

## Productive possibilities of new lines of Burley Tobacco

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### Abstract

Dyulgerski, Yo. (2024). Productive possibilities of new lines of Burley Tobacco. *Bulg. J. Agri. Sci.*, 30(1), 75–80

The economic indicators of 8 samples Burley tobacco for yield and percentage of classes are assessed. The results of the study showed a strong influence of the factor “meteorological conditions during the year of testing“ on tobacco yield. The influence of this factor on the percentage of tobacco classes is weaker, but also considerable. Average for the period of study Line 1533 gives the highest yield per decare and secondly narrowly ranks Line 1484. The lowest yield during the period of study has presented the standard Pliska 2002 variety. Average for the period of study highest percentage of first class is obtained from Line 1484, which excels with very minimal margin Line 1533. The standard Pliska 2002 variety is given the lowest percentage of first class from all the studied variants and same time the highest percentage of third class. With the stable economic performance in different years of study are presented Line 1533 and Line 1484. These two lines can be defined as high-yielding and comparative high-quality. All new selection lines strongly outperform the testimony of the standard Pliska 2002 variety, both in terms of yield and in terms of percentage of classes, which is a success for selection work. Line 1535, Line 1531 and Line 1485, also outperform Burley 1317 variety and are with relatively close to each other economic results. Line 1533 and Line 1484 are formed as variants with the highest economic and breeding value and deserve to be presented in EAVTFISC (Executive Agency for Seed Testing, Approbation and Seed Inspection) for recognition, as new varieties Burley tobacco.

*Keywords:* Burley tobacco; new lines; economical indicators; yield and percentage of classes

### Introduction

Bulgaria is a traditional producer of Oriental tobaccos. In addition to tobacco from this varietal group, large-leaf tobaccos are also grown, as during the period 2011-2021 their relative share increases. Burley tobacco is a characteristic representative of large-leaf tobaccos, which is grown in Bulgaria since 1969. In recent years, its production in Bulgaria has steadily and steadily decreased, as have the rest of the tobaccos that are grown in our country. A much lower rate of first class and a much higher rate of third class compared to other countries.

There are a number of problems with growing this tobacco that lead to unstable production over the years. The yield is up to 2 to 3 times lower than the leading producing countries at a much higher cost of production. The quality of the raw material produced in Bulgaria is much lower than

that of the traditional producing countries (Bozhinova, 2006; Bozhinova & Hristeva, 2022; Dimanov & Masheva, 2011; Yonchev, 2014). The reasons for this are many and complex, the main ones being of an economic and political nature. Of great importance for the poor state of the branch, however, is the inefficient variety structure (Dyulgerski, 2011; Bridges et al., 2011). Climate change and the lean but permanent drought that is observed in recent years in our latitudes also give its reflection. However, the varieties implemented so far in production are outdated and do not meet the criteria neither of the tobacco producers nor of the fabrication (Nicolova & Drachev, 2006; Nicolova et al., 2008). The foreign varieties that are imported to our country do not go through the necessary introduction process, which often has a deplorable effect on the results obtained from them. It is also necessary for the new created varieties to be more adaptable considering the permanently changing climate of the Balkans (Kinay

et al., 2022). Therefore, it is necessary to carry out selection and research work to update the varietal composition and introduce more efficient Burley tobacco varieties (Boaretto et al., 2020; Dyulgerski, 2011; Dimitrieski et al., 2006; Kınay & Kurt, 2022; Mitreski et al., 2018; Risteski et al., 2010; 2012; Pearce et al., 2014; 2019; Sarala & Rao, 2008).

The purpose of this study is to evaluate the most important production characteristics of Burley tobacco varieties and newly selected tobacco lines and to evaluate their use in breeding programs.

## Material and Methods

In order to achieve the target in the period 2016–2020, eight samples of Burley tobacco are tested in the experience field of TTPI – Markovo, namely the most widely cultivated Burley 1317 variety, six promising consolidated lines, which showed very good economic results, as well as and the use of standard Pliska 2002 variety. The subject of research and analysis are the economic indicators: the yield of hectares, the percentage of the first, second and third classes.

All variants have the same type of cultivation technology. The harvesting of the tobacco is carried out of whole plants and the drying is carried out at the TTPI drying base. The experiments are based on the methodology of Zapryanov & Dimova (1995).

The years during which the survey is conducted (2016–2020) vary in the amount of rainfall that has fallen from the time of transplanting to harvesting Burley tobacco (Table 1). For all five years of the study, the amount of precipitation for all other months during the vegetative period is below the norm, at least in 2016 (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).

