

Effect of pruning and paclobutrazol application on yield and quality of mango (*Mangifera indica* var. Neelum)

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ABSTRACT

A field experiment was conducted during 2008-2009 at Horticultural College and Research Institute, Periyarkulam with a view to rejuvenate the senile mango orchard by subtending different pruning intensities such as 'severe pruning' and 'light pruning' with soil application of paclobutrazol to induce good yield and fruit quality in forty years old unproductive orchard. Results revealed that the fruit yield and its components namely fruit size and number of fruits harvested per tree were improved significantly by the application of paclobutrazol in both types of pruning. The treatments involving 'severe pruning' with addition of paclobutrazol resulted in greater fruit size, whereas the treatment involving 'light pruning' with addition of paclobutrazol accounted for higher number of fruits harvested per tree. The fruit quality assessed in terms of total soluble solids, total sugars, reducing sugars, non-reducing sugars, ascorbic acid and carotenoid content were also enhanced substantially when treated with paclobutrazol in both 'severe' and 'light' pruning treatments during main and off season. The physiological loss in weight was also found to be lowest in treatments involving 'severe pruning' with addition of paclobutrazol.

Key words : Paclobutrazol, Pruning, Mango, Main season, Off season

INTRODUCTION

India continues to be the largest mango producing country of the world, accounting for more than 50 per cent of the world production. It is grown in about 1.60 million hectares with an annual production and productivity of 10.78 million tonnes and 8.71 tonnes per hectare, respectively. Rejuvenation of old and senile orchards has become the need of the hour to counteract the problem of lower productivity through pruning technology. The judicious use of growth retardants particularly paclobutrazol enhances early panicle emergence and also enable the trees to produce shorter and compact panicle, with more number of hermaphrodite flowers which results in more of fruit set. Pruning along with paclobutrazol application can induce off-season bearing during October-November in the variety 'Neelum'. Hence, the present study was undertaken to study the influence of different pruning intensities and paclobutrazol application on yield and quality of mango var. Neelum.

MATERIALS AND METHODS

The material of the present investigation consisted of pruning and paclobutrazol application of the mango trees. The pruning treatment *i.e.*, 'severe and light pruning' were enforced in the trees from the first week of September. Severe pruning includes removal of all foliage above a height of 5 m above the ground level and light pruning includes heading back of all scaffold branches up to 100cm. Soil drenching of paclobutrazol was done in

March by dissolving required quantity of paclobutrazol in 3-5 litres of water and this solution was poured in the root zone along the drip circle after making holes using crow bar. Observations were recorded on twelve qualitative and quantitative characters of the fruit collected from the old trees treated with various treatment combinations *viz.*, severe or light pruning along with or without application of paclobutrazol at varying doses level *i.e.*, 1.5 g a.i.(gram active ingredient) per tree and 2.3 g a.i. per tree, no pruning with paclobutrazol application @ 1.5 g a.i. per tree and 2.3 a.i. per tree, respectively and no pruning with water spray alone. Observations were recorded for main and off seasons on number of fruits, fruit weight, fruit yield in kilogram(kg) per tree, physiological loss in weight(per cent), shelf life (days), Total soluble solids(TSS °Brix), total sugars, reducing and non reducing sugars, titrable acidity, ascorbic acid and carotenoid content. Total sugars, reducing and non reducing sugars in fruits were estimated as per the method suggested by Somogyi(1952) and ascorbic acid and titrable acidity as per the methods suggested by A.O.A.C.(1975). Data collected on yield and quality attributes were subjected to statistical analysis as per the method suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

The highest total number of fruits harvested per tree (122.50) during off season was registered in trees treated with light pruning and soil application of paclobutrazol

