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ASSESSMENT OF THE IMPACT OF CONVENTIONAL AND ORGANIC FERTILIZATION ON THE DRYING PROCESS AND THE QUALITY CHARACTERISTICS OF 'STANLEY' PLUM FRUIT

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Abstract

During the period 2016-2017, in order to improve the soil fertility and the quality of the fruit production in the RIMSA - Troyan, a nourishing conventional and organic fertilizer was applied to the plum plantation with 'Stanley' cultivar. The impact of the applied fertilizers and the drying process on the quality characteristics of the plums was determined. It was found that plums in the organic chicken manure fertilization variant had the highest sensory evaluation and high quantitative values on the colour indicators, such as brightness, red and yellow colour tone. After the drying process, it was found through a heat pump dryer that the applied temperature regime $t = 43 \pm 2°C$ and $\varphi = 10\%$, had an impact on the quantitative values of fruit colour. In the case of dried fruits from bio fertilization, the red and yellow components of the colour increased, and for all other fruits from the variants, including the control, they decreased significantly. Dried fruits from conventional fertilization had the highest sensory score, while dried fruits from bio fertilization had the lowest.

Key words: *plums, fertilization, heat pump drying, quality characteristics, colour parameters.*

INTRODUCTION

Nowadays, effective management of soil fertility is needed to maintain the standards for quality fruit production (Staneva & Gospodinova, 2018). This requires updating or changing fertilization technologies (Pešaković et al., 2020). Fertilization is one of the main agrotechnical events in the cultivation of fruit plants (Georgiev et al., 2019), but before the selection and application of fertilizers it is necessary to determine the current agrochemical status of the plantation (Hristova, 2017; 2018). By establishing the impact of different fertilization rates on the growth characteristics and nutritional status of plants (Akova et al., 2019), from different fertilization variants (organic and conventional) on the biological activity and antioxidant potential of fresh and dried fruits (Hristova et al., 2020) achieved the possibility of growing and storing quality products that meet the requirements of the final user (Petrescu et al., 2020). Sensory indicators such as appearance, colour, texture, taste and aroma are used to characterize fruit quality, consumer preferences and consumption (Bruhn, 1991; Costa, 2011; Pathare, 2013). In turn, sensory evaluation is an opportunity to qualify high-quality products, with an increased guarantee of acceptance by consumers (Calín-Sánchez et al., 2020).

Colour is one of the most important sensory qualities when choosing for fresh fruits consumation (Silva et al., 2019) and dried products (Krokida & Maroulis, 2000). It results from the availability of natural pigments (chlorophylls, carotenoids, anthocyanins, flavonoids and betalains), which change continuously during fruit ripening (Barrett et al., 2010).

Colour changes can also occur during storage or processing of fruit products (Montefiori, 2005; Krokida, 2001). The reason for this is the activation and course of a number of biochemical processes, such as the degradation of the pigment composition (Roshanak et al., 2016), enzymatic and non-enzymatic reactions (Maskan, 2001; Terefe, 2014), which depend mainly on light, temperature and treatment (Lancaster, 1997; Bonazzi, 2011). Therefore, the colour parameters can be used as an indicator of the quality of fruit that has undergone heat treatment (Demirhan & Ozbek, 2009).

The process of fruit drying is widespread in the processing of raw materials in Bulgaria. Less well known is the process of drying with a heat pump dryer.

Thermodynamically, heat pumps are identical to refrigeration machines. The difference is that the heat obtained is used for the process. Their energy saving effect is based on the fact that the heat of the environment is used. When drying on a heat pump principle, the cold is used to condense the evaporated moisture from the dried product. Drying takes place at temperatures up to 45°C, which preserves the high quality and native properties of the product. The process takes place in a closed cycle, using the same air and eliminating additional microbial contamination from outside air.

The main objective of the present study is to monitor the effect of the applied conventional and organic fertilizers on the quality and colour characteristics of fresh and dried plums of 'Stanley' cultivar.

MATERIALS AND METHODS

Raw materials

Plum trees are grown in RIMSA-Troyan, and the applied variants of foliar and soil nourishing conventional and organic fertilization are from two consecutive years (2016-2017). The analyzed fresh and dried plums of 'Stanley' cultivar are from the 2017 harvest.

