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Effect of Soil applied Paclobutrazol on Fruit Retention, Fruit Size and Tree Yield in Mango Cvs, Dashahari, Langra, Chausa and Fazri

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ABSTRACT

The experiment was conducted to find out the effect of paclobutrazol on 21 years old alternatively bearing mango Cvs. Dashahari, Langra, Chausa and Fazri trees were treated with Paclobutrazol as a soil drench (1.0g. and 0.5g/meter canopy diameter) during 15 Oct. and 15 Sept, Average over the two years, the vegetable flushes were significantly reduced by the two soil drench treatments of the stem bearing terminal vegetative shoots compared with control. Flowering ratio in the trees subjected to all the paclobutrazol treatments was higher than that of the control, but the fruit set only slightly increased by these treatments. Paclobutrazol remained in the soil up to 11 months when it was applied to soil and three months in soil drench without soil cover. Paclobutrazol inhibited tree growth by reducing annual shoot length and trunk diameter, compared with the control. The most pronounced effect was that of higher doses of paclobutrazol applied at 15 Oct. Compare to lower doses of paclobutrazol applied at 15 Sept. of the second year with the control. These trees also gave higher flowering on 15 Oct. compare to 15 Sept. with the control. Soil drenches were applied to the cultivars Dashahari, Langra, Chausa and Fazri during 1997 and 1998 with good result. Chemical names used [(2RS, 3RS)-1-(4-Chlorophenyl)-4, 4-dimethyl-2-(1, 2, 4-Trizol-l-yl)] pentan-3-ethanol.

Keywords: *Paclobutrazol (PBZ, PP333), Vegetative growth, tree size control.*

INTRODUCTION

Mango (*Mangifera indica* L.) is the most important fruit crop of India. The annual world production of mango is approximately 19.5 million tones. Mango because of its great utility, occupied a pre-eminent place amongst the fruit crops grown in India. Presently, mango is produced about.

In India, Mango is grown in about 2212 '000' hectare area with an annual production of 19506 '000' tons in the year 2017. India occupies top position among mango growing countries of the world and produces 40.48% of the total world mango production.

China and Thailand stood at second and third position among mango producing countries in the world with 4,366 and 2,551 thousand tons respectively. Which is very low compared to other mango growing countries. The existing mango production falls appreciably short to fulfill the national demand. Irregular or erratic flowering, low fruit set as well as retention leading to low yield, fruits of poor quality and short availability period are the major problems in mango production. Soil application of paclobutrazol induced precocious flowering in young trees and promoted early flowering in bearing trees (Kulkarni, 1988). Inflorescence becomes visible within 2.5 to 4 months after the application of paclobutrazol depending on cultivar (Junthasri et al., 2000). Improvement in fruit set and fruit retention in mango cv. Gulab Khas as well as the highest yields were recorded under soil application of paclobutrazol (Singh and Singh, 2006).

The research regarding regulation of flowering and harvesting time, increasing yield and quality of mango by using paclobutrazol is almost absent in Bangladesh. The Major factor of low productivity are alternate bearing habit like other cultivars(Ram and Sirohi, 1989), fruit

drop, diseases and pests and the Cultivars of North India viz. Dashahari, Langra, Chausa and Fazri flowering, fruiting in alternate years. The plant Growth retardants, particularly paclobutrazol are being used to stimulate or enhanced early flowering unlike the other classes of growth retardants which are normally applied in foliar application. Paclobutrazol is usually applied to the soils due to its low solubility and long residual activity, this class of growth retardants is most efficacious as it reduces shoot elongation and promotes flowering, and yield in the Commercial mango of Indo China., Australia and South Africa (Tongumpai *et al*., 1989; Rowley, 1990; Hillier and Rudge, 1991 and Voon *et al*, 1991.) reduced numbers of panicles for the uses of paclobutrazol despite increased fruit set resulting increased yield (Goguey, 1990).

Gibberellins, most likely GA3 are necessary for normal shoot elongation. Inhibition of bud break and shoot elongation is response to application of Growth Retardants Chloremquate Chloride (Kulkarni, 1972a) and Trizoles (Kulkarni, 1988a; Burondkar and Gunjat, 1991, 1993; Tongumpaia *et al*., 1991a; Kurian *et al*., 1992; Winston, 1992; Kurian and Iyer, 199a,b; Nunez-Elisea *et al*, 1993; Werner, 1993) have been reported.

