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Effect of paclobutrazol application and growth regulators on flowering, yield and quality parameters in the off season mango (*Mangifera indica* L.) cv. Bangalora

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Abstract

The field experiment was conducted at farmer's field at Gurugapatty on the "Studies on the yield and quality attributes in the Paclobutrazol treated fields on off season mango (*Mangifera indica* L.) cv. Bangalora." during the years 2018 to 2021. In the experiment conducted in Bangalora variety the paclobutrazol was applied during the month of June for off season as soil drenching. It was applied as a common dose at 0.75 g a.i. m^{-2} through soil in all the treatments except T_1 (Absolute control). The growth regulators were applied as foliar spray during September, October and November for three years. The three year pooled analysis on the application of growth regulators during off season observed that the application of PBZ @ 0.75 g a.i m^{-2} + MAP (1%) + NAA (20 ppm) during off season recorded the the highest number of panicles per m^2 canopy area (35.10) , the fruit length (20.16 cm), girth of the fruit (12.50 cm) and individual fruit weight (491.03g) and yield per tree (240.35 kg/tree) followed by increased yield in the application of PBZ @ 0.75 g a.i m^2 + MAP (1%) with 209.45 kg/tree.The results showed that an yield increment of 52% over the control (114.51t ha^{-1})

Keywords: Paclobutrazol, Banglora, Plant growth regulators, Foliar application....

Introduction

Mango (*Mangifera indica* L.*)* is an important fruit crop of tropical and subtropical regions which belongs to family Anacardiaceae with its origin in South East Asia. India is the largest producer of mango occupying about 22.6 lakh thousand hectares, with production of 20.7 million tonnes and productivity about 9.1MT/ha (India Stat 2017-2018). In India, the major mango growing states are Uttar Pradesh, Andhra Pradesh, Karnataka, Bihar, Gujarat and Tamil Nadu. The major mango producing districts in Tamil Nadu are Krishnagiri, Dharmapuri, Vellore, Dindigul, Thiruvallur and Theni. Among these

districts, Krishnagiri ranks first in production and the cultivated area is about 54,000 ha. From this 4.07 lakh MT of mangoes are harvested and the productivity is about 5.15 tonnes/ha.

In Krishnagiri district, production of mangoes during off season is done in an area about 10,000 ha. The major mango cultivated areas in Krishnagiri district are Hosur, Pochampalli, Uthangarai and Denkanikottai. Among these areas, Pochampalli ranks first in position in Krishnagiri district. The popular mango varieties in this district are Alphonso, Bangalora, Banganapalli, Sendura, Mulgoa and Neelum. Among this, the mainly cultivated variety is Bangalora which is used for pulping industry in Krishnagiri (Palanivel *et al.*, 2015). Forty per cent of the total mango pulp production in the country is from Krishnagiri district (Sengodi, 2016).

The productivity of off season fruits under chemical methods is negligible compared to the main season mango under Indian conditions. The off season bearing gets premium price in the market. The foliar application of plant growth regulators has a very important role in improving the productivity of mango. Earlier studies have reported that foliar spray of plant growth regulators in mango cause significant response in improving flowering and yield parameters Hedge *et al*.(2018). The flowering and fruit yield parameters, earlier studies are restricted to the main season and information on off season is limited. Hence, the present research was taken up to find out the effect of soil application of paclobutrazol and foliar application of growth regulators on flowering attributes and yield characters of off season mango (*Mangifera indica*) cv. Bangalora.