'Stanley' cultivar characteristics

'Stanley' is the most common American plum cultivar grown worldwide (Okie & Ramming, 1999). It was obtained by crossing 'd'Agen' and 'Grand Duke' cultivars at the New York Agricultural Experimental Station Geneva, USA. Due to its tolerance to *Plum pox virus,* since 1985, it is the main cultivar for Bulgaria (Djouvinov & Vitanova, 2002), occupying 80% of the plum plantations in the country (Georgieva & Serbezova, 2018). The cultivar is self-fertile and a good pollinator.

In many cases, it is used as a standard in comparative testing of culture genotypes. The fruits ripen in late August - early September. They are large, back ovoid, asymmetrical. The skin is healthy, thin, dark purple-blue with abundant wax. The flesh is greenish-yellow, dense, medium juicy, odorless, with good taste. The fruits are transport stable, with universal application. They are used for fresh and dried consumption or processed into various products (brandy, compotes, jams, etc.) (Djouvinov et al., 2012).

Experimental setup

The improvement of soil fertility in 'Stanley' plum plantation with nourishing fertilizer was applied in an experimental setup of four options.

Fertilization variants

I variant - Biofertilization **- including fertilizers, such as:** Agriful (soil) - 5 l/da, Tecamin Flower (foliar) - 0.3%, Teknokel Amino Ca (foliar) - 0.4%.

II variant - Conventional fertilization - Yara Mila Complex (soil) - 0.500 kg/tree, Yara Vita Frutrel (leaf) - 0.500 ml/da, Yara Vita Universal Bio (leaf) - 0.500 ml/da, ammonium nitrate - 0.220 gr/tree.

III variant - Organic fertilization (granulated chicken manure- 0.500 kg/tree).

IV variant - Control (without fertilization).

Composition of fertilizers

Agriful: Total humic extract-306 g/l; Fulvic acid - 306 g/l; Nitrogen (N) - 55 g/l; Phosphorus (P_2O_5) - 13 g/l; Potassium (KjO) - 13 g/l; Total organic matter - 551g/l; pH - 4.7.

Tecamin Flower: Seaweed Extract - 51g/l; Free "L" amino acids - 38 g/l; Nitrogen (N) - 38 g/l; Phosphorus (P_2O_5) - 127 g/l; Boron (B) - 13 g/l; Molybdenum (Mo) - 6.5 g/l; pH - 2.

Teknokel Amino Ca: Calcium oxide (CaO) water-soluble - 148 g/l; Boron (B) water-soluble - 3 g/l; Free "L" amino acids - 89 g/l; pH - 4.0-4.5.

YaraMila Complex: Nitrogen (N) - 12%; Potassium (K) - 18%; Magnesium (MgO) - 2.7%; Boron (B) - 0.015%; Manganese (Mn) - 0.02%; Phosphorus (P) - 11%; Sulfur (SO_3) - 20%; Iron (Fe) - 0.2%; Zinc (Zn) - 0.02%.

YaraVita Frutrel - Calcium Oxide (CaO) - 280 g/l; Phosphorus (P) - 104 g/l; Nitrogen (N) - 69 g/l; Magnesium (MgO) - 100 g/l; Zinc (Zn) - 40 g/l; Boron (B) - 20 g/l.

YaraVita Universal Bio - Nitrogen (N) - 100 g/l; Phosphorus (P_2O_5) - 40 g/l; Potassium (K_2O) - 70 g/l; Manganese (Mn) -1.3 g/l; Copper (Cu) - 1.0 g/l; Zinc (Zn) - 0.7 g/l;

Boron (B) - 0.2 g/l; Molybdenum (Mo) - 0.03 g/l.

Granulated chicken manure Vita Organic: Nitrogen (N) - 1.2%; Phosphorus (P) - 1.99%; Potassium (K) - 2.5%; Calcium (Ca) - 10.85%; Magnesium (Mg) - 0.75%; Zinc (Zn) - 350 mg/kg; Copper (Cu) - 50 mg/kg; Manganese (Mn) - 443 mg/kg; Iron (Fe) - 3450 mg/kg.

Fertilizer application periods

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

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

Teknokel Amino Ca - imported twice. Applied after blossoming and a month before harvesting.

YaraMila Complex - imported once in the intra row spacing.

Ammonium nitrate - implied once in 2017;

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

YaraVita Universal Bio - three-fold application. Applied before and after blossoming and after harvest.

Granulation of chicken manure - one application in 2016.

