

## RESULTS OF STUDIES ON RECENTLY DEVELOPED VIRGINIA TOBACCO GENOTYPES UNDER DIFFERENT GROWING CONDITIONS IN SERBIA

Slobodan Dražić<sup>1</sup>, Ilija Risteski<sup>2</sup>, Kiril Filiposki<sup>2</sup>, Karolina Kocoska<sup>2</sup>

<sup>1</sup>Institute for Medicinal Plant Research Dr Josif Pančić, Belgrade, Serbia

<sup>2</sup>University "St. Kliment Ohridski"- Bitola,  
Scientific Tobacco Institute, Kichevski Pat, bb. 7500 Prilep, R. Macedonia

### ABSTRACT

The paper presents results of the studies on production traits of 12 recently developed Virginia tobacco genotypes. Seven experimental varieties (V- 817, V- 814, V- 813, V-81/VS, V-N 7/VS, V- H 97 and V-C 7/VS) were from Serbia and five varieties (V-88/09, V-82/07, V-53, V-33/09 and V-30/09) were from Macedonia. The variety Hevesi 9 was used as a check. The varietal trial was carried out in two locations in Serbia in 2011. The following parameters were analysed during the growing period: plant height, number of leaves per stalk, dimensions of leaves cutters and yield. The leaf colour on the stalk and the leaf colour after curing were estimated. Reliably higher yields in relation to the check (3,340 kg ha<sup>-1</sup>) were recorded in the varieties V - 817 (4,030 kg ha<sup>-1</sup>), V- 814 (3,940 kg ha<sup>-1</sup>) and V- 81/VS (3,810 kg ha<sup>-1</sup>). Yields of remaining genotypes were lower than the yield of the check. The leaf colour on the stalk was yellowish in the majority of genotypes, and it turned yellow after curing.

**Key words:** agroecological conditions, recently developed genotypes, yield, varietal trial, Virginia.

### РЕЗУЛТАТИ ОД ИСТРАЖУВАЊАТА НА НОВОСОЗДАДЕНИ ГЕНОТИПОВИ ВИРЦИНИЈА ОДГЛЕДУВАНИ ВО РАЗЛИЧНИ ПРОИЗВОДНИ УСЛОВИ ВО СРБИЈА

Во трудот се прикажани производните резултати од истражувањата на дванаесет новосоздадени генотипови вирцинија. Експерименталните сорти од Србија се (V- 817, V- 814, V- 813, V-81/VS, V-N 7/VS, V- H 97 и V-C 7/VS) и од Македонија (V-88/09, V-82/07, V-53, V-33/09 и V-30/09). Сортата Hevesi 9 е користена како стандард. Сортниот опит беше изведен во 2011 година на два локалитети во Србија. Во текот на вегетацијата се анализирани: висина, број листови на стеблото, димензии на средните листови и приносот. Оценувана е бојата на листовите на стеблото и после сушење. Сортите : V- 817 (4.030 kg/ha), V- 814 (3.940 kg/ha) и V- 81/VS (3.810 kg/ha) оствариле значајно повисоки просечни приноси на суви листови во однос на стандардот (3.340 kg/ha). Останатите генотипови оствариле пониски приноси во однос на стандардната сорта. Кај повеќето генотипови бојата на листовите на стеблото е жолтеникава, а после сушењето жолта.

**Клучни зборови:** агроеколошки услови, новосоздадени генотипови, принос, сортен опит, вирцинија.

## INTRODUCTION

Previous studies showed that the introduced varieties of Virginia flue-cured tobacco did not fully expressed their genetic potential as they did in the regions of their origin and growth. This was confirmed by comparative trials with locally bred tobacco varieties, which mainly overyielded the introduced varieties. Therefore, the introduced varieties are most often used as an initial material in hybridisation, as they express more traits of important characteristics for this type of tobacco (Dražić and Prodanović, 1999. Dražić 1986, 2003, 2004, Risteski et al., 2009, Kocoska and Risteski, 2011).

The development of a new variety presents the accumulation of desirable genes and their recombination into one genotype, which will under certain growing conditions have high and

stable yields and will be of good quality. Factors affecting the final product, in this case leaf yield and leaf quality can be classified into two groups: external (soil, weather conditions, growing space, nutrition, harvest, curing) and genetic (variety with its biological, morphological, productive and physiological traits, response to the type of soil, uptake of nutrients). The yield level depends on the genetic potential of the variety, and stability depends on its response to environmental conditions, which is caused by its genetic composition (Dražić, 2001, 2007).