Elongation of inflorescence is also inhibited, especially by high level of trizoles (Kulkarni, 1988b; Winston, 1992; Salomon and Reuvini, 1994) reinforcing the essential role of Gibberellins in normal panicle elongation. Inflorescence in treated trees may become compact improving opportunities for disease and insect attack (Winston, 1992).

The first report about the use of paclobutrazol (PBZ) on mango (*Mangifera indica* L.) came from India where Kulkarni (1988) tested concentrations of 1.25 to 10 g per tree on 'Dashehari' and 'Banganepalli'. PBZ is a synthetic plant growth regulator, which has been used in fruit tree crops to control vegetative growth and to induce flowering (Swietlik & Miller 1985). Davenport & Nunez-Elisea (1997) elaborated that unlike the other classes of growth retardants that are normally applied as foliar sprays, PBZ is usually applied to the soil because of its low solubility and long residual activity.

PBZ (especially soil drenched at higher concentrations) has been observed to reduce vegetative growth and increase flowering, percentage hermaphrodite flowers, fruit set as well as yield (Singh 2000) whereas it reduced incidence of floral malformation (Singh & Dhillon 1992). Some PBZ residues may remain in the fruit.In commercial mango plantations; it is desirable to control the vegetative growth and the canopy size to prevent or reduce alternate bearing and to facilitate cultural practices. Ethiopia being situated very near to the equator is characterized by two flowering periods resulting from bimodal rainy periods and low temperature (main rainy season is June-August and the short one is February-March).

This situation exhausts the tree. Besides, excessive vegetative growth is a common characteristic of most mango cultivars that results in unmanageable and large trees. The maximum residue limit of PBZ accepted by the Food and Agriculture Organization of the United Nations (FAO) in stone fruit is 0.05 mg/kg (Singh & Ram 2000).

This report discusses the effect of PBZ on vegetative growth, shoot total non-structural carbohydrate contents, leaf mineral content, flowering, yield, and fruit qualitative aspects of 'Tommy Atkins' mango trees grown at the Upper Awash Agro-industry Enterprise in Ethiopia. This is the first study in Ethiopia on the effect of growth retardants on fruit trees and other crops (Ethiopian Agricultural Research Organization planning office pers. comm)

MATERIAL AND METHODS

The experiment was carried out an uniform trees (21-22 years) of cultivars Dashahari, Langra, Chausa and fazri during 1997-99 to find out the optimum doses of Paclobutrazol application. The treatment consisted of different doses of Paclobutrazol namely 1.0 g and 0.5 g per canopy diameter along with control. Paclobutrazol was applied once in a year 15 Oct 1997 and 15 Sep 1998 in soil around the tree canopy spread.

The aqueous suspension of the individual treatments the observation recorded 20 shoots of each tree were tagged in four directions and the data from these shoots along with tree circumstances and crown diameter of trees was measured with standard tools and shoots length, thickness. Intermodal length and number of leaf were recorded on 20 tagged shoots.

The prepared solutions of paclobutrazol as per treatment uniformly drenched into the wholes and the soil was reworked after application of paclobutrazol. Only water was applied in the

control plants. The data of the following parameters were recorded: length of terminal shoot, number of leaves per terminal shoot, leaf area, length of Mango as influenced by soil drench application and recorded no of panicle, number of secondary branches per panicle, total number of panicles, fruit set per panicle, number of fruits retained per panicle at 15 day intervals starting from pea stage up to date of harvest, number of fruits per plant, fruit weight, yield, edible portion, stone pulp ratio, peel pulp ratio, shelf-life, TSS, titratable acidity, vitamin C, dry matter, reducing sugar, non reducing sugar and total sugar content.

