

Effects of Paclobutrazol on fruit yield and physico-chemical characteristics of mango Cvs. Dashehari, Langra, Chausa and Fazri

Ashok Kumar¹, C.P. Singh², I.D.Bist³

¹Professor, Uttaranchal college of Agriculture Science, Uttaranchal University, Dehradun-248007, U.K. India.

^{2,3}Professor, Department of Horticulture, G.B.P.U.A&T- Pant Nagar, U.P., India.

Abstract— *Paclobutrazol is triazoles derivatives [(2 RS, 3RS)-1-(4-Chloropheny)-4, 4-dimethyl-2- (1, 2, 4 triazole-1-yl)] Pentane - 3 - ethanol. It is taken up of xylem and translocated acropetally to sub apical meristem. Paclobutrazol is metabolized in plant in 10-15 days but persists in soil generally for more than one year Pactbutrazol was applied on a basic trunk drench (1.0 g/m, 0.5 g/m tree canopy diameter) in 21-22 year old mango tree Paclobutrazol treatment induced early ripening, reduced fruit sized when applied continuously for more than one year. However that quality was better in terms of higher TSS, total sugar, and β -carotene and Ascorbic aid.*

Keywords— *Paclobutrazol (PBZ), Auxins (IAA), Gibbrellins, Cytokinins and Plant growth regulator.*

I. INTRODUCTION

Mango (*Mangifera Indica L.*) is the most important fruit crop of India. The production scenario of different fruits in India indicates that all the fruits occupied 6,480 thousand ha area with 92,846 thousand MT production and 14.3 MT/ha productivity during 2016-17. The total allocation to the fruits in the country has been increased from 6,235 to 6,480 thousand ha over the previous year, while the total production of fruits has also been increased from 89,512 to 92,846 thousand MT. The area and production of mango has been almost continuously increases over the years. The area under mango cultivation was 1077.6 thousand ha during 1991-92 which reaches up to 2516 thousand ha in 2013-14 and recorded 2262.8 thousand ha in 2016-17. However, the production has been fluctuating drastically. During 1991-92, the total production was 8,715.6 thousand MT which was increased up to 13,997 thousand MT in 2007-08. During 2008-09 the production was declined from 13997 thousand MT to 12,750 thousand MT. From 2009-10 there is continuous increase in the mango production (15,026.7 thousand MT) to 2016-17 (19,686.9 thousand MT). A total 109.99 % increase in area under mango cultivation has been recorded from 1991-92 to 2014-15 while, 125.88 % increase in production was recorded during the same period. However, productivity has been fluctuating drastically from 1991-92 to 2014-15. The productivity of 8.1 MT/ha was recorded during 1991-12 whereas, it was declined up to 5.5 MT/ha in 2008-09 and again increased up to 8.5 MT/ha in 2014-15 and reached up to maximum productivity of 8.7 MT/ha in 2016-17. There was overall increase of 7.41 % in productivity of mango from 1991-92 to 2014-15. In 2017, global mango production amounted to about 50.65 million metric tons. In India it is grown on an area of 2.516 million hectares with annual production of 18.431 million tonne having productivity of 7.3 metric tonne per hectare Anonymous (2017).

Although, alternate bearing is a major problems in mango production and its means "a condition at which high or optimum fruit production in on year or higher and certain year bear little or no fruit (off year), but growth regulators such as cultar reported to be effective on inducing flowering mango off year (Sinde et al.,2000). Paclobutrazol increased photosynthesis activity in apple (16%) (Kirn et al., 1990: Steffens, et al., 1990). Pecan (7.54%) (Wood 1984: Deyton, et al., 1991). Citrus (Deng et al, 1990). It also increased chlorophyll content in apple (Steffens, et al, 1983, 1984; Steffens and Wang, 1984,

