

Effect of growth retardant on flowering and fruiting characteristics of Jackfruit (*Artocarpus heterophyllus*)

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ABSTRACT: An experiment was conducted during the year 2010-11 and 2011-12 to study effect of growth retardant on flowering and fruiting characteristics of Jackfruit (*Artocarpus heterophyllus*). The experiment was conducted on eleven years old jackfruit trees cv. Pant Garima by using variable concentrations of paclobutrazol. Paclobutrazol was applied as soil drench @ 5, 10, 15, 20 and 25 ml with 5 litre of water in each treatment/tree and as foliar spray @ 2.5, 5, 7.5, 10 and 12.5 ml with 5 litre of water in each treatment/tree in the month of September. Findings revealed that increased flowering with more number of male and female flowers as well as fruit set were recorded with treatment T₃ (soil drench @ 15 ml paclobutrazol/tree. Maximum fruit yield per tree was also recorded in treatment T₃ (soil drench @ 15 ml/tree). In general it was observed that paclobutrazol @ 15 ml/tree applied by soil drench method on jackfruit was proved beneficial to obtain promising results in respect of yield and quality.

Key words: Growth retardant, Jackfruit, paclobutrazol, reproductive growth, vegetative growth

The jackfruit, *Artocarpus heterophyllus*, is a member of the family Moraceae. It was previously known as *Artocarpus integrifolia*. The jackfruit is a native to India and is now widely cultivated throughout the tropical region (Haq, 2006). The jackfruit is another fruit of great importance in India which is not generally cultivated in regular plantations. It is also popular, remunerative and commercially important fruit of eastern and southern India (Das and Das, 2003). All higher plants are unable to initiate reproductive development immediately after germination and have to undergo a process of shoot maturation or juvenile development phase. The development of flower spike and a sufficient fruit set are basic requirements for fruit growers to generate a marketable crop. However fruit trees remain in a juvenile phase (non flowering) for many years, and after a transition stage they enter the adult phase of tree life (Hanke *et al.*, 2007). Length of juvenile period in jackfruit is also a big problem. Seedling plant of Jack fruit gives fruits after 12 to 15 years while vegetatively propagated plants starts fruiting 2-3 years earlier than seedling plants (Haq, 2006). Some chemicals or growth retardants like paclobutrazol reduce the juvenile phase of some fruit crops. The paclobutrazol reduces vegetative growth and stem elongation in many fruit trees by interrupting gibberellic acid synthesis at kaurene biosynthesis stage. Usually it is applied to the soil due to its low solubility in water and mobility, but poses a long

residual effect (Sarkar *et al.*, 1998). The objective of this experiment was to study the effect of paclobutrazol on flower initiation and fruiting in Jackfruit.

MATERIALS AND METHODS

The present investigation was carried out during the year 2010-11 and 2011-12 at Horticulture Research Center, Patharchatta, Department of Horticulture, G.B.P.U.A.T., Pantnagar, Distt. Udham Singh Nagar, Uttarakhand. The experiment was conducted on eleven years old jackfruit trees cv. Pant Garima by using growth retardant i.e. Paclobutrazol. The experiment was laid out in Randomized Block Design having 11 treatments with 4 replications. Paclobutrazol was applied as soil drench @ 5, 10, 15, 20 and 25 ml with 5 litre of water in each treatment/tree and as foliar spray @ 2.5, 5, 7.5, 10 and 12.5 ml with 5 litre of water in each treatment/tree in the month of September. Observations on reproductive parameter were taken during January, February, March, April and at the time of harvesting. Numbers of male and female flowers were counted on each tree by visual counting. Number of fruit set/plant was counted in each plant at the time of harvesting. The per cent fruit set was calculated on the basis of total number of flowers. Per cent fruit retention was determined by counting the number of fruits at harvest time / initial number of fruit set X 100. Ratio of pulp and peel was calculated by dividing average pulp weight by average peel weight. The Total

soluble solids of fruits were measured with the help of hand refractometer and it was expressed in degree brix ($^{\circ}$ B) and mean values were presented.

RESULTS AND DISCUSSION

The data pertaining to the flowering and fruiting parameters are presented in Table 1 and 2, respectively.

Number of both male and female flowers were significantly increase by paclobutrazol treatments and maximum number of total flower as well as male and female flowers were recorded with treatment T₃ (soil drenching of 15 ml paclobutrazol/tree) while, minimum number of male and female flowers recorded with control (T₁₁) during both the years. In the present study

Table1: Response of different concentrations and application methods of paclobutrazol on flowering of Jackfruit

