

## ASSESSMENT OF BIOLOGICAL INDICATORS AND PRODUCTION CHARACTERISTICS OF PERSPECTIVE LINES BURLEY TOBACCO

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### ABSTRACT

Examined are the biological and production parameters of seven newly created lines of Burley tobacco. Research results show that with the best biological assessment presents Line 1540, followed by a line 1521. With the shortest and yet most favourable vegetative period differs Line 1531 (74,7 days). With favourable the vegetative period is presented and Line 1521 (76,2 days). All test variants have a shorter vegetative period than the standard variety, Pliska, which is a success in selection work by this indicator. Line 1540 gives the highest yield per hectare (3607 kg/ha) as an average over the period of study and three years of study. From this line gets the highest percentage of first class (45%) and at lower than third class (6%), as average for the period of study and for three years of study. All new created lines strongly outweigh the testimony of the standard variety, both in terms of production and in terms of percentage of classes, which is an indication of the success of the selection work. Line 1540 Line 1521 and Line 1536 are formed as options with the highest production and selection value. In complex of biological indicators and productive characteristics most stands Line 1540 and therefore may be offered for production test and presentation for recognition as a new variety Burley tobacco.

**Key words:** Burley tobacco, new created lines, biological indicators, production characteristics

### ОЦЕНКА НА БИОЛОШКИ И ПРОИЗВОДНИ КАРАКТЕРИСТИКИ НА ПЕРСПЕКТИВНИ БЕРЛЕЈСКИ ЛИНИИ ТУТУН

Истражувањата се за биолошко-производните показатели на седум новосоздадени линии тутун Берлеј. Резултатите од истражувањето покажуваат дека со најдобра биолошка проценка се одликува Линија 1540 и Линија 1521. Со најкраток и истовремено доста поволен вегетационен период се одликува Линија 1531 (74,7 дена). Со поволен вегетационен период се одликува и Линија 1521 (76,2 дена). Сите испитувани варијанти имаат пократок вегетационен период од стандардната сорта, Плиска, што е поволен показател при избор и работа по овој показател. Линија 1540 дава најголем принос по хектар (3607 кг/ха), како просек за периодот на истражување, така и за трите години на истражување. Од оваа линија се добива највисок процент на првата класа (45%) и низок од трета класа (6%), како просек за периодот на истражување, така и за трите години на истражување. Сите новоселкционирани линии покажуваат голема предност и ја надминуваат стандардната сорта, како во однос на производството, така и во однос на процентот на класите што е индикација за успех на избор и работа. Линија 1540, линија 1521 и линија 1536 се варијанти со највисока биолошко-производна, и селекциона вредност. Според биолошките и производните индикатори најмногу се издвојува Линија 1540 и поради тоа може да се предложи за производство, тестирање и перформанси и за признавање како новата сорта тутун Берлеј.

**Клучни зборови:** Берлејски тутун, нови линии, биолошки показатели, производни карактеристики

## INTRODUCTION

Burley tobacco is indispensable component of American blend cigarettes (Tomov and Minev, 1996; Davis and Nielsen, 1999). Although he held increasingly important part of total tobacco production in Bulgaria, the yield and quality of the produced raw material in the country significantly inferior to that in the traditional producing countries (Bozukov, 2012). The unsatisfactory situation of the tobacco production in country is a serious obstacle for even greater expansion of cultivated areas (Dyulgerski, 2011).

The main reasons for this are old varieties in production (Dimanov and Masheva, 2011). Embedded currently in production varieties Burley tobacco not satisfy the contemporary requirements, neither farmers nor the tobacco industry (Dyulgerski, 2011; Masheva, 2008; Nikolov et al., 2004). Imported Burley tobaccos seriously outperform our tobaccos from this varietal group on most indicators. (Docheva and

Stoilova, 2011; Kirkova et al., 2006; Milanova all., 2013; Stoilova and Bojinova, 2007; Nicolova and Drachev, 2006; Popova et al., 2006).

The unsatisfactory situation of the Burley tobacco requires the creation and deployment of new, xigh-yielding and higher quality varieties, which can only be done through selection-research for development and introduction of new higheffective varieties (Dyulgerski, 2011; Yonchev, 2015; Calvert et al., 2000; Dimitrieski et al., 2006; Pearce et al., 2014; Risteski et al., 2012; Snell, 2006).

The purpose of this study is to evaluate the most important biological indicators and productive characteristics of new lines Burley tobacco and the possibilities for their use in selection programs, as well as a possible submission of the best of them for production testing and recognition, new varieties of Burley tobacco.

