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Effects of Different Levels of Sugar in Wine Production from Grapefruit

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ABSTRACT

The present research work entitled "Effect of different levels of sugar in wine production from Grapefruit" was undertaken in the Post- Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2020-2021. There were eight treatments under observation they are T_1Grapefruit juice (700 ml) + Sugar (200g) + Wine yeast (1.2 g) T_2 Grapefruit juice (700 ml) + Sugar (250 g) + Wine yeast (1.2 g), T_3 Grapefruit juice (700 ml) + Sugar (300 g) + Wine yeast (1.2g), T_4 Grapefruit juice (700 ml) + Sugar (350 g) + Wine yeast (1.2 g), T5 Grapefruit juice (700 ml) + Sugar (400 g) + Wine yeast (1.2 g),T_6 Grapefruit juice (700 ml) + Sugar (450g) + Wine yeast (1.2 g), T_7 Grapefruit juice (700 ml) + Sugar (500 g) + Wine yeast (1.2 g) and T_8 Grapefruit juice (700 ml) + Sugar (550 g) + Wine yeast (1.2g). The experiment was laid out in CRD (Complete Randomized Design) with 8 treatments replicated thrice. Here attempt of preparation of wine were done and its physical and sensory quality was evaluated to determine its suitability. Analysis revealed that the sensory quality was increased when the treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine Yeast 1.2g) was used for wine preparation. The treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine Yeast 1.2 g) was found superior in respect of the parameters like Total Soluble Solids, Acidity, pH, Alcohol content, Specific gravity. With respectively Colour and Appearance, Taste, Aroma and Overall acceptability also T_3 was found best.

Keywords Grapefruit, Wine, Sugar, Yeast, Juice.

INTRODUCTION

In recent years, increasing interest in human health, nutrition and disease prevention has enlarged consumer's demand for functional foods including fruits and their products such as wine. Functional or health-enhanced foods include "those in which the concentrations of one or more ingredients have been manipulated or modified to enhance their contribution to a healthy diet". The functional interest in

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wine, particularly red wine can be traced to the term "French paradox" referring to the observation that French people consume a high saturated fat diet, but their mortality rate from coronary heart disease is low because of high wine consumption. Long-term moderate consumption of wine has reportedly reduced the incidence of ailments such as risk of coronary heart disease, atherosclerosis and cancers, attributed to phytoalexins like resveratrol present in wine which have cancer chemo-preventive activity. Recent study suggests that, wine consumption is correlated with reduction of neurodegenerative disorders associated to oxidative stress such as Alzheimer's and Parkinson's diseases. With these evident potential health benefits of wine, interest in fruit wines have been accordingly aroused and nowadays consumers are perceiving wine as a healthy product. In recent years, grapefruit wine as value-added product has become more popular because of its appealing flavor, it is one of the non-vintage wines which is produced and fermented in a manner similar to grape wine. The produce wine is said to have a tarty and tangy taste with an underlying sweetness. Major steps involved during production of wine from grapefruit includes peeling and cutting of fruit, juice extraction, fermentation, clarification, bottling and maturation. Preparation of wine from fruits other than grapes has increased in recent years, such as kiwi, banana, mango, cocoa and cupuassu, wherein apples and oranges have been widely used. Wine ageing and its ability to potentially improve wine quality for its consumption is most important step after wine production. Storage is an important consideration for wine that is being kept for long-term ageing and, fresh wine should be aged till it is drinkable and marketable, thus the evolution of the product in the bottle before its consumption is very important.