Wang et al, 1985, San Wavini et al, 1986; Kwon and Lee, 1986; Kim et al, 1990; Hao, et al, 1991, Pear (Bonomo and Neri, 1986), Peach (Coston, 1986; Choi et al, 1988), Strawberry (Archibold and Houtz, 1988), Grape (Shaltout et al., 1988), Banana (El-Qtmani et al, 1992) and Citrus (Deng et al., 1990). Paclobutrazol did not affect Sugar, pH, Colors or Glucose, Fructose ratio in Grape (Zoeckleni et al., 1991), Amino Cyclopropane, Carboxylic Acid, Ethylene, Respiration Sorbitol, Fructose, Glucose, Sucrose and Malic Acid in Apple (Wang and Steffen's, 1987). Paclobutrazol reduced sugar concentration in Apple (Green and Murray, 1983; Greene, 1986; Byun and Chang. 1986; Luo et al, 1989; El fving et al., 1990; El-Khoreiby et al 1989; Forlanin and Cappola, 1992), Persimmon (Lee and Kim, 1991), TSS in Cherry (Looney and Mc Killar, 1987), acidity in Apricot (Mehta et al., 1990), and grape (Shaltout et al, 1988; Zoecklein et al. 1991, Reynold et al, 1992).

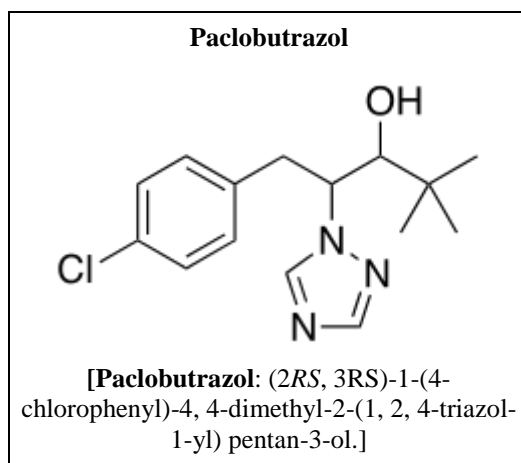


FIGURE 1: TOXICITY

TABLE 1

EFFECTS PACLOBUTRAZOL TREATMENT POST HARVEST LIFE OF MANGO CVS. DASHERI, LANGRA, CHAUSA AND FAZRI (1998-99)

Treatment	TSS (%)	Acidity (%)	Total Sugar (%)	Reducing Sugar (%)	Non reducing Sugar (%)	βcarotene	Ascorbic acid (mg)
Dashehari Control 1.0g PBZ m tree canopy diam.	23.40 23.73	0.22 0.20	15.33 15.39	3.89 3.90	11.46 11.51	1.42 1.14	36.79 37.16
Langra Control 1.0g PBZ m tree canopy diam.	21.07 21.83	0.18 0.17	17.35 17.39	5.82 5.85	11.54 11.56	1.38 1.39	132.34 132.43
Chausa Control 1.0g PBZ m tree canopy diam.	21.66 21.71	0.26 0.25	17.47 17.51	5.34 5.36	12.14 13.23	1.12 1.13	38.86 39.35
Fazri Control 1.0g PBZ m tree canopy diam.	17.57 17.81	0.31 0.29	13.64 13.69	5.66 5.67	7.98 8.05	1.15 1.16	12.91 13.21
CD at 5% Cultivar Treatment Interction	0.20 0.14 0.28	0.84 0.59 NS	0.19 0.13 NS	0.12 0.86 NS	0.40 0.28 NS	0.76 0.54 NS	0.51 0.36 0.72

