International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(4): 1327-1329

Received: 28-05-2019
Accepted: 30-06-2019

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Effect of cultural practices on suppression of post monsoon vegetative flush of mango (*Mangifera indica* L.) cv. Alphonso

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Abstract
The experiment was laid out in Randomized Block Design with eight treatments and four replications. Among the various treatments, T_1 (Basin exposure once in last week of September) recorded best performance minimum days required for induction of vegetative shoot (44.63) days, T_2 (Basin exposure once in second week of October) recorded lowest percent new vegetative shoot (19.23%), and all other treatments T_3 (Basin exposure twice in Last week of September and last week of October recorded maximum flowering intensity (69.19%), length of panicle (19.06 cm), breadth of panicle (17.22 cm), hermaphrodite flowers (16.03%), fruit set per panicle (14.47%) and basin size (305.00 cm), canopy volume (459.68 m^3) which found to be significant and treatment T_7 (smudging) showed maximum fruit retention (0.86%). In case of yield, treatment T_3 (Basin exposure twice in Last week of September and last week of October) recorded higher yield (183.25 no. of fruits/tree, 49.83 kg/tree and 4.99 t/ha) and this treatment resulted in early induction of flowering panicle (68.00 days) which led to early harvest (105.25 days). From present investigation, it was concluded that treatment T_3 i.e. Basin exposure twice in last week of September and last week of October helped for early flowering panicle emergence and further led to early harvest with higher yield to Alphonso mango.

Keywords: Cultural practices, suppression, post monsoon vegetative flush, mango, *Mangifera indica* L. cv. Alphonso

Introduction
Mango (*Mangifera indica* L.) belongs to family Anacardiaceae, is the oldest and choicest fruit of the world. It is considered as 'National fruit of India' and known as 'King of fruits' and cv. Alphonso called as 'King of all Mango varieties' in India owing to its nutritional richness, unique taste, pleasant aroma and its religious and medicinal importance (Purseglove, 1972) [8].
India is the largest producer of mango in the world and ranks first in area and production. The total production of mango in India is 18642.5 MT from about 2208.6 million ha area with the productivity of 8.4 MT ha^{-1}. In Maharashtra, mango covered the area of 162.10 thousand ha. With production of 463.20 thousand MT and the productivity is 2.9 MT ha^{-1} (Anon. 2017b) [3].
Nearly 1000 varieties of mango are grown in India. Konkan region on the west cost of Maharashtra is one of the largest mango growing belts which contribute nearly 10 per cent of total mango area in the country; occupying 111715 ha area under mango cultivation having annual production of 353066 MT with the productivity of mango in Konkan is about 3.16 MT ha^{-1} (Anon. 2018) [2]. Major variety in this area is Alphonso.
Weather during initiation of flowering in the month of September and October plays key role for induction of flowering at appropriate time. In spite of paclobutrazol application for induction of regular flowering, recently it is often observed that climatic aberrations especially delayed monsoon, abnormal rains etc. in September-October lead to production of vegetative flush instead of flowering flush. This new flush takes another 80-100 days to get mature and induce flowers. Hence, flowering is considerably delayed. The delayed flowering leads to delay fruit development and harvesting. The late harvested fruits fetch low market price. Flowering mechanism in mango is a complex and still poorly understood. Although it clearly depends on environmental factors, usually new vegetative flush which appears become mature when winter begins which trigger flowering in mango. Very less work has been found in suppression of vegetative flush in post monsoon season in Alphonso mango.

Material and Methods

The experiment was laid out in Randomized Block Design with eight treatments namely, T_1 (Basin exposure once in last week of September), T_2 (Basin exposure once in Second week of October), T_3 (Basin exposure twice in Last week of September and last week of October), T_4 (Weeding of basin area in September last week), T_5 (Weeding of basin area in October second week), T_6 (Smudging) and T_7 (Removal of dead, diseased and intermingling branches) T_8 (Control) which were replicated four times.

The selected plants were applied Paclobutrazol during the month of July. On these plants instead of flowering the vegetative shoots emerged in the month of November. As per the treatment details cultural practices were taken on the basin area of tree. The first basin exposure was done by in the 28th September, 2017. Smudging was carried out when 1 year old mature shoots with plump terminal buds were present on the tree (Gonzales, 1923) [6]. Smudging operation was started in December month and done continuously for several days. The observations were recorded.

