AGRONOMSKI GLASNIK 2-3/2016.
ISSN 0002-1954

Original scientific paper
Izvorni znanstveni članak

MAJOR TECHNOLOGICAL PROPERTIES OF SOME ORIENTAL VARIETIES OF YAKA TOBACCO

VAŽNIJA TEHNOLOŠKA SVOJSTVA DUHANA NEKIH ORIJENTALNIH SORTI TIPA "JAKA"

J. Trajkoski, M. Mitreski, Valentina Pelivanoska, R. Mavroski, M. Trajkoski

ABSTRACT

Technological properties are a number of properties divided into three groups: physical, morphological and organoleptic. Knowledge and determination of these properties is very important because in practice, they help in the evaluation of raw tobacco leaf.

The purpose of this study was to examine the important technological properties: representation of the midrib in the leaves, the thickness of tobacco leaves and materiality, and by them to show the technological and commercial quality of the tested varieties.

Investigations were carried out in the Scientific Tobacco Institute - Prilep. The trial was set up by the method of randomized blocks with four replications. Three varieties of Yaka tobacco were examined: Yaka YV 125/3 Ø (control), Yaka YZ - 7 and Yaka YK- 48.

The results obtained in the accredited Laboratory for control of authenticity and quality of raw tobacco - L04 in Scientific Tobacco Institute - Prilep, showed that percentage representation of midrib was within the boundaries of the quality of raw tobacco or 16.05% in variety JZ - 7 to 18.25% in JK – 48. Materiality is from 44.92 g/m^2 (YV 125/3), to 48.90 g/m^2 (YZ - 7).

The obtained results show that the investigated Yaka tobacco varieties have good technological properties and high technological and commercial quality.

Keywords**:** technological properties, Yaka varieties, technological and commercial quality

SAŽETAK

Tehnološka svojstva duhana podijeljena su u 3 skupine: fizičke, morfološke i organoleptičke. Poznavanje i određivanje ovih svojstava od velikog je značenja jer se u praksi pomoću njih procjenjuje sirovi duhan.

Cilj ovih istraživanja bio je utjecaj tehnoloških karakteristika: zastupljenost glavnog rebra, debljina listova i prinos na tehnološko-komercijalnu kvalitetu ispitivanih sorti.

Ispitivanja su izvršena na pokusnom polju Znanstvenog duhanskog instituta - Prilep. Pokus je postavljen u 4 ponavljanja po metodi randomiziranih blokova. Ispitane su 3 sorte duhana Jaka: JV 125/3 (kontrola), JZ-7 i JK-48.

Rezultati dobiveni u laboratoriju za ispitivanje kvalitete i autentičnosti duhanske sirovine L04 Znanstvenog instituta duhana - Prilep pokazali su da je udio zastupljenosti glavnog rebra kod ispitivanih sorti u granicama kvalitete duhanske sirovine od 16,05% kod sorte JZ-7, do 18,25% kod sorte JK-48, a masa od 44,92 g/m^2 (JV 125/3) do 48.90 g/m^2 (JZ-7).

Dobiveni rezultati pokazuju da sorte duhana Jaka imaju vrlo dobra tehnološka svojstva, odnosno imaju visoku tehnološko-komercijalnu kvalitetu.

Ključne riječi: tehnološka svojstva, tip "Jaka", tehnološko-komercijalna kvaliteta

INTRODUCTION

Tobacco production has a long tradition in the Republic of Macedonia. In recent years it has been cultivated on over 19 000 ha, which represents 3.5% of the total arable land, and the production of raw tobacco ranges from 22 to 27000 tons, with a tendency to rise.The value of raw tobacco is determined by specific characteristics which depend on the condition of vegetation and after-harvest processing.

Boceski (2003.) divided these characteristics into two groups: technological and biochemical. Technological characteristics include a large number of properties of physical, morphological and organoleptic character.

Our tobacco is mainly intended for export, given the fact that the high quality raw tobacco is always appreciated and demanded by the world market and achieves a good price. Bearing this in mind, it is very important to determine the technological properties of leaves, because in practice they serve as tools for assessment of tobacco quality.

According to Uzunoski (1985.) thickness of tobacco leaf is inversely proportional to tobacco quality. Higher thickness denotes lower tobacco quality (except for tobaccos whose thin leaf tissue is due either to immaturity or to overmaturation). According to the leaf thickness, tobacco is divided into three groups:

- thin, malnourished leaves
- leaves with highsubstantiality
- bulky and woody leaves.

