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Effect of soil applied Paclobutrazol at different time on growth and flowering of mango (*Mangifera indica* L.) CV. Kesar

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Abstract
An experiment entitled "Effect of soil applied Paclobutrazol treatments at different time on growth and flowering of mango (*Mangifera indica* L.) cv. Kesar" was carried out at Fruit Research Station, Sakkarbaug, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh, Ta. & Dist. – Junagadh (Gujarat) during 2019-20 and 2020-21. The experiment was laid out in Randomized Block Design with Factorial concept consisting two factors with three replications. The treatment comprised with three time of paclobutrazol application *viz.*, 15th July, 1st August and 15th August and four dose of paclobutrazol application *i.e.* 5 g *a.i.*, 8.5 g *a.i.*, 11.5 g *a.i.* and 14.5 g *a.i.* The result revealed that significantly minimum days to flower bud initiation (48.68), days to 50% flowering (62.99) and days to full bloom (74.23) were recorded on application on 15th July during both the years and in pooled. However, significantly minimum numbers of new shoots per terminal (1.32), length of new shoot (10.58 cm), days taken to flower bud initiation (46.04), days to 50% flowering (61.82) and days to full bloom (70.26) were observed with application of paclobutrazol dose @ 14.5 g *a. i.* during both the years and in pooled. The interaction effect of time and dose of paclobutrazol application were produce non significant effect on growth and flowering of mango cv. Kesar, respectively.

Keywords: paclobutrazol, mango, Kesar

1. Introduction
The mango (*Mangifera indica* L.) (2n=2x=40) belongs to the family Anacardiaceae and originated in Indo-Burma region. It is the national fruit of India. It is one of the choicest fruit of tropical and sub-tropical region of the world, especially in Asia. India produce mango around 207.98 lakh tonne of mango from 22.93 lakh ha area with 8.71 t/ha productivity. Gujarat produces 12.22 lakh tonne of mango from 1.66 lakh ha area (Anon., 2019) [1].
Kesar is the most popular and important commercial cultivar and also leading variety for export. It is also preferred variety for mango pulp processors. The area under Kesar variety is increasing not only in Gujarat but also in nearby states like Maharashtra, Madhya Pradesh and Andhra Pradesh due to its higher productivity, regularity in bearing, excellent fruit quality, pleasant flavour and overall high commercial value. It is known for its vigorous growth, having good consumer's acceptance, attractive shape and size, colour of fruit pulp and good keeping quality. It has excellent sugar: acid blend with good processing quality.
Flowering in mango, the most important thing is the trees should be able to produce new vegetative growth in the 'on' year which should also be mature to be ready to enter in to reproduction phase and give flowering in following season. The main objective of a mango grower is to harvest maximum quantity with good quality of marketable fruits at the lowest cost in early season. Early flowering results in advanced fruit maturity and provided opportunities to have the commercial advantages of early marketing in season.
Paclobutrazol has been extensively used in the horticulture industry to regulate the growth and production of fruit trees. This is anti- gibberellin compound which is very active low rates, taken up into the xylem through the leave, stems or root and translocate to growing sub apical meristems. Movement of paclobutrazol within plant is acropetal (base to apex), absorbed by roots and translocate in the xylem only. It results in retardation of vegetative growth and diversion of assimilates to reproductive organs there by enhance the bud break and improve the fruit set and yield.

Application of paclobutrazol in mango plants in the month of July- August promote the inflorescence emergence during October to November and fruits mature in the month of middle of march to April. Taking the crop during March – May by means of paclobutrazol application is highly remunerative to the farmer due to more market demand which fetch high price to produce. Soil application of paclobutrazol increase the yield by checking the vegetative growth and increase the flowering, fruit set, fruit weight, fruit size and also quality enhanced (Burondkar and Gunjate, 1993) [3].

The endogenous hormonal level of tree especially in vegetative growth is probably the most favour for this problem. So, exogenous application of chemicals play a major role in the enhancing flowering, reducing fruit drop and increasing fruit yield and quality of mango fruit. With this background, the present study "Effect of soil applied Paclobutrazol treatments at different time on growth, flowering, fruiting, yield and quality of mango (*Mangifera indica* L.) cv. Kesar" was undertaken to enhance earliness in flowering and fruiting to increase commercial advantage to the farmers.

2. Materials and Methods

The present experiment was carried out at Fruit Research Station, Sakkarbaug; Junagadh Agricultural University, Junagadh during 2019-20 to 2020-21. The treatment comprised with three time of paclobutrazol application *viz*., 15th July, 1st August and 15th August and four dose of paclobutrazol application *i.e*. 5 g *a.i.*, 8.5 g *a.i.*, 11.5 g *a.i.* and 14.5 g *a.i.*, were allocated in randomized block design with factorial concept in twelve treatment combinations with three replications.

