

Results of testing of new hybrids Burley Tobacco

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Abstract

Dyulgerksi, Y. (2024). Results of testing of new hybrids Burley tobacco. *Bulg. J. Agric. Sci.*, 30(6), 1015–1019

An assessment is made the biological, economical and chemical indicators of ten samples Burley tobacco, from which eight new promising lines, standard Pliska 2002 variety and Burley 1317 variety. As a result, the study found that that the most favorable biometric indicators are presented in Line 1506 and Line 1527. With the short vegetative period is characterized Line 1522, and the longest – standard Pliska 2002 variety. All new selection lines excel at length of the vegetative period standard Pliska 2002 variety. The highest yield was represented by Hybrid 1470, followed by Hybrid 1449. The highest percentage of first class is derived from Hybrid 1482, which gives the lowest percentage of third class. With favorable ratio of classes are formed Hybrid 1470 and Hybrid 1449. All new lines superior the standard variety Pliska 2002, to as yield, so and percentage of first class. With the most well-balanced chemical composition is Hybrid 1482. Generally, all new lines strongly outperform standard Pliska 2002 variety and to a lesser extent Burley 1317 variety. Complex assessment of biological, economic and chemical indicators shows that with the best parameters differs Hybrid 1470, and work with it will continue with production testing. Hybrid 1482 Hybrid 1469 and especially Hybrid 1449 are also emerging as promising.

Keywords: Burley tobacco; new hybrid; biological; economic and chemical indicators

Introduction

Both in the world and in Bulgaria, the use of heterosis varieties in tobacco is widely used (Patel et al., 2012; Kinay & Kurt, 2022; Pearce et al., 2014; Aleksoski, 2023). Heterosis varieties are used only in the first hybrid generation, because they are most pronounced in it and because the plants are phenotypically identical (Stamatov & Tosheva, 2017; Schnable & Spinger, 2013). Heterosis varieties of Virginia tobacco have been grown since 1973 (Shabanov & Tomov, 1989). The varieties V 0295, V 0297, V 0372 and V 0199 were created (Tchinchev, 1984). Variety Virginia 4241-F1 (LHSE 68 x P 1349) is widely produced (Popchristev, 1977). For more than 30 years, the main tobacco varieties of this variety group have been the hybrid varieties Virginia 0514 and Virginia 0454 (Tchinchev & Stoyanov, 1985). But while the use of first-generation hybrids is a common practice in Virginia tobacco growing, this is not the case with Burley

tobacco. The first heterosis variety of Burley tobacco is Zlatolist 1 variety, such is Burley 1351 variety, but they never enter production (Stoyanov & Apostolova, 2000).

The inefficient and limited varietal structure is one of the main reasons for the unsatisfactory state of Burley tobacco production in our country (Dyulgerski, 2011). The quality of the raw material extracted in our country is significantly inferior to that of the traditional producing countries (Bozhinova & Hristeva, 2022). In addition, the yield of dry tobacco is significantly lower, with a low percentage of the first class and a high cost of the obtained production (Bozhinova, 2006). In general, Bulgarian tobaccos from the Burley varietal group have an unfavorable chemical composition for the type (Nikolova, 2007; Nikolov et al., 2022). This necessitates carrying out selection work to expand and improve the varietal composition of Burley tobacco (Boaretto et al., 2020; Kocoska, 2018; Kurt et al., 2020). The widespread cultivation of heterosis varieties around the world in the to-

bacco of this variety group is a prerequisite for the selection and creation of new hybrid varieties of Burley tobacco (Patel et al., 2012; Risteski et al., 2010; Pearce et al., 2019; Mitreski et al., 2018; Sufan et al., 2023; Tsaliki et al., 2023).

The aim of the present study is to evaluate newly created hybrids in the first generation of large-leaf Burley tobacco in terms of biological, economic and chemical indicators and to establish the possibility of presenting the best of them for production testing, as well as to establish the reliability of heterosis selection in tobacco of this varietal group.

