

Flowering, Fruit Set, Fruit Drop, Fruit Retention, Fruit Maturity and Yield of Seven Cultivars of Pomegranate Grown in the Semi-Arid Region of West Bengal

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Abstract

An experiment was conducted during 2003 to 2004 in a private orchard to study about flowering, fruit set, fruit drop, fruit retention and yield of seven cultivars of pomegranate in the semi-arid region of West Bengal. It revealed that the period required for flower bud development varied between 15 days in Ruby to 18 days in Amblethane, Ganesh, Jyoti and Mridula. From opening of flower to attainment of fruit set stage, it took 3 to 5 days in different cultivars. The total period required from initiation of flower bud (pin-head stage) to fruit maturity ranged between 111 days (Mridula) to 123 days (Bassein Seedless). Time of anthesis of Mrig bahar crop in different cultivars was from 6.30—7.00 am to 12.30—1.00 pm while time of dehiscence of anthers was 7.30—8.00 am to 2.30—3.00pm. However, in Ambe bahar crop the time of anthesis in different cultivars was from 8.00—8.30 am to 12.30—1.00 pm while time of dehiscence of anthers was 10.00 am to 3.00 pm. The total fruit drop percentage was highest in Ruby (95%) and lowest in Ganesh (72%) during 2003 while during 2004, it was recorded highest in Jalore Seedless (95%) and lowest in Amblethane (71%). The final fruit retention percentage varied from 5% in Ruby to 28% in Ganesh during first year. However, in the second year the final fruit retention percentage varied from 5% in Jalore Seedless to 29% in Amblethane. The average yield was found maximum in Ganesh (24.3 kg) followed by Ruby (21.4 kg) and Bassein Seedless (19.6 kg).

Key words : Pomegranate cultivars, Flowering, Fruit set, Fruit maturity, Yield.

Pomegranate (*Punica granatum* L.) belonging to the family Punicaceae, is extensively cultivated in the states of Maharashtra and is gaining popularity in the arid and semi-arid regions of India. Its cultivation is spread all over the country due to its versatile adaptability, hardy nature, high yield with low maintenance cost, fine dessert and therapeutic value and good keeping quality with high export potential (1). In pomegranate our strength lies in the year round production and easy access to international market (2). In pomegranate many flowers fail to set fruits and even among the set fruits there is some amount of dropping. Several studies on floral biology, fruit drop, fruit retention, period required for fruit maturity and yield of different pomegranate cultivars were studied in India by different workers (3—7). To look at the possibilities of utilizing pomegranate fruits for commercial use and to choose them for dessert and processing purpose and to help the breeders in bringing crop improvement by selecting suitable types, it is

desirable to study the period required for flower bud development, anthesis and dehiscence of anthers, fruit set, period required for fruit maturity, fruit retention and yield of pomegranate cultivars. Information available on these aspects in West Bengal is meagre. Hence, the present investigation was undertaken to standardize the crop to go well with the local needs, to start any breeding work for bringing crop improvement in future and to originate appropriate cultural practices that may influence the performance eventually.

Methods

The investigation was carried out in a private orchard at Jhargram, West Midnapore, situated at 5 km away from the Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, West Bengal during 2003-2004. The plants of seven pomegranate cultivars viz. Amblethane, Bassein Seedless, Ganesh, Jalore

Table 1. Time required for flower bud development, fruit set and fruit maturity of seven cultivars of pomegranate in Mrig bahar crop. NS=Non-significant.

