Karnataka J. Agric. Sci.,24 (3) : (362 - 365) 2011

Effect of chemicals on growth, yield and economics of mango (*Mangifera indica* L.)

Y. N. TANDEL AND N. L. PATEL

Regional Horticultural Research Station,
ASPEE College of Horticulture and Forestry
Navsari Agricultural University Navsari-396 450, India
Email : yatintandel1512000@yahoo.co.in

(Received : January, 2010)

Abstract: The pertaining of results opined that the number of fruits per tree and fruit yield per tree and per hectare were recorded the maximum in all mango varieties drenched with paclobutrazol 5g a.i. per tree (cultar 20 ml/tree) in mid July *i.e.* T_1 which was statistically at par with T_2 and T_3. While in case of average weight of mango fruits was obtained maximum in control (T_6) treatment which was at par with treatments T_5 and T_1. On the basis of calculated economics of all three varieties *viz.*, Alphonso, Kesar and Rajapuri, the maximum net realization and CBR was obtained with treatment T_1 *i.e.* paclobutrazol at 5g a.i. per tree (cultar 20 ml/tree) in mid of July. However, more realization and higher CBR was also obtained with other chemical treatments *i.e.* T_2, T_3, T_4 and T_5 as compared to control (T_6).

Key words : Gibberlins, mango, paclobutrazol, vegetative

Introduction

Mangoes are considered alternate bearers, although they are less severely alternate than avocadoes. There is some lack of clarity about their cropping habits and often alternation is used as synonyms for poor yield. One of the most important factors responsible for low yield and inferior orchard efficiency is biennial bearing, which means that the tree carries optimum load of crop in one year, but in the following year it fails to flower or/ and produce unsatisfactory crop. Biennial bearing, alternate bearing or cropping periodicity in mango cropping is synonyms, which are different from unfruitfulness and shy cropping. The most important thing in case of flowering in mango is to produce new vegetative growth in the 'on' year which should also be mature to be ready to enter into reproduction phase and give out flower in following season. Moreover, induction of early flowering results in early maturity of the mango fruits which fetch the higher price in the market as compared to late maturing mango fruits.

Material and methods

A field experiment was conducted at Regional Horticultural Research Station, Navsari Agricultural University, Navsari (Gujarat) for three years from 2005 to 2007. Three chemicals *viz.*, paclobutrazol, ethrel and KNO_3 were tried for their effect on yield and calculated the economics of the treatments along with control. Six treatments comprised of bio-regulators *viz.*, paclobutrazol at 5g a.i. per tree [cultar 20 ml/tree drenched in mid of July (T_1), August (T_2) and September (T_3)]; ethrel 200 ppm (T_4 : 15th September until flower bud differentiation at 15 days interval); KNO_3 2% (T_5 : Mid September and October) along with control (T_6). This investigation was laid out in randomized block design (RBD) with three replications. Fifteen years old one tree of individual variety *viz.*, Alphonso, Kesar and Rajapuri was taken as one replication. Three years data was statistically analysed and pooled data is interpreted here.

Results and discussion

In the present investigation, paclobutrazol (cultar) was applied 20 ml per tree in mid of July, August and September; ethrel (200 ppm) was applied at 15th September until flower bud initiation at 15 days interval, while KNO_3 (2%) was applied twice during mid September and mid October in 'Alphonso', 'Kesar', and 'Rajapuri' mango cultivars. The results obtained were discussed under following headings.

In the present experiment, paclobutrazol, irrespective of time of application, reduced the vegetative growth during October-November. Paclobutrazol applied in mid of July, significantly reduced the number of shoots per terminal in Alphonso, Kesar and Rajapuri. It also checked the growth of new shoots in Alphonso, Kesar and Rajapuri. An application of paclobutrazol (cultar) 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 had been reported by Hoda *et al.*(2001); Shinde *et al.* (2000). Spraying of ethrel and KNO_3 had no significant effect observed on the vegetative growth of the mango by Mendonca *et al.*(2003).

