

PERSPECTIVE LINE OF BURLEY TOBACCO VARIETY - LINE 1334

Yovko Dyulgerski, Stefka Kirkova

*Tobacco and Tobacco Products Institute (TTPI), Markovo, Bulgaria**(e-mail: yovko_dulg @abv.bg)***ABSTRACT**

The new perspective line of Burley tobacco has been studied. The results show that Line 1334 has the most favorable values for all biometrical identifiers. It is formed as variant with the shortest vegetative period. In the period of research, Line 1334 gave the highest yield per hectare and can be defined as high-yielding. Line 1334 and variety Burley 1317 produce the highest percentage of first class. Of all investigated variants, Line 1334 gives the lowest percentage of third class. According to the requirements of Burley tobacco, only Line 1334 possesses balanced chemical composition. It is the variant with the most favorable technological parameters. Line 1334 significantly outperforms the standard variety Burley 21 and the control variety Burley 1317 in all investigated parameters. It has many advantages and can be offered for testing and recognition as a new Burley tobacco variety.

Keywords: Burley tobacco, biometrical indices, yield, chemical composition, technology assessment

ПЕРСПЕКТИВНА ЛИНИЈА ТУТУН ОД ТИПОТ БЕРЛЕЈ – ЛИНИЈА 1334

Испитувана е новосоздадената перспективна линија тутун од типот берлеј. Добиените резултати покажуваат дека Линија 1334 поседува најдобри вредности во однос на сите биометриски показатели. Таа е оформува како варијанта со најкраток вегетациски период. Во периодот на истражување, Линија 1334 постигна највисок просечен принос по хектар и може да се определи како високоприносна. Од Линија 1334 и сортата Берлеј 1317 добиен е највисок процент на прва класа. Линија 1334 дава најмал процент на трета класа од сите испитувани варијанти. Согласно со барањата на типот Берлеј, само Линија 1334 поседува избалансиран хемиски состав. Таа е и варијантата со најповолни технолошки својства. Линија 1334 значително ја надминува стандардната сорта Берлеј 21 и контролата Берлеј 1317 во сите испитани својства. Таа има многу предности и може да биде предложена во ИАСАС за испитување и признавање како нова сорта тутун од типот Берлеј.

Клучни зборови: тутун берлеј, биометриски показатели, принос, хемиски состав, технолошка оценка

INTRODUCTION

With regard to yield and quality, Burley tobacco production in Bulgaria is seriously inferior to that in most other producing countries. One of the main reasons for

that is the inefficient varietal structure (Dyulgerski, 2011; Mutafchieva 2009). The implemented measures in production of Virginia and Burley varieties to date

do not meet modern requirements, neither of the farmers nor of the tobacco industry (Kirkova, 2005). Of all variety groups, Burley tobacco is the one that is most poorly represented in the country. That requires creation and implementation of new varieties which will meet the needs of both producers and consumers (Dimanov and Masheva, 2011, Risteski et al., 2007). The lack of high-quality tobacco varieties prevents Bulgaria to be presented as a

competitive manufacturer worldwide (Turner, 1989). This proves the necessity to strengthen the selection-research work in order to improve the varietal composition of Burley tobacco (Dyulgerski, 2011, Snell, 2006).

The purpose of this study is to present a complete characterization of the Line 1334 in view of the possibility for recognition as a variety for deployment in the production of Burley tobacco.

MATERIALS AND METHODS

In the period 2003 - 2010, in the experimental field of TTPI Markovo investigations were made with Line 1334 of the Burley variety group. Variety Burley 1317 was used as control, the most widespread in the production, and variety Burley 21 was used as a standard for Burley tobacco by 2010. Line 1334 is also comparable with variety Tennessee 86 and Line 1104, which are its parental components.

The investigations included biometric measurements, necessary phenological observations, productional manipulation, technological expert evaluation and chemical analysis. Complete

characterization was made of the morphology, biological properties, yield, quality, chemical composition and technological specifications of the new line. Mathematical processing of data was made by inserting the SPSS products and STATUSTUCA, as are calculated:

- the arithmetic mean - \bar{x}
- standard error of the arithmetic mean - S_x
- coefficient of variation - VC %

To detect differences between the variants we used the ANOVA test and Duncan's range test (1995).