MATERIALS AND METHODS

The present research work entitled "Effect of different levels of sugar in wine production from Grapefruit" was undertaken in the Post- Harvest Laboratory, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2020-2021. Eight treatment combinations viz. T_1- Grapefruit juice (700 ml) + Sugar (200 g) + Wine yeast (1.2 g), T_2- Grapefruit juice (700 ml) + Sugar (250 g) + Wine yeast (1.2 g), T_3- Grapefruit juice (700 ml) + Sugar (300 g) + Wine yeast (1.2 g), T_4- Grapefruit juice (700 ml) + Sugar (350 g) + Wine yeast (1.2 g), T_5- Grapefruit juice (700 ml) + Sugar (400 g) + Wine yeast (1.2 g), T_6- Grapefruit juice (700 ml) + Sugar (450 g) + Wine yeast (1.2 g), T_7- Grapefruit juice (700 ml) + Sugar (500 g) + Wine yeast (1.2 g), T_8- Grapefruit juice (700 ml) + Sugar (550 g) + Wine yeast (1.2 g), were applied during the research work. The grapefruit wine was analyzed for the following quality parameters during fermentation and storage. In order to judge the suitability of grapefruit fruit in preparation of wine, it is necessary to have a closer look on its physico- chemical composition. The observations were recorded as TSS ^{0}Brix), Titratable acidity (%), pH, Alcohol content (%), Specific gravity, Color and Appearance, Taste, Aroma, Overall acceptability.

The Grapefruit, fresh, ripe and matured were purchased from a local market at Khan chauraha, Maheva, Prayagraj on 28th January 2021, stored at room temperature. At its optimum and wholesome stage for wine production the fruits were washed, weighed and must prepared from it. On 30th January 2021 processing was started. Commercial wine yeast *Saccharomyces cerevisiae* Lalvin (EC-1118) used in fermentation was obtained from vinsura winery Pvt Ltd, lasalgaon Nashik, Mumbai. Lastly, most of the equipment's used were supplied from the University laboratory. The fruits were selected and washed with tap water, skin peeled, sliced and cut into pieces and pulverized using sterile Philip electric blender with the addition of water. The slurry was further diluted in a ratio of 1:1 (water and pulp) and sieved with a muslin cloth of pore size 0.8 mm to obtain the filtrate "must". Chaptalization and supplementation of the "Must". The methods of Amerine and Kunkee as used by Robinson were used. These bottled juices were cold stored till further experiments were conducted. Bottles were washed thoroughly with hot water and kept it for sun dry and get it sterilized. The yeast starter culture was prepared from a known quantity of the must for fermentation, small quantity of sugar, yeast and a known volume of water. The mixture of all these were treated and allowed to stand for 24 h. Approximately 200 ml of water was boiled and allowed to attain 37 °C and 200 ml of the mixture of

grapefruit must respectively treated with sugar was added. Exactly 3.7 ml representing approximately 108cfu/ml (measured using McFarland standard) of the yeast (*S. cerevisiae*) after centrifugation was added to the mixture, stirred properly and allowed to stand for 24 h before use. The following parameters were monitored before and during fermentation process are; Specific gravity, pH, Titratable acidity, Total soluble solid and Alcohol content. The primary fermentation was initiated by the addition of the starter culture. The must was stirred every 12 h with subsequent reading of the specific gravity, pH, temperature and alcohol content for 4 days. After 4 days, the wine was racked into the secondary fermenter. The secondary fermentation was done in an air tight container in which a tube was passed into a clean bottle containing clean water. The essence was to monitor the course of fermentation. This was allowed until completion of fermentation as was evidenced by lack of the appearance of bubbles in the container usually within 3 weeks. Secondary fermentation was done for 21 days. When fermentation stopped, the wine was promptly racked on the lees ensuring mini-mum exposure to oxygen, the upper liquid was transfer to the other clean container in order to remove impurities. Then the mixture continued to ferment at 20°C for more days. After that, under the storage conditions of 20°C aged 3 months. Microbial analysis, alcohol, sugar content, specific gravity, titratable acidity and pH of the wine were also monitored at the end of the secondary fermentation. After completion of fermentation, the obtained wine was siphoned off and filtered through a clean sterilized muslin cloth, Whatman No.1 filter paper, sieve and syphon tubes sterilized by 70 % alcohol and collected in sterile glass jars. The wine was racked for a period of 3 weeks to clear the wine. The residues were removed and the filtrates were allowed to mature before other chemical analysis was carried out. Clarification is an important procedure in wine production as the fermented wine contains sediments. After clarification, the wine was kept in the refrigerator for maturation (2 weeks) and then packaged for further analysis. Wine ageing and its ability to potentially improve wine quality for its consumption is most important step after wine production. After maturation, the supernatant was taken off and transferred into fresh sterile bottles, corked and subjected for pasteurization at 82^{0}C for 20 minutes. After cooling, further allowed to age in long neck 750 ml bottles for 17 days at 22-25^{o}C before analysis. The wine was analyzed for physi-co- chemical properties at 30 days interval after 30 days from fermentation i.e., 30, 60, 90 days. Wines were also evaluated organoleptically after maturation with panel of judges for knowing the acceptance by different categories of consumers.

