

PHYSICAL COMPOSITIONS OF TOBACCO OF THE VARIETY PRILEP 66 9, DEPENDING ON THE MATURITY OF THE TOBACCO LEAVES AT THE TIME OF HARVEST

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ABSTRACT

The physical characteristics of tobacco leaves are the basic indicators that enable the assessment of tobacco quality in practice. They reflect the structure and chemical composition of the leaf and are closely related to the smoking and flavor properties of the tobacco. A field experiment with the oriental tobacco variety Prilep 66-9 was conducted in 2022 at the experimental field of the Scientific Tobacco Institute – Prilep, following standard methodology. Three variants were included in the experiment: tobacco harvested at technological maturity, before technological maturity (green/unripe state), and after technological maturity (overripe state). The main aim of the experiment was to assess the quality of tobacco depending on the time of harvest. Considering their importance in the industrial processing of tobacco, leaf substantiality, thickness and midrib content were analyzed. The results showed significant differences among the investigated maturity stages for all examined physical properties ($p < 0.05$), with the highest leaf thickness and substantiality recorded at technological maturity.

Keywords: oriental tobacco, variety Prilep 66 9, physical characteristics, maturity.

ФИЗИЧКИ СВОЈСТВА НА ТУТУНОТ ОД ТИПОТ ПРИЛЕП П 66 9 ВО ЗАВИСНОСТ ОД БЕРБАТА НА ЛИСТОВИТЕ ВО РАЗЛИЧНА ЗРЕЛОСТ

Физичките карактеристики на листовите од тутун се основниот индикатор што овозможува проценка на квалитетот на тутунот во пракса. Тие ја рефлектираат структурата и хемискиот состав на листот и се тесно поврзани со својствата на пушење и вкус на тутунот. Имајќи ги предвид претходните сознанија на површините од експерименталното поле на Научниот институт за тутун - Прилеп во 2022 година беше поставен опит од типот прилеп П 66 9 по стандардна методологија. Три варијанти беа вклучени во испитувањето - берба на тутунот за време на технолошка зрелост, пред технолошка зрелост (зелена состојба), како и берба на тутунските листови по технолошка зрелост (презреана состојба). Целта на ова испитување беше да се воочи квалитетот на тутунот во зависност од времето на бербата. Имајќи го предвид нивното значење за индустриската преработка на тутунот, беа анализирани материјалноста и дебелината на листот и содржината на главното ребро. Резултатите покажаа статистички значајни разлики меѓу испитуваните степени на зрелост за сите анализирани физички својства ($p < 0,05$), при што највисоки вредности за дебелината и материјалноста на листот беа утврдени во технолошка зрелост.

Клучни зборови: ориентален тутун, сорта Прилеп 66 9, физички својства, зрелост.

INTRODUCTION

The physical characteristics of tobacco leaves are the basic indicators that enable the assessment of tobacco quality in practice. Visible characteristics of tobacco leaves, such as dimensions, form and color, are largely determined by their anatomical structure and chemical composition and are therefore useful indicators of technological and smoking quality. They reflect the structure and chemical composition of the leaf and are closely related to the smoking and flavor properties of the tobacco. So, this is mostly used in determining the tobacco quality, the internal content is determined according to the visible characteristics of the tobacco leaves, and according to that an opinion for the technological and smoking properties of the tobacco is formed. The aim

of this study was to assess the quality of tobacco depending on the time of harvest. Among the most important physical properties in the oriental aromatic tobaccos are: Leaf substantiality measured in g/m^2 , leaf thickness measured in microns and midrib content measured in %. Nuneski (1986) came to the conclusion that Prilep type tobaccos have the best quality when the substantiality of the leaf tissue is between 57.7 and 81.9 g/m^2 . According to Timov et al. (1974) the midrib content in oriental tobaccos is usually between 14 and 18%. Considering their great importance in the industrial processing of tobacco, we decided to analyze the following major physical properties (leaf substantiality, thickness and midrib content) of the standard variety Prilep 66 9.

MATERIAL AND METHODS

The trial was set up in the experimental field of the Scientific Tobacco Institute - Prilep, during the 2022 harvest. Tobacco that was harvested at the stage of technological maturity was used as a standard in the trials. For comparison in terms of quality and quantity, harvests were performed before technological maturity (green/unripe state) and after technological maturity (overripe state). The aim of this study was to assess the quality of tobacco depending on the time of harvest. The seedlings were produced in the usual way in conventionally prepared cold

seedbeds, covered with polyethylene fabric, on an area of 40 m^2 , in the nursery of the Scientific Tobacco Institute - Prilep. The trial was set up in randomized block design, three variants in three replications and transplanting was done manually at 40 cm $\times$ 15 cm spacing (Figure 1). Five laboratory measurements were performed for each field replicate. The mean values were subjected to analysis of variance (ANOVA), and differences among treatments were evaluated using the LSD test at the 0.05 probability level.



Figure 1. Tobacco plantation

The tobacco was harvested by hand at technological maturity stage (standard), before technological maturity stage (green/unripe state) and after technological maturity stage (overripe state) (Figure 2). The tobacco was strung by hand and sun-cured on racks covered with polyethylene

cloth, all placed in one or two rows (Figure 3, Figure 4).

The qualitative assessment of the cured tobacco was carried out according to the Regulations for qualitative and quantitative evaluation of raw tobacco leaf for oriental tobacco types.