The thickness normally increases from the lower to the upper insertions and from younger to older parts of the leaf, i.e. from the base to the top and from the middle to leaf margins. Leaf thickness in Prilep tobacco is 110.4 μm, in Yaka 86.3 μm and in Otlja 105 μm.The aim of our investigation was to study the midrib content, substantiality and thickness of tobacco leaf – important traits that determine the quality of raw tobacco.

MATERIAL AND METHODS

Three varieties of Yaka tobacco (YV 125/3 Ø, YZ - 7 and YK – 48) were included in the trial set up at the Experimental field of the Scientific Tobacco Institute - Prilep in 2013, on deluvial-colluvial soil. The plot was adequately prepared with one autumn and three spring ploughings. Fertilization was performed during the second spring ploughing with a complex mineral fertilizer (300 kg/ha NPK 10:30:20). During the growing season of tobacco in the field, all necessary agro-technical measures were applied for normal growth and development of plants. In July and August tobacco was irrigated once by wing sprinklers with 25 l/m^2. After harvest, tobacco was stringed manually and sun-cured in the traditional way.The trial was set up in randomized blocks with four replications. Analyses on midrib content, substantiality and thickness of cured tobacco leaves were performed in the accredited laboratory L04 of Tobacco Institute - Prilep according to standard and recognized methods.

CLIMATE CONDITIONS

Temperature is one of the environmental factors which highly effects the growth and development of tobacco plant. The basic physiological processes in tobacco plant can take place only within certain temperature limits. As a sub-tropical plant, tobacco requires relatively high temperatures during all stages of its development.

Tobacco seed can germinate even at 6 to 7 ^{o}C, but in that case germination is slow and lasts very long, so it is considered that the lowest temperature needed for tobacco germination is 12 - 13 ^{o}C.

Uzunoski (1985.) reported that the optimum temperature for normal growth of tobacco plant was 20 - 30 ° C and the maximum 40 - 50 °C. According to Bailov (1965.), the optimum temperature range is 20-23 °C, while according to Atanasov (1972.) the limit values are below 18 °C and over 30 °C.

Buchinski (quot. by Donev, 1974.), reported that high quality tobacco could be obtained at a temperature above 25 °C.

The following meteorological factors were recorded in our investigations during tobacco growing season (May - September): mean monthly air temperature, mean monthly relative air humidity, monthly precipitation, total precipitation and total number of rainy days (Table 1).

Table 1. Meteorological data for 2013

Tablica 1. Meteorološki podatci u 2013

Meteorological factors	Decade	Months					$\bar{X}$ / Σ
		May	June	July	August	September	
Mean decade air temperature ^{o}C	I	17,4	16,0	20,3	24,6	20,0	
	II	16,2	20,6	20,9	23,3	15,6	
	III	15,7	20,4	23,9	20,9	15,5	
Mean monthly air temperature ^{o}C		**16,4**	**19,0**	**21,7**	**22,9**	**17,0**	**19,4**
Mean monthly maximum air temperature ^{o}C		**24,9**	**27,6**	**30,3**	**32,2**	**26,4**	**28,3**
Mean monthly minimum air temperature ^{o}C		**9,8**	**12,2**	**13,5**	**14,2**	**8,8**	**11,7**
Mean monthly relative air humidity %		**54**	**54**	**49**	**48**	**54**	**52**
Rainfall mm	I	33,0	24,0	11,0	---	---	
	II	11,0	11,0	---	1,0	21,0	
	III	3,0	16,0	---	8,0	14,0	
Total precipitation mm		**47,0**	**51,0**	**11,0**	**9,0**	**35,0**	**153**
Rainy days	I	5	3	3	---	---	
	II	3	3	---	1	7	
	III	3	3	---	2	1	
Total number of rainy days		**11**	**9**	**3**	**3**	**8**	**34**

According to the data presented in Table 1, the average temperature during the growing season was below the optimum for normal development and growth of tobacco. This average, however, includes the months in the beginning of the growing season, when tobacco is still in the stage of root formation and temperatures are relatively low (below 19 ^{o}C), but it has no negative impact on the growth process and meets all the requirements of young tobacco plant. In July and August the average temperature gradually increased to 21.7 °C and 22.9 °C respectively, and in September it decreased again to 17.0 °C. It can be concluded that the average air temperature by months during 2013 was favorable for obtaining a good-quality raw tobacco.

In the first two months of the growing season (May and June), the relative air humidity was slightly higher (54%), while in August it had the lowest rate (48%).

Precipitation is another meteorological factor, besides temperature, which has the most important role in tobacco production. With sufficient amounts of heat, light, nutrients etc., tobacco growth and development depends on the supply of water, both in terms of total amount of precipitation and its distribution during the growing season.

Atanasov (1972.) found that the optimum amount of rain for a good-quality tobacco is 120-150 mm.