Drying

'Stanley' plums from different fertilization variants were compared to the control and used for the study.

The technological processes describing the drying process are: receiving, weighing, sorting, washing, separating the stones, cutting, drying and storage.

Fruit drying was performed in the laboratory of the Food Technologies Department at FRDI-Plovdiv on a heat pump stand for drying. The process takes place in a thin layer with a transversely oriented air flow relative to the product layer at a speed of 5-7 $m.s^{-1}$, with an initial temperature of 45°C and circulating air with an initial humidity of 8%. During the drying process, the mass of the sample was measured for the first two hours every 10 minutes, then every 30 minutes. The condition for the end of the experiment is drying to moisture balance. The dried fruit samples were packed in paper bags and stored at room temperature in the absence of light until the day of analysis.

Sensory analysis

Sensory evaluation of fresh and dried fruits from different fertilization variants was performed, based on the use of a 5 - point evaluation scale with a step of 0.25 on the indicators: appearance; colour; consistency/ hardness/; fruity taste and aroma.

Colour measurements

The colour characteristics of fresh and dried fruits from the fertilization variants were measured at the laboratory of Food Research and Development Institute - Plovdiv.

Gardner colour scale - laboratory apparatus "GOLORGRAD2000" was used, BYK-GARDNER INC. USA.

The samples from the analyzed variants of fresh and dried fruits were ground on a laboratory wolf МРІЯ–2М with a diameter of the openings of the grid 4 mm. The indicators were reported according to the CIELab system. During the measurement, the colour coordinates L, a and b were taken: L - colour brightness (L = 0 black and L = 100 white); + a - red colour; -a- green colour; + b - yellow colour - b - blue colour.

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

The colour saturation (C) was determined by the formula $\sqrt{a^2 + b^2}$

The colour differences were calculated by the following formulas:

$\Delta L = L - L_0$,

$\Delta a = a - a_0$

$\Delta b = b - b_0$

$\Delta E = \sqrt{\Delta L^2 + \Delta a^2 + \Delta b^2}$

where for fresh fruits L_0, a_0 and b_0 are the control values, and L, a and b are the measured values of the fruits from the fertilization variants.

In the case of dried fruits, the colour difference was calculated by the same formulas, but L_0, a_0 and b_0 are the values of the fresh fruits from the fertilization variants, and L, a and b are the measured values of the dried fruit from the variants.

Statistical processing of the samples was performed by triplicate replications, the data were presented as averages and processed with the ANOVA program.

RESULTS AND DISCUSSIONS

Drying

The convective drying process is one of the most common methods for drying fruits, vegetables and medicinal plants in the food industry (Chua et al., 2019), transferring both heat and mass (Ertekin & Yaldiz, 2004; Nunez-Vega, 2012).

According to Kandić et al. (2017) the nature of the heat flow and the mass transfer process can be most fully described on the basis of experimental data through the drying curves. The change in moisture content as a function of time at constant temperature and air velocity for drying plums of the Stanley variety is shown in Figure 1.

$$U = f(\tau) \quad (1)$$

where: U is the moisture content (kg H_2O/kg dry matter) and τ- drying time (min).

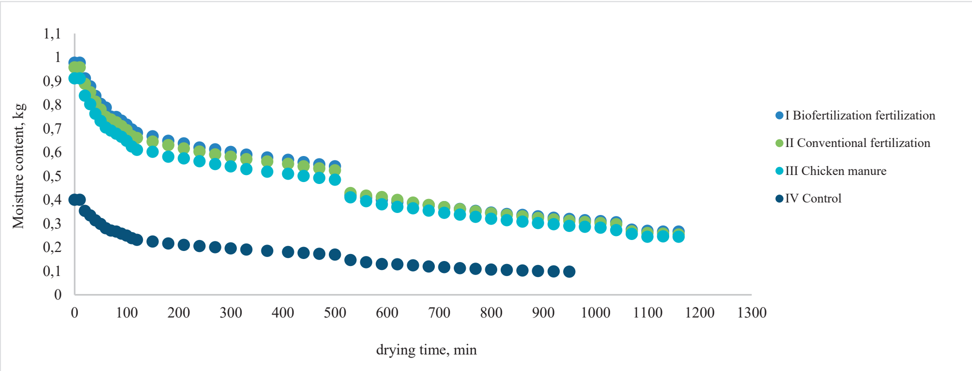

Figure 1. Drying curves of plums

The drying speed curves, could be seen by the drying curves through their graphical differentiation, defined by the dependence:

$$dU/d\tau = f(U) \quad (2)$$

The drying rate in the first period is described by the equation:

$$-\frac{dU}{d\tau} = N = const \quad (3)$$

where N is the drying rate during the first period (min^{-1}).

