Influence of flower inducer on flowering, yield and fruit quality of mango (*Mangifera indica* L.) cv. Amrapali planted under different spacing

ABSTRACT

Flowering is the first of several events that lay the foundation for mango production every year. The temperatures below 15°C readily promote floral induction. Decrease in temperature below 20 ^{0}C is common in sub-tropical regions but seldom occurs in many tropical ones. So, an alternative strategy for optimum flower initiation under tropical condition is essentially required for increasing the productivity of plant. Among different strategies evolved, paclobutrazol and potassium nitrate application is effective not only in flower induction but also in early and offseason flower production in mango. Hence, an experiment was conducted to study the effect of paclobutrazol and potassium nitrate on the flowering, fruit yield and quality of Amrapali mango (*Mangifera indica* L.) plants grown under different plant spacings at Horticultural Research Station, OUAT, Bhubaneswar during 2018-19 and 2019-20**.** The experiment was laid out in a Factorial Randomized Block Design with 24 treatment combinations and 2 replications. The treatment combinations consist of four levels of spacings (2.0 x 2.0 m, 4.0 x 2.0 m, 4.0 x 4.0 m, 8.0 x 2.0 m) and 6 levels of chemical treatments (Paclobutrazol@0.25, 0.50 and 0.75 g a.i. per meter of canopy spread and KNO_3@ 2% and 4%) and a control with water application. The results revealed that plants spaced at 4.0 x 4.0 m with application of paclobutrazol 0.50 g a.i. recorded maximum flowering intensity (82.48%), fruit set percentage (6.47%) and yield (11.12 kg/tree). Whereas the fruit quality parameters like TSS, acidity, reducing sugar, total sugar, ß carotene content are not significantly influenced by either due to plant spacing or flower inducer such as paclobutrazol and potassium nitrate.

Key words: Mango, Amrapali, spacing, paclobutrazol, potassium nitrate, flowering, yield, quality

1. INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important tropical and subtropical fruits which are being cultivated throughout the world [1]. It is known as the king of fruits in the Indian sub-continent and is believed to be native to South East Asia, especially Indo-Burma regions. India is the largest producer of mangoes in the world [2]. Flowering is the first of several events that lay the foundation for mango production every year. A fundamental understanding of flowering is essential to efficiently utilize cropping management systems,

which would extend both the flowering and crop production seasons [3, 4]. Flowering is influenced by numerous physiological (carbohydrate reserve and hormonal content) and environmental factors (temperature, rainfall, relative humidity, photoperiod and water stress), among them temperature is one of the major factors which controls flowering phenomenon in most of the fruit crops including mango.

The temperatures below 15°C readily promote floral induction, whereas vegetative growth is generally promoted by warmer temperatures. Decrease in temperature below 20^0 C, which is common in sub-tropical regions but seldom occurs in many tropical ones. Under field conditions of humid tropical climate, the duration of cool inductive temperature (cold units) for reproductive morphogenesis might not be sufficient for a specific cultivar, or may revert from inductive to non-inductive conditions before complete floral induction is achieved. So, an alternative to dependence on the environmental stimulus for flower initiation is evolving management strategies substitute for these signals. Among different strategies evolved to induce flowering in mango crop as a substitute to environment signals, KNO_3 application is effective not only in flower induction but also in early and offseason flower induction in mango [5, 6].

Physiological factor which influenced flowering is carbohydrate reserve and hormonal content. The consideration to use paclobutrazol to increase the flowering intensity and yield is based on the premise that, PBZ stimulates flowering in weakly inductive shoots of fruit crops [7] by inhibition of gibberellins biosynthesis. The inhibitory effect of GA to flowering, probably arises from its ability to mobilize carbohydrate thereby preventing starch accumulation. Once GA level falls below a threshold, starch can start to accumulate allowing the tree's competence to flower to be expressed. Paclobutrazol, a gibberellins inhibitor, also reduces VP level and thereby increases FP/VP ratio which stimulates flowering shoots in weakly inductive shoots of fruit crops [7]. The influence of Paclobutrazol (PBZ) and potassium nitrate on flowering, yield and fruit quality on mango cv. Amrapali has not been studied under Odisha condition.

Hence, this experiment was designed to determine the ability of paclobutrazol (PBZ) and potassium nitrate (KNO_3) to intensify flowering, fruiting and fruit quality of mango cv. Amrapali planted under different spacing.

2. MATRERIALS AND METHODS

The experiment was conducted during 2018-19 and 2019-20 in the Horticulture Research Station, Baramunda, Odisha University of Agriculture and Technology, Bhubaneswar, Odisha. The Horticulture Research Station is about 5 km away from OUAT campus, Bhubaneswar situated at a latitude of 20^0 16' N and longitude of 85^0 47' E with an