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Evaluation of Fruit Quality in Different Pomegranate Cultivars Under Sub- Mountain Low Hill Zone of Himachal Pradesh

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ABSTRACT

Six cultivars of pomegranate namely Kandhari Kabuli, Kandhari Hansi, Chawla, G – 137, Mridula and Bhagwa were tested for their fruit quality at the experimental farm of Regional Horticultural Research Station, Jachh (Nurpur) H.P in the year 2012 and 2013. The climate of the zone is hot and dry during summer (April- June) and hot and humid during rainy season (July – September). Study revealed that in term of fruit size Kandhari Kabuli, Kandhari Hansi and G – 137 were observed to be the best varieties in the hot and the humid zone of the Himachal Pradesh. Mridula and Bhagwa produced the small sized fruits. Fruit shape was globose in all the cultivars except Chawla where the fruit shape was oblate. Fruit colour varied from greenish yellow in G-137, red in Kandhari Kabuli , Kandhari Hansi and yellowish pink in Chawla . Large fruited cultivars such as Kandhari Kabuli, Kandhari Hansi and G – 137 had significantly more thicker rind when compared to the small fruited cvs. such as Bhagwa and Mridula . Aril size and weight was significantly higher in Kandhari Hansi followed by G – 137 and Kandhari Kabuli . Aril percentage was significantly more in large fruited cultivars when compared to the small fruited cultivars mainly the Bhagwa. Juice content was found to vary from 63.4 per cent in Chawla to 72.4 per cent in G – 137. Maximum (14.4 %) total soluble solids content were recorded in Bhagwa followed by Kandhari Hansi. Percent acidity was observed maximum (0.80)in Kandhari Kabuli followed by Kandhari Hansi (0.72). Fruit of Chawla cultivar was observed less acidic. All the cultivars tested were observed susceptible to the pomegranate butter fly.

INTRODUCTION

Pomegranate (*Punica granatum* L.) is an important and an ancient fruit plant belonging to family punicaceae (2 n= 2 x=16, 18). It is indigenous to South-West Asia, probably originated in Iran and some adjoining countries and first introduced into India from Persia or Afghanistan in the first century. It can be grown from plains to an

elevation of 2000 amsl. The major pomegranate growing states in India are Maharashtra accounting for 67.81percent of total production followed by Karnataka (16.4%), Andhra Pradesh (8.2%), Gujrat (5.6%) and is also grown on limited scale in the states of Punjab, UP, Haryana, J&K and Himachal Pradesh. The total area in Himachal Pradesh under pomegranate cultivation is 1083 ha with an annual production of 475 MT (Anonymous, 2011). In the state its commercial cultivation has been taken up by farmers of mid hill zone in the Bajaura Valley of Kullu District and the main cultivars grown are, Khandhari Kabuli, Bhagwa, G-137 and Mridula. The climate of the valley remains usually dry during fruit development stages which results in quality fruits. Recently the other districts like Mandi, Hamirpur and Bilaspur has started growing pomegranate on the commercial scale. In the sub-tropical conditions of Himachal Pradesh the pomegranate cultivation can help in diversification of horticulture as the crop is suited to high density plantation. Frequent monsoon rains starting by the end of June and continuing upto August are typical feature of this zone. So far studies with respect to performance of pomegranate in submontane low hill zone of Himachal Pradesh have not been conducted. Therefore, present studies on the performance of six pomegranate cultivars were taken up during 2012 and 2013 with the objective of recommending/selecting a suitable cultivar(s) for cultivation under submontane low hill zone of Himachal Pradesh.

MATERIALS AND METHODS

The investigations was conducted at the experimental farm of Regional Horticultural Research Station, Jachh (Nurpur) of Dr. Y. S. Parmar University of Horticulture and Forestry representing sub tropical submontane low hill zone-I Climate. The research station is situated at 32^0 18'N and$75^0$55'E at an altitude 428m above sea level. The plants of varying age of six different cultivars of pomegranate namely Khandhari Kabuli, Khandhari Hansi ,G-137, Mriduila ,Chawla and Bhagwa raised as mother block (3x3 m) were selected to assess the fruit quality. The observations on various physico-chemical attributes like fruit weight, fruit size, fruit colour, rind thickness, no of arils/fruit ,aril size, aril percent, 100-aril weight, arils colour, juice percentage, TSS, acidity, reducing sugar, total sugars were recorded. The acidity, reducing sugars and total sugars were estimated as per method suggested by AOAC (1995). The experiment was laid out in RBD with four replications. Single tree was considered as a replication and sample of 20 fruits was used to record observations on various parameters.

