Chemical composition of oriental tobacco of the Basmi variety group upon organic production

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Abstract

Organic tobacco is a new industrial plant product that is grown in special certified organic fields without the use of conventional plant protection products. Globally, it is believed that there is already a niche market for biological tobacco, which is gaining an increasing percentage of the market. Extended chemical characteristics are needed to more complete characterization biological tobacco. The aim of this study is to carry out an extended chemical characteristic on the basis of the chemical components of oriental tobacco variety Krumovgrad 58, grown upon organic production and to compare it with conventional production of the same variety. It is found that biological tobacco has lower nicotine content compare to conventional tobacco, which is in accordance with the WHO requirement for the production of low-nicotine tobacco. The content of ash and heavy metals is lower than that of conventionally produced tobacco, which is a sign of good quality and environmental friendliness of tobacco.

Key words: oriental tobacco; organic production; chemical components

INTRODUCTION

For the last 50 years, agricultural production has been heavily dependent on the use of synthetic fertilizers and plant protection products. The treatment of the soil with agrochemicals leads to pollution of surface and groundwater resources (Bozukov, 2018).

Organic farming is an agricultural activity whose main aim is to minimize human effect on the environment in order to reduce the use of pesticides, synthetic fertilizers, regulators and stimulants. This type of agriculture restores and maintains soil fertility, ensures the balance of agro-ecosystems, involves the production of healthy and quality food products (Bozukov, 2018; Bozukov et al., 2019).

Organic production is based on pre-developed and approved production standards and principles - regional, national, European Union and World Standards (Linkova, 2013).

Organic tobacco is a new industrial plant product that is processed and grown in special certified biofields, without the use of conventional plant protection products. Globally, it is believed that there is already a niche market for organic tobacco, which is gaining an increasing percentage of the market. There is a lack of in-depth research in the scientific literature on the cultivation and chemical composition of organic tobacco. Organic farming in general, including tobacco growing, is more environmentally friendly. There is no doubt, that the activity of organic tobacco production creates demand, thus stimulating people to do better business and cause less harm to the environment. However, some tobacco products that are advertised as natural are often even more dangerous to smokers' health due

to the fact that some of the tobacco elements - such as tar or nicotine - are actually contained in these products in a higher percentage compared to usual cigarettes (Wechsler, 1999; Qing et al., 2009; Hight, 2001; Reddy, 2019).

In order to find a market niche for Bulgarian organic tobacco, in-depth chemical research and comparison with conventionally produced tobacco are needed (Bozukov, 2018; Bozukov et al., 2019).

Chemical components are the major tool for objective evaluation of tobacco. The study of basic and specific chemical components of tobacco is especially important for monitoring the influence of a number of factors on the formation of tobacco. The extended chemical characteristics give an objective expression of the specific properties of the tobacco. This objective assessment would serve in the practice of the Bulgarian tobacco market (Staykova et al., 2014; Kirkova et al., 2019).

The aim of this study is to carry out an extended chemical characteristic on the basis of the chemical components of oriental tobacco variety Krumovgrad 58, grown upon organic production and to compare it with conventional production of the same variety.

MATERIAL AND METHODS

Oriental tobacco from variety group of Basmi, Krumovgrad ecotype Krumovgrad, variety 58 was used. The tobacco was grown in two experimental fields of the Institute of Tobacco and Tobacco Products, Markovo village, under different conditions. - In the conditions of organic production in a certified experimental field Gotse Delchev; - Conventional production in an experimental field in the village of Kozarsko. The tobacco leaves are dried and ground to a powder. Standardized methods have been used to determine the main and specific components in tobacco. The content of nicotine, sugars and total nitrogen was determined with an automatic analyzer in stream AA3, Seal respectively according to ISO 15152, ISO 15154 and BDS 15836. The content of heavy metals in tobacco was determined with atomic absorption spectrometer Spektra AA 220, Varian by method BDS 17365.

