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AP Samant
Department of Horticulture, Dr. Balasheb Sawant Konkon Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

RT Bhingarde
Department of Horticulture, Dr. Balasheb Sawant Konkon Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

SPS Solanki
Department of Fruit Science, Punjab Agricultural University, Ludhiana, Punjab, India

BR Salvi
Department of Horticulture, Dr. Balasheb Sawant Konkon Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

MM Kulkarni
Department of Horticulture, Dr. Balasheb Sawant Konkon Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

RV Dhopavakar
Department of Horticulture, Dr. Balasheb Sawant Konkon Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

Correspondence
AP Samant
Department of Horticulture, Dr. Balasheb Sawant Konkon Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

Response of cultural practices on induction of flowering, fruit set and yield of mango (*Mangifera indica* L.) cv. Alphonso

AP Samant, RT Bhingarde, SPS Solanki, BR Salvi, MM Kulkarni and RV Dhopavakar

Abstract
The experiment was laid out in Randomized Block Design with nine treatments and three replications. T_1 (Basin exposure once in Last week of September) recorded best performance minimum days required for induction of vegetative shoot (39) days, T_6 (Smudging) recorded lowest percent new vegetative shoot (18.25%) with highest length of panicle (20.43 cm), breadth of panicle (16.50 cm). The treatment T_3 (Basin exposure twice in Last week of September and last week of October (T_1 +T_2) recorded maximum flowering intensity (70.94%), hermaphrodite flowers (18.45%), fruit set per panicle (13.45) which found to be significant and treatment T_8 (pinching of terminal bud) showed maximum fruit retention (0.40%). In case of yield, treatment T_3 (Basin exposure twice in Last week of September and last week of October (T_1 + T_2) recorded higher yield (185.75 no. of fruits/tree, 48.76 kg/tree and 4.88 t/ha) and this treatment resulted in early induction of flowering panicle (69.00 days) which led to early harvest (110 days). It was concluded that treatment T_3 i.e. Basin exposure twice in last week of September and last week of October (T_1 +T_2) helped for early flowering panicle emergence and further led to early harvest with higher yield to Alphonso mango.

Keywords: Cultural practices, fruit, yield of mango, *Mangifera indica* L.

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.

India is the major mango producer in the world, with an area of 2.263 million ha. And the annual production of 19.687 million tonnes with productivity of 8.7 MT/ha (Anon., 2017 a) [2]. India contribute about 64% of the world mango production. In Maharashtra, are covered during year 2016-17 was 0.157 million hectares with a production of 0.514 million tones and productivity of 3.2 MT/ha (Anon., 2017b) [3].

Weather during initiation of flowering in the month of September and October plays important role for initiation 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 get low market price. Further, pre-monsoon rain during May often spoils the appearance and quality of these fruits. Hence, it is utmost important to develop a practical solution so as to overcome the adverse climate and to induce flowering. Application of cultural practices like basin exposure, weeding and pruning, application of growth regulators are some of the ways for induction of flowering in various fruit crops.

Material and Methods
The present experiment was carried out in the mango orchard in Department of Horticulture, College of Agriculture, Dapoli (M.S.) during 2017-2018. The experiment was laid out in Randomized Block Design with nine treatments namely, T_1 (Basin exposure once in last week

of September), T2 (Basin exposure once in Second week of October), T3 (Basin exposure twice in Last week of September and last week of October (T1 +T2), T4 (Weeding of basin area in September last week), T5 (Weeding of basin area in October second week), T6 (Smudging) and T7 (Removal of dead, diseased and intermingling branches) T8 (Pinching of terminal bud) and T9 (control) which were replicated three times.

Basin exposure was done with help of mini power tiller from trunk of the tree to peripheral area. The soil is digged up to 8-10 cm and weed material is removed. It was carried out in September and October according to the treatment. Weeding was done manually in basin area of the tree with help of labours. Smudging was carried out when 1 year old mature shoots with plump terminal buds were present on the tree (Gonzales, 1923) [7]. Smudging operation was started in December month and done continuously for several days. Smokey fire below the tree canopy and allows smoke to pass through the foliage for several days. To produce heavy smoke, moist rice husk was placed on top of combustible materials such as dry leaves, dry weeds. 8 - 10 heaps of combustible materials with moist rice husk on top was placed along the periphery of the tree. Smudging operation was carried out in early morning hours (7 – 10 a.m.). Removal of dead, diseased and intermingling branches was done in September month with help of long pruning shear. Pinching was done on terminal buds when post monsoon vegetative shoots were observed. Pinching was done in month of September and October. The observations were recorded.