Material and Methods

For the achievement of the defined goal for the period 2019 – 2021, in experimental fields of TTPI – Markovo are tested at samples of Burley tobacco, of which eight newly created promising lines, the standard Pliska 2002 variety and Burley 1317 variety, which is also used for control as it is the most common in the production variety. All lines are in advanced generations and have shown very good preliminary results. The studied variants are very well aligned vegetative and morphologically. Subject of the research and analysis are the most important biometrical, economic and chemical parameters in Burley tobacco. All of these are biometric measurements of plant height, number and sizes of leaves of middle harvesting belt, and phenological observations for the length of the vegetative period. Of economic indicators are calculated yield per hectare and percentage of first, second and third class. From chemical indicators are researched percentage of nicotine, sugars, total nitrogen, ashes and ammonia by the following procedure:

- Nicotine, % (ISO 15152, 2003);
- Soluble sugars /carbohydrates / % – (ISO 15154, 2003);
- Total nitrogen, % (BDS 15836, 1988);
- Ashes, % (ISO / FDIS 2817, 1999);
- Ammonia, % (BDS 15836, 1988).

All the options apply a uniform technology of cultivation. The harvesting of tobacco is performed on whole plants and the air drying is performed in a heating base of TTPI. Field trials are set according to the methodology of Zapryanov & Dimova (1995).

Mathematical treatment of the data is made with the accompanying products SPSS 20. Experimental data are processed by a process of analysis of variance (Anova), a difference between the variant are established of many ranking test of Dunkan (1995).

The years during which the survey is conducted (2019–2021) vary in the amount of rainfall that has fallen from the time of transplanting to harvesting Burley tobacco (Table 1). For all tree years of the study, the amount of precipitation

for all other months during the vegetative period is below the norm, except for the month of June, 2019 (Kyuchukova, 1983). The rainfall that falls during the period of study is insufficient for the growth and development of tobacco. The values of the average daily temperatures are almost the same in the five experimental years and are optimal for Burley tobacco cultivation (Koleva & Peneva, 1990).

Table 1. Meteorological data-Plovdiv, 2019–2021

Month	Norm*	Average day and night temperature, °C		
		2019	2020	2021
June	20.9	23.5	20.9	20.3
July	23.2	24.2	24.2	23.6
August	22.7	25.3	22.9	23.1
		Amount of rainfall – l/m ²		
month	norm**	2019	2020	2021
June	63	142.3	64	52
July	49	38.5	27	46
August	31	8.7	23	34

* – by Koleva and Peneva, 1990

** – climate reference book for NPR, ed. Kyuchukova, 1983

Results and Discussion

Biological indicators

Hybrid 1470 is characterized by the highest plant height during the study period, followed by Hybrid 1449 (Table 2). Apart from them, Hybrid 1494 has also developed plant height over 170 cm. The two control varieties are presented with the lowest height of plants. All studied variants are presented with a height that is within the optimal limits for the variety group Burley tobacco. In correlation with the large plant height, the largest number of leaves is distinguished in Line 1470 again followed by Hybrid 1449 (Table 2). These two hybrids are the only variants that have given more than 30 leaves. All variants are superior in number of leaves to the standard Pliska 2002 variety, which develops the smallest number of leaves.

In terms of sizes of leaves with the most favorable indicators is presented Line 1470, which is superior to all other variants, both in length and width of the leaves (Table 2). In second place with a small but proven difference in length and width of the leaves is Hybrid 1449. Hybrid 1494, Hybrid 1482 and Hybrid 1469 are also distinguished by favorable leaf sizes. All newly created hybrids exceed the standard Pliska 2002 variety both in the length of the leaves and especially in the width of the leaves. All of them are superior in size to the leaves, and the other control Burley 1317 variety.

The Hybrid 1482 has the shortest and at the same time favorable length of the vegetative period (Table 2). With a

Table 2. Data from biometric indicators of studied variants average for the period of study