RESULTS AND DISCUSSION

Investigation of the basic components of Krumovgrad 58 tobacco variety

The basic chemical components such as nicotine, total sugars and total nitrogen are studied. They are the main chemical components for its objective qualitative assessment. They provide information on the consumer qualities of tobacco, which are related to market requirements (Gyuzelev, 1983; Leffingwell, 2001; Staykova et al., 2014; Kirkova et al., 2019). In recent years market demands have imposed the need of high-nicotine oriental tobacco with a nicotine content of about and above 1.5% (Gyuzelev, 1983). The variety Krumovgrad 58, grown conventionally, meets these requirements, as the average nicotine content of class I and class II is 1.70%. The content of nicotine in tobacco Krumovgrad 58, grown upon organic production is lower than conventionally produced tobacco. The average nicotine content of class I and II for harvest 2019 is 0.91%, and for harvest 2020 - 0.76%. The results are presented in Table. 1.

Table 1. Content of basic chemical components in Krumovgrad 58, grown upon organic and conventional production, %

Tobacco variety	Harvest	Nicotine	Total sugars	Total nitrogen
Krumobgrad 58, I classes – O*	2019	0.72	22.9	1.74
Krumobgrad 58, II classes – O*		1.10	18.6	1.78
Krumobgrad 58, I cl. – O*	2020	0.82	23.2	1.45
Krumobgrad 58, II classes – O*		0.71	22.1	1.48
Krumobgrad 58, I кл. – C**	2020	1.26	19.8	1.67
Krumobgrad 58, II кл. - C**		2.14	13.8	1.90

O* - organic production
C** - conventional production

In recent years, the WHO has recommended reducing the content of tar and nicotine in tobacco smoke, which is associated with a reduction in the content of nicotine in tobacco. In this regard, although the nicotine content of biotobacco is lower than that of oriental tobacco, it is in compliance with the requirements of the WHO (Otmar & Dimitrios, 2007; Bruns et al., 2008). The amount of sugars in all studied tobaccos is higher than the typical for oriental tobacco range from 8 to 14%. The content of Krumovgrad 58 upon organic production varies between 18.6% class II (harvest 2019) and 23.2% - class I (harvest 2020) and is higher than that of conventionally produced tobacco - 13.8% II class and 19.8% - I class.

There is no significant variation in the sugar content between classes and in different years - Table. 1. The amount of nitrogenous substances in tobacco is defined as total nitrogen. Nitrogen-containing substances in tobacco are represented by the following groups: alkaloids, proteins, amino acids, amide compounds, nitrates, ammonia and other nitrogenous bases (Gyuzelev, 1983; Leffingwell, 2001). The amount of total nitrogen is negatively correlated to the quality of tobacco. Its content in tobacco leaves can vary from 1 to 6%, and a lower quality tobacco contains a larger amount of total nitrogen (Gyuzelev, 1983). The amount of total nitrogen in Krumovgrad 58 upon organic production of harvest 2020 (average 1.47%) is lower than conventionally produced tobacco (average 1.78%) and biotobacco harvest 2019 (average 1.76%). Tobacco Krumovgrad 58, grown upon organic production, has a lower content of nicotine and total nitrogen and a higher content of sugars not only of the same variety, but also with other varieties and lines of oriental tobacco of ecotype Ustina and ecotype Srednogorska yaka, grown conventionally (Staykova et al., 2015; Bozukov et al., 2019; Kirkova et al., 2019).

Investigation of specific components of Krumovgrad 58 tobacco variety

The mineral composition of tobacco is important for its quality. It is expressed through the indicators of ash and individual macro- and microelements (Gyuzelev, 1983).

The total mineral content of the studied tobaccos is represented by the ash. In oriental tobacco, the ash content varies from 11% to 15%, with a negative correlation between ash content and tobacco quality (Gyuzelev, 1983). From the results presented in table 2 it is noteworthy that the ash content of bio-tobacco is lower than that of conventionally produced tobacco, which shows the higher quality of the biotobacco.

The mineral composition of tobacco is determined by the following macronutrients - potassium, calcium, magnesium, phosphorus, chlorine. They are in the largest quantity. In biotobacco the content of calcium and chlorine is lower; while the magnesium is higher in comparison with conventionally produced tobacco.