The treatment combinations were soil application of paclobutrazol at 15th July + 5.0 g *a.i.* (S_1D_1), 15th July + 8.5 g *a.i.* (S_1D_2), 15th July + 11.5 g *a.i.* (S_1D_3), 15th July + 14.5 g *a.i.* (S_1D_4), 1st August + 5.0 g *a.i.* (S_2D_1), 1st August + 8.5 g *a.i.* (S_2D_2), 1st August + 11.5 g *a.i.* (S_2D_3), 1st August + 14.5 g *a.i.* (S_2D_4), 15th August + 5.0 g *a.i.* (S_3D_1), 15th august + 8.5 g *a.i.* (S_3D_2), 15th August + 11.5 g *a.i.* (S_3D_3) and 15th August + 14.5 g *a.i.* (S_3D_4)

Observations were recorded in respect to number of new shoots per terminal and length of new shoot manually counted and recorded. Days to flower bud initiation, days to 50% flowering and days to full bloom was also counted and recorded manually from cutoff date 1st October.

3. Result and Discussion

3.1 Effect of time

The results of the study indicated that application of different time of paclobutrazol application had produced non significant effect on growth parameters like number of new shoots per terminal and length of new shoot.

Days to flower bud initiation, days to 50% flowering and days to full bloom were significantly influenced by various time of paclobutrazol application. Among the different time of paclobutrazol application, time of soil application of paclobutrazol was found significant and minimum days to flower bud initiation (48.68), days to 50% flowering (62.99) and days to full bloom (74.23) were recorded on application at on 15th July (S_3).

Application of paclobutrazol in mid of July suppressed the vegetative growth and induced early and profuse flowering during investigation. In other words, the flower inductive cycle which is a part of phenological and physiological cycle of mango tree may commence earlier in the season, but flowering is prevented by the inhibitor until the build-up of sufficient promoter to counteract the inhibitor. Paclobutrazol thus, appears to help in achieving this stage much earlier because of its inhibitory activity. This hypothesis looks particularly attractive while considering the flower-inhibitory role of gibberellins in trees together with the anti-gibberellins activity of paclobutrazol. The result of present investigation induced earliness in flowering, advanced fruit maturity and provided opportunities to have the commercial advantages of early marketing in season.

The result was confirmed by Kulkarni (1989) [10]; Padhiar (1999) [17]; Joshi *et al.* (1998) [9]; Shinde (2015) [21]; Medina-Urrtia and Buenrostro- Nava (1995) and Bonomo *et al*. (1989) [2].

3.2 Effect of doses

It is obvious from the data analyzed that significantly minimum numbers of new shoots per terminal (1.32), length of new shoot (10.58 cm), days taken to flower bud initiation (46.04), days to 50% flowering (61.82), days to full bloom (70.26) were recorded with application of paclobutrazol dose @ 8.5 g *a. i.* (D_4).

Paclobutrazol significantly reduced the outbreak of new vegetative flush of October-November in mango. Likewise, number of shoots per terminal and shoot length was also reduced by paclobutrazol treatments. Thus, paclobutrazol exerted the significant effect in reduction of vegetative growth in terms of number of shoots per terminal and shoot length. An application of paclobutrazol had effectively controlled the emergence of this vegetative flush of October-November by interrupting the biosynthesis of gibberellins. Because paclobutrazol is a gibberellins bio-synthesis inhibitor. The considerable reduction in vegetative growth in the trees treated with paclobutrazol.

The result was confirmed by Hoda *et al*. (2001) [7]; Kulkarni, (1989) [10]; Padhiar (1999) [17]; Kurein and Iyer (1993) [12]; Desai (1994) [6]; Burondkar *et al*. (2000) [3]; Nafeez *et al*. (2010) [15] and Pal *et al*. (2017) [18].

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. The soil-applied paclobutrazol treatments 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.

Flowering earliness in paclobutrazol treated plants was reported by Kulkarni (1989) [10]. He also ascribed that the flower-inductive factor might commence earlier in the season. It is also probable that the application of paclobutrazol caused an early reduction of endogenous gibberellins levels within the shoots, causing them to reach maturity earlier of the trees. This finding is similar to that of Sarker and Rahim (2012), where paclobutrazol induced flowering 85 days after treatment application. The total activity of auxin-like substances increased the higher starch reserve, total carbohydrates and higher C: N ratio in the shoots favour flower bud initiation in mango. 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.

