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Prelimiary results for a new horticultural product obtained from two table grape varieties

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Abstract
Obtaining finished products in the modern period is one of the main activities of producers and in the case of those specialized in family production business, the main or only source of income. Over time, the vine became food in its raw form, and then various finished products were processed using fruit-bearing grape varieties as raw material. The main objective of the study is to contribute to the development of finished products obtained using raw material grape varieties - Afuz Ali and Italy. Grape samples were harvested at full maturity in October. The quality of the raw material - grapes - was determined by evaluating the amount of sugar (Afuz ali – 133 g/l and Italia – 121 g/l), the total acidity, pH, and weight of 100 berries. A mixture was obtained from both grape varieties by boiling the grapes. Two variants (ascorbic acid and citric acid as preservatives) were created for each variety. For all the resulting variants (Afuz Ali with citric acid / ascorbic acid and Italy with ascorbic acid / citric acid) the dry matter, sugar content, vitamin C, and pH level were determined. The vitamin C was significantly higher in Afuz Ali/acid ascorbic – 89,79 mg/100 sp and in Italia/acid ascorbic – 86,56 mg/100 g sp. The obtained mixture was appreciated organoleptically with favorable results for Italy variants and acid ascorbic variants. The mix was created to capitalize on grape varieties that, under the conditions in Cluj, do not reach full maturity and have a high acidity content.

Key words: horticultural product, table grapes, citric acid, ascorbic acid, organoleptic analysis

Introduction

Ten years ago, the production of table grapes saw dynamic growth globally, with a total output of 27 million tons, marking a nearly 71% increase from the production levels recorded in 2000 [6]. In Europe, the overall trend is to reduce the cultivated areas of table grape vineyards, but Italy, Spain, Greece, and Bulgaria collectively accounted for 27.2% of global table grape production in 2014. Global exports of table grapes in 2014 amounted to 4.2 million tons, marking a 50% increase from the 2.8 million tons reported in 2000. The main drivers influencing international trade in table grapes are primarily linked to evolving consumer preferences and the emergence of new producers and exporters [5].The transformation necessitates changes in wholesale and retail trade, advancements in cultivation techniques as suggested by Hooker et al. [7], enhancements in the storage, packaging, and transportation of goods, and the implementation of information and communication technologies [11], [12].

In the past thirty years, Romania has experienced a 73.47% decrease in the total area dedicated to table grape production, along with a 63.34% reduction in actual production. During this time, there has been an evident imbalance in the distribution of table grape growing areas in Romania, particularly in the significant reduction of areas classified as very favorable and favorable for table grape cultivation [3].

After 2010, there has been a consistent rise in the consumption of fresh grapes. In 2014, Romania experienced a 625% increase in the import of fresh grapes compared to the year 2000. The import value, which includes dried grapes, saw a surge of 2862% between 2011 and 2017 when compared to the period of 1991 to 1995 [4]. Grapes could be used as fresh fruit and as processed fruit in the form of grape juice, jam and jelly, molasses, and raisins [8]. In this aspect, there is a important amount of grapes that could remained unselled and this method of processing would save the product.

Although, in the years in which the varieties were obtained, climate change was modestly anticipated and the possibility that they could be cultivated in/an area less friendly for obtaining raisins, the results obtained demonstrate this advantage of them [13].

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Material and Method

During 2021 harvest season, grape samples were collected from Ampelographic Collection of Faculty of Horticulture and Business in Rural Development of University of Agricultural Sciences and Veterinary Medicine UASVM of Cluj Napoca (46°46′0″N, 23°35′0″E). The collection is located in the center part of Transilvania (northwest of Romania), and this region is not included in a traditional viticultural area, but the climatic condition of the 2021 year, favored the ripening of grapes. Two kilograms of grapes samples from both varieties 'Afuz ali' and 'Italia' – table grapes were collected. One kilogram was used for biochemical analysis and the other kilogram were used for processing.

After weighing the samples, the content of sugar, total acidity level and pH was determined. The samples were analyzed in the Laboratory of Oenology of UASVM Cluj-Napoca, for each sample, three repeats were used. The determination of sugar in must samples was performed using the hand refractometer, according to Bora et al., 2014. The total acidity level of the must samples, was made by titration method in the presence of phenolphthalein, expressed in g/L H2SO4, according to Bora et al. 2014 [1]; Călugăr et al., 2022 [2].