Figure 2. Maturity of tobacco leaves at different harvest stages



Figure 3. Cured tobacco leaves harvested at different maturity stages



Figure 4. Tobacco curing

RESULTS AND DISCUSSION

After the manipulation of the raw tobacco leaf, a qualitative assessment was performed according to the Regulations for qualitative and quantitative evaluation of raw tobacco leaf for oriental tobacco types. After that, samples were taken for laboratory testing. The laboratory examination referred to the physical properties of the obtained raw material depending on the time of harvest. The study of the dependence between the quality of tobacco and its physical properties is of particular importance, since they first determine the so-called technological-commercial quality of tobacco leaf (Uzunoski, 1985). Physical properties vary depending on the variety, insertion, agro-ecological conditions and the applied

agronomic measures (Dimitrieski and Miceska, 2009; 2019). In most cases there is a consistent relationship between chemical composition, anatomical structure, numerous external organoleptic properties and physical traits of tobacco leaf, which are widely used in determination of tobacco quality (Timov et al., 1974).

Leaf substantiality as a physical indicator of quality is of particular importance to the fabrication, because it indicates the total dry matter content of the leaf, it depends on the volume weight, which determines how many cigarettes you will get from one kg of tobacco in leaf (Dimitrieski, 1990). Obtained results of the technological examinations are presented in Table 1.

Table 1. Technological properties

Harvest time	Harvest	Components		Thickness, μm	Substantiality, g/m ²
		Rib, %	Leaf blade, %		
Technological maturity	Middle belt	16.84	83.16	77.00	78.85
	Upper belt	14.45	85.55	81.50	83.90
Green (unripe) state	Middle belt	16.90	83.10	75.00	72.35
	Upper belt	14.88	85.12	78.00	77.85
Overripe state	Middle belt	15.84	84.16	72.50	60.10
	Upper belt	14.35	85.65	72.50	72.02
LSD 0.05	Middle belt	0.121	0.121	0.556	0.598
	Upper belt	0.101	0.101	0.569	0.712

LSD 0.05 – Least Significant Difference at the 5% probability level. Differences between mean values greater than the corresponding LSD value are statistically significant ($p < 0.05$)

Technological properties that have been processed are significant because they affect the quality of tobacco and manufacturing yield. Tobacco as a crop is grown, i.e. it is used in a dry condition. In order to obtain raw material that can be used in cigarette manufacturing, it is important to obtain a high level of quality during production and further processing. More important and more significant for tobacco quality are the

thickness of the leaf and the substantiality, i.e. the proportions of the midrib and leaf blade. From the obtained results, it can be seen that the highest thickness was measured in leaves harvested at technological maturity stage, upper belt 81.5 μm and middle belt 77 μm, and the smallest value was measured in tobacco leaves picked after technological maturity – 72.5 μm. The differences in leaf thickness among the investigated maturity

stages were statistically significant ($p < 0.05$) in both the middle and upper belts and exceeded the corresponding LSD 0.05 values. Bogdancheski et al. (1988), examining the technological properties of tobacco in several varieties of the Prilep type in the region of Delchevo, found an average thickness of the upper zone of the leaves from 78 to 95 μm . These values are an indicator of the nutrition of the leaf, which means that if the leaf is more nourished during the vegetation, it will be thicker and vice versa. In this study, overripe leaves showed lower thickness values. The higher insertions, which are also more nourished, have a greater thickness. This is confirmed by the obtained results shown in Table 1. The thickness of the leaf also depends on the leaf nervature expression, i.e. on the proportions of the midrib and leaf blade. If the nervature is more pronounced, the leaf appears thicker, because the side ribs are disproportionately thicker than the blade. It is a sign of poorer quality, while a thicker blade with a fine nervature is not an expression of poor quality. From the results shown in terms of the proportions of the midrib and leaf blade expressed in percentages, the leaves harvested at technological maturity have the best quality,

16.84% rib and 83.16% leaf blade on the leaves from the middle belt and 14.45% rib and 85.55% leaf blade on the leaves from the upper belt. Statistically significant differences among maturity stages were also determined for the proportions of the midrib and leaf blade ($p < 0.05$). Tobacco leaves harvested after technological maturity have lower values of midrib proportion for the middle and upper belt. The leaf is more delicate, thinner with indistinct nervature. Leaf substantiality represents the absolute amount of matter per unit area. According to leaf substantiality, it is estimated whether the tobacco is with high content, full or empty. From the results shown in Table 1, the lowest values in terms of leaf substantiality have the leaves from the middle and upper belt of the tobacco harvested after technological maturity (60.10 g/m^2 and 72.02 g/m^2), which indicates a considerably lower leaf substantiality compared with tobacco harvested at technological maturity. The differences among all three maturity stages were statistically significant ($p < 0.05$) in both stalk positions, with the highest substantiality recorded at technological maturity.

CONCLUSIONS

According to the proportion of the midrib and leaf blade, expressed in percentages, the leaves harvested at technological maturity stage have the best quality, 16.84% rib and 83.16% leaf blade on the leaves from the middle belt and 14.45% rib and 85.55% leaf blade on the leaves from the upper belt. The upper stalk positions, which are also more nourished, have a greater thickness. The greatest thickness was measured in leaves harvested at technological maturity stage, upper belt 81.5 μm and middle belt 77 μm , and the smallest value was measured in tobacco leaves harvested after technological maturity, 72.5 μm . According to leaf

substantiality, it is assessed whether the tobacco is with high content, full or empty. The lowest leaf substantiality values were recorded in the middle and upper leaf belts of tobacco harvested after technological maturity (60.10 g/m^2 and 72.02 g/m^2 , respectively), indicating lower leaf substantiality and consequently less favorable physical quality compared with tobacco harvested at technological maturity. Statistical analysis confirmed significant differences among the investigated maturity stages for all examined physical properties in both the middle and upper belts (LSD, $p < 0.05$).

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