

COMPARATIVE INVESTIGATIONS OF SOME FOREIGN AND DOMESTIC HYBRID VARIETIES OF VIRGINIA TOBACCO IN THE REGION OF PRILEP

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ABSTRACT

Two-year investigations (2008 - 2009) were carried out in the field of Tobacco Institute-Prilep. The trial included six varieties of domestic and foreign origin: K-326, Ø (USA), V-513 (Bulgaria), Virginia SKR (Zimbabwe) and V-78/07 CMS F₁, V-82/07 CMS F₁, V-63/04 CMS F₁ (created in Tobacco Institute-Prilep, Macedonia).

Investigations were performed using the standard methodologies. According to the obtained results, domestic hybrid CMS varieties have shown better quality characteristics compared to the foreign varieties. From all varieties investigated, we would especially emphasize the domestic male-sterile hybrid V-63/04 CMS F₁.

Key words: virginia, hybrid varieties, tobacco

РЕЗУЛТАТИ ОД КОМПАРАТИВНИ ИСПИТУВАЊА СО НЕКОИ СТРАНСКИ И ДОМАШНИ ВИРЦИНСКИ ХИБРИДНИ СОРТИ ВО ПРИЛЕПСКИОТ РЕОН

Во двегодишните испитувања (2008-2009 год) беше изведен полски опит на површините од опитното поле во Научниот институт за тутун – Прилеп.

Во испитувањата беа вклучени 6 сорти од домашниот и странскиот сортимент и тоа : K-326 F₈ Ø (САД), V-513 (Бугарија), Virginia SKR (Зимбабве), и V-78/07 ЦМС F₁, V -82/07 ЦМС F₁, V-63/04 ЦМС F₁, сите креации на НИТ – Прилеп.

Испитувањата се извршени по стандардни методологии. Според добиените резултати, домашните хибридни ЦМС сорти покажуваат подобри квалитативни својства во споредба со странските, при што посебно ја издвојуваме домашната новосоздадена хибридна машкостерилна сорта V-63/04 ЦМС F₁.

Клучни зборови: вирцинија, хибридни сорти, тутун

INTRODUCTION

China and USA are the world's largest producers of Virginia tobacco. This type originates from sub-tropic regions and is successfully grown in areas at 60° north and 40° south latitude (S.N. Hawks Jr., W.K. Collins, 1994). In the structure of world tobacco production, Virginia is represented with the highest percentage (63.12%) and its share in the content of blend cigarettes is over 60% (Filiposki K., Stojanoska S., 2000).

Production of Virginia tobacco in Macedonia started in 1970 in the region of Prilep, and afterwards it was spread in other regions with

suitable soil and climate conditions.

According to Risteski I. (2000), about 1633 tons of Virginia were produced in the period 1976-1988 and 1475 tons in 1989-1997, but after 2002 this production was reduced to a minimum. Despite this reduction, new hybrid CMS varieties of Virginia tobacco with good quality and competitive with foreign varieties have been created in Tobacco Institute - Prilep.

The aim of this paper is to present the results of two-year investigations on the newly created Virginia varieties, for which we hope to find their place in the production of blend cigarettes.

MATERIAL AND METHODS

The trial was set up in the field of Tobacco Institute-Prilep with 4 replications in randomized blocks at 90 x 50 cm spacing. Six foreign and domestic varieties (K-326, Ø - USA, V-513 - Bulgaria, Virginia SKR (Zimbabwe) and V-78/07 CMS F₁, V-82/07 CMS F₁, V-63/04 CMS F₁ - created in Tobacco Institute-Prilep) were included in the investigation. The soil was pretreated and fertilized with 300 kg/ha NPK 8:22:20. Two hoeings and one nutrition with KAN (3-4 g/stalk) were made and irrigations were applied depending on climate conditions and plant requirements. During the vegetation period, several treatments were applied against diseases and pests.

After harvesting and stringing, tobacco

was cured in barns specially designed for Virginia tobacco and the length of vegetation period was recorded (beginning of flowering, 50% of flowering and the end of flowering) for each variety in the trial. Weather conditions were registered in Meteorological Station of Tobacco Institute-Prilep and agro-ecological properties of soil were investigated in its Department of Agrotechnics, according to internationally recognized methods. Qualitative estimation of dry tobacco was made in accordance with the current Rules on tobacco quality. Yield per stalk and hectare was estimated by the method of Rimker, while evaluation of average price and gross income were based on valid price for Virginia tobacco.