Variety/Line	Height, cm	Number of leaves	Length of 13 leaf, cm	Width of 13 leaf, cm	Vegetative period, days
Pliska 2002	164.7 ^h	26.7 ^f	61.5 ^h	29.1 ^h	81.8 ^a
Burley 1317	165.2 ^h	27.2 ^{ef}	61.8 ^{gh}	31.5 ^g	76.4 ^b
Hybrid 1438	167.2 ^f	27.8 ^{dc}	62.3 ^{ef}	32.4 ^{ef}	70.8 ^g
Hybrid 1449	172.6 ^b	30.3 ^b	63.7 ^b	33.4 ^b	72 ^c
Hybrid 1462	166.2 ^g	27.3 ^{ef}	62.2 ^{fg}	31.9 ^f	72.4 ^c
Hybrid 1469	170.1 ^d	28.8 ^c	62.8 ^{cd}	32.5 ^{de}	71.4 ^f
Hybrid 1470	174.2 ^a	31.6 ^a	64.4 ^a	33.9 ^a	69.8 ^h
Hybrid 1482	166.7 ^{fg}	27.6 ^{dc}	62.6 ^{de}	32.8 ^{cd}	68.3 ⁱ
Hybrid 1494	171.2 ^c	29.8 ^b	63.2 ^c	33.1 ^{bc}	74.3 ^c
Hybrid 1499	169.3 ^c	28.3 ^{cd}	62.1 ^{fg}	32.3 ^{ef}	73.3 ^d
GD ^{5%}	0.8	1	0.4	0.4	0.6

small but proven difference in second place is the Hybrid 1470. These two variants are presented with less than 70 days length of the vegetative period. Hybrid 1438 and Hybrid 1469 are also presented with a relatively short vegetative period. The standard Pliska 2002 variety is presented with the longest vegetative period, which is too long for the tobacco of this variety group. All newly selected lines surpass not only the standard variety in the length of the vegetative period but also the other control variety Burley 1317.

Economic indicators

With the highest yield on average for the study period is Hybrid 1470, which is the only option that gives over 3500 kg/ha and surpasses the standard Pliska 2002 variety by 36% (Table 3). In second place in terms of yield with a small but proven difference from the first is Hybrid, which exceeds the standard by 33%. Hybrid 1494 is also distinguished by high yield, which ranks third and exceeds the indications of the Pliska 2002 variety by 31%. These three options can be

defined as high yield. The lowest yield has the standard Pliska 2002 variety. All other variants are given over 3000 kg / ha. In terms of yield of dry tobacco per hectare, all newly created lines significantly exceed the standard Pliska 2002 variety. In addition, all newly selected lines exceed in terms of yield and Burley 1317 variety.

With the highest percentage of first class on average for the period is formed Hybrid 1482 – 47% (Table 3). It is also the option that gives the lowest percentage of the third class. However, this line gives the lowest yield of all new hybrids. The Hybrid 1470 is ranked second in the percentage of classes, but the second class is already slightly predominant. Hybrid 1449 is the third variant, which gives over 40% first class. These three hybrids are the only ones that present less than 10% third class.

The standard Pliska 2002 variety is the variant that is characterized by both the lowest percentage of first class and the highest percentage of third class. Hybrid 1494, which is otherwise high-yielding, is formed with a low percentage of first

Table 3. Yield and percentage of classes of the studied variants and percentage of the standard Pliska 2002 variety average for the period of study

Variety/line	Yield, kg/ha	Percentage of standard, %	Classes, %		
			I	II	III
Pliska 2002 variety	261.4 ^h	100	20	64	16
Burley 1317 variety	306.3 ^g	117.2	29	57	14
Hybrid 1438	325.6 ^e	124.6	34	54	12
Hybrid 1449	348.6 ^b	133.3	41	50	9
Hybrid 1462	316.7 ^f	121.1	39	51	10
Hybrid 1469	338 ^d	129.3	37	52	11
Hybrid 1470	356.3 ^a	136.3	45	48	7
Hybrid 1482	308.2 ^g	117.9	47	47	6
Hybrid 1494	343.3 ^c	131.3	28	58	14
Hybrid 1499	322.7 ^e	123.4	36	53	11
GD 5%	5.3				

class. It is the only variant of the newly created hybrids, which is inferior in this indicator to the other control – Burley 1317 variety. The results of the economic evaluation show that all newly selected lines have exceeded the standard Pliska 2002 variety, both in yield and in percentage of first class.

