International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(6): 241-244

Received: 13-09-2018
Accepted: 14-10-2018

G Panjavarnam
Grapes Research Station (TNAU), Anaimalayanpatty, Royappanpatty Post, Theni District, Tamil Nadu, India

M Selvarajan
Grapes Research Station (TNAU), Anaimalayanpatty, Royappanpatty Post, Theni District, Tamil Nadu, India

Correspondence
G Panjavarnam
Grapes Research Station (TNAU), Anaimalayanpatty, Royappanpatty Post, Theni District, Tamil Nadu, India

Studies on the effect of different chemicals and paclobutrazol on growth and yield of mango (*Mangifera indica* L.) Cv. Imam pasand

G Panjavarnam and M Selvarajan

Abstract
A field experiment was conducted to assess the effect of different chemicals, soil application of paclobutrazol and combined application of paclobutrazol with chemicals as foliar spray on flowering physiology and yield in mango cv. Imam Pasand at Department of Fruit Crops, Horticultural College and Research Institute, Periyakulam during the period between 2011 and 2012. The experiment was laid out with sixteen treatments and two replication in a Randomized Block Design. The soil application of paclobutrazol @ 0.75.a.i. m^{-2} of tree canopy diameter during September month along with foliar spray of KNO_3 @ 1 percent twice during October and November at 20 days interval was very effective in suppressing the tree height (2.69 m), canopy spread (5.10 m N - S, 4.17 m E - W), shoot length (9.37 cm), inter nodal length (2.07 cm). In both the treatments *viz*., foliar spray of KNO_3 combined with soil application of paclobutrazol @ 0.75.a.i. m^{-2} of tree canopy diameter and application of paclobutrazol alone were recorded the highest yield characters *viz.*, panicle length (34 cm & 33.63 cm), hermaphrodite flowers (12.62% and 12.58%) and fruit yield (33.50 kg $tree^{-1}$ and 31.40 kg $tree^{-1}$) respectively are on par and statistically significant.

Keywords: Chemicals, paclobutrazol, growth, yield, mango, *Mangifera indica* L. Cv. Imam pasand

Introduction
India continues to be the largest mango producing and consuming country of the world, accounting for about 50 percent of the world production. Owing to its excellent flavour and delicious taste it has potential demand among the domestic consumers and fetches premium price in the market. The present research was made for enhancing the productivity of this variety to the farmers with objective to study the effect of different chemicals on fruit set and yield. The present research was made for enhancing the productivity of this variety to the farmers with the objective of find out a cost effective technology for increasing the productivity of yield. The results of the present study are discussed here under.

Materials and Methods
The investigation on the effect of different chemicals and paclobutrazol on flowering and fruiting in mango (*Mangifera indica* L.) cv. Imampasand was undertaken at the Department of Fruit Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Periyakulam during the year 2011-2012. The experimental field was located at NSKP Farms, Gudalur, Theni District which is about 60 km away from Horticultural College and Research Institute, Periyakulam. The experiment was laid out in a Randomized Block Design (RBD) with sixteen treatments in two replications. Ten year old uniform sized trees of mango cv. Imampasand spaced at 10 x 5 m were selected for this experiment. The detailed treatments are T_1 (Control), T_2 (Potassium nitrate (KNO_3 @ 1%) T_3 **(**Potassium sulphate (K_2SO_4 @ 1%), T_4 (Thiourea @ 1%), T_5 (Potassium dihydrogen phosphate (KH_2PO_4 @ 1%), T_6 (Potassium humate @ 2%), T_7 (IIHR Mango special mixture (B + Zn + Mg) @ 0.5 percent), T_8 (Calcium Ammonium Nitrate (CAN) @ 1%), T_9 (Soil application of paclobutrazol (Cultar) @ 0.75 g a.i / m^{-2} canopy diameter), T_{10} (T_9 + T_2), T_{11} (T_9 + T_3), T_{12} (T_9 + T_4),T_{13} (T_9 + T_5), T_{14} (T_9 + T_6), T_{15} (T_9 + T_7), T_{16} (T_9 + T_8). The different chemicals were applied as foliar sprays twice first during the month of October (15.10.2011) and second during the month of November (05.11.2011) at 20 days interval. The soil application of paclobutrazol (Cultar 23% W / W and 25% W / V of Syngenta Crop Science Ltd.,) @ 0.75 g a.i m^{-2} of canopy diameter was given

during the month of September, 2011. The required quantity of paclobutrazol was dissolved in water @ 1 ml litre^{-1} and poured in small holes (10 - 15 cm depth) around the collar region of the fertilizer ring as suggested by Burondkar and Gunjate (1993). All the other crop management practices including pruning were done as recommended in the crop production techniques of horticultural crops for Tamil Nadu (Anon., 2004).