The length and number leaves of ten randomly selected terminal shoots at flowering stage were measured and the average was worked out. Leaf area was measured for all the 50 leaves taking 5 from each of ten above selected shoots by a leaf area meter and expressed as square centimeter. The length and number of secondary branches per panicle of 15 randomly tagged panicles covering the whole tree was recorded and the average was worked out. Ten panicles were randomly selected from each treatment. The initial number of fruits of each panicle and the fruits to be retained per panicle at 15 day intervals starting from pea stage up to harvest was recorded and the average was worked out The recorded data on different parameters of the experiment were tabulated and analyzed and the treatment means were separated by two factorial RBD test (RBD) test at 5 % level of significance.

The data on flowering were counted on tagged shoots. Length of Panicles was measured from its base to the tip, where as Penicle thickness was measured at the base of Penicle. Number of Penicles, Number of Primary and secondary rachis with its spread, penicle length and date of penicle emergence were recorded on tagged shoots with flowered. The numbers of hermaphrodite flower were counted at full bloom and fruit set stage after 15 days of anthesis (first and second week of April).

Table1A. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra,Chusa and Fazli (1997-99)*

Treatment	Length of shoots(cm)			Diameter of shoots(cm)			No of leaves /shoots		
	15 Sept. 1998	15 June 1999	% increase	15 Sept. 1998	15 June 1999	% increase	15 Sept. 1998	15 June 1999	% increase
Dashehari Control 1.0g	11.69	11.92	2.13	0.68	0.70	2.94	9.42	9.54	1.81
PBZ m tree canopy diam.	12.39	12.52	1.04	0.64	0.69	7.81	11.56	11.68	1.03
Langra Control 1.0g PBZ	10.40	10.67	2.59	0.63	0.64	1.58	8.06	8.26	2.48
m tree canopy diam.	11.49	11.64	1.30	0.63	0.67	6.34	9.15	9.32	1.85
Chausa Control 1.0g PBZ	9.33	9.68	3.75	0.65	0.66	1.53	9.16	9.32	1.74
m tree canopy diam.	9.56	9.65	2.00	0.56	0.58	3.57	8.34	8.47	1.55
Fazri Control 1.0g PBZ m	9.95	10.15	2.01	0.65	0.66	1.53	7.71	7.88	2.20
tree canopy diam.	9.59	9.76	1.77	0.65	0.67	3.07	8.58	8.75	1.98
CD at 5% Cultivar	0.64	0.62	0.96	0.20	0.19	0.41	0.67	0.64	0.41
Treatment	NS	NS	NS	0.29	0.27	NS	0.95	0.91	NS
Interaction	NS	NS	0.13	NS	NS	0.59	1.34	1.29	0.59

Table1B. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra, Chusa and Fazli (1997-99)*

Treatment	Width of leaves(cm)			Length of shoots(cm)			Intermodal length(cm)		
	15 Sept. 1998	15 June 1999	% increase	15 Sept1998	15 June 1999	% increase	15 Sept. 1998	15 June 1999	% increase
DashehariControl 1.0g PBZ m tree	4.59	4.72	2.83	17.73	17.98	1.14	2.97	2.97	6.83
canopy diam.	4.81	4.90	1.87	16.76	16.84	0.47	2.68	2.78	3.77
Langra Control 1.0g PBZ m tree	4.40	4.53	2.59	16.59	16.81	1.32	2.80	2.93	4.64
canopy diam.	4.61	4.66	1.08	16.76	16.82	0.35	2.70	2.81	4.07
Chausa Control 1.0g PBZ m tree	4.35	4.51	3.67	16.73	16.95	1.31	2.65	2.85	7.47
canopy diam.	4.39	4.45	1.36	16.77	16.82	0.71	2.36	2.44	3.38

Fazri Control 1.0g PBZ m tree canopy diam.	4.99 4.51	5.10 4.35	2.20 1.77	16.33 16.67	16.85 16.80	2.55 0.77	2.46 2.57	2.54 2.65	3.25 3.11
CD at 5% Cultivar Treatment Interction	NS NS NS	0.42 NS 0.64	0.41 0.29 0.59	NS NS NS	3.54 NS NS	0.82 NS 0.11	NS 0.20 0.14	NS 0.17 0.34	0.38 NS 0.54

Table2A. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra, Chusa and Fazli (1997-99)*