## MATERIAL AND METHODS

For the achievement of defined goal for the period 2013 - 2015 in experimental fields of TTPI - Markovo are tested eight samples of Burley tobacco, namely: Line 1500, Line 1521, Line 1525, Line 1531, Line 1535, Line 1536, Line 1540 and Pliska 2002 variety used to standard in Burley tobacco. Subject of research and analysis are the most important biological and economic parameters in Burley tobacco. Of the biological parameters are researched: plant height, number of leaves; length and width of 13 leaf, respectively, for mid harvesting belt. Estimated is the length of the vegetative period. Dimensions are 120 plants from the option. Of economic indi-

cators are calculated yield per hectare and percentage of first, second and third class. 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 and Dimova (1995).

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

## RESULTS AND DISCUSSION

### I. Biological assessment

#### 1. Biometrical indicators

Not observed significant differences in the height of the options explored in the three years of study. The highest plants are in 2014 and the lowest in 2015 at all options. In 2013 and 2014 the greatest height of plant develops Line 1521 and Line 1540 through 2015.

Average for the period of study with the highest values in terms of the height of the plants presents Line 1521 (169.8 cm) and Line 1540 (168,7 cm). With the smaller height are formed Line 1500 and Line 1531. There are no significant differences between the testimonies of the variants. All present values for height of plants that are optimal for group Burley tobacco (Table 1). In unison with the the biggest height of most leaves all options developed in 2014, with no significant differences in the number of leaves over the years. And in the three years of researches most leaves gives Line 1540 (32.7 leaves), followed by Line 1521 (Table 1). At least leaves and in the three years of study gives Line 1525 (26.6 leaves). Most leaves - 33 averages during the reporting period develops Line 1540, followed by a small but proven difference Line 1521.

These lines are the only one the variant that give more than 30 leaves. With at least leaves are shape Line 1525 (26.6 leaves) and Line 1500 (27 leaves). Although the testimony of options regarding the number of leaves are not optimal, though they satisfy the requirements of Burley tobacco of this indicator (Table 2).

And in terms of size of the leaves no significant differences in different years of study, both the width and length of the leaves. In this case, most large leaves in all the variants are produced in 2014. The results also are unidirectional - the greatest length and width of the leaves are derived from Line 1540, invariably followed by Line 1521. And in the three years to study the control variety Pliska is characterized by the smallest width of the leaves.

Average for the period of study with the greatest length of the leaves is presented Line 1540 (63.5 cm) followed a slightly different line from Line 1521 (63.1 cm). All others variant given more than 60 cm long of the leaves and satisfy the requirements of Burley tobacco (Table 2).

**Table 1. Data from biometric indicators of studied variants by years in the period of study**

Variety/Line	Height in cm.	Number of leaves	Length of 13 leaf in cm.	Width of 13 leaf in cm.	Vegetative period in days
2013					
Pliska	166,7 <sup>ab</sup>	27,7 <sup>ab</sup>	61,5 <sup>cd</sup>	28,8 <sup>e</sup>	82,7 <sup>a</sup>
Line 1500	163 <sup>b</sup>	26,8 <sup>b</sup>	61,3 <sup>d</sup>	30,3 <sup>de</sup>	78,3 <sup>c</sup>
Line 1521	169,5 <sup>a</sup>	29,2 <sup>ab</sup>	63,3 <sup>ab</sup>	33,2 <sup>ab</sup>	76 <sup>e</sup>
Line 1525	165 <sup>ab</sup>	26,3 <sup>b</sup>	61,7 <sup>bcd</sup>	31,3 <sup>cd</sup>	80,8 <sup>b</sup>
Line 1531	163,7 <sup>ab</sup>	27,4 <sup>ab</sup>	61,8 <sup>bcd</sup>	31,8 <sup>bcd</sup>	74,3 <sup>f</sup>
Line 1535	164,3 <sup>ab</sup>	28 <sup>ab</sup>	62,3 <sup>abcd</sup>	32,1 <sup>abc</sup>	77,4 <sup>d</sup>
Line 1536	166,5 <sup>ab</sup>	28,9 <sup>ab</sup>	62,9 <sup>abc</sup>	32,7 <sup>ab</sup>	77 <sup>d</sup>
Line 1540	169,2 <sup>a</sup>	31,6 <sup>a</sup>	63,6 <sup>a</sup>	33,5 <sup>a</sup>	78,5 <sup>c</sup>

