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PERSPECTIVES OF RASPBERRY USE IN OENOLOGY

Haidai Iryna[1*], Novak Larysa[1], Matenchuk Liudmyla[1], Novikov Volodymyr[1]

*[1]Faculty of Engineering and Technology, Uman National University of Horticulture, Uman city, Ukraine, *gaydayira35@gmail.com*

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ABSTRACT

The main physical-and-chemical parameters of raspberry of Polka and Zieva varieties were given. Reliable difference between berries of raspberry depending on the variety and the harvest year was determined. Very high correlation dependencies between physical-and-chemical parameters of raspberry berries were established. Organoleptic parameters of raspberry berries were studied and the best variety was defined.

Output of juice from raspberry berries of two pomological varieties was shown, and essential influence of the variety factor and method of squash processing was ascertained. Qualitative parameters of fresh juice from raspberry berries including phenolic substances were under research and the best variety by this parameter was found. Calculations of raspberry juice strength with alcohol to volume fraction of alcohol by 16% were made. The way of using raspberry alcohol juice was proposed.

1.Introduction

Market of alcohol production is quite saturated with quality alcoholic beverages, the volume of production and consumption of beverages is increasing. There is a large number of new varieties of multicomponent alcoholic beverages on the consumer market, which include compositions that can change biological activity of ethyl alcohol.

A wide range of liqueur-and-alcoholic products is based on the use of various vegetative raw materials in the production of semi-finished products - aromatic alcohols, liqueurs, alcoholic juices, fruit drinks, etc. On the one hand, it opens practically unlimited possibilities for the formation of taste, aroma, colour of liqueur-and-alcoholic products, on the other hand, difficulties in determining and rationing of its chemical composition, ensuring of constant and predictable consumer characteristics arise (Kuzmin and others, 2012).

Liqueur-and-alcoholic industry uses a large amount of raw materials which assortment is constantly replenished by new types. Specification and deepening of knowledge regarding biochemical principles of blending of receipt ingredients during production of alcoholic beverages promotes the improvement of the quality of semi-finished products and finished products. The analysis of accumulated domestic and foreign data makes it possible to make corrections in the technological process and expand the raw material assortment for alcohol industry (Holovko and others, 2017, Altinier et al., 2007, Ashurst, 2005), in particular viniculture industry.

Variety of beverages is achieved by using semi-finished products of liqueur-and-alcoholic production which include alcoholic juices, fruit drinks, liqueurs and aromatic alcohols (Domaretsky, 2005; Litovcenko and Tiurin, 2002).

Alcoholic juice is a semi-finished product of liqueur-and-alcoholic or wine production with strength of 16 ... 25%, made by pressing of fruit-berry squash and by bleaching of received juice with rectified ethyl alcohol from food raw materials (Kovalevskaya, 1997).

The main source of many vitamins is natural raw materials, including berries. Berries as a source of vitamins, medicinal remedy and a human digestive regulator have an advantage over other foods. Raspberry is among these berries. This culture is characterized by high nutritional value, a pleasantly delicate aroma, a sweet taste.

Raspberry is a valuable berry culture, spread in all natural-and-climatic zones of Ukraine. It takes the second place after strawberries by taste and dessert qualities. Raspberry berries are eaten fresh, dried, frozen, canned and processed (drinks, juices, syrups, extracts, wines, preserves, jams, etc.). They are delicate, sweet, with a specific aroma. Contain 5-10% of sugars (mainly fructose and glucose), 0.7-2.5% of organic acids (apple, lemon, wine, salicylic), fiber - 5,1%, pectin - 0,6%, vitamin C - up to 50-70 mg/100 g, catechins up to 80 mg/100 g and anthocyanins up to 250 mg/100 g, potassium - 225 mg/100 g, as well as iron, manganese, copper, boron, iodine and vitamins B_2, E , antibiotics, essential oils, sterols. Raspberries prevail over black currant and strawberries by the number of carotene, vitamins B_2 and E. Harmonious ratio of vitamins makes it possible to use raspberry berries for the treatment of ulcerous diseases and various vascular permeability disorders (Georgievsky and others, 1990; Tomenko, 2013; Domaretskyi and Prybylskyi, 2005). Phytotherapists used leaves and branches of raspberry for the preparation of tinctures for treating cough and angina. Ointments for treatment of skin diseases can be made from fresh raspberry leaves. It belongs to the category of the most valuable berries (Yanovsky and others, 2009).

