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*RESEARCH PAPER*

# Economics of chemical and non-chemical approaches for induction of early flowering in mango cv. Alphonso

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**Abstract :** Mango cv. Alphonso is established on more than 90 per cent of area in Konkan region of Maharashtra. Early flowering is for early harvest which assures premium rate in market. In recent years climatic aberrations such as delayed rains especially during initiation of flowering badly affected the performance of Alphonso. The delayed flowering further delay fruit development and harvesting. The late harvested fruits often trapped in early rains and fetches low market price. An attempt was made to estimate benefit ratio and net returns of various non-chemical approaches for mango cv. Alphonso in relation to early induction of flowering which lead to early harvesting to earn lucrative market price. The experiment entitled "Economics of chemical and non-chemical approaches for induction of early flowering in mango cv. Alphonso" which was conducted at college of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli during the year 2018-19 and 2019-20. Experiment was laid out in randomized block design with seven treatments viz., $T_1$- removal of new shoots, $T_2$- removal of old shoots below new, $T_3$- foliar spray of paclobutrazol @ 500 ppm, $T_4$- foliar spray of paclobutrazol @ 1000 ppm, $T_5$- foliar spray of ortho-phosphoric acid @ 0.5 %, $T_6$- foliar spray of ortho-phosphoric acid @ 1 % and $T_7$- control which were replicated at thrice. From the pooled analysis, early induction of flowering was rapid in $T_1$(35.83 days) and had maximum yield (6.19 t/ha), higher gross return (Rs.309657), maximum net profit (Rs.217781.70) and highest B:C ratio (3.37) which was followed by $T_2$ (3.34), $T_3$ (2.99) and $T_4$ (2.75). The minimum yield (2.90 t/ha), gross return (Rs. 124860), minimum net profit (Rs. 65509.20)with minimum B:C ratio were found in control.

**Key Words :** Mango, Alphonso, Chemical, Non-chemical approaches, B: C ratio

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## INTRODUCTION

Mango (*Mangifera indica* L.) is important fruit crop of India belongs to family Anacardiaceae. Mango is one of the important tropical fruit crop in world. India is the major mango producing country in the world with 38% share in world mango production (Altendorf, 2019). Mango is a significant source of foreign exchange earnings in India, with earnings of Rs. 400.21 cores from exports of 49,658 tonnes of fresh fruit (Anonymous, 2020a) and Rs. 584.31 cores from exports of 85,725 tonnes of mango pulp (Anonymous, 2020b). Uttar Pradesh, Bihar, Andhra Pradesh, Karnataka, Tamil Nadu,

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Gujarat and Maharashtra are the major mango growing states in India.

In Konkan region of Maharashtra, mango is important cash crop. Alphonso is mostly growing variety in Konkan region. Early induction of flowering in mango is important aspects for getting higher benefits. Early induction of flowering leads to the early fruiting and harvesting. Early harvested fruits fetches higher market prize than late harvested fruits. This is leads to the better net returns and higher benefit cost ratio. The chemical and non-chemical approaches like annual shoot tip pruning and foliar application of paclobutrazol and ortho-phosphoric acid provides early and synchronized flowering in mango. An attempt was made to estimate benefit cost ratio and net returns of different chemical and non-chemical approaches for early induction of flowering in mango cv. Alphonso.

## MATERIAL AND METHODS

The experiment was conducted at College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Maharashtra during 2018-19 and 2019-20. The 40 years old uniform mango plants of variety Alphonso were selected for experiment. The trial was laid out in randomized block design with seven treatments *viz*., $T_1$- removal of new shoots, $T_2$- removal of old shoots below new, $T_3$- foliar spray of paclobutrazol @ 500 ppm, $T_4$- foliar spray of paclobutrazol @ 1000 ppm, $T_5$- foliar spray of ortho-phosphoric acid @ 0.5 %, $T_6$- foliar spray of ortho-phosphoric acid @ 1 % and $T_7$- control. The removal of new and old shoots were done after emergence of new shoots after monsoon in October/ November. Whereas first foliar application of paclobutrazol and ortho-phosphoric acid was done after the emergence of new shoots after monsoon in October/ November. The second foliar application was performed 10 days after first spray. Total 150 shoots per experimental plant were removed at point of emergence to the mature wood. In control, removal of old and new shoots and foliar application of PBZ and ortho-phosphoric acid was not performed. The data was analysed by using statistical methods suggested by Panse and Sukhatme (1985).

