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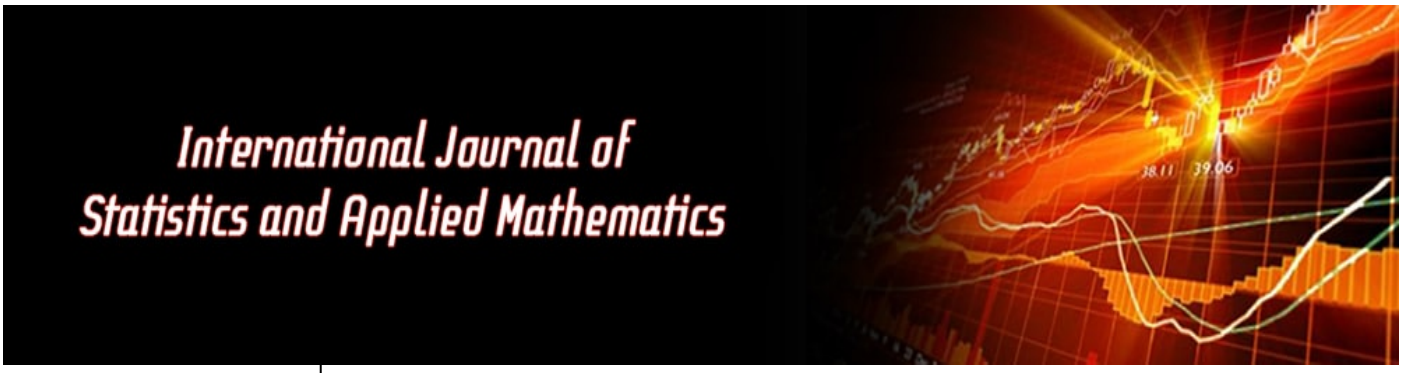

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Assessment of proper doses of paclobutrazol to mitigating irregular bearing in mango

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Abstract
Alternate bearing is one of the important challenges of the mango industry, there are several practices to overcome alternate bearing and among them use of growth retardants like paclobutrazol have become most effective. Hence an experiment was conducted to study the "assessment of proper doses of Paclobutrazol to mitigating irregular bearing in mango". The treatment T_3 showed positive effect on fruit set at mustard stage (58.81), Fruit set at pea stage (16.3), Mature Fruits/ panicle (5.77), number of fruits/tree (585), Fruit yield/ tree (134.56 kg) and yield (269.12q/ha) over control in mango. With respect to different treatments of paclobutrazol the treatment T_3 (30 ml) showed highest TSS (20.55 °B), Total sugar (15.46), reducing sugar (4.05), non- reducing sugar (11.57), βcarotene (1.16) and it is on par the treatment T_2. The treatment T_1 showed highest acidity (0.23%), ascorbic acid (37.75 mg/100 g) and it is on par with the treatment T_3. Cost benefit ratio was maximum of 1:5.90 was with T_3 (30 ml paclobutrazol) and least cost benefit ratio of 1:3.90 was with control.

Keywords: Paclobutrazol, Fruit quality, Mango, Yield and Economics

Introduction
Mango (*Mangifera indica* L.), the king of fruits, predominantly grows in a short harvest period from May to July in India. Irregular flowering, low fruit set as well as retention leading to low yield and fruits of poor quality are also the prevalent problems in mango production. The availability of fresh fruits after the normal fruiting season for a longer period, in addition to increasing yield and quality can be extended by using paclobutrazol. Soil application of paclobutrazol induces precocious flowering in young trees and promotes early flowering in bearing trees (Kulkarni, 1988) [13]. Inflorescence becomes visible within 2.5 to 4 months after the application of paclobutrazol depending on cultivar (Junthasri *et al.*, 2000) [11]. PP333 (Paclobutrazol) enhances the flower and fruit production in mango (Anbu *et al.*, 2002) [2]. Improvement of fruit set and fruit retention in mango cv. Gulab Khas as well as the highest yield had been noticed under soil application of paclobutrazol (Singh and Singh, 2006) [19]. Paclobutrazol exhibits the pronounced effect on increasing the parameters like ascorbic acid, total sugar, reducing sugar and TSS, except for acidity in fruits of Alphonso mangoes at Coimbatore, India (Vijayalakshmi and Srinivasan, 2000) [22]. Mango trees treated with paclobutrazol had higher results for number of panicles produced, yield as well as quality of fruit compared to control (Yeshitela *et al.*, 2004) [24]. Hence an experiment was conducted to Assessment of proper doses of Paclobutrazol to mitigating irregular bearing in mango.