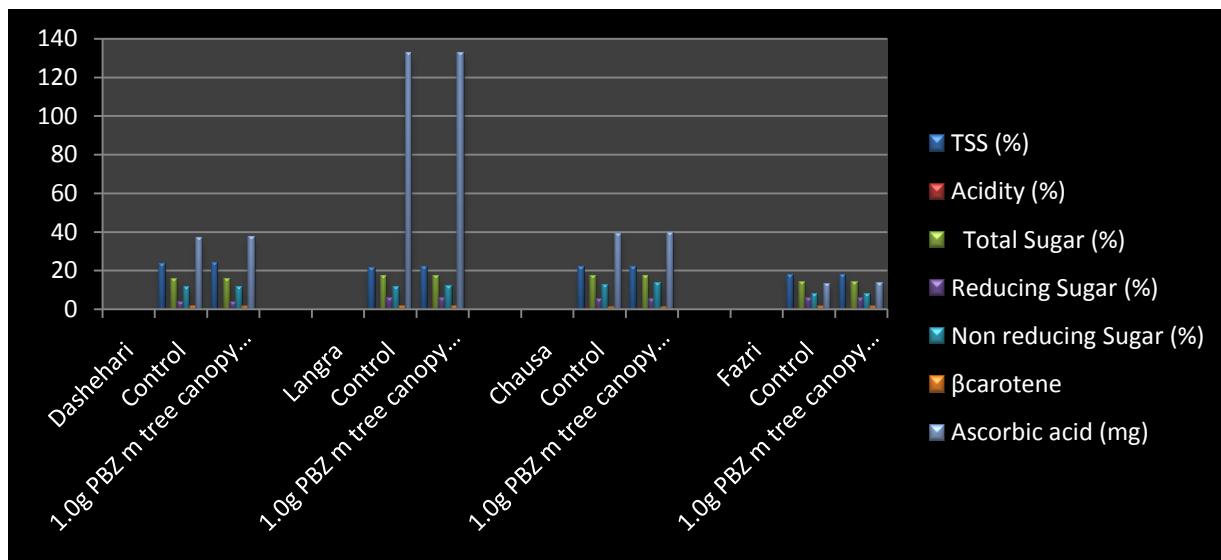


FIGURE 2: Effects Paclobutrazol treatment on Post Harvest life of Mango cvs. Dashehari, Langra, Chausa and Fazli. (1997-98).

**TABLE 3
PACLOBUTRAZOL TREATMENT ON POST HARVEST LIFE OF MANGO CVS. DASHERI, LANGRA, CHAUSA AND FAZRI (1998-99)**

Treatment	TSS (%)	Acidity (%)	Total Sugar (%)	Reducing Sugar (%)	Non reducing Sugar (%)	βcarotene	Ascorbic acid (mg)
Dashehari Control 0.5g PBZ/ m tree canopy diam.	23.31 23.65	0.23 0.20	15.35 15.42	3.88 3.88	11.44 11.48	1.13 1.14	37.75 37.12
Langra Control 0.5g PBZ/ m tree canopy diam.	21.11 21.78	0.18 0.17	17.37 17.41	5.81 5.83	11.54 11.54	1.37 1.38	132.32 132.37
Chausa Control 0.5g PBZ/ m tree canopy diam.	21.64 21.81	0.26 0.25	17.48 17.54	5.33 5.36	12.13 13.15	1.11 1.13	38.97 39.33
Fazri Control 0.5g PBZ/ m tree canopy diam.	17.54 17.75	0.31 0.29	13.64 13.73	5.67 5.65	8.46 8.04	1.14 1.16	22.89 13.17
CD at 5% Cultivar Treatment Interction	0.60 0.43 0.86	0.84 0.59 NS	0.11 0.79 NS	0.43 0.30 0.61	0.37 0.26 NS	0.56 0.40 NS	0.44 0.31 0.63

