

Fruit Yield and Quality of Some Pomegranate Cultivars Grown in Laterite Soil of West Bengal (India)

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Abstract: Ten varieties of pomegranate were evaluated under semi arid climatic conditions at private orchard, Jhargram, Paschim Midnapore district of West Bengal for 3 years from 2010 to 2012. The plantation was nine years' old planted at a spacing of 3 m × 3 m. The results showed significant variations among all the yield and quality parameters due to various cultivars. The highest number of fruits per plant (57.00) and yield per plant (11.12 kg) were recorded in cv. Amlidana. Average fruit weight (249.67 g), average fruit diameter (8.60 cm) and 100 aril weight (25.20 g) were recorded maximum in cv. G-137, whereas maximum fruit length (8.37 cm) was recorded in cv. Jyothi. Maximum TSS (13.67^o brix), TSS/acid ratio (42.71) juice recovery percentage (73.00 %) aril percentage (69.70 %), minimum peel percentage (30.30) and acidity (0.32) were recorded in cv. Ruby. The cultivar P-26 recorded highest reducing sugars (12.17) and 100 seed weight (8.41 g). Maximum peel thickness was registered in cultivar Bassein seedless (0.98 cm). Specific gravity was highest in a Ganesh (1.006). From this study it was concluded that the ambledana recorded highest fruit yield and ruby cultivar gave second highest fruit yield with good quality fruits having highest TSS, TSS/acid ratio and minimum acidity among the cultivars grown in lateritic soil of West Bengal (India).

Keywords: Laterite soil, Pomegranate, Quality, Semi arid and Yield.

INTRODUCTION

Pomegranate (*Punica granatum* L.) belongs to the Punicaceae family and is one of the commercially important fruits which is extensively cultivated in many tropical and subtropical regions of the world (Tehranifar and Mahmoodi-Tabar, [18]). More recently pomegranate production and consumption is increased due to recognition of its multiple nutritional and medicinal health benefits for human (Gozlekci *et al.*, [6] and Orhan *et al.*, [12]). In India, it is found to be growing from Kanyakumari to Kashmir but the commercial plantations of pomegranate exists only in Maharashtra, Gujarat, Rajasthan, Karnataka and to a limited extent in Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Punjab, Haryana and Tamilnadu owing to its preference for arid climate. There is wide scope of its expansion for commercial cultivation in the western part of West Bengal where the prevailing climatic conditions are of semi arid type. However, the performance of the plant will be excellent if

maintenance is with protective irrigation. To boost pomegranate production in India both for home and export, identification and development of improved varieties/hybrids having attractive rind, bold and dark red- soft aril with sweet taste is required (Pareek and Samadia, [13]). This is enabled by evaluation of the available germplasm which results in selection of superior genotypes suited to that particular region. Lack of information on varietal performance of pomegranate in laterite soils of West Bengal especially with irrigation input, inspired to take up the present study with the view to find out best cultivar/cultivars based on yield and fruit quality.

MATERIALS AND METHODS

The plants of ten pomegranate cultivars *viz.*, Amlidana, Bassein Seedless, Ganesh, Jalore Seedless, Jyothi, Mridula, Ruby, G-137, P-23, and P-26 were planted during 2001 in a private orchard situated at 5 km away from Regional research Station, Jhargram

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Table 1
Fruit yield and physical properties of fruits of Ambe-bahar crop of ten pomegranate cultivars grown on lateritic soil of West Bengal under semi arid climatic conditions.

Cultivars	Number of Fruits Per Plant	Average Fruit Weight (g)	Fruit length (cm)	Fruit diameter (cm)	Fruit yield per plant (Kg)	Specific gravity	Peel thickness (cm)	Peel (%)	Juice recovery (%)	Aril (%)
Ganesh	41.38	244.67	8.13	8.37	9.83	1.006	0.87	37.00	69.33	63.00
Jyothi	37.86	232.33	8.37	8.57	8.32	0.953	0.71	38.50	68.33	61.50
Ruby	45.89	210.33	7.80	7.80	9.13	0.970	0.70	30.30	73.00	69.70
Amlidana	57.00	177.67	7.33	7.77	11.12	0.980	0.61	32.00	65.00	68.00
Bassein seedless	39.64	211.00	7.67	7.93	8.88	0.956	0.98	32.20	69.67	67.80
Jalore seedless	36.56	239.33	7.90	8.23	8.49	0.980	0.91	32.60	62.33	67.40
Mridula	35.00	188.33	7.30	7.90	6.59	0.976	0.83	31.90	67.33	69.10
G-137	29.89	249.67	8.07	8.60	7.65	0.966	0.97	31.60	68.00	64.40
P-23	33.78	191.00	7.97	8.47	7.95	0.960	0.83	33.10	64.00	66.90
P-26	30.33	226.67	8.20	8.73	8.66	0.966	0.92	39.60	66.33	60.40
C.D	2.46	12.11	0.449	0.468	2.034	0.020	0.04	1.79	3.986	3.88