Materials and Methods
The present study was carried out by KVK, Saharsa under the guidance of Bihar Agricultural University, Sabour, Bhagalpur, Bihar as well as ICAR-ATARI (Zone-IV) during Rabi season as an On-Farm Trial at seven farmers' fields of an adopted village i.e. Panchgachiya, Barahsher, Purikh of Sattarkataiya block of Saharsa district in Bihar. The farmers, who grow Mango and suffer due to irregular bearing and low yield, have been chosen for the experiment. The area under each trial is 0.3 ha (i.e. 1 bigha). In each trial, there were three treatments. The treatments considered are presented in Table 1 where T_1 i.e. the farmers' practice has been followed as control. Each farmer's field was treated as one replication.

The experiment was conducted in a Randomized Block Design with 7 replications (= 7 farmers) and 3 treatments with recommended agronomic practices.

By dissolving 20 and 30 ml of 25% paclobutrazol (Syngenta Chem. Co. Ltd., India) into one litre of fresh water each, the solutions of 7500 and 10000 ppm were prepared, respectively. Paclobutrazol solutions, each of 1 litre were soil drenched according to Burondkar & Gunjate (1993) [4], where 10 small holes (10-15 cm depth) were prepared in the soil around the collar region of the plants just inside the fertilizer ring. The prepared solutions of paclobutrazol as per treatment uniformly drenched into the holes and the soil was reworked after application of paclobutrazol. The data of the following parameters were recorded: Fruit set at mustard stage, Fruit set at pea stage, Mature Fruits/ panicle, No. of fruits/ Tree, Fruit yield tree, fruit weight, Length of fruit, Width of fruit, TSS, acidity, β-carotene, reducing sugar, non-reducing sugar, ascorbic acid and total sugar content. The initial number of fruits of each panicle and the fruits retained per panicle at 10 day intervals starting from pea stage up to harvest were recorded and the average was worked out. After harvest, ten randomly selected fruits were allowed to ripen at room temperature and fruit quality was determined using 10 fruits per tree. Total Soluble Solid (TSS) of 10 fully ripened fruits for each treatment was estimated by a hand refractometer and the average was worked out. The acidity (Rangana, 1979) [16], vitamin C (Plummer, 1971) [15], reducing sugar (Miller, 1972) [14] and total sugar content (Jayaraman, 1981) [9] in mango pulp were determined.

Results and Discussion

With respect to different treatments of paclobutrazol the treatment T_1 (control) has shown highest fresh fruit weight (215.45 g), length of fruit (10.31 cm), width of fruit (6.80 cm) and all these parameters were on par with the treatment T3. Similar results were observed in by Burondkar *et al*. (2000) [3] in which he reported that all the PBZ treated mango trees recorded reduction in fruit size as compared to untreated control (Table-1).

The treatment T_3 showed positive effect on fruit set at mustard stage (58.81), Fruit set at pea stage (16.3), Mature Fruits/panicle (5.77), number of fruits/tree (585), Fruit yield/ tree (134.56 kg) and yield (269.12q/ha) followed by treatment T_2 showed fruit set at mustard stage (56.12), Fruit set at pea stage (15.41), Mature Fruits/ panicle (5.16), number of fruits/tree (517.75), Fruit yield/ tree (103.88 kg) and yield (207.76 q/ha) over control in mango (Gopu, 2011) [6]. Hasan *et al*. (2013) [7] found that application of paclobutrazol in the months of August and September (before 150 and 120 days of flower emergence) at 20 and 30 ml of canopy spread showed positive influence for fruit set, No. of fruits and fruit yield. Similar results were noticed by Singh *et al*. (2010b) [18] and Upreti *et al*. (2013) [20] in mango.

