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Effect of Different Levels of Yeast and Sugar Concentrations on Preparation of Wine from Bael

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A B S T R A C T

Bael (*Aegele marmelos*), being an unexploited and underutilized fruit is known for its high nutritional and medicinal values. Marmelosin is most probably the therapeutically active principle in bael. Preparation of value added product like wine from bael by using modern processing technology proves beneficial for economic security of farmers. Setting - up of fruit wineries besides industrialization of the fruit growing belts could result in economic upliftment of the farmer. Keeping this in view an experiment was carried out during 2015-16 at Post Harvest Technology Laboratory, Section of Horticulture, College of Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was laid out in Factorial Randomized Block Design with two factors as factor A, levels of yeast and factor B, sugar concentrations. The chemical observations were recorded periodically at two months interval upto 7 months of maturation. From the findings it was observed that the level of yeast, *Saccharomyces cerevisiae* var. ellipsoideus inoculated at 15 ml/l and sugar concentration 24 ^{0}B of must for 5 months and 7 months wine was found significantly superior for total soluble solids, pH, phenol content and titratable acidity.

Introduction

Bael (*Aegle marmelos*) is an indigenous fruit of India belongs to family Rutaceae. Bael is a sub-tropical, deciduous, medium sized tree. Plant grows in dry forest, now it is cultivated in India. Plant is recorded in India from ancient time (Deshpande, 2011). Bael fruit has numerous seeds, which are densely covered with fibrous hairs and are embedded in a thick, gluey, aromatic pulp (Kaushik *et al.*, 2002). Fruit though very important from the therapeutic and nutritional point of view, it is not consumed freely in the fresh form because of difficulty in eating and it is due to its hard shell, mucilaginous texture and numerous seed, it is not popular as a dessert fruit, thus if exploited properly has the potential of transforming the economy of the farmers. The bioactive compounds present in bael fruit are marmelosin, luvangetin, aurapten, psoralen, and tannin. Bael is reported to contain a number of coumarins, alkaloids, sterols and essential oils such as palmitic and linoleic acid. A fair amount of pectin is found in bael.

Fruit wines are un-distilled alcoholic beverage which are nutritive and more tasty and mild stimulants. European explorers in the 16th century introduced the wine into the new world (Amerine *et al.,* 1980) Being a fruit based beverage, wine provides minerals, vitamins and energy.

Wine is a product of sugar metabolism through alcoholic fermentation of yeast having long shelf life. Wine is safe, healthful beverage and has been used long as food and medicine since ages (Chaudhary *et al.,* 2014). It has been used as an antiseptic, a painkiller and to treat dermatological conditions and digestive disorders (Feher *et al.,* 2005, Robinson, 2006).Setting - up of fruit wineries besides industrialization of the fruit growing belts could result in economic upliftment of the people, generating employment opportunities and providing better returns of their produce to the orchardists (Amerin *et al.,* 1980; Fowles 1989; Joshi *et al.,* 2004).

Materials and Methods

Fully matured and well ripened bael fruits were procured from local market of Akola, Maharashtra during the month of April, 2016 (day temperature, 32 ± 2°C and night temperature, 28 ± 2°C).wine is an alcoholic product obtained by fermentation of fruit juices with yeast.

The fruits were brought followed by the extraction of juice, preparation of wine, its analysis and storage at Post-Harvest Technology Laboratory, Section of Horticulture, College of Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The experiment was conducted with two factors i.e. yeast levels and concentration of sugar with twelve treatment combination which were replicated thrice. Treatment details of the experiment consisted of -