<b>GD<sub>5%</sub></b>	5,9	4,5	1,4	1,5	0,8
<b>2014</b>					
Pliska	168,3 <sup>ab</sup>	28,6 <sup>bcd</sup>	61,8 <sup>b</sup>	29,3 <sup>c</sup>	81,8 <sup>a</sup>
Line 1500	166,8 <sup>ab</sup>	27,8 <sup>cd</sup>	62,2 <sup>bc</sup>	30,6 <sup>bc</sup>	78,5 <sup>b</sup>
Line 1521	173,3 <sup>a</sup>	31,4 <sup>ab</sup>	63,4 <sup>ab</sup>	33,4 <sup>a</sup>	75,7 <sup>c</sup>
Line 1525	165,2 <sup>ab</sup>	26,6 <sup>cd</sup>	61,4 <sup>b</sup>	31,5 <sup>ab</sup>	80,5 <sup>b</sup>
Line 1531	164 <sup>b</sup>	28,6 <sup>bcd</sup>	62,5 <sup>abc</sup>	32,1 <sup>ab</sup>	74 <sup>d</sup>
Line 1535	164,6 <sup>ab</sup>	29,2 <sup>bcd</sup>	62,4 <sup>bc</sup>	32,3 <sup>ab</sup>	77 <sup>bc</sup>
Line 1536	167,7 <sup>ab</sup>	30,6 <sup>abc</sup>	63 <sup>ab</sup>	32,8 <sup>ab</sup>	76,5 <sup>c</sup>
Line 1540	171,5 <sup>ab</sup>	32,7 <sup>a</sup>	63,8 <sup>a</sup>	33,8 <sup>a</sup>	78,3 <sup>b</sup>
<b>GD<sub>5%</sub></b>	7,8	3,3	2,2	2,1	1,6
<b>2015</b>					
Pliska	166,5 <sup>ab</sup>	27,3 <sup>bc</sup>	61,3 <sup>ab</sup>	28,5 <sup>c</sup>	83,7 <sup>a</sup>
Line 1500	161,1 <sup>c</sup>	26,5 <sup>bc</sup>	61,4 <sup>ab</sup>	30,1 <sup>bc</sup>	78,7 <sup>cd</sup>
Line 1521	166,7 <sup>ab</sup>	30,8 <sup>a</sup>	62,7 <sup>ab</sup>	32,7 <sup>a</sup>	77 <sup>d</sup>
Line 1525	163,3 <sup>bc</sup>	26 <sup>c</sup>	61 <sup>b</sup>	30,7 <sup>abc</sup>	81,5 <sup>b</sup>
Line 1531	163 <sup>bc</sup>	26,8 <sup>bc</sup>	61,6 <sup>ab</sup>	31,3 <sup>ab</sup>	75,3 <sup>e</sup>
Line 1535	163,4 <sup>bc</sup>	27,8 <sup>bc</sup>	62,1 <sup>ab</sup>	31,6 <sup>ab</sup>	79 <sup>cd</sup>
Line 1536	165,5 <sup>abc</sup>	29,2 <sup>ab</sup>	62,5 <sup>ab</sup>	32,4 <sup>ab</sup>	77,5 <sup>d</sup>
Line 1540	168,6 <sup>a</sup>	31,3 <sup>a</sup>	63,1 <sup>a</sup>	33,1 <sup>a</sup>	79,7 <sup>bc</sup>
<b>GD<sub>5%</sub></b>	4,9	2,7	2,0	2,6	2,1

The greatest width of the leaves is presented Line 1540 (33,5 cm), followed by a margin of line 1521 (33,2 cm). With the narrower width of the leaves are set forth control va-

riety Pliska, which does not fully meet standards in Burley tobacco. The testimony of others the variant in this index satisfy the requirements of group Burley (Table 2).

## 2. Length of vegetative period

With regard to the length of vegetation period is observed significant difference between different options. All the variants with the longest vegetative period in 2015 and the shortest in 2014, the difference over the years at different options is not significant (Table 1). This shows that all options show stability on this indicator. And in the three years of study with the longest the vegetative period is the standard variety Pliska, and with the shortest Line 1531. Average for the period of study with the shortest and yet most favourable the vegetative period differs Line 1531 (74,7 days). With favourable vegetative period is presented and Line 1521 (76,2 days).

These two lines can be used as a donor for hybridization to shorten the length of the vegetative period in the selection of Burley tobacco. The greatest length of the vegetation period is characterized standard variety Pliska (82,7 days). All test variants have a shorter the vegetation period than the standard variety, which is a success in selection work on this indicator.

Line 1525 (80,9 days) and especially variety Pliska are presented with too long for Burley tobacco vegetative period. For the rest of the variant the length is with values satisfy the selection criteria for Burley tobacco (Table 2).