Raspberry berries, in which raw materials of Ukraine are rich, are the real treasury of biologically active substances. They have a clear expressed physiological effect on the human body. Natural resources allow not only to prepare them for local needs, but also to use in a wine-making sector.

The purpose of our work is to study the quality of the use of raspberry berries in viniculture.

2. Materials and methods

The research was conducted in 2015-2016 in conditions of the laboratory of the Department of technology of storage and processing of fruits and vegetables of Uman National University of Horticulture with raspberry of pomological varieties Pegas and Zieva. Raspberry was gathered at the stage of technical ripeness. Preparation of raspberry berries included sorting, washing, removing from the fruit-stalks, inspecting and crushing. It was received juice from raspberry berries by pressing in a laboratory. Enzyme preparation: Fructosim Gx20 in the amount of 0.03% of the weight of the squash in order to obtain a larger output of juice before pressing.

The content of the components of the chemical composition in berries and juice was determined from at least two kilograms of raw materials.

Physical-and-chemical parameters were determined according to generally accepted methods, sampling and preparation for analysis - according to GSTU 46.067-2003; mass concentration of sugars (in terms of invert) by ferricyanide method according to DSTU 4954:2008; mass concentration of titrated acids by titration of 0,1 n alkaline solution (NaOH) according to DSTU 4957:2008; vitamin C by iodometric method

according to GOST 24556-89; mass fraction of dry soluble substances in raw materials and juices by refractometric method according to DSTU ISO 2173: 2007, mass concentration of phenolic substances by using Folin–Ciocalteu reagent. Rectified alcohol with strength of 96% was used for bleaching. Calculations of fortifying by alcohol to volume fraction of alcohol of 16% were carried out according to the general rules KDU 00011050-15.94.10-1: 2008 for processing fruits and berries for wine materials (Lytovcheko and others, 2002).

Researches were conducted in four replications randomized in time. Data processing was performed by using Microsoft Office and Statistica 10 programs. Replicates of each experiment were processed by descriptive statistics to determine the coefficient of variation. In the case of a weak variation of the samples data of each experiment, received values were statistically processed. Connections between the factors were determined by using dispersion and correlation-and-regression analysis (Table 1).

Experiment characteristics:

- number of factors – 2;
- number of blocks – 2;
- number of runs – 10 (nc=4, ns=4, nc_0=1, ns_0=1);
- alpha for rotatability – 1,4142, alpha for orthogonality – 1,4142.

The number of analytical replications – 3. The coefficients of variation by analytical replications were less than 10 which corresponded to a non-significant variation (Moiseichenko, 1992, Maltsev and others, 1973).

Table 1. Steps and levels of experiment variation

Factor	Low Value	Low Label	Center Value	Center Label	High Value	High Label	StarLow Label	StarHigh Label
Temperature, C	30	Low	45	Center Pt	60	High	23,7	66,2
Duration of infusion, minutes	8	Low	16,5	Center Pt	25	High	4,4	28,5

3.Results and discussions

The leading factor determining the activity of plant development was heat and moisture supply. However, these factors were extremely unstable, so two climatic years and two yields can never be the same (Haidai, 2011). The influence of weather conditions affected the formation of raspberry quality. The main parameters characterizing the quality of raw materials for fruit-and-berry winemaking were the mass concentration of dry soluble substances and sugars. For two years of research, berries of Zieva variety in 2016 (Figure 1, a, b) accumulated the mass concentration of dry soluble substances and sugars better – 13.4% and 8.8% respectively.

The important feature of the fruits suitable for processing in fruit-and-berry winemaking is titrated acidity. There was no significant difference between the varieties by accumulation of titrating acids. The mass concentration of titrating acids varied within 1.60-1.92% over two years of research, that is, was quite high (Figure 1, c). Therefore, you need to add water in order to normalize the mass concentration of titrating acids if you have the purpose to make unstrong wine materials from raspberry.

One of the main parameters of consumer quality of fruits in fresh state is the content of vitamin C (Hernández et al., 2006). There was no significant difference between the varieties by accumulation of vitamin C (Figure 1, d).