Data are the means of three years from 2010 to 2012.

of Bidhan Chandra Krishi Viswavidyalaya West Bengal. Nine plants in each cultivar of uniform size, vigour and productivity were selected. All plants were given uniform cultural practices throughout the period of experimentation. The experiment was laid out in a randomized block design with 10 treatments and each treatment was replicated thrice at spacing of 3 × 3m. The fruits of Ambe-bahar flowering (January-February) were harvested during June-August in all three years and used for the study. The plants were forced to Ambe bahar flowering by withholding irrigation and manipulating fertilizers application.

The fruit yield per plant was calculated by collecting the total number of harvested fruits from the plant weighting with balance and it was expressed in kg per plant. Physico-chemical characteristics were recorded from ten randomly selected matured fruits from each replication. The physico-chemical characteristics of fruits were taken for three years. The TSS of randomly selected fruits was determined with the help of Erma hand refractometer (0-32°Brix). The titratable acidity was determined by the method given by Association of Analytical Chemists (AOAC, [1]) using Phenolphthalein (1%) as an indicator by titrating against N/10 NaOH. The reducing sugars, was determined as per the standard methods given by AOAC [1].

The data (average of three years from 2010 to 2012) was statistically analyzed using RBD by Online Statistical Analysis Package (OPSTAT, Computer Section, CCS Haryana Agricultural University, Hissar).

RESULTS AND DISCUSSION

Statistical analysis revealed highly significant differences among the existing ten pomegranate cultivars in all the characters (Table 1). The mean performance of cultivars revealed that cv. Amlidana recorded significantly the maximum number of fruits/plant (57.00) and minimum (29.89) was recorded in cv. G-137. Number of fruits/ plant was directly related to the ultimate yield which in turn determines the yield potential of the cultivar. The highest fruit yield (11.12 kg/plant) was noted in cv. Amlidana followed by Ruby (9.13 kg/plant). The yield factor was attributed to number of fruits/plant and size of the fruit which varies due to genetic make-up of the cultivar. Apart from genetic make-up, environmental factors and age of plants affects the number and size of the fruits which in turn is responsible for overall yield efficiency. There were significant differences in average weight of fruits. The maximum average fruit weight (249.67 g) was recorded in cv. G-137 followed by Ganesh (244.67 g) and minimum (177.67 g) was in Amlidana. The deviation in size with respect to fruit weight may be due the variations in the form as sometimes they are obscurely ridged and many sided as recorded by Nath and Randhawa [11]. The analysis of variance revealed maximum specific gravity in cv. Ganesh (1.00). The cultivar G-137 was superior in respect of fruit diameter in comparison to all other cultivars. The maximum fruit length was noticed in cv. Jyothi followed by P-26 cultivar.

As far as rind thickness is concerned, it was minimum (0.61 cm) in cv. Amlidana, which was significantly less in comparison to the rest of the cultivars under test. The peel percentage is an

Table 2
Rind colour, aril colour, 100 aril weight, 100 seed weight and fruit quality of the ten pomegranate cultivars grown on lateritic soil of West Bengal under semi arid climatic conditions.