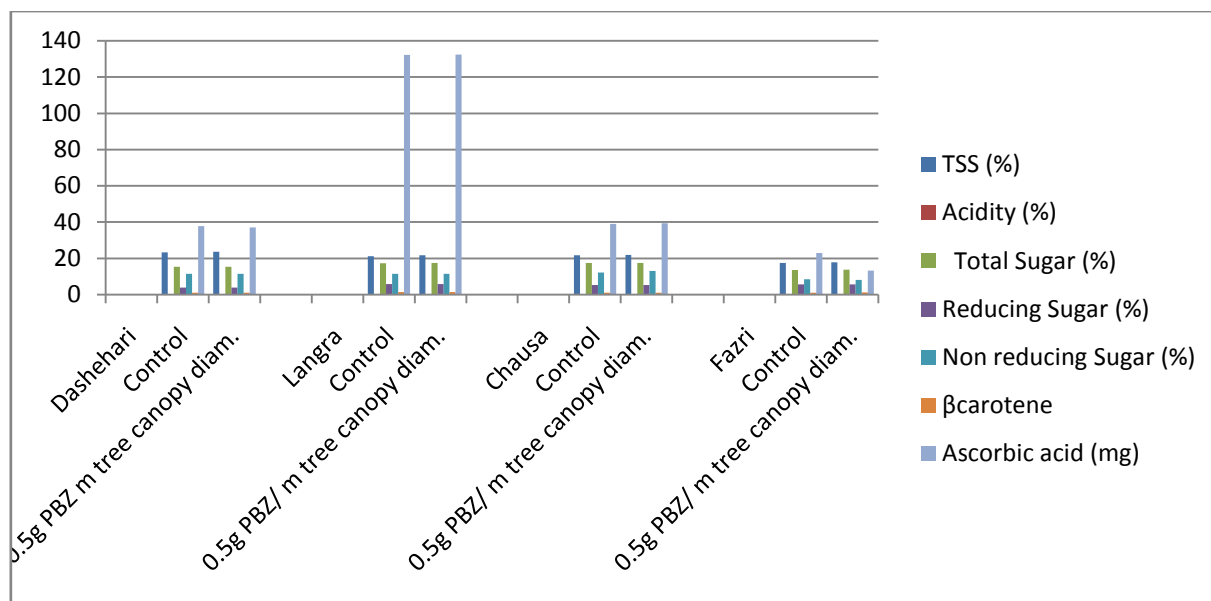


FIGURE 3: Effects Paclobutrazol treatment on Post Harvest life of Mango cvs. Dasherri, Langra, Chausa and Fazri (1998-99)

The acute oral LD50 of rats was 2000mg/kg (male), 1300mg/kg (female); for mice oral: 490mg/kg (male), 1,200mg/kg (female); for rabbit, the acute oral LD50: 840 mg/kg (male), 940 mg/kg (female). Rat and rabbit: acute percutaneous LD50> 1000mg/kg. For rat, acute inhalation has a LC50: 4.79mg/L (male) (4h), 3.13mg/L (female) (4h). It has certain irritant effect on the skin and eyes of the rat and rabbit. The no-action dosage for feeding rats of 2 years is 250 mg/kg; the no-action dosage for feeding dog of 1 year is 75 mg/kg; No mutagenicity effect. For rainbow trout, LC50:27.8mg/L (96h), carp LC50:23.5mg/L (48h), and Daphnia LC50> 7900mg/L. Low toxicity to bees, LD50> 0.002mg/only.

II. MATERIAL AND METHODS

The uniform size fruits were harvested along with 5 cm stalk length with help of hand Scatters. Harvested fruits were washed and kept in Corrugated Fiber Board (CFB) boxes in single layer, under ambient temperature (30-33 C) for shelf life study.

2.1 Physio Chemical Analysis

The observation on various physio-chemical characters were recorded from 22 June and 22 July, harvested fruits were recorded at 10 days of storages in all replications according to the experiments. The physio-chemical parameters viz. TSS (Total Soluble Solids) was determined with the help of hand refractometer. Fruit Acidity was estimated by titrating pulp extract with 0.1N NaOH using phenolphthalein indicator Total sugar, β-carotene was determined according to method suggested by Raganna (1992).

2.2 Statically Design

The observation recorded were subjected to statically analysis by using Completely Randomized Design for lab experiments valid conclusions were drawn only on significant differences between the treatment mean at 5 % level of Probability (Conchran and Cox, 1959) In order to compare treatment means, critical difference were calculated

III. RESULT AND DISCUSSION

The fruits were kept in corrugated Fiber Board (CFB) boxes in single layer under ambient temperature (30-33°C). The time taken for ripening of fruits in cultivars Dashehari, Langra, Chausa and Fazri were 1-2 days earlier in both the consecutive years. However, lowest doses of Paclobutrazol 0.5 g/m canopy diameter was ineffective on early ripening, similar was the dots, oblong to oblong oblique with base rounded to oblique round medium sized, skin smooth, medium thick, though and non adhering. The flesh is yellow, firm with almost no fibber, scanty juice and delightful aroma, very sweet test of excellent quality. Table 1A,1B shown that Paclobutrazol treated Dashehan Mango is slightly increase TSS (23.40%), acidity (0.22%), total sugar (15.33%), reducing sugar (3.89%) non-reducing sugar (11.46%), β-carotene (1.42%) and ascorbic acid (36.79mg) However, this treatment is better in higher doses of Paclobutrazol (1.0 g/meter canopy diameter) compare to lower doses (0.5 g/meter canopy diameter).