Treatment	Main stem diameter (cm)			Circumferences of Tree(cm)			Tree crown diameter(m)		
	15 Oct. 1997	15 July 1998	% increase	15 Oct. 1997	15 July 1998	% increase	15 Oct. 1997	15July 1998	% increase
Dashehari Control 1.0g PBZ m tree canopy diam.	18.57 20.75	19.20 21.12	1.74 1.78	16.34 15.03	16.77 15.16	2.63 0.93	5.27 4.78	5.35 4.82	1.51 0.83
Langra Control1.0g PBZ m tree canopy diam.	30.12 29.25	30.49 29.77	1.22 1.77	19.12 21.08	19.38 21.18	1.36 0.47	6.01 6.71	6.16 6.77	2.49 0.89
Chausa Control 1.0g PBZ m tree canopy diam.	30.74 33.00	31.12 33.80	1.20 2.42	21.29 24.50	21.69 24.60	1.87 0.41	6.77 6.16	6.90 7.24	1.92 1.12
Fazri Control1.0g PBZ m tree canopy diam.	29.50 31.50	29.83 32.40	1.11 2.85	20.01 19.65	20.31 19.73	1.49 0.41	6.40 6.76	6.54 6.84	2.18 1.18
CD at 5% Cultivar Treatment Interactions	NS 3.77 NS	NS 3.88 NS	0.67 0.47 0.95	NS 2.63 NS	NS 2.78 NS	0.84 NS 0.59	NS 0.76 NS	1.07 NS NS	0.75 NS 0.10

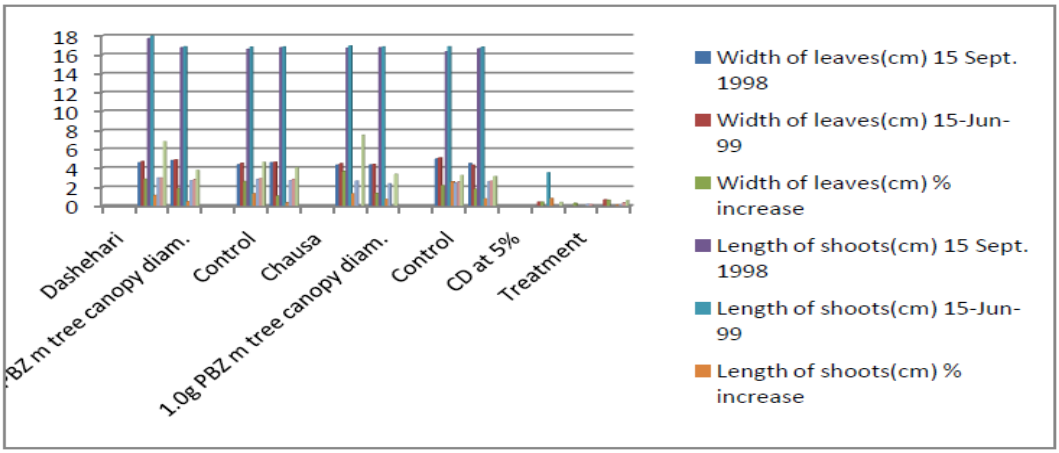

Fig1B. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra, Chusa and Fazli (1997-99)*

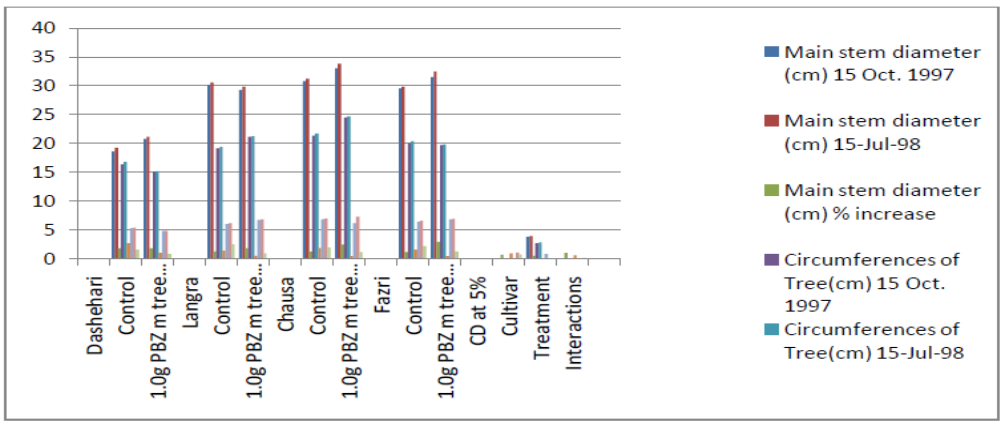

Fig2A. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra, Chusa and Fazli (1997-99)*