Net return was calculated by formula:

**Net return = Gross income – Cost of cultivation**

Benefit cost ratio was calculated by formula:

$$\text{Benefit cost ratio} = \frac{\text{Net returns}}{\text{Cost of cultivation}}$$

## RESULTS AND DISCUSSION

The pooled analysis showed that the minimum days required for panicle emergence were registered in the treatment $T_1$ (35.83 days) which was at par with $T_2$ (38.33 days). Treatment $T_4$ (54.33 days) and $T_3$ (56.50 days) were at par with each other. It was followed by treatment $T_5$ (60.33 days) and Treatment $T_6$ (61 days). The maximum days took for panicle emergence were noted in control $T_7$ (73.50 days). The annual shoot tip pruning in mango provide reliable synchronized flowering in selected shoots year after year in trees which also helped to maintain the canopy size of the plants for several years (Davenport, 2006). Srilatha and Reddy (2015) reported that among the different pruning levels, removal of current season's growth recorded earliest flowering in mango cv. Raspuri. The pooled data indicated that, $T_1$ (6.93 kg/tree) registered highest yield

**Table 1: Effect of various non-chemical and chemical meanson days required from treatment exposure up to induction of flowering in mango cv. Alphons**

| Treatments | Days required from treatment exposure up to induction of flowering | | |
|---|---|---|---|
| | 2018-19 | 2019-20 | Pooled |
| $T_1$- Removal of new shoots | 27.00 | 44.67 | 35.83 |
| $T_2$- Removal of old shoot below new shoots | 30.00 | 46.67 | 38.33 |
| $T_3$- PBZ@500 ppm foliar application | 53.00 | 60.00 | 56.50 |
| $T_4$- PBZ@1000 ppm foliar application | 51.67 | 57.00 | 54.33 |
| $T_5$- Ortho-phosphoric acid @ 0.5 % foliar application | 55.67 | 65.00 | 60.33 |
| $T_6$- Ortho-phosphoric acid @ 1 % foliar application | 58.00 | 64.00 | 61.00 |
| $T_7$- Control | 70.00 | 77.00 | 73.50 |
| Mean | 49.33 | 59.19 | 54.26 |
| S.E. ± | 1.60 | 1.52 | 1.16 |
| C.D. at 5% | 4.92 | 4.67 | 3.48 |

which was at par with $T_2$ (60.63 kg/tree) and $T_4$ (56.76 kg/tree). Treatment $T_3$ (55.95 kg/tree) and $T_6$ (54.88 kg/tree) were at par with each other. It was followed by $T_5$ (46.73 kg/tree) whereas lowest yield was obtained in $T_7$

**Table 2: Effect of various non-chemical and chemical means on fruits kg per treein mango cv. Alphonso**

| Treatments | Fruits kg/tree | | |
|---|---|---|---|
| | 2018-19 | 2019-20 | Pooled |
| $T_1$- Removal of new shoots | 48.20 | 75.67 | 61.93 |
| $T_2$- Removal of old shoot below new shoots | 48.96 | 72.30 | 60.63 |
| $T_3$- PBZ @ 500 ppm foliar application | 44.73 | 67.18 | 55.95 |
| $T_4$- PBZ @ 1000 ppm foliar application | 45.74 | 67.83 | 56.79 |
| $T_5$- Ortho-phosphoric acid @ 0.5 % foliar application | 45.60 | 47.86 | 46.73 |
| $T_6$- Ortho-phosphoric acid @ 1 % foliar application | 47.61 | 62.15 | 54.88 |
| $T_7$- Control | 21.61 | 36.36 | 28.98 |
| Mean | 43.21 | 61.34 | 52.27 |
| S.E. ± | 1.23 | 2.87 | 1.73 |
| C.D. at 5% | 3.79 | 8.84 | 5.32 |

**Table 3: Effect of various non-chemical and chemical means on production economics (B:C ratio) in mango cv. Alphonso (2018-19)**

| Treatments | Yield (t/ha) | Expenditure Incurred (Rs/ha) | Gross return (Rs/t) | Net Profit | B:C ratio |
|---|---|---|---|---|---|
| $T_1$- Removal of new shoots | 4.82 | 80447.47 | 241000 | 160552.53 | 3.00 |
| $T_2$- Removal of old shoot below new shoots | 4.89 | 81030.80 | 244500 | 163469.20 | 3.02 |
| $T_3$- PBZ @ 500 ppm foliar application | 4.51 | 77612.47 | 200500 | 122887.53 | 2.58 |
| $T_4$- PBZ @ 1000 ppm foliar application | 4.61 | 86800.80 | 221700 | 134899.20 | 2.55 |
| $T_5$- Ortho-phosphoric acid @ 0.5 % foliar application | 4.56 | 81937.67 | 211000 | 129062.33 | 2.58 |
| $T_6$- Ortho-phosphoric acid @ 1 % foliar application | 4.76 | 92047.07 | 211000 | 118952.93 | 2.29 |
| $T_7$- Control | 2.16 | 55040.80 | 99000 | 43959.20 | 1.80 |

