CHEMICAL PROPERTIES OF THE RAW MATERIAL OF PRILEP P 66 9 TOBACCO TYPE, DEPENDING ON THE HARVEST TIME

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Abstract

Chemical composition as the basic material component of tobacco leaves manifests itself both in their external appearance and in the smoking properties. Knowing the chemical composition of tobacco is of particular importance because leaves harvested at different stages of maturity have different chemical compositions.
When assessing the quality of tobacco based on its chemical composition, the balance of the components may play a more crucial role than their individual content.
Taking into consideration the prior knowledge, an experiment with tobacco type Prilep P 66 9 was conducted at the experimental field of the Scientific Tobacco Institute - Prilep, following a standard methodology.
Three variants were included in the trial - oriental tobacco harvested during technological maturity, before technological maturity (green state), as well as tobacco leaves harvested after technological maturity (overripe state). The aim of this study was to perceive the quality of tobacco depending on the time of harvest.
Considering the great importance for the tobacco quality, we decided to analyze the following important chemical properties: nicotine, nitrogen and total nitrogen, proteins, soluble sugars, mineral substances and Schmuck's number.
The ratio between soluble sugars and proteins is used as an objective indicator of tobacco quality.

Keywords: tobacco quality, chemical composition, maturity, nicotine, total nitrogen, soluble sugar.

Introduction

The chemical composition plays a significant role in determining the qualitative value of tobacco raw material. Quality of tobacco does not depend on the chemical components it contains, but on their mutual relationship, as well as on the changes that occur under the influence of growing conditions and the curing method [1].
The optimal tobacco quality depends on harvesting the leaves at technological maturity. Maturity is judged subjectively, based on the leaf color, visual appearance, sound when removed from the plant and the angle at which the leaf is oriented relative to the plant's main stem. Chemical composition of tobacco is also manifested through the external appearance of the leaves, especially through the color and materiality of the leaf [8]. After curing, immature tobacco leaves have a greenish shade, poor texture, higher content of nitrogen substances and low Shmuk's number. Overripe leaves in a dry state crumble during handling, have a lower content of soluble sugars and contain a higher percentage of mineral substances compared to leaves harvested at technological maturity.

Material and methods

During the 2020 harvest, a trial with tobacco type P 66 9 was carried out on the experimental field of Scientific Tobacco Institute - Prilep.
Tobacco harvested during technological maturity was used as the standard in the tests. For quality and quantity comparison, two harvests of tobacco leaves were performed, one before technological maturity (green state) and one after technological maturity (overripe state). The aim of this study was to perceive the quality of tobacco depending on the time of harvest.
The seedlings were produced in the usual manner, in cold crafted beds covered with polyethylene cloth on an area of 40 m2, in the nursery of Scientific Tobacco Institute - Prilep. The field experiment was performed using the method of randomized blocks, three variants in three replications. Tobacco planting was done manually at a distance of 40x15 cm. The tobacco was harvested manually at technological maturity (standard), before technological maturity (green state) and after technological maturity (overripe leaves). It was harvested by hand and cured in the sun on racks covered with polyethylene cloth placed in one row. Obtained tobacco raw material from the three variants was examined for technological and chemical properties as indicators of quality. Following chemical properties will be elaborated in this paper: nicotine, total nitrogen, proteins, soluble sugars, ash and Shmuk's number. Chemical tests were performed according to recognized standard methods in an accredited laboratory of Scientific Tobacco Institute - Prilep.

Results and discussion

Important chemical properties of tobacco

Harvest Time	Harvest	Nicotine %	Total nitrogen %	Protein nitrogen %	Proteins %	Soluble sugars %	Ash %	Shmuk's number
Technological maturity	Middle belt	0,75	1,78	1,20	5,95	27,14	9,82	4,56
	Upper belt	0,65	1,73	1,15	6,14	26,97	10,15	4,39
Green state	Middle belt	1,00	3,37	1,20	7,38	18,16	13,63	2,46
	Upper belt	1,10	3,40	1,60	8,23	18,63	12,84	2,26
Overripe state	Middle belt	0,65	1,62	0,85	5,80	24,14	12,12	4,16
	Upper belt	0,55	1,58	0,81	5,95	25,19	11,09	4,23

