



Non Chemical Approaches for Induction of Appropriate Flowering in Mango cv. Alphonso

O. S. Warang¹, P. M. Haldankar¹, Y. R. Parulekar¹, B. R. Salvi¹, S. A. Chavan², N. V. Dalvi¹, S. B. Thorat¹ and A.V. Bhuwad¹

1 - Department of Horticulture, College of Horticulture, Dr.

BalasahebSawantKonkanKrishiVidyapeethDapoli-415 712, Maharashtra

2 - Department of Agronomy, College of Agriculture, Dr. BalasahebSawantKonkanKrishiVidyapeeth

Dapoli-415 712, Maharashtra

Corresponding author e-mail- omkarwarang30@gmail.com

ABSTRACT

Alphonso mango is important cash crop of Konkan region. The early harvesting of the fruits is of immense importance for fetching attractive market rate. In recent years, the climatic aberration such as delayed rains especially during initiation of flowering during September and October result in production of vegetative shoots instead of flowering panicles in spite of application of paclobutrazol. It delayed harvesting cause financial loss to the growers. The non-chemical approaches such as girdling and removal of new shoots (tip pruning) have shown promising results in induction of flowering in fruit crops. The experiment entitled "Non chemical approaches for induction of appropriate flowering in mango cv. Alphonso." was conducted with eight treatments viz., T₁- Girdling on first fortnight of September, T₂- Girdling on first fortnight of October, T₃- Girdling on first fortnight of September and Girdling on first fortnight of October, T₄- Girdling on first fortnight of September and removal of new shoots, T₅- Girdling on first fortnight of October and removal of new shoots, T₆- Girdling on first fortnight of September and Girdling on first fortnight of October and removal of new shoots, T₇- Removal of new shoots and T₈- Control which were replicated three times. Girdling during first fortnight of September and removal of new shoots (T₄) resulted in early panicle emergence as compared to control which led to early harvest. It also registered highest flowering, hermaphrodite flowers percentage and maximum fruit set and fruit retention. The physical and chemical parameters of fruits did not varied due to girdling and removal of new shoots.

Keywords: Mango, Alphonso, girdling, pinching, flowering, fruit set, yield.

Received 28.09.2019

Revised 19.10.2019

Accepted 12.11.2019

INTRODUCTION

Alphonso is a premium variety of mango known for its taste and flavour but it is shy and alternate bearer. The application of paclobutrazol is recommended to address regular flowering of mango for this variety in coastal region of Maharashtra. In spite of the application of paclobutrazol, the weather during the time of initiation of flowering in the month of September and October play key role for induction of flowering at appropriate time. Under normal climatic conditions the rainfall in Konkan region ceases in the month of October and flowering in mango commences in the month of November. Since 2006, it is often noticed that climatic aberrations during September-October such as delayed rains overcast, high temperature and humidity lead to production of vegetative shoots instead of flowering panicles. This new vegetative flush takes another 80-100 days to mature to produce flowers. Thus, flowering is considerably delayed, which further lead to delayed fruit development and harvesting. The late harvested fruits fetch low rates in market. The pre-monsoon rains during May often spoil the appearance and quality of late maturing fruits. Importantly, it is also noticed that many of the new vegetative shoots, produced after monsoon do not produce flowers and hence, the flowering remains sparse, which lead to very poor yield. Hence, it is utmost important to develop a practical solution for induction of flowering at appropriate time. The nonchemical approaches are unique tools to attempt for regulation of flowering. Annual shoot tip pruning in mango provide reliable synchronized flowering in selected shoots year after year in trees

thus making them remaining in same size for many years [1]. This is particularly useful where trees have a vegetative flush just prior to flowering. The young flushes are cutback to mature wood; the resulting flush should be floral one. Girdling is the removal of the bark in circular manner of either branch or trunk of woody plants. Girdling stops the basipetal movement of assimilates through phloem which results in accumulation of carbohydrates above girdle which ultimately helps for induction of early and assured flowering. Urban *et al.*, [2] reported that girdling is one of the ways to improve the earliness and intensity of flowering in mango. Hence a field investigation was conducted to study non chemical approaches for induction of appropriate flowering in mango cv. Alphonso under coastal condition of Maharashtra.

MATERIAL AND METHODS

The experiment was conducted at Department of Horticulture, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli (Maharashtra) during season of 2017-18. Uniformly grown mango plants of variety Alphonso of age 30 years under uniform management practices were selected. Paclobutrazol was not applied to these plants. The experiment was laid out in Randomized Block Design with eight treatments viz. T₁ (girdling on first fortnight of September), T₂ (girdling on first fortnight of October), T₃ (girdling on first fortnight of September and October), T₄ (girdling on first fortnight of September and removal of new shoots), T₅ (girdling on first fortnight of October and removal of new shoots), T₆ (girdling on first fortnight of September and October and removal of new shoots), T₇ (Removal of new shoots) and T₈ (Control). Treatment were replicated Three times, with a unit of three plants per treatment per replication.