In the process of fruit drying in the variants and the control, a period of constant speed and a period of decreasing drying speed was observed, periods described by Kurmanov et al. (2015). Identical to Abasi et al. (2009), a continuous decrease of the speed of drying with increasing drying time, respectively reduced the moisture content in the product.

The values of the kinetic constants obtained during the second period for the control fruits and the bio-fertilization fruits are in high correlation with the experimental data ($R^2 > 0.75$) (Table 1).

Table 1. Speeds (N, min^{-1}) and coefficients (K, min^{-1}) of drying of plums, at different variants of fertilization

Variants	N, min^{-1}	R^2	K, min^{-1}	R^2
I. Biofertilization fertilization	4.21	0.94	0.04	0.78
II. Conventional fertilization	4.61	0.85	0.06	0.32
III. Chicken manure	4.83	0.82	0.10	0.57
IV. Control	3.54	0.98	0.05	0.83

Sensory analysis

Sensory continuity of food has been extremely important for people from an early age (Bourne, 2002). It characterizes its physicochemical quality and is a leading indicator in consumer choice (Kitzberger et al., 2017).

Figure 2 presents a sensory profile of fresh ‘Stanley’ cultivar plums, in different variants of fertilization and control. Sensory indicators were analyzed: appearance, colour, texture, taste and aroma.

With a maximum assessment of appearance 5 are the fruits of control, bio-fertilization and organic chicken manure. The fruits from the conventional fertilization had a good grade of 4.55 ± 0.29.

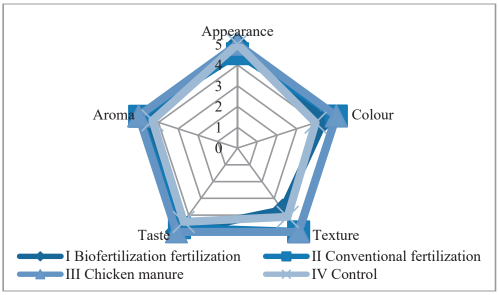

Figure 2. Sensory profile of fresh plums, with different fertilization variants

In terms of colour, the fruits of the fertilization variants had higher scores than the fruits of the control. The tasters gave the maximum marks for colour 5 to the fruits from the conventional fertilization with organic chicken manure. The consistency of the fruits from the bio-fertilization had the lowest marks 3.7 ± 0.37 in comparison with the fruits from the control 4.1 ± 0.25 and the other two variants 5. In terms of taste and aroma, the lowest marks were given to the fruits from the control in comparison with the fruits treated with bio-fertilizers and conventional fertilization. The analysis of the obtained average evaluations from the sensory indicators shows that the fruits from the variants of fertilization with organic chicken manure were maximally evaluated by the tasters in terms of appearance, colour, texture, taste and fruity aroma, confirming the cultivar characterristics described by Dzhuvinov et al. (2012).

The applied agrotechniques had an impact on the sensory characteristics of the fruits from the fertilization variants (conventionally and biofertilization) ($P < 0.05$).

Sensory analysis was also performed on the dried plums from the control and from the fertilization variants (Figure 3).

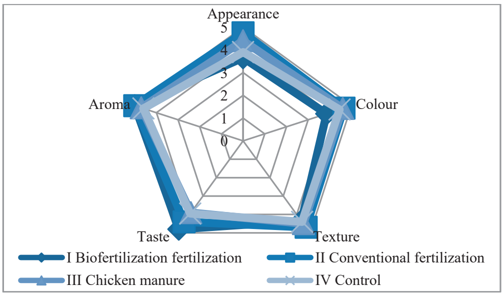

Figure 3. Sensory profile of dried plums, with different fertilization variants

Impressive is the lower assessment of dried fruits compared to fresh ones of the studied variants.

Assessments of the appearance of dried fruit significantly decreased after the applied drying regime.

