



Original Research Article

Studies on Screening of Different Pomegranate Cultivars for Wine Production

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A B S T R A C T

The experiment on ‘Studies on screening of different pomegranate cultivars for wine production’ was carried out at Vasantrao Naik of College of Agricultural Biotechnology, Yavatmal during the year 2016-17. The procedure of wine making from pomegranate juice was developed and standardized at the Biotechnology laboratory of the VNCAB, Yavatmal. The four different cultivars of pomegranate viz., Bhagwa, Bhagwa super, Ganesha and Ruby were screened for wine production with the yeast *Saccharomyces cervisiae*. Physiochemical properties of wine viz., pH, TSS, titrable acidity, alcohol content, reducing sugar, non-reducing sugar, total sugar and ascorbic acid were analyzed from the prepared wines of four cultivars of pomegranate during ageing after the 30 days of fermentation. The organoleptic evaluation of the four cultivar’s wine was taken for overall acceptance of the wine. Among all the four varieties, the variety Bhagwa was found most suitable for wine making as scored maximum points for overall acceptability followed by Bhagwa super, Ganesha and Ruby. Also regarding the physio-chemical parameters, the wine prepared from the cultivar Bhagwa recorded the highest contents of TSS, titrable acidity, reducing sugar, non-reducing sugar, total sugar and alcohol and thus found most suitable for wine production among all the four tested varieties.

Keywords

Pomogranate cultivars,
Bhagwa,
Bhagwa super,
Ganesha,
Ruby, Yeast,
Organoleptic test, Wine.

Introduction

Pomegranate (*Punica granatum* L.) commonly known as ‘Anar’ belongs to family *Punicaceae* is native to the Middle East probably Iran. Pomegranate fruits being one of the most powerful nutrient dense food, rich in polyphenols, specially ellagic acid and pinicalagins, both of which can act as potent antioxidants. In India the area under pomegranate is estimated to be 1.3 lakh ha. with an annual production of 13.46 lakh tonnes. Maharashtra contributes about 75% production share in the country. Ellagic acid found in red arils of pomegranate and punicalagins found only in outer skin of

pomegranate are estimated to have twice the antioxidant capability of red wine and green tea. The pomegranate juice as having considerable health promoting properties like antimicrobial, antiviral, anticancer, antioxidant and antimutagenic effects is well known energetic health drink. Ganesha, Bhagwa, Bhagwa super ad Ruby are some of the important pomegranate cultivars of Maharashtra state. Pomegranate juice as contains good amount of sugar, hence can produce good quality wine as convert sugar into alcohol and gives good colour and appearance. Pomegranate wine is an

alcoholic beverage resulting from an anaerobic fermentation of fruit juice by yeast, in which sugars are converted into alcohol and CO₂ (Adsule *et al.*, 1995).

The technology of manufacturing wine from grapes is advanced. However limited information is available on production of wine from different pomegranate cultivars. The present investigation was carried out to screen the four cultivars of pomegranate namely, Bhagwa, Bhagwa super, Ganesha and Ruby for quality wine production by using the yeast *Saccharomyces cervisiae* in order to study the most suitable cultivar for wine production.

Materials and Methods

The experiment on ‘Studies on screening of different pomegranate cultivars for wine production’ was carried out at Biotechnology laboratory of VNCAB, Yavatmal. For the study, fresh fruits of four different cultivars of pomegranate viz., Bhagwa, Bhagwa super, Ganesha and Ruby were collected from the progressive farmers associated with the Krishi Vigyan Kendra, Mohod, district Ahmadnagar. Matured fresh fruits of uniform size, fully ripened were selected and utilized for processing. The fruits before processing were washed in lukewarm water. The juicy arils from the fresh fruits according to cultivars were separated with the help of stainless steel knives. The fleshy arils were then crushed by hand and the juice was collected in the different conical flasks sterilized before the sampling. The collected juice samples were ameliorated to 25°Brix by adding sugar and pH was adjusted to 3.2 by addition of sodium bicarbonate wherever necessary in must.

The yeast *Saccharomyces cervisiae* was activated and prepared the starter culture for

fermentation. The 5% yeast inoculums was added as starter culture to collected juice samples in different flasks. The flasks were plugged with cotton to avoid the head spaces and placed them at room temperature for fermentation. After completion of fermentation in 2 to 3 weeks, racking was done 3 to 4 times at weekly interval. After final racking the wines were clarified again by adding 400 mg/lit. Bentonite clay (0.1%) and let the samples undisturbed for four days.