Treatment	Number of female flowers		Number of male flowers		Total number of flowers	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
T ₁ : Soil Drenching of 5 ml paclobutrazol /tree	5.75	16.25	82.50	658.75	88.25	675.00
T ₂ : Soil Drenching of 10 ml paclobutrazol/tree	10.50	19.75	157.00	934.50	167.50	954.25
T ₃ : Soil Drenching of 15 ml paclobutrazol/tree	13.50	21.50	280.75	1072.50	294.25	1094.00
T ₄ : Soil Drenching of 20 ml paclobutrazol/tr	7.25	11.75	246.25	637.00	253.50	648.75
T ₅ : Soil Drenching of 25 ml paclobutrazol/tree	7.25	17.00	209.00	885.00	216.25	902.00
T ₆ : Foliar Application of 2.5 ml paclobutrazol/tree	4.00	8.00	46.00	297.25	50.00	305.25
T ₇ : Foliar Application of 5 ml paclobutrazol/tree	4.50	13.75	50.75	437.00	55.25	450.75
T ₈ : Foliar Application of 7.5 ml paclobutrazol/tree	4.00	6.00	57.75	421.75	61.75	427.75
T ₉ : Foliar Application of 10 ml paclobutrazol/tree	5.00	13.50	59.25	628.25	64.25	641.75
T ₁₀ : Foliar Application of 12.5 ml paclobutrazol/tree	5.00	10.00	102.00	542.00	107.00	552.00
T ₁₁ : Control (water spray)	4.50	6.75	41.25	220.25	45.75	227.00
C.D. at 5%	2.23	1.65	19.27	52.13	19.73	52.78

Table 2: Response of different concentrations and application methods of paclobutrazol on fruiting of Jackfruit

Treatment	Number of fruit set		Per cent fruit set		Per cent fruit retention		Yield per tree (Kg)	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
T ₁ : Soil Drenching of 5 ml paclobutrazol /tree	2.25	7.75	2.69	1.25	56.67	54.01	5.22	34.25
T ₂ : Soil Drenching of 10 ml paclobutrazol/tree	5.50	8.75	2.02	0.92	52.62	53.64	6.95	34.75
T ₃ : Soil Drenching of 15 ml paclobutrazol/tree	7.25	9.50	2.28	0.88	63.33	54.79	10.67	41.27
T ₄ : Soil Drenching of 20 ml paclobutrazol/tr	2.75	5.25	2.16	0.77	64.58	50.68	6.60	27.27
T ₅ : Soil Drenching of 25 ml paclobutrazol/tree	3.50	8.00	1.57	0.91	61.82	49.40	5.22	31.12
T ₆ : Foliar Application of 2.5 ml paclobutrazol/tree	1.00	2.75	2.04	0.86	45.83	42.36	3.15	10.87
T ₇ : Foliar Application of 5 ml paclobutrazol/tree	1.00	5.50	1.84	1.22	45.83	49.60	3.72	25.82
T ₈ : Foliar Application of 7.5 ml paclobutrazol/tree	1.00	2.00	1.67	0.44	58.33	45.53	4.32	10.12
T ₉ : Foliar Application of 10 ml paclobutrazol/tree	1.50	6.25	2.30	0.96	50.00	57.87	5.70	30.37
T ₁₀ : Foliar Application of 12.5 ml paclobutrazol/tree	1.75	2.75	1.64	0.49	56.25	34.90	5.77	11.32
T ₁₁ : Control (water spray)	1.25	2.00	2.67	0.85	54.17	38.33	4.95	9.05
C.D. at 5%	0.85	1.18	0.22	0.11	6.80	4.39	1.01	3.24

paclobutrazol increased the number of male and female flowers as well as total number of flowers per tree in jackfruit. These findings are also in accordance with the findings in other crops like apple (Lever, 1986). Paclobutrazol has increased the number of flower buds on apple (Lever, 1986) and cherry (Webster *et al.*, 1986) in some studies. Although paclobutrazol treatments in general gave more consistent annual bearing, sometimes it can lead to precocious flowering. Repeated applications throughout the growing season are better than one large dose and root or stem applications are much more effective than foliar sprays. Paclobutrazol is taken up by stem or roots and is transported in the transpiration stream through xylem to the growing sub apical meristem. Therefore, it is most effective when it is applied directly or transported to the shoot apex. On the other hand, paclobutrazol absorbed by mature leaves is not translocated to the stems or shoot tips (Quinlan and Richardson, 1986).

Number of fruits was significantly affected by different doses of paclobutrazol. The maximum number of fruits was recorded with the treatment T₃ (soil drenching of 15 ml paclobutrazol/tree) and minimum was recorded with the treatment T₈ (foliar application of 7.5 ml paclobutrazol/tree) followed by treatment T₁₁ (control) in both the years. The data presented in Table 2 on per cent fruit-set in Jackfruit on the basis of total number of flowers per tree was significantly affected with different doses of paclobutrazol during both the years. It was significantly higher with the treatment T₁ (soil drenching of 5 ml paclobutrazol/tree) during both years i.e. 2010-11 and 2011-12. The lowest per cent fruit set was recorded