Result and Discussion

The data presented in Table 1 shows that the treatment T_1 (Basin exposure once in last week of September) recorded the lowest number of days taken for first vegetative shoot induction *i.e.* (44.63) days which is best while treatment T_3 (Basin exposure twice in last week of September and last week of October) recorded the highest number of days taken for first vegetative shoot induction i.e. (54.75). The treatment T_2 (Basin exposure once in second week of October) recorded the minimum percent of new vegetative shoot after monsoon i.e. (19.23%) which was at par with T_7 - Removal of dead, diseased and Intermingling branches (19.91%) and T_6- Smudging (20.01%). The minimum number of days (68.00) required for emergence of panicle was in T_3 (Basin exposure twice in last week of September and last week of October) which was at par with T_7 - Removal of dead, diseased and intermingling branches (70.00). The maximum number of days (78.00) required for induction of flowering panicle was recorded in T_8 (Control). The highest per cent (69.19%) of flowering intensity of panicle was observed in T_3 (Basin exposure twice in last week of September and last week of October) which was at par with T_7, T_5, T_6 and T_4. The highest per cent number of hermaphrodite flowers was recorded in T_3 (16.03%) which was superior to all other treatments. Maximum fruit set (14.68) per panicle was recorded in T_3 which was at par with treatment T_8 (control) i. e. (14.47). The minimum fruit set (8.36) was recorded in treatment T_1 (Basin exposure once in last week of September). The highest fruit retention per panicle was noticed in T_7-Removal of dead, diseased and intermingling branches i. e. (0.52) which was superior to all other treatments. The minimum fruit retention was recorded in T_8 (control) i. e. 0.24.

The results indicated that might be due to basin exposure promoted accumulation of ethylene, ascorbic acid, abscissic acid, cytokinins and lowering of gibberellins reduced the required days for induction of flowering as compared to control. This might be due to paclobutrazol is a gibberellins bio-synthesis inhibitor. The considerable reduction in vegetative growth in the trees. The results indicated that cultural practices enhanced the induction of flowering as compared to control. All these factors lead to flowering (Ghavale *et al*. 2016) [5]. The similar findings observed by Srilatha and Reddy (2015) [11], Uddin *et al*. (2015) [12] and Samant *et al*. (2019) [9].

The highest fruit set in treatments might be due to increased sink activity and also due to increase in respiration or activation of enzymes or growth promoting substances. According to Chauhan *et al*. (2013) [4] cultural treatment had highest fruit set in mango cv. Mallika. Nagao *et al*. (2000) [7] also reported that cultural treatment of vegetative shoot increased the fruit set in litchi cv. Kaimana.

The data presented in Table 2 shows that the minimum (105.25 days) number of days required for harvesting from flowering was observed in T_3 (Basin exposure twice in last week of September and last week of October) which was superior to all other treatments. Treatment T_8 (control) recorded highest number (140 days) days required for harvesting from flowering. Treatment T_4 (Weeding of basin area in September last week) recorded highest number (114.63 days) days required for harvesting from flowering. The highest number of fruits per tree (183.25 fruits/tree) was recorded in treatment T_3 which was superior to all other treatments. The lowest number of fruits per tree (110.00 fruits/tree) was recorded in treatment T_6 (smudging). The highest yield (49.83 kg/tree) (4.99 t/ha) was recorded in T_3 which was superior to all treatments. The lowest yield (21.50 kg/tree) (2.15 t/ha) was recorded in T_4.

The Alphonso mango fruits rates are highly market sensitive. These rates fluctuate even per day. The early harvested fruits fetch premium price than the late harvested fruits. On this background the present study resulted in vital leads for induction of early flowering and early harvesting. Srilatha and Reddy (2015) [11] reported that number of days from flowering to harvest ranged between 128.3-149.3 days under the different treatments in mango cv. Raspuri. Similar results are recorded by Samant *et al* (2019) [9] in mango. Shaban (2005) [10] reported that heading back of shoots of mango tree cv. Hindi-Bi-Sinnara recorded highest number of fruits per tree, Adhikari and Kandel (2015) [1] concluded that 20 cm tip removal in guava enhanced the yield.

Conclusion

The above investigation helps to conclude that adoption of various cultural practices is beneficial for suppression of post monsoon vegetative flush and early induction of flowering and early harvesting. Among various treatments T_1 (Basin exposure once in last week of September) required minimum days for flowers induction and T_2 (Basin exposure once in second week of October) recorded minimum percent of new vegetative shoots after monsoon and T_3 (Basin exposure twice first in last week of September and second during last week of October) was helpful for early harvesting by 9.38 days as compared to control. It also recorded superior performance for the yield.

