

THE INFLUENCE OF GENOTYPE ON YIELD, QUALITY AND ECONOMIC EFFECTS OF BURLEY TOBACCO

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ABSTRACT

During 2010 and 2011 investigations with 6 Burley tobacco varieties and lines were made in order to study their influence on yield and quality of the obtained raw material, and to evaluate their economic effects. The results of investigations showed absolute dominance of variety Pelagonec CMS F₁ and line B-98/N CMS F₀ over the other varieties, which was statistically confirmed. From a practical point of view, these results can be a good guideline to tobacco growers in selection of tobacco variety.

Key words: tobacco, variety, Burley, yields, economic effects

ВЛИЈАНИЕТО НА ГЕНОТИПОТ ВРЗ ПРИНОСОТ, КВАЛИТЕТОТ И ЕКОНОМСКИТЕ ЕФЕКТИ КАЈ ТУТУНОТ ОД ТИПОТ БЕРЛЕЈ

Во текот на 2010 и 2011 година во испитувањата беа вклучени 6 берлејски сорти и линии тутун со цел да се испита нивното влијание врз приносот и квалитетот на добиената суровина и економскиот ефект што го даваат истите. Добиените резултати од испитуваните својства покажаа апсолутна доминација на сортата Пелагонец ЦМС F₁ и линијата Б-98/Н ЦМС F₀ над другите сорти што и статистички беше потврдено. Од практичен аспект овие резултати во иднина можат да бидат добра смерница при изборот на сорта од страна на примарните производители.

Клучни зборови: тутун, сорта, берлеј, приноси, економски ефект.

INTRODUCTION

Raw material of Burley and Virginia tobaccos participate in the composition of blend cigarettes with about 80%. The first steps towards introducing the type Burley in the Republic of Macedonia were made by Rudolf Gornik, who reported (1953) that this tobacco can be successfully cultivated only in rich soils and humid climate with frequent rainfalls. In early

70ies efforts were made towards creating a variety which will prove to be the best in most of the properties, especially in yield and quality. In that period, the main representative of this type of tobacco in the Republic of Macedonia was the Croatian male sterile variety Chulinec. Later on, male sterile varieties Burley B-96/85 CMS F₁, Burley 1 CMS F₁, B-2/93 CMS F₁ and

Pelagonec CMS F₁ were created in Tobacco Institute - Prilep. These varieties were a satisfactory substitute for the variety Chulinec, and some of them found their way beyond the borders of Macedonia. The fact that there is no ideal variety created once and for all, but that some variety at a given moment is better than the others, motivated the breeders of Tobacco Institute - Prilep to create new varieties (genotypes) with improved characters, i.e. with higher yields and quality. Since these characters are governed by the genetic structure, parents in which these characters are predominant

are used in the process of hybridization. This process is exclusively intervarietal and is conducted with the aim to obtain male sterile hybrid varieties. The best of them are tested in field, in comparative trials with other standard varieties (domestic and foreign) for a period of at least two years. If they show better results than the standard, they are submitted to the State Variety Commission for recognition. This paper will present the results of investigations on yield and quality of the raw material obtained from the varieties and lines represented in the research.

MATERIAL AND METHODS

The investigations were carried out in the Experimental field of Tobacco Institute - Prilep during 2010 and 2011, on coluvial-alluvial soil. It included three introduced fertile varieties of Burley tobacco (B-21 from USA, Banquet 21 from Zimbabwe and B- 1317 from Bulgaria), the male sterile hybrid variety Pelagonec CMS F₁ and lines B-98/N CMS F₉, B-136/07. The variety B-21 was used as a check. Autumn ploughing was carried out at about 40 cm depth and prior to spring ploughing, the soil was fertilized with 300 kg/ha NPK 8: 22: 20. Before transplanting, the soil was treated with herbicide and, immediately after, it was incorporated into the soil by harrowing. The trial was set up in randomized blocks with 4 replications, at 90 × 50 cm spacing. Two hoeings of

tobacco were applied, followed by addition of 5g of 26% CAN. A few additional irrigations during the growing period were applied when necessary. After harvest and stringing, tobacco was yellowed and air-cured in special curing barns for Burley tobacco. Qualitative estimation of dried tobacco was made according to the Rules for standard measurements of quality of leaf tobacco of the type Burley. Corrected yield per stalk and per hectare was estimated by the method of Rimker and gross income (denars/ha) was assessed when the yield per hectare was multiplied with the average price per 1 kg of raw tobacco. Statistical processing of data was performed using the analysis of variance technique.

RESULTS AND DISCUSSION

The yield of tobacco, as in many other crops, is affected by the genotype, as well as genotype : environment interaction. Tobacco yield as quantitative character is in close correlation with leaf number, size and thickness. There are differences between the varieties of the same type, but it still must be typical for that type. Budim

T. (1988) reports that the average yield of Burley tobacco in Zimbabwe in the period 1980-1985 ranged from 1202 to 1760 kg/ha. The development of selection of this tobacco in the world resulted in creation of new genotypes that produce significantly higher yields, without negative effects on quality. Stoyanov Boris and Apostolova

Elena (1999) reported that the yields of B-1317 variety in some parts of Bulgaria can reach up to 3380 kg / ha.