Varieties	Time required for flower bud development (days)	Time required from flowering to fruit set (days)	Total time from initiation of flower bud (pin head stage) to maturity (days)
Ambledane	18	5	116
Bassein Seedless	16	3	123
Ganesh	18	3	118
Jalore Seedless	17	4	115
Jyoti	18	4	120
Mridula	18	4	111
Ruby	15	3	117
CD at 5%	NS	NS	6.95

Seedless, Jyoti, Mridula and Ruby planted during 2001 were selected for study. The experimental site is a drought prone semi-arid zone with an average annual rainfall of 1100—1500 mm of which 80% rainfall occur during July to September. The experiment was laid out in a randomized block design with four replications at spacing of 3 m × 3 m. Two plants under each variety or replication were used for recording the data. The plants under the experiment were manured with 20 kg well rotten farm yard manure and fertilized with 200 g of nitrogen, 100 g each of phosphorus and potassium per plant per year in the form of urea (46% N), rock phosphate (24% P₂O₅) and muriate of potash (60% K₂O) respectively. The manures and fertilizers were applied in a circular trench of 20 cm wide between a radial distance of 45 and 65 cm. Fertilizers were applied in 2 equal splits in June and September while cow dung manure was applied along with first split application of chemical fertilizers. The plants were

irrigated after cessation of monsoon at 15—20 days interval. The experimental field was kept free from weeds by removing them mechanically (ploughing by power tiller) and manually before and after monsoon. The necessary plant protection measures were taken as and when necessary. Moreover, the plants were grown with uniform cultural practices throughout the period of experimentation. Data on different parameters were recorded from Mrig Bahar (June—July flowering) and Ambe Bahar (February—March flowering) crops.

The total days required from emergence of flower bud to its opening was considered as the period required for flower bud development. Twenty flower buds just at the stage of emergence were tagged at random all over the plant for recording period for flower bud development. The time taken from opening of flower to petal fall stage (fruit set) was recorded from the same tagged flower buds. For recording anthesis and dehiscence of anthers, twenty fully matured and well bulged flower buds of similar size to be opened next day were tagged and the number of flower buds that opened on each day from 6.00 am to 5.00 pm was noted at hourly interval. The same flowers were used for studying the anther dehiscence immediately after anthesis at hourly interval. Anther dehiscence was studied by using magnifying lens. Fruit set was recorded by tagging 100 opened flowers while the fruit drop percentage at monthly interval was recorded by tagging 100 number of just setted fruits upto their maturity. Total number of fruits per plant was counted at mature stage and the yield per plant was calculated by multiplying the number of fruits with the mean fruit weight. All the datas were statistically analyzed following standard procedure as described by Panse and Sukhatme (8). Angular transformation of data on

Table 2. Anthesis, and dehiscence of anthers of seven cultivars of pomegranate grown at Jhargram.

Varieties	Mrig Bahar Crop		Ambe Bahar Crop	
	Time of anthesis	Time of dehiscence of anthers	Time of anthesis	Time of dehiscence of anthers
Ambledane	6:30 to 7:00 am	11:00 am to 1:00 pm	9:30 to 10 : 00 am	11:00 am to 12:00 pm
Bassein Seedless	12:30 to 1:00 pm	1:30 to 2:30 pm	12:00 to 1:00 pm	1:00 to 2:00 pm
Ganesh	8:30 to 9:00 am	10:30 to 11:00 am	8:00 to 8:30 am	10:00 to 11:00 am
Jalore Seedless	6:30 to 7:00 am	7:30 to 8:00 am	10:00 to 11:00 am	10:30 to 11:30 am
Jyoti	10:30 to 11:00 am	11:00 to 11:30 am	11:00 to 11:30 am	11:30 am to 12:00 pm
Mridula	12:30 to 1:00 pm	2:30 to 3:00 pm	12:00 to 1:00 pm	2:00 to 3:00 pm
Ruby	11:00 to 11:30 am	12:00 to 12:30 pm	10:30 to 11:00 am	12:00 to 12:30 pm

Table 3. Fruit drop percentage of Mrig-bahar crop of seven cultivars of pomegranate grown at Jhargram (during 2003). Figures in parentheses are angular transformed values.