Table2B. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra, Chusa and Fazli (1997-99)*

Treatment	Tree Volume			Tree Height(m)		
	15 Oct. 1997	15 July 1998	% increase	15 Oct. 1997	15 July 1998	% increase
Dashehari Control 1.0g PBZ m tree canopy diam.	276.45 210.24	279.45 210.81	1.12 0.27	4.47 4.60	4.65 4.67	3.50 1.52
Langra Control 1.0g PBZ m tree canopy diam.	431.09 606.15	433.16 606.85	0.48 0.11	6.11 6.16	3.32 6.26	3.43 1.62
Chausa Control1.0g PBZ m tree canopy diam.	597.11 707.91	600.23 708.10	0.52 0.02	7.47 6.90	7.64 6.90	2.27 0.86
Fazri Control 1.0g PBZ m tree canopy diam.	521.47 538.15	528.33 539.00	1.31 0.15	6.27 6.89	6.57 6.98	4.78 1.30
CD at 5% Cultivar Treatment Interactions	NS 191.56 NS	NS 200.54 NS	0.46 0.32 0.65	NS 0.55 NS	NS 0.59 NS	0.14 NS 0.20

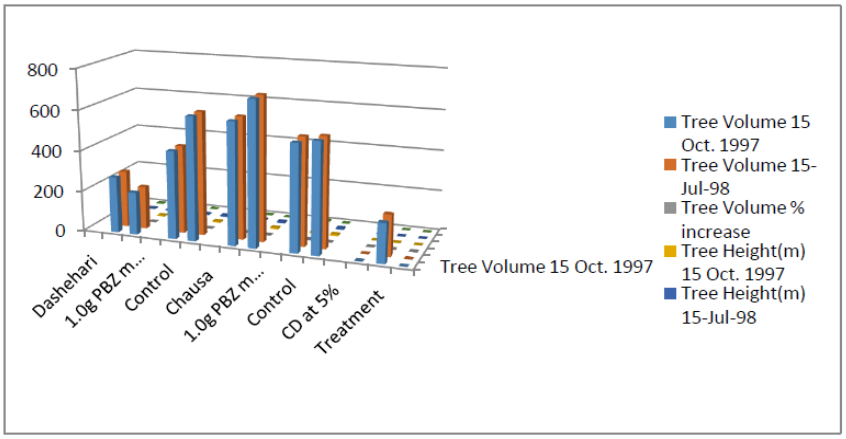

Fig2B. *Effect of Paclobutrazol treatments on vegetatative growth on mango cvs. Dashehari, Langra, Chusa and Fazli (1997-99)*

Table3A. *Effect of Paclobutrazol on fruit set, fruit growth and yield of Mango Cvs. Dashehari, Langra, Causa and Fazri (1997-99)*

Treatment	Fruit set at mustard stage	Fruit set at pea stage	Mature Fruits/ pnicle	No. of fruits/ Tree	Fruit yield tree (kg)	Per fruit weight (gm)	Per fruit volume	Length of fruit (cm)	Width of fruit (cm)
Dashehari Control 0.5g PBZ m tree canopy diam.	47.60 56.12	13.15 15.41	3.79 5.16	375.75 577.75	98.37 136.38	245.45 200.65	241.25 195.00	10.31 10.00	6.80 6.70
Langra Control 0.5g PBZ/ m tree canopy diam.	21.11 21.78	13.92 17.11	3.23 4.14	273.75 405.25	73.49 107.62	270.25 265.57	261.12 235.16	9.43 9.00	7.40 4.29
Chausa Control 0.5g PBZ/ m tree canopy diam.	21.64 21.81	13.65 15.03	2.80 3.58	252.45 392.50	73.31 112.16	290.50 285.75	282.35 265.82	11.71 11.33	6.56 6.50
Fazri Control 0.5g PBZ/ m tree canopy diam.	39.76 47.10	10.10 12.11	1.95 2.28	212.50 390.00	91.50 166.32	430.75 426.50	422.50 426.50	12.42 12.10	7.90 7.75
CD at 5% Cultivar Treatment Interaction	0.72 0.51 1.02	0.64 0.45 NS	0.28 0.20 0.40	28.28 40.00 NS	10.94 7.73 15.47	2.98 2.10 NS	3.42 2.42 NS	0.22 0.16 NS	0.14 0.10 1.00