Dried fruits from organic fertilization had the most significant differences compared to fresh fruits and the lowest scores on indicators of appearance, colour and texture compared to dried fruits of the control and the other two variants of fertilization. Very good ratings for the appearance of 4.75 ± 0.22, colour 4.65 ± 0.37 and consistency 4.7 ± 0.1 were given for dried fruits from conventional fertilization. In terms of taste and aroma, the dried fruits of the control and those fertilizers with organic chicken manure had equally lower scores compared to the dried fruits from organic fertilization and conventional fertilization ($P > 0.05$). The drying method and the applied agrotechniques had a significant impact on the sensory characteristics of the fruits of 'Stanley' ($P <0.05$).

For dried fruits from all variants of fertilization and control, a negative linear dependence was found, with an average coefficient $R^2 = 0.65$ between the sugar-acid coefficient of the fruit and the taste evaluation given by the tasters. (Figure 4). No such dependence was found in fresh plums.

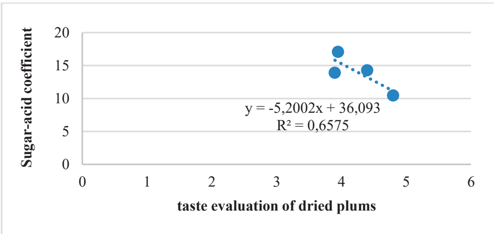

Figure 4. Regression dependence between the sugar-acid coefficient of fresh and the taste evaluation of dried plums

Colour characteristics

According to Pathare et al. (2013), by measuring the color characteristics it is possible to pre-model the nutritional qualities of fresh and processed foods.

The CIELab colour coordinates of fresh plums presented in figure 5 show that the brightness of the fruits had the highest values in the variant of organic chicken manure fertilization (L = 30.88). The results of the other fruits treated with biofertilizers and conventional fertilization were statistically indistinguishable from the control fruits (P > 0.05). With high quantitative values of red (a = 7.68) and yellow colour tone (b = 19.33), colour saturation (C = 20.8), and colour differences (ΔL = 2.83; Δa = 1.99; Δb = 11.9) were the fruits of third variant, with applied chicken manure. The applied agrotechnics (P <0.05) had an impact on the values of the studied indicators.

The red colour tone (a) in the fruits of the other fertilization variants and those of the control did not have statistically significant differences (P > 0.05). The applied fertilizers do not affect the values of the measured indicator (P > 0.05). This also applies to the quality indicator colour tone (a/b) (P > 0.05).

The yellow colour tone (b) and the colour saturation (C) were the lowest quantitatively in the control fruits (b = 7.42; C = 9.35). There were no significant differences in the studied colour parameters in the fruits of the variants of bio and conventional fertilization (P > 0.05). The applied agrotechniques in these two variants did not affect the yellow colour tone and colour saturation.

The change in colour characteristics (L, a, b) in turn can lead to a significant change in the value of the total colour difference (ΔE). According to Adekunte et al. (2010), ΔE can be used to classify differences in visual colour, which can be classified as very different (ΔE > 3), different (1.5 < ΔE < 3) and with a small difference (1.5 < ΔE).

In the present study, insignificant colour differences were found in fruits from the variants of conventional fertilization and bio-fertilization in comparison with the control. The colour difference of fruits from the studied variants of fertilization was influenced only by the organic chicken manure (ΔE = 12.4) (P < 0.05).

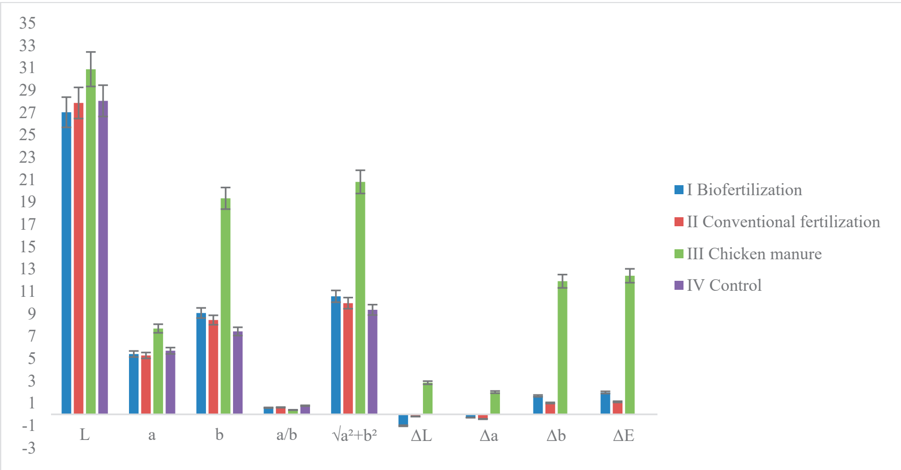

Figure 5. CIELab values and colour indices of fresh plums of 'Stanley' cultivar, according to the fertilization and control variants

After the drying process, the fruits significantly changed their qualitative and quantitative values of color (P < 0.05) (Figure 6).

