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INVESTIGATIONS OF THE VARIABILITY OF QUANTITATIVE CHARACTERS OF ORIENTAL BASMAK TOBACCO

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Abstract

Three-year comparative investigations (2009, 2010 and 2011) were carried out on the Experimental field of Scientific Tobacco Institute - Prilep with the following oriental tobacco varieties: YK -7-4/2 (control variety), MK-1, MB-2 and MB-3. The experimental design was randomized block system with five replications with transplantation spacing of 45×12 cm. Standard agrotechnics was applied in seedling and tobacco growing on the investigated varieties' field. The aim of investigations was to estimate the variability of morphological characters of tobacco varieties using the basic statistical parameters: standard deviations, degree of variability and LSD test. Basmak varieties, compared to the control variety, showed a very low variability of the investigated morphological characters, which indicates that basmak varieties are characterized by high level of uniformity and they are typical oriental varieties. The results of investigations led to the following conclusions: MK-1 and MB-2 are Basmak varieties with relatively short growing season of 59 and 61 days, respectively, after tobacco planting in the field, while the variety MB-3 blooms after 77 days. The investigated varieties are characterized by medium plant height and by leaf number ranging from 26 in the control to 35 in MB-3. The short growing season of the basmak tobacco variety lets the grower harvest and dry tobacco in time which will lead to a higher quality raw tobacco material with a higher price. We hope that these high quality characters of the basmak varieties will encourage growers, as well as tobacco factories, manufacturers and tobacco dealers.

Key words: *Tobacco, variability, standard deviation (†), degree of variability*

Introduction

Tobacco is a culture with a multi-century tradition which represents a main occupation of a large number of families. It is produced not only in the poorer countries, but it is also produced in the richer countries, such as China, which participates with 40% of the total world tobacco production, the USA with 9%, Brazil, Italy, etc.

90% of the total production of oriental tobacco in R. Macedonia (which represents 25-30 thousand tons) is exported to foreign markets. Due to the quality oriental tobacco which is produced in the Republic of Macedonia, it has gained a reputation of being a country with a small area and small population, but with the largest tobacco production per capita in the world. The change of smokers' tastes cause manufacturers to change their demands of certain raw oriental tobacco material which is used in the mass production cigarettes. Thus, every year foreign buyers are offered raw material from different types i.e. varieties in order to satisfy their demands regarding aroma, flavor and other tobacco characters. Basmak tobaccos are known in the world as being high quality and highly appreciated oriental tobaccos which are primarily grown in Greece and Turkey. However, with the drastic decrease of their production in these countries (especially in Greece), tobacco factories from R. Macedonia consider this as an opportunity to redirect part of that production to places with suitable soil and climate conditions. In order to make this production more attractive to manufacturers, we

created not only varieties with short growing season, but their price is somewhat higher in comparison with other oriental tobaccos.

Material and methods

The following 4 varieties were used in the process of the three-year investigations (2009, 2010 and 2011): YK 7 - 4/2 (control) (\emptyset), and basmak varieties MK – 1 , MB – 2 and MB – 3. Tobacco type Yaka YK 7-4/2 was created at the Scientific Tobacco Institute-Prilep in 1932 by Rudolph Gornik. It was obtained by massive selection of Xanthi Yaka. Basmak varieties MK-1, MB-2 and MB-3 were created at the Scientific Tobacco Institute-Prilep with individual selection from local population by a group of authors from The Scientific Tobacco Institute-Prilep and The Faculty of Agricultural Sciences and Food –Skopje with the support of the tobacco industry. They were acknowledged by the Commission for National variety list of agricultural crops in 2010.

The seedling was produced with the usual method in cold beds covered with polyethylene fabric at the seed-bed of the Scientific Tobacco Institute-Prilep. During the investigation, we used elite seed material with quantity of 5 g per 10 m². All necessary agrotechnics was applied in the production of the seedling (Photography 1). The soil was prepared with one autumn and three spring ploughings before tobacco planting in the field. The manuring of the soil during the three years of investigation was done with 300 kg/ha mineral manure NPK (8:22:20). The seedling of the experiment was planted on 02. 06. 2009, 07. 06. 2010 and 11. 06. 2011. Investigated varieties were set up with randomized block system with 5 replications applying planting density of 45×12 cm on a previously prepared soil (Photography 2).



Photo. 1. Production of seedling Photo. 2. Field experiment (Method-randomized block system)

The useful area of the experiment was 214 m². During the growing season we monitored the length of the growing period of tobacco in the field.

We also conducted morphological measurements of the following parameters on 50 plants per variety: plant height and number of leaves per plant, and we checked the variability of morphological characters of tobacco varieties using the basic statistical parameters: standard deviations, degree of variability and LSD test.

Results and discussion

Length of the growing season per phases

The length of field growing period is considered to be a varietal character, thus we differentiate varieties with short, medium and long growing periods. Table 1 shows the following plant growing phases beginning of flowering in days , 50 % flowering, and 100 % flowering, in days.