With respect to different treatments of paclobutrazol the treatment T_3 (30 ml) showed highest TSS (20.55 °B), Total sugar (15.46), reducing sugar (4.05), non- reducing sugar (11.57), βcarotene (1.16) and it is on par the treatment T_2. The treatment T_1 showed highest acidity (0.23%), ascorbic acid (37.75 mg/100g) and it is on par with the treatment T_3 (Table-2).

The fruit qualities were formed better due to soil application of paclobutrazol than control (Hillier, 1991) [8]. Similar results as that of the findings of present investigation were also reported by Vijayalakshmi and Srinivasan (2002) [21], Yeshitela and Stassen (2005) [23], Karuna *et al*. (2007) [12], Jayavalli *et al*. (2009) [10], Adil *et al*. (2011) [1], Sarker and Rahim (2012) [17] and Hasan *et al*. (2013) [7] in mango. The application of paclobutrazol combined with ethephon also improves the fruit quality characters (Gnanasekaran, 2007) [5].

The highest net return was recorded from the treatment -3 of Technology option –III Rs. 506264/ ha and it was followed by treatment -2 of Technology option –II Rs. 380572/ ha and Technology option –I Rs. 283780/ ha in order of merit. The present findings are in agreement with the results of Chaurasia, 2005. The lowest gross return was obtained in Farmers' Practice plot Rs. 356180/ ha. The incremental C:B ratio of different treatments showed that maximum incremental C:B ratio of 5.90 was obtained from the treatment Technology option-III (Table-3).

Table 1: Effect of Paclobutrazol on fruit set, fruit growth and yield of Mango

Treatment	Fruit set at mustard stage	Fruit set at pea stage	Mature Fruits/ panicle	No. of fruits/ Tree	Fruit yield/ tree (kg)	fruit Weight (gm)	Length of fruit (cm)	Width of fruit (cm)
Farmers practices	47.60	13.15	3.79	375.75	80.95	215.45	10.31	6.80
Paclobutrazol @ 20 ml	56.12	15.41	5.16	517.75	103.88	200.65	10.00	6.70
Paclobutrazol @ 30 ml	58.81	16.3	5.77	585	134.56	230.03	9.85	6.60
S.Em±	0.67	0.58	0.42	0.54	0.64	0.44	0.59	0.90
CD @ 5%	1.46	1.27	0.91	1.18	1.39	0.96	1.29	1.97

Table 2: Effect of paclobutrazol on fruit quality parameters of mango

Treatment	TSS (°B)	Acidity (%)	Total Sugar (%)	Reducing Sugar (%)	Non reducing Sugar (%)	βcarotene	Ascorbic acid (mg)
Farmers practices	19.31	0.23	15.35	3.38	11.44	1.13	37.75
Paclobutrazol @ 20 ml	20.15	0.20	15.42	3.88	11.48	1.14	37.12
Paclobutrazol @ 30 ml	20.55	0.19	15.46	4.05	11.57	1.16	36.27
S.Em±	0.58	0.68	3.83	1.26	2.94	0.79	8.81
CD @ 5%	1.27	1.48	8.34	2.74	6.40	1.72	19.19

Table 3: Effect of paclobutrazol on economics of mango

Treatment	Yield (q/ha)	Cost of cultivation (Rs./ha)	Gross income (Rs./ha)	Net income (Rs./ha)	Benefit cost ratio
Farmers practices	161.90	72700	356180	283780	3.90
Paclobutrazol @ 20 ml	207.76	76500	457072	380572	4.97
Paclobutrazol @ 30 ml	269.12	85800	592064	506264	5.90
S.Em±	4.88	-	-	-	-
CD @ 5%	10.64	-	-	-	-

Conclusion

Paclobutrazol (PP333), an effective anti-gibberellins, has been proved to have profound effect in inducing flowering and fruiting in many fruit crops. The study revealed that soil application of 20 and 30 ml was found effective in improving economic traits *viz*., plant, fruit and quality traits, besides yield and quality. The highest t dose of 30 ml was increased total carotenoids, TSS, sugars, ascorbic acid and sugar-acid ratio as compared to control, the response being linear with the increasing concentrations.

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