Therefore, the objective of the present study was to observe production traits of recently developed Virginia tobacco genotypes under environmental conditions of the production regions of Serbia.

## MATERIAL AND METHODS

Trials with 12 recently developed Virginia flue-cured tobacco varieties were set up in 2011. The varieties V-817, V-814, V-813, V-81/VS, V-N 7/VS, V-H 97 and V-C 7/VS were developed by the Institute for Medicinal Plant Research, Belgrade, Serbia, while the remaining five varieties V-88/09, V-82/07, V-53, V-33/09 and V-30/09 were derived by the Tobacco Institute, Prilep, Macedonia. The variety Hevesi 9 (Hungary) was used as a check. Male-sterile flowers were used in trails. According to cytoplasmic male sterility flowers belong to the type 3, which is suitable for cross pollination (Dražić, 1980).

The varietal trial was set up in two locations: Nova Pazova and Starčevo that are 30 km away from Belgrade. Nova Pazova and Starčevo are located North West and East of Belgrade, respectively. The tobacco seedling production was done in semi-hot beds during the March-May period. Planting was performed at a distance of 90 x 50cm with four replications at the end of May. The elementary plot size amounted to 12m<sup>2</sup>. The following production traits were analysed: plant height, number of leaves per stalk, dimensions of leaves cutters and yield. The leaf colour on the stalk and after curing was

estimated (Skalenkatalog, 1977/78). Results were processed by the analysis of variance. The significance of differences of observed traits was determined by the LSD test.

***The conditions under which the trials were performed.*** - The soil in Nova Pazova is chernozem. According to agrochemical analyses, this soil is humus (3.21%), well supplied with available nitrogen (3.86%), optimally supplied with phosphorus (22 mg/100 g/soil) and potassium (21 mg/100 g/soil) and its reaction is neutral (pH in KCl=7.05). The soil in Starčevo is alluvium poorly supplied with humus (1.46%), which is desirable for the Virginia tobacco (Group of authors, 1976, Hawks, 1978, Dražić, 1995). Results of agrochemical analysis show that this soil is poorly supplied with nitrogen (1.1%), optimally supplied with phosphorus (23 mg/100 g/soil) and fairly supplied with potassium (13.8 mg/100 g/soil). Mean annual air temperatures were approximate (Starčevo-13.4°C, Nova Pazova -13.0°C). On average, the precipitation sums during the growing season (April-September) were approximate in both locations (380-410 mm). It can be stated that soil and heat conditions were favourable for the growth and development of tobacco, which resulted in higher mean values of the production traits in the trial.

## RESULTS AND DISCUSSION

**Plant height (cm).** - The average plant height (cm) in Nova Pazova amounted to 170cm, while plants in Starčevo were higher (185cm), although the final values were similar to values obtained in Nova Pazova. It is considered that the tall stalk can be a disadvantage. A shorter stalk means a redistribution of the total organic matter in favour of leaves, and a greater plant resistance to deviation from the vertical position (Tables 1 and 2).

**Number of leaves per stalk.** - The number of leaves, as a varietal characteristic, was, on average, 22-24. The values of the minimum and the maximum were very close. Genotypes V-H97, V-33/09 and V-30/09 had the same number of leaves (24) in both locations. It should be stated that the highest number of leaves (26) was recorded in the variety V-N7/VS (Tables 1 and 2).

**Dimensions of leaves.** - Previous studies show that dimensions of leaves are affected by the variety, applied cropping practices and the soil (Dražić, 2001). Dimensions of all observed genotypes were approximate, nearly identical (57cm x 28cm). It is necessary to point out that the length to width ratio amounted to 2:1, which is desirable for this type of tobacco (Tables 1 and 2).

**Leaf yield (g/plant<sup>-1</sup>).** - The yield, as a complex trait, is affected by the variety, applied cropping practices and the soil, Dražić, 2001.

These studies show that average yields were approximate (174 and 171 g/plant<sup>-1</sup>) for both locations. However, yields varied with the locations from 105g/plant<sup>-1</sup> (V-88/09) to 237g/plant<sup>-1</sup> (V-817) in Nova Pazova and from 101g/plant<sup>-1</sup> (V-30/09) to 238 g/plant<sup>-1</sup> (V-81/VS) in Starčevo. Five varieties in Nova Pazova had a reliably higher yield than the check, while just one variety in Starčevo had significantly higher yield than the variety Hevesi 9. This is a result of a higher yield of the check (210g/plant<sup>-1</sup>) (Tables 1 and 2).