All the chemical treatments in the experiment induced early flowering in mango trees of all the varieties. Application of paclobutrazol (cultar) in mid of July, August and September suppressed the vegetative growth and induced early and profuse flowering during investigation as compared to control. 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 (Kulkarni, 1991). The result of present investigation induced earliness in flowering, advanced fruit maturity and provided opportunities to avail the commercial advantages of early marketing in season. Moreover, the

Table 1. Effect of different bio-regulators on vegetative growth and flowering in different varieties of mango

Treatments	No. of shoots / terminal			Shoot length (cm)			Date of full bloom		
	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri
T_1	0.98	1.02	1.11	11.08	11.40	10.56	24th Dec.	23rd Dec.	18th Dec.
T_2	1.17	1.11	1.27	11.84	12.84	13.30	28th Dec.	3rd Jan.	23rd Dec.
T_3	1.29	1.21	1.30	12.45	13.34	13.40	26th Dec.	24th Dec.	23rd Dec.
T_4	2.08	2.01	2.02	17.54	16.57	16.04	9th Jan.	10th Jan.	13th Jan.
T_5	1.98	2.07	2.03	17.02	17.75	17.00	1st Jan.	12th Jan.	15th Jan.
T_6	2.20	2.25	2.21	22.06	23.90	21.41	15th Jan.	18th Jan.	22nd Jan.
S. Em ±	0.07	0.04	0.06	0.51	0.50	0.49			
CD at 5 %	0.20	0.11	0.16	0.47	1.45	1.41			
CV %	11.81	7.24	9.59	9.80	9.62	9.77			

Note : All interactions between year and treatments were found to be non-significant.

Table 2. Effect of different bio-regulators on fruit setting in different varieties of mango

Treatments	Fruit set at pea stage (%)			Fruit set at marble stage (%)			Fruit set at harvest (%)			Fruit retention (%)		
	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri
T_1	11.74	11.17	11.33	1.68	1.87	1.74	1.07	0.87	1.04	9.10	7.81	9.31
T_2	11.44	10.81	10.93	1.46	1.34	1.65	0.99	0.75	0.92	8.68	6.96	8.50
T_3	11.26	10.52	10.54	1.39	1.30	1.53	0.91	0.67	0.82	8.05	6.43	7.82
T_4	10.35	9.53	9.77	1.20	1.06	1.35	0.67	0.44	0.49	6.47	4.63	5.05
T_5	10.26	9.18	9.82	1.18	1.07	1.38	0.49	0.31	0.43	4.87	3.42	4.34
T_6	8.11	6.30	8.56	0.69	0.63	0.54	0.16	0.07	0.17	2.02	1.19	1.98
S. Em ±	0.32	0.33	0.28	0.09	0.16	0.19	0.04	0.03	0.06	0.31	0.33	0.65
CD at 5 %	0.91	0.93	0.80	0.25	0.59	0.67	0.11	0.08	0.23	0.89	0.96	2.37
CV %	9.00	10.15	8.28	18.09	17.58	11.59	15.22	16.40	15.88	14.09	19.42	18.58

Note : All interactions between year and treatments were found to be non-significant.

application of ethrel and KNO_3 was also found effective for induction of early flowering compared to control in all the cultivars under study. Ethrel releases ethylene when comes in contact with the plant tissue. This, in turn, triggers the mechanism of flowering and brings the shoots to flowering. The earlier flowering in KNO_3 may be due to breaking of dormancy of shoots. Similar effect of ethrel and KNO_3 on induction of early flowering had been reported in mango by Dalal *et al.* (2005).

Results showed that the application of various treatments had significantly increased the production of flowers which ensured an increase in fruit production through higher fruit set within a panicle at pea stage in all the cultivars under study. Improved fruit set in cultar treated trees under different Indian agro-climatic conditions had been reported (Desai, 1993).