The motivation for obtaining this proccessed product was to capitalize on the grapes from these two late-ripening table varieties, which in the Cluj area, due to the climatic conditions, do not reach full maturity and remain with a high level of acidity. After harvesting, the berries were manually separated from the rachis, washed, dehulled and the seeds were removed. From each variety, 500 g of berries were used. The berries were boiled separately by variety. They were boiled on an electric stove for 30 minutes, stirring the contents every few minutes to prevent them from sticking to the walls. During boiling, 20 g of sugar was added for each variant. After cooling the dressing mix, the contents were put into 100 ml jars where 1 g of ascorbic acid was added - for one variant and 1 g of citric acid for the second variant (Figure 1 and Figure 2).

The biochemical determinations of the final product were carried out in the laboratory of the Horticultural Products Technology discipline, such as: soluble dry substance by the refractometric method, acidity by the titrimetric method, C vitamin by the iodometric method; using the standardized methodologies presented in the specialized literature [9].

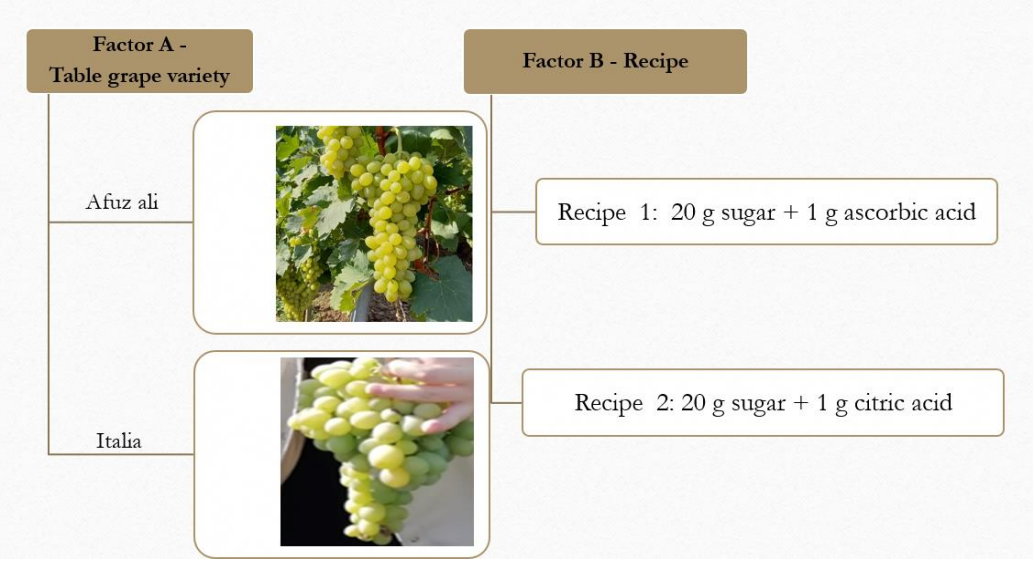

Figure 1. The biological material and the experimental variants

The organoleptic evaluation of the grape dressing was for color, aroma, consistency, transparency/clearness, external appearance and homogeneity. The samples were presented to 11 students from the Horticulture specialization, comparing them and assigning them grades between 1-5, where 1 represents extremely unpleasant and 5 represents extremely pleasant.

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Figure 2. Tehnological process to obtain the mix – the horticultural product

Results and Discussions

Proximate chemical composition of table grapes variety were registered as follow – 133 g/l sugar content for Afuz ali and 121 g/l sugar content for Italia grape variety. The total acidity was measured by tritrimetric method, with values of 4.76 g/l tartric acid for Afuz ali and 4.06 g/l tartric acid for Italia (Table 1).

Table 1. Table grape chemical composition

Tabel grape variety	Grape weight [g]	Sugar content [g/l]	Total acidity [g/l tartric acid]	pH
'Afuz ali'	543.0***	133*	4.76^{ns}	3.32**
'Italia'	512.0 ^{ooo}	121^{o}	4.06^{ns}	3.02^{oo}
Mean of experience	527.5	127	4.41	3.18

Grape jams – horticultural product prepared on laboratory scale by boiling of grape resulted from removal of spared from stem, skin and seeds. The boiling was continue at 30 minute, at 80°C and by ading 20 g of sugar for both variants. After cooling the product, was poured in 100 ml jars by adding 1 g of ascorbic acid (R1) and 1 g of citric acid (R2). Tables 2 and 3 shows the contents of dry matter, as well as vitamin C after grapes proccesing, For both variant, the recipy with ascorbic acid had highest content of dry matter 48.81 % - Afuz ali and 42.54 % - Italia. Vitamin C content was significantly higher in variants with ascorbic acid for both table grapes varieties, than in variants with citric acid (Table 2 and 3).

