

## Studies on Screening of Pomegranate Cultivars for Wine Production

S.S.MATAPATHI, A.B. PATIL, P. JONES NIRMALNATH AND V.V. SAVALGI

Department of Agricultural Microbiology  
College of Agriculture, Bijapur - 586 101

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**Abstract:** The procedure for wine making from pomegranate juice was developed and standardized at the Microbiology Laboratory of Agricultural College, Bijapur, Karnataka. The three different cultivars of pomegranate comprising Ganesha, Arakta and Kesar were screened for their suitability for wine production with three yeast strains viz., FWY-4, FWY-6 and standard *Saccharomyces ellipsoideus* No. 101. The wine produced from these cultivars was tested for its alcohol per cent, residual sugar, tannins, aldehydes and esters. The overall acceptance of the wine was considered by organoleptic evaluation. Though all the three varieties of pomegranate were found suitable for wine making, the wine from Arakta variety scored the maximum points and adjudged to be the best followed by wine from Ganesha and Kesar cultivars with standard wine yeast culture of *Saccharomyces ellipsoideus* No. 101.

### Introduction

In India, the area under pomegranate (*Punica granatum* L.) is estimated to be 81,585 ha with an annual production of 6,70,035 tonnes. The fruits of pomegranate are mainly used for dessert and juice purpose. The pomegranate loses its marketability and keeping quality due to fruit cracking and fruit spots. The pomegranate juice is liked for its refreshing juicy arils having a balanced blend of sugars, acids and tannins. The important pomegranate cultivars grown in this region are Ganesha, Arakta and Kesar. One kg of grapes yield about 700 ml of juice and pomegranate yield about 500 ml of juice. On fermentation with wine yeast, 650 ml and 450 ml of wine can be produced from grape and pomegranate, respectively (Adsule *et al*, 1992).

Wine is a fermented juice of fresh fruits and it is a compound of water, alcohol, pigments, esters, vitamins, carbohydrates, minerals, acids, tannins with a number of flavouring compounds. Among minerals K, Ca, Na, Mg are important major elements in wines. Wines especially

contain vitamin B. The colour and taste of the wine depends upon the total quantity and properties of phenolic compounds modified during aging. Technology developed to produce quality pomegranate wine as a value added product from the fruits of three pomegranate cultivars of Ganesha, Arakta and Kesar with two local isolates of wine yeasts FWY-4, FWY-6 and standard wine yeast of *Saccharomyces ellipsoideus* strain No. 101 is reported.

### Material and Methods

The pomegranate fruits of Ganesha, Arakta and Kesar cultivars were collected from gardens of progressive pomegranate growers of Bijapur district of Karnataka. The fruits after gentle washing in lukewarm water were used for wine preparation in the laboratory scale flask fermentors.

The juicy arils were separated from fresh fruits with the help of stainless steel knives. The fleshy arils were then crushed by hand and ameliorated to 24° Brix by adding sugar and pH was adjusted to 3.2 by adding baking soda and

further 200 ppm of potassium metabisulphite (KMS) was added. Yeast cultures of *Saccharomyces ellisoideus* No. 101 and two local yeasts isolates FWY - 4 and FWY-6 were added separately. The 5 per cent yeast inoculum was added as starter culture after 3 hours of adding KMS to must and allowed to ferment at room temperature. The cotton plug was replaced after 24 hours from lab. fermentor with rubber cork fitted with rubber tube, whose other end was kept in water. After completion of the fermentation in 2-3 weeks, racking was done 4 times at weekly intervals. After final racking, wines were clarified again by adding 400 mg/litre bentonite clay. The clear wine samples were siphoned into clean pre-sterilised bottles and tightly corked without leaving headspace and kept for maturation at 15-16°C. After maturation for a period of six months, wine samples were tested for chemical and sensory properties.

