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REGULATION OF SHOOT GROWTH AND FLOWERING IN MANGO CV. *GULAB KHAS* BY PACLOBUTRAZOL

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ABSTRACT

Paclobutrozol (cultar) was used to induce flowering in mango cv. Gulab Khas during off year. It was applied in both on and off years. Effects were more pronounced in off year than on year. It was found that soil application of paclobutrazol @ 5 g a.i. per tree was most effective to induce more number of flowering shoots and improved the fruit set and fruit retention during the off year (1996 and 1999). Highest yield during off year was recorded under soil application of paclobutrazol @ 5gm a.i. per tree followed by 10 g a. i. per tree being 70.50 and 68.70 kg per tree, respectively. Soil treatment with paclobutrazol also improved the fruit quality attributes.

Key words : Paclobutrozol (cultar), shoot growth, panicles, fruit set, fruit retention and fruit yield.

Mango (*Mangifera indica* L.) is the most important fruit of India and it contributes about 62.2% of total mango production of the world, however, our productivity (8.9 t/ha.) is very low in spite of great potential (Desai and Chundawat, 1994). There are number of reasons for this dismal performance of which alternate bearing is most important. Gulab Khas is an early commercial cultivar of mango in Bihar but it suffers from alternate bearing habit like several other cultivars (Ram and Sirohi, 1989, Ram and Tripathi, 1993, Desai and Chundawat 1994, Singh and Singh, 2003). A number of attempts have been made to understand and solve this problem from various angles. The critical review reveals that flowering in mango is on terminals and therefore, after harvest the plant should put up new vegetative growth, which must physiologically mature before the flower bud differentiation. To achieve this, influence of gibberellins in growing shoots will have to be checked for flowering in following seasons (Pandey, 1989, Chadha and Pal, 1993). Cultar (Paclobutrazol), a gibberellin biosynthesis inhibitor, has been demonstrated to induce flowering in a number of fruit crops and in general, important fruit crops and in general, soil application is more effective (Desai and Chundawat, 1994 and Jain and Bist, 1997). Soil application of paclobutrozol (cultar) during on and off year was found effective to induce flowering but effects were more pronounced during off year (Desai and Chundawat, 1994). Therefore, to overcome the problem of alternate bearing in mango cv. Gulab Khas, present investigation was carried out to determine the optimum concentration of paclobutrozol for desired effects on flowering, fruiting and fruit quality attributes under Sabour (Bihar) conditions.

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MATERIALS AND METHODS

The investigation was carried out in the experimental orchard of Department of Horticulture, B.A.C., Sabour during 1996-1999. The experimental materials consisted of 12-year old grafted trees of cultivar Gulab Khas having uniform size and vigour spaced at 10 x 10 m. apart. There were seven treatments, T1 - cultar 500 ppm spray, T2-cultar 1000 ppm spray, T3-cultar 2000 ppm spray, T4 - cultar 5 g a.i. per tree by trunk soil line pour method. T5-cultar 10 g a.i. per tree by trunk soil line pour method, T6- control (water spray), T7-control (water trunk soil line pour method). These treatments

Table 1. Effect of paclobutrozol on flowering and fruiting of *Gulab Khas* mango

Treatments	1996 (on year)						1997 (off year)					
	Length of terminal shoots (cm)	Flowering shoots (%)	Length of panicles (cm)	Fruit set (%)	Fruit retention (%)	Fruit yield /plant (kg)	Length of terminal shoot (cm)	Flowering of shoot (%)	Length of panicles (cm)	Fruit set (%)	Fruit retention (%)	Fruit yield / plant (kg.)
T1	11.12	53.39	25.45	49.19	5.47	130.59	11.21	24.37	22.17	29.37	3.79	50.63
T2	9.89	51.49	27.19	51.19	5.31	140.49	9.97	23.34	19.24	47.47	3.91	65.34
T3	9.83	59.79	27.19	51.12	5.27	144.33	9.95	25.40	19.10	37.39	4.12	64.90
T4	9.62	61.11	28.49	52.49	5.93	146.40	9.72	39.18	18.84	49.38	4.45	70.50
T5	9.68	63.17	29.89	53.11	4.91	150.90	9.77	36.57	19.29	47.30	4.65	68.70
T6	12.29	40.41	23.97	36.14	2.81	125.18	12.49	21.67	27.18	31.45	1.96	20.34
T7	12.01	39.19	24.16	38.44	2.03	118.00	12.16	22.14	28.63	29.37	1.92	22.59
C.D. (P=0.05)	0.51	3.98	3.70	2.41	0.62	9.33	1.42	2.39	1.79	5.60	0.29	3.70