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@2.3 g a.i./tree. With addition of paclobutrazol, the number of fruits were found to be significantly higher in those treatments receiving light pruning. This was in accordance with the findings of Singh and Sant Ram (1997) in mango 'Fazli'. The individual fruit weight (390.81 g) was more during main season and was recorded in severe pruned trees treated with paclobutrazol @2.3 g a.i. per tree. The least fruit weight was observed in control. This was in accordance with the findings of Mohan Swaroop *et al.* (2001) in mango 'Dasher' who reported increased average fruit size with an increase in pruning intensity. Sundararajan and Muthuswamy (1966) also reported that paclobutrazol treated trees significantly increased the fruit size as compared to control. In respect of the yield per tree, trees with no pruning and paclobutrazol application @2.3 g a.i. per tree was able to

produce higher yield during main season (7.796 kg/tree) and trees with light pruning and paclobutrazol application @2.3 g a.i. per tree during off season (39.37 kg/tree). Highest yield in light pruning is due to adequate number of shoots with sufficient supply of carbohydrates maintaining a proper balance (Nath, 1994). The reason attributed to increased yield with paclobutrazol may have been due to its effect on shifting of assimilates, chlorophyll, mineral elements and soluble proteins in leaves, stems and roots (Wang *et al.*, 1995).

In regard to shelf life of fruits, severe pruning treatments with addition of paclobutrazol recorded higher shelf life of the fruits as against control. Severe pruning along with paclobutrazol application @2.3 g a.i./kg/tree recorded highest shelf life of 11.52 days (Table 1). Similarly, physiological loss in weight assessed at 5 days

Table 1 : Effect of pruning and paclobutrazol on the yield attributing characters, yield and self life of mango fruits in var. 'Neelum' during main and off season

| Treatments | Total number of fruits per tree | | Single fruit weight(g) | | Fruit yield (kg/tree) | | Physiological loss in weight (%) | | Shelf life of the fruits (days) | |
|-------------------------------------------------------------------------|---------------------------------|------------|------------------------|------------|-----------------------|------------|----------------------------------|------------------|---------------------------------|------------|
| | Main season | Off season | Main season | Off season | Main season | Off season | Main season | Off season | Main season | Off season |
| Control | 17.17 | 18.17 | 278.18 | 270.48 | 5.162 | 1.206 | 6.283 (14.54) | 6.392 (14.65) | 9.138 | 9.017 |
| No pruning + No paclobutrazol application (only water spray) | 17.33 | 23.00 | 296.30 | 290.52 | 4.848 | 2.997 | 6.100 (14.30) | 6.267 (14.54) | 9.790 | 9.668 |
| No pruning + soil application of paclobutrazol@1.5 g a.i. per tree | 17.67 | 35.83 | 300.70 | 314.73 | 6.189 | 13.54 | 5.300 (13.31) | 5.467 (13.56) | 9.855 | 9.758 |
| No pruning + soil application of paclobutrazol@2.3 g a.i. per tree | 23.83 | 52.17 | 330.16 | 339.86 | 7.796 | 18.07 | 5.138 (13.05) | 5.175 (13.18) | 10.18 | 10.05 |
| Severe pruning + no paclobutrazol application | 7.500 | 43.83 | 348.07 | 337.43 | 2.614 | 17.09 | 1.783 (7.71) | 1.915 (7.92) | 10.64 | 10.55 |
| Severe pruning + soil application of paclobutrazol @1.5 g a.i. per tree | 5.333 | 67.17 | 355.04 | 344.25 | 1.884 | 23.55 | 1.097 (6.02) | 1.148 (6.02) | 10.68 | 10.58 |
| Severe pruning + soil application of paclobutrazol @2.3 g a.i. per tree | 3.000 | 76.17 | 390.81 | 381.02 | 1.460 | 29.50 | 0.441 (3.80) | 0.495 (4.05) | 11.52 | 11.36 |
| Light pruning + No paclobutrazol application | 16.67 | 103.67 | 291.24 | 257.35 | 4.227 | 27.20 | 4.490 (12.25) | 4.537 (12.25) | 10.22 | 9.938 |
| Light pruning + soil application of paclobutrazol @1.5 g a.i. per tree | 14.50 | 113.17 | 255.33 | 279.49 | 4.299 | 32.78 | 4.825 (12.66) | 4.857 (12.79) | 10.42 | 10.38 |
| Light pruning + soil application of paclobutrazol @2.3 g a.i. per tree | 13.17 | 122.50 | 323.13 | 311.33 | 4.383 | 39.37 | 4.627 (12.39) | 4.680 (12.52) | 10.67 | 10.52 |
| S.E.± | 3.0052 | 1.1421 | 26.8556 | 9.5801 | 0.9119 | 0.8165 | 1.1612 | 1.1740 | 0.2019 | 0.2270 |
| C.D. (P=0.05) | 6.3138 | 2.3994 | 56.4223 | 20.1274 | 1.9158 | 1.7155 | 2.4396 | 2.4665 | 0.4242 | 0.4769 |