**Table 4 : Effect of various non-chemical and chemical means on production economics (B:C ratio) in mango cv. Alphonso (2019-20)**

| Treatments | Yield (t/ha) | Expenditure Incurred (Rs/ha) | Gross return (Rs/t) | Net Profit | B:C ratio |
|---|---|---|---|---|---|
| $T_1$- Removal of new shoots | 7.57 | 103339.13 | 378350 | 275010.87 | 3.66 |
| $T_2$- Removal of old shoot below new shoots | 7.23 | 100530.80 | 361500 | 260969.20 | 3.60 |
| $T_3$- PBZ @ 500 ppm foliar application | 6.72 | 98589.13 | 326360 | 227770.87 | 3.31 |
| $T_4$- PBZ @ 1000 ppm foliar application | 6.78 | 97117.47 | 283600 | 186482.53 | 2.92 |
| $T_5$- Ortho-phosphoric acid @ 0.5 % foliar application | 4.79 | 82224.33 | 212720 | 130495.67 | 2.59 |
| $T_6$- Ortho-phosphoric acid @ 1 % foliar application | 6.21 | 105097.07 | 289300 | 184202.93 | 2.75 |
| $T_7$- Control | 3.64 | 63660.80 | 150720 | 87059.20 | 2.37 |

**Table 5 : Effect of various non-chemical and chemical means on production economics (B:C ratio) in mango cv. Alphonso (Pooled)**

| Treatments | Yield (t/ha) | Expenditure Incurred (Rs/ha) | Gross return (Rs/t) | Net Profit | B:C ratio |
|---|---|---|---|---|---|
| $T_1$- Removal of new shoots | 6.19 | 91893.30 | 309675 | 217781.70 | 3.37 |
| $T_2$- Removal of old shoot below new shoots | 6.06 | 90780.80 | 303000 | 212219.20 | 3.34 |
| $T_3$- PBZ @ 500 ppm foliar application | 5.61 | 88100.80 | 263430 | 175329.20 | 2.99 |
| $T_4$- PBZ @ 1000 ppm foliar application | 5.70 | 91959.13 | 252650 | 160690.87 | 2.75 |
| $T_5$- Ortho-phosphoric acid @ 0.5 % foliar application | 4.67 | 82081.00 | 211860 | 129779.00 | 2.58 |
| $T_6$- Ortho-phosphoric acid @ 1 % foliar application | 5.49 | 98572.07 | 250150 | 151577.93 | 2.54 |
| $T_7$- Control | 2.90 | 59350.80 | 124860 | 65509.20 | 2.10 |

(29.98 kg/tree). Thus, removal of new shoots increased the yield. It might be attributed to the sufficient supply of carbohydrates maintaining a proper balance which helped high per cent of flowering panicle and greater fruit retention with good fruit size (Nath, 1994). The present findings are in accordance with Warang *et al*. (2019) in mango cv. Alphonso and Nachare (2020) in mango cv. Ratna.

The data on removal of new shoots, foliar application of paclobutrazol and ortho-phosphoric acidon production economics (B: C ratio) in mango cv. Alphonso are presented in Table 26, 27 and 28. The data during the year 2018-19 showed that, $T_2$ had the higher gross return (Rs.244500) as well as maximum net profit (Rs. 163469.20) with highest B:C ratio (3.03) which was followed by $T_1$ (3.00), $T_3$ and $T_5$ (2.58). The B:C ratio for control was (1.80). The highest gross return during the year 2019-20 was recorded in $T_1$ (Rs. 378350) as well as maximum net profit (Rs. 275010.87) with highest B:C ratio (3.66) which was followed by $T_2$ (3.60), $T_3$ (3.31) and $T_4$ (2.92). The lowest B:C ratio was noticed in $T_7$ (2.37). Pooled data indicated that, $T_1$ had the higher gross return (Rs.309657), maximum net profit (Rs.217781.70) and highest B:C ratio (3.37) which was followed by $T_2$ (3.34), $T_3$ (2.99) and $T_4$ (2.75). The B:C ratio for control was (2.10). The results in present investigation are in similar lines with findings of Warang*et al*., (2019) in mango cv. Alphonso and Nachare (2020) in mango cv. Ratna.

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