



Stability of the yield in commercial tobacco varieties in Republic of Macedonia

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Abstract

Investigations were carried out with five commercial oriental aromatic tobacco varieties of the type Prilep: P – 23, PV 156/1, NS – 72, P – 66 – 9/7 and P – 79 – 94, to study green mass yield per stalk. The trial was set up in the Experimental field of Tobacco Institute – Prilep in 2010, 2011 and 2012, in randomized block design with four replications. Traditional agricultural practices were applied for realization of the experiment.

The aim of investigations was through biometric analysis of the above quantitative trait to evaluate the variability of the commercial varieties, and thus give an assessment of their stability and guidance for their further expansion and maintenance. No significant differences were observed between the three years of investigation, which is an indication that green mass yield per stalk is highly heritable traits and varietal characteristic. Statistical parameters of variability are low, which is an indication of stable and homozygous genotypes, adapted to agro-ecological conditions of the region. Results on the standard deviation and variability coefficient were lower in 2012, because the seed sown in this crop was obtained from one stalk for each variant isolated in 2010 and again from one stalk isolated in 2011. Varieties PV 156/1 and NS – 72 have approximately the same average value for the trait, but the statistical indicators of the variability is lower in PV 156/1. From the dates it is concluded that the investigated varieties are stable and the most stable is P – 66 – 9/7, which is also with the highest yield. The findings of this paper imply a basis for further research in different locations and different application of statistical models for assessing interactions GxL (genotype x location) and GxY (genotype x year), which would have completed the image about stability of commercial varieties in Republic of Macedonia.

Keywords: tobacco (*Nicotiana tabacum L.*), yield, standard deviation, variability coefficient.

Introduction

Macedonia is a known producer of high quality aromatic oriental tobacco, mostly for export. The raw material of this type participates in blends of the highest quality brands of cigarettes in the world. Production of dry tobacco during this last year was over 20 000 tons, with a tendency to rise to 30 000 tons or more. The most common types are: Prilep, Yaka, Djebel and Basmak, but type Prilep dominates with about 70%.

There is great interest among the selectionists for the stability of varieties, as well as their power to adapt to different locations to provide optimum yield (Gornik R., 1973; Borojević S., 1981). Research in this direction is primarily related to the calculation of parameters of variability, and then to interactions GxL (genotype x

location) and GxY (genotype x year), as well as selection of multivariational statistical methods and models such as: AMMI model- Additive Main Effects and Multiplicative Interaction (Tadeu dos Santos Dias, C., Krzanowski W.J., 2006), SREG model - Sites Regression Analysis (Cossa J. et al., 2002), SHMM model - Shifted Multiplicative Model (Cossa J. et al., 1993) etc.

The aim of this paper is through biometric analysis of the green mass yield to evaluate the stability of commercial varieties of Prilep tobacco in Republic of Macedonia. Obtained information will open a field for further study on the trials placed in different locations, which will gives a complete picture of their stability in different agro-ecological conditions.

Materials and Methods

Investigations included studies of five oriental aromatic commercial tobacco varieties of the type Prilep: P – 23, PV 156/1, NS – 72, P – 66 – 9/7 and P – 79 – 94. The trial was carried out in 2010, 2011 and 2012 in the field of Tobacco Institute – Prilep in diluvial (coluvial) soil, in a randomized block design with four replications. During the vegetation period, traditional agro-technical practices were applied on tobacco.

In the period of tobacco vegetation in field (May - September) in 2010, mean monthly temperature was 18,9 °C, number of rainy days was 35 and total precipitation amount was 298 mm. In the same period in 2011, mean monthly temperature was 19,04 °C, number of rainy days was 32 and total precipitation amount was 180 mm. In the same period in 2012, mean monthly temperature was 20,3 °C, number of rainy days 26 and total precipitation amount 186 mm.

Subject of the investigations was the quantitative trait green mass yield per stalk.

Standard deviation (σ) is an indicator of the variability of quantitative traits. It indicates the mean square deviation from the arithmetic mean and is a result obtained from the square root of the variance. It is calculated by the following formula:

$$\sigma = \pm \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$$

If the representative sample consists of lower number of individuals, the following formula is used:

$$\sigma = \pm \sqrt{\frac{\sum(x - \bar{x})^2}{n-1}}$$

Standard deviation is expressed with the same measurement with which the investigated trait was measured.

The degree of variability of characters is calculated from the standard deviation by the following formula:

$$V (\%) = \frac{\sigma \cdot 100}{\bar{x}}$$

The above formulas for calculation of standard deviation and variability coefficient were used by Najceska (2002).

General characteristics of the commercial tobacco varieties

Cultivation of sun-cured tobacco varieties in this region have started long ago, in the time of Ottoman Empire. With centuries they have adapted to the local agro – ecological conditions, acquired

resistance to drought and to many diseases, and now they present good basis for breeding creativity. Today there are a number of varieties superior to the old one, but the most dominant are those from the type Prilep.

Prilep P – 23 – created by Kostadin Nikoloski and Milan Mitreski, through hybridization and selection in Tobacco Institute – Prilep; recognized by the Ministry of Agriculture, Forestry and Water Management of the Republic of Macedonia in 1995 (Korubin – Aleksoska A., 2004). It has elliptical – conical habitus, with 50 – 55 leaves densely arranged on stem (Figure 1).