Similar kinds of results were observed by Kurian and Iyer (1993) [12]; Khader (1991); Tongumpai *et al.* (1997) [24]; Nartvaranant *et al.* (2000) [16]; Jogdande and Choudhari, (2001) [8]; Cardenas and Rojas (2003) [5]; Sanjay and Jaynt (2003) [20]; Yeshitela *et al.* (2004) [25]; Patil and Talathi (2005) [19]; Singh and Ranganath (2006) [22]; Singh and Singh (2006) [23]; Kumari and Mankar (2008) [11] and Mistry and Patel (2009) [14].

3.3 Interaction effect of time and dose

The interaction effect of time and dose of paclobutrazol application were produce non significant effect on growth and flowering parameters, respectively.

Table 1: Effect of time and dose of soil application of paclobutrazol on number of shoots per terminal and length of new shoot in mango cv. Kesar

Treatment	Number of new shoots per terminal			Length of new shoot (cm)		
	2019-20	2019-20	Pooled	2019-20	2020-21	Pooled
Time (S)						
S1	1.46	1.35	1.41	12.75	12.32	12.54
S2	1.51	1.38	1.44	13.00	12.66	12.83
S3	1.57	1.42	1.50	13.66	13.16	13.41
S.Em.±	0.040	0.032	0.026	0.349	0.373	0.256
C.D. at 5%	NS	NS	NS	NS	NS	NS
Dose (D)						
D1	1.62	1.48	1.55	15.22	14.95	15.09
D2	1.54	1.42	1.48	14.40	13.88	14.14
D3	1.48	1.35	1.42	12.07	11.74	11.91
D4	1.41	1.27	1.34	10.86	10.29	10.58
S.Em.±	0.046	0.037	0.030	0.403	0.431	0.295
C.D. at 5%	0.14	0.11	0.08	1.18	1.26	0.84
Interaction (S x D)						
S.Em.±	0.080	0.064	0.051	0.699	0.746	0.511
C.D. at 5%	NS	NS	NS	NS	NS	NS

Table 2: Effect of time and dose of soil application of paclobutrazol on days to flower bud initiation, days to 50% flowering and days to full bloom in mango cv. Kesar

Treatment	Days to flower bud initiation			Days to 50% flowering			Days to full bloom		
	2019-20	2019-20	Pooled	2019-20	2020-21	POOLED	2019-20	2020-21	Pooled
Time (S)									
S1	48.00	49.37	48.68	62.40	63.58	62.99	73.64	74.83	74.23
S2	51.27	52.14	51.70	66.42	67.79	67.11	75.54	76.73	76.14
S3	54.75	56.34	55.56	73.73	74.11	73.92	81.01	82.27	81.64
S.Em.±	0.933	1.095	0.719	1.616	1.443	1.083	1.816	1.663	1.231
C.D. at 5%	2.74	3.21	2.05	4.74	4.23	3.09	5.33	4.88	3.51
Dose (D)									
D1	58.04	58.95	58.50	72.62	73.25	72.93	84.27	85.19	84.73
D2	53.03	53.98	53.50	69.92	71.05	70.48	78.91	80.06	79.49
D3	49.11	50.68	48.89	66.10	67.49	66.79	74.14	75.61	74.88
D4	45.17	46.90	46.04	61.44	62.20	61.82	69.61	70.90	70.26
S.Em.±	1.077	1.265	0.831	1.866	1.667	1.251	2.097	1.920	1.422
C.D. at 5%	3.16	3.71	2.37	5.47	4.89	3.57	6.15	5.63	4.05
Interaction (S x D)									
S.Em.±	1.865	2.191	1.439	3.232	2.887	2.167	3.633	3.326	2.463
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS

4. Conclusion

From the foregoing discussion, it can be concluded that the soil application of paclobutrazol on 15th July can be reduced growth, earliness in flowering and fruiting, increase in yield and quality in mango cv. Kesar.

While, the soil application of paclobutrazol dose @ 8.5 g *a.i.* improved yield and quality of mango cv. Kesar.