Table 2. Effect of paclobutrozol on flowering and fruiting of Gulab Khas mango

Treatments	1998 (on year)						1999 (off year)					
	Length of terminal shoots (cm)	Flowering shoots (%)	Length of panicles (cm)	Fruit set (%)	Fruit retention (%)	Fruit yield /plant (kg)	Length of terminal shoot (cm)	Flowering of shoot (%)	Length of panicles (cm)	Fruit set (%)	Fruit retention (%)	Fruit yield / plant (kg.)
T1	11.40	54.39	24.45	50.19	5.57	140.59	11.29	25.37	21.17	28.37	3.87	55.63
T2	10.20	52.49	26.19	52.19	5.37	148.49	9.99	25.34	18.24	46.47	3.98	71.34
T3	10.10	60.79	26.19	52.12	5.35	152.33	9.98	27.40	18.10	35.39	4.23	70.90
T4	9.85	62.11	27.49	53.49	5.99	155.40	9.78	40.18	17.84	47.38	4.55	78.00
T5	9.89	64.17	28.89	54.11	4.97	158.90	9.82	37.57	18.29	45.30	4.74	74.17
T6	12.50	42.41	22.97	38.14	2.88	129.18	12.54	23.67	26.18	30.45	1.98	25.34
T7	12.20	40.19	23.16	40.44	2.11	124.00	12.27	24.14	27.63	27.37	1.97	24.59
C.D. (P=0.05)	0.51	3.98	3.70	2.41	0.62	9.33	1.42	2.39	1.79	5.60	0.29	3.70

Table 3. Effect of paclobutrozol on fruit quality attributes of *Gulab Khas* mango

Treatments	1996 (on year)					1997 (off year)				
	TSS (%)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100g)	TSS (%)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100g)
T1	20.90	0.38	4.98	17.80	72.10	20.83	0.36	4.61	17.69	76.11
T2	21.10	0.36	5.03	17.99	77.11	20.88	0.35	4.69	17.89	78.24
T3	21.20	0.36	5.13	18.20	79.00	21.00	0.35	4.73	17.93	80.14
T4	21.60	0.35	5.31	18.35	79.90	21.30	0.34	4.98	18.06	86.18
T5	21.80	0.34	5.51	18.41	82.00	21.75	0.38	5.13	18.34	89.45
T6	21.34	0.37	4.50	17.50	67.00	20.50	0.36	4.36	17.34	66.00
T7	20.50	0.34	4.71	17.61	68.13	20.56	0.35	4.41	17.43	69.00
C.D. (P=0.05)	0.52	NS	0.08	0.21	2.41	0.40	NS	0.09	0.28	2.41

Table 4. Effect of paclobutrozol on fruit quality attributes of *Gulab Khas* mango

Treatments	1998 (on year)					1999 (off year)				
	TSS (%)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100g)	TSS (%)	Acidity (%)	Reducing sugar (%)	Total sugar (%)	Ascorbic acid (mg/100g)
T1	20.81	0.37	4.96	17.83	73.11	20.84	0.36	4.62	17.70	77.00
T2	21.11	0.36	5.04	17.98	78.00	20.90	0.36	4.70	17.90	78.90
T3	21.22	0.36	5.14	18.22	79.13	21.10	0.38	4.75	17.96	81.00
T4	21.63	0.35	5.34	18.39	79.93	21.40	0.37	4.99	18.16	87.20
T5	21.84	0.38	5.54	18.44	82.12	21.78	0.34	5.16	18.40	90.00
T6	20.38	0.34	4.53	17.55	67.59	20.52	0.38	4.38	17.41	67.11
T7	20.54	0.39	4.72	17.64	69.00	20.59	0.38	4.45	17.53	70.12
C.D. (P=0.05)	0.42	NS	0.06	0.21	2.33	0.45	NS	0.05	0.26	2.33

replicated thrice in randomized block design. After cessation of rains periodical irrigations were given. Soil and foliar spray of cultar was done in the month of September. The effect of treatments was observed on flowering, fruiting and fruit quality attributes by adopting standard procedures. The total soluble solids, acidity, total sugar and vitamin C content were estimated by the method advocated by A.O.A.C. (1977). The tree received uniform recommended does of nutrition and plant protection measures during the experimentation.

