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## **EXAMINATION AND ANALYSIS OF YIELD, QUALITY AND ECONOMIC EFFECT WITHIN VARIETES OF BURLEY TOBACCO**

### **SUMMARY**

The purpose of these researches and analysis is to compare of some quantitative, qualitative and economic indicators between some standard foreign varieties with newly created varieties tobacco in Scientific Tobacco Institute – Prilep, R. Macedonia. During 2016 and 2017 investigations with 6 Burley tobacco varieties were made 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 hybrids B-204/15 and B-206A/16 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

### **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 that this tobacco can be successfully cultivated only in rich soils and humid climate with frequent rainfalls (Gornik, 1953). During this timeframe, in former Yugoslavia examination of possibility for production of this type of tobacco, was conducted on the areas of Monte Negro as well, particularly in Bar area (Jovovič, 1957). 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 variety Chulinec. Later hybrids varieties: Burley B-96/85, Burley 1, B-2/93 and Pelagonec 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

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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 represented in the research.

### **MATERIAL AND METHODS**

The investigations were carried out in the Experimental field of Tobacco Institute - Prilep during 2016 and 2017, on colluvial - alluvial soil. It included three introduced fertile varieties of Burley tobacco (Kentucky 12 from USA, L-8 from Zimbabwe and B-963 and B-1246 from Bulgaria), the hybrids varieties B-204/15 and B-206A/16, (Flowers of these hybrids are male sterile.) The variety L-8 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 hoeing's 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 (US\$/ha) was assessed when the yield per hectare was multiplied with the average price per 1 kg of raw tobacco. Conversion in US\$ was calculated by middle exchange rate of National Bank of Republic of Macedonia on 01.02.2018 (49,3979 ден. for 1 US\$, rounded on 49,40ден. for 1 US\$). Statistical processing of data was performed using the analysis of variance.

### **RESULTS AND DISCUSSION**

The yield of tobacco, as in many other crops, is affected by the genotype, as well as 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 (Budín, 1988) reports that the average yield of Burley tobacco in Zimbabwe in the period 1980-1985 ranged from 1 202 to 1 760 kg/ha. In the 1950ties, yield in Bar was around 1 276 kg/ha (Jovović, 1957). There, the production of type Burley in Monte Negro, to be on more richer soils, in the region of Skadar, where

climate is suitable for good grow and development of Burley, as well (Klikovac, 1994). 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. Researchers from Bulgaria reported that the yields of B-1317 variety in some parts of Bulgaria can reach up to 3 380 kg/ha (Stoyanov and Apostolova, 1999). Another researcher argues that the yield of Burley tobacco should not be lower than 3 500 kg/ha (Dyulgorski 2009). Researchers from Scientific Tobacco Institute from Prilep, reported that Burley varieties created in Tobacco Institute - Prilep gave a yield of 3 500-4 500 kg/ha. (Risteski and Kočoska 2012). The yield of this tobacco type is strongly affected by agrotechnical measures applied. Pelivanoska, (2001) reported that by different variants of fertilization and irrigation, the yields of B-2/93 in the regions of Ohrid and Struga can reach up to 6 000 kg/ha.

### Yield per stalk (g/stalk)

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

**Table 1. Corrected yield, g/stalk**

Varieties	Years	Average yield g/stalk	Average 2016/2017	Differences from the average		
				Absolute	Relative	Range
L-8 s	2016	107,8	116,3	\	100	6
	2017	124,7				
Kentucky 12	2016	118,2 <sup>+</sup>	132,2	+16,9	114,53	5
	2017	148,2				
B-963	2016	132,4 <sup>++</sup>	146,3	+30,0	125,79	4
	2017	160,2 <sup>++</sup>				
B-1246	2016	158,0 <sup>++</sup>	148,7	+32,4	127,86	3
	2017	139,4				
B-204/15	2016	185,1 <sup>++</sup>	200,5	+84,2	172,39	1
	2017	215,9 <sup>++</sup>				
B-206A/16	2016	182,2 <sup>++</sup>	191,8	+78,5	164,91	2
	2017	201,5 <sup>++</sup>				