The mathematical processing of the data is done with the applied products SPSS 20. The experimental data are processed by the method of analysis of variance (Anova), and the differences between the variants are established by Duncan multi-rank test (1995).

## Results and Discussion

### Yield

Highest yield per hectare in 2016 are given Line 1533, followed by a slight difference of line 1484 (Table 2). These two lines have provided over 3000 kg per ha. The third place with a proven difference from the second is Line 1535. The results of Line 1535, Line 1531 and Line 1485 are close. The lowest yield is obtained from the control Pliska 2002 variety, which only yields less than 3000 kg per ha. The penultimate variant in the ranking of Line 1481 is far superior to the standard variety, but inferior to the proven difference of Burley 1317 variety.

**Table 2. Yield, percentage of the standard Pliska 2002 variety and percentage of classes of studied variants for 2016**

Variety/ Line	Yield kg/ ha	Percent- age of standard	Classes, %		
			I	II	III
Pliska 2002	261.3 <sup>c</sup>	100	13	70	17
Burley1317	261.3 <sup>c</sup>	122.1	31	58	11
Line1481	319.3 <sup>c</sup>	117	19	66	15
Line 1484	305.8 <sup>d</sup>	134.4	38	64	8
Line 1485	351.3 <sup>a</sup>	126.8	31	55	14
Line1531	331.3 <sup>b</sup>	124	30	66	14
Line1533	324 <sup>c</sup>	136	36	64	10
line 1535	355.3 <sup>a</sup>	128	33	55	12
GD <sub>5%</sub>	7.2				

**Table 1. Meteorological data – Plovdiv, 2016–2020**

Month	Norm*	Average day and night temperature in °C				
		2016	2017	2018	2019	2020
June	20.9	23.5	23.8	23	23.5	20.9
July	23.2	26	25	24.7	24.2	24.2
August	22.7	24.7	25.3	24.8	25.3	22.9
month	norm**	Amount of rainfall – l/m <sup>2</sup>				
		2016	2017	2018	2019	2020
June	63	24.8	15	139.9	142.3	64
July	49	5	65	82.7	38.5	27
August	31	16.3	9	45.6	8.7	23

\* – by Koleva and Peneva, 1990

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

**Table 3. Yield, percentage of the standard Pliska 2002 variety and percentage of classes of studied variants for 2017**

Variety/ Line	Yield, kg/ ha	Percent- age of standard	Classes, %		
			I	II	III
Pliska 2002	245.8 <sup>f</sup>	100	17	69	14
Burley1317	308.8 <sup>d</sup>	125.6	33	54	13
Line1481	288.8 <sup>c</sup>	117.5	26	62	12
Line 1484	333.5 <sup>b</sup>	135.7	40	53	7
Line 1485	317.5 <sup>c</sup>	129.2	35	55	10
Line1531	322.3 <sup>c</sup>	131.1	36	53	11
Line1533	340.3 <sup>a</sup>	138.4	40	52	8
line 1535	311.3 <sup>d</sup>	126.6	37	53	10
GD <sub>5%</sub>	6,2				

In 2017, a lower yield is obtained compared to the previous year for all studied variants. There is no variant that exceeds 3500 kg per hectare, and besides Pliska 2002 variety, Line 1481 also yields less than 3000 kg per hectare. Again, the highest yield is obtained from Line 1533, followed by Line 1484 with a small but proven difference (Table 3). In third place is Line 1531, which is also second to second with a small but proven difference. The lowest yield in 2017 is obtained from the standard Pliska 2002 variety.

In 2018, all studied varieties are given the highest yield. This year, the highest yield is observed during the study period – 3738 kg/ha. In 2014, the highest yield is obtained from Line 1533, again in second place with a small but proven difference being Line 1484 (Table 4). This year, over 3500 kg per ha also yields third in the arrangement – Line 1535. Again the lowest yield is obtained from the standard Pliska 2002 variety. Overall, the results obtained in 2016 and 2017 in most variants are close.

**Table 4. Yield, percentage of the standard Pliska 2002 variety and percentage of classes of studied variants for 2018**

Variety/ Line	Yield, kg/da	Percent- age of standard	Classes, %		
			I	II	III
Pliska 2002	277.3 <sup>g</sup>	100	25	65	10
Burley1317	329 <sup>c</sup>	118.6	35	55	10
Line1481	311.3 <sup>f</sup>	112.3	32	57	11
Line 1484	366.3 <sup>b</sup>	132.1	45	50	5
Line 1485	341.3 <sup>d</sup>	123.1	38	53	9
Line1531	331.3 <sup>c</sup>	119.5	39	53	8
Line1533	373.8 <sup>a</sup>	134.8	44	49	7
line 1535	352.8 <sup>c</sup>	127.2	41	51	8
GD <sub>5%</sub>	7.4				

In 2019 a lower yield is obtained compared to the previous three years in all studied variants except Line 1481 (Table 5). This year, the highest yield is obtained from Line 1484, which is slightly smaller than the second difference in the ranking Line 1533. The third position is Line 1531, and the results of this line and Line 1485, Line 1535 and Burley 1317 are quite similar. In 2019, the lowest yield is again obtained with the Pliska 2002 standard. Overall, the results obtained in 2017 and 2019 in most of the variants are close.