RESULTS AND DISCUSSION

- Soil and climate conditions

Soil and climate conditions significantly affect tobacco yield and quality. For a more rapid growth, Virginia tobacco requires sandy or loam-sandy soils, with approximately 25-38 mm of rainfall every 7-10 days (S.N. Hawks Jr., W.K. Collins, 1994). Our trial was made in loamy soil with poor content of humus (1.27%),

total N (0.059%) and low pH (6.48 and 5.69). The supplies of P₂O₅ and K₂O were extremely high (74.3 mg/100g and 28.6 mg/100g of soil, respectively). Fertilization with NPK and additional nutrition with KAN were applied prior to transplanting.

Table 1 Plot 26 - Seedbeds of Tobacco Institute - Prilep

Depth cm	Humus %	N %	pH		Available in mg/100g of soil		Soil classification after Wigner
			H ₂ O	KCl	P ₂ O ₅	K ₂ O	
0 - 30	1,27	0,059	6,48	5,69	74,3	28,6	Light loam

Temperature, precipitations and relative air humidity are the factors which have essential impact on tobacco growth and its biomorphological, technological and chemical characteristics.

Tobacco plant originates from regions with tropic climate and therefore requires higher

temperatures compared to other crops. The optimum temperature range throughout the whole period of tobacco growth is 20 - 30°C (Hawks & Collins 1994, Rubin B.A. 1971).

Data on climate conditions during vegetation period (May-September) in the two-year investigations are presented in Table 2.

Table 2. Meteorological data for the period May – September 2008/2009, Tobacco institute – Prilep

Meteorological data	Year	Months					X /Σ
		V	VI	VII	VIII	IX	
Mean monthly air temperature °C	2008	16,7	19,9	22,3	23,6	15,8	19,7
	2009	15,8	18,5	21,9	21,4	17,1	18,9
Mean monthly relative humidity of the air %	2008	60	53	49	50	71	57
	2009	58	57	42	50	54	52
Days with precipitation	2008	8	5	4	2	10	29
	2009	10	10	3	7	5	35
Total precipitations mm	2008	41,3	10,0	11,0	11,0	110,0	183,3
	2009	55,0	75,0	8,0	43,0	15	196,0

The lowest mean monthly air temperatures in both years were recorded in May (16.7 °C in 2008 and 15.8°C in 2009), but they had no negative effects on tobacco growth and development. Optimum temperatures were recorded in July (22.3°C in 2008 and 21.9°C in 2009) and August (23.6°C in 2008 and 21.4°C in 2009).

The average air temperature in the period May-September reached 19.7°C in 2008 and 18.9°C in 2009 and is somewhat lower from the optimum.

Relative air humidity is closely related to precipitations, number and quantity of additional irrigations, air temperature, etc. The lowest

values of relative humidity were recorded in June (49% in 2008 and 42% in 2009), and the highest in May and September (71% in September 2008 and 58% in May 2009). The average relative humidity for the whole vegetation period (May-Sept.) was 57% in 2008 and 52% in 2009.

Precipitation amounts in both years of investigation were the lowest in June and July (11.0 mm in 2008 and 8.0 mm in 2009) and the highest value was achieved in September 2008 (11.0 mm). Due to irregular precipitations, especially in 2008, additional waterings were applied, so that the total amount reached 183.3 mm in 2008 and 196.0 mm in 2009.

- Length of the vegetation period

The shortest period to the beginning of flowering stage (58 days) has the standard variety K-326. This period was the longest in varieties V-513 and V - 63/04 CMS F₁ (68 days, i.e. 10 days later than the standard variety).

