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Response of Different Sources of Sugar on Production and Quality Analysis of Banana (*Musa paradisiaca*) Fruit Wine cv. Grand Naine

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ABSTRACT

*The present study was carried for the evaluation of production and quality assessment of banana wine as affected by different sources of sugar such as table sugar, jaggery and sucrose. The pulp was maintained to 29°Bx and was inoculated with Saccharomyces cerevisiae (Brewers's Yeast) for primary fermentation. The secondary fermentation was allowed till the 41st day. Wine was analyzed for different chemical parameters such as TSS, Acidity, Specific Gravity, Alcohol content, pH.In table sugar TSS varies from 19°Bx to 10.1°Bx, pH from 4.8-3.85, Acidity from 0.88-0.93%, Specific Gravity from 1.099-0.93, Alcohol from 8.9-10.0% (v/v). For Jaggery TSS varies from 16.2- 9.2°Bx, pH from 4.6-3.90, Acidity ranges from 0.91-0.97%, Specific Gravity ranges from 1.071-0.89, Alcohol content varies from 8.3-9.5% (v/v). In Sucrose Alcohol content ranged from 8.5-10.1% (v/v)**, TSS reduced from 17.2-10.3°Bx. Acidity ranges from 0.80-0.89%, pH from 4.1-3.80 and Specific Gravity ranged from 1.068-0.82%. Sensory evaluation was done on 41st,56th and 71st day by different panels of judges. Overall acceptability range was good and concluded that the wine obtained by three sugar sources was generally accepted by consumers.*

Key words: *Banana Wine, Alcohol, Fermentation of Banana, Bevearage, Quality Analysis*

INTRODUCTION

India is a second largest producer of fruit in the world. Banana (*Musa paradisica*) cultivation is exclusively tropical[8]. Banana is one of the most important food crops of the world which is consumed extensively throughout the tropics which it is grown and also valued in the temperate zone for its Flavour, nutritional value, and availability throughout the year. Banana is a very popular fruit due to its low price and high nutritive value. All parts of the banana plant have medicinal applications. The flowers are used in bronchitis and dysentery treatments. Cooked flowers are given to diabetics; the astringent plant sap in cases of hysteria, epilepsy, leprosy, fevers, hemorrhages, acute dysentery and diarrhea, and it is applied on hemorrhoids, insect and other stings and bites; young leaves are placed as poultices on burns and other skin afflictions, They are used for treating malignant ulcers. Antifungal and antibiotic principles are found in the peel and pulp of fully ripe bananas.