**Table 5. Yield, percentage of the standard Pliska 2002 variety and percentage of classes of studied variants for 2019**

Variety/ Line	Yield, kg/da	Percent- age of standard	Classes, %		
			I	II	III
Pliska 2002	241.3 <sup>c</sup>	100	12	70	18
Burley1317	311.5 <sup>c</sup>	129.1	27	58	15
Line1481	295 <sup>d</sup>	122.3	17	69	16
Line 1484	328.5 <sup>a</sup>	136.1	33	57	10
Line 1485	313.5 <sup>c</sup>	130	22	53	15
Line1531	316.5 <sup>b</sup>	131.2	28	58	14
Line1533	326 <sup>a</sup>	135.1	32	57	11
line 1535	312.3 <sup>c</sup>	129.4	24	60	16
GD <sub>5%</sub>	3				

In 2020, the lowest yield is obtained from the entire survey period in all studied variants except Pliska 2002 variety (Table 6). As in 2019, the highest yield is obtained from Line 1484, which is superior to the small and unproven difference of the second in the ranking in yield – Line 1533. Third place with unproven difference from the second is Line 1535. In 2020, Line 1531, Line 1485 and Burley 1317 variety are presented with similar results.

**Table 6. Yield, percentage of the standard Pliska 2002 variety and percentage of classes of studied variants for 2020**

Variety/ Line	Yield, kg/da	Percent- age of standard	Classes, %		
			I	II	III
Pliska 2002	245.3 <sup>c</sup>	100	14	71	15
Burley1317	305.5 <sup>c</sup>	124.5	30	57	13
Line1481	289 <sup>d</sup>	117.8	22	65	13
Line 1484	323 <sup>a</sup>	131.7	38	65	7
Line 1485	307 <sup>c</sup>	125.2	28	58	14
Line1531	309 <sup>c</sup>	126	32	56	12
Line1533	321 <sup>ab</sup>	130.9	37	65	8
line 1535	317.3 <sup>b</sup>	129.4	31	55	14
GD <sub>5%</sub>	5.7				

Regarding yield is observed a strong influence of the year factor. The yield data obtained during the years of research showed that Line 1533, Line 1484 and partly Line 1531 and Burley 1317 variety showed stability in terms of this indicator.

Average for the study period Line 1533 yields the highest yield per ha and exceeds the standard Pliska 2002 variety by 35% (Table 7). With a minimal and unproven difference, Line 1484 ranks second, exceeding the standard reading by 34%. These two lines yield more than 3400 kg per ha on average over the entire study period. These two lines should be defined as high-yielding. Also relatively high yielding are Line 1535, Line 1531 and Line 1485, which have similar results, yielding over 3200 kg per ha. Third in the ranking – Line 1535 is presented with unstable results during the different years of the survey. The standard Pliska 2002 variety is presented with the lowest yield during the study period.

**Table 7. Yield, percentage of the standard Pliska 2002 variety and percentage of classes of studied variants average for the period of study**

Variety/ Line	Yield, kg/da	Percentage of standard	Classes, %		
			I	II	III
Pliska 2002	254.2 <sup>c</sup>	100	16.2	68.2	15.6
Burley1317	314.8 <sup>cd</sup>	123.8	31.2	54.4	14.4
Line1481	298 <sup>d</sup>	117.2	23.2	73.4	13.4
Line 1484	340.5 <sup>ab</sup>	133.9	38.8	53.8	7.4
Line 1485	322.1 <sup>bc</sup>	126.7	30.8	56.8	12.4
Line1531	320.6 <sup>bc</sup>	126.1	33	55.2	11.8
Line1533	343.3 <sup>a</sup>	135.1	37.8	53.4	8.8
line 1535	325.6 <sup>abc</sup>	128.1	31.2	66.8	12
GD <sub>5%</sub>	19.3				

All newly selected lines are superior in yield to the standard Pliska 2002 variety, and with the exception of Line 4181, are superior also Burley 1317 variety (Table 7). This is an indication of the success of breeding work on this most important agronomic indicator. Although the yield of Line 1481 exceeds by a proven difference, that of the standard variety, it yields below that of Burley 1317 variety and also yields less than 3000 kg per hectare. Therefore, its results should be considered unsatisfactory.