Girdling was done on tertiary branches (2 to 2.5 inch diameter) by giving a deep circular cut with the help of sharp knife as per the treatment time. Total 50 branches were girdled per experimental plant. On these plants vegetative shoots were emerged in month of November of the total new shoots. 150 shoots per experimental plant were removed at the point of emergence of mature shoots. In control, girdling and removal of new shoots was not performed.

The observations were recorded on date of emergence of flowering, flowering intensity (%), length of panicle (cm), width of panicle (cm), hermaphrodites flowers (%), fruit set, fruit retention (%), days required from experimentation to harvesting, number of fruit per plants, yield per plant (kg) and yield per hectare (t). Fruits per plant per replication were randomly selected at harvest to record physical parameters, viz fruit weight (g), pulp weight (g) and pulp to stone ratio while chemical parameters like TSS (°B), acidity (%), reducing sugars (%), total sugars (%) and ascorbic acid (mg/100 g) were recorded at ripe stage. The data was analyzed by the using statistical methods suggested by Panse and Sukhatme [3].

RESULT AND DISCUSSION

The girdling on first fortnight of September and removal of new shoots (T₄) induced early panicle emergence at 39.33 days in mango cv. Alphonso (Table 1) which was significantly superior over control (135 days). The maximum flowering intensity was registered in T₄ (65.67 %) which was superior to all other treatments. The minimum flowering intensity was recorded in control T₈ (27.33 %). The shortest length of panicle was noticed in T₇ (19.38 cm) which was at par with T₆ (19.62 cm) and T₄ (20.00 cm). The longest panicle length was observed in control T₈ (28.55 cm). Treatment T₄ resulted in minimum panicle width (14.54cm), hermaphrodite flowers 16.87%, highest fruit set (9.66) and fruit retention (1.12%) which was significantly superior over control. The untreated control resulted in maximum panicle width (25cm), minimum hermaphrodite flowers (13.96%), minimum fruit set (5.23) and fruit retention (0.52%). (Table 1.)

The favorable effect on flower initiation to appreciably increased concentration of all carbohydrates and the high C: N ratio caused by the girdling treatment [4]. Girdling is one of the means to improve the earliness and intensity of flowering in mango cv. Cogshall [2]. Shoot pruning reduce the auxin synthesis at the apex of the branches, directing the transport of assimilates and cytokinins to the axillary buds of branches under flowering conditions [5], induce the formation of axillary inflorescences [6]. The branch tip pruning provided a higher percentage of flowering and a higher number of fruits per branch of 'Ubá' mango trees by more than 30 % [7]. The reduction in panicle length and panicle width might be due to the direct effect of tip pruning on GA biosynthesis [8]. Pruning reduced panicle length of Dashehari mango [9]. The percentage of perfect flowers was significantly increased due to girdling treatments in olive cv. Manzanillo [10]. Gaskins [11] found in trial with 4-year-old mango seedlings that fruit set was better on the flowering trees which were girdled than on those which flowered without girdling. Tip pruning had highest fruit set in mango cv. Mallika [12].

Table 1. Effect of girdling and removal of new shoots on panicle emergence, flowering intensity, length and width of panicle, hermaphrodite flowers, fruit set and fruit retention in mango cv. Alphonso

Treatments	Days for panicle emergence	Flowering intensity (%)	Length of panicle (cm)	Width of panicle (cm)	Hermaphrodite flowers (%)	Fruit set	Fruit retention
T ₁	130.00	35.33	26.69	22.31	14.61	6.76	0.64
T ₂	101.33	43.00	24.81	21.19	15.52	6.43	0.61
T ₃	99.67	32.00	22.50	20.06	14.65	7.25	0.77
T ₄	39.33	65.67	20.00	14.54	16.87	9.66	1.12
T ₅	46.00	50.00	21.01	16.39	15.60	7.81	0.70
T ₆	43.33	33.67	19.62	15.55	16.60	8.95	0.83
T ₇	48.67	31.00	19.38	15.36	16.41	6.14	0.61
T ₈	135.00	27.33	28.55	25.00	13.96	5.23	0.52
SE±	0.92	4.04	0.40	0.49	0.12	0.16	0.05
CD	2.07	9.11	0.91	1.10	0.28	0.37	0.13

The early flowering induced in treatment T₄ resulted in earliest harvesting of fruits after 155 days of experimentation. The treatment T₄ also contributed for maximum number of fruits (148.33 days), highest yield (10.57 kg/tree). In control where girdling and tip pruning was not performed the harvesting took place after 253.67 days. The treatment also exhibited lowest fruit yield per tree (34.37 fruits/tree) and 10.57 kg/tree). The performance of all other varieties ranged in between these two treatments. (Table 2.) The minimum days were required for flowering to harvesting in plants where ringing were done in first fortnight of May in mango cv. Alphonso [13]. Girdling can improve carbohydrate availability to fruits and as a consequent lead to an increased fruit set percentage with decreased bud drop due to branch girdling and also leads to increased maximum number of fruit per shoots and maximum fruit weight which help to increased fruit yield kg per plant and fruit yield kg per hectare [14].