**2016**

**LSD 5%<sup>+</sup>**

9,62 g/stalk

**LSD 1%<sup>++</sup>**

13,32 g/stalk

**2017**

**LSD 5%<sup>+</sup>** 25,09 g/stalk

**LSD 1%<sup>++</sup>** 34,75 g/stalk

According to the above data, the highest average yield per stalk of 200,5 g was recorded in the F<sub>1</sub> hybrid B-204/15. It is 84,2 g or 72,39% higher compared to the check variety L-8, which average yield was 116,3 g/stalk. In the other varieties, the average yield ranges from 132,2 g/stalk in variety Kentucky 12 to 191,8 g/stalk in F<sub>1</sub> hybrid B-206A/16. Sjeranj examining two Burley varieties (DKH-28 and DKH-33) in the region of Podgorica came to conclusion that 23 650 stalks in ha, yield per stalk was from 101 gr to 152 gr, and yield per hectare from 2 389 kg to 3 594 kg, or on average 2 829 kg/ha (Seranj *et. al.*, 2008).

#### 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. Topping of the inflorescence, combined with sucker control in Burley tobacco can result in 28% yield increase per hectare (Berenji and Nikolič, 1996)

**Table 2. Corrected yield per hectare (kg/ha)**

Varieties	Years	Average yield kg/ha	Average 2016/2017	Differences from the average		
				Absolute	Relative	Range
L-8 <sup>o</sup>	2016	2 395	2 583	\	100	6
	2017	2 772				
Kentucky 12	2016	2 626 <sup>+</sup>	2 959	+376	114,55	5
	2017	3 293				
B-963	2016	2 943 <sup>++</sup>	3 251	+668	125,86	4
	2017	3 560 <sup>++</sup>				
B-1246	2016	3 512 <sup>++</sup>	3 305	+722	127,95	3
	2017	3 098				
B-204/15	2016	4 114 <sup>++</sup>	4 457	+1874	172,55	1
	2017	4 800 <sup>++</sup>				
B-206A/16	2016	4 050 <sup>++</sup>	4 263	+1680	165,04	2
	2017	4 477 <sup>++</sup>				

**2016**

**LSD 5%<sup>+</sup>**

213,6 kg/ha

**LSD 5%<sup>+</sup>**

**2017**

557,8 kg/ha

**LSD 1%<sup>++</sup>**

295,9 kg/ha

**LSD 1%<sup>++</sup>**

772,5 kg/ha

According to the data presented in Table 2, the highest average yield per hectare of 4 477 kg was recorded in the variety B-204/15, which is 1 874 kg (72,55%) higher compared to the check variety L-8, which average yield was 2 583 kg/ha. In other varieties, the average yield per hectare ranged from 2 959 kg in the variety Kentucky 12 to 4236 kg in hybrid B-206A/16. In both years of investigations of yields, statistically significant differences at a level of 1%, compared to the check were registered with variety B-963 and B-204/15. In the period from 2012 till 2014 in experimental tobacco station in Markovo in Bulgaria, examining seven burley varieties, was found that line 1546 in three years of examination, showed highest yields with average of 3 578 kg/ha, which is 37% higher than control variety Pliska (Dylgorski and Dosheva, 2017). Hristoski from the reseach in region of Prilep, in period from 2009 to 2010 with three burley varieties, came to concusion that Pelagonec had average yield per stalk of 180,4 gr and average yield per hectare of 4 009 kg/ha. Control variety, B-21 achieved 144 gr per stalk and 3 221 kg per hectare, which was for 24% less compared with Pelagonec (Hristoski, 2014).