Result and Discussion

The data presented in Table 1 shows that the treatment T1 (Basin exposure once in last week of September) recorded the lowest number of days taken for first vegetative shoot induction i.e. (39) days which is best while treatment T3 (Basin exposure twice in last week of September and last week of October (T1+T2) recorded the highest number of days taken for first vegetative shoot induction i.e. (47). The treatment T6 (Smudging) recorded the minimum percent of new vegetative shoot after monsoon i.e. (18.25%) which is at par with T2 (Basin exposure once in second week of October i.e. (20.75%). Treatment T9 (Control) recorded the maximum percent of vegetative shoot after monsoon (39.27%). The minimum number of days (69.00) required for emergence of panicle was in T3 (Basin exposure twice in last week of September and last week of October (T1+T2) which was at par with T6 (Smudging) i.e. (70). The maximum number of days (80.00) required for induction of flowering panicle was recorded in T9 (Control). The highest per cent (70.94) of flowering intensity of panicle was observed in T3 (Basin exposure twice in last week of September and last week of October (T1+T2) which was at par with T4 T5, T6, T7. The highest per cent number of hermaphrodite flowers was recorded in T3 (18.45%) which was superior to all other treatments. the highest sex ratio is recorded in T3 (0.23) which was superior to all other treatments. The lowest sex ratio is recorded in control T9 (0.13). Maximum fruit set (13.45) per panicle was recorded in T3 which was superior to all other treatments. The minimum fruit set (7.25) was recorded in treatment T9. The highest fruit retention per panicle was noticed in T8 (0.40%) which was superior to all other treatments. The minimum fruit retention was recorded in T9 (0.25%).

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) [6]. The similar findings observed by Srilatha and Reddy (2015) [10], Uddin *et al*. (2015) [11] and Gawade *et al*. (2018) [5].

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) cultural treatment had highest fruit set in mango Cv. Mallika. Nagao *et al*. (2000) 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 (110 days) number of days required for harvesting from flowering was observed in T3 (Basin exposure twice in last week of September and last week of October (T1+T2) which was superior to all other treatments. Treatment T9 (control) recorded highest number (140 days) days required for harvesting from flowering. The highest number of fruits per tree (185.75 fruits/tree) was recorded in treatment T3 which was superior to all other treatments. The lowest number of fruits per tree (90.75 fruits/tree) was recorded in treatment T9. The highest yield (48.76 kg/tree) was recorded in T3 which was superior to all treatments. The lowest yield (23.74 kg/tree) was recorded in T9. The highest yield (4.88 t/ha) was recorded in T3 which was superior to all other treatments. The lowest yield (2.37 t/ha) was recorded in T9.

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) [10] reported that number of days from flowering to harvest ranged between 128.3-149.3 days under the different treatments in mango Cv. Raspuri. Basin exposure twice in last week of September and last week of October (T1+T2) increased the yield. Similar results are recorded by Gawade *et al*. (2018) [5] in mango. Shaban (2005) [9] 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 T3 (Basin exposure twice in last week of September and last week of October T1+T2) required minimum days for flowers induction and T6 (Smudging) recorded minimum percent of new vegetative shoots after monsoon and T3 (Basin exposure twice first in last week of September and second during last week of October T1+T2) was helpful for early harvesting by 30 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 (%)	Sex ratio	Fruit set	Fruit retention
T_1	39	33.38	73	66.34	15.51	0.18	9.45	0.30
T_2	44	20.75	75	53.29	14.56	0.17	11.55	0.32
T_3	47	27.67	69	70.94	18.45	0.23	13.45	0.32
T_4	41	31.53	76	68.47	14.65	0.17	8.25	0.28
T_5	42	30.10	77	69.90	14.23	0.17	8.45	0.29
T_6	45	18.25	70	69.08	15.34	0.18	10.00	0.29
T_7	40	29.67	78	68.71	14.88	0.17	8.33	0.27
T_8	46	31.29	72	67.23	15.33	0.18	10.55	0.40
T_9	43	39.27	80	60.73	11.54	0.13	7.25	0.25
SE	1.31	1.19	1.11	1.20	0.5444	0.0051	0.6258	0.01
CD @ 5%	2.95	2.69	2.51	2.70	1.2267	0.0116	1.4102	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	126	142.00	37.04	3.70
T_2	119	153.75	40.27	4.03
T_3	110	185.75	48.76	4.88
T_4	128	121.75	31.94	3.19
T_5	133	131.50	34.42	3.44
T_6	116	141.88	36.32	3.63
T_7	126	135	35.77	3.58
T_8	133	150	39.00	3.90
T_9	140	90.75	23.74	2.37
SE	0.69	0.91	1.40	0.14
CD @ 5%	1.55	1.92	2.96	0.29

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