Result and Discussion

Growth characters

The pattern of the growth flushes of mango is affected by various factors such as cultivar, age of the tree and crop load in the previous season. Several researchers have confirmed that reduction in vegetative growth particularly inter nodal length encouraged reproductive growth in mango (Yeshitela and Stassen, 2005) [9]. In the present study among the different treatments, soil application of paclobutrazol @ 0.75.a.i m^{-2} of canopy diameter during the month of September + foliar application of KNO_3 @ 1 percent twice during October and November at 20 days interval was very effective in suppressing the vegetative growth parameters *viz*., shoot and inter nodal length (Table 1) due to the suppression of vegetative growth of the tree height and canopy diameter. This result conforms to that of the results obtained by Rademacher (1991) who stated that the most striking effect of paclobutrazol was the reduction of shoot elongation. Contrary to this, Singh *et al*. (2010) reported that KH_2PO_4 alone or in combination with KNO_3 @ 1 percent was very effective in suppressing the vegetative growth.

Flowering and yield characters

Flowering is the first of several events that set the stage for mango production each year. Given favorable growth conditions, the timing and intensity of flowering greatly determines when and how much fruit are produced during a given season (Davenport, 2011). The data on time taken for flowering and fruiting due to different treatments, in the present study revealed that application of paclobutrazol @ 0.75.a.i m^{-2} + KNO_3 @ 1 percent was found to be induce earlier flowering and paclobutrazol @ 0.75.a.i m^{-2} was the next best to induce earlier flowering. The results obtained in this experiment are in agreement with the findings of Kulkarni (1988) [3]. Foliar application of potassium nitrate @ 2 and 4 percent alone or in combination with one percent urea thrice at two weeks intervals before bud break stage produced regular and early flowering and higher percent of hermaphrodite flowers than control. This is in close conformity with the findings of Adams (1986). Soil application of paclobutrazol @ 0.75.a.i m^{-2} + KNO_3 @ 1 percent also reported an earlier harvesting by 10.37 days when compared to control. Similar results were also reported in different important mango cultivars (Winston, 1992) [7]. Application of paclobutrazol would have probably reduced the gibberellic acid levels which in turn resulted in early flowering and harvesting. Application of paclobutrazol @ 0.75.a.i m^{-2} also reported the highest panicle length and percentage of hermaphrodite flowers. This can be substantiated as a seasonal effect where in paclobutrazol induced early and intense flowering while late season weather conditions were not conducive for inflorescence development. Flowering in mango cv. Imam Pasand is reported to be associated with the reduced vegetative growth which was often induced by lower level of gibberellin and the highest IAA oxidase activity. In general, paclobutrazol owing to its anti - gibberellin activity, could induce or intensify flowering by blocking the conversion of kaurene to kaurenoic acid (Voon *et al*., 1991). The soil applications of paclobutrazol @ 0.75.a.i m^{-2} had an impact on reduction of vegetative growth with the required physiological changes, which resulted in high intensity of flowering. Following the reduction in vegetative growth parameters, there was a high chlorophyll content, carbohydrate, carbohydrate - nitrogen ratio, phosphorus and potassium content in leaves at bud break stage which were the other causes for better flowering characters. A higher accumulation of reserves in the current year shoots before flowering was also observed by Stassen *et al*. (1997). One of the principal effects of gibberellin was to mobilize carbohydrate by stimulating their degradation to glucose (Jacobsen and Chandler, 1987).