After clarification, the supernatant wine was siphoned off and transferred into fresh sterile bottle and corked without leaving headspace and kept for maturation at 15-16°C. During maturation, the wine was racked regularly. The wine samples were analyzed for physio-chemical properties at 30 days after fermentation. Wines were evaluated organoleptically after maturation with panel of five judges, keeping grape wine as standard (1:1 dilution) by using 20 points scale developed by Amerine *et al.*, (1972).

The chemical composition of pomegranate juice and wine samples of the four different cultivars were analyzed. pH was determined by using digital pH meter, TSS by Hand Refractometer of 0 to 32 scale. The titrable acidity, alcohol content, reducing sugar, non-reducing sugar, total sugar and ascorbic acid content of juice and wine samples were tested by Ranganna method (1977).

Results and Discussion

Physio-chemical parameters of juice

The data from the table 1 showing Physio-chemical parameters of juice inferred that, pomegranate cultivars Ganesha and Bhagwa yielded maximum fruit juice i.e. 492 and 490 ml/kg fruit respectively with a fruit:

juice ratio 1: 0.49 followed by Bhagwa super yielded fruit juice 482 ml/kg fruit with fruit juice ration 1:0.48 and Ruby yielded fruit juice 452 ml/kg fruit with fruit juice ration 1: 0.45. The fruit: Juice ratio obtained with Ganesha is relevant to the findings obtained by Leena (1990).

In case of TSS, pomegranate cvs. all the four pomegranate cultivars recorded the TSS ranged from 13.5 to 16.4° B. Pomegranate cv. Bhagwa recorded the maximum value (16.4° B) followed by Bhagwa super (15° B), Ganesha (14.5° B) and Ruby (13.5° B). The fully ripened grapes generally have the TSS 22-23° B. The quality wine production requires a TSS of 22-23° B. Hence, to prepare a good quality wine from pomegranate cultivars, the pomegranate fruit juice of all the cultivars under study were ameliorated with sugar to maintain the TSS at 25° B.

The pH of fruit juice of all the four cultivars was found in the range between 3.00 and 3.25 and hence maintained the pH at 3.2 by addition of sodium bicarbonate for preparation of wine. Regarding pH all the four pomegranate cultivars under study were found acceptable for winery.

The maximum titrable acidity of fruit juice was found in fruit juice of cv. Bhagwa i.e. 0.58 followed by 0.55 in Bhagwa super, 0.53 in Ganesha and 0.52 with Ruby.

Chemical parameters of wine

The data presented in table 2 showed the chemical properties of wine prepared from different cultivars of pomegranate.

pH of wine

An increasing trend in pH in all cultivar's wine was observed during the study. The

data revealed that, sweet wine during ageing after 30 days after fermentation recorded highest pH 2.18 with cv. Ruby wine and minimum 3.4 with cvs. Bhagwa and Bhagwa super wine, however, cv. Ganesha wine reported pH 3.35. During ageing of wine all the treatments recorded an increase in pH values. Similar observation regarding increasing in pH during ageing has been reported by Saravana *et al.*, (2001) in strawberry wine. The pH was found to be decreased proportionally with increase in sugar concentration of wine during storage of wine, but during ageing of wine an increased in pH was observed. The increase was due to precipitation of acids during fermentation. The difference in pH found to be varied from 3.40 to 3.15 during fermentation.

TSS of wine

Similarly maximum TSS was found in sweet wine of Bhagwa (9.12) followed by Bhagwa super wine (9.10), Ganesha wine (8.40) and Ruby wine (7.38). Jackson and Badrie (2003) found that, in banana wine preparation, addition of 15% peel gave significantly higher TSS (9.07° B) than other wines ranged TSS between 7.02–7.57° B. Initially the TSS of pomegranate juice was 25° B, but during ageing of wine, it was found decreased. This may be due to the conversion of sugar into alcohol during the period of ageing.