Brief characteristics of the Line 1334

Line 1334 is a hybrid combination between the variety Tennessee 86 introduced from the U.S.A. and Line 1104, which is identical with the selection formula of variety Burley 1000. It has a typical habit hybrids with powerful growth. It develops the largest leaves and has the highest thickness of the stalk of all tested lines and varieties. The length of the vegetation period it is in accordance with all remaining lines and varieties tested, except for variety Burley 1344. The seedlings sprout first, but it is difficult to grow in this phase. The studies performed in TTPI show that this line is

resistant to PVY and TMV and moderately resistant to *Alternaria* (Yonchev et al., 2011). The line is less susceptible to stolbur and TSWV. The leaves are elliptical, slightly wavy with a smooth surface, symmetrical and rounded tip. The raceme is like an umbrella, the corolla color is dark pink to red. The line is not hygrophyte but withstands prolonged drought. The line is well aligned vegetatively and morphologically. Due to the large stalk it is harder to dry and not fully adapted for harvesting and curing as a whole plant.

RESULTS AND DISCUSSION

The results of the biometric measurements showed that all tested variants provide the optimal plant height for Burley tobacco. Line 1334 has almost identical values with those of the variety Burley 1317 (Table 1). These two variants are distinguished by the height of plants (167.3 cm and 168.7 cm). Regarding the number of leaves, Line 1334 has the most favorable values (31.5 leaves).

This line greatly surpasses this important indicator compared to other varieties, while it has the lowest values of variational coefficient VC% (8.8 %). The difference from the next in the ranking by the number of leaves - variety Burley 1317 is 4 leaves. The lowest results were recorded in the standard variety Burley 21.

Table 1. Average biometric data of the investigated varieties and lines over the period of study – plant height and leaf number

| VARIETY/ LINE | Plant height $\bar{x} \pm s\bar{x}$ | VC % | Leaf number $\bar{x} \pm s\bar{x}$ | VC % |
|------------------|--|------|---------------------------------------|------|
| Burley 21 | 160,6± 0,44 | 10,8 | 25,2 ± 0,34 | 13,1 |
| Burley 1317 | 167,3 ± 0,63 | 9,7 | 26,8 ± 0,28 | 11,4 |
| Line 1104 | 156,8 ± 0,41 | 6,8 | 26,3 ± 0,24 | 9,5 |
| Tennessee 86 | 165,5 ± 0,47 | 10,2 | 25,8 ± 0,41 | 12,9 |
| Line 1334 | 168,7 ± 0,43 | 6,9 | 31,5± 0,22 | 8,8 |

The data on leaf size in lower harvesting belt of Line 1334 are favorable compared to other variants (Table 2). Regarding the leaf length (62.4 cm), it seriously outperforms other varieties and lines included in the experiment. With respect to leaf width,

it also achieved the highest levels and is slightly superior to variety Tennessee 86 (32.4 cm). The lowest values for this trait were recorded in variety Burley 21 (29.3 cm).

Table 2. Average biometric data of the investigated varieties and lines over the period of study – size of the leaves from the lower harvesting belt

| VARIETY/ LINE | Length | | Width | |
|------------------|------------------------|------|------------------------|------|
| | $\bar{x} \pm s\bar{x}$ | VC % | $\bar{x} \pm s\bar{x}$ | VC % |
| Burley 21 | 58,5±0,28 | 18,6 | 29,3± 0,21 | 17,1 |
| Burley 1317 | 60,4±0,25 | 17,9 | 30,0 ± 0,29 | 17,3 |
| Line 1104 | 59,2±0,21 | 14,4 | 31,6 ± 0,18 | 14,8 |
| Tennessee 86 | 60,7±0,40 | 18,1 | 32,2 ± 0,34 | 17,7 |
| Line 1334 | 62,4±0,23 | 13,7 | 32,4 ± 0,12 | 14,0 |

The results for the size of the mid harvesting belt of Line 1334, which is most important for Burley tobacco, are also the most favourable (Table 3). It greatly exceeds the results obtained in other variants both in terms of leaf length and width (64.7 cm and 34.5 cm, respectively). In this case, however,

the difference from the other varieties and lines is even more pronounced. Again, the lowest values were recorded in the standard variety Burley 21 (60,5 cm length and 30,4 width).