**Leaf yield (kg/ha<sup>-1</sup>).** - The average yield of cured leaves amounted to 3,085 kg/ha<sup>-1</sup> for both locations. The lowest yield of 1,710 kg/ha<sup>-1</sup> was recorded in the variety V-30/09, which presents the decrease in the yield of 1,630 kg/ha<sup>-1</sup> or 48.8% in comparison to the yield of the check. The highest yield was detected in the variety V-817 (4,030 kg/ha<sup>-1</sup>), which is higher by 690 kg/ha<sup>-1</sup> or by 20.7% than the yield of the variety Hevesi 9. Beside the variety V-817, whose yield was significantly higher than the check, high yields were also recorded in the varieties V-813 and V-N7/VS. The remaining genotypes had lower yields, Table 3.

**The colour estimation of leaves on stalks** shows that it was yellowish for several genotypes, but after curing, it was yellow especially in the Macedonian varieties, Table 4.

Table 1. Average values of the analysed traits (location: Nova Pazova)

O. no.	Genotype	Plant height cm	Number of leaves	leaves/cutters cm	Yield g/plant <sup>-1</sup>	Rank
1.	V- 817	165	22	56x28	237**	2
2.	V- 814	192**	24	62x31	209**	4
3.	V- 813	145	24	52x26	257**	1
4.	V- 81/VS	160	26	54x25	124	10
5.	V- N7/ VS	155	26	58x24	223**	3
6.	V- H97	180*	23	64x30	162	8
7.	V- C7/VS	170	24	62x26	195*	5
8.	V-88/09	185	22	55x29	105	13
9.	V-82/07	196**	26	50x26	123	11
10.	V-53	187**	26	55x26	176	6
11.	V-33/09	151	24	50x25	166	7
12.	V-30/09	163	24	50x30	119	12
13.	Hevesi 9	162	24	60x30	161	9
	Average	170	24	56x27	174	-

\* significant at 0.05 and \*\* 0.01 probability level

Table 2. Average values of the analysed traits (location: Nova Pazova)

O. no.	Genotype	Plant height cm	Number of leaves	leaves/cutters, cm	Yield g/plant <sup>-1</sup>	Rank
1.	V- 817	149	20	60x30	209	3
2.	V- 814	161	22	63x34	157	9
3.	V- 813	151	20	57x29	181	6
4.	V- 81/VS	166	21	62x33	238*	1
5.	V- N7/ VS	170	26*	55x25	200	4
6.	V- H97	135	23	60x30	147	10
7.	V- C7 VS	147	22	50x25	171	8
8.	V-88/09	190**	20	57x30	138	11
9.	V-82/07	188**	24	62x34	190	5
10.	V-53	190**	22	58x29	181	7
11.	V-33/09	169	24	50x28	105	12
12.	V-30/09	135	24	40x24	101	13
13.	Hevesi 9	150	22	64x36	210	2
	Average	185	22	57x29	171	-

\* significant at 0.05 and \*\* 0.01 probability level

Table 3. Average yield of cured leaves (kg ha<sup>-1</sup>)

O. no.	Genotype	Average kg/ha <sup>-1</sup>	Difference		Rank
			absolute	relative	
1.	V- 817	4030**	+ 690	120.7	1
2.	V- 814	3290	-50	98.5	5
3.	V- 813	3940**	+ 600	118.0	2
4.	V- 81/VS	3260	-80	97.6	7
5.	V- N7/ VS	3810*	+ 470	114.0	3
6.	V- H97	2790	- 550	83.5	10
7.	V- C7/VS	3290	- 50	98.5	6
8.	V-88/09	2190	-1150	65.6	12
9.	V-82/07	2820	-520	84.4	9
10.	V-53	3220	-120	96.4	8
11.	V-33/09	2410	-930	72.2	11
12.	V-30/09	1710	-1630	51.2	13
13.	Hevesi 9	3340	-	100.0	4
	Average	3085	-	-	-