No is observed significant variation of bi-

ological indicators in the experienced variant during the years of the study, which is

prerequisite for vegetative and morphology uniformity.

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

Variety/Line	Height in cm.	Number of leaves	Length of 13 leaf in cm.	Width of 13 leaf in cm	Vegetative period in days
Pliska	166,5 <sup>abc</sup>	27,9 <sup>d</sup>	61,6 <sup>de</sup>	28,9 <sup>f</sup>	82,7 <sup>a</sup>
Line 1500	163,6 <sup>c</sup>	27 <sup>de</sup>	61,5 <sup>e</sup>	30,3 <sup>e</sup>	78,5 <sup>c</sup>
Line 1521	169,8 <sup>a</sup>	30,5 <sup>b</sup>	63,1 <sup>ab</sup>	33,1 <sup>ab</sup>	76,2 <sup>e</sup>
Line 1525	164,1 <sup>bc</sup>	26,6 <sup>e</sup>	61,4 <sup>e</sup>	31,2 <sup>d</sup>	80,9 <sup>b</sup>
Line 1531	163,5 <sup>c</sup>	27,6 <sup>de</sup>	62 <sup>de</sup>	31,7 <sup>cd</sup>	74,7 <sup>f</sup>
Line 1535	164,5 <sup>bc</sup>	28,3 <sup>cd</sup>	62,3 <sup>cd</sup>	32 <sup>c</sup>	77,8 <sup>cd</sup>
Line 1536	167,2 <sup>ab</sup>	29,6 <sup>bc</sup>	62,8 <sup>bc</sup>	32,6 <sup>b</sup>	77 <sup>de</sup>
Line 1540	169,7 <sup>a</sup>	31,9 <sup>a</sup>	63,5 <sup>a</sup>	33,5 <sup>a</sup>	78,8 <sup>c</sup>
<b>GD<sub>5%</sub></b>	5,2	1,4	0,6	0,6	1,3

## II. Production characteristics

### 1. Yield

The greatest yield per hectare in 2013 gives Line 1540 (3591 kg/ha) followed with proven deference by Line 1521 (3443 kg/ha) (Table 3). At lower yield is obtained from the control Pliska variety (2527 kg/ha). In 2014 again the highest yield is obtained from Line 1540 (3775 kg/ha), followed by Line 1521 (3537 kg/ha). At lower yield is obtained from the standard Pliska variety (2724 kg/ha). This year, all study variants give the highest yield, which in unison with the most favorable biometric identifiers received in the same year. And in 2015 the highest yield is obtained from Line 1540 ( 3162 kg/ha), again followed by Line 1521 (3637). Again the lowest yield, which is obtained from the control Pliska variety (2582). In that year Line 1521 and especially Line 1531 (3162 kg/ha) show significantly lower yield than in the previous two. It can be concluded that with the exception of Line 1531 other tested variants exhibited stability in terms of yield in individual years.

Average for the period of study Line

1540 gives the highest yield per hectare 3607 kg/ha (Table 4). In unproven difference its results superior to those of the next in the ranking in yield per hectare, namely Line 1521 (3462 kg/ha). The yield of Line 1540 exceeds this of standard variety with almost 38%, and the next Line 1521 by 33%. Only those lines receive over 3500 kg per hectare, and therefore can be defined as high-yielding. Favourable extraction and is third in the ranking Line 1536 (3416 kg/ha). The lowest yield presents the standard Pliska 2002 variety (2611 kg/ha) (Table 4). All new selection lines outperform production standard variety. This is an indication of the success of the selection work on this most important agronomic indicator. Although Line 1525 exceeds 8% yield of the standard variety, its results and those of variety Pliska should be defined as unsatisfactory.

## 2. Percentage of classes

In terms of percent of classes is observed a strong influence of factors - year (Table 3). Observed are significant differences between the variant during the three years of study, as by all of them are the most favorable in 2014 and the worst in 2015 and during the three years of study. With the highest percentage of first-class is Line 1540, which it is with the lowest percentage of third class. Second and third place with small difference between them in the three years of study are Line 1521 and Line 1336. And during the three years studied with the lowest rate first and highest third class is the standard Pliska variety.

Average for the period of study highest percentage of first class (45 %) is results from Line 1540 (Table 4). As it is presented in the three years of study in the first place on this indicator, it can be concluded that exhibits stability in terms of quality. This is the variant that gives the lowest percentage of third grade (6%). This line can be defined as a relatively high-quality.