The fruit of Langra Mango is greenish yellow with medium is big dark green dots ovals-oblong, 8-10.5 cm long by 6.5-7.5 cm broad by 6-7 cm thick, weighting 235-735 g. The skin is medium smooth thick. The flesh firm to soft, fibreless, lemon yellow, very sweet with strong pleasant aroma, juice moderately abundant, mono embryonic seed is medium sized, flattened stone covered with dense, soft and short fibber, quality is very good, early to mid season varieties.

Therefore, the fruits taken time for ripening in general 8-10 days higher doses of PBZ (1.0 g/meter canopy diameter) were effective on early ripening. Langra Mango, 2-3 days early ripe with slightly significant effect on TSS, acidity, totals sugar, reducing and non-reducing sugar percent. Data 1A, 1B is shown that higher doses of PBZ (1.0 g/meter canopy diameter) is slightly increased TSS (21.07%), acidity (0.18%), total sugar (17.35%), reducing sugar (5.82%), non-reducing sugar (21.83%), β -Carotene (1.38%), total sugar (17.39%) reducing (5.85%), non-reducing (11.56%), β -Carotene (1.39), ascorbic acid (132.43 mg) as well as lower doses (0.5 g/m canopy diameter).

Chausa is late maturing cultivars of Mango. The fruit is canary yellow raw sienna when fully ripe with numerous obscure medium sized dotes with minute specks inside them, oblong with prominent beak, obtuse to rounded medium sized. The skin is thin and same what adhering pulp raw sienna soft and fucy with canty fine long fibber near the skin. The fruit is very sweet with luscious, delightful aroma of excellent quality. Seed mono embryonic in a thick, medium sized oblong stone with fine, short fibbers all over the surface and a tuft of long fibbers on the ventral edge and a light bearer.

The fruits of Chausa are harvest on 24th July was kept at ambient temperature (30-33°C) for ripening and data on their weight, TSS, acidity, total sugars, β -Carotene and change of peal and pulp color during ripening. Data's further show that Chausa fruit take 6-8 days to ripen when harvested on 24th July. Data on fruit quality in table 1A, 1B show that Paclobutrazol forces the fruit to ripen early (1-2 days) without any significant on percent fruit weight loss, stone ratio, width of fruit and stone. Data again shows that Paclobutrazol reduced fruit weight, fruit volume, and width of fruit and length of fruit. The various cultivars responded effectively to reduction of fruit size and stone.

Data further shows that higher doses of PBZ (1.0 g/meter canopy diameter) were more effective than lower doses of PBZ (0.5 g/meter canopy diameter) and slightly increased fruit quality in terms of TSS, Acidity percent, reducing and non-reducing sugar, β -Carotene content and ascorbic acid. The fruit of Fazri is light chrome yellow with small, dark colored fairly sparse dots. Oblique oval with base slightly rounded and beak distinct to slightly prominent, large. average 14.3 cm long by 9.8 cm board, weighting 500 g. on average with a medium thick skin average with a medium thick skin that is smooth with some inclination to be warty and firm to soft fibreless flesh of a light cadmium yellow with a pleasant aroma and a sweet taste, having juice that may be scanty to moderately abundant seed mono embryonic in large oblong stone that is covered with sparse short and soft fibber, mid to late varieties.

Fazri took 11.5 days for ripening at ambient temperature. Data 1A, 1B show that Paclobutrazol. Higher doses of 1.0 g/m tree canopy diameter treatments had slightly increase acidity percent; total sugar percent and ascorbic acid than control (expect TSS, reducing and non-reducing sugar percent and β -carotene). The interaction between Paclobutrazol and cultivars were non-significant except TSS percent, fruit quality was differed in different cultivars without any interaction effect between PBZ and cultivars. Data 1A, 1B on fruit quality show that Paclobutrazol forces the fruit to ripen early 1-2 days.

Paclobutrazol treatment induced early ripening, reduced fruit size, when applied continuously for more than one year. However, fruit quality was better in terms of higher TSS, Ascorbic Acid, β -carotene and total sugar. The fruit produced by PBZ treatment were settler in terms of TSS, acidity and ascorbic acid reducing and non-reducing sugar and β - carotene. However, fruits were slightly smaller than those of untreated control. In general, post bloom application of Paclobutrazol in soil is better than the pre bloom Paclobutrazol in early maturing Cvs. Dashehari. However, such effects were not observed in medium and late maturing Cvs. Langra, Chausa and Fazr.

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