 day – 50+50 ml/dka	2,27	12,30	2,13	12,56
9. Basipetally 40 + 55 day – 50+50 ml/dka	2,27	14,10	2,09	12,80

In the second-class tobacco, after treatment with Glyphogan 480 SL, the variation in the chemical indicators was as follows: nicotine from 2.10% in the control to 2.97% in the variant with two applications of a high dose of the substance basipetally. Sugars ranged from 8.09% in the control to 14.80% in the variant with two applications of a low dose of the substance basipetally. Total nitrogen had the lowest content - 1.95% for the same variant and the highest content - 2.50% for the variant with a single application of a low dose of the substance acropetally. Ashes were 12.01% for variant 6 and 15.94% in the control (Table 2).

It is noteworthy that the nicotine content of all batches of the second class was above 2.00%, and, according to BVL, is higher than optimal for the variety.

Under the conditions of the experiment, the sugars and total nitrogen content in second class oriental tobacco of the Plovdiv 7, for all variants, had values that meet the standard.

According to Gyuzelev (1983), oriental tobaccos with the highest quality leaves have ash in the range from 9% to 14%. From the results obtained, it can be seen that only the control and variant 5 had higher ash contents. These two variants were defined as of average quality in terms of ash content.

It is noteworthy that the variation in all tested chemical parameters was within a narrow range. It is worth noting that Kasheva (2013) found analogous changes in the quality of oriental tobacco of the Basma variety group as a result of natural fermentation.

In conclusion, it can be stated that almost all variants have good technological properties.

Table 2. Chemical composition of oriental tobacco, Plovdiv 7 variety, treated with glyphosate to control broomrape – second class

Variant	Nicotine, %	Sugars, %	Total nitrogen,%	Ashes, %
1. Control	2,10	8,09	2,27	15,94
2. Acropetally 40 day – 30 ml/dka	2,35	9,12	2,50	13,37
3. Basipetally 40 day – 30 ml/dka	2,46	9,70	2,07	13,23
4. Acropetally 40 day – 50 ml/dka	2,54	11,40	2,02	13,28
5. Basipetally 40 day – 50 ml/dka	2,66	12,70	2,04	14,30
6. Acropetally 40 + 55 day – 30+30 ml/dka	2,70	12,20	2,25	12,01
7. Basipetally 40 + 55 day – 30+30 ml/dka	2,93	14,80	1,95	13,12
8. Acropetally 40 + 55 day – 50+50 ml/dka	2,79	9,02	2,33	13,93
9. Basipetally 40 + 55 day – 50+50 ml/dka	2,97	14,30	2,09	13,02

The complex influence of some chemical indicators will be used to characterize objectively the smoking properties of the tobacco. For example, the ratio of soluble sugars to nicotine gives an idea of the density and smoothness of taste and the occurrence of burning and sharpness (Kasheva, M., Kochev, J., 2012). The optimal values of the ratio of soluble sugars to nicotine for oriental tobacco of the Basma group are between 6.0 - 10.0.

The ratio of soluble sugars to nicotine was in the range 6.00 - 10.00 for first class in the control and in variants 3, 5, 7, 9. In these variants the tobacco smoke when smoking had a well expressed fullness, harmony and smoothness of the taste. For second class tobacco, all variants had values less than 6.00. Only variant 7, for which the ratio of sugars to nicotine was 5,05, came close to a good quality tobacco (Table 3).

When the ratio of soluble sugars to nicotine is less than 6.00 the tobacco is of a lower quality. Within this range were variants 2, 4, 6, 8 of the first class and all variants of the second class. These tobaccos had an expressed sharpness and harshness of the tobacco smoke to the taste. These sensations were due to the higher percentage of nicotine in combination with the lower percentage of sugars.

Table 3. Soluble sugars to nicotine ratio by option and class

Variant	I class	II class
1. Control	8,61	3,85
2. Acropetally 40 day – 30 ml/dka	5,96	3,88
3. Basipetally 40 day – 30 ml/dka	6,52	3,94
4. Acropetally 40 day – 50 ml/dka	5,92	4,49
5. Basipetally 40 day – 50 ml/dka	7,20	4,77
6. Acropetally 40 + 55 day – 30+30 ml/dka	5,22	4,52
7. Basipetally 40 + 55 day – 30+30 ml/dka	6,18	5,05
8. Acropetally 40 + 55 day – 50+50 ml/dka	5,42	3,23
9. Basipetally 40 + 55 day – 50+50 ml/dka	6,21	4,81

Conclusion

The nicotine content of first class oriental tobacco had optimal values in the control and in the variants with a single treatment with Glyphogan 480 SL dosed at 30 ml/dka acropetally and a single treatment with Glyphogan 480 SL dosed at 50 ml/dka basipetally applied for the control of broomrape.

For second class tobacco, the nicotine content in all variants was above the 2% limit.

The amount of sugars and total nitrogen in tobacco batches of the first and second class for all variants were within the reference values.

The ashes in all variants, except for the control and the second class variant with a single application of Glyphogan 480 SL dosed at 50 ml/dka basipetally, were within the reference values.

For first-class oriental tobacco of the Plovdiv 7 variety treated with glyphosate (Glyphogan 480 SL), in the control and all variants with treatment basipetally, the tobacco smoke when smoking had a well expressed fullness, harmony and smoothness to the taste.

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