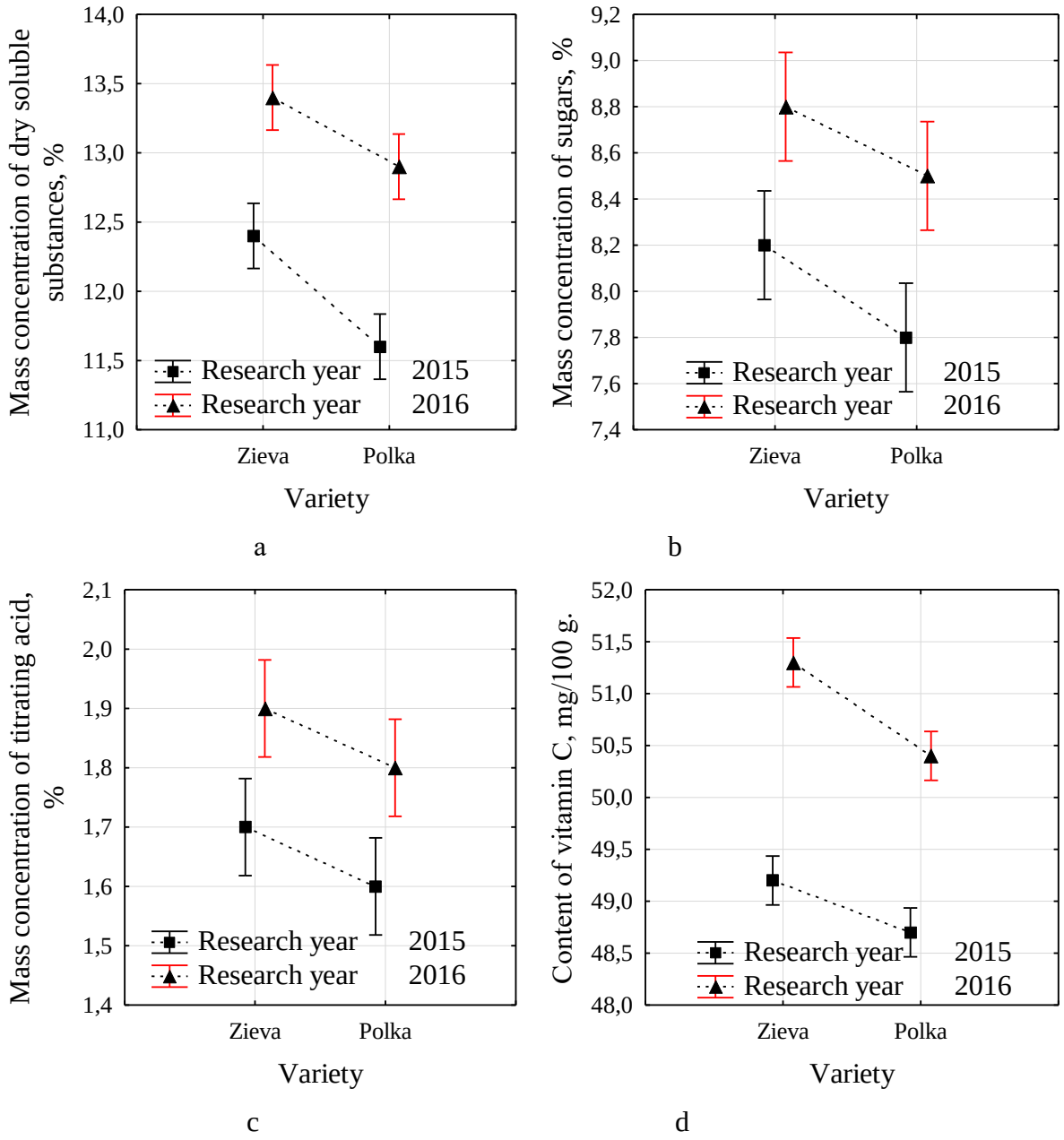

Figure 1. Amount of the components of chemical content of raspberry berries a – Mass concentration of dry soluble substances, %; b – Mass concentration of sugars, %; c – Mass concentration of titrating acid, %; d – Content of vitamin C, mg/100 g.

The content of vitamin C in raspberry berries of Zieva variety in 2015 was 51.3 mg/100g, and the amount of vitamin C in Polka variety in the same year was 50.4 mg/100g.

It was found that the quality of raw materials significantly differed depending on the year of yield and variety.

It was determined very high correlation dependence (r=0.98) between accumulation of dry soluble substances and mass concentration of sugars (Figure 2); (r=0.98) between titrated acidity and sugars content (Figure 3); (r=0,96) between the content of vitamin C and mass concentration of dry soluble substances (Figure 4); (r=0,95) between titrated acidity and dry substances (Figure 5); (r=0.93) between the content of vitamin C and content of sugars (Figure 6); (r=0.92) between the content of vitamin C and titrated acidity (Figure 7).