Varieties	Fruit drop percentage (days after fruit set)				Total fruit drop percentage	Final fruit retention percentage
	30 DAFS	60 DAFS	90 DAFS	120 DAFS		
Ambledane	85 (67.21)	5 (12.92)	2 (8.13)	1 (5.74)	93 (74.66)	7 (15.34)
Bassein Seedless	73 (58.69)	7 (15.34)	2 (8.13)	0 (0.0)	82 (64.90)	18 (25.10)
Ganesh	42 (40.40)	19 (25.84)	7 (15.34)	4 (11.54)	72 (58.05)	28 (31.95)
Jalore Seedless	74 (59.34)	7 (15.34)	6 (14.18)	6 (14.18)	93 (74.66)	7 (15.34)
Jyoti	47 (43.28)	28 (31.95)	13 (21.13)	3 (9.97)	91 (72.54)	9 (17.46)
Mridula	71 (57.42)	13 (21.13)	3 (9.97)	2 (8.13)	89 (70.63)	11 (19.37)
Ruby	71 (57.42)	16 (23.58)	6 (14.18)	2 (8.13)	95 (77.08)	5 (12.92)
CD at 5%	1.90	0.96	1.35	0.50	1.63	2.06

percentage was done following Snedecor (9). The significance of difference of different sources of variation was tested by error mean square by Fisher-Snedecor's t test at probability levels of 0.05.

Results and Discussion

The results of the investigation presented in the Table 1, revealed that the period required for flower bud development varied between 15 days in Ruby to

18 days in Ambledane, Ganesh, Jyoti and Mridula as compared to 14 to 27 days in various cultivars of pomegranate studied by Nath and Randhawa (10). From opening of flower to attainment of fruit set stage, it took 3 to 5 days in different cultivars. The cultivars Bassein Seedless, Ganesh and Ruby took 3 days from flowering to first set, while in Ambledane it was 5 days (Table 1). The total period required from initiation of flower bud (pin-head stage) to fruit maturity ranged between 111 days (Mridula) to 123 days

Table 4. Fruit drop percentage of Mrig-bahar crop of seven cultivars of pomegranate grown at Jhargram (during 2004). Figures in parentheses are angular transformed values.

Varieties	Fruit drop percentage (days after fruit set)				Total fruit drop percentage	Final fruit retention percentage
	30 DAFS	60 DAFS	90 DAFS	120 DAFS		
Ambledane	52 (46.15)	9 (17.46)	6 (14.18)	4 (11.54)	71 (57.42)	29 (32.58)
Bassein Seedless	70 (56.79)	6 (14.18)	4 (11.54)	4 (11.54)	84 (66.42)	16 (23.58)
Ganesh	65 (53.73)	6 (14.18)	4 (11.54)	3 (9.97)	79 (62.73)	21 (27.27)
Jalore Seedless	89 (70.63)	2 (8.13)	1 (5.74)	3 (3.97)	95 (77.08)	5 (12.92)
Jyoti	85 (67.21)	2 (8.13)	1 (5.74)	1 (5.74)	89 (70.63)	11 (19.37)
Mridula	73 (58.69)	6 (14.18)	9 (17.46)	3 (9.97)	91 (72.54)	9 (17.46)
Ruby	76 (60.67)	3 (9.97)	1 (5.74)	4 (11.54)	84 (66.42)	16 (23.58)
CD at 5%	1.18	1.12	0.92	0.72	2.33	2.51

Table 5. Number of fruits and yield per plant of seven cultivars of pomegranate grown at Jhargram (Plant age=2 years).

Varieties	Number of fruits per plant			Yield/plant (kg)		
	2003	2004	Pooled	2003	2004	Pooled
Ambledane	106	97	102	12.3	13.3	12.8
Bassein Seedless	70	80	75	20.4	18.7	19.6
Ganesh	74	121	98	17.9	30.6	24.3
Jalore Seedless	84	49	67	20.7	13.8	17.3
Jyoti	40	56	48	9.7	14.9	12.3
Mridula	49	80	65	6.8	16.6	11.7
Ruby	94	103	99	19.6	23.2	21.4
CD at 5%	14.60	10.63	10.20	3.38	2.35	2.03

(Bassein Seedless). The cultivar Jalore Seedless took 115 days for maturity that was in close proximity with the findings of Prasad et al. (11) who reported that 85 to 90% maturity was completed within 120 days after anthesis. However, Dhillon and Kumar (7) reported that the cultivars of pomegranate like Ganesh, Kandhari and Nabha took 140 days after anthesis to attain harvest maturity under Ludhiana condition.

