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COLOUR PARAMETERS OF FRESH AND DRIED PLUM FRUIT OF CULTIVAR 'TEGERA', AFTER APPLICATION OF SOME CONVENTIONAL AND ORGANIC FERTILIZERS

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Abstract

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The influence of some fertilizers with conventional and biological application on the color parameters of fresh and dried plum fruits of 'Tegera' cultivar is studied. The trees are cultivated in a collection plantation of the Research Institute of Mountain Stockbreeding and Agriculture - Troyan. The indicators were reported by the CIE Lab system in three colour coordinates L - color brightness, + a - red color; + b - yellow color. It was found that in fresh fruit plums after the application of bio fertilizers the quantitative value was increased for two indicators: brightness of the colour and yellow colour tone compared to the control. Red and yellow colour values in dried fruit were higher for conventional fertilization.

Key words: plum, ferilization, brightness of colour, colour parameters

Introduction

Plum (P. domestica L.), along with apple and pear, are among the most wide spread fruits in temperate regions of the world (Zohary et al., 2012). Due to the abundance of bioactive compounds, such as anthocyanins, pectin, carotenoids, plums represent a valuable component of our diet in terms of their nutritional and dietary value (Ionica et al., 2012). Plums can be eaten fresh, dried or processed into various products (juice, jam, fruit preserve, pestil, etc.). Unfortunately, the consumption of fresh plums is seasonal. Their processing offers an alternative that allows their availability and consumption throughout the year. The method of drying increase the period of duration of their storage and consumption. It is one of the oldest and most important thermal treatment techniques aimed at inactivating enzymes, reducing water activity and limiting microbial growth (Krokida et al., 2001). The application of different processing techniques can lead to significant losses of natural bioactive compounds. Colour is the most important maturity indicator for many fruit species (Drake et al., 1982). It is also used to determine the quality in many applications (Blasco, Aleixos and Molto, 2003; Cubero, Aleixos, Molto, Gomez-Sanchis end Blasco, 2010; Quevedo, Aguilera, and Pedreschi, 2008; Rocha and Morais, 2003). It is not only an important sensory attribute that provides basic information about the quality of human perception, but also has a close connection with quality factors, such as freshness, maturity, diversity, attractiveness and preservation of food. Therefore, color is an important classification factor for most food products (Wu and Sun, 2012), because consumers first rate the food by color, then by taste and aroma. It is mainly influenced by the concentration and distribution of various anthocyanins in

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the fruit skin (Gao and Mazza, 1995; Fanning et al., 2014), as well as by other factors such as light, temperature, method of treatment and others (Lancaster et al.,1997). Wherefore soil properties and fertilization are an important element of soil fertility management because they are one of the main factors influencing the processes in the soil, the activity of the root system and the absorption of nutrients from the plants and, as a result, the production quality (Stockdale et al., 2002; WWOOF, 2011).

The aim of the present study is to investigate the influence of some fertilizers with conventional and biological application on the colour parameters of fresh and dried fruits of 'Tegera' cultivar.

Material and Methods

The experiment was carried out in 2016 in a collection plantation of the Research Institute of Mountain Stockbreeding and Agriculture - Troyan.

The object of the study are fruits of plum cultivar 'Tegera'. The fruit species is cultivated according its agrotechnical requirements. The experiment is set up in the following variants:

I variant – Bio fertilizers - including the following fertilizers: Agriful (soil application) - 5 l/da, Tecamin Flower (foliar application) - 0.3%, Teknokel Amino Ca (foliar application) – 0.4%;

II variant – Conventional - Yara Mila Complex (soil application) – 0.500 kg/tree, YaraVita Frutrel (foliar application) - 0.500 ml/da, Yara Vita Universal Bio (foliar application) – 0.500 ml/da;

III variant – Granulation of chicken manure – 0.500 kg/tree;

IV variant – Control.

Fertilization schedule:

Agriful – applied five times from the beginning of vegetation over a period of 15-20 days;

Tecamin Flower - imported twice. Applied before flowering and during the formation of a fruit-set;

Tecnokel Amino Ca – imported twice. Applied after flowering and a month before harvesting;

Yara Mila Complex – imported once in the intra row spacing;

YaraVita Frutrel – four-fold application. First in the phase of winter buds, in a phase of white button, during the formation of fruit-set and a month before the harvest;

Yara Vita Universal Bio – three-fold application. Applied before and after blossoming and after harvest.

Granulation of chicken manure - one application in the intra row spacing.

The drying process of fruits was carried out in the FRDI-Plovdiv, by means of a heat pump.

Drying took place at temperatures up to 45°C, which preserved high quality and native properties of the product. The process runs in a closed cycle using the same air and eliminates the additional microbial visitation from outside air.