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The antibiotic acts against Mycobacteria. A fungicide in the peel and pulp of green fruits is active against a fungus disease of tomato plants. Norepinephrine, dopamine, and serotonin are also present in the ripe peel and pulp. The first two elevate blood pressure; serotonin inhibits gastric secretion and stimulates the smooth muscle of the intestines.Banana is an energy source for athletes: The concept of banana products suited for sports applications has recently been harnessed by a food processor, in the production of energizing drinks and dried banana bars for athletes. Its energy value, in combination with vitamins and minerals (K, Mg) prevents muscular contractions[14]. Bananas are used in special diets where ease of digestibility, low fat, minerals and vitamin content are required. These special diets are used for babies, the elderly and patients with stomach problems, gout, and arthritis[11]. Green bananas possess antidiarrheal action[13]. It is traditionally used to cure intestinaldisorders[3]. Bananas are climacteric fruit which undergo a post-harvest ripening process that plays a crucial role in commercial banana fruit quality and shelf life. Banana fruits are highly perishable and thus spoil due to over ripening. More than 22 per cent of banana is wasted due to improper handling and lack of utilization as value added products. In order to avoid over ripening spoilage and economic losses to farmers, value added products can be made. Food Processing is very important to minimize postharvest loss and to improve linkages between industry and agriculture. The loss can be minimized by converting the surplus food in to various value added products like fermented and unfermented beverages. Fermentation is a potential tool in the development of new products from fruits with modified physico-chemical and sensory qualities especially flavor and nutritional components. Fruit wines have been made and consumed by man since time immemorial and have been used as therapeutic agents. Over ripened bananas are suitable for making wines. There comes the vast scope for banana wineries in India. France is the largest wine producing country in the world[1]. Traditionally, fruit juice was fermented by wild yeast[10]. It is primarily the alcohol in wine that provides the calories. One gram of alcohol provides 7 kilocalories of energy[4]. The use of wine in religious ceremonies is common to many cultures and regions. Wine has also played an important role in medicine. Epidemiological studies have consistently demonstrated that moderate consumption of alcohol and wine is statistically associated with a decrease in death due to cardiovascular events such as heart failure, although excessive alcohol consumption has adverse health effects[9]. They are effective anti-bacterial agents against strains of Streptococcus[6]. It controls Blood Pressure. Staggering amounts of fiber and certain unique compounds confer banana wine the ability to keep your gut in good health. It is a wonderful Vitamin Source. Vitamins including B_5, B_6, C, A are all present in banana wine and this makes it one of the high ranking beverage over other alcoholic ones. Sonia *et al*.[15] reported that 8-18% of ethanol (%v/v) can inhibit bacteria, yeast and mould growth but effectiveness depends upon different physical and environmental factors. Studies also have shown the beneficial effects of wine consumption due to phenolics and alcohol in wine, which protects human body from free radical attack and increase HDL level in the body. Vitamin A helps in restoration of eye sight. Many of the vitamins help in better absorption of calcium into bones and tissues. Thus, along with replenishing various vitamins, you also supply your body with enough of calcium. Vitamin B5 in it is greatly involved in synthesizing special kind of short chain fatty acids that form the inner walls of your small intestine.Wine manufacture is challenging in which marketable product can be obtained, but the processes involved in its production are relatively straight forward[1].Banana has higher carbohydrate content, so it can be used for wine production. Such a way the produced bananas can be utilized by converting into value added product. The Indian alcoholic market has been growing rapidly for the last ten years, due to

the rising income levels, changing age profile, changing lifestyles and reduction in beverages prices. So thus the study was carried out to know the quality of banana wine produced by using three sources of sugar because of the growing future of wine industry.

MATERIALS AND METHODS

All the experiments related to research work entitled- production and quality evaluation of banana wine as affected by different sources of sugar was conducted at Post-harvest laboratory, Department of Horticulture, NAINI Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, UP. Three treatments having three replications was analyzed in Completely Randomized Design.

Materials Used

Well ripened Banana fruit from local market of Allahabad (Variety- Grand Naine), sugar, sucrose, Jaggery, yeast (*Saccharomyces cerevisiae*), water.

Preparation of juice

Well ripened banana fruits were peeled, cutinto pieces and boiled by adding water for 25 minutes. Allowed it to cool and strained the juice obtained.

Fermentation of banana juice:

The banana juice is mixed with different forms of sugar such as Table sugar, Jaggery and Sucrose respectively and was adjusted to 29°Bx. Three gram *Saccharomyces cerevisiae* was inoculated to 1l of above each combination. They were kept three days for primary fermentation at 30°C and then transferred into 2 l glass bottles and were kept for secondary fermentation for 21 days. The wine was filtered and kept for aging in 750 ml long necked glass bottles at room temperature.

Analytical Methods

Physiochemical parameters such as TSS, Acidity, Specific Gravity, Alcohol Content and pH was evaluated to check the quality of banana wine produced by using different sources of sugar. The TSS content was determined using refractrometer. The pH was determined using, digital pH meter. The acidity was determined by titration. The alcohol content was determined by using hydrometer and the specific gravity determined using a Brix hydrometer. Analysis was done from 41st day with a 15 days interval followed by 41, 56 and 71 days.

Statistical analysis

Statistical analysis was done in Completely Randomized Design (CRD) for Physio–chemical analysis and sensory evaluation. The variance analysis using the Statistics software WASP (Web Agri Stat Package) was used to compare the averages for different variables studied. The test was considered statistically significant if $p < 0.05$.

Sensory evaluation:

Banana wine produced using three sugar sources was compared using 5-point hedonic scale where noted as like extremely to dislike extremely. A panel of 5 judges tested it organoleptically 3 times after fermentation and aging ie; 41st,56th and 71st days.