RESULTS AND DISCUSSION

Physical characteristics

Results for fruit size in term of length and diameter revealed that maximum (8.3 cm) fruit length was recorded in Khandhari Kabuli and Kandhari Hansi while minimum (5.6 cm) in Bhagwa cultivar (Table1). Fruit diameter was observed to vary from 5.4 cm (Bhagwa) to 9.6 cm (Chawla**).** Nirmal et al.(2005) observed such variations in fruit size in term of length and diameter. Fruit size is reported to be dependant on genetic constitution of a cultivar. Average fruit weight (Table 1) in different cultivars ranged between 87.6g (Bhagwa) and 399.5g (G-137). Cultivar G-137 had significantly highest fruit weight when compared to Bhagwa and Mridula under study. However , it was statistically at par to the fruit weight of Chawla (367.2g), Kandhari Hansi (363.8g) and Kandhari Kabuli (314.6g). The differences noticed in the present study can be attributed to genetic make up of these cultivars (Prasad and Banker 2000).

Fruit shape was observed to be globose in all the cultivars under study except Kandhari Hansi where it was oblate (Table 1). Different fruit shapes in the different cultivars have earlier been reported by Malhotra et al. (1983 a). Fruit color recorded in different cultivars was and observed to vary from greenish yellow (G-137) to yellowish pink (Chawla) and pinkish yellow (Mridula) and red in Kandhari Kabuli, Kandhari Hansi and Bhagwa (Table 1). These findings are in line with that of Nirmal et al. (2005). Rind of the pomegranate fruit is responsible for its keeping quality and hence its long distance shipment can be done. Rind thickness (Table1) was observed to be maximum (0.78 cm) in Kandhari Hansi whereas minimum

Table 1: Physical characteristics of pomegranate cultivars

Cultivar	Fruit Size(cm)		Fruit wt.(g)	Fruit Shape	Fruit color	Rind Thickness(cm)
	L	D				
Kandhari Kabuli	8.3	8.2	314.6	Globose	Pinkish Red	0.52
Kandhri Hansi	8.3	9.5	363.0	Oblate	Red	0.78
G -137	8.4	9.4	399.5	Globose	Greenish Yellow	0.67
Mridula	6.2	6.7	136.3	Globose	Pinkish Yellow	0.43
Chawla	7.9	9.6	367.2	Globose	Yellowish Pink	0.47
Bhagwa	5.6	5.4	87.6	Globose	Red	0.26
$SE_m(\pm)$	0.11	0.13	33.51			0.02
CD 0.05	0.24	0.27	68.12			0.24

Table 2: Aril characteristics of pomegranate cultivars

Cultivar	Aril Size (cm)		100- aril wt.(g)	Aril (%)	Aril color	No. of aril/ fruit
	L	D				
Kandhari Kabuli	1.00	0.83	24.7	69.7	Light pink	413
Kandhri Hansi	1.10	0.80	42.6	68.3	Red	302
G- 137	1.01	0.67	25.1	68.4	Light pink	579
Mridula	0.90	0.84	22.9	68.7	Red	342
Chawla	1.00	0.83	22.2	68.2	Light pink	626
Bhagwa	0.98	0.61	18.2	60.4	Red	242
$SE_m(\pm)$	0.02	0.01	0.92	1.75		65.8
CD 0.05	0.04	0.02	2.01	3.92		142.7

Table 3: Chemical characteristics of pomegranate cultivars

Cultivar	Juice (%)	TSS (^{0}B)	Acidity (%)	Reducing sugars (%)	Total sugars (%)
Kandhari Kabuli	68.3	14.4	0.80	9.8	11.3
Kandhri Hansi	71.7	15.8	0.72	7.3	11.6
G- 137	72.4	13.2	0.28	9.7	10.7
Mridula	68.2	12.5	0.35	8.9	10.6
Chawla	63.4	12.8	0.21	8.5	9.7
Bhagwa	69.2	14.8	0.27	9.4	11.8
$SE_m(\pm)$	0.92	0.16	0.01	0.08	0.01
CD 0.05	1.98	0.36	0.02	0.17	0.02

Table 4: Reaction of pomegranate cultivars to various biotic and biotic stresses

Cultivar	**Infestation of anar butterfly (%)**	**Incidence of fruit spots (%)**	**Fruit Cracking (%)**
Kandhari Kabuli	85.9	54.2	1.3
Kandhri Hansi	72.3	43.4	2.4
G-137	68.5	35.6	1.9
Mridula	79.6	88.4	3.6
Chawla	72.4	25.8	2.1
Bhagwa	88.5	78.9	3.7

(026 cm) in Bhagwa. Mishra et. al., (1983) reported rind thickness to vary from 0.27 cm to 0.69 cm while Nirmal et al.(2005) reported that it to vary from 0.15 cm to 0.44 cm in eight different pomegranate cultivars.