According to the data presented in Table 1, total rainfall of 153 mm was measured during the growing season, with the minimum achieved in August (only 9.0 mm) and the maximum in June (51.0 mm). Although the average values satisfied the water needs of tobacco, it is important to emphasize that distribution of precipitation during this period was unfavorable due to which it was necessary to apply additional watering of tobacco.

SOIL CONDITIONS

Production of high quality tobacco is closely related to the soil type. Soil with its mechanical composition and nutrients content is a medium in which tobacco plants grow, develop and reach their genetic potential.

The trials were performed on diluvial–colluvial, the most represented soil type in the region of Prilep, characterized by the following stratigraphic profile:

I 10-30 cm: humus-accumulative topsoil horizon, yellowish brown, mechanical composition: sandy loam, non-carbonate, presence of roots throughout the soil depth, non-structural;

II 30-75 cm: reddish brown; sandy clay loam, compact, non-carbonate; presence of skeleton particles.

III 57-83 cm: yellowish brown, sandy loam, non-carbonate.

IV 83-100 cm: yellowish brown color, sandy clay loam, non-carbonate, very rich in skeleton particles.

V>100 cm: yellowish brown, non-carbonate soil, presence of skeleton.

Agrochemical characteristics of the soil on which the trial was conducted are presented in Table 2.

Table 2. Agrochemical characteristics of the soil

Tablica 2. Agrokemijske karakteristike zemljišta

Horizon	Depth (cm)	Humus (%)	$CaCO_3$ (%)	pH		Available nutrients mg/100 g		N (%)	C/N
				H_2O	KCl	P_2O_5	K_2O		
I	0 - 30	0,53	-	6,00	4,96	7,25	13,3	0,055	5,59
II	30 - 57	0,43	-	5,94	4,78	1,75	19,2	0,055	4,53
III	57 - 83	0,39	-	6,15	4,95	1,9	18,5	0,055	4,11
IV	83 - 100	0,26	-	6,29	5,05	1,25	13,3	0,049	3,08
V	> 100	0,24	-	6,70	6,01	2,00	9,3	0,046	3,03

Data presented in Table 2 show that the soil on which the trial was conducted is characterized by a very low organic matter content , low total nitrogen, moderately acidic, slightly acidic to neutral pH of the soil solution, low to extremely low supply of P_2O_5 and medium to good supply of physiologically active K_2O.

RESULTS AND DISCUSSION

The quality of raw tobacco is determined by several external indicators. Technological properties, as one of these indicators, complete the picture of raw tobacco quality. The study of these properties is of particular importance because they primarily determine the so-called technological and commercial quality (Uzunoski 1985.).

Boceski (2003.), cited by Mitreski (2012.), divided the technological properties into 3 groups:

- morphological (insertion, leaf vein system, leaf size and shape);
- physical (substantiality, leaf thickness, volumetric weight, elasticity and water retention capacity);
- organoleptic (leaf color, subtleness and aroma).

Results of our investigations on technological properties are presented in Table 3.

Table 3. Technological properties of tobacco leaf (average values)

Tablica 3. Tehnloška svojstva duhanskih listova (prosječne vrijednosti)

No.	Yaka tobacco varieties	Midrib content (%)	Leaf lamina content (%)	Thickness (µm)	Substantiality (g/m^2)
1.	YB 125/3 Ø	17.41	82.59	93.00	44.92
2.	YZ - 7	16.05	83.95	81.00	48.90
3.	YK - 48	18.25	81.75	70.50	40.37

Midrib content

The midrib content denotes the density of leaf tissue on one side and thickness of the leaf on the other. It is considered that leaf thickness has negative effects on tobacco fabrication. The midrib content is a distinction of the type and variety and it differs from tobacco to tobacco.

Compared to leaf parenchyma, the midrib contains lower amount of total nitrogen, proteins, nicotine and soluble sugars and higher content of woody material (cellulose), mineral matters, chlorine, calcium and especially oxalic acid, which gives a bitter taste to cigarettes.

Patce and Uzunovski (1969.) studied the vein system of Yaka tobacco and reported that the midrib content was relatively low, accounting for 18.79% of the total leaf weight in the middle leaves and 15.46% in the upper leaves.

In our investigations (Table 1), the highest percentage of midrib was recorded in the variety YK - 48 (18.25%) and the lowest in YZ - 7 (16.05%).

Leaf thickness

Leaf thickness is the essential component for determining the compactness of leaf tissue. As a physical indication of tobacco quality, it reflects the anatomic structure of the leaf, which depends on the size of parenchyma, intracellular spaces, the epidermis and the cuticle. Leaf thickness is a distinctive feature of the type and variety, but because of its high variability due to climate and soil conditions, applied cultural practices, insertion, degree of maturity etc., some authors believe that it is not a specific characteristic of the type. It is considered that thick leaves have a lower quality and vice versa - thinner leaves have a better quality, except when thin leaves are a result of nutrient deficiency.