RESULTS AND DISCUSSION

Phsico-chemical analysis was done and the following observations were noted. The chemical composition of banana wine using different sources of sugar including Table sugar, Jaggery and sucrose is shown in Table 1,2 and 3. In three of sugar sources TSS shows a reducing rate and acidity increased during the aging of wine. Alcohol content increases and thus the specific gravity and pH decreases. It is shown that the three sources of sugars are good for the preparation of wine. The Titrable Acidity increased and pH decreased as the fermentation progressed. TSS and specific gravity decreased and alcohol content increased during fermentation. During aging TSS, Titrable Acidity, Specific gravity decreased. In wines, alcohol is a macro nutrient and is an energy source, capable of providing calories for all essential biological activities of the human cells, energy for physical work and thermo genesis.

Sensory evaluation

The sensory evaluation was done to assess the overall acceptability of wine after fermentation and after aging after 41 days and then within in a 15 days interval following41st ,56th&71stday. Overall acceptability was high

for the third treatment (T3: Fruit Extract+ Sucrose +Yeast) and the flavor and appearance was also better for the wine produced using sucrose. Taste of wine produced using jaggery was not accepted by all because of the superior taste of jaggery. So it has obtained that the wine produced using sucrose was accepted more by the consumers.

Overall acceptability was high for the third treatment (T3: Fruit Extract+ Sucrose +Yeast) and the flavor and appearance was also better for T_3. Taste of T_3 was not accepted by all because of the superior taste of jaggery. So it has obtained that the wine produced using sucrose was accepted more by the consumers.

Table 1: Physio-chemical properties of banana wine using Table sugar

Days	Chemical Parameters				
	TSS(°Bx)	**Acidity(%)**	**Alcohol%(v/v)**	**pH**	**Specific Gravity**
41st day	19.1±0.05	0.890±0.01	8.8±0.05	4.76±0.05	1.090±0.01
56th day	14.2±0.05	0.903±0.01	9.8±0.05	4.40±0.05	0.947±0.01
71st day	10.1±0.05	0.927±0.01	10.1±0.05	4.00±0.05	0.927±0.01

Table 2: Physico-chemical properties of banana wine using Jaggery

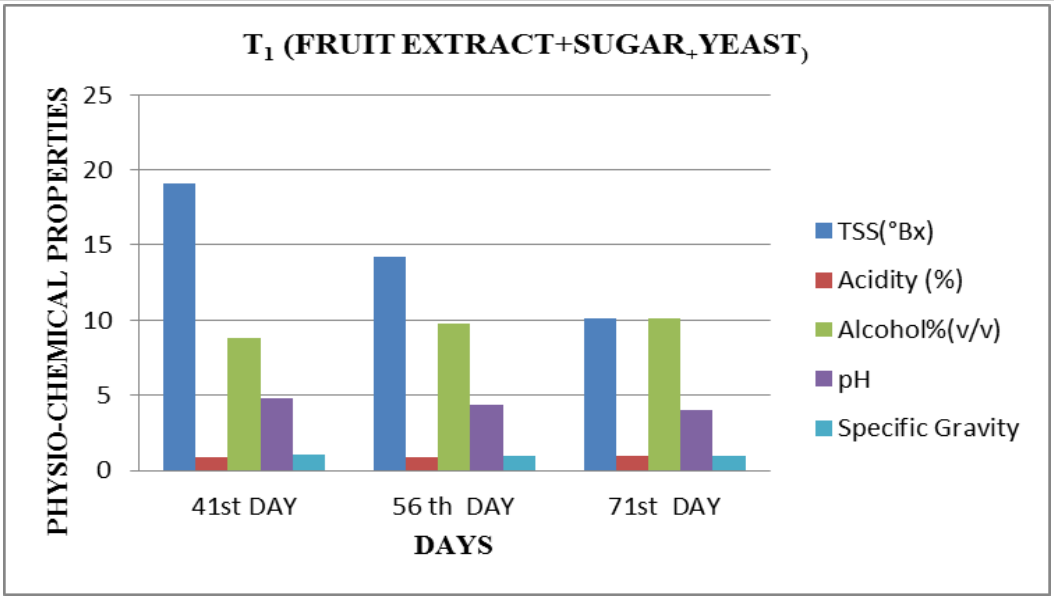
Days	Chemical Parameters				
	TSS (°Bx)	**Acidity (%)**	**Alcohol%(v/v)**	**pH**	**Specific Gravity**
41st day	16.1±0.05	0.917±0.01	8.3±0.05	4.60±0.05	1.070±0.0
56th day	13.8±0.05	0.923±0.01	8.4±0.05	4.10±0.05	0.923±0.01
71st day	9.2±0.05	0.967±0.01	9.4±0.05	3.9±0.05	0.887±0.01