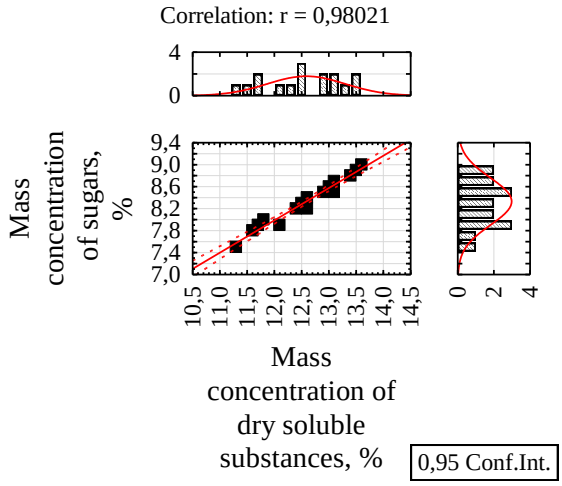

Figure 2. Accumulation of dry soluble substances and mass concentration of sugars

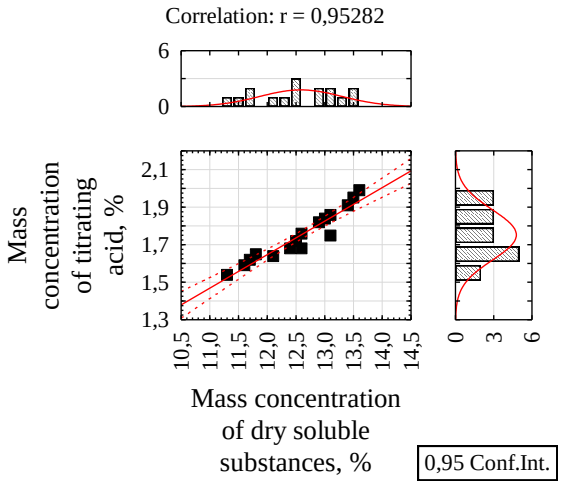

Figure 3. Correlation connection between titrated acidity and sugars content

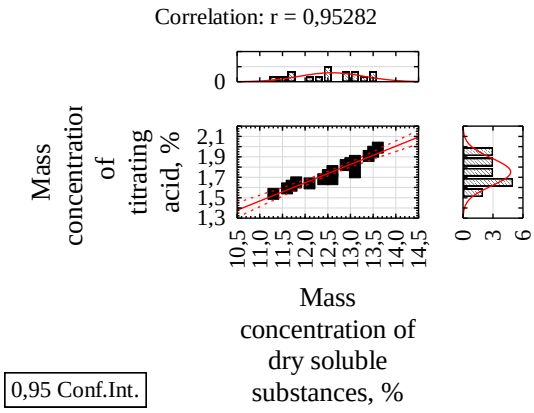

Figure 4. Correlation connection between the content of vitamin C and mass concentration of dry soluble substances