According to Djulgovski Yovko (2009), the yield of Burley tobacco should not be lower than 3500 kg/ha. Ilija Risteski and Karolina Kocoska (2012) reported that Burley varieties created in Tobacco

Institute- Prilep gave a yield of 3500-4500 kg/ha. The yield of this tobacco type is strongly affected by agrotechnical measures applied. Pelivanoska V. (2001) reported that by different variants of fertilization and irrigation, the yields of B-2/93 CMS F₁ varieties in the region Ohrid-Struga can reach up to 6000 kg/ha.

Yield per stalk (g/stalk)

Data on variations of yields per stalk in varieties and lines investigated in the trial are presented in Table 1.

Table 1 Corrected yield, g/stalk

Varieties	Years	Average yield, g/stalk	Average 2010/11	Differences from the average		Range
				Absolute	Relative	
B-21	2010	123.5	122.3	/	100.00	3
	2011	121.1				
B-1317	2010	118.8	119.7	- 2.6	97.84	5
	2011	120.6				
Banquet 21	2010	122.3	118.9	- 3.4	97.22	6
	2011	115.9				
B-136/07	2010	121.4	121.6	- 0.7	99.42	4
	2011	121.9				
B-98/N CMS F ₉	2010	158.3 ⁺⁺	166.0	+ 43.7	135.73	2
	2011	173.7 ⁺⁺				
Pelagonec CMS F ₁	2010	168.3 ⁺⁺	176.0	+ 53.7	143.91	1
	2011	183.8 ⁺⁺				
	2010	2011				

LSD 5% = 21.11 g/stalk + LSD 5% = 14.97 g/stalk +

1% = 29.23 g/stalk ++ 1% = 20.74 g/stalk ++

According to the above data, the highest average yield per stalk of 176.0 g was recorded in the variety Pelagonec CMS F₁. It is 53.7 g or 43.91% higher compared to the check variety B-21, which average yield was 122.3g/stalk. The lowest average yield of 118.9 g/stalk was achieved in the variety Banquet 21, and it is 3.4 grams or 2.78% less than that of the check variety.

In the other varieties and lines, the average yield ranges from 119.7 g/stalk in variety B-1317 to 166.0 g/stalk in line B-98/N CMS F₉. In both years of investigations, statistically significant differences at a level of 1% compared to the check were estimated in the variety Pelagonec CMS F₁ and line B-98/N CMS F₉.

Yield per hectare (kg / ha)

The yield per hectare is closely related with quality per stalk. The combination of these two characters is a more expressive indicator in assessing the economic value of the genotype. Beside the impact of the variety, this character is also affected by some agro-technical measures. Janos Berenji and Miroslava Nikolic (1996) found that topping of the inflorescence, combined with sucker control in Burley tobacco can result in 28% yield increase per hectare.

Table 2 Corrected yield per hectare (kg/ha)

Varieties	Years	Average yield, kg/ha	Average 2010/11	Differences from the average		
				Absolute	Relative	Range
B-21	2010	2744	2717	/	100.00	3
	2011	2691				
B-1317	2010	2641	2661	- 56	97.93	5
	2011	2681				
Banquet 21	2010	2641	2608	- 109	95.99	6
	2011	2575				
B-136/07	2010	2698	2704	- 13	99.52	4
	2011	2710				
B-98/N CMS F ₉	2010	3520 ⁺⁺	3692	+ 975	135.88	2
	2011	3864 ⁺⁺				
Pelagonec CMS F ₁	2010	3740 ⁺⁺	3912	+ 1195	143.98	1
	2011	4085 ⁺⁺				

2010

2011

LSD 5% = 466.56 kg/ha+ LSD 5% = 332.72 kg/ha +

1% = 646.17 kg/ha++ 1% = 460.82 kg/ha ++

According to the data presented in Table 2, the highest average yield per hectare of 3912 kg was recorded in the variety Pelagonec CMS F₁, which is 1195 kg (43.98%) higher compared to the check variety B-21, which average yield was 2717 kg/ha. The lowest average yield per

hectare of 2608 kg was obtained in variety Banquet 21. In other varieties and lines, the average yield per hectare ranged from 2661 kg in the variety B-1317 to 3692 kg in line B-98 / N CMS F₉ in both years of investigations (2010 and 2011).

Average price, denars / kg

The average price is, in fact, an indicator of quality of the obtained tobacco raw expressed in monetary value. However, the quality of tobacco is a very complex concept, affected by many mutually dependent factors and influences. So this indicator is only the beginning of a series of procedures for estimation of tobacco quality (physical and chemical properties,

degustation, etc.). The quality of tobacco raw and the average price depend on a number of adequately performed cultural practices in field, in the time of harvest, yellowing, curing, etc. Data on the average price per 1 kg of dry tobacco in investigated varieties and lines are presented in Table 3.