Chemical indicators

Hybrid 1482 has the highest and at the same time most favorable nicotine content, which is much superior to the other variants in this indicator (Table 4). In addition, Hybrid 1449 is also provided with more than 3% nicotine, which is a prerequisite for defining these two options as those with relatively high nicotine content. Hybrid 1494 has the lowest nicotine content, which is only inferior to the standard Pliska 2002 variety in this respect.

Hybrid 1482 is characterized by the lowest and desired by sugars content (soluble carbohydrates). It is relatively favorable in Hybrid 1449 and Hybrid 1470. Hybrid 1494 is given the highest sugar content in its samples, which is unfavorable in Burley tobacco (Table 4). The sugar content of Hybrid 1499 and Hybrid 1462 is also high for the standards of this tobacco.

Hybrid 1482 is presented with the most favorable indicators in terms of total nitrogen content. Hybrid 1470 and Hybrid 1449 are also presented with very good data (Table 4). In general, all options have good data on this indicator. Although the range of variation in terms of ash content is relatively large, all variants have indicators that meet the standard requirements for the variety group on this index. All studied variants are also given ammonia content that meets the requirements of the Burley variety group. With the lowest and at the same time the most favorable one is Hybrid 1482, and with the highest and unfavorable – Hybrid 1494 (Table 4).

Hybrid 1482 has the most favorable ratio of classes, has a very well balanced chemical composition and a very short vegetative period. However, it is not high-yielding, which renders its production testing. High-yielding hybrid 1494 has

an unfavorable class ratio and unfavorable chemical composition, which reduces its consumer value. Of interest for heterosis selection is the Hybrid 1449, which is presented with relatively good production and consumer qualities and is retreated only to the Hybrid 1470.

According to the complex of biological, economic and chemical indicators, Hybrid 1470 is formed in the first place. It is highly productive with a favorable ratio of classes, with a short length of the vegetative period and has a relatively favorable chemical composition. This allows, after a production test, to be presented to the Executive Agency for Seed Testing, Approbation and Seed Inspection as a new heterosis variety of Burley tobacco.

Conclusion

With the most favorable biometric indicators in terms of plant height, number and size of leaves is presented Hybrid 1470, followed by Hybrid 1449.

Hybrid 1482 is characterized by the shortest and at the same time most favorable length of the vegetative period, as the Hybrid 1470 is slightly inferior to it. All newly created hybrids are far superior by length of the vegetative period to the standard Pliska 2002 variety and to a lesser extent Burley 1317 variety.

The highest yield is the Hybrid 1470, which gives over 3500 kg per hectare. In second place with a small but proven difference is the Hybrid 1449.

Hybrid 1482 is given the highest percentage of the first and at the same time the lowest of the third class. Hybrid 1470 and Hybrid 1449 are also presented with favorable percentages of the classes. All newly selected hybrids strongly surpass the standard Pliska 2002 variety, both in terms of yield and percentage of classes.

Hybrid 1482 has the best balanced chemical composition. Hybrid 1470 and Hybrid 1449 are also formed with a relatively favorable one.

Table 4. Data on the chemical composition of the studied variants

Variety/line	Nicotine, %	Sugars, %	Total nitrogen, %	Ashes, %	Ammonium, %
Pliska 2002 variety	2.53	0.94	2.74	17.76	0.35
Burley 1317 variety	2.71	0.99	2.78	16.88	0.35
Hybrid 1438	2.64	0.98	2.92	16.45	0.35
Hybrid 1449	2.93	0.89	3.08	18.13	0.34
Hybrid 1462	2.62	1.01	2.88	16.31	0.36
Hybrid 1469	2.75	0.92	2.96	17.33	0.34
Hybrid 1470	3.17	0.83	3.27	17.27	0.33
Hybrid 1482	3.38	0.77	3.57	17.45	0.30
Hybrid 1494	2.47	1.12	2.66	19.06	0.39
Hybrid 1499	2.56	1.04	2.83	15.84	0.37

The complex assessment of the biological, economic and chemical indicators shows that the Hybrid 1470 performs best of all variants. Selection work with this hybrid will continue with production testing and possible presentation to the Executive Agency for Seed Testing, Approbation and Seed Inspection for recognition as a new heterosis variety of Burley tobacco.

Hybrid 1449 is emerging as quite promising, as well as Hybrid 1469 and Hybrid 1482 to some extent.

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