The dried fruits from bio-fertilization had the highest values according to the studied colour parameters (L = 28.3; a = 7.89; b = 12.55; C = 14.82; ΔE = 13.98) (Figure 6).

Nowacka et al. (2017) state that if ΔE is higher than 2, then the observer will see a clear and visible colour difference between fresh and processed fruits. This statement confirms that the drying process had a significant impact on the studied indicators of fruits from the fertilization variants.

In both variants, fresh and dried fruits, the tendency to dehydrate fruits from the control variant with the lowest values according to the studied colour indicators was preserved (L = 19.99; b = 1.98; C = 3.80).

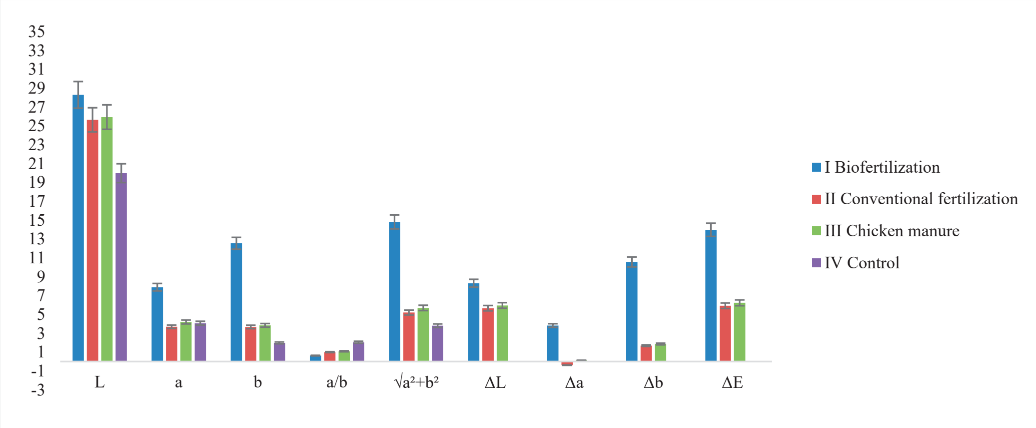

Figure 6. CIELab values and colour indices of dried plums of 'Stanley' cultivar, according to the fertilization and control variants

With average statistically indistinguishable values were the studied colour characteristics red, yellow colour tone, colour tone in dried fruits from conventional fertilization and chicken manure ($P > 0.05$). The applied drying mode did not affect the measured parameters ($P > 0.05$).

The colour difference in the brightness of the dried fruits in the control and the generalized colour difference in the dried fruits treated with organic chicken manure ($\Delta E = 16.63$) ($P < 0.05$) were significant.

The most stable colour was registered in dried fruits treated with biofertilizers, followed by dried fruits from conventional fertilization.

CONCLUSIONS

It was found that fertilization variants affect the quality of fresh fruit. Fruits in the organic chicken manure fertilizer were distinguished with the highest sensory assessment, formed by the indicators, such as appearance, colour, consistency, taste and aroma, and high quantitative values of the colour indicators, such as brightness, red and yellow colour tone, intensity of colour and total colour difference.

It was found that plums drying, by means of a heat pump dryer had an impact on their quantitative values of colour. In the dried fruits of the organic fertilizer variant, the red and yellow components of the colour increased, and in the other variants, including the control, they decreased significantly. The dried fruits from the conventional fertilization were evaluated with the highest sensory evaluation, and with the lowest in the organic fertilization.

REFERENCES

Abasi, S., Mousavi, S. M., Mohebi, M., & Kiani, S. (2009). Effect of time and temperature on moisture content, shrinkage and rehydration of dried onion. *Iranian Journal of Chemical Engineering*, 6(3), 57–70.

Adekunte, A., Tiwari, B., Cullen, P., Scannell, A., & O'Donnell, C. (2010). Effect of sonication on colour, ascorbic acid and yeast inactivation in tomato juice. *Food Chemistry*, *122*(3), 500–507.