Material and Methods

The present investigation was conducted at Regional Research Station, Paiyur during the year 2017-2018. The study was conducted in a farmer's field, which was located at Gurugapatti Village, Pochampalli taluk, Krishnagiri district. The experimental site is geographically located at latitude 11°09' N, longitude 76°57' E and altitude 426.76 m above MSL. The experiment was laid out in a Randomized Block Design (RBD), with eight treatments and replicated thrice in both off and main seasons. Twenty five years old uniform sized trees of mango cv. Bangalora spaced at 8m x 8 m were selected for this study. The treatmental details are as follows T_1 – Absolute control,T_2 – PBZ @ 0.75 g a.i m^{-2} (control) ,T_3 – PBZ @ 0.75 g a.i m^{-2}+ K_2SO_4 (1%) ,T_4 – PBZ @ 0.75 g a.i m^{-2} + MAP (1%) ,T_5 – PBZ @ 0.75 g a.i m^{-2} + KNO_3 (1%) ,T_6 – PBZ @ 0.75 g a.i m^{-2} + K_2SO_4 (1%) + NAA (20 ppm) ,T_7 – PBZ @ 0.75 g a.i m^{-2} + MAP (1%) + NAA (20 ppm) ,T_8 – PBZ @ 0.75 g a.i m^{-2} + KNO_3 (1%) + NAA (20 ppm).The paclobutrazol concentration was calculated based on the diameter of the tree, and applied @ 0.75 g a.i per m^2 which was done during the month of June 2018 for off season. Soil drenching of paclobutrazol was done as per the procedure reported by Burondkar & Gunjate 1992. The foliar sprays of nutrients was imposed at different months *viz*., September, October, November. Chlorophyll index was recorded using portable Chlorophyll Meter (Opti – science model, CCM-200 plus) and the average value was computed using method described by Monje & Bugbee (1992).Number of panicles were counted per square meter area at four different locations on a tree with help of wooden frame 1m x 1m dimension and the mean was expressed in numbers. Length of panicle

was measured with the help of scale and thread at full bloom stage. It was measured from the point of emergence to the apex of panicle. The yield parameters *viz*., number of fruits per tree, fruit yield, fruit weight, fruit girth, pulp weight, peel weight, stone weight, were recorded after fruit set and the results are furnished below. The number of fruits harvested from all the treated trees during the season was recorded and the mean value was expressed as number of fruits per tree. All the fully matured fruits harvested from each tree were weighed using weighing scale and the mean yield was expressed as kg per tree. The individual fruit weight was recorded using weighing scale in randomly selected five fruits in each treatment and the mean value was expressed in gram. The pulp weight of fruits was recorded after excluding peel and stone from fully ripened five fruits are selected and the mean was expressed in gram. The peel weight was recorded using a weighing scale in fully ripened selected five fruits after removing the pulp and stone and the mean was expressed in gram. The stone was separated from the randomly selected fully ripened five fruits per tree and weighed individually by using weighing scale. The mean stone weight was expressed in gram. The total soluble solids content in the pulp was determined by using an 'ERMA' hand refractometer (ERMA®, Japan). Readings were recorded in ^{o}Brix. Statistical analysis of data was done by adopting statistical procedures as per the methods of by Panse & Sukhatme (1985).

Results and Discussion

Impact of paclobutrazol and foliar application of growth regulators on the flowering and fruiting characters of off season mango

The three year pooled analysis on the application of growth regulators during off season observed that the application of PBZ @ 0.75 g a.i m^{-2} + MAP (1%) + NAA (20 ppm) during off season recorded the the highest number of panicles per m^2 canopy area (35.33), Paclobutrazol could enhance the total phenolic content of terminal buds and altered the xylem to phloem ratio of the stem, which is important in restricting the vegetative growth and enhancing flowering by altering assimilates partitioning and patterns of nutrient supply for new growth (Kurian and Iyer, 1992).Spraying mango tree with Phosphorus containing compounds at pre and post flowering periods enhance floral induction, differentiation and hasten floral bud break and panicle emergence. Improve mango flowering characteristics and fruit productivity. Raj Kumar *et al*., (2007) stated that H_3PO_4, KH_2PO_4, K_2HPO_4, KNO_3 and P333 for chemical flowering induction and improvement of mango, they found that, spraying H_3PO_4 and KH_2PO_4 were superior in induction of early flowering, panicle length and diameter and flowering intensity. According to the statement Marschner (2002), the number of flowers formed is reduced in the case of a deficiency of P. This result also agrees with that reported by other fruits, in which an application of P increased flowering (Agusti, 2003) and increased metabolism in these buds, Phosphorus promotes the absorption of Mg, an element that is fundamental in the floral formation and promotes the synthesis of nucleic acids (Feucht, 1982).

The panicle length was the highest in the application of PBZ @ 0.75 g a.i. m^{-2} + KNO_3 (1%) + NAA (20 ppm) during the off season (35.75cm). This is in line with Sudha *et al.*, 2012 reported that the foliar application of 2% KNO_3 in mango cv. Alphonso which resulted in maximum number of flowering shoots, number of panicles, panicle length. Paclobutrazol, being a growth retardant, might have resulted in

accumulation of reserves which could have led to the better development of reproductive organ namely flower panicles. Jasmine *et al.* (2011) also witnessed similar effect of panicle enlargement with NAA in mango. NAA is a known auxin compound which has a profound role on cell division and elongation (Vijayalakshmi and Srinivasan, 1998).