The chemical composition of pomegranate juice and wine were analysed. The total soluble solids (TSS) was determined with hand refractometer of 0-32 scale, and pH by using digital pH meter. The total acidity (as malic acid) and aldehydes as acetaldehyde were estimated by Anon. (1965) methods. Esters (as ethyl acetate) was estimated by Liebmman and Scheril method (1949). The organoleptic evaluation of wine was carried out by a panel of five judges by using 20 point scale developed by Amerine *et al.* (1972). Sweet wines are prepared by adding 15% cane sugar after final racking. Wines stored in pre-sterilized bottles after clarifying with bentonate clay.

## Results and Discussion

The results (Table 1) revealed that fruits of Ganesha after crushing yielded the maximum juice of 490 ml per kg of fruits with a fruit to juice ratio of 1.0:0.49, followed by Arakta (469 ml and 1.0 : 0.47) and Kesar fruits (458 ml and 1.0: 0.46) (Leena, 1990). In the case of total soluble solids

(TSS) (Table 2) Ganesha recorded the highest values (14.5 °Brix) followed by Kesar (14.0 °B) and Arakta (13.0 °B). The quality wine production require a TSS of 22-23° Brix. The fully riped grapes generally have TSS of 22-23 °Brix. The pomegranate juice therefore needs to be ameliorated with cane sugar to make TSS 22 to 23° Brix. The pH of fruit juices of all the three cultivars was found in the range of 2.93 to 3.02 and hence required to be raised to a pH of 3.2 by the addition of sodium bicarbonate (baking soda) for better quality wine production. The non reducing sugar (2.2%) and ascorbic acid (1 3.62 mg/1 00 ml) and titrable acidity (0.59) were found to be maximum in Arakta fruit juice with medium concentration (87 mg/100 ml) of tannins that perhaps possibly make the Arakta wine better accepted than the other two. The results shown in table 3 indicates that the performance of standard wine yeast culture of *Saccharomyces ellipsoideus* strain No. 101 was better than the other two local isolates and the alcohol per cent was also highest in all the three varieties inoculated with standard wine yeast. The titrable acidity of the wines of all the three varieties inoculated with either of the wine yeast strains was in the range of 0.55 to 0.59 per cent. Irrespective of yeast cultures the residual sugar content was more in wine from Kesar fruits followed by Arakta and Ganesha (Sood *et al.*, 1982).

The tannin content in Kesar was highest (37.52 mg/100 ml) and lowest in Ganesha (27.31 mg/100 ml). Since the tannin content in Arakta was at a medium level (33.42 mg/100 ml), the taste of Arakta wine is neither too bitter nor too astringent, resulting in a better quality wine compared to Kesar and Ganesha. In matured wines, the aldehydes and esters were found in the range between 132.00 to 138.77 and 38.05 to 45.33 mg/lit. The overall chemical analysis of pomegranate wine indicates that the pH of 3 to 3.3, titrable acidity of 0.5 to 0.6, tannins of 33.42 mg/100 ml, aldehydes of 136.18 mg/litre, esters

Table 1. Physical parameters of pomegranate juice

Sl.No.	Parameters	Pomegranate cultivars		
		Ganesha	Arakta	Kesar
1.	Fruit colour	Yellow to red	Red	Red
2.	Arils colour	Pink	Dark red	Dark red
3.	Rind colour	Yellow	Yellow	Yellow
4.	Average fruit weight (g)	245.6	290.0	210.0
5.	Fruit waste (g/kg fruit)	510.0	531.0	542.0
	a. Rind waste (g/kg fruit)	368.0	373.0	368.0
	b. Seed Waste (g/kg fruit)	142.0	158.0	174.0
6.	Per cent seeds/kg fruit	14.20	15.80	17.40
7.	Juice yield (ml/kg fruit)	490.0	469.0	458.0
8.	Fruit: Juice ratio	1:0.49	1:0.47	1:0.46