\* significant at 0.05 and \*\*0.01 probability level

Table 4. Qualitative traits of Virginia tobacco genotypes

O. no.	Genotype	Trait and designation	
		Leaf colour	
		on the stalk	after curing
1.	V- 817	S-5 pale green	S-5 light brown to-orange yellow
2.	V- 814	S-3 yellowish	S-3 yellow
3.	V- 813	S-5 pale green	S-6 light brown
4.	V- 81/VS	S-5 pale green	S-3 yellow
5.	V- N7/ VS	S-7 strong green	S-3 yellow
6.	V- H97	S-7 strong green	S-5 light brown to-orange yellow
7.	V- C7/VS	S-3 yellowish	S-4 lemon-yellow
8.	V-88/09	S-1 yellow	S-3 yellow
9.	V-82/07	S-3 yellowish	S-3 yellow
10.	V-53	S-3 yellowish	S-3 yellow
11.	V-33/09	S-3 yellowish	S-3 yellow
12.	V-30/09	S-3 yellowish	S-4 lemon-yellow
13.	Hevesi 9	S-3 yellowish	S-3 yellow

## CONCLUSION

Under agroecological conditions of Serbia (Nova Pazova and Starčevo) the average yield of cured leaves amounted to 3,085 kg/ha<sup>-1</sup>. The highest yield of 4,030 kg/ha<sup>-1</sup> was recorded in the variety V-817 (4,030 kg/ha), which was higher by 690 kg/ha<sup>-1</sup> or by 20.7% than the yield of the check (Hevesi 9- 3,340 kg/ha). High yields were also recorded in varieties V-813 and V-N7/VS.

The lowest yield of 1,710 kg/ha<sup>-1</sup> was detected in the variety V-30/09. This yield presents the decrease in the yield of 1,630 kg ha<sup>-1</sup>

or 48.8% in relation to the check. The yield of the other eight varieties (V-814, V-81/VS, V-H97, V-C7/VS, V-88/09, V-82/07, V-53 and V-33/09) was lower than the check. The average plant height over locations amounted to 170-185cm. There were more genotypes with shorter stalks, which is a desirable trait. The number of leaves was on average 22-24. The leaf dimensions were uniform (57cm x 28cm), while the length to width ratio of 2:1 was favourable. The colour of leaves on stalks was mainly yellowish, and after curing it turned yellow.

## REFERENCES

1. Dražić S., 1980. Neka svojstva cveta pri citoplazmatičnoj muškoj sterilnosti. Arhiv za poljoprivredne nauke, vol.41, N 143, sv.3, 393-399. Beograd .
2. Dražić S., 1986. Prilog ispitivanju morfoloških i produktivnih svojstava novih linija flue-cured duvana. Tutun/Tobacco, vol.36, N 7-8, 193-201. Prilep.
3. Dražić S., 1995. Proizvodnja duvana, izd. Poljoknjiga, Beograd, ISBN 86.901397-5-3, ID=32419596
4. Dražić S., Prodanović S., 1999. Phenotypic divergence of flue-cured virginian tobacco varieties. Genetika, vol.31, N°1, 83-90, Belgarde.
5. Dražić S., 2001. Varijabilnost i međuzavisnost komponenti prinosa i prinosa kod virdžinijskih flue-cured duvana. Tutun/Tobacco, Vol.51, N 5-6, 121-127, Prilep.
6. Dražić S., 2003. Oplemenjivanje duvana u Jugoslaviji. Tutun/Tobacco. Vol.53, 3-4, 130-135, Prilep.

7. Dražić S., 2004. Identifikacija donora poželjnih alela za poboljšanje prinosa duvana (*N.tabacum* L.). *Tutun/Tobacco*, vol.54, 9-10, 193-197. Prilep.
8. Dražić S., 2007. Variability in collection of flue-cured Virginia tobacco. *Vak, A Journal of Saurashtra University*, special issue on Biotechnology, vol. 2, 2, 72-76. Rajkot, India.
9. Group of Authors, 1976. Tobacco Production, USDA, Agricultural research service, Agriculture information bulletin, N 245, USA.
10. Hawks S.N., Jr., 1978. Principles of flue-cured tobacco production. Preveo, dr Nikola Vuletić, Duhanski institut, Zagreb.
11. Kocoska Karolina, Risteski I., 2011. Comparative investigation of some foreign and domestic hybrid varieties of virginia tobacco in the region of Prilep, *Tutun/Tobacco*, vol. 61, N 1-6, 3-9. Prilep, R.Macedonia.
12. Risteski I., Kočoska K., Hristiski Ž., 2009. Morfološki karakteristiki na neкои stranski i novosozdadeni domašni maškosterilni hibridni sorti )linii tutun od tipot virdžnija. *Tutun/Tobacco*, vol.59, N 11-12, Prilep, R.Makedonija.
13. Skalenkatalog fur die Erfassung von Merkmalen bei *Nicotiana*. 1977/78. band 24/25, S 43-63, Institute for Tabakforschung, Dresden, DDR