Fruit retention at marble stage was also found to be significant. Paclobutrazol applied 20ml per tree in mid July increased the fruit retention in Alphonso, Kesar and Rajapuri. This resulted into higher production of mature fruits at harvest per panicle and hastened the maturity by 20-25 days than the normal harvest period in control. It is obvious that early flowering resulted into early maturity of fruits in paclobutrazol (cultar) treated trees. Application of paclobutrazol had increased the yield in terms of number of fruits and total fruit yield (kg) per tree in all cultivars *viz.*, Alphonso, Kesar and Rajapuri. This increased production could be the cumulative effect of profuse flowering, increased fruit set and retention at marble and maturity stage per panicle in the year of investigation. An increase in production was also achieved in Alphonso at Vengurla, in Maharashtra (Burondkar and Gunjate, 1993), Valsad, in Gujarat (Desai, 1993) and in Andhra Pradesh (Kulkarni, 1991) by application of paclobutrazol. Results also showed that the spraying of ethrel and KNO_3 had significantly increased fruit production as compared to control. Dalal *et al.* (2005) had also achieved the similar results by spraying Ethrel and KNO_3.

The quality of fruits in terms of physical and chemical properties was also rewarded in all the cultivars during the course of experimentation. The trees treated with paclobutrazol in mid September increased pulp: skin ratio and reduced stone weight in all the cultivar. Improvement in above parameters was also observed by Desai (1993) with paclobutrazol treatment.

In the present experiment, chemical composition of fruits revealed that all chemical treatments neither improved nor impaired the reducing, total sugars, acidity and total soluble solids (TSS) in all the cultivars. The present findings are in accordance with Padhiar (2000). The treatments had no significant effect on the shelf life and the weight loss of fruits in all the cultivars.

Economics is the major consideration for the farmers while taking a decision regarding the adoption of a new technology, hence the cost of cultivation, gross income, net income and benefit cost ratio were computed for different treatments. In the

Table 3. Effect of different bio-regulators on quality parameters in different varieties of mango

Treatments	Pulp to skin ratio			Stone weight (g)			TSS (%)		
	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri
T_1	5.46	4.93	5.61	32.88	36.43	53.09	20.20	18.05	16.84
T_2	5.53	4.73	5.71	32.62	36.32	52.51	20.04	17.77	16.55
T_3	5.70	5.58	5.88	30.62	33.68	50.51	20.63	17.68	16.39
T_4	4.81	4.68	5.25	36.79	36.73	52.07	19.39	17.74	16.80
T_5	4.78	5.00	4.91	36.18	35.47	52.34	19.72	17.42	16.79
T_6	4.84	4.73	4.39	38.25	37.89	55.69	19.51	17.25	16.92
S. Em ±	0.14	0.12	0.11	0.82	0.60	0.67	0.24	0.25	0.93
CD at 5 %	0.41	0.33	0.32	2.35	1.73	1.91	0.70	NS	NS
CV %	8.36	7.09	6.35	7.01	4.68	3.74	3.57	4.32	2.27

Note : All interactions between year and treatments were found to be non-significant.

Table 4. Effect of different bio-regulators on yield parameters in different varieties of mango

Treatments	No. of fruits / tree			Average weight of fruit (g)			Yield (kg/tree)		
	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri	Alphonso	Kesar	Rajapuri
T_1	846.1	920.6	714.2	225.2	214.9	603.3	11310	11826	25188
T_2	824.8	872.1	681.1	214.4	213.1	604.1	10458	11124	24096
T_3	808.5	845.3	672.2	207.4	203.9	595.6	9894	10254	23352
T_4	752.1	797.3	626.3	203.5	204.6	619.7	9156	9678	22260
T_5	683.8	816.3	589.4	236.9	200.1	622.1	9708	9732	21654
T_6	514.0	552.5	450.2	240.6	184.3	622.0	7404	6133	16632
S. Em ±	26.95	26.94	17.23	7.92	6.48	18.42	282.6	393.6	399.3
CD at 5 %	76.40	76.39	48.86	22.45	18.38	NS	802.2	1116.6	1138.1
CV %	12.33	11.48	8.72	12.59	10.85	10.41	10.58	14.08	6.78

Note : All interactions between year and treatments were found to be non-significant.