Tobacco raw material has a different chemical composition depending on the type of tobacco, insertion, technological processing, as well as the conditions during the vegetation. According to its chemical composition, tobacco is a complex chemical substance composed of a large number of chemical compounds which, during combustion, pass into the tobacco smoke partially or completely, or are transformed into other compounds and thus act to a certain extent on the smoker's body. Nicotine, as the most typical representative of the alkaloid group, is one of the most important indicators of tobacco quality [2]. Nicotine is present in all parts of tobacco except the ripe seeds and is mostly present in the leaf [5]. The leaves harvested in green state contain the most nicotine: 1.00% middle belt leaves and 1.10% upper belt leaves (Table 1), because the decomposition of nicotine is carried out incorrectly. Overripe leaves have the lowest values, 0.65% in the middle belt and 0.55% in the upper belt. Nicotine content of Pilep type ranges from 0.59% to 0.84% [6]. Nicotine should not be analyzed in isolation as an indicator of quality, but in correlation with the composition of other chemical compounds that neutralize its negative effect on the quality of tobacco.

Nitrogen substances (total nitrogen, protein nitrogen and proteins) expressed in percentages are most prevalent in tobacco harvested in green state, which indicates a lower quality. Total nitrogen content is negatively correlated with tobacco quality and total nitrogen content above 3% has a negative impact on quality [3]. Leaves harvested in the green state contain total nitrogen expressed in percent 3.37 for the middle belt and 3.40 for the upper belt (Table 1).

Soluble sugars are the only chemical component that has a positive effect on taste. During the combustion of tobacco, they neutralize the alkaline reaction produced by the proteins and other compounds in the leaf. High quality oriental tobacco should contain more than 14% soluble sugars, good quality 10-11% and poor quality less than 9% [8]. Compared to leaves harvested in green state, where the content of soluble sugars is 18.16% for middle belt leaves and 18.63 for upper belt leaves (Table 1), tobacco harvested at technological maturity gives a high quality tobacco raw material with a content of soluble sugars of 27.14% for middle belt leaves and 26.97% for upper belt leaves.

In Table 1 it can be seen that tobacco raw material obtained from the leaves harvested at technological maturity has a lower and more favorable content of mineral substances (9.82% for the middle belt leaves and 10.15% for the upper belt leaves) and higher content when harvesting the leaves in the green state (13.63% for the middle belt leaves and 12.84 % for the upper belt leaves).

In addition to the values for presence of certain chemical components from the chemical composition of tobacco, so-called quality coefficients are also used to represent the mutual relations of these components [7]. In our research, we decided to analyze the Shmuk's number (shown in Table 1) due to its frequent use worldwide and in our region. In green tobacco leaves, there is an unfavorable ratio of soluble sugars to proteins, specifically a very low Shmuk's number (2.46 for the middle belt leaves and 2.26 for the upper belt leaves). According to the tested chemical properties, the most favorable ratio of soluble sugars to proteins, with the highest values of Shmuk's number, is found in the middle and upper belt leaves harvested at technological maturity (4.56 and 4.39). Ratio between soluble sugars and proteins is used as an objective indicator of tobacco quality [4].

Conclusions

Based on the results from the analysis of chemical properties of Prilep P 66 9 tobacco raw material, which was obtained by harvesting tobacco leaves at different stages of maturity, the following conclusions can be drawn:

- The nicotine content varies from 0.55% in overripe leaves to 1.10% in leaves harvested in green state;
- Nitrogen compounds (total nitrogen 3.40%, proteins 8.23%) are most abundant when tobacco leaves are harvested in green state;
- Tobacco harvested at technological maturity has a high content of soluble sugars (27.14% for the middle belt leaves and 26.97% for the upper belt leaves), indicating high-quality tobacco in terms of its chemical composition. The ratio between soluble sugars and proteins, represented by Shmuk's number, reaches its highest values of 4.56 and 4.39 for the leaves from the middle and upper belts, which were harvested at technological maturity;
- Tobacco leaves harvested at technological maturity have the most favorable chemical composition, indicating high-quality tobacco raw material.

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