Table 2. Effect of girdling and removal of new shoots on yield and days required form experimentation to harvesting in mango cv. Alphonso.

Treatments	Days required form experimentation to harvesting	No. of fruits per tree	Yield (kg/plant)
T ₁	247.33	47.67	11.26
T ₂	219.66	123.00	25.01
T ₃	219.00	72.00	13.45
T ₄	155.00	148.33	30.64
T ₅	164.67	54.67	17.55
T ₆	160.33	57.67	15.57
T ₇	167.67	56.00	13.32
T ₈	253.67	34.67	10.57
SE±	0.97	15.99	3.45
CD	2.19	36.05	7.78

The harvesting of T₁ was started and over in 4th week of May. The harvesting of T₂ was started and over in 4th week of May (Figure 1). The harvesting of T₃ was started and over in 3rd week of May. The harvesting of T₄ was started in 4th week of April and ended in 2nd week of May. The harvesting of T₅ was started in 1st week of May and ended in 3rd week of May. The harvesting of T₆ was started in 1st week of May and ended in 3rd week of May. The harvesting of T₇ was started and ended in 3rd week of May. The harvesting of T₈ was started and ended in 4th week of May. (Figure 1.)

The prevailing trend of rates per kg of market indicated that during last week of April and first week of May the raw mango fruits were sold @ Rs. 80 per kg which reduced to Rs. 60 per kg during second and third week of May and further minimized to Rs. 50 per kg during fourth week of May. The girdling and removal of new shoots treatments helped to induce early flowering which further lead to early harvesting which gave better returns.

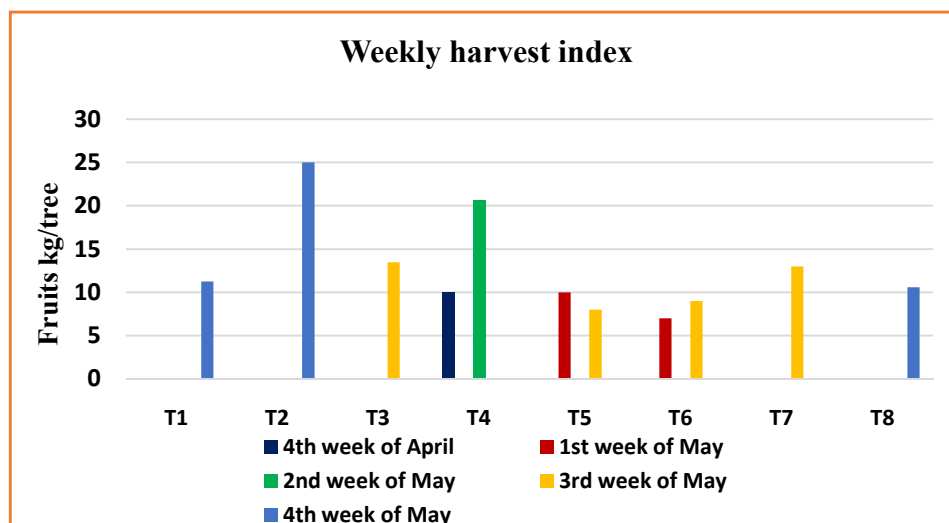


Figure 1. Effect of girdling and removal of new shoots on yield pattern of mango cv. Alphonso.

The physical parameters of mango cv. Alphonso at harvest stage and chemical composition at ripe stage was non-significant which indicated that girdling and removal of new shoots had no adverse effect on the fruit quality of mango cv. Alphonso (Table 3.).