### Average price, US\$/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.

**Table 3. Average price, US\$/kg**

Varieties	Years	Average price US\$/kg	Average 2016/2017	Differences from the average		
				Absolute	Relative	Range
L-8 <sup>o</sup>	2016	0,71	0,79	\	100	6
	2017	0,88				
Kentucky 12	2016	0,86 <sup>++</sup>	+0,88	+0,09	111,39	3/4
	2017	0,91				
B-963	2016	0,87 <sup>++</sup>	+0,88	+0,09	111,39	3/4
	2017	0,90				
B-1246	2016	0,86 <sup>++</sup>	+0,85	+0,06	107,59	5
	2017	0,85				
B-204/15	2016	0,98 <sup>++</sup>	+1,01	+0,22	127,84	1
	2017	1,04 <sup>++</sup>				
B-206A/16	2016	0,93 <sup>++</sup>	+0,96	+0,17	121,52	2
	2017	1,00 <sup>++</sup>				

2016

2017

LSD 5%<sup>+</sup>

0,076 US\$/kg

LSD 5%<sup>+</sup>

0,088 US\$/kg<sup>+</sup>

LSD 1%<sup>++</sup>

0,106 US\$/kg<sup>++</sup>

LSD 1%<sup>++</sup>

0,122 US\$/kg<sup>++</sup>

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 are presented in Table 3.

### Gross income, US\$/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 investigated in the trial.

**Table 4. Gross income, US\$/ha**

Varieties	Years	Gross income, US\$/ha	Average 2016/2017	Differences from the average		
				Absolute	Relative	Range
L-8 s	2016	1 675	2 057	\	100	6
	2017	2 439				
Kentucky 12	2016	2 258 <sup>++</sup>	2 627	+570	127,71	5
	2017	2 996 <sup>+</sup>				
B-963	2016	2 560 <sup>++</sup>	2 882	+825	140,10	3
	2017	3 204 <sup>++</sup>				
B-1246	2016	3 021 <sup>++</sup>	2 826	+762	137,38	4
	2017	2 631				
B-204/15	2016	4 032 <sup>++</sup>	4 512	+2455	219,34	1
	2017	4 992 <sup>++</sup>				
B-206A/16	2016	3 767 <sup>++</sup>	4 122	+2065	200,38	2
	2017	4 477 <sup>++</sup>				

**2016**

**2017**

**LSD 5%<sup>+</sup>** 363,68 US\$/ha      **LSD 5%** 477,34 US\$/ha

**LSD 1%<sup>++</sup>** 503,70 US\$/ha      **LSD 1%** 661,11 US\$/ha

According to the above data, the highest average gross income of 4 512 US\$/ha was recorded in the hybrid B-204/15, which is 2 455 US\$/ha, i.e. 119% higher than the check variety L-8, which achieved 2 057 US\$/ha. In other

varieties, the gross income ranges from 2 627 US\$/ha in variety Kentucky 12 to 4 122 US\$/ha in B-206A/16. Statistically significant differences at 1% level compared to the check variety were found in variety B-963, in hybrids B-204/15, B-206/16 in both years (2016, 2017) and only in 2016 variety Kentucky 12 and B-1246. In the area of Prilep, in 2009 and 2010, Hristoski examined three burley varieties and found that hybrid variety Pelagonec opposed to control (B-21) achieved, on average, higher economic effect by 25,8% (Hristoski, 2014).

### CONCLUSION

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

- All varieties and hybrids varieties 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 B-204/15 (200,5 g/stalk and 4 457 kg/ha), and the lowest in the variety L-8 (116,3 g/stalk and 2 583 kg/ha).
- The average price for 1 kg of raw tobacco was the highest in the variety B-204/15 (1,01 US\$/kg) and the lowest in L-8 (0,79 US\$/kg).
- The gross income was the highest in the variety B-204/15 (4 512 US\$/ha), and the lowest in the variety L-8 (2 057 US\$/ha).
- Data obtained from the investigations show absolute dominance of the hybrids B-204/15 and B-206A/16 over the other varieties, which has been confirmed statistically.
- The obtained results lead to a conclusion that the varieties have 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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