Titrable acidity

Regarding the titrable acidity, the data from table 2 showed that, sweet wine recorded highest titrable acidity with Bhagwa wine (0.58%) followed by Bhagwa super and Ganesha wine (0.56%) and lowest with Ruby wine (0.53%). This finding are in confirmation with the findings of Matapathi *et al.*, (2004), who reported the titrable

acidity ranged from 0.55% to 0.58% in wines prepared from the different cvs. of pomegranate using different yeasts. During the ageing with the increased in ageing period, the titrable acidity of wine samples was also found to be increased after fermentation. This may be possibly due to the production of certain salts derived from mineral acid or organic acids during the process of fermentation by yeast cells.

Ascorbic acid

The data revealed that, the highest ascorbic acid content in sweet wine was found in Ruby wine (8.40) followed by Ganesh wine (7.92), Bhagwa super wine (7.90) and lowest with Bhagwa wine (7.68). This indicated that, higher the TSS, minimum be the ascorbic acid content of the wine. The higher ascorbic acid concentration in Ruby wine might be due to the production of organic acids during the process of fermentation.

Sugar content in wine

The sweet wine prepared from the cv. Bhagwa reported highest reducing sugar (7.12%), non-reducing (0.74%) and total sugar (7.86%) followed by Bhagwa super (7.11%, 0.71%, 7.82%), Ganesh (7.10%, 0.54%, 7.64%) and minimum with Ruby (6.20%, 0.50%, 6.71%) respectively. The decrease in sugar content of wine indicated the utilization of sugar during fermentation. The results are in accordance with the results obtained by Bardiya *et al.*, (1974) who reported 7.2% reducing sugar in guava wine. Sugar contents of wine were found parallel with the TSS content. Similar behaviour was observed by some workers with respect to change in reducing sugar and non-reducing sugars levels of pomegranate wine before and after ageing. The variation in reducing sugars of wine due to varietal

differences have been reported by Adsule and Kadamb (1995) in pomegranate wine, whereas Bhajipale *et al.*, (1998) in Karonda wine that recorded a maximum of 12.82% reducing sugar.

Alcohol content in wine

The changes in alcohol content of sweet wine recorded in table 2 revealed that, highest alcohol percentage was reported in Bhagwa wine (8.05%), followed by Bhagwa super wine (8.03%), Ganesh wine (8.00) and lowest in Ruby wine i.e. 7.8%. The findings are in confirmation with the results reported by Chikkasubbanna *et al.*, (1992), who reported similar range of alcohol content in wine of banana and ber (7.6%), jamun (8.4%), sapota (7.2%), and strawberry (7.05). Reddy and Reddy (2009) in mango wine and Joshi *et al.*, 2005 in peach wine due to variation in varieties and reported alcohol percent of the wine increased due to decrease in TSS as well as yeast activity during fermentation. During ageing, the alcohol level increased slightly in all the cultivars wine. This increase in alcohol might have been due to very slow fermentation that occurred during ageing.

Organoleptic evaluation of wine

The organoleptic evaluation of pomegranate sweet and dry wine was assessed by the panel of five judges using 20 points sensory evaluation scale given by Amerine *et al.*, (1972). The wine scoring less than 10 points are considered as poor quality wine, points ranged from 11 to 15 be considered as medium quality wine and points scored more than 15 be considered as good quality wine. The results from table 3 showed that, Bhagwa wine prepared by using the standard yeast *Saccharomyces cervisiae* scored maximum points i.e. 14.59 for overall acceptability for medium quality wine

followed by Bhagwa super wine with 12.62 points, Ganesha wine with 12.00 points and Ruby wine with 11.00 points. Dry wine prepared from all the four cultivars scored points less than 10 for overall acceptance and hence considered as poor quality wine. The organoleptic evaluation of the wines revealed that, pomegranate wine with 25°B of sugar syrup i.e. sweet wine had the maximum score for overall acceptability of 14.59 while the lowest was obtained for dry wine for Ruby cv. 7.09 i.e. pomegranate arils with distilled water. From the study, it was stated that, pomegranate cv. Bhagwa was found to most suitable for wine production. Shinghnagi and Manjrekar (1975), Kulkarni *et al.*, (1980) and Onkarayya (1985) reported scored points of Ganesha wine in organoleptic evaluation tests ranged from 12 to 13.5.

From the studies conducted on 'Studies on screening of different pomegranate cultivars for wine production using yeast *Saccharomyces cervisiae*', it was concluded that, Bhagwa cultivar was found to be the most suitable cultivar for wine production as recorded highest values for TSS, titrable

acidity, reducing sugar, non-reducing sugar, total sugar and alcohol content followed by Bhagwa super, Ganesha and Ruby. Also the sweet wine of Bhagwa scored the highest points for overall acceptability for organoleptic evaluation test and hence be the most suitable cultivar for production of wine among all the four cultivars. However, dry wine prepared from all the cultivars as scored points less than 10 in organoleptic evaluation test showed poor performance for overall acceptance.