Table 2. Chemical parameters of pomegranate fruit juice

Sl. No.	Parameters	Pomegranate cultivars		
		Ganesha	Arakta	Kesar
1.	TSS(°Brix)	14.50	13.00	14.00
2.	pH	3.02	2.95	2.93
3.	Titration acidity (% malic acid)	0.57	0.59	0.59
4.	Total sugars (%)	10.40	10.20	9.65
5.	Reducing sugars (%)	8.40	8.00	7.30
6.	Non reducing sugars	2.00	2.20	2.35
7.	Tannins (mg/100 ml)	76.00	87.00	91.00
8.	Ascorbic acid (mg/100ml)	12.50	13.62	13.16

of 42.33 mg/litre, alcohol of 8 per cent were found optimum for better acceptability that was noticed in Arakta wine (Sachde *et al.*, 1979).

The clarity, colour, flavour and taste are the characters responsible for acceptance or rejection of any wine. In the 20 point sensory evaluation scale given by Amerine *et al.* (1972), the wine scoring less than 10 points are considered as poor quality wines, the wine scoring points between 11 to 15 are considered as medium quality and wines scoring above 15 points are considered to be of good quality. The results in table 4 shows that Arakta sweet wine inoculated with standard wine yeast of *Saccharomyces*

*ellipsoideus* No. 101 scoring 15 & 16 points was found to be the best followed by Arakta wine only with other local yeast isolates. The Arakta wine can be used to blend with other wines from Ganesha and Kesar fruit juices to improve their quality.

Organoleptic studies indicate that Arakta is found to be the best both in dry wine and sweet wine with either of the wine yeast isolates tested. Among dry wines Arakta followed by Kesar and Ganesha were found to be better, while among sweet wines it was again Arakta followed by Kesar and Ganesh found to be better (Singhnagi and Manjrekar, 1975, Kulkarni *et al.*, 1980 and Onkarayya, 1985).

Table 3. Chemical analysis of pomegranate wine

Varieties	Residual sugars (%)			Alcohol (%)			Titrable acidity (%)		
	Yeast strains			Yeast strains			Yeast strains		
	<i>S. ellipsoideus</i>	FWY-4	FWY-6	<i>S. ellipsoideus</i>	FWY-4	FWY-6	<i>S. ellipsoideus</i>	FWY-4	FWY-6
	No.101			No.101			No.101		
Ganesha	2.02	2.07	2.08	2.06	8.31	8.23	8.10	0.55	0.55
Arakta	2.15	2.19	2.20	2.18	8.25	8.18	7.95	0.57	0.58
Kesar	2.37	2.41	2.44	2.40	8.23	8.04	7.90	0.58	0.58
Source	S.Em $\pm$	CD (0.01)			S.Em $\pm$	CD (0.01)		S.Em $\pm$	CD (0.01)
Yeast strains	0.010	0.042			0.010	0.042		NS	NS
(YS)									
Variety (V)	0.010	0.042			0.010	0.042		0.010	0.042
Interaction	NS	NS			0.018	0.073		NS	NS
(YSXV)									
Varieties	Tannins (mg/100 ml)			Aldehydes (mg/l)			Esters (mg/l)		
	Yeast strains			Yeast strains			Yeast strains		
	<i>S. ellipsoideus</i>	FWY-4	FWY-6	<i>S. ellipsoideus</i>	FWY-4	FWY-6	<i>S. ellipsoideus</i>	FWY-4	FWY-6
	No.101			No.101			No.101		
Ganesha	27.31	27.31	27.32	27.31	132.01	132.06	132.50	45.30	45.33
Arakta	33.44	33.42	33.42	33.42	136.21	136.17	136.18	42.35	42.32
Kesar	37.52	37.53	37.52	37.52	138.23	138.77	138.26	38.25	38.06
Source	S.Em $\pm$	CD (0.01)			S.Em $\pm$	CD (0.01)		S.Em $\pm$	CD (0.01)
Yeast strains	NS	NS			NS	NS		NS	NS
(YS)									
Variety (V)	0.25	1.00			0.23	0.95		0.047	0.188
Interaction	NS	NS			NS	NS		NS	NS
(YSXV)									
NS - Non Significant									