Patce and Georgievski (1987.), reported that leaf thickness was a negative phenomenon and that it could range from 50 to 150 μm. According to the same authors (cit.by Tomic and Demin), the average leaf thickness of Yaka tobacco is 92 μm.

Nuneski R. (2008.), in his comparative investigations on some technological properties of oriental tobaccos Izmir-Basma, Prilep P-23 and Yaka YV 125/3 reported that leaf thickness ranged from 47.50 μm in variety YV 125/3 and 69.00 μm in P-23 to 77.54 μm in Izmir-Basma variety.

The data in Table 1 show that the highest average leaf thickness was recorded in the check variety YV 125/3 (93.00 μm), while the lowest values were obtained in variety YK - 48 (70,50 μm). According to the results, it can be concluded that all of the investigated varieties gave a good quality raw material.

Substantiality

Tobacco leaf substantiality indicates the amount of dry matter per leaf area. This physical indicator of quality is the most outstanding sign of the inner leaf content and primarily serves for indirect determination of the cigarette utilization.

Substantiality increases from the lower towards the upper insertions, due to the fact that lower insertions have the best conditions for rapid growth and development, their tissue is with larger and emptier.

According to Boceski (2003.), tobacco of higher absolute weight has higher substantiality per unit area. Usually, better quality tobaccos are more substantial, because they have more favorable ratio of chemical components. If the substantiality crosses the border, the favorable chemical ratio is disturbed and has a negative effect on tobacco quality. The absolute weight increases progressively from the lower to the upper insertions and reaches its maximum at the top.

Uzunoski (1985.) reported that Macedonian tobaccos are characterized by moderate substantiality. Accordingly, the substantiality of some Macedonian tobaccos which indicates the highest quality of the middle primings is: 61-67 g/m^2 for the type Prilep, 48-57 g/m^2 for the type Yaka and 56-57 g/m^2 for the type Otlja.

In our comparative investigations of Yaka tobacco (Table 1), the highest substantiality was recorded in the variety YZ - 7 (48.90 g/m^2) and the lowest in the variety YK - 48 (40.37 g/m^2). The average substantiality in the check variety was 44.92%.

CONCLUSIONS

Based on the results of our investigation, the following conclusions can be drawn:

1. The average midrib content ranges from 16.05% in the variety YZ - 7 to 18.25% in YK-48.

2. The thickness of tobacco leaf in the varieties included in the trial ranges within the optimal limits for a good quality raw tobacco. The highest leaf thickness was recorded in the check variety (93.00 μm) and the lowest in the variety YK - 48 (70.50 μm).

3. Leaf substantiality of the investigated varieties also gave satisfactory results, ranging from the lowest 40.37 g/m^2 in the variety YK – 48 to the highest 48,90 g/m^2 in YZ – 7, compared to the check variety with 44.92 g/m^2.

4. From these results we can conclude that all the varieties are characterized by good technological properties and high technological and commercial quality.

REFERENCES

1. Atanasov, D., (1972.): Tobacco production, Plovdiv.
2. Bailov, M., (1965.): Tobacco production and initial processing, Sofia.
3. Boceski, D., (2003.): Knowledge and processing of raw tobacco. Tobacco institute - Prilep, II additional edition.
4. Donev, N., (1974.): Tobacco in Bulgaria, Plovdiv.
5. Mitreski, M., (2012.): Comparative studies of major manufacturing, quality and technological properties of some varieties of type "Prilep", Doctoral dissertation, scientific tobacco institute - Prilep.
6. Nuneski, R., (2008.). Studying the technological properties of raw material from type "Izmir Basma", focusing on quality properties holders quality tobacco blends, Doctoral dissertation, Scientific tobacco institute - Prilep.
7. Patche, L., Georgievski, K., (1987.): Knowledge of raw tobacco, Economic newspaper, Skopje.
8. Uzunoski, M., (1985.): Tobacco production, Economic newspaper, Skopje.

Adresa autora – Author's address:
Jordan Trajkoski, e-mail:trajkoski89@gmail.com
Milan Mitreski,
Valentina Pelivanoska,
Robin Mavroski
Scientific Tobacco Institute - Prilep, Kicevska bb. 7500 Prilep, Macedonia
University of "Sv. Kliment Ohridski" - Bitola, Macedonia

Marjan Trajkoski
SEKE D.O.O.E.L Prilep, Moše Pijade 319, 7500 Prilep, Macedonia

Primljeno- received:
20.06.2016.