Table 3 Average price denars/ kg

Varieties	Years	Average price, denars/kg	Average 2010/11	Differences from the average		Range
				Absolute	Relative	
B-21	2010	30.98	32.63	/	100.00	5
	2011	34.29				
B-1317	2010	36.27	34.57	+ 1.94	105.94	3
	2011	32.87				
Banquet 21	2010	28.10	28.77	- 3.86	88.17	6
	2011	29.44				
B-136/07	2010	36.27	32.74	+0.11	100.33	4
	2011	29.21				
B-98/N CMS F ₉	2010	37.22 ⁺⁺	40.38	+7.75	123.75	2
	2011	43.55 ⁺⁺				
Pelagonec CMS F ₁	2010	44.67 ⁺⁺	44.79	+12.16	137.26	1
	2011	44.92 ⁺⁺				

2010

2011

LSD 5% = 2.27 kg/ha+ LSD 5% = 3.15 kg/ha +

1% = 3.14 kg/ha++

1% = 4.36 kg/ha ++

Data from the table show that the highest average price of 44.79 denars / kg was obtained with variety Pelagonec CMS F₁, and that is 12.16 denars / kg or 37.26% higher compared to the check variety with an average price of 32.98 denars / kg.

The lowest quality and the lowest average price of only 28.77 denars / kg was recorded in the variety Banquet 21. In

other varieties and lines, the average price ranges from 32.74 denars/kg in line B-136/07 to 40.38 day / kg in line B-98/N CMS F₉. Statistical differences at 1% significance level compared to the check in both years of investigation were obtained in the variety Pelagonec CMS F₁ and the line B-98 / N CMS F₉.

Gross income, denars/ha

The most important factors in the formation of this character are the average yield per hectare and the average price of 1

kg raw tobacco, i.e. it represents the yield and quality achieved by the varieties and lines investigated in the trial.

Table 4 Gross income (economic effect, denars /ha)

Varieties	Years	Gross income, denars/ha	Differences from the average			
			Average 2010/11	Absolute	Relative	Range
B-21	2010	85 568	88 588	/	100.00	5
	2011	91 609				
B-1317	2010	98 094	93 212	+ 4 624	105.22	3
	2011	88 330				
Banquet 21	2010	76 260	79 530	- 9 058	89.77	6
	2011	82 801				
B-136/07	2010	98 094	88 738	+150	100.17	4
	2011	79 383				
B-98/N CMS F ₉	2010	131 596 ⁺⁺	150 438	+61 850	169.91	2
	2011	169 281 ⁺⁺				
Pelagonec CMS F ₁	2010	167 613 ⁺⁺	175 528	+86 940	198.0	1
	2011	183 443 ⁺⁺				

2010

2011

LSD 5% = 20 843 kg/ha+

LSD 5% = 14 186 kg/ha +

1% = 28 867kg/ha++

1% = 19 647 kg/ha ++

According to the above data, the highest average gross income of 175 528 denars/ha was recorded in the variety Pelagonec CMS F₁, which is 86 940 denars/ha, i.e. 98.13% higher than the check variety B-21, which achieved 88 588 denars/ha. This indicator has the lowest value in the variety Banquet 21 (79 530 denars / ha). In other varieties and lines, the gross income

ranges from 88 738 denars/ha in line B-136/07 to 150 438 denars/ha in line B-98/N CMS F₉. Statistically significant differences at 1% level compared to the check variety were estimated in variety Pelagonec CMS F₁ and line B-98/N CMS F₉ in both years of investigation (2010 and 2011).

CONCLUSIONS

Based on the data obtained during the investigation, the following conclusions can be drawn:

- All varieties and lines included in the field trial developed under the same conditions of growing, but in the end they showed different results, as a product of various reactions of the varieties dictated by their genetic structure.
- The yields per stalk and per hectare were the highest in the variety Pelagonec CMS F₁ (176.0 g/stalk and 3912 kg/ha), and the lowest in the variety Banquet 21 (118.9 g/stalk and 2608 kg/ha).
- The average price for 1 kg of raw tobacco was the highest in the variety Pelagonec CMS

F₁ (44.79 denars/kg) and the lowest in Banquet 21 (28.77 denars/kg).

- The gross income was the highest in the variety Pelagonec CMS F₁ (175 528 denars/ha), and the lowest in the variety Banquet 21 (79 530 denars/ha).
- Data obtained from the investigations show absolute dominance of the variety Pelagonec CMS F₁ and line B-98/N CMS F₉ over the other varieties and lines, which has been confirmed statistically.
- The obtained results lead to a conclusion that the variety has a very big influence on some productional characters. For this reason, in selection of varieties it is very important to have a deep knowledge of their properties.

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