Results and Discussion

Application of cultar tended to reduce the length of terminal shoots and effect was more pronounced during of years 1997 and 1999. Minimum length of terminal shoot i.e. 9.62 cm was recorded in soil application of cultar @ 5 g a.i. per plant which was closely followed by soil gibberellin biosynthesis for which cultar is known (Desai and Chundawat, 1994). There is considerable evidence to show that cultar reduces vegetative growth and stem elongation in many fruit trees by interrupting gibberellic acid sysnthesis (Burondkar and Gunjate, 1991). Cultar has resulted in early physiological maturity of vegetative growth causing higher flower bud initiation. Consequently in the present investigation, cultar treatment induced profuse flowering, which contributed higher production over control (Tables 1 & 2). Highest flowering shoots were recorded under soil application of cultar @ 5 g a.i. per tree while minimum was found under control during off year. Cultar treatment showed significant effect on length of panicles. Average panicle length was reduced with the effect of both soil and spray treatments of cultar during off year. However, minimum length (18.84cm) was recorded under soil application of cultar @ 5 g a.i. per tree. Reduction in panicle length in cultar treated plants might be due to more number of panicles per tree. In the contrary, Ram and Tripathi, 1993, reported that cultar had no significant effect on panicle length and sex ratio in mango cv. Dashehari under Pantnagar conditions. During the off year (1997) fruit set was also improved by cultar treatment. Similarly fruit retention and yield was improved due to cultar treatments. The tree treated with cultar as soil application @ of 5 g a.i. per tree produced maximum fruit yield (70.5/kg plant) followed by soil application of cultivar @ 10 g a.i./tree (68.70 kg) during the off year 1997. Spray treatments of cultar were less effective than soil application. Control (water spray) recorded the minimum fruit yield i.e. 20.34 kg./plant during off year (1997). Similar pattern was also followed during two successive years (1998 and 1999) in all the treatments with regard to flowering and fruiting attributes. Cultar has been found to be a potent inhibitor of gibberellin bio-synthesis (Hedden and Graebe, 1985). Increase in yield with soil application of cultar may have been due to its effect on shifting of assimilates, chlorophyll, mineral elements and soluble proteins in leaves, stem and roots (Wang *et al.* 1985). The effect of cultar on suppression of growth and increase in fruiting and yield without loss of fruit quality has been reported in mango by other workers also (Burondkar and Gunjate, 1993, Hiller, 1993, Tangumpai *et al.* 1991, Ram and Tripathi, 1993, Desai and Chundawat, 1994) as well as in other fruit crops (Arun *et al.* 1983, Copas *et al.* 1985, Jain and Bist 1987.

The effect of cultar treatment given for regulating bearing was also observed on the quality of fruits in terms of total soluble solids, total sugar, reducing sugar and ascorbic acid during the experimentation (1996 - 1999). However, there was no effect of cultar on acidity of cultar on acidity of fruits. Soil application of cultar @ 5 & 10 g a.i. per tree was found most effective to improve fruit quality attributes. Fruit quality may have improved due to diversion of photosynthates towards the fruits (Rai and Bist, 1992 and Singh and Singh, 2003) in cultar treated trees. Similar result were obtained by Ram and Tripathi, 1993 and Desai and Chundawat, 1994 in mango. Some of the obvious effects of cultar during off year have been that it reduced the length of terminal shoots, produced more number of flowering shoot, helped in better fruits retention and increased the fruit yield and

suppressed the tendency of alternate bearing in mango with no adverse effect on fruit quality attributes of Gulab Khas mango during on year too.

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