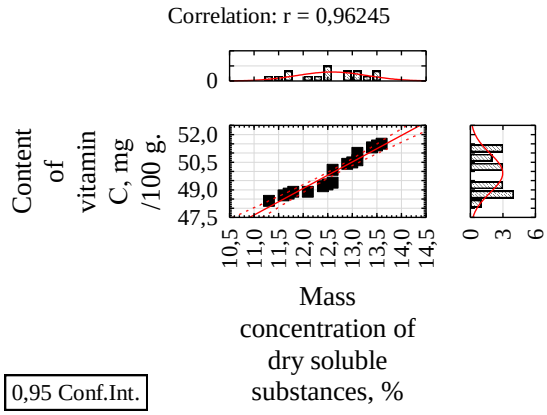

Figure 5. Correlation connection between titrated acidity and dry substances

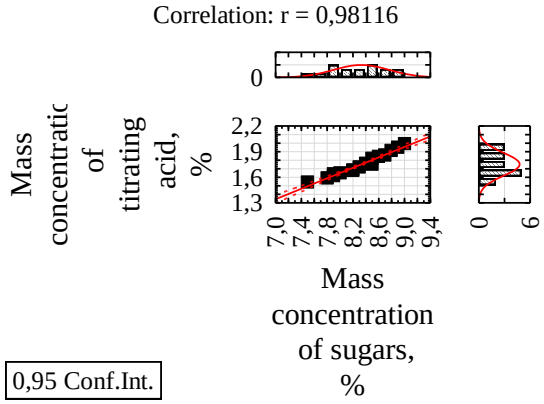

Figure 6. Correlation connection between

the content of vitamin C and content of sugars

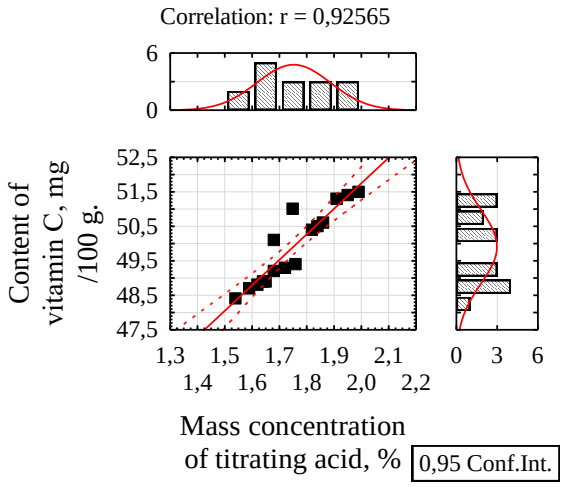

Figure 7. Correlation connection between the content of vitamin C and titrated acidity

The quality evaluated organoleptically is an important market factor. Tasting estimation of raspberry varieties was carried out according to five main features: appearance, colour, aroma, taste and consistency. The analysis of the results showed (Figure 8) that organoleptic characteristics depended to a large extent on the pomological variety of raspberry berries.

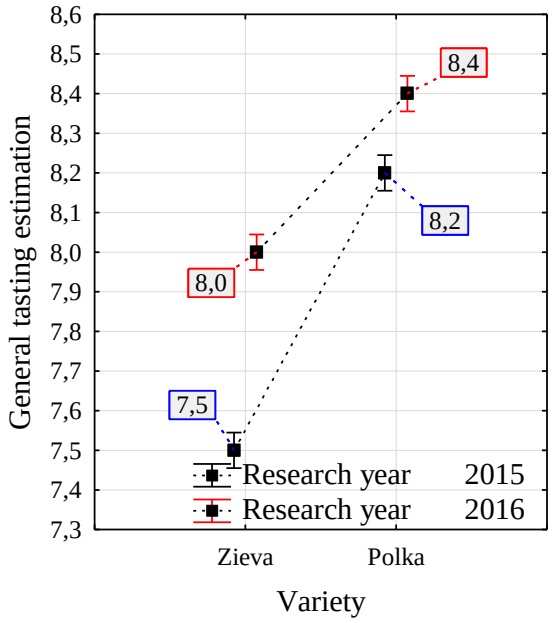

Figure 8. General tasting estimation of raspberries berries, grades

The best berries by general tasting estimation were Zieva variety.

Heat treatment and squash treatment with a pectolytic enzyme preparation was used to increase juice output. The influence of the methods of raspberry pretreatment of Polka and Zieva varieties on juice output is shown on Figure 9.

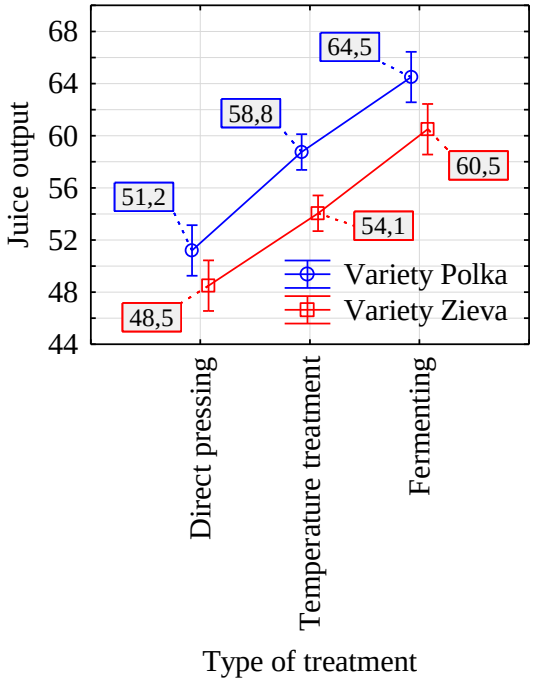

Figure 9. Influence of the methods of raspberry pretreatment of Polka and Zieva varieties on juice output, %

Infusing under temperature regime and extraction increased juice output for both varieties of raspberry. Juice output increases, for Polka variety by 6.5% compared to the control, and for Zieva veriety by 8.3% respectively, comparing the effect of temperature treatment in variants without fermentation.