Table 3. Average biometric data of the investigated varieties and lines over the period of study – size of the middle belt leaf

| VARIETY/ LINE | Length | | Width | |
|------------------|------------------------|------|------------------------|------|
| | $\bar{x} \pm s\bar{x}$ | VC % | $\bar{x} \pm s\bar{x}$ | VC % |
| Burley 21 | 60,5±0,34 | 18,4 | 30,4 ± 0,19 | 17,1 |
| Burley 1317 | 61,6±0,38 | 17,9 | 31,6 ± 0,22 | 16,7 |
| Line 1104 | 60,7±0,20 | 14,7 | 32,6 ± 0,22 | 13,2 |
| Tennessee 86 | 60,6±0,42 | 18,6 | 32,4 ± 0,39 | 18,7 |
| Line1334 | 64,7±0,22 | 13,8 | 34,5 ± 0,15 | 12,5 |

With respect to leaf size of the upper harvesting belt (length and width), the results obtained for Line 1334 are in accordance with those for the middle belt (Table 4) and are again the most favourable, exceeding other variants with a pronounced difference (54,5 cm length and 25,4 cm width). In this

harvesting belt, only the results of this line may be considered favorable. In Line 1334 no small leaves were observed in the upper belt, which is the case with other variants and which presents a big problem in the selection of Burley tobacco.

Table 4. Average biometric data of the investigated varieties and lines over the period of study – size of the leaves from the upper harvesting belt

| VARIETY/ LINE | Length | | Width | |
|------------------|------------------------|------|------------------------|------|
| | $\bar{x} \pm s\bar{x}$ | VC % | $\bar{x} \pm s\bar{x}$ | VC % |
| Burley 21 | 50,6±0,43 | 15,1 | 20,2 ± 0,34 | 14,0 |
| Burley 1317 | 52,1±0,37 | 14,4 | 20,4 ± 0,37 | 13,3 |
| Line 1104 | 50,5±0,34 | 11,9 | 22,3 ± 0,31 | 10,7 |
| Tennessee 86 | 51,4±0,47 | 14,8 | 22,7 ± 0,40 | 14,5 |
| Line 1334 | 54,5±0,51 | 11,5 | 25,4 ± 0,43 | 10,5 |

In all three belts, the coefficient VC% of Line 1334 for leaf length and width is lower (11,5 % and 10,5 %), which is a great advantage for the breeder.

All biometric identifiers of Line 1334 have the most favourable values, which is also optimal according to the standard requirements of Burley tobacco.

Length of the vegetative period

Regarding the length of the vegetative period, Line 1334 outperforms other variants both in seedling stage and in the field (Table 5). This line has 9 days shorter vegetation in field than the standard Burley 21. The data for this line are superior to the

results obtained for parental varieties. It is formed as a variety with the shortest period of vegetation, which is its major advantage, and its variation coefficient VC% is 1,8% in seedlings and 4,9% in field.

Table 5. Data on the average length of the vegetative period in the seedling phase and in the field for the period of study (in days)

| VARIETY/ LINE | Length of the vegetative period - seedlings | | Length of the vegetative period – field | |
|------------------|--|------|--|------|
| | $\bar{x} \pm s\bar{x}$ | VC % | $\bar{x} \pm s\bar{x}$ | VC % |
| Burley 21 | 71,7±0,36 | 2,5 | 82,0 ± 0,40 | 8,8 |
| Burley 1317 | 66,3±0,28 | 1,8 | 75,5 ± 0,32 | 6,3 |
| Line 1104 | 69,5±0,31 | 2,0 | 79,7± 0,29 | 5,1 |
| Tennessee 86 | 72,3±0,34 | 2,6 | 81,5 ± 0,37 | 9,3 |
| Line1334 | 65,0±0,22 | 1,8 | 73,0 ±0,26 | 4,9 |

Yield and percentage of classes

In the period of research, Line 1334 gave the highest average yield - 3345 kg/ha (Table 6 and 7). These results are highly superior to those of the next ranking - variety Burley 1317. The yield of Line 1334 exceeded that of the standard variety Burley 21 by over 20%. This line is characterized by a high yield, as evidenced in our other research (Dyulgierski, 2011). The lowest yield was recorded in its parent component, variety Tennessee 86.

In terms of percentage of high classes, data obtained for Line 1334 and variety Burley 1317 are almost equal (Table 7). These two variants gave the most favorable results with regard to this indicator. They achieved

the same percentage of first-class (42%), but Line 1334 gave higher percentage of the second class (50%) and lower percentage of the third class (8%). It gave the lowest percentage of third class compared to all investigated variants. Only in this line, the percentage of third class was below 10%. Low quality was recorded in variety Tennessee 86. The standard variety Burley 21 also gave unsatisfactory results.

Although the highest in terms of percentage of high classes, the results obtained in Line 1334 should be considered satisfactory. It provides a high rate of the second class, although less than that of the first class. It should be considered its weakness.