after harvest invariably showed that severely pruned trees recorded minimum (0.495 per cent) as compared to control (6.267 per cent) during both the seasons. Dorayappa Gowda (2002) reported that the loss in fruit weight during ripening is due to transpiration and respiration, since fruits are living commodities and continue to live even after harvest. Severely pruned trees produced greater fruit size and as the fruit size increases, the respiration and transpiration rate is reduced. Smaller the fruit size and

higher the storage temperature, higher was the loss in weight (Srivastava, 1967).

Quality as assessed in terms of TSS, total sugars, reducing and non reducing sugars, ascorbic acid and carotenoid content was found to be influenced favourably in both severe and light pruning treatments (Table 2). Severe pruning treatments recorded higher fruit quality in terms of TSS, total sugars, reducing and non reducing sugars, ascorbic acid and carotenoid content. The highest

Table 2 : Effect of pruning and paclobutrazol on the fruit quality parameters in mango 'Neelum' during main and off season

| Treatments | Total soluble solids(° Brix) | | Total sugars content (%) | | Reducing sugars(%) | | Non reducing sugars(%) | | Titrable acidity(%) | | Ascorbic acid content (mg 100 g ⁻¹) | | Carotenoid content (mg 100 g ⁻¹) | |
|------------------------------------------------------------------------|------------------------------|------------|--------------------------|------------|--------------------|------------|------------------------|------------|---------------------|------------|-------------------------------------------------|------------|----------------------------------------------|------------|
| | Main season | Off season | Main season | Off season | Main season | Off season | Main season | Off season | Main season | Off season | Main season | Off season | Main season | Off season |
| Control | 21.32 | 20.03 | 14.69 | 14.58 | 4.283 | 4.188 | 10.41 | 10.40 | 0.275 | 0.283 | 36.27 | 36.10 | 4.480 | 4.469 |
| No pruning + No paclobutrazol application(only water spray) | 21.35 | 21.00 | 14.83 | 14.73 | 4.410 | 4.318 | 10.42 | 10.41 | 0.273 | 0.272 | 36.30 | 36.20 | 4.490 | 4.478 |
| No pruning + soil application of paclobutrazol@1.5 g a.i.per tree | 21.38 | 21.08 | 14.89 | 14.76 | 4.440 | 4.328 | 10.45 | 10.42 | 0.255 | 0.2681 | 37.45 | 37.22 | 4.918 | 4.911 |
| No pruning + soil application of paclobutrazol@2.3 g a.i.per tree | 21.78 | 21.47 | 14.96 | 14.78 | 4.452 | 4.338 | 10.51 | 10.43 | 0.252 | 0.245 | 37.63 | 37.27 | 4.951 | 4.943 |
| Severe pruning + no paclobutrazol application | 22.57 | 21.75 | 15.18 | 14.95 | 4.653 | 4.413 | 10.53 | 10.54 | 0.232 | 0.232 | 40.13 | 40.07 | 5.256 | 5.245 |
| Severe pruning + soil application of paclobutrazol @1.5 g a.i.per tree | 22.60 | 22.23 | 15.26 | 14.99 | 4.685 | 4.428 | 10.57 | 10.56 | 0.200 | 0.205 | 40.93 | 40.68 | 5.266 | 5.256 |
| Severe pruning + soil application of paclobutrazol @2.3 g a.i.per tree | 23.18 | 22.90 | 15.35 | 15.04 | 4.715 | 4.457 | 10.64 | 10.59 | 0.183 | 0.197 | 41.53 | 41.53 | 5.325 | 5.315 |
| Light pruning + No paclobutrazol application | 21.43 | 20.35 | 14.88 | 14.79 | 4.448 | 4.358 | 10.44 | 10.43 | 0.258 | 0.273 | 38.63 | 38.40 | 5.189 | 5.182 |
| Light pruning + soil application of paclobutrazol @1.5 g a.i.per tree | 21.70 | 20.88 | 14.95 | 14.82 | 4.482 | 4.358 | 10.47 | 10.46 | 0.247 | 0.262 | 38.85 | 38.47 | 5.193 | 5.184 |
| Light pruning + soil application of paclobutrazol @2.3 g a.i.per tree | 22.00 | 22.02 | 15.02 | 14.87 | 4.503 | 4.375 | 10.51 | 10.49 | 0.233 | 0.235 | 39.35 | 39.07 | 5.234 | 5.225 |
| S.E. ± | 0.1548 | 0.7136 | 0.0092 | 0.0095 | 0.0050 | 0.0079 | 0.0105 | 0.0052 | 0.0049 | 0.0178 | 0.2865 | 0.2993 | 0.0180 | 0.0176 |
| C.D. (P=0.05) | 0.3252 | 1.4993 | 0.0194 | 0.0199 | 0.0105 | 0.0166 | 0.0220 | 0.0109 | 0.0104 | 0.0374 | 0.6019 | 0.6288 | 0.0378 | 0.0369 |