Table 2 revealed that the time of anthesis of different cultivars of pomegranate of Mrig bahar crop was 6.30—7.00 A.M. (Ambledane and Jalore Seedless) to 12.30—1.00 pm (Bassein Seedless and Mridula) while that of Ambe bahar crop was 8.00—8.30 am (Ganesh) to 12.30—1.00 pm (Bassein Seedless and Mridula). Similarly, the time of dehiscence of anthers in different cultivars of pomegranate was 7.30—8.00 am (Jalore Seedless) to 2.30—3.00 pm (Mridula) of Mrig bahar crop and 10.00—11.00 am (Ganesh) to 2.00—3.00 pm (Mridula) of Ambe bahar crop (Table 2). The time of dehiscence of anthers varied in different cultivars and no general sequence was found in the time of anthesis (10).

In the first year (2003) maximum fruit drop occurred at 30 days after fruit set and subsequently decreased upto maturity (Table 3). At 30 days after fruit set, the fruit drop percentage varied from 42 per cent in Ganesh to 85% in Ambledane. At maturity fruit drop varied from 0% in Bassein Seedless to 6% in Jalore Seedless. The total fruit drop percentage was highest in Ruby (95%) and lowest in Ganesh (72%) during 2003 while during 2004, it was recorded highest in Jalore Seedless (95%) and lowest in Ambledane (71%) in the red laterite soils of West

Bengal (Tables 3 and 4). On contrary, Sharma et al. (12) found it in the range of 0 to 15.4% during 1992 and 0.5 to 11.1% during 1993 under Ludhiana condition in different cultivars. The reason may be related to the extent of fruit cracking and insect pest and disease like fruit spot and fruit borer attack, varietal characteristics, different agro-climatic condition and plant age. The final fruit retention percentage varied from 5% in Ruby to 28% in Ganesh during first year (Table 3). However, in the second year the final fruit retention percentage varied from 5% in Jalore Seedless to 29% in Ambledane (Table 4). However, Messaoud and Mohamed (2004) found highest fruit retention (8.5%) in pomegranate cv Gabsi under Tunisian condition.

The cultivars Ambledane (106) and Ganesh (121) bore highest number of fruits per plant in the first year (2003) and second year (2004) of investigation respectively (Table 5). However, Sharma et al. (13) obtained it in the range of 10 to 23 (during first year) and 20 to 63 (during second year) under Ludhiana condition. From the pooled data it was observed that the number of fruits per plant were highest in Ambledane (102) closely followed by Ruby (99) and Ganesh (98) while Jyoti bore the minimum number of fruits (48). Sharma et al. (13) found a yield of 57 fruits per plant in Ganesh. The fruit yield was maximum in Jalore Seedless (20.7 kg) followed by Bassein Seedless (20.4 kg) and Ruby (19.6 kg) in the first year. In the second year, it was maximum in Ganesh (30.6 kg) followed by Ruby (23.2 kg) and Bassein Seedless (18.7 kg). However, from the pooled data, it was found maximum in Ganesh (24.3 kg) followed by Ruby (21.4 kg) and Bassein Seedless (19.6 kg). Higher fruit yield in Ganesh, Ruby, Bassein Seedless and Jalore Seedless may be due to their higher fruit weight and higher number of fruits having more canopy volume. The average fruit yield of pomegranate cultivars in general was low (11.7 to 24.3 kg) as compared to the cultivars studied by Aulakh (5) under Punjab condition. The mean fruit yield in Ganesh and Bassein Seedless in general was higher as compared to those obtained by Prasad and Bankar (14) under Jodhpur condition. This may be due to growing of these cultivars under different agro-climatic conditions and age of the plant.

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