Table 1: Effect of cultural practices vegetative shoots, flowering, fruit set and fruit retention in mango cv. Alphonso

Treatments	Days required for induction of vegetative shoots	New vegetative shoots after monsoon (%)	Days for induction of flowering	Flowering intensity (%)	Hermaphrodite flowers (%)	Fruit set	Fruit retention
T_1	44.63 (44.63 ± 1.49)	32.50 (32.50 ± 2.55)	71.00 (71.00 ± 1.94)	64.81 (64.81 ± 2.49)	14.33 (14.33 ± 0.36)	8.36 (8.36 ± 0.96)	0.27 (0.27 ±0.002)
T_2	54.38 (54.38 ± 2.25)	19.23 (19.23 ± 1.41)	71.50 (71.50 ± 2.84)	51.44 (51.44 ± 2.83)	15.54 (15.54 ± 0.63)	10.98 (10.98 ± 0.43)	0.31 (0.31 ± 0.004)
T_3	54.75 (54.75 ± 2.63)	33.93 (33.93 ± 1.58)	68.00 (68.00 ± 1.18)	69.19 (69.19 ± 3.08)	16.03 (16.03 ± 0.40)	14.68 (14.47 ± 0.58)	0.31 (0.31 ± 0.002)
T_4	54.00 (54.00 ± 2.12)	23.50 (23.50 ± 1.63)	73.00 (73.00 ± 3.12)	66.06 (66.06 ± 2.68)	14.88 (14.88 ± 0.01)	9.98 (9.98 ± 0.34)	0.29 (0.29 ± 0.001)
T_5	54.63 (54.63 ± 2.46)	33.23 (33.25 ± 2.27)	75.00 (75.00 ± 1.11)	68.13 (68.13 ± 3.50)	15.43 (15.43 ± 0.50)	13.33 (13.33 ± 1.01)	0.30 (0.30 ± 0.001)
T_6	52.38 (52.38 ± 1.75)	20.01 (20.01 ± 1.41)	72.00 (72.00 ± 2.08)	68.13 (68.13 ± 3.68)	15.10 (15.10 ± 0.13)	13.09 (13.09 ± 0.54)	0.45 (0.45 ± 0.04)
T_7	51.33 (51.33 ± 0.62)	19.91 (19.91 ± 1.99)	70.00 (70.00 ± 0.87)	66.13 (66.13 ± 2.36)	15.90 (15.90 ± 0.48)	11.01 (11.01 ± 1.00)	0.52 (0.86 ± 0.02)
T_8	50.71 (50.71 ± 2.03)	27.48 (27.48 ± 1.33)	78.00 (78.00 ± 2.99)	60.38 (60.38 ± 1.65)	15.94 (15.94 ± 0.80)	14.47 (14.68 ± 1.00)	0.24 (0.24 ± 0.001)
SE	1.07	0.90	0.98	1.50	0.24	0.41	1.01
CD @ 5%	3.14	2.64	2.97	4.41	0.72	1.20	0.03

Table 2: Effect of cultural practices on days for harvesting and yield of mango cv. Alphonso

Treatments	Days required for harvesting from flowering	No. of fruits per tree	Yield (kg/tree)	Yield (t/ha)
T_1	111.25 (111.25 ± 0.96)	124.50 (124.50 ±5.26)	26.44 (26.44 ± 1.90)	2.64 (2.64 ± 0.78)
T_2	109.75 (109.75 ± 0.96)	151.00 (151.00 ± 2.00)	30.88 (30.88 ± 1.85)	3.08 (3.08 ± 0.85)
T_3	105.25 (105.25 ± 0.96)	183.25 (183.25 ± 5.56)	49.83 (49.83 ± 2.40)	4.99 (4.99 ± 0.92)
T_4	114.63 (114.63 ± 0.75)	123.50 (123.50 ± 6.61)	21.50 (21.50 ± 1.40)	2.15 (2.15 ± 0.88)
T_5	112.75 (112.75 ± 0.96)	153.50 (153.50 ± 7.23)	47.96 (47.96 ± 2.31)	4.79 (4.79 ± 0.92)
T_6	110.75 (110.75 ± 0.96)	110.00 (110.00 ± 7.44)	40.72 (40.72 ± 1.49)	4.07 (4.07± 0.93)
T_7	113.00 (104.00 ± 0.82)	181.50 (1.91 ± 1.91)	40.82 (40.82 ± 1.96)	4.08(4.08 ± 0.57)
T_8	111.75 (111.75 ± 0.96)	175.00 (175.00 ± 5.77)	38.26 (38.26 ± 1.80)	3.82 (3.82 ± 0.61)
SE	0.48	2.58	1.01	0.43
CD @ 5%	1.41	7.60	2.98	1.28

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