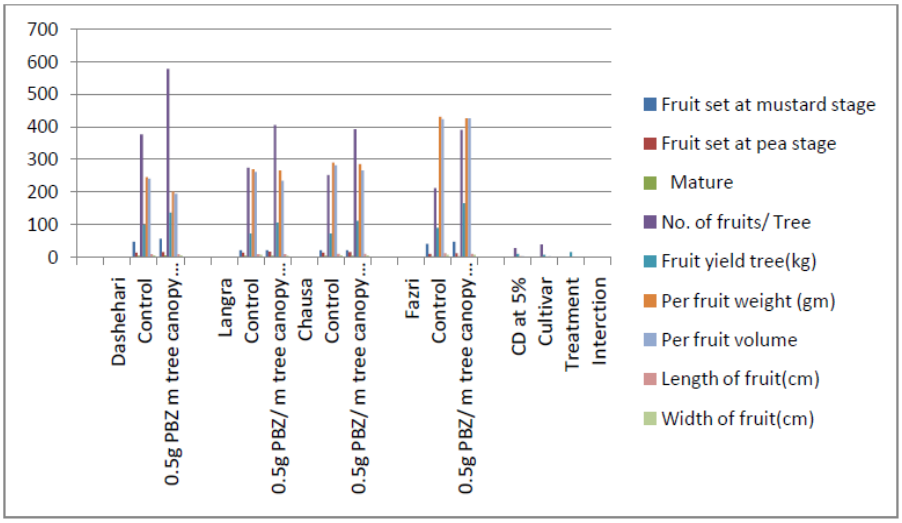

Fig3A. *Diagrametic reprensntation of effect of Paclobutrazol on fruit set, fruit growth and yield of Mango Cvs. Dashehari, Langra, Causa and Fazri (1997-99)*

RESULT AND DISCUSSION

Data in Table 1A to 3B show that Paclobutrazol application on 15 Sept. and 15 Oct in cvs. Dashahari, Langra, Chausa and Fazri @1.0g and 0.5g PBZ meter tree canopy diameter significantly decreased tree height, circumference, main stem diameter and canopy volume and show, that 15 Sept. treatment was highly Effective than the 15 Oct. in all the cultivars.

The effect of PBZ on growth, flowering and cropping in Sensation is shown in Tables 1 and 2. Number of fruit retained and tree yield were apparently not affected. Soil applied PBZ has also been reported to reduce the number of nodes or leaves on mango shoots (Kurian and Iyer, 1993a), as well as to suppress apical dominance (Kulkarni, 1988).

These findings are not supported by the present study. Furthermore, Werner (1993) found that lateral sprouting in mango was reduced by PBZ. In deciduous fruit trees, it is generally found that the reduction in shoot length caused by PBZ is more due to reduced internodes length than to a reduction in the number of nodes formed (Blanco, 1987; Blanco, 1988, Curry, 1988; Forshey, 1991).

PBZ has not formerly been found to affect an increase in fruit size in mango. An increase in fruit size in association with suppressed inflorescence development has been previously observed, however (Oosthuyse, 1993), and possibly relates to a lesser depletion of carbohydrate and other nutrient reserves by inflorescences whose development is suppressed (Monselise and Goldschmidt, 1982; Chauhan and Pandey, 1984).

The leaves on the new shoots of the treated Tommy Atkins trees were clustered. It might be considered that photosynthesis of the leaves on these shoots was reduced owing to mutual leaf shading. A decline in fruit retention resulting from diminished photo assimilate availability has been shown (Chacko et al., 1982).