#### *Percentage of classes*

With the highest percentage of first class in 2016 is presented Line 1484, followed by a slight difference from Line 1533 (Table 2). They are also the options with the lowest percentage of third class. With a relatively favorable percentage of the classes, this year and a close result are Line 1535, Line

1531, Line 1485 and Burley 1317. In this case, the percentage of the third class exceeds that of the first.

With the highest percentage of first class in 2017 are presented equally Line 1484 and Line 1533 (Table 3). They are also the options with the lowest percentage of third class. With a relatively favorable percentage of the classes this year and with similar results are presented Line 1535, Line 1531 and Line 1485, but in this case the percentage of first class slightly exceeds that of third.

In 2018, with the highest percentage of the first class, is presented Line 1484, which this year yields 45% of the first class, which is the highest percentage, obtained during the period of study (Table 4). It also is given the lowest percentage of the third class – 5%, which is the lowest percentage of this class in the study. Second in line with 44% is Line 1533, which also is given a very low percentage of third class. With the lowest percentage of the first class is formed the standard Pliska 2002 variety, which is given the highest percentage of the third class. This year, all experimental variants are given the highest percentage of the first and the lowest of the third class.

The next 2019 from all variants is obtained the lowest percentage of first and highest percentage of third grade. The highest first-class percent this year is presented Line 1484, followed by a slight difference from Line 1533 (Table 5). They are also the options with the lowest percentage of third class. The standard Pliska 2002 variety is formed with the lowest percentage of the first and the highest percentage of the third class. In this case, the percentage of the third class exceeds the one of the first class.

In 2020, the percentages of the trial classes are similar to those in 2016. Line 1484 is the highest in the first class, followed by a slight difference from Line 1533 (Table 6). They are also the options with the lowest percentage of third class. With the lowest percentages of the first and the highest percentages of the third class, is formed the standard Pliska 2002 variety. In this case, the percentages of the first and third classes are almost equal.

In terms of grade percentage, a weaker but still significant effect is observed of the factor – year. In all variants, the most favorable data are in 2018 and the most unfavorable in 2019. Data over the three years show that in terms of the percentage of stability the classes are shown by Line 1484 and Line 1533.

For the average of the study period, the highest percentage of the first class is obtained from Line 1484, which is superior to the very minimal difference Line 1533 (Table 5). Line 1484 is the variant that is given the lowest percentage of the third class, followed by Line 1533. These two lines should be defined as relatively high quality. With a similar

result are Line 1535, Line 1531, Line 1485 and Burley 1317 variety.

The standard Pliska 2002 variety is given the lowest percentage of the first class of all tested variants (Table 7). It also is given the highest third grade rate. In this variety, the percentages of the first and third classes are almost equal. Although it gives a lower percentage of third class than Burley 1317, Line 1481, it also gives a lower percentage of first class than it.

Although all variants are given a significantly higher percentage of the first class than the standard variety, the results on this indicator can be considered satisfactory, since in all of them the percentage of the second class exceeds that of the first (Table 7).

The most favorable from an economic point of view is 2018. The most unfavorable year for yield per hectare is shaping up to be 2020, and in terms of the percentage of classes 2019. Line 1533 and Line 1484 are presented with the most stable economic indicators.

All newly selected lines strongly outperform the testimony of the standard variety, both in yield and in percentage of classes. This shows that breeding work on economic indicators has achieved its objectives. As a result of the research, it is found that Line 1533 and Line 1484 performed best, especially the first. Apart from them, the other four newly created lines also represent a selection interest, as carriers of carriers of valuable selection indicators, and work with them will continue.

## Conclusion

Average for the period of study Line 1533 is given the highest yield per hectare. The highest percentage of the first class is obtained on the average for the studied period from Line 1484. Line 1533 and Line 1484 are the most stable economic indicators.

Regarding yield, a strong influence of the year factor is observed, and regarding the percentage of classes, a weaker, but still significant influence of the particular year of research. Line 1533 and Line 1484 are presented with the most stable economic indicators.

All the newly selected lines greatly exceeded the indications of the standard variety both in terms of yield and percentage of classes, which is a sure indicator of the success of the selection work.

Line 1533 and line 1484 are formed by the variants with the highest economic and selection value, with a slight advantage of the first. Due to the high stable yield per hectare and the favorable class ratio, these two lines deserve to be presented to Executive Agency for Seed Testing, Approba-

tion and Seed Inspection for recognition as new Burley tobacco varieties.

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*Received: September, 24, 2022; Approved: October, 03, 2022; Published: February, 2024*