Table 3:Physico-chemical properties of banana wine using Sucrose:

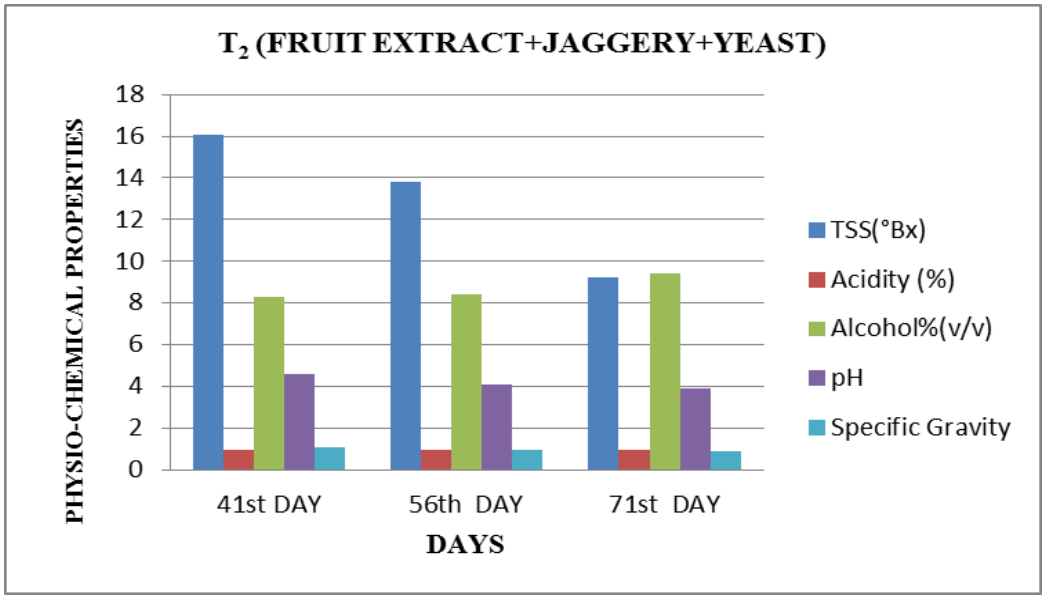
DAYS	CHEMICAL PARAMETERS				
	TSS(°Bx)	**Acidity(%)**	**Alcohol %(v/v)**	**pH**	**Specific Gravity**
41st day	17.2±0.05	0.807±0.01	8.5±0.05	4.10±0.05	1.063±0.01
56th day	14.0±0.05	0.877±0.01	9.6±0.05	3.90±0.05	0.843±0.01
71st day	10.2±0.05	0.887±0.01	10.0±0.05	3.60±0.05	0.830±0.01