Table 3 - The length of the vegetation period

Variety	Crop	Days from transplanting to the beginning of flowering	Average 2008/2009		Difference from the average		Days to 50% of flowering	Average 2008/2009		Difference from the average		Days to 100% of flowering	Average 2008/2009		Difference from the average	
			Absolute	Relative	Absolute	Relative		Absolute	Relative	Absolute	Relative					
K - 326 Ø	2008	50	58	/	100.00	67	66	/	100.00	72	70	/	100.00			
	2009	56				65				68						
V - 513	2008	70	68	+10	117.24	73	72	+6	109.09	78	77	+7	110.00			
	2009	66				74				76						
Virginia SKR	2008	66	64	+6	110.30	71	69	+3	104.54	76	74	+4	105.71			
	2009	62				67				72						
V-78/07 CMS F ₁	2008	67	66	+8	113.79	73	72	+6	109.09	79	77	+4	110.00			
	2009	65				71				75						
V - 82/07 CMS F ₁	2008	68	66	+8	113.79	74	72	+6	109.09	78	78	+8	111.42			
	2009	64				70				75						
V - 63/04 CMS F ₁	2008	70	68	+10	117.24	74	73	+7	110.60	80	79	+9	112.85			
	2009	66				72				78						

Also the period to 50% of flowering was shortest in the standard variety K-326 (67 days) and longest in V-63/04 CMS F₁ (73 days). The same regularity can be observed for the period 100% of flowering, which ranges from 70 days in the standard variety K-326 to 79 days in V-63/04 CMS F₁. The 10-days difference between the first-blossomed and last-blossomed varieties is not significant enough to

seriously affect leaf maturation and collection of seed material. S.N. Hawks Jr. and W.K. Collins 1994) reported that For best maturation of plants, Virginia tobacco requires 60 days for flowering and 120 days without frost during its field growth. Our investigations revealed that the newly created varieties have adequate length of vegetation period which enables their complete development and leaf maturation.

- Corrected yield per stalk, g/stalk

The highest average yield of 135.75 g/ stalk was achieved with the new domestic variety V-63/04 CMS F₁, with 11.18% higher relative difference compared to the check variety. In

both investigating years this variety showed 5% statistically significant difference in relation to the check (Table 4).

Table 4. Yield per stalk, g/stalk

Variety	Crop	Average	Average 2008/2009	Difference from the average		Range
				Absolute	Relative	
K - 326 Ø	2008	127,7	122,10	/	100,00	4
	2009	115,5				
V - 513	2008	120,5	114,75	-7,35	93,98	5
	2009	109,0				
Virginia SKR	2008	99,0	94,40	-27,70	77,31	6
	2009	89,8				
V- 78/07 CMS F ₁	2008	132,2	125,60	-3,5	102,87	2
	2009	119,0				
V – 82/07 CMS F ₁	2008	130,7	123,85	-1,75	101,43	3
	2009	117,0				
V – 63/04 F ₁	2008	142,5 ⁺	135,75	+13,65	111,18	1
	2009	129,0 ⁺				

	2008	2009
LSD	5% = 12,42 g / stalk	5% = 10,60 g / stalk
LSD	1% = 17,21 g / stalk	1% = 14,67 g / stalk

The lowest average yield was observed in foreign varieties Virginia SKR (94.40 g/stalk) and V- 513 (114.75 g/stalk), which showed no statistically significant difference.

The other newly created varieties also showed higher average yield compared to the foreign varieties (V-78/07 CMS F₁ - 125.60 g/stalk ; V-82/07 CMS F₁ - 123.85 g/stalk) .

- Corrected yield per hectare, kg/ha

The highest average yield (2998 kg/ha) was achieved with the new domestic hybrid variety V-63/04 CMS F₁, with relative difference

11.70% higher than the check variety and 5% statistically significant difference in both years of investigation (Table 5).

Table 5 Yield per hectare, kg/ha

Variety	Crop	Average	Average 2008/2009	Difference from the average		Range
				Absolute	Relative	
K - 326 Ø	2008	2825	2684	/	100,00	4
	2009	2543				
V - 513	2008	2669	2536	-148	94,49	5
	2009	2403				
Virginia SKR	2008	2192	2083	-601	77,61	6
	2009	1973				
V- 78/07 CMS F ₁	2008	2926	2780	+96	104,17	3
	2009	2634				
V – 82/07 CMS F ₁	2008	2896	2896	+212	107,90	2
	2009	2896				
V – 63/04 CMS F ₁	2008	3156 ⁺	2998	+314	111,70	1
	2009	2840 ⁺				

	2008	2009
LSD	5% = 223,79 kg/ha	5% = 250,24 kg/ha
	1% = 309,95 kg/ha	1% = 346,58 kg/ha

The lowest yield was observed in foreign varieties Virginia SKR (2083 kg/ha) and V- 513 (2536 kg/ha). The other newly created varieties

showed higher average yield compared to the check (V-82/07 CMS F₁ - 2896 kg/ha; V-78/07 CMS F₁ - 2780 kg/ha).