Fermentation of squash increased juice output for Polka variety by 10.5%, and for Zieva variety by 12% compared with the control variant, that described these variants

as optimal. Factor of the variety and method of squash processing greatly influenced the juice output.

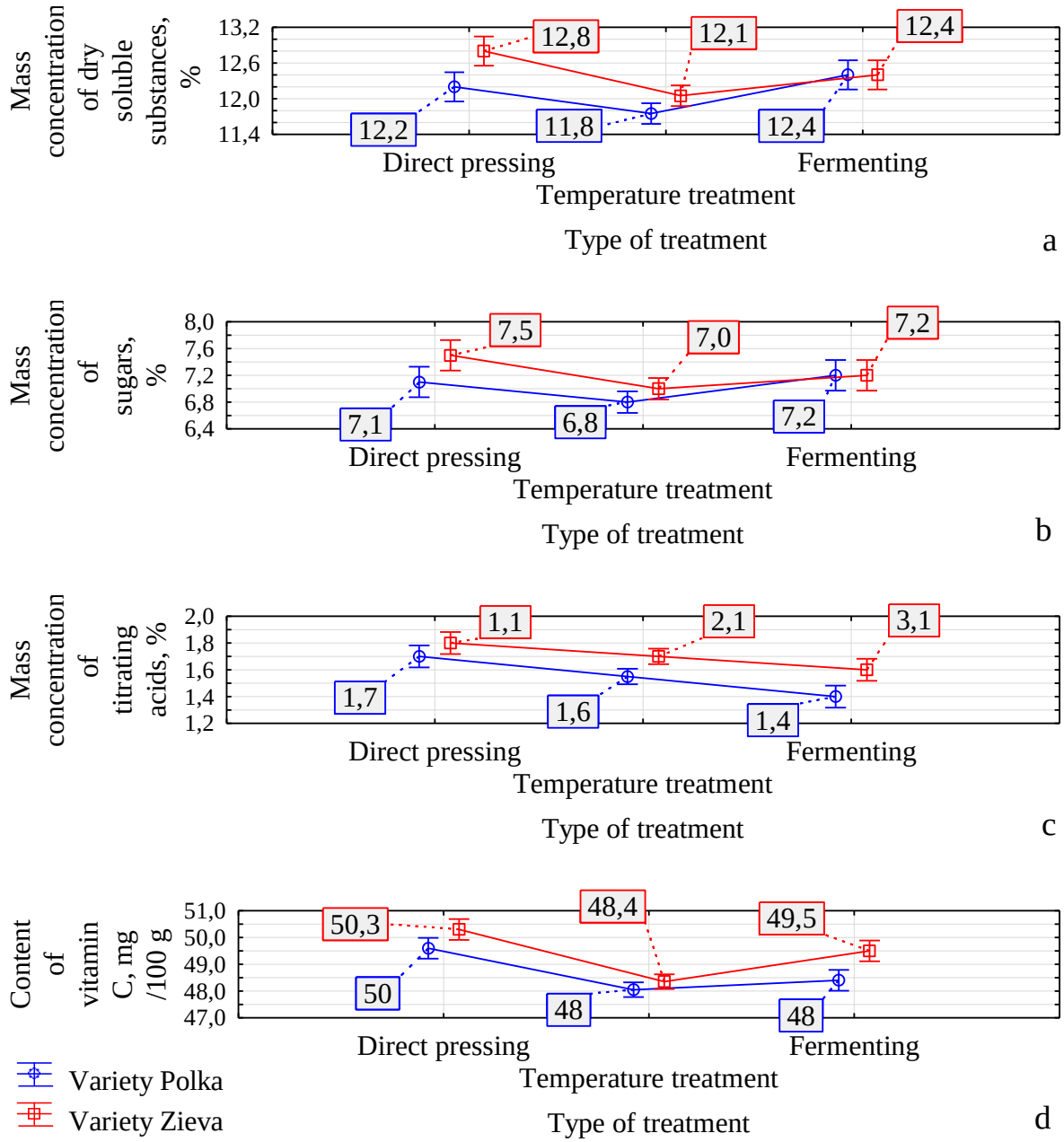

Figure 10. Physical-and-chemical parameters of fresh juice from raspberry berries: a – Mass concentration of dry soluble substances, %; b – Mass concentration of sugars, %; c – Mass concentration of titrating acids, %; d – Content of vitamin C, mg/100 g.