The hormonal concept of flowering in mango implied that the cyclic synthesis of floral stimulus in the leaves and the difference between two such cycles would determine the flowering behaviour of a cultivar (Kulkarni, 1988). The development of hermaphrodite flowers needed more reserves from the tree than unisexual flowers because of the additional structures required. Consequently, in the current observation, the percentage of hermaphrodite flowers was higher in soil application of paclobutrazol @ 0.75.a.i m^{-2} + KNO_3 @ 1 percent which had the higher reserves. This finding is in close conformity to that of Yeshitela (2004). The fruit set pattern and yield of fruits tree^{-1} followed a similar trend to that of percentage of hermaphrodite flowers and length of panicle for the same reason discussed above (Fig. 3). The impact of suppressed vegetative growth observed due to soil application of paclobutrazol @ 0.75.a.i m^{-2} + KNO_3 @ 1 percent contributed to superior yield observed (Table 3). Research evidence in support of this finding has been observed in different cultivars of mango (Kulkarni, 1988) [3]. Other than the application of paclobutrazol @ 0.75.a.i m^{-2} and the combined application of paclobutrazol 0.75.a.i m^{-2} + KH_2PO_4, paclobutrazol 0.75.a.i m^{-2} + CAN @ 1 percent produced early flowering, higher number of fruits and yield. This might be due to the high values in respect of specific leaf weight, chlorophyll content, soluble protein content, IAA oxidase activity and the lower level of gibberellin content recorded in these treatments. In addition, the nutrient content *viz*., nitrogen, phosphorus, potassium, carbohydrate and carbohydrate - nitrogen ratio at bud break stage were also conducive for the production of more number of hermaphrodite flowers, high fruit set and yield in these treatments.

Table 1: Effect of different chemicals and paclobutrazol on tree growth and physiological characters of mango cv. Imam Pasand

Treatments	Tree height (m)	Canopy spread (m)		Shoot length (cm)	Inter nodal length (cm)
		N - S	E - W		
T_1 - Control	3.56	6.64	6.25	12.05	3.85
T_2 - KNO_3 @ 1%	3.05	6.15	5.15	9.55	2.86
T_3 - K_2SO_4 @1%	3.41	6.10	5.02	11.22	2.52
T_4 - Thiourea @ 1%	3.25	5.94	4.94	10.47	3.12
T_5 - KH_2PO_4 @ 1%	3.41	6.07	5.35	11.27	2.40
T_6 - Potassium humate @ 2%	3.30	5.93	5.45	11.37	2.65
T_7 - IIHR mango special mixture @ 0.5%	3.10	5.72	5.07	11.85	3.17
T_8 - Calcium Ammonium Nitrate @ 1%	3.42	5.50	4.40	11.40	2.55
T_9 - Paclobutrazol @ 0.75 g a.i.	2.71	5.20	4.19	9.40	2.15
T_{10} - T_9 + T_2	2.69	5.10	4.17	9.37	2.07
T_{11} - T_9 + T_3	2.74	5.25	4.85	11.13	2.21
T_{12} - T_9 + T_4	2.90	5.46	4.92	11.35	2.44
T_{13} - T_9 + T_5	2.82	5.72	4.20	11.20	2.32
T_{14} - T_9 + T_6	3.05	5.33	4.86	11.27	2.65
T_{15} - T_9 + T_7	3.12	5.16	4.52	11.15	3.12
T_{16} - T_9 + T_8	2.91	5.24	4.33	10.30	2.75
SE (d)	0.0878	0.1022	0.0586	0.1395	0.2175
CD (P = 0.05)	0.1872	0.2179	0.1249	0.2974	0.4636

Table 2: Effect of different chemicals and paclobutrazol on flowering characters of mango cv. Imam Pasand

Treatments	Number of days taken for 50 percent flowering (days)	Number of days taken for flowering to harvest	Percentage of flowering shoots	Panicle length (cm)	Percentage of hermaphrodite flowers
T_1 - Control	126.50	120.87	5.01	20.14	8.50
T_2 - KNO_3 @ 1%	124.50	115.25	10.80	30.87	9.39
T_3 - K_2SO_4 @1%	119.00	118.50	11.17	27.47	10.12
T_4 - Thiourea @ 1%	115.00	110.85	8.00	25.58	10.72
T_5 - KH_2PO_4 @ 1%	113.00	115.50	9.15	29.29	10.13
T_6 - Potassium humate @ 2%	116.00	117.00	12.05	25.54	10.07
T_7 - IIHR mango special mixture @ 0.5%	118.00	114.62	10.15	24.80	11.15
T_8 - Calcium Ammonium Nitrate @ 1%	116.00	114.00	12.22	24.69	11.35
T_9 - Paclobutrazol @ 0.75 g a.i.	97.60	110.75	13.45	33.63	12.58
T_{10} - T_9 + T_2	93.15	110.50	14.00	34.00	12.62
T_{11} - T_9 + T_3	117.50	114.25	10.70	26.97	11.26
T_{12} - T_9 + T_4	117.00	112.75	12.70	24.30	10.87
T_{13} - T_9 + T_5	115.10	114.20	9.55	31.07	11.16
T_{14} - T_9 + T_6	115.00	115.50	12.85	22.55	11.24
T_{15} - T_9 + T_7	118.00	112.75	11.37	25.25	11.45
T_{16} - T_9 + T_8	114.00	110.90	12.32	23.77	10.32
SE (d)	2.0124	2.5389	0.3772	0.4597	0.3086
CD (P = 0.05)	4.4640	5.4116	0.8039	0.9798	0.6578