Factor A

Levels of yeast

S_1 - *Saccharomyces cerevisiae var. ellipsoideus* inoculated at 15 ml

S_2 -*Saccharomyces cerevisiae var. ellipsoideus* inoculated at 20 ml

S_3 - *Saccharomyces cerevisiae var. ellipsoideus* inoculated at 25 ml

Factor B

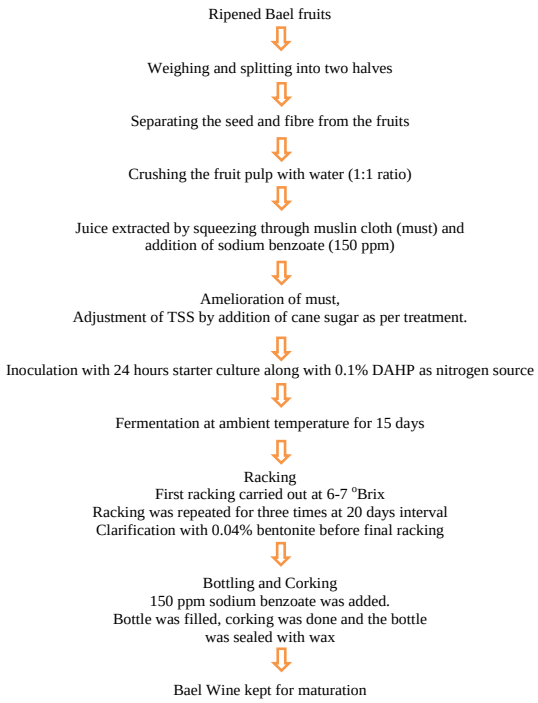
Concentrations of sugar

T_1 - 22°B
T_2 - 24°B
T_3 - 26°B
T_4 -28°B

The observation regarding the total soluble solids, pH, phenol and titratable acidity of bael wine was taken at the interval of 2 months from fresh wine till 7 months of maturation. The procedure for Wine making was thus carried out with slight modification in the general method described by (Joshi 1995). The wine prepared from bael was analyzed for physico - chemical characteristics by standard methods described by A.O.A.C. (2000). The ethyl alcohol content of wine was estimated by using specific gravity (Ranganna, 1979). The Total Soluble Solids (TSS) was determined by using Atagomake RX 1000 digital refractometer. pH of the wine was determined with the help of digital pH meter(Model 411). The method described by Ranganna (1979) was adopted for the determination of titratable acidity of wine, in which one gram sample was diluted with 10 ml of distilled water and then filtered the solution. Then filtered solution was titrated against the standard NaOH (0.1N) solution, using phenolphthalein

as an indicator. The appearance of light colour considered the end point of titration. The total phenolic content of bael wine was estimated by using the method described by Mazumdar and Majumdar (2003). Folin-Ciocalteu method based on the reduction of a phosphor tungstate- phosphor molybdate complex by phenolic compounds to blue reaction products was used.

Flow Chart for the Preparation of Bael Fruit Wine



Results and Discussion

During the course of investigation the observations were recorded on various aspects i.e. physicochemical characters of bael wine are presented in table 1 to 4.

Total soluble solids

An interaction effect of different levels of yeast and sugar concentrations on total soluble solids content of bael wine was found significant at all stages of observation. After 5^{th} and 7^{th} months of maturation of bael wine, minimum TSS was found in S_1T_2 (4.36 °B) and (4.29 °B), respectively which was significantly superior than rest of all other treatment combinations.

From the result it is cleared that, bael wine prepared by using *Saccharomyces cerevisiae var. ellipsoideus* inoculated at 15 ml/l. and maintaining 24 °B sugars in must (S_1T_2) shows decreasing trend with regard to TSS and obtained good TSS for quality wine after 7 months of maturation.

The results are in conformity with Joshi *et al.*, (2014) observed in mandarin wine that during maturation, there is decreasing trend in TSS of wine. Precipitation of soluble solids during interaction of various components might have resulted in a decrease of TSS.

Lenkannavar *et al.*, (2015), Panda *et al.*, (2014) and Chaudhary *et al.*, (2014), noted that, the TSS was decreased as the storage period advanced in all the treatments in aonla,

bael and grape wine respectively during storage. This might be due to conversion of sugars to alcohol by yeasts and also consumption of sugars by yeast.

pH

Data with respect to change in pH of bael wine was influenced by different levels of yeast and sugar concentrations exhibited significant differences. In general, the data shows that, pH of bael wine were gradually increased in all treatments upto 7 months of maturation. After 5th and 7thmonths of maturation, maximum pH (3.32) and (3.33), respectively of bael wine was recorded in treatment combination S_1T_2 and this was significantly superior than rest of the treatment combinations. This was followed by S_3T_4 (3.28) and S_3T_1 (3.27).

pH of bael wine ranges from 3.30 to 3.33 which proves beneficial for obtaining good quality wine. Change in pH of bael wine shows that pH increases with advancement of maturation time but the increase was meager upto 7 months of maturation. The increase in pH of bael wine during maturation could be attributed to precipitation of acids during fermentation.

Table.1 Effect of different levels of yeast and sugar concentrations on total soluble solids of 5 and 7 months maturated of bael wine

Treatment	TSS (°Brix)									
	5 Months Maturated Wine					7 Months Maturated Wine				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
S_1	4.47	4.36	4.59	4.72	4.54	4.42	4.29	4.50	4.67	4.47
S_2	5.31	5.54	5.75	5.88	5.61	5.24	5.49	5.70	5.83	5.56
S_3	6.26	6.48	6.77	6.36	6.47	6.21	6.42	6.73	6.32	6.42
Mean	5.35	5.46	5.70	5.66		5.29	5.40	5.65	5.61	
	S		T		SXT	S		T		SXT
'F' test	Sig		Sig		Sig	Sig		Sig		Sig
SE (m) ±	0.007		0.008		0.013	0.006		0.007		0.011
CD at 5 %	0.019		0.022		0.039	0.017		0.019		0.034

Table.2 Effect of different levels of yeast and sugar concentrations on pH of 5 and 7 months maturated bael wine

Treatment	pH									
	5 Months After Maturation					7 Months Maturated Wine				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
S_1	3.24	3.32	3.26	3.22	3.26	3.25	3.33	3.27	3.23	3.27
S_2	3.26	3.26	3.21	3.23	3.24	3.26	3.27	3.22	3.24	3.25
S_3	3.27	3.26	3.18	3.28	3.25	3.27	3.27	3.19	3.29	3.25
Mean	3.26	3.28	3.22	3.24		3.26	3.29	3.23	3.25	
	S		T		SXT	S		T		SXT
'F' test	Sig		Sig		Sig	Sig		Sig		Sig
SE (m) ±	0.002		0.003		0.005	0.003		0.004		0.006
CD at 5 %	0.007		0.009		0.015	0.009		0.011		0.018