total soluble solids (23.18° Brix) and total sugar content (15.35 %) of the fruits during main season was registered with the severely pruned trees along with the soil application of paclobutrazol @ 2.3 g a.i./tree. Kundu *et al.* (1995) revealed that since the TSS contents in the fruits largely depends on the sink source relationship, increased vigour and decreased number of fruits (sink) in severely pruned trees resulted in higher TSS content. Severe pruning with paclobutrazol application @ 2.3 g a.i. per tree reflected superiority over other treatments with respect to reducing and non-reducing sugars. The highest reducing sugars content of the fruit during main season and off season was registered 4.715 per cent and 4.457 per cent, respectively, wherein for non-reducing sugars, the values were recorded 10.64 per cent and 10.59 per cent both during main season and off season, respectively.

The lowest acid content of the fruit during main season (0.183 per cent) and off season (0.197 per cent) was registered for the trees with severe pruning and paclobutrazol application with 2.3 g a.i./tree. Similarly, the highest ascorbic content (41.53 mg 100g⁻¹) and (41.53 mg 100g⁻¹) of the fruits during main season and off season, respectively was registered in trees treated with severe pruning and paclobutrazol application @ 2.3 g a.i./tree. The highest carotenoid content of the fruit recorded the values of 5.325 mg 100g⁻¹ and 5.315 mg 100g⁻¹ during main season and off season, respectively for the trees with severe pruning and paclobutrazol application @ 2.3 g a.i./tree. Irrespective of the pruning treatments, paclobutrazol application improved the fruit quality in terms of TSS, reducing and non-reducing sugars, ascorbic acid and carotenoids as observed in 'alphonso' (Vijayalakshmi and Srinivasan, 2000). Fruit quality in paclobutrazol treated trees may have improved due to diversion of photosynthates towards the fruit (Rai and Bist, 1992). Also, they have reported the significant influence of paclobutrazol treatment over the carotenoid content in fruits.

Thus, it may be concluded that the treatment severe pruning with addition of paclobutrazol had registered the greatest fruit quality attributes. Whereas the treatment light pruning with addition of paclobutrazol had registered the highest yield. Hence, for the rejuvenating age old trees in senile orchards, severe pruning after harvest *i.e.* during September combined with soil application of 2.3 g a.i. of paclobutrazol per tree during the month of March in mango

'Neelum' produced more fruit yield especially during off season. In all treatments the fruit yield was more in off season than main season.

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