Table 1. Length of the growing season per phases (days)

Variety	Year	Planting	Beginning of flowering, in days	Differences from the average			50% flowering, in days	Average (days) 09/11	Differences from the average		100% flowering, in days	Average (days) 09/11	Differences from the average	
				Absolute	Relative	Absolute			Relative	Absolute			Relative	
YK 7-4/2 Ø	2009	2.06	30				53				56			
	2010	7.06	39	37	/	100	50	52	/	100	54	56	/	100
	2011	11.06	42				52				59			
-1	2009	2.06	38				53				58			
	2010	7.06	44	43	+6	116	54	54	+2	104	57	59	+3	105
	2011	11.06	47				58				61			
B-2	2009	2.06	40				55				59			
	2010	7.06	50	47	+10	127	57	57	+5	110	63	61	+5	109
	2011	11.06	52				60				62			
B-3	2009	2.06	45				60				70			
	2010	7.06	57	53	+16	143	72	65	+13	125	84	77	+21	137
	2011	11.06	56				64				78			

According to average values, variety YK 7-4/2 started to bloom first (in 37 days), and variety MB - 3 started to bloom last (in 53 days). The phase from planting to 50 % blossom is earliest noticed in standard variety YK 7-4/2 (in 52 days), and latest in MB-3 (in 65 days) where the absolute difference is 13 days more than the control.

Full (100 %) blossom is earliest noticed in the control variety YK 7-4/2 (56 days), and latest in MB-3 (77 days), where the absolute difference is 21 days more than the standard. Variety MK-1 reaches full blossom in 59 days and MB-2 in 61 days. These two newly acknowledged varieties have a shorter growing season as compared to the newly acknowledged variety MB-3, which has a longer growing season.

Plant height with inflorescence

Under the influence of agro-ecological conditions and applied agricultural engineering, plant height varies within certain range which is typical of tobacco type and variety. Karajankov, et al. (2007) reported that tobacco plant height is a type and varietal character, ranging from 50 cm to 300 cm, and more. The same authors divide tobacco plants, according to their height measured from the base to the top of inflorescence, into four groups:

Types and varieties with short height (up to 70 cm),

Types and varieties with medium height (71 to 131 cm),

High types and varieties (131 cm to 210 cm),

Very high types and varieties (over 211 cm).

Uzunoski (1985) reported that tobacco height is quantitative trait which highly depends on variety and environmental conditions.

According to data presented in Table 2, the lowest stalk height with inflorescence in 2009 was measured in control variety YK 7-4/2 (85 ± 0.92 cm), with standard deviation of 5.12 cm and variational coefficient of 6.04%. Variety MB-3 is characterized by the highest stalk height (93 ± 0.81 cm), with standard deviation of 4.33 cm and variational coefficient of 4.66%, and these are the lowest in comparison with the values of the investigated varieties.

Table 2. Stalk height with inflorescence

Variety	2009 year			2010 year			2011 year			Difference			
	$\bar{x} \pm c \cdot x$	σ	cV %	$\bar{x} \pm c \cdot x$	σ	cV %	$\bar{x} \pm c \cdot x$	σ	cV %	Average cm	Absolute	Relative	
YK 7-4/2 Ø	85 ± 0.92	5.12	6.04	80 ± 1.11	7.03	6.93	80 ± 1.12	7.03	8.84	82	/	100.00	
-1	$91 \pm 0.98^{++}$	6.90	6.29	$89 \pm 1.15^{++}$	8.42	9.50	82 ± 1.27	9.41	11.41	87	+5	106.10	
B-2	$92 \pm 0.99^{++}$	6.55	7.07	$90 \pm 1.05^{++}$	7.12	7.93	84 ± 1.15	7.84	9.31	89	+7	108.54	
B-3	$93 \pm 0.81^{++}$	4.33	4.66	$106 \pm 0.85^{++}$	5.41	5.12	$101 \pm 0.95^{++}$	6.42	6.34	100	+18	121.95	
2009 year LSD 5%			3.96 ⁺	2010 year LSD 5%			3.47 ⁺	2011 year LSD 5%			4.80 ⁺		
			1% 5.57 ⁺⁺				1% 4.88 ⁺⁺				1% 6.74 ⁺⁺		

In 2010, the lowest stalk height was measured in control variety (80 ± 1.11 cm), with standard deviation of 7.03 cm and variational coefficient of 6.93%. Variety MB-3 is characterized by the highest stalk height (106 ± 0.85) and the lowest values of standard deviation (5.41 cm) and variational coefficient (5.12%).

In 2011, the lowest plant height was measured in control variety YK 7-4/2 (80 ± 1.12 cm), with standard deviation of 7.03 cm and variational coefficient of 8.84%. The highest stalk height was measured in basmak variety MB-3 (101 ± 0.95 cm), with standard deviation of 6.42 cm and variational coefficient of 6.34 cm.