In general cultivar response to Paclobutrazol was similar and interacting between paclobutrazol dozes and cultivars were not-significant except slight increase in main stem diameter, tree crown diameter and circumference of the tree. Effect of paclobutrazol on leaf, shoot and panicle characters of mango paclobutrazol treatments markedly influenced the terminal shoot length, number of leaves per terminal shoot, leaf area, panicle length, number of secondary branches per panicle and number of panicles per plant (Table 1 -2). Regardless of the concentrations used, paclobutrazol caused a marked reduction in terminal shoot length, leaf number per terminal shoot and leaf area as compared with the control and the reduction of above traits was noted the maximum when paclobutrazol was applied in soil drenched at 10000 ppm (1 g), which was closely followed by paclobutrazol at 5000 ppm (0.5 g). Plants received paclobutrazol at 5000 ppm produced the longest panicle, highest number of secondary branches per panicle and number of panicles per plant. There was significant variation due to time of application in respect of terminal shoot length and number of leaves as against no significant variation in leaf area,

panicle length, number of secondary branches per panicle and number of panicles per plant (Table 2).

Plants treated with paclobutrazol on 15 September demonstrated longer terminal shoot, higher number of leaves and panicles per plant as compared to those of 15 October. The highest suppression of vegetative growth was manifested when paclobutrazol was treated at 10000 ppm (1.0 g) on 15 October (Table 1-2). According to Kurian and Iyer (1992) paclobutrazol can enhance the total phenolic content of terminal buds and alter the phloem to xylem ratio of the stem, which is important in restricting the vegetative growth and enhancing flowering by altering assimilate partitioning and patterns of nutrient supply for new growth. Suppressed vegetative growth of 'Tommy Atkins' mango trees due to soil drench application of paclobutrazol at 5.50 and 8.25 g per tree are reported (Yeshitela et al., 2004). Soil drenches applications of Culture (Paclobutrazol) to mango CV.

Dashehari at Ludhiana prior to flower bud differentiation during the first week of October affected the vegetative growth and promoted flowering (Zora et al., 2000). According to Cardenas and Rojas (2003) paclobutrazol inhibited the vegetative growth and stimulated flower development. Length of panicle, number of secondary branches per panicle and number of panicles per plant were noticed to be higher when paclobutrazol was used at 5000 ppm on 15 October (Table 1-2). The soil-applied paclobutrazol treatments at 5000 ppm had an impact on reduction of vegetative growth, resulting in a higher intensity of flowering. Higher total non-structural carbohydrates (TNC) in the shoots of the paclobutrazol treated trees 2 weeks before flowering compared with the control have been reported by Yeshitela et al. (2004).

He also stated that the increased number of panicles for paclobutrazol treated plants was due to lower expenditure of tree reserves to the vegetative growth parameters and consequently no assimilates limitations, compared with an excessive vegetative growth on the control trees. It is also probable that the application of paclobutrazol caused an early reduction of endogenous gibberellins levels within the shoots as also observed by Anon. (1984), causing them to reach maturity earlier than those of untreated trees. Regular, profuse and early bearing was also reported to be found due to paclobutrazol application in mango cv. Banganapalli grown at Andaman and Nicobar Islands, India (Singh and Ranganath, 2006).

Data further show that as a result of paclobutrazol application, % of new shoot production, decreased along with their shoot length, internodal length and wide of leaves with slight increased diameter of shoot, number of leaves, short main diameter, tree crown diameter and circumference of tree. paclobutrazol was nonsignificant suggesting a higher doze (1.0g PBZ/m tree canopy diameter) was more effective for dwarfing of the all cultivars. Data further show that in response to different dozes of paclobutrazol treatments in cultivars Dashahari, Langra, Chausa and Fazri significant effect on flowering.

Data further shows that paclobutrazol treatment decreased length of panicles intermodal length, maximum panicles spread and panicles length with increase panicle thickness in different cultivar interaction between treatment and cultivar generally non significantThe combined effect of paclobutrazol and time of application on harvest time, number of fruits yield and fruit characters. The earlier harvest due to paclobutrazol of the current study is in line with the result of Xie et al. (1999), where spraying of paclobutrazol in late August/early September in the southwestern part of Hainan province had promoted flowering and ripening date by 1-3 months. The advancement of harvesting by 40-45 days in case of paclobutrazol application in mango cv. Banganapalli grown at Andaman and Nicobar Islands, India (Singh and Ranganath, 2006) provides support to the result of the present investigation. Paclobutrazol irrespective of concentrations exhibited earlier harvest than that of the control. Number of fruits per plant, fruit weight, edible portion, stone pulp ratio, peel pulp ratio, shelf-life and yield due to the concentration of paclobutrazol and the combined effect were noticed to be significant while time of application had significant effect only on number of fruits, shelf life and yield (Table 3A&B).