Table.3 Effect of levels of yeast and sugar concentrations on phenol content of 5 and 7 months maturated bael wine

Treatment	Phenol Content (mg/100ml)									
	5 Months Maturated Wine					7 Months Maturated Wine				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
S_1	0.77	0.69	0.88	0.92	0.81	0.71	0.63	0.81	0.86	0.75
S_2	0.96	0.89	0.77	0.84	0.86	0.89	0.84	0.72	0.79	0.81
S_3	0.98	1.03	1.42	0.99	1.10	0.93	1.01	1.74	0.96	1.16
Mean	0.90	0.87	1.02	0.91		0.84	0.83	1.09	0.87	
	S		T		SXT	S		T		SXT
'F' test	NS		NS		NS	NS		NS		NS
SE (m) ±	0.127		0.127		0.127	0.174		0.201		0.348
CD at 5 %	--		--		--	--		--		--

Table.4 Effect of different levels of yeast and sugar concentrations on titratable acidity of 5 and 7 months maturated bael wine

Treatment	Titratatable Acidity (%)									
	5 Months Maturated Wine					7 Months Maturated Wine				
	T_1	T_2	T_3	T_4	Mean	T_1	T_2	T_3	T_4	Mean
S_1	0.32 (1.15)	0.29 (1.14)	0.33 (1.15)	0.37 (1.17)	0.33 (1.15)	0.28 (1.13)	0.25 (1.12)	0.29 (1.13)	0.31 (1.15)	0.28 (1.13)
S_2	0.36 (1.17)	0.35 (1.16)	0.37 (1.17)	0.36 (1.17)	0.36 (1.17)	0.30 (1.14)	0.32 (1.15)	0.31 (1.15)	0.32 (1.15)	0.31 (1.15)
S_3	0.37 (1.17)	0.42 (1.19)	0.47 (1.21)	0.45 (1.20)	0.43 (1.19)	0.31 (1.15)	0.38 (1.17)	0.44 (1.20)	0.40 (1.18)	0.38 (1.18)
Mean	0.35 (1.16)	0.36 (1.16)	0.39 (1.18)	0.39 (1.18)		0.30 (1.14)	0.31 (1.15)	0.35 (1.16)	0.34 (1.16)	
	S		F		SXF	S		F		SXF
'F' test	Sig		Sig		Sig	Sig		Sig		Sig
SE (m) ±	0.007		0.008		0.013	0.006		0.007		0.012
CD at 5 %	0.019		0.022		0.039	0.017		0.020		0.034

The above findings are in close agreement with the findings of different research workers. The increase in pH of wine noticed might be due to precipitation of acids during and after fermentation and might be due to reduction in acidity through precipitation of potassium tartrate salts from wine or might be due to enhanced synthesis of esters from ethyl alcohol and volatile acids, Kumar *et al.*, (2016), Sharma and Joshi, (2003) and Lokesh *et al.*, (2014).

Phenol content

An effect of different levels of yeast, sugar concentrations and its Interaction effect on phenol contents of bael wine was found to be non significant in fresh as well as 3, 5, and 7 months maturated bael wine.

Titratable acidity

The data regarding titratable acidity of bael wine was influenced by different levels of

yeast and sugar concentrations recorded for 5 and 7 months of maturation of bael wine are presented in Table 4.

An interaction effect of different levels of yeast and sugar concentrations on titratable acidity content of bael wine was found significant at all stages of observation which showed decreasing trend during maturation.

At 5 and 7 months of maturation of bael wine, significantly minimum titratable acidity was found inS_1T_2 (0.29 %) and (0.25 %) respectively which was at par with treatment combinations S_1T_1 and S_1T_3. While, significantly maximum titratable acidity was recorded in treatment combination S_3T_3.

From the above results it is apparent that, titratable acidity of bael wine is due to yeast levels and sugar concentrations decreases gradually as the maturation period advances. The mentioned results are in conformity with the findings of research workers worked on several fruit wines.

Kumar *et al.,* (2016) observed during preparation of custard apple wine that the titratable acidity decreased significantly the possible reason for the decrease in acidity could be the precipitation of different acids in terms of their respective salts (Joshi *et al.*, 2012). Similar results were also reported by Sharma and Joshi (2003) in strawberry wine and Joshi *et al.,* (2012) in jamun wine. Lokesh *et al.,* (2014) observed decreasing trend of titratable acidity after fermentation and during ageing of jamun wine.

From the present investigation it can be concluded that, different levels of yeast and sugar concentrations exerted significantly positive effect on chemical characters of 5 and 7 months maturated bael wine. Among different yeast levels, S_1 (*Saccharomyces cerevisiaevar. Ellipsoideus* inoculated at 15 ml/litre) and among different sugar concentrations T_2 (24 ^{0}B) was found significantly superior for TSS, pH, total sugars, titratable acidity and phenol content of bael wine.

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