The average height of plants with inflorescence ranges from 82 cm in control variety YK 7-4/2 to 100 cm in MB-3, or it represents 21.95 % more in comparison with the control.

Analyzing by years, a high significant difference of 1 % was noticed in the three basmak varieties MK-1, MB-2 and MB-3 in 2009 and 2010 and in variety MB-3 in 2011. If we compare MK-1 and MB-2 with the control variety, we can notice that these didn't show any significant difference in the drier year 2011. The results show that all investigate varieties belong to the group of tobaccos with medium plant growth. Dimitrieski et al. (2011), in his investigations on variety P-66-9/7 suggested that under normal conditions for growth, plant height ranges from 65 to 75 cm. Korubin – Aleksoska (2004) report the following average stalk heights: P-23-65 cm, P12-2/1-55cm and P-79-94 – 70 cm. Mitreski (2012) report the

average values for the height of the stalk with inflorescence ranged from 59.3 cm in Prilep P 12-2/1 to 148.1 cm Prilep Basma 82.

Total number of leaves in investigated varieties

The number of leaves represents a varietal character which, depending on soil, climate and agricultural engineering conditions, changes only within certain range.

Table 3 shows that the lowest number of leaves in 2009 was counted in control variety YK 7-4/2 (26±0.95), with standard deviation of 1.64 and variational coefficient of 6.33%. The highest number of leaves was counted in variety MB-3 (34±0.70), with the lowest standard deviation of 1.18 and the lowest variational coefficient of 3.46%.

Table 3. Number of leaves per variety

Variety	2009 year			2010 year			2011 year			Average number of leaves	Difference	
	$\bar{x} \pm s_x$	σ	cV %	$\bar{x} \pm s_x$	σ	cV %	$\bar{x} \pm s_x$	σ	cV %		Absolute	Relative
YK 7-4/2 Ø	26±0.95	1.64	6.33	27±0.94	1.68	6.27	25±0.99	1.80	7.07	26.0	/	100.00
-1	29±0.99 ⁺⁺	2.00	6.93	30±0.88 ⁺⁺	1.67	5.53	28±0.94 ⁺⁺	1.75	6.30	29.0	+3.0	111.54
B-2	31±0.87 ⁺⁺	1.63	5.35	31±0.79 ⁺⁺	1.38	4.45	30±0.85 ⁺⁺	1.55	5.10	30.7	+4.7	118.08
B-3	34±0.70 ⁺⁺	1.18	3.46	38±0.69 ⁺⁺	1.28	3.32	34±0.75 ⁺⁺	1.37	4.02	35.3	+9.3	135.77
2009 year. LSD 5% = 1.10 ⁺			2010 year LSD 5%= 1.88 ⁺			2011 year LSD 5%= 1.03 ⁺						
1% = 1.15 ⁺⁺			1% = 2.64 ⁺⁺			1% = 1.45 ⁺⁺						

In 2010, the lowest number of leaves was counted in control variety (27±0.94), with the highest standard deviation of 1.68 and the highest variational coefficient of 6.27%. Basmak variety MB-3 has the highest number of leaves in 2010 (38±0.69) and the lowest variational coefficient (3.32%). In 2011, the number of leaves in control variety ranges from 25±0.99 with variational coefficient of 7.07%, to 34±0.75 in the newly acknowledged variety MB-3 and variational coefficient of 4.02%. The average number of leaves ranges from 26 in YK 7-4/2 to 35.3 in variety MB-3, or it represents 35.77 % more in comparison with the control variety. During investigations, newly acknowledged varieties (MK-1, MB-2 and MB-3) were characterized by highly significant difference with level of probability of 1 % in comparison with the control variety YK 7-4/2. Ko oska (2006), reports that the number of leaves in half-oriental varieties and lines is higher by 1-3 leaves in watered variant in comparison with the non-watered variant. Gornik (1983) reports that variety YK 7-4/2 has 26 - 32 sessile leaves which was also confirmed with our investigations.

Conclusion

- Newly created basmak tobacco varieties which were used in the investigations, like the control variety, are characterized by short growing season , from 56 to 77 days to 100%

blossom. This enables the formation of leaves and the processes of ripening, harvesting and drying to be done in favourable conditions which will result in quality raw tobacco material.

- The average plant height with inflorescence ranges from 82 cm in control variety YK 7-4/2 to 101 cm in MB-3, which is by 21.95 % more in comparison with the control variety.

- The number of leaves ranges from 26.0 in control variety YK 7-4/2 to 35.3 in variety MB-3, which is by 35.77 % more in comparison with the control variety. Regarding this character, varieties MK-1, MB-2 and MB-3 are characterized by highly significant difference of 1 % in comparison with the control variety.

These investigations and their results have shown that basmak tobaccos can be successfully grown in the Republic of Macedonia which will result in a more diverse assortment and it will increase production of oriental tobaccos.

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