Table 6. Analysis of variance for cured tobacco yield

| Source of Variation | Sum of Square | DF | Mean Square | Sig of F |
|---------------------|---------------|----|-------------|----------|
| Variants | 15688,700 | 4 | 3922,175 | 2082,571 |
| Years | 28,250 | 15 | 1,883 | ,386 |
| 2- way interactions | 15716,950 | 19 | 3924,058 | |

Table 7. Average yield and percentage of high classes of Burley tobacco varieties and lines included in the trial for the period of study

| VARIETY/ LINE | Yield kg/ha | Percentage of classes | | |
|-------------------|-------------------|-----------------------|----|-----|
| | | I | II | III |
| Burley 21 | 2673 ^d | 33 | 46 | 21 |
| Burley 1317 | 3117 ^b | 42 | 47 | 11 |
| Line 1104 | 3032 ^c | 40 | 46 | 14 |
| Tennessee 86 | 2610 ^e | 25 | 52 | 23 |
| Line 1334 | 3345 ^a | 42 | 50 | 8 |
| LSD _{5%} | 46,4 | | | |

Chemical composition

The results for chemical composition showed that Line 1334 significantly exceeds the other variants in all six investigated indicators (Table 8). Only in this line the content of nicotine and total nitrogen was lower than 3%. The results obtained for sugar content (1,21%) can also be considered as

very favorable. This trait can be defined as satisfactory in the variety Burley 21.

The laboratory tests show that only line 1334 has a balanced chemical composition typical for Burley tobacco, which is another significant advantage of this line.

Table 8. Chemical characteristics of Burley tobacco varieties and lines included in the trial

| VARIETY/ LINE | Nicotine % | Sugars % | Total nitrogen % | Ashes % | Ammonia% | Proteins % |
|------------------|---------------|-------------|---------------------|---------|----------|---------------|
| Burley 21 | 2,66 | 0,85 | 2,84 | 17,40 | 0,32 | 10,8 |
| Burley 1317 | 2,59 | 1,04 | 2,65 | 16,73 | 0,33 | 8,6 |
| Line 1104 | 1,91 | 1,13 | 2,17 | 15,81 | 0,34 | 7,7 |
| Tennessee 86 | 1,86 | 1,21 | 2,32 | 16,46 | 0,34 | 13,7 |
| Line 1334 | 3,18 | 0,52 | 3,29 | 18,85 | 0,31 | 10,2 |

Technological parameters

In general, all physical and technological parameters of investigated variants conform to the standards of Burley tobacco (Table 9). Line 1334, however, has the lowest percentage of stalk, the lowest leaf density

and, especially, the highest utilization in cigarettes. Only in Line 1334, the number of cigarettes obtained from 1 kg of tobacco exceeds 1785.

Table 9. Physical and technological parameters of varieties and lines Burley tobacco included in the trial

| Variety/ Line | Leaf number/ kg. tobacco | Midrib% | Length cm | Width cm | Weight unit leaf area g/cm ² | Density of tobacco leaves g/cm ³ | Density of cut tobacco g/cm ³ | Conditional yield Number of cigarettes / kg tobacco |
|------------------|-----------------------------|---------|--------------|-------------|---|--|---|---|
| B 21 | 167 | 28,6 | 48,5 | 19,7 | 0,0051 | 0,426 | 0,178 | 1656 |
| B 1317 | 165 | 28,8 | 49,2 | 20,9 | 0,0054 | 0,423 | 0,173 | 1633 |
| L 1104 | 169 | 29,7 | 48,9 | 21,8 | 0,0055 | 0,438 | 0,181 | 1585 |
| Tenn. 86 | 172 | 30,1 | 45,9 | 23,3 | 0,0058 | 0,449 | 0,186 | 1511 |
| L 1334 | 154 | 26,3 | 53,3 | 22,8 | 0,0043 | 0,0402 | 0,168 | 1785 |

CONCLUSION

Line 1334 has the most favorable values for all biometric identifiers, which is optimal according to the standard requirements for Burley tobacco. This variant has the shortest vegetative period, which is its big advantage.

Average data for the period of investigation show that Line 1334 gives the highest yield per hectare and can be considered as a high-yielding variety.

Line 1334 yields the highest percentage of first class (42%) and the lowest percentage of third class (8%) compared to all other variants investigated.

Only Line 1334 has a balanced chemical composition in accordance with requirements of Burley tobacco. It is a variant with the most favorable technological parameters. Also, only in Line 1334, the number of cigarettes obtained from 1 kg of tobacco exceeds 1785.

Line 1334 considerably outperforms the standard variety Burley 21 and the control variety Burley 1317 in all investigated parameters. It has many advantages and can be offered for testing and recognition as a new variety of Burley tobacco.

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