Akova, V., Nesheva, M., Staneva, I., Malchev, S., Nikolova, V., Bozhkova, V., & Neshev, N. (2019). Nutrient content in the leaves of young plum trees depending on the rootstock and nitrogen fertilization. *Scientific Papers, Series B, Horticulture*, *LXIII* (1), 103–108.

Barrett, D. M., Beaulieu, J. C., & Shewfelt, R. (2010). Color, flavor, texture, and nutritional quality of fresh-cut fruits and vegetables: desirable levels, instrumental and sensory measurement, and the effects of processing. *Critical Reviews in Food Science and Nutrition*, *50*(5), 369–389.

Bonazzi, C., & Dumoulin, E. (2011). Quality changes in food materials as influenced by drying processes. In: Tsotsas, E., Arun, S., & Mujumdar, A. S., (eds.), *Drying Technology:Product Quality and Formulation* (1st edn., Vol. 3, pp. 1–20). Wiley-VCH Verlag GmbH & Co. KGaA. Published.

Bourne, M. (2002). *Food texture and viscosity. Concept and measurement* (2nd ed.). San Diego [etc.]: Academic Press.

Bruhn, C. M., Feldman, N., Garlitz, C., Harwood, J., Ivans, E., Marshall, M., Riley, A., Thurber, D., & Williamson, E. (1991). Consumer perceptions of quality: Apricots, cantaloupes, peaches, pears, strawberries, and tomatoes. *Journal of Food Quality*, *14*, 187–195.

Calín-Sánchez, Á., Lipan, L., Cano-Lamadrid, M., Kharaghan,i A., Masztalerz, K., Carbonell-Barrachina, Á. A., & Figiel, A. (2020). Comparison of traditional and novel drying techniques and its effect on quality of fruits, vegetables and aromatic herbs. *Foods*, *9*(9), 1261

Chua, L. Y. W., Figiel, A., Chong, C. H., Wojdyło, A., Szumny, A., Lech, K., & Chua, B. L. (2019). Characterisation of the convective hot-air drying and vacuum microwave drying of cassia alata: Antioxidant activity, essential oil volatile composition and quality studies. *Molecules,* 24, 1625.

Costa, C., Antonucci, F., Pallottino, F., Aguzzi, J., Sun, D., & Menesatti, P. (2011). Shape analysis of agricultural products: a review of recent research advances and potential application to computer vision. *Food and Bioprocess Technology*, *4*(5), 673–692.

Demirhan, E. & Ozbek, B. (2009). Color change kinetics of microwave-dried basil*. Drying Technology, 27*(4), 156–166.

Djouvinov, V. & Vitanova, I. (2002). Plum production in Bulgaria. Acta Horticulturae, *577*, 25–31.

Dzhuvinov, V., Dinkova, H., Bozhkova, V., Minev, I., Dragoyski, K., Kutinkova, H., Gercheva, P., Nacheva, L., & Stefanova, B. (2012). *Plum*. Biofruit BG - EOOD, Plovdiv, BG., 138–139.

Ertekin, C. & Yaldiz, O. (2004). Drying of egg plant and selection of a suitable thin layer drying model. *Journal of Food Engineering*, 3, 349–359.

Georgiev, D., Mihova, T., & Georgieva, M. (2019). Effect of fertilization on biochemical composition of fruits of black currant and red currant. *Journal of Mountain Agriculture on the Balkans*, *22*(1), 228–237.

Georgieva, L. & Serbezova, D. (2018). Cultivar structure of plum plantations in Bulgaria. *Journal of Management and Sustainable Development*, *3*, 70.

Hristova, D., Georgiev, D., Ivanova, P., & Stefanova, B. (2020). Quality of fresh and dried Stanley plum after application of conventional and organic fertilizers. *Journal of Balkan Ecology, 23*(1), 81–87.

Hristova, D., Georgiev, D., Markov, E., & Stefanova, B. (2018). Agrochemical soil status for 'Stanley' cultivar plantation. *Journal of Mountain Agriculture on the Balkans*, *21*(4), 220–227.

Hristova, D., Markov, E., Georgiev, D., & Valeva, S. (2017). Assessment of the main agrochemical status of soil in 'Tegera' plum cultivar after organic stockpile fertilization in trenches. *Journal of Mountain Agriculture on the Balkans*, *20*(2), 317–325.