Table 4: Sensory attributes of banana fruit wine

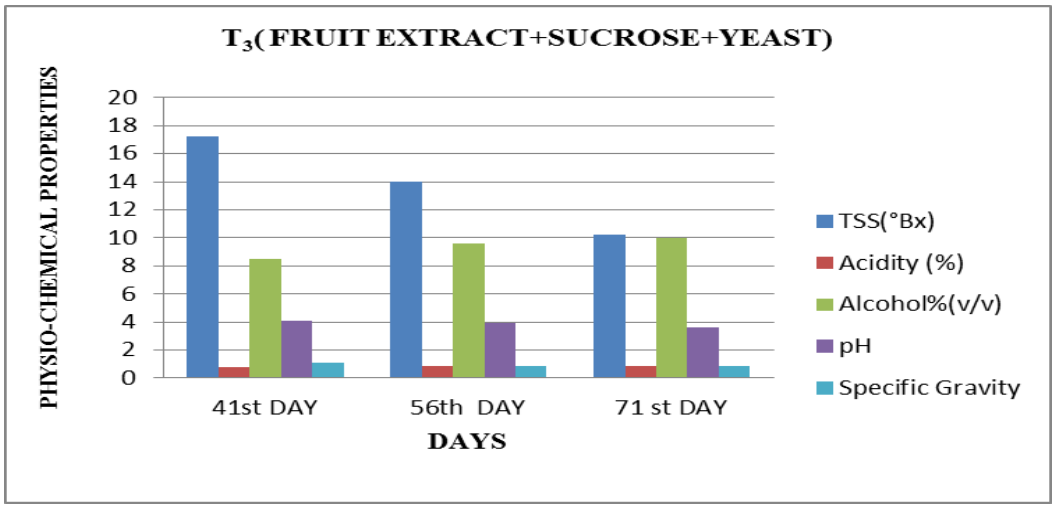
Treatments	Sensory attributes					
	Taste	**Color**	**Appearance**	**Flavor**	**Aroma**	**Overall acceptability**
T_1 (FRUIT EXTRACT+SUGAR+YEAST)	4.1	4.3	4.3	4.3	4.1	4.22
T_2(FRUIT EXTRACT+JAGGERY+YEAST)	3.9	3.9	4.1	4.1	4.0	4
T_3(FRUIT EXTRACT+SUCROSE+YEAST)	4.2	4.3	4.4	4.4	4.3	4.32



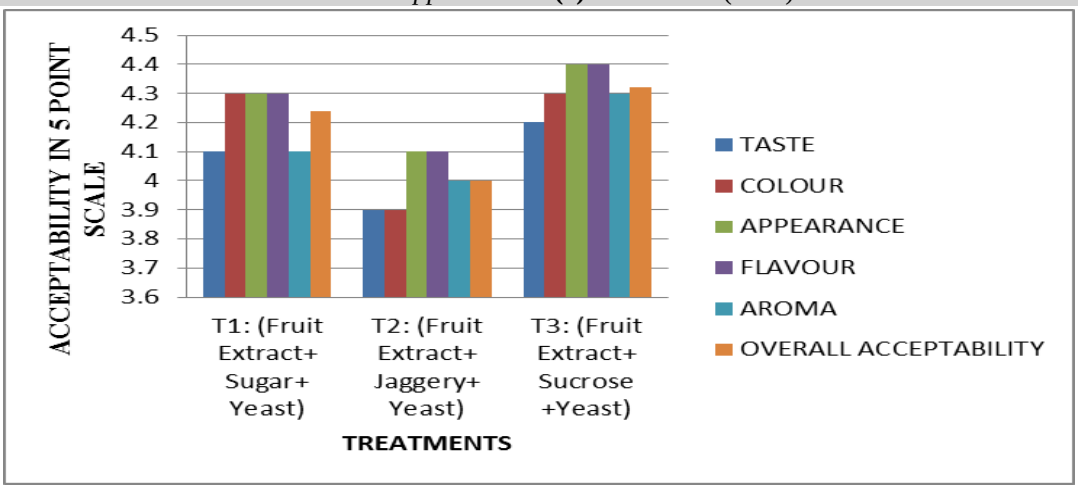
Graph 1:Physiochemical properties of banana wine using Table sugar:



Graph 2:Physiochemical properties of banana wine using Jaggery:



Graph 3:Physiochemical properties of banana wine using Sucrose:



Graph 4: Sensory evaluation graph of banana fruit wine

Image 1: Banana fruit wine produced using Table sugar, Jaggery and Sucrose

CONCLUSION

Experiment shows that banana fruit is suitable for making wine; sugar sources will also affect the quality of wine in physic-chemical and sensory qualities. Even though it is good for commercial production for the variety loving growing generations the wine produced from banana fruit is highly acceptable by the consumers due to its flavor, Aroma and also wine has played an important role in medicine. It was concluded that the banana wine can be prepared by using three sources of sugar including Table sugar, Jaggery and Sucrose. They are qualified in physicochemical evaluation and also in the sensory evaluation. Different sources of sugar affected the alcohol content and other physic o-chemical properties of wine and is concluded in this trial that the sugar sources affects the quality of wine. Thus it was accepted generally by the consumers. I would like to recommend this sugar sources for making wine in the commercial wine production for the energetic world.

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