The effect of different plant growth regulators and nutrients on number of fruits per tree which was highly significant in off season is furnished in table. Among the different treatments, PBZ @ 0.75 g a.i. m^{-2} + MAP (1%) + NAA (20 ppm) recorded the highest number of fruits per tree (493.02). The effect of different plant growth regulators and nutrients on fruit weight which was highly significant in off season parameters presented in Table. Among the different treatments, the highest fruit weight (491.03 g) was recorded in T_7.Among the different treatments, the highest fruit yield (240.35 kg/tree) was recorded in T_7. Raj Kumar *et al*., (2005) illustrated that, spraying chemical inductive agents (KH_2PO_4 and H_3PO_4) on mango trees increased number of perfect flowers / panicle, fruit set % and improved all flowering and fruiting characters as well as mango fruit yield. This is supported by the study by Reddy and Majumber (1988) obtained the highest mango fruit yield by spraying trees with H_3PO_4 0.5 % + urea 2 %. The effect of different plant growth regulators and nutrients on total soluble solids which was significant in off season are presented in Table. Among the different treatments, the highest TSS (15.17° B) was recorded in PBZ @ 0.75 g a.i. m^{-2} + KNO_3 (1%) + NAA (20 ppm). The lowest TSS (10.80° B) was recorded in PBZ @ 0.75 g a.i m^{-2}+ K_2SO_4 (1%) during the off season.

The study concluded that the soil application of paclobutrazol and foliar application of growth regulators during off season observed that the application of PBZ @ 0.75 g a.i m^{-2} + MAP (1%) + NAA (20 ppm) recorded highest yield per tree (240.35 kg/tree) followed by increased yield in the application of PBZ @ 0.75 g a.i m^2 + MAP (1%) with 209.45 $kgtree^{-1}$ The results showed that an yield increment of 52% over the control (114.51 $kgtree^{-1}$).Off season fruits fetches premium price in the market so the encouraging results of foliar application of MAP (1%) + NAA (20 ppm) shows the scope for growth regulators and nutrients on the improvement of off season yield.

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Table 1. Effect of application of plant growth regulators and nutrients on flowering, yield and quality characters in off season mango var. Bangalora

Treatments	Number of panicle /m^2	Length of panicle (cm)	Length of fruit (cm)	Girth of fruit(cm)	Individual fruit weight (gm)	No of fruits/tree	Yield /tree (kg)	Stone weight (gm)	Pulp weight (gm)	Peel weight (gm)	TSS brix
T_1 – Absolute control	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T_2 – PBZ @ 0.75 g a.i m^{-2} (control)	18.70	24.25	12.84	7.17	310.77	358.96	114.51	55.50	201.93	52.21	10.80
T_3 – PBZ @ 0.75 g a.i m^{-2}+ K_2SO_4 (1%)	21.07	26.58	13.33	7.92	346.96	373.40	136.51	63.91	232.80	61.02	11.93
T_4 – PBZ @ 0.75 g a.i m^{-2} + MAP (1%)	27.30	29.72	17.16	10.13	413.57	459.73	209.45	68.66	304.32	68.18	15.50
T_5 – PBZ @ 0.75 g a.i m^{-2} + KNO_3 (1%)	23.22	27.38	14.47	8.52	343.76	399.59	149.51	64.91	272.07	56.13	12.77
T_6 – PBZ @ 0.75 g a.i m^{-2} + K_2SO_4 (1%) + NAA (20 ppm)	26.81	28.62	15.71	8.34	367.37	387.41	172.84	66.30	247.64	73.00	14.10
T_7 – PBZ @ 0.75 g a.i m^{-2} + MAP (1%) + NAA (20 ppm)	35.33	33.54	20.16	12.50	491.03	493.02	240.35	74.09	323.58	87.89	15.17
T_8 – PBZ @ 0.75 g a.i m^{-2} + KNO_3 (1%) + NAA (20 ppm)	26.56	35.75	17.37	11.64	386.88	427.76	189.32	69.13	259.79	71.65	13.50
SEd	1.7741	2.0368	1.0325	1.5634	34.66684	32.913	22.0162	3.42798	31.519	5.60922	1.186342
CD @ 5%	3.8038	5.3296	2.2110	3.0799	74.36038	98.2903	47.2249	7.35301	67.608	12.03178	2.544704