Table 3. Effect of girdling and removal of new shoots on physical parameters at harvest and chemical composition at ripe of fruits in mango cv. Alphonso

Treatments	Fruit weight (g)	Pulp weight (g)	Pulp to stone ratio	TSS (°Brix)	Acidity (%)	Reducing sugars (%)	Total sugars (%)	Ascorbic acid (mg/100 g)
T ₁	260.33	160.63	4.00	17.80	0.39	3.95	14.98	50.68
T ₂	252.12	157.60	3.52	17.43	0.37	3.91	14.83	49.67
T ₃	267.79	180.43	3.45	17.13	0.38	3.96	15.01	50.74
T ₄	272.71	185.50	4.56	17.43	0.34	4.08	15.13	52.52
T ₅	261.57	181.87	3.46	16.93	0.39	3.99	14.89	51.13
T ₆	284.86	195.43	5.37	18.03	0.35	4.17	15.19	53.33
T ₇	235.84	164.27	3.37	17.13	0.41	3.88	14.75	48.76
T ₈	286.00	182.17	3.15	17.00	0.43	3.67	14.62	47.65
SE±	11.31	12.13	0.48	0.78	0.04	0.11	0.11	1.16
CD	NS	NS	NS	NS	NS	NS	NS	NS

CONCLUSION

The trial concluded that the non-chemical approach viz. girdling and removal of new shoots in mango cv. Alphonso were beneficial for early induction of flowering and early harvesting. Among all treatments T₄ (Girdling on first fortnight of September and removal of new shoots) was the best for early harvesting with early induction of flowering, highest hermaphrodite flowers, maximum fruit set and retention and also contributed for highest yield with greater appreciation with respect to rate in market. Girdling and removal of new shoots did not influence the physiochemical composition of mango.

REFERENCES

- Davenport, T. L. (2006). Pruning strategies to maximize tropical mango production from the time of planting to restoration of old orchards. *Hort. Sci.*, 41: 544-48.
- Urban, L.M., Lechaudel, M. and Alphonso, L. (2009). The effect of girdling on flowering and leaf net photosynthesis in mango Cv. Cogshall. *Acta Horticulturae*, 820:251-258.
- Panse, V. G. and Sukhatme, P. V. (1995). Statistical methods for Agricultural Workers. ICAR Rev. Ed. By Sukhatme, P. V. and Amble, V. N. pp. 97 - 156.
- Das Chowdhury, T. K. (1969). Physiological studies on factors governing Fruit-bud differentiation in mango (*Mangifera indica* L.). D. Phil. Agri. Thesis, Univ. of Calcutta.
- Taiz, L.; Zeiger, E. (2012). Fisiologia vegetal. 5. ed. Porto Alegre: Artmed.
- Srivastava, L. M. (2002). Plant growth and development: hormones and the environment. New York: Academic Press.

7. Oliveira, G. P., Siqueira, D. L., Salomao, L. C. C., Paulo R. and Machado D. L. M. (2017). Paclobutrazol and branch tip pruning on the flowering induction and quality of mango tree fruits, *Agropec. Trop., Goiania*, **47**(1): 7-14.
8. Jadhav, A.B. (1996). Studies on effect of pruning and paclobutrazol application on flowering, fruiting, yield and fruit quality of old mango trees (*Mangifera indica* L.) cv. Alphonso MSc. (Horti). Thesis, (unpubl.) submitted to Dr. B.S.K.K.V.Dapoli.
9. Mohan, S.N., Sant Ram, R., Singh, C.P. and Shukla, P. (2001). Effect of pruning on growth, flowering and fruiting in mango. *Ind. J. Horti.*, **58**(4): 303-308.
10. Nabila, E. K., AbouRayya, M. S. and Thanaa, S. M. (2015). Productivity of Manzanillo olive cultivar as affected by girdling times. *International Journal of Chem. Tech Research*, **8**(9): 272-278.
11. Gaskins, M. H. (1963). Girdling mango seedlings for inducing early fruit bearing.,[http://www.fshs.org/proceedings-o/1963-vol-76/360-363%20\(GASKINS\).pdf](http://www.fshs.org/proceedings-o/1963-vol-76/360-363%20(GASKINS).pdf).
12. Chauhan, V.K., Joshi, A.K. and Chauhan, N. (2013). Rejuvenation of frost affected mango orchard through pruning treatments. *Int. J. of Farm Sci.*,**3**(2):32-40.
13. Shinde, V. V., Dubale, J. J., Haldankar, P. M., Parulaker, Y. R. and Thorat, S. B. (2014) Effect of ringing on flowering and yield of mango (*Mangifera indica* L.) cv. Alphonso. *Asian Resonance*, **3**(3):115-117.
14. Goren, R., Huberman, M. and Goldschmidt, E. E. (2004) Girdling: *Physiological and horticultural aspects. Hort. Rev.*,**30**:1-35.

CITATION OF THIS ARTICLE

O. S. Warang, P. M. Haldankar, Y. R. Parulekar, B. R. Salvi, S. A. Chavan, N. V. Dalvi, S. B. Thorat and A.V. Bhuvad. Non Chemical Approaches for Induction of Appropriate Flowering in Mango cv. Alphonso. *Bull. Env. Pharmacol. Life Sci.*, Vol 8 [Suppl. 1] November 2019: S58-S62