Table 2. Chemical analysis of 'Afuz ali' grape product – after proccesing

'Afuz ali'	Dry matter [%]	pH	Vitamin C [mg/100 g f.w.]
Ascorbic acid	48.81**	3.67*	89.79***
Citric acid	47.46 ^{oo}	3.58^{o}	47.69^{ooo}
Mean of experience	48.44	3.62	68.74

Table 3. Chemical analysis of 'Italia' grape product – after proccesing

'Italia'	Dry matter [%]	pH	Vitamin C [mg/100 g f.w.]
Ascorbic acid	42.54^{ns}	3.62*	86.56***
Citric acid	41.89^{ns}	3.53^{o}	45.23^{ooo}
Mean of experience	42.22	3.57	65.89

The content of soluble dry matter in grapes can fluctuate according to several factors (genetic, biological, ecological, technological). Tables 2 and 3 shows the contents of dry matter, as well as vitamin C after grapes proccesing, For both variant, the recipy with ascorbic acid had highest content of dry matter

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Grapes berries contains a significant amount of soluble dry matter, as they could be photosynthetic organs of the plant and contain a variety of organic substances necessary for plant metabolism and growth. Regarding the influence of the content of soluble dry matter, it is found that, regardless of the variety, it depends on the variant recipes values. Analyzing the significance of the differences of the two resulting variants, the 'Italia' variety stands out with a content of 48.81 % for ascorbic acid variant and 47.46 % for citric acid variant, with a significant difference from the experience average of 48.44 % (Table 2). The lowest values results were recorded for the 'Afuz ali' variety, with a values of 42.54 % for ascorbic acid, and 41.89 % for citric acid variant (Table 3).

It is important to note that the acidity of grapes can also be different, depending on the eco-pedological conditions (altitude, climate, soil and other environmental factors). It is also possible that some varieties of grapes have different levels of acidity, and this can also be influenced by the stage of development on harvest. The significance of the differences of the two varieties after proccessing in terms of the pH content (Table 2 and Table 3), shows that the variety 'Afuz ali' registers a pH of 3.62 (as a mean of experience), being in close proximity of the variety 'Italia' with a mean of experience pH value of 3.57. Those data are higher than pH value from grape, before proccessing due to the adding of ascorbic acid and citric acid as preservatives for the new horticultural product.

C vitamin, also known as ascorbic acid, is an antioxidant essential to human health, being involved in numerous metabolic processes and having multiple health benefits, including boosting the immune system and protecting against free radicals. Grapes are not known to be a rich source of C vitamin, compared to other horticultural species such as citrus fruits or berries, but it can still contain a significant amount of this vitamin. C vitamin is a powerful antioxidant that can help protect plant cells against oxidative stress. The C vitamin content of the horticultural product shown in Table 2 and Table 3, records high values for variant for which ascorbic acid was used as a preservative method. The content of vitamin C for 'Afuz ali' grape proccessed product was 89.79 mg/100 g.f.w for variant with ascorbic acid, significantly higher content against 47.69 mg/100 g.f.w for the variant with citric acid. Similar situation is also for 'Italia' grape proccessed product (86.56 mg/100 g.f.w for variant with ascorbic acid, significantly higher content against 45.23 mg/100 g.f.w for the variant with citric acid).

Vitamin C content in leaves can be influenced by environmental factors such as sunlight, temperature and nutrient availability. An increased content of soluble dry matter can be associated with better photosynthesis and better absorption of nutrients, which can also stimulate the production of vitamin C.

The external appearance and uniqueness of the grape dressing was assessed visually, through the analysis of the tasting sample. Scores ranged from 1 (unpleasant) to 5 (pleasant). The total number of respondents was 10. The data obtained in the questionnaire were analyzed and their average represented graphically was obtained. Following the organoleptic assessment, it was found that the mix obtained from the Italia variety obtained the highest average for appearance and homogeneity (3.8). Using this machine, the whole beans were very well crushed and the external appearance pleasant, thanks to the coloring pigments in the skin.