Acknowledgements

To start with, we are sincerely thankful to Dr. Rajendra M. Gade, Associate Dean, VNCAB, Yavatmal for providing necessary guidance and all the necessary facilities to conduct the project work successfully. We are thankful to Dr. Mahendra S. Dudhare, Training Co-ordinator for HOT-481 and Assistant professor, Mr. Hemant Wagh for keen interest in the project and suggesting valuable guidance during the project work. We are grateful to the authors from past and present whose contributions were of great help to undertaken this investigation

Table.1 Physico-chemical parameters of pomegranate juice of different cultivars

S.N.	Parameters	Pomegranate cultivars			
		Bhagwa	Bhagwa super	Ganesha	Ruby
1.	Fruit colour	Red	Red	Yellow-Red	Deep Red
2.	Arils colour	Deep Red	Deep Red	Pink	Deep Red
3.	Rind colour	Yellow	Yellow	Yellow	Yellow
4.	Av. Fruit weight (g)	258.20	248.4	250.6	210.0
5.	Juice yield (ml/kg fruit)	490.0	482.0	492.0	452.0
6.	Fruit : Juice ratio	1:0.49	1:0.48	1:0.49	1:0.45
7.	TSS (°B)	16.4	15.0	14.50	13.5
8.	pH	3.25	3.25	3.12	3.00
9.	Titrable acidity	0.58	0.55	0.53	0.52

Table.3 Organoleptic evaluation of pomegranate wine from four different cultivars of pomegranate after 30 days of ageing
 (Judge on the mean of 5)

S.N.	Samples	Appea-rance (2)	Colour (2)	Aroma (2)	Bouquet (1)	Vinegar (2)	Total acidity (2)	Sweetness (2)	Body	Flavour (2)	Astringency (2)	General quality (2)	Overall acceptability
A)	Set-I : Dry wine												
Treat ments	T ₁ -Bhagwa wine	1.34	1.3	0.94	0.66	0.8	0.66	0.16	0.64	0.78	0.94	1.3	9.52
	T2-Bhagwa super wine	1.34	1.24	0.84	0.66	0.68	0.62	0.2	0.74	0.68	0.94	1.1	9.08
	T3-Ganesha wine	1.2	1.2	0.64	0.60	0.98	0.7	0.12	0.62	0.48	0.64	1.04	8.3
	T4-Ruby wine	0.94	1.24	0.78	0.49	0.38	0.44	0.18	0.52	0.46	0.68	1.0	7.09
B)	Set-I : Sweet wine												
Treat ments	T ₁ -Bhagwa wine	1.5	1.52	1.14	0.85	1.5	0.9	0.96	0.7	0.56	1.6	1.46	14.59
	T2-Bhagwa super wine	1.2	1.44	0.84	0.76	1.24	0.46	0.7	0.8	0.28	1.6	1.5	12.62
	T3-Ganesha wine	1.2	1.3	0.8	0.76	1.2	0.3	0.58	0.76	1.26	1.5	1.34	12.00
	T4-Ruby wine	1.1	1.3	0.94	0.64	1.0	0.98	0.42	0.66	1.32	1.58	1.06	11.00

Source: Organoleptic evaluation score card a suggested by Amerine *et al.*, (1972).

Table.2 Physico-chemical parameters of pomegranate wine of different cultivars

S.N.	Parameters	Pomegranate cultivars			
		Bhagwa	Bhagwa super	Ganesha	Ruby
1.	pH	3.4	3.4	3.35	2.18
2.	TSS (^o B)	9.12	9.10	8.40	7.38
3.	Titrable acidity (%)	0.58	0.56	0.56	0.53
4.	Ascorbic acid (100mg/ml)	7.68	7.9	7.92	8.40
5.	Reducing sugar (%)	7.12	7.11	7.10	6.20
6.	Non reducing sugar (%)	0.74	0.71	0.54	0.50
7.	Total sugar (%)	7.86	7.82	7.64	6.71
8.	Alcohol (%)	8.05	8.03	8.00	7.8

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