Kandić, M., Mitrović, O., & Popović, B. (2017). The drying curves of plum cultivar Čačanska Rodna. *Journal of Mountain Agriculture on the Balkans*, *20*(2), 283–296.

Kitzberger, C. S. G., Medeiros da Silva, C., Scholz, M. B., Ferreira., M. I. F., Bauchrowitz, I. M., Eilert, J. B., & Neto, J. (2017). Physicochemical and sensory characteristics of plums accesses (*Prunus salicina*). *AIMS Agriculture and Food*, *2*(1), 101–112.

Krokida, M. K., &, Maroulis, Z.B. (2000*). Quality changes during drying of food materials. In: Drying Technology in Agriculture and Food Sciences*. Science Publisher, 61–98.

Krokida, M. K., Maroulid, Z. B. & Saravacos G. D. (2001). The effect of the method of drying on the colour of dehydrated products*. International Journal of Food Science and Technology*, *36*, 53–59.

Kurmanov, N., Shingissov, A., Kantureyeva, G., Nurseitova, Z., Tolysbaev, B., & Shingisova, G. (2015). Research of plum drying process. *CBU International Conference Proceedings*, *ISE Research Institute*, *3*(9), 494–498.

Lancaster, J. E., Lister, C. E., Reay, P. F. & Trigs, C. M. (1997). Influence of pigment composition on skin colour in a wide range of fruit and vegetables. *Journal of the American Society of Horticultural Science*, *122*(4), 594–598.

Maskan, M. (2001). Kinetics of colour change of kiwifruits during hot air and microwave drying. *Journal of Food Engineering, 48*(2), 169–175.

Montefiori, M., Costa, G., McGhie, T. & Ferguson, A. R. (2005). Effects of light and temperature on colour changes in ripening fruit of *Actinidia macrosperma*. *Acta Horticulturae*, 682, 185-190.

Nowacka, M., Tylewicz, U., Romani, S., Dalla Rosa, M., & Witrowa-Rajchert, D. (2017). Influence of ultrasound-assisted osmotic dehydration on the main quality parameters of kiwi fruit. *Innovative Food Science & Emerging Technologies*, 41, 71–78.

Nunez-Vega, A.-M., Hugenschmidt, S., & Hofacker, W. (2012). Numerical Simulation of the Convective Drying of Apple Slices. *DAAAM International Scientific Book* (pp. 339-356). Vienna, Austria.

Okie, W. R. & Ramming, D. W. (1999). Plum breeding worldwide. Horttechnology, *9*(2), 162–176.

Pathare, P. B., Opara, U. L., & Al-Said, F. A. (2013). Colour measurement and analysis in fresh and processed foods: A review. *Food and Bioprocess Technology*, *6*, 36–60.

Pešaković, M., Glišić, I., Tomić, J., Karaklajić-Stajić, Ž., Rilak, B., Mandić, L., & Dukić, D. (2020). Evaluation of innovative and environmentally safe growing practice suitable for sustainable management of plum orchards. *Acta Agriculturae Serbica*, *25*(49), 77–82.

Petrescu, D. C., Vermeir, I., & Petrescu-Mag, R. M. (2020). Consumer understanding of food quality, healthiness, and environmental impact: A Cross-National Perspective. *International Journal of Environmental Research and Public Health*, *17*(1), 169.

Roshanak, S., Rahimmalek, M., & Goli, S.A.H. (2016). Evaluation of seven different drying treatments in respect to total flavonoid, phenolic, vitamin C content, chlorophyll, antioxidant activity and color of green tea (*Camellia sinensis* or *C. assamica*) leaves. *Journal of Food Science and Technology, 53*(1), 721–729.

Silva, E. S. D., Brandao, S. C. R., Silva, A. L. D., Silva, J. H. F. D., Coelho, A. C. D., & Azoubel, P. M. (2019). Ultrasound-assisted vacuum drying of nectarine. *Journal of Food Engineering, 246*, 119–124.

Staneva, I. & Gospodinova, M. (2018). Organic fruit production. *Rastenievadni nauki*, *55*(2), 53–62.
Terefe, N. S., Buckow, R. & Versteeg, C. (2014). Quality-related enzymes in fruit and vegetable products: Effects of novel food processing technologies, part 1: High-pressure processing. *Critical Reviews in Food Science and Nutrition*, *54*(1), 24–63.