Aril characteristics

Aril size was minimum (0.90 x 0.840 cm) in Mridula while Kandhari Hansi had the maximum (1.1x0.80 cm) (Table 2). Pandey and Bist (1997) have observed such variations in aril size. Results for100- aril weight revealed that Kandhari Hansi had significantly highest (42.6g) 100- aril weight followed by G-137 (25.1g), Kandhari Kabuli (24.7g), Mridula (22.9g) and Chawla (22.2g). The cultivar Bhagwa had the lowest (18.2g) 100-aril weight (Table 2). Nirmal et al. (2005) observed that 100-aril weight varied from18.5 g in Ganesh to 40 g in Kandhari Hansi. Aril colour ranged from light pink to red in different cultivars. Similar observations have been recorded at Rahuri (Anon., 1991). Average number of arils/ fruit were observed to be maximum (626) in Chawla . The cultivar G-137 (579) arils/fruit was statistically at par with this cultivar (Table 2). However, cultivar Bhagwa has the significantly minimum (242) number of arils/fruit. Such observations for number of arils/fruit have been recorded by Nirmal et al. (2005). Aril percentage varied from 60.4 to 68.7 percent in different cultivars under study (Table 2). However, aril percentage was significantly lowest (60.4%) in the Bhagwa variety. Such variations for aril percentage have been reported to occur (Anon.1986).

Chemical characteristics

Juice percentage was highest (72.4 %) in G-137 which statistically superior to all other cultivars except Kandhari Hansi (Table 3). Such variations in juice content have been reported earlier to occur due to their genetic constitution and have been reported in different pomegranate cultivars (Malhotra et. al., 1983 b). Non-significant differences for TSS content was recorded among Mridula and Chawla whereas significant differences were observed to occur in the other cultivars. Total soluble solids content varied between 12.5°B in Mridula and 15.8°B in Kandhari Hansi cultivar. Malhotra et al. (1983b) obtained variations in TSS content in different pomegranate cultivars at Ludhiana. But Prasad and Banker (2000) observed higher total soluble solids (16.2°B) in arid climate of Jodhpur. The differences observed in TSS content at various places might be due to climatic conditions. Significant differences (Table 3) in acid content were recorded in all the cultivars under study except G-137 (0.28 %) and Bhagwa (0.27 %). The acid content varied between 0.21 percent in Chawla to 0.80 percent in Kandhari Kabuli. Such variations in acid content have earlier been reported by Shulman et. al. (1984). These changes in acid content can b attributed to picking stage and prevailing temperature at the time of fruit maturity.

Reducing sugars were observed to vary from 7.3percent in Kandhari Hansi to 9.8 percent in Kandhari Kabuli (Table 3). Chundawat (1995) and Nirmal et al. (2005) have recorded variations in reducing sugar content. Pomegranate are reported to be sweet under hot arid climate as compared to cooler climate (Patil and Karale 1992). Significant variations in total sugars were recorded in different cultivars under study (Table 3). Cultivar Kandhari Hansi had the maximum (11.6 %) whlie Chawla had the minimum(9.7 %).Varietal differences for TSS content have been reported by Mir et al. (2007).

Reaction to various biotic and abiotic stresses

Reaction to various biotic and abiotic stresses in different cultivars was also recorded (Table 4). All the cultivars were found to susceptible to the attack of anar butterfly and the infestation varied from 68.5 percent in G-137 to 85.9 percent in Kandhari Kabuli. No incidence of bacterial blight was observed under Jachh conditions. There was heavy infestation of fungal spots maximum (88.4 %) in Mridula and least (25.8 %) in the Chawla cultivar. Some fruit cracking was also noticed in the cultivars under study.

CONCLUSION

Kandhari Kabuli, Kandhari Hansi and G – 137 were observed to be the most promising varieties in the hot and the humid zone of the Himachal Pradesh in term of fruit size and most of other fruit quality parameter.

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