The colour characteristics of different variants of fresh and dried plum fruit of 'Tegera' cultivar is reported in the laboratory of Food Research and Development Institute - Plovdiv.

The colour is determined according to Gardner Colour Scale – by a labaratory apparatus "GOLORGRAD2000" of BYK-GARDNER INC. USA. Plum samples are milled in a laboratory apparatus "МРІЯ" –2М with a mesh diameter of 4 mm. The sample was deaerated in a vacuum chamber at a vacuum of 0.85 kPa for 10 minutes. The indicators are reported according CIE Lab system. The color coordinates L, a and b were taken during the measurement: L – color brightness; + a – red colour; + b – yellow colour.

The value of the colour tone or the dominant wavelength is represented by the ratio a / b.

Results and Discussion

Determining the degree of influence of applied fertilizers after agrotechnical measures on fruit colour characteristics is an important element characterizing their quality. In this connection is the opinion of Maskan et al., 2002 on fruit colour parameters that can be used to describe colour changes and provide useful data on quality control of vegetables and fruits. Data from the tests on fresh and dried fruits of 'Tegera' cultivar are presented in Tables 1 and 2.

The highest value of colour brightness of fresh fruit is found in the variant with bio fertilizer – 25.10 (Table 1), followed by the control and the other two fertilization variant. According to this indicator the variability in the values is very low. As regards the red colour tone, the highest values are found in the fruits of the control – 31.08 and the bio-fertilization variant – 29.21. Significant difference in the results of this indicator is reported between the conventional fertilization and control. The fertilization has the greatest impact on yellow colour component of fruits in the bio-fertilizer variants – 15.81 and the lowest in the conventional fertilization – 9.20. The quality indicator of colour tone has the highest value in conventional fertilization, followed by control, chicken manure and bio-fertilization. The impact of organic fertilizers on the brightness and yellow colour tone can be taken into account as an analysis of the results for fresh fruit.

Table 1. Colour characteristics of fresh plums of 'Tegera' cultivar

Colour characteristics / Variant	L	a	b	a/b
I	25.10±0.78	29.21±0.51	15.81±0.42	1.85
II	21.34±0.12	21.57±0.35	9.20±0.19	2.34
III	22.45±0.25	27.85±0.68	13.01 ±0.05	2.14
IV	24.04±0.11	31.08±0.82	13.70±0.78	2.27
CV %	7.17	15.03	21.32	10.07

Table 2. Colour characteristics of dried plums of 'Tegera' cultivar

Colour characteristics / Variant	L	a	b	a/b
I	18.65±0.79	5.07±0.72	0.73±0.13	6.94
II	17.32±0.73	6.69±0.62	4.71±0.51	1.42
III	19.50±0.22	4.96±0.66	2.38±0.85	2.08
IV	17.16±0.46	4.67±0.22	1.18±0.33	3.96
CV %	6.15	17.03	79.19	68.69

The colour brightness of dried fruit has lower value in comparison with fresh. The reported results are in the range of 17.16 (control) to 19.50 (chicken manure) (Table 2). Compared to fresh, dried fruit, there are no significant differences in the values between the variants of the red color component. The largest amount is recorded in the conventional fertilization – 6.69, and the lowest in the nontreated control – 4.67. After the drying process, the colour component has higher values for nontreated variants. A high variation coefficient was established for the yellow colour tone as a result of its significant variation between the experiments. The highest amount is found in the conventional fertilization – 4.71, followed by the chicken fertilizer – 2.38, the control – 1.18 and the bio fertilization – 0.73. The significant change can be noted in the values of the organic fertilizer component in dried fruits compared to the same variant of fresh ones. In the same context, the lowest reduction in yellow colour tone is recorded in conventional fertilizers – 4.71.

The same tendency for significant differences between the variants is also observed in the colour characteristic of colour tone. In dried plum fruits, the first bio-fertilizer variant is distinguished by its high value of 6.94, which is a sign of deterioration between the fruit's color parameters compared to the fresh ones.

The reported control quantity is almost twice lower - 3.96, followed by the chicken fertilizer variant – 2.08 and the conventional fertilization – 1.42. The different values found between the variants set a high variation coefficient of 68.69%. From the analysis of the quality characteristics, the least change is recorded in the variants of fresh and dried fruit with the application of chicken manure.

Conclusions

It was found that in fresh fruit plums after the application of bio fertilizers the quantitative value was increased for two indicators: brightness of the colour and yellow colour tone compared to the control. Red and yellow colour tone values in dried fruit were higher for conventional fertilizer variant.

The determination of the colour tone characterizing the quality indicator of the fruit is most consistent with the chicken manure variant.

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