The quality of fruit-and-berry juices and wines depended on the quality and characteristics of raw materials. It was established that mass concentration of dry soluble substances (Figure 10, a), sugars (Figure 10, b), titrating acids (Figure 10, c)

and vitamin C content (Figure 10, d) in raspberry juices of both varieties after temperature treatment and fermentation of squash unsignificantly decreased in relation to the control variant, which meant that physical-and-chemical parameters of raspberry juice of these varieties did not greatly affect the main technological parameters of juices.

Content of phenolic substances became less depending on the method of squash treatment of both varieties (Figure 11).

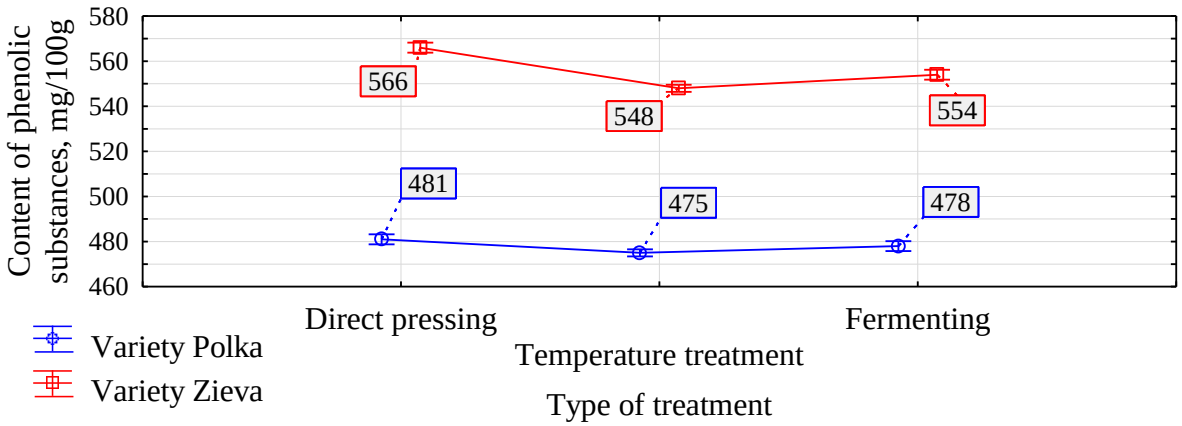

Figure 11. Influence of the methods of raspberry pretreatment of Polka and Zieva varieties on the content of phenolic substances in juices, mg/100g

The difference in mass concentration of phenolic substances between varieties was 85 mg/100 g, and in the variant with heat treatment was 74 mg/100 g in the control variant. Variants with squash fermentation were characterized by reasonably large difference between the content of phenolic substances of 76 mg/100 g comparing the change in the content by mass concentration of phenolic substances; in the result raspberry of Zieva variety turned out to be the best one.

Having studies peculiarities of raspberry berries of Polka and Zieva varieties for the content of the components of chemical composition and the best juice output, we decided to choose Zieva raspberry variety for the further use, which is characterized by a high content of phenolic substances, for enlarging alcoholic juices with biologically active substances in fruit-and-berry winemaking. Rectified alcohol with strength of 96% was used for vinage. Calculations of fortifying raspberry juice of Zieva variety berries with alcohol to the volume fraction of alcohol 16% are given in Table 2.

Table 2. Use of rectified alcohol and output of alcoholic juice on 100 decalitre

Experiment variant	Juice output, %	Amount of fresh juice, decalitre	Use of rectified alcohol 96 %, decalitre	Concentration, decalitre	Output of alcoholic juice, decalitre /100 kg
1. Direct pressing	48,5	46,2	9,102	0,70	54,6
2. Temperature treatment	56,8	54,3	10,698	0,89	64,2
3. Fermentation	60,5	57,7	11,368	0,95	68,2

4. Conclusions

Experiments present practicability of using raspberry of Zieva variety in winemaking which is characterized by a high content of phenolic substances (566-547 mg/100 g), for fortification of alcoholic juices with biologically active substances.

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