Sl. No.	Treatments	Scores given by panel of judges in 20 point scale										Overall acceptability (20 points)	
		Appearance (2)	Colour (3)	Aroma (2)	Bouquet (1)	Vinegar (2)	Total acidity(2)	Sweetness (1)	Body (1)	Flavour (2)	Astringency(2)		General quality (2)
1.	Ganesh+ <i>S. ellipsoideus</i> No. 101	0.50	1.00	1.00	0.00	1.00	1.25	0.00	1.00	2.00	2.00	1.00	10.75
2.	Ganesh+FWY-4	1.00	0.50	1.00	0.50	1.00	1.00	0.00	1.00	1.50	1.00	1.00	9.50
3.	Ganesh+FWY-6	1.00	1.00	1.00	0.00	0.50	1.00	0.00	1.00	2.00	1.75	0.75	10.00
4.	Arakta+ <i>S. ellipsoideus</i> No.101	2.00	2.50	2.00	1.00	1.50	1.50	0.00	0.50	1.00	1.00	2.00	15.00
5.	Arakta+FWY-4	2.00	2.00	2.00	0.50	1.00	1.00	0.00	0.25	1.00	2.00	2.00	13.75
6.	Arakta+FWY-6	2.00	2.25	2.00	0.75	1.25	1.00	0.00	0.25	0.75	1.00	1.00	12.25
7.	Kesar+ <i>S. ellipsoideus</i> No. 101	1.00	2.00	2.00	0.75	1.00	1.00	0.00	0.25	1.00	1.00	1.50	11.50
8.	Kesar+FWY-4	1.75	2.00	2.00	0.50	0.50	1.00	0.00	0.25	1.00	1.00	1.00	11.00
	Kesar+FWY-6	2.00	2.00	2.00	0.00	1.00	0.75	0.00	0.00	1.00	0.75	1.00	10.50

Table 5. Organoleptic evaluation of pomegranate sweet wines (mean average of five judges)

Sl. No.	Treatments	Scores given by panel of judges in 20 point scale											Overall acceptability (20 points)
		Appearance (2)	Colour (3)	Aroma (2)	Bouquet (1)	Vinegar (2)	Total acidity(2)	Sweetness (1)	Body (1)	Flavour (2)	Astringency(2)	General quality (2)	
1.	Ganesh+ S. <i>elipsoideus</i> No. 101	0.50	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	13.50
2.	Ganesh+FWY-4	1.00	0.50	1.25	1.00	1.75	1.25	1.00	1.00	1.75	1.00	1.00	12.00
3.	Ganesh+FWY-6	1.25	1.50	1.00	0.50	1.00	1.25	1.00	1.00	1.50	2.00	1.00	13.00
4.	Arakta+ S. <i>elipsoideus</i> No.101	2.00	2.50	2.00	1.00	1.75	1.75	1.00	0.50	1.50	1.00	1.00	16.00
5.	Arakta+FWY-4	1.75	2.25	1.50	0.75	1.00	1.00	1.00	0.25	2.00	1.00	1.50	14.00
6.	Arakta+FWY-6	1.50	2.00	1.75	0.50	1.00	1.50	0.75	0.00	1.75	1.00	1.75	13.50
7.	Kesar+ S. <i>elipsoideus</i> No. 101	1.50	2.00	1.50	0.50	1.00	0.50	1.00	0.25	1.50	1.00	1.50	12.25
8.	Kesar+FWY-4	1.50	2.00	1.00	1.00	0.25	1.00	1.00	0.25	1.50	1.00	1.00	11.50
9.	Kesar+FWY-6	1.50	2.00	0.75	0.50	1.00	1.00	1.00	0.75	1.50	1.00	0.75	11.75

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