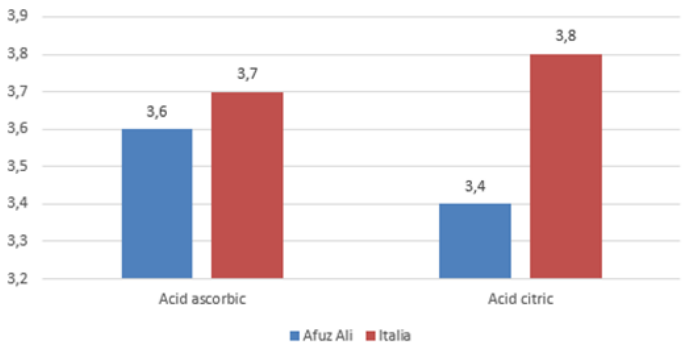

Figure 3. Homogeneity and external appearance of horticultutal product

The characteristics regarding color, aroma and consistency were assessed visually and by taste. The color must be uniform, corresponding to the color of the fruit from which the dressing is made. Darker shades are allowed in light colored juices/other products and insignificant discoloration of darker colored fruit

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juices/other products. Also, the taste and aroma must be natural, well pronounced, corresponding to the fruits from which the juice was obtained. In no case, foreign taste and smell are not allowed.

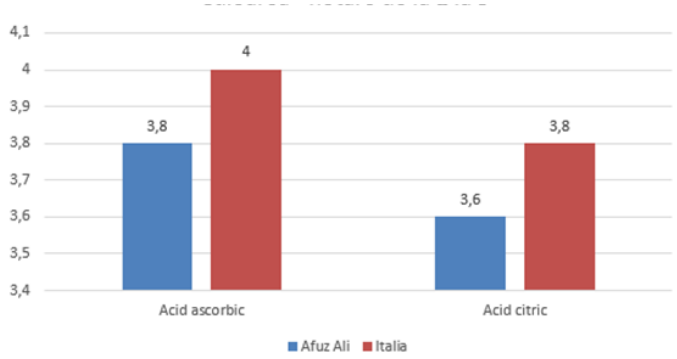

Figure 4. Color of the horticultural product

Regarding the homogenity and general aspect of horticultural product, the variant obtained from Italia had the highest values against the Afuz ali (Figure 3). The same aspect was observed for the color parameter, according to the assessor, the product obtained from Italia, had a better color than Afuz ali. Regarding the color, the highest score (4) following the organoleptic assessment was obtained by the dressing-mix variant from the Italia variety with ascorbic acid. The same value of the appreciation notes on the color (3.8) was obtained for the variants from the Afuz ali variety with ascorbic acid and from the Italia variety with citric acid (Figure 4). The lowest value (3.4) in terms of dressing color was obtained for the Afuz ali variant with citric acid. This was probably due to the initial color of the grapes of the Afuz ali variety being greener compared to the Italia variety (yellow berry color).

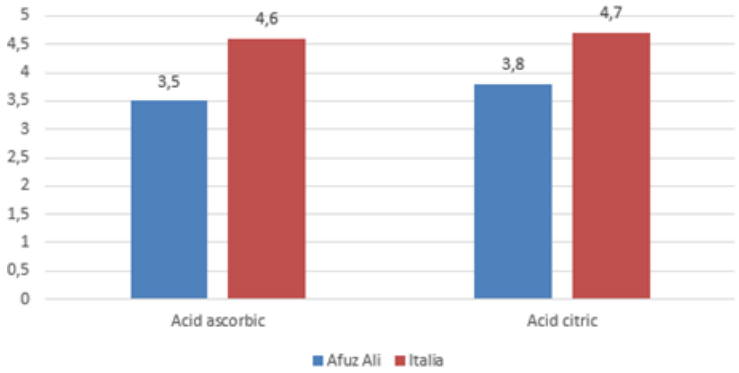

Figure 5. Aroma of the horticultural products

Regarding the aroma (Figure 5), this character was appreciated by taste. In the variants where the Italia variety was used, the aroma was better perceived. For these variants, the grades obtained were 4.6 – for the dressing variant with ascorbic acid and 4.7 for the dressing variant with citric acid. The Italia variety, being an aromatic variety, also perceived the aroma of Muscat, comparing the variants from the Afuz ali variety. According Figure 3 – the assesors prefered the product obtained from Italia grapes, maybe due to the natural aroma of this variety. Following the organoleptic assessment, the Afuz ali variety dressing variants scored 3.5 – the variant with ascorbic acid and 3.8 – the variant with citric acid.

Grapes are perishable commodities with substantial nutritional profiles and health benefits. Post-harvest shelf life of grapes is too short so the development of value-added products like jam, juices, jellies or other types of products will be a great approach to commercialize [10].

Conclusions

Recovering the raw material from wasting and obtaing the new horticultural products are a main objective of food waste management. This new horticultural product could be industrially produced, due to the large amounts of raw material from table grape industry. This product satisfy the need of consumers for

different and divers new product in the market, that could be used in menues and salad garnish due to high acidity, which gives a taste of freshness.

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