Cultivars	Rind colour	Aril colour	100 Aril weight (g)	100 Seed weight (g)	TSS (°Brix) (%)	Acidity (%)	Reducing sugars	TSS: acid ratio
Ganesh	Yellowish to Reddish Green	Off White	25.10	6.30	12.23	0.37	10.44	33.06
Jyothi	Reddish Green	Off White	20.70	5.40	13.20	0.35	11.34	37.71
Ruby	Light Red	Reddish White	21.50	4.32	13.67	0.32	11.46	42.71
Amlidana	Yellowish Red	Off White	24.10	4.75	13.20	1.89	8.95	6.98
Bassein seedless	Yellowish Green	Off White	23.60	6.00	12.93	0.35	11.30	38.03
Jalore seedless	Yellowish Red	Off White	20.30	4.70	12.50	0.34	10.82	36.78
Mridula	Deep Red	Deep Pinkish White	20.00	5.80	12.43	0.37	10.52	32.73
G-137	Reddish Yellow	Off White	25.20	5.23	13.07	0.38	10.84	35.06
P-23	Reddish Green	Off White	22.80	6.29	13.23	0.33	10.20	40.09
P-26	Reddish Green	Off White	22.50	8.41	12.87	0.33	12.17	39.00
C.D			1.35	0.46	0.760	0.05	0.61	2.49

Data are the means of three years from 2010 to 2012.

important non-edible part of fruit. The minimum peel percentage (30.30 %) was registered in cv. Ruby which is at par with Mridula and Amlidana followed by Bassein seedless. The rind thickness values were higher than values reported by Verma *et al.*, [19] and Sarkhosh *et al.*, [15]. Aril percentage varied significantly and was recorded maximum in cv. Ruby followed by Mridula. The least Aril percentage per fruit was observed in cv.P-26. From the pooled data the cultivar Ruby was significantly superior with regard to juice content (73.00 %) in comparison to all other cultivars under test followed by Bassein Seedless and minimum in Jalore Seedless (62.33 %). Variation in juice content was also supported by Singh [17] who reported that cultivars differ in their juice content due to their genetic constitution.

From the pooled data (Table 2) as far as general appearance of the fruit rind colour is concerned, cv. Mridula recorded the highest deep red colour followed by Ruby (Reddish Green). Colour of aril also differed according to cultivars. In Mridula having aril colour was deep Pinkish White, Ruby-reddish white and other cultivars were having off-white in colour. As regards the 100 aril weight G-137 (25.20 g) was significantly superior to rest of the cultivars followed by Ganesh (25.10 g). The cultivar P-26 recorded highest 100 seed weight (8.41 g) followed by Ganesh (6.30 g).

From the pooled data (Table 2) the TSS content of cultivars ranged from 12.23°Brix (cv. Ganesh) to 13.67° Brix (cv.Ruby). The variation in TSS content was also reported by Mir *et al.*, [10]. These results were lower than values observed (16-19° Brix) by Poyrazoglu *et al.*, [14]. Similar results were reported in pomegranate by Fadavi *et al.*, [5] and Shulman

et al., [16]. Similarly, the fruit acidity content (expressed as citric acid) ranged between 0.32 % (Ruby) to 1.89 % (Amlidana). The inter-varietal differences were highly significant. The prevalence of wide range in acid content in juice of different cultivars is probably the reason to use this character to classify pomegranate cultivars as sweet, sour or bitter sweet (Cains, [2] and Cheema *et al.*, [4]).The highest total sugars were recorded in cv. P-26 followed by Ruby. The maturity index (TSS/ acid ratio) is responsible for the taste and flavour of pomegranate, which some author used for classifying the pomegranate cultivars (Martinez *et al.*, [9] and Cam *et al.*, [3]).

The TSS/ acid ratio which determine taste of the fruit varied significantly ranging from 6.98 in Amlidana to 42.71 in Ruby. The lowest TSS/acid ratio in Amlidana was due to its highest fruit acidity. In previous studies variable ranges of maturity indices (Verma *et al.*, [19] Mir *et al.*, [10]) were reported.

This variation in physico chemical characteristics of fruits and yield were mainly due to genotypic variation of the varieties Mahajan and Dhillon, [7], though agro climatic conditions could not be overlooked (Mail & Prasad [8]).

CONCLUSION

Out of the ten cultivars Amlidana gave higher fruit yield with more acidic so this cultivar can be useful for anardana purpose. The Ruby cultivar can be recommended for cultivation in the red laterite soils of West Bengal under irrigated condition for table purpose as it gave second highest fruit yield after Amlidana and produced quality fruits (Highest TSS: acid ratio) having highest TSS, Juice content and minimum acidity in Ambe bahar cropping season.

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