Irrespective of concentration, paclobutrazol increased the number of fruits per plant although the highest number of fresh fruits per plant was harvested from the plants soil drenching with paclobutrazol at 5000 ppm (0.5 g), whereas the control plants gave the lowest number of fruits. Applying paclobutrazol on 15 October noted

higher number of fruits per plant. The result revealed that October application of paclobutrazol exhibited superior performance in terms of fruit number over December application.

The highest number of fruits per plant was harvested from the plants combined treated with 5000 ppm paclobutrazol on 15 October compared to the lowest value in control. Plants treated with paclobutrazol at 5000 ppm also recorded the heaviest fruit, highest edible portion, lowest stone pulp and peel pulp ratio and highest shelf-life when compared with the control (water application).

Plants received paclobutrazol on 15 October produced higher shelf-life. Paclobutrazol at 5000 ppm applied on 15 October attained the heaviest fruit, highest edible portion, lowest stone pulp and peel pulp ratio and maximum shelf-life.

The highest yield (37.85 kg/plant) was noted in plants which received paclobutrazol at 5000 ppm as against the very low yield (6.34 kg/plant) in control. Plants treated with paclobutrazol on 15 October resulted in higher yield as compared to 15 September.

A significantly higher fruit set and fruit retention in the paclobutrazol treated plants had a favorable impact on culminating higher final fruit number and yield per plant. Paclobutrazol has been reported to exert influence on partitioning the photosynthesis to the sites of flowering and fruit production consequent to the reduction of vegetative growth. In this context, Kurian et al. (2001) reported that paclobutrazol appeared too favorable alter the source sink relationship of mango to support fruit growth with a reduction in vegetative growth. Plants treated with paclobutrazol at 7.5 g per plant of mango cv. Langra in Sabour, Bihar, India produced the highest.

EXPERIMENTAL

Data therefore, suggested that paclobutrazol decreases all parameter of vegetative growth compare than control. Data further suggested that higher doses of PBZ (1.0g/m tree canopy diameter) were more effective than lower dozes including control. Data again show that different response to the same dozes of PBZ in cultivars of different fruits species appear to be generally linked with the nature of growth but increased their spread.

Combined effect of paclobutrazol and time of application on qualitative characters of mango Paclobutrazol at 5000 ppm showed superior performances in respect of all above qualitative characters compared to those of control. Yeshitela et al. (2004) claimed that paclobutrazol improved fruit quality. Singh and Singh (2006) stated that soil treatment either at 5 or 10 g a.i. per tree with paclobutrazol improved the fruit quality.

CONCLUSION

Soil drench application of paclobutrazol at 5000 ppm or 10000 ppm on 15 October caused earlier panicle emergence by 19 days and harvesting by 15 days in mango cv. BARI Aam -3 (Amrapali) compared with control. Paclobutrazol at 5000 ppm on 15 October gave the highest yield, heaviest fruit and improved the fruit quality. In general Sept. application of paclobutrazol in soil is better than the 15 Oct.

Particularly is early maturing cultivars Dashahari. However, such effects were not observed in late maturing cultivars chausa and fazri. Data further suggest that it is slowly degraded in mango plant but rate of degradation is not faster than rate of absorption. Therefore, when PBZ was applied in first year 1.0g and 0.5g PBZ/m canopy diameter in second year

It should not be required in 1/4 dozes of in the third year to utilized residue present in soil and plant. In the present investigation PBZ treatment reduced tree height, tree crown, length of shoot, intermodal length in diameter tree circumference, tree volume commercial mango cultivars Dashahari, Langra, Chausa and fazri. PBZ treatment also controlled alternate bearing by inducing flowering and fruiting in these alternate bearing cultivars regularly two years.

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