5. References

1. Anonymous. National Horticulture Board 2019. Horticulture Statistics Division, Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, Government of India. Available at http://nhb.gov.in/Statistics/horticulture 2021.
2. Bonomo R, Neri D, Sansavini S. Dry matter and nutrient partioning, seasonal water consumption and gas exchange of paclobutrazol growth-controlled apple trees. Acta Horticulturae 1989;239:159-166.
3. Burondkar MM, Gunjate RT. Control of vegetative growth and induction of regular and early cropping in Alphonso mango with paclobutrazol. Acta Horticulturae 1993;341:206-215.
4. Burondkar MM, Gunjate RT, Magdum MB, Govekar MA. Rejuvanation of old and over crowded Alphonso mango orchard with pruning and use of paclobutrazol. Acta Horticulturae 2000;509:681-686.
5. Cardenas K, Rojas C. Effect of paclobutrazol and nitrates of potassium and calcium on the development of the mango 'Tommy Atkins'. Bioagro 2003;15(2):83-90.
6. Desai MM. Regulation of flowering in mango (*Mangifera indica* L.) cv. Alphonso. Ph.D. Thesis, Gujarat Agric. Univ., Navsari, India 1994.

7. Hoda MN, Singh S, Singh J. Effect of cultar on flowering, fruiting and fruit quality of mango cv. Langra. Indian journal of Horticulture science 2001;58(3):224-227.
8. Jogdande ND, Choudhari KG. Seasonal changes in auxin content and its role in flowering of mango (*Mangifera indica* L.). Orissa Journal of Horticulture science 2001;29(2):10-12.
9. Joshi AB, Magdum MB, Sawant UK. Effect of paclobutrazol on growth and flowering in mango (*Mangifera indica* L.) cv. Ratna. lndian Journal of Forestry 1998;21(1):68-69.
10. Kulkarni VJ. Chemical control of tree vigor and promotion of flowering and fruiting bin mango (*Mangifera indica* L.) using paclobutrazol. Journal of Hortticulture Science 1989;63:557-566.
11. Kumari K, Mankar A. Effect of urea, paclobutrazol and bio regulators in vegetative growth and productivity of Langra mango. Orissa Journal of Horticulture science 2008;36(2):88-92.
12. Kurian RM, Iyer CPA. Chemical regulation of tree size in mango cv. Alphonso III. Effects of growth retardants on yield and quality of fruits. Journal of horticulture science 1993;68:361-364.
13. Mendonca V, Neto SE, Ramos JD, Pio R, Souza PA. Production and quality of Tommy Atkins mango fruits after application of paclobutrazol. Revista de Ciencias Agrarias 2001;38:39-149.
14. Mistry, P. M. and Patel, B. N. Impacct of heading back plus paclobutrazol on rejuvenation of old and over Alphonso orchards. Indian journal of Horticulture science 2009; 66(4): 520-521.
15. Nafeez M, Faqueer M, Ahmad S, Khan M, Jamil M, Aslam M. Paclobutrazol soil drenching supresses vegetative growth, reduces malformation and increases production in mango. International journal of fruit science 2010;10:431-440.
16. Nartvaranant P, Subhadrabandhu S, Tongumpai P. Practical aspects in producing off season mango in Thailand. Acta Horticulturae 2000;509:661-668.
17. Padhiar BV. Use of paclobutrazol in mango (*Mangifera indica* L.) in South Gujarat condition. Ph.D. Thesis submitted to G.A.U., S.K. Nagar 1999.
18. Pal P, Modal S, Kundu S. Effect of Paclobutrazol on vegetative response production of mango Cv. Himsagar. International Journal of Current Microbilogy and Applied Sciences 2017;**6**(12):1264- 1275.
19. Patil HK, Talathi JM. Economic viability of paclobutrazol application on mango cv. Alphonso. South Indian Journal of Horticulture 2005;47(6):145-146.
20. Sanjay S, Jayant S. Effect of cultar on flowering, fruiting and fruit quality of mango cv. Dashehari. Indian journal of Horticulture science 2003;58:224-227.
21. Shinde VK. Response of paclobutrazol application time on flowering, fruiting and yield of mango (*Mangifera indica* L.) cv. Alphonso. Indian journal of Horticulture science 2015;8(1):1-6.
22. Singh DB, Ranganath HR. Induction of regular and early fruiting in mango by paclobutrazol under tropical humid climate. Indian journal of Horticulture science 2006;63(3):248-250.
23. Singh S, Singh AK. Regulation of shoot growth and flowering in mango cv. Gulab Khas by paclobutrazol. Annals Agriculture Research 2006;27(1):4-8.
24. Tongumpai P, Chantkulchan K, Subhadrabandhu S, Ogata R. Foliar application of paclobutrazol on flowering of mango. Acta Horticulturae 1997;455:175-179.
25. Yeshitela T, Robbertse PJ, Stassen PJC. Paclobutrazol suppressed vegetative growth and improved yield as well as fruit quality of 'Tommy Atkins' mango (*Mangifera indica* L.) in Ethiopia. New Zealand Journal of Crop and Horticulture Science 2004;32(3):281-293.