Figure 1. Prilep P – 23

Prilep PV 156/1 – created by Milan Uzunovski, through hybridization and selection; recognized in 1984 in former Yugoslavia, as one of the first varieties of the type Prilep obtained by crossing; characterized by cylindrical – elliptical habitus with approximately 45 – 50 sessile leaves, elliptical in shape (Figure 2)



Figure 2. Prilep PV 156/1

Prilep NS – 72 – created by Dushko Boceski and Simeon Karayankov; recognized in 1984 in former Yugoslavia as one of the first varieties of the type Prilep obtained by crossing (Korubin – Aleksoska A. et al., 2012); characterized by cylindrical – elliptical habitus with approximately 50 sessile leaves, elliptical in shape (Figure 3).



Figure 3. Prilep NS – 72

Prilep P – 66 – 9/7 – created in Tobacco Institute – Prilep by Miroslav Dimitrieski and Gordana Miceska; recognized by the Ministry of Agriculture, Forestry and Water Management of R. Macedonia in 2004 (Korubin – Aleksoska A. et al., 2012); characterized by elliptical – conical habitus,

with 54 – 60 ovate leaves, sessile and evenly distributed on the stem. It has been the most represented tobacco variety in our country in recent years (Figure 4).



Figure 4. Prilep P – 66 – 9/7

Prilep P – 79 – 94 – created in Tobacco Institute – Prilep by Milan Bogdanceski; recognized by the Ministry of Agriculture, Forestry and Water Management of R. Macedonia in 2001 (Korubin – Aleksoska A., 2004); characterized by cylindrical – elliptical habitus with 56 – 60 sessile leaves densely distributed, especially in the upper part of stem (Figure 5).

Results

The three-year biometric investigations of the commercial tobacco varieties in Republic of Macedonia for the quantitative trait green mass yield per stalk showed low standard deviation and low degree of variability, which is an indication of stability and uniformity as a result of their homozygotness. The lowest values were recorded in P – 66 – 9/7 (134,76 g/stalk – 2010, 133,59 g/stalk – 2011 and 133 g/stalk – 2012) and P – 79 – 94 (95,01 g/stalk – 2010, 94,17 g/stalk – 2011 and 95,03 g/stalk – 2012), (Table 1).

Data presented in the table show that mean values of the investigated trait with their statistical errors in 2010 were approximately the same with those of 2011 and 2012. Variability parameters are almost identical in the three investigating years. Meteorological reports reveal that 2010 is characterized by more rain than the other two years of research. 2011 and 2012 were very similar in relation to their mean monthly temperatures and precipitation amounts from May to September. This

points out to precise estimations and good performance of the trial.

Korubin – Aleksoska et al. (2012). In two years of research (2009 and 2010), for dry mass yield in the varieties Prilep and Basmak, for commercial varieties of type Prilep received the following information: P – 23 – $\bar{x} = 18,07$ g/stalk, $\bar{x} = 2717$ kg/ha; NS – 72 – $\bar{x} = 17$ g/stalk, $\bar{x} = 2569$ kg/ha; P – 66 – 9/7 – $\bar{x} = 21,88$ g/stalk, $\bar{x} = 3297,45$ kg/ha; and P – 79 – 94 – $\bar{x} = 16,94$ g/stalk, $\bar{x} = 2548,2$ kg/ha. The three – year average values for green mass yield presented in this paper are the following: P – 23 – $\bar{x} = 93,95$ g/stalk; NS – 72 – $\bar{x} = 107,25$ g/stalk; P – 66 – 9/7 – $\bar{x} = 133,78$ g/stalk; and P – 79 – 94 – $\bar{x} = 94,73$ g/stalk.



Figure 5. Prilep P – 79 – 94

Table 1. Mean value and variability of the green mass yield per stalk in commercial tobacco varieties from Republic of Macedonia

Tobacco varieties	Green mass yield per stalk (g)									
	2010			2011			2012			
	$\bar{x} \pm s_x$	δ	V (%)	$\bar{x} \pm s_x$	δ	V (%)	$\bar{x} \pm s_x$	δ	V (%)	
P-23	$93,13 \pm 1,42$	6,37	6,84	$92,57 \pm 1,32$	5,90	6,37	$96,15 \pm 0,96$	4,30	4,47	
PV 156/1	$106,91 \pm 0,79$	3,53	3,30	$107,40 \pm 0,76$	3,39	3,16	$108,61 \pm 0,53$	2,38	2,19	
NS-72	$106,97 \pm 1,22$	5,45	5,09	$106,17 \pm 1,12$	5,03	4,74	$108,62 \pm 0,91$	4,09	3,76	
P-66-9/7	$134,76 \pm 0,62$	2,78	2,07	$133,59 \pm 0,44$	1,96	1,47	$133,00 \pm 0,33$	1,49	1,11	
P-79-94	$95,01 \pm 0,61$	2,74	2,89	$94,17 \pm 0,56$	2,49	2,64	$95,03 \pm 0,34$	1,53	1,61	

Taking into account the data on the ratio of dry : green mass which is 1 : 5 – 6, then we can conclude that the resulting yield of dry weight in 2009 and 2010 corresponds to the yield of green mass in 2010, 2011 and 2012. This data confirms the high stability of the commercial varieties in the country.

Conclusion

The commercial oriental aromatic tobacco varieties: P – 23, PV 156/1, NS – 72, P – 66 – 9/7 and P – 79 – 94 are characterized with:

Homozygosity, for which their population is with high genetic stability. Low standard deviation and variability of the investigated characters, which indicates high phenotypic and genotypic uniformity.

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