Table 3: Effect of different chemicals and paclobutrazol on flowering and fruit set characters of mango cv. Imam Pasand

Treatments	Fruit set (%)	Number of fruits tree^{-1}	Percentage of hermaphrodite flowers	Individual fruit weight (g fruit^{-1})	Fruit yield (kg tree^{-1})
T_1 - Control	0.24	58.28	8.50	380.00	20.25
T_2 - KNO_3 @ 1%	0.27	56.45	9.39	372.00	21.00
T_3 - K_2SO_4 @1%	0.26	53.98	10.12	376.00	20.30
T_4 - Thiourea @ 1%	0.28	56.18	10.72	364.00	20.45
T_5 - KH_2PO_4 @ 1%	0.25	64.64	10.13	362.00	23.40
T_6 - Potassium humate @ 2%	0.26	56.43	10.07	363.28	20.50
T_7 - IIHR mango special mixture @ 0.5%	0.27	59.52	11.15	361.20	21.50
T_8 - Calcium Ammonium Nitrate @ 1%	0.28	77.43	11.35	355.15	27.50
T_9 - Paclobutrazol @ 0.75 g a.i.	0.39	92.87	12.58	338.10	31.40
T_{10} - T_9 + T_2	0.41	100.76	12.62	332.45	33.50
T_{11} - T_9 + T_3	0.28	70.81	11.26	360.11	25.50
T_{12} - T_9 + T_4	0.29	62.08	10.87	346.28	21.50
T_{13} - T_9 + T_5	0.28	78.40	11.16	376.26	29.50
T_{14} - T_9 + T_6	0.27	67.36	11.24	371.12	25.00
T_{15} - T_9 + T_7	0.27	65.55	11.45	366.10	24.00
T_{16} - T_9 + T_8	0.28	80.65	10.32	378.15	30.50
SE (d)	0.0031	0.3563	0.3086	18.0165	1.2045
CD (P = 0.05)	0.0067	0.7265	0.6578	14.4312	2.401

References

1. Adil OS, Rahim A, Elamin OM, Bangerth FK. Effect of paclobutrazol (PBZ) on floral induction and associated hormonal and metabolic changes of biennial bearing mango (*Mangifera indica* L.) during off year. J Agri. Biol. Sci. 2011; 6(2):55-76.
2. Benjawan C, Chutichudat V, Boontiang K, Chanaboon T. Effect of chemical paclobutrazol on fruit development, quality and fruit yield of Kaew mango (*Mangifera indica* L.) in North East Thailand. Pakistan J Biol. Sci. Informn. 2007; 9(4):717-722.
3. Kulkarni VJ. Chemical control of tree vigour and promotion of flowering in mango (*Mangifera indica* L.) using paclobutrazol. J Hort. Sci. 1988; 63(3):557-566.
4. Panse VG, Sukhatme PV. Statistical Method for Agricultural workers, Indian Council Agriculture Research. New Delhi. 1967; 167-174.
5. Wahdan MT, Habib SE, Bassal MA. Qaoud EM. Effect of some chemicals on growth, fruiting, yield and fruit quality of mango cv. Succary Abiad. J American Sci. 2011; 7(2):651-658.
6. Werner H. Influence of paclobutrazol on growth and leaf nutrient content of mango cv. Blanco. Acta Hort. 1993; 341:225-231.
7. Winston EC. Evaluation of Paclobutrazol on growth, flowering, and yield of mango cv. Kensington pride. Aust. J Exp. Agric. 1992; 32:97-104.
8. Yeshitela TB. Potassuin Nitrate and urea spray affected flowering and yield of 'Tommy Atkins' mango in Ethiopia. South African J Plant Soil. 2004; 32(2):154-172.
9. Yeshitela TB, Stassen PJC. Paclobutrazol suppressed vegetative growth and improve yield as well as fruit quality of 'Tommy Atkins' mango (*Mangifera indica* L.) in Ethiopia. New Zealand J Crops Hort. Sci. 2005; 32: 281-293.