Minerals have a direct effect on the flammability of tobacco, which is expressed not so much by the absolute content of each element, but mostly by their ratio. The relationship between potassium and chlorine is considered to have the most significant effect on flammability. Numerous studies highlight the positive effects of potassium and the negative

Table 2. Content of mineral macro elements in Krumovgrad 58, grown upon organic and conventional production, %

Tobacco variety	Harvest	K	Ca	Mg	P	Cl	Ash
Krumobgrad 58, I classes – O*	2019	2,02	1,54	0,40	0,37	0,31	9,22
Krumobgrad 58, II classes – O*		2,51	1,79	0,50	0,35	0,64	11,87
Krumobgrad 58, I cl. – O*	2020	1,85	1,18	0,35	0,45	0,09	8,56
Krumobgrad 58, II classes – O*		1,51	1,24	0,34	0,47	0,09	8,29
Krumobgrad 58, I кл. – C**	2020	2,01	2,16	0,27	0,30	0,27	10,79
Krumobgrad 58, II кл. - C**		2,11	2,54	0,25	0,30	0,18	12,62

O* - organic production
C** - conventional production

Table 3. Content of micro elements in Krumovgrad 58, grown upon organic and conventional production, mg/kg

Tobacco variety	Harvest	Cd	Pb	Cu	Zn
Krumobgrad 58, I classes – O*	2019	0,4	1,0	22,2	39,1
Krumobgrad 58, II classes – O*		0,5	0,0	23,4	40,3
Krumobgrad 58, I cl. – O*	2020	0,6	1,0	14,6	38,7
Krumobgrad 58, II classes – O*		0,8	0,0	13,8	42,3
Krumobgrad 58, I кл. – C**	2020	0,5	6,0	14,0	69,2
Krumobgrad 58, II кл. - C**		1,1	5,0	12,0	73,8
Maximum permissible concentrations established for Bulgaria		5	30	50	150

O* - organic production
C** - conventional production

effects of chlorine on tobacco flammability. At a ratio of K:Cl> 2.0, the negative effect of chlorine is eliminated. In all tobaccos tested, the K: Cl ratio significantly exceeded 2 (Gyuzelev, 1983).

Table 3 shows the content of the studied micro elements - heavy metals cadmium, lead, copper and zinc. Micro elements, and in particular heavy metals, are a qualitative indicator of the environmentally pure material (Stoilova et al., 2014). In all tested tobaccos the content of heavy metals does not exceed the maximum permissible concentrations established for Bulgaria (Cd - 3 mg / kg; Pb - 120 mg / kg, Cu - 300 mg / kg, Zn - 400 mg / kg) (Stoilova et al., 2014).

The results obtained for the content of heavy metals are significantly lower than reported by Stoilova et al., 2014, where the content of cadmium in Bulgarian varieties of oriental tobacco varies from 2.40 mg / kg to 4.38 mg / kg, the lead content is from 9.5 mg / kg to 30 mg / kg, copper content from 7.10 mg / kg to 20.4 mg / kg. Bojinova, 2019, found that the lead content in the leaves of oriental tobacco varies between 10.7 mg / kg and 12.5 mg / kg, and cadmium from 1.33 mg / kg to 3.30 mg / kg, which significantly exceeds the values obtained for tobacco Krumovgrad 58, grown under organic production.

CONCLUSIONS

An extended chemical characteristic is made on the basis of chemical components of oriental tobacco variety Krumovgrad 58, grown under organic production. The obtained data are compared with the same chemical components of the same variety of tobacco grown under conventional production.

It was found that tobacco grown in a certified biofield has lower nicotine content and higher sugar content, compare to the conventional production of the same variety tobacco - Krumovgtad 58. The obtained data are in accordance with the requirements of WHO for production of lower nicotine content tobacco.

Tobacco, grown upon organic production has higher quality than conventionally produced based on the ash content. The content of heavy metals is relatively low, which is a qualitative indicator of the ecological purity of the tobacco raw material.

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