with treatment T₅ (soil drenching of 25 ml paclobutrazol/tree) during first year (2010-11), while during second year (2011-12) the lowest per cent fruit set was recorded with treatment T₈ (foliar application of 7.5 ml paclobutrazol/tree). The data presented in Table 2 revealed that different doses of paclobutrazol had significant effect on per cent fruit retention. Maximum per cent fruit retention was found with treatment T₄ (soil drenching of 20 ml paclobutrazol/tree) and treatment T₉ (foliar application of 10 ml paclobutrazol/tree) during first and second year, respectively. While, minimum per cent fruit retention was found with the treatment T₆ (foliar application of 2.5 ml paclobutrazol/tree) and treatment T₁₀ (foliar application of 12.5 ml paclobutrazol/tree) during the year 2010-11 and 2011-12, respectively. Application of paclobutrazol with soil drench method gives better result on increasing fruit retention percentage as compared to control and foliar application of paclobutrazol. Yield was also significantly affected with paclobutrazol application during both the years. Maximum yield was recorded with treatment T₃ and minimum yield was recorded with treatment T₁₁ (control) during both the years. The perusal of data presented in Table 3 revealed that the effect of paclobutrazol on fruit weight was found significant effect during both the years. The maximum fruit weight was recorded with control (T₁₁) during both the years. While, minimum fruit weight was observed with the treatment T₄ (soil drenching of 20 ml paclobutrazol/tree) during both the years. The data presented in Table 3 revealed that the effect of paclobutrazol on pulp and peel ratio was found significant during both years. The maximum pulp and peel ratio was

Table 3: Response of different concentrations and application methods of paclobutrazol on fruit quality of Jackfruit

Treatment	Weight per fruit (Kg)		Pulp : Peel ratio		Total Soluble Solids (°B)	
	2010-11	2011-12	2010-11	2011-12	2010-11	2011-12
T ₁ : Soil Drenching of 5 ml paclobutrazol /tree	2.32	5.42	0.21	0.22	14.00	15.50
T ₂ : Soil Drenching of 10 ml paclobutrazol/tree	2.37	4.80	0.25	0.31	15.50	16.50
T ₃ : Soil Drenching of 15 ml paclobutrazol/tree	1.85	4.25	0.21	0.25	15.50	16.75
T ₄ : Soil Drenching of 20 ml paclobutrazol/tr	1.17	3.20	0.14	0.22	15.00	15.75
T ₅ : Soil Drenching of 25 ml paclobutrazol/tree	1.75	3.62	0.19	0.24	14.50	14.75
T ₆ : Foliar Application of 2.5 ml paclobutrazol/tree	3.15	3.95	0.32	0.31	11.00	13.00
T ₇ : Foliar Application of 5 ml paclobutrazol/tree	3.72	4.92	0.32	0.34	12.50	12.50
T ₈ : Foliar Application of 7.5 ml paclobutrazol/tree	4.32	4.27	0.27	0.36	12.75	13.75
T ₉ : Foliar Application of 10 ml paclobutrazol/tree	3.82	4.90	0.36	0.28	12.00	14.75
T ₁₀ : Foliar Application of 12.5 ml paclobutrazol/tree	4.10	3.35	0.26	0.30	13.00	14.50
T ₁₁ : Control (water spray)	4.47	6.50	0.32	0.32	10.50	12.50
C.D. at 5%	0.51	0.67	0.05	0.06	1.84	1.64

found with the treatment T₉ (foliar application of 10 ml paclobutrazol/tree) during first year and with the treatment T₈ (foliar application of 7.5 ml paclobutrazol/tree) in second year. While, minimum pulp and peel ratio was observed with the treatment T₄ (soil drenching of 20 ml paclobutrazol/tree) during both years. It is apparent from the data presented in Table 3 showed that there was significant effect of different paclobutrazol treatments on total soluble solids. During first year, highest total soluble solids was recorded with the treatment T₂ and T₃ (soil drenching of 10 and 15 ml paclobutrazol/tree, respectively) as compared to other treatments of paclobutrazol. While, during second year it was significantly higher with the treatment T₃. The lowest total soluble solids was recorded with the treatment T₁₁ (control) during both the years i.e. 2010-11 and 2011-12.

The results indicated that soil drenching of 15 ml paclobutrazol per tree (T₅) is beneficial for enhancing the number of fruits per tree at harvest and subsequently the fruit yield per tree, It could be due to retardation of vegetative growth and accumulation of more carbohydrates in leaves by application of paclobutrazol. Similar increase in number of fruits/tree and yield in mango were also reported by Anbu *et al.* (2001); Bagel *et al.* (2004); RajKumar *et al.* (2007) and in pear Rai and Bist (1992). Singh and Singh (2003) reported that more fruits/tree and fruit yield per tree were recorded in 4 g a.i. treated Dashehari tree, whereas 6 g a.i. per tree of paclobutrazol was found more effective in cvs. Chausa and Langra.

CONCLUSION

On the basis of above results, it can be concluded that paclobutrazol @ 15 ml/tree as soil drench method should be applied for obtaining maximum flowering and fruit yield. The long term effects of the paclobutrazol in jackfruit need to be studied to arrive at valued conclusion.

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