In second place but with a big difference from the first is ranks Line 1521 (42 %). With small ranks third Line 1531 (37 %). These two variants also provide less than

10% third class (Table 4).

The standard variety Pliska 2002 gives the lowest percentage of first class from all studied the variant (12 %). Only in him the percentage of third class exceeds that of the first class (Table 3).

Although all variants provide significantly higher rate of first-class than the standard variety, the results of this indicator can be considered satisfactory, since all of them second-class rate exceeds that of the first (Table 4).

All new created lines surpass strong testimony of the standard variety, both in terms of yield and in terms of percentage of classes. This indicates that the selection work in terms of economic indicators is achieved its goals.

Line 1540 Line 1521 and Line 1536 form as options with the highest productive and selection value. In complex biological and economic indicators most stands Line 1540. Because exhibited optimal biometric identifiers favorable length of the vegetation period, high stable yield per hectare and satisfactory percentage of first class, this line deserves to be presented in IASAS for recognition as variety.

**Table 3. Production characteristics of studied variants by years in the period of study**

Variety/Line	Yield kg/ha	Percentage of standard	Classes in %		
			I	II	III
2013					
Pliska	2527 <sup>e</sup>	100	10	73	17
Line 1500	3323 <sup>e</sup>	131	17	69	14
Line 1521	3443 <sup>b</sup>	136	42	51	7
Line 1525	2701 <sup>d</sup>	107	28	59	13
Line 1531	3342 <sup>c</sup>	132	36	55	9
Line 1535	3362 <sup>c</sup>	133	30	58	12
Line 1536	3377 <sup>c</sup>	134	37	56	7
Line 1540	3591 <sup>a</sup>	142	44	51	5
<b>GD<sub>5%</sub></b>	63				

		2014				
Pliska	2724 <sup>f</sup>	100	18	70	12	
Line 1500	3391 <sup>d</sup>	124	21	67	11	
Line 1521	3637 <sup>b</sup>	134	46	48	6	
Line 1525	2956 <sup>e</sup>	109	34	55	11	
Line 1531	3420 <sup>d</sup>	126	43	50	7	
Line 1535	3454 <sup>cd</sup>	129	41	51	8	
Line 1536	3515 <sup>c</sup>	127	38	56	6	
Line 1540	3775 <sup>a</sup>	139	51	46	3	
<b>GD<sub>5%</sub></b>	87					
		2015				
Pliska	2582 <sup>f</sup>	100	8	64	19	
Line 1500	3130 <sup>d</sup>	121	15	70	15	
Line 1521	3307 <sup>b</sup>	128	37	53	10	
Line 1525	2787 <sup>e</sup>	108	20	63	17	
Line 1531	3162 <sup>cd</sup>	122	31	56	13	
Line 1535	3331 <sup>bcd</sup>	129	27	57	16	
Line 1536	3357 <sup>bc</sup>	130	34	55	11	
Line 1540	3456 <sup>a</sup>	134	39	52	9	
<b>GD<sub>5%</sub></b>	136					

Table 4. Production characteristics average for the period of study

Variety/Line	Yield kg/ha	Percentage of standard	Classes in %		
			I	II	III
Pliska	2611 <sup>c</sup>	100	12	72	16
Line 1500	3281 <sup>b</sup>	126	18	69	13
Line 1521	3462 <sup>ab</sup>	133	42	50	8
Line 1525	2815 <sup>c</sup>	108	27	59	14
Line 1531	3308 <sup>b</sup>	127	37	53	10
Line 1535	3382 <sup>ab</sup>	130	33	55	12
Line 1536	3416 <sup>ab</sup>	131	36	56	8
Line 1540	3607 <sup>a</sup>	138	45	49	6
<b>GD<sub>5%</sub></b>	221				

## CONCLUSION

In our study samples of Burley tobacco with the most favourable biological indicators is characterized Line 1540. With very good evaluation is presented and Line 1521. Average for the period of study with the

shortest and yet most favourable the vegetative period differs Line 1531 (74,7 days). With favourable the vegetative period is presented and Line 1521 (76,2 days). Line 1540 gives the highest yield per hect-

are (3607 kg/ha) as an average over the period of study and for the three years of study. From this line is prepared highest percentage of first class (45 %), as average for the period of study and for the three years of study.

All new created lines highly superior to the readings of the standard variety in terms of yield and in terms of percentage of the classes. This is an indication of the success

of the selection work.

Line 1540 Line 1521 and Line 1536 stand out as the variants with the highest value selection.

The final results show that Line 1540 is ranked first, with complex of biological indicators and production characteristics and should be proposed for production testing and recognition as a new variety.

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