Table 5. Effect of different bio-regulators on economics in different varieties of mango production

Treatment	Yield (kg/ha)	Income (`/ha)	Cost (`/ha)			Net realization (` /ha)	CBR
			Common cost	Treatment cost	Total cost		
				Alphonso			
T_1	11310	226200	30955	6540	37495	188705	5.03
T_2	10458	209160	30529	6540	37069	172091	4.64
T_3	9894	197880	30247	6540	36787	161093	4.38
T_4	9158	183120	29878	4000	33878	149242	4.40
T_5	9708	194160	30154	2300	32454	161706	4.98
T_6	7404	148080	29002	800	29820	118278	3.96
				Kesar			
T_1	11826	177390	30113	6540	36653	140737	3.83
T_2	11124	166860	29762	6540	36302	130558	3.59
T_3	10254	153810	29327	6540	35867	117943	3.28
T_4	9678	145170	29039	4000	33039	112131	3.39
T_5	9732	145980	29066	2300	31366	114614	3.65
T_6	6132	91980	27266	800	28066	63914	2.27
				Rajapuri			
T_1	25188	201504	34594	6540	41134	160370	3.89
T_2	24096	192768	34048	6540	40588	152180	3.74
T_3	23352	196816	33676	6540	40216	146600	3.64
T_4	22260	178080	33130	4000	37130	140950	3.79
T_5	21654	173232	32827	2300	35127	138105	3.93
T_6	16632	133056	30316	800	31116	101940	3.27

Fruit price : Alphonso @ ` 20 per kg, Kesar @ ` 15 per kg and Rajapuri @ ` 8 per kg

present experiment, the highest economical yield with the highest net return and cost benefit ratio in Alphonso, Kesar and Rajapuri was recorded with the treatment of application of paclobutrazol (cultar 20ml per tree) in mid of July.

References

Burondkar, M.N. and Gunjate, R.T., 1993, Control of vegetative growth and induction of regular and early cropping in 'Alphonso' mango with paclobutrazol. Acta Hort., 291: 79-84.

Dalal, S.R., Gonge, V.S., Jadhao, B.J. and Jogdande, N.D., 2005, Effect of chemical on flowering and fruit yield of mango. Int. J. Agric. Sci., 1 : 24-25.

Desai, M. M. 1993. Regulation of flowering in mango (*Mangifera indica* L.) cv. Alphonso. *Ph.D. Thesis*, Gujarat Agric. Univ., S.K. Nagar (India).

Hoda, M.N., Singh, S. and Singh, J., 2001, Effect of cultar on flowering, fruiting and fruit quality of mango cv. Langra. Indian J. Hort., 58 (3) : 224-227.

Kulkarni, V. J., 1991, Chemical control of tree vigour and the promotion of flowering and fruiting in mango (*Mangifera Indica* L.) using paclobutrazol. J. Hort. Sci., 63 (3) 557-566.

Mendonca, V., Ramos, J.D., Menezes, J.B., Innecco, R. and Pio, R., 2003, Utilization of paclobutrazol, ethephon and potassium nitrate in the flowering induction of mango in the semi arid northeast. Ciencia-e-Agrotechnologia, 27 (6) : 1285-1292.

Padhiar, B. V., 2000, Use of paclobutrazol (cultar) in Mango (*Mangifera indica* L.) in South Gujarat. *Ph.D. Thesis*, Gujarat Agric.Univ., S. K. Nagar (India).

Shinde, A.K., Waghmare, B.H., Waghand, R.G and Burondkar H.M., 2000, Effect of dose and time of paclobutrazol application on flowering and yield of mango. Indian J. Plant. Physiol., 5(1) : 82-84.