-Gross monetary income (economic effect), den/ha

The highest economic effect (Table 6) was achieved with the new domestic hybrid variety V-63/04 CMS F₁ (169 712 den/ha), with relative difference 6.93% higher than the check variety. The lowest economic effect was

observed in the foreign variety Virginia SKR, with relative difference 3073% lower than the check. Statistically important differences for this feature compared to the check have not been observed in both years of investigation.

Table 6 Gross monetary income (economic effect), den/ha

Variety	Crop	Average	Average 2008/2009	Difference from the average		Range
				Absolute	Relative	
K - 326 Ø	2008	168 122	158 706	/	100,00	3
	2009	149 290				
V - 513	2008	138 742	131 500	- 27 206	82,86	5
	2009	124 258				
Virginia SKR	2008	116 549	109 932	-48 774	69,27	6
	2009	103 315				
V-78/07 F ₁	2008	172 000	162 791	+4 085	102,57	2
	2009	153 581				
V – 82/07 CMS F ₁	2008	169 922	161 924	+3 218	102,03	4
	2009	153 925				
V - 63/04 CMS F ₁	2008	179 375	169 712	+11 006	106,93	1
	2009	160 049				

2008

2009

LSD 5% = 25193,96 den/ha 5% = 19980.04 den/ha

1% = 34893,04 den/ha 1% = 27671.88 den/ha

CONCLUSION

Based on the two-years investigation of qualitative characteristics of the foreign and some domestic newly created hybrid varieties of the type Virginia, the following can be concluded:

- Soil and climate conditions of R. Macedonia are not very favorable for production of the type Virginia, but with additional fertilization and irrigation it will be possible to obtain a good quality of this tobacco.

- The shortest period to the beginning of flowering (58 days) and 100% flowering stage (70 days) was observed in the variety K-326 . The longest period to the beginning of flowering was recorded in V-513 and V-63/04 CMS F₁ (68 days). The longest period to 100% of flowering was achieved in V-63/04 CMS F₁ (78 days) - 8

days later than the standard, but this difference has no negative impact on quality characteristics of this newly created variety.

- The highest average yield per stalk was observed in the new domestic variety V-63/04 CMS F₁ (135.75 g/stalk) and the lowest in foreign variety Virginia SKR (94.40 g/stalk).

- The average corrected yield per hectare was the highest in V-63/04 CMS F₁ (2998 kg/ha) and the lowest in foreign varieties Virginia SKR (2083 kg/ha) and V-513 (2536 kg/ha).

- The highest economic effect per hectare was achieved in domestic variety V-63/04 CMS F₁ (169 712 denars/ha), and the lowest in foreign variety Virginia SKR (109 932 den/ha).

REFERENCES

1. Ристески И., 2000. Триесет години вирџинија во Македонија –почетоци, состојби и перспекти. Тутун/ Tobacco, vol 50, N° 7-8, 152-163, Tobacco Institute-Prilep.
2. Ристески И., 1999. Корелација помеѓу хранливата површина и некои производно технолошки својства на тутунот од вирџиниската сортата МВ-1. Master thesis, Faculty of Agriculture – Skopje.
3. Трајкоски Ј., 1998. Влијанието на продлабочувањето на ограничниот слој и минералната исхрана врз приносот и квалитетот на тутунот тип вирџинија. Doctoral dissertation, Tobacco Institute-Prilep.
4. Rubin V.A., 1971. Физиологија сељскохознајственнџин растениј – Московского университета – 1971.
5. Узуноски М., 1985. Производство на тутун. Стопански весник Скопје.
6. Филипоски К., Стојаноска С., 2000. Распространетост и динамика на производството на тутунот во светот и во Република Македонија. Тутун/Tobacco, vol 50, N° 4-6, 94-108, Tobacco Institute-Prilep.
7. S. N. Hawks. Ir., W.K. Colins., 1994. Nacela proizvodnje virziniskog duhana. Croatian edition, translation.