RESULTS AND DISCUSSION

Total soluble solids of wine, at the end of fermentation period, is an important quality parameter and an indicative of the stability and completeness of fermentation. From the result obtained in Table 1, it has been concluded that the lowest score of TSS (6.92) after storage was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine yeast 1.2 g). The total soluble solids content of grapefruit wine was showed decreasing trend in all grapefruit wine during storage. The decrease in total soluble solids content of grapefruit wine with different levels of wine yeast and sugar during storage may possibly be due to fermentation of sugars into alcohol by the action of yeast. In general, reduction in TSS was a function of time and was evidently due to the fermentation of sugar by the yeast. The above results are similar with the findings of Akubor *et al*. (2001), Isitua and Ibeh (2010) and Jadhav *et al.* (2016).

From the result obtained in Table 1, the highest score of Alcohol content (7.23) was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine yeast 1.2g) followed by treatment T_2 (Grapefruit juice 700 ml + Sugar 250 g+ Wine yeast 1.2 g) with (6.57), whereas the minimum score was observed in treatment T_8 (Grapefruit juice 700ml + Sugar 550 g + Wine yeast 1.2 g) with (2.44) during storage. The trend of alcohol increase or TSS fall during fermentation was similar to the fermentation behavior of any fruit to make wine. The increase in Alcohol content of grapefruit wine with different levels of wine yeast and sugar during storage may possibly due to the variation in performance of the yeast to utilize the fermentable sugars affecting the fermentability, hence the varied alcohol production. The above results are similar with the findings of Chowdhury and Ray (2007), Idise (2011) and Kiin *et al.* (2019).

Table 1. Effects of different levels of sugar on the physico-chemical properties, quality and acceptability of grapefruit wine.

Treatments	TSS (^{0}Brix)	Alcohol content	Acidity (%)	pH	Specific gravity	Color and appearence	Taste	Aroma	Overall acceptability
T_1 Grapefruit juice (700 ml) + Sugar (200 g) + yeast (1.2 g)	7.83	6.12	0.70	3.91	1.07	5.33	6.00	6.67	5.00
T_2 Grapefruit juice (700 ml) + Sugar (250 g) + yeast (1.2 g)	7.75	6.57	0.67	3.84	1.05	6.33	7.00	6.67	6.67
T_3 Grapefruit juice (700 ml) + Sugar (300 g) + yeast (1.2 g)	6.92	7.23	0.63	3.82	0.96	7.67	8.00	7.67	7.67
T_4 Grapefruit juice (700 ml) + Sugar (350 g) + yeast (1.2 g)	8.97	5.24	0.76	4.11	1.16	4.66	5.67	5.00	4.67
T_5 Grapefruit juice (700 ml) + Sugar (400 g) + yeast (1.2 g)	11.16	4.17	0.86	4.57	1.24	5.00	5.33	4.67	5.33
T_6 Grapefruit juice (700 ml) + Sugar (450 g) + yeast (1.2 g)	12.56	3.46	0.93	4.73	1.35	4.66	4.66	3.67	4.33
T_7 Grapefruit juice (700 ml) + Sugar (500 g) + yeast (1.2 g)	14.70	2.94	0.97	5.02	1.89	5.00	4.33	4.67	4.00
T_8 Grapefruit juice (700 ml) + Sugar (550 g) + yeast (1.2 g)	15.47	2.44	1.10	5.13	1.94	3.00	3.00	3.00	3.00
SEd (±)	0.06	0.022	0.008	0.019	0.019	0.588	0.41	0.38	0.35
CD at 5%	0.128	0.048	0.018	0.041	0.041	1.288	0.83	0.77	0.74

From the result given in Table 1, the lowest score of Acidity (0.63) was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine yeast 1.2 g), followed by treatment T_2 (Grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (0.67), whereas the maximum score was observed in treatment T_8 (Grapefruit juice 700 ml + Sugar 550 g + Wine yeast 1.2 g) with (1.10) during storage. The increase in Acidity of grapefruit wine with different levels of wine yeast and sugar during storage may possibly be due to the effect of different yeast strain and fermentation period. The above results are similar with the findings of Kumar *et al.* (2009) and Reddy *et al*. (2010).

From the result obtained in Table 1, the lowest score of pH (3.82) was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine yeast 1.2 g) followed by treatment T_2 (Grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (3.84), whereas the maximum score was observed in treatment T_8 (Grapefruit juice 700 ml + Sugar 550 g + Wine yeast 1.2 g) with (5.13) during storage. Variation observed was due to the effect of different yeast strain and fermentation period. Studies have shown that during fermentation of fruits, low pH is inhibitory to the growth of spoilage organisms but create conducive environment for the growth of desirable organisms. Also, low pH and high acidity are known to give fermentation yeast comparative advantage in natural environments. The above results are similar with the findings of Clemente and Scapim (2005) and Kiin *et al*. (2019).

As results obtained in Table 1, the lowest score of Specific gravity (0.96) was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g+ Wine yeast 1.2 g) followed by treatment T_2 (Grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (1.05), whereas the maximum score was observed in treatment T_8 (Grapefruit juice 700 ml + Sugar 550 g + Wine yeast 1.2 g) with (1.94) during storage. The maximum score of colour and appearance (7.667) was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine yeast 1.2 g), followed by treatment T_2 (Grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (6.333) whereas the minimum score was observed in treatment T_8 (Grapefruit juice 700 ml + Sugar 550 g+ Wine yeast 1.2 g) with (3.000) during storage. The specific gravity of the Garpefruit wine produced in this study reduces as the fermentation days of the wine increases. The decrease in Specific gravity of Grapefruit wine with different levels of sugar during storage may possibly be due to the type of yeast used in the wine production. The above results are similar with the findings of Uma-

shankar *et al*. (2014) and Jadhav *et al.* (2016).

In Table 1 it was concluded that, the maximum score of Taste (8.000) was observed in treatment T_3 (grapefruit juice 700 ml + Sugar 300 g + Wine yeast 1.2g) followed by treatment T_2 (grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (7.000) whereas the minimum score was observed in treatment T_8 (Grapefruit juice 700 ml + Sugar 550 g+ Wine yeast 1.2 g) with (3.000) during storage. The maximum score of Aroma (7.667) was observed in treatment T_3 (Grapefruit juice 700 ml + Sugar 300g + Wine yeast 1.2 g) followed by treatment T_2 (grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (6.667) whereas the minimum score was observed in treatment T_8 (Grapefruit juice 700 ml + Sugar 550 g+ Wine yeast 1.2 g) with (3.000) during storage. The maximum score of Overall acceptability (7.667) was observed in treatment T_3 (grapefruit juice 700 ml + Sugar 300g + Wine yeast 1.2 g) followed by treatment T_2 (grapefruit juice 700 ml + Sugar 250 g + Wine yeast 1.2 g) with (6.667) whereas the minimum score was observed in treatment T_8 (Grapefruit juice 700ml + Sugar 550g+ Wine yeast 1.2 g) with (3.000) during storage. Based on findings of the present experiment it is concluded that treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine Yeast 1.2 g) was found superior in respect of the parameters like Total Soluble Solids, Acidity, pH, Alcohol content, Specific gravity. With respectively Colour and Appearance, Taste, Aroma and Overall acceptability also T_3 was found best.

CONCLUSION

Based on findings of the present experiment it is concluded that treatment T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine Yeast 1.2 g) was found superior in respect of the parameters like Total Soluble Solids, Acidity, pH, Alcohol content, Specific gravity. With respectively Color and Appearance, Taste, Aroma and Overall acceptability also T_3 (Grapefruit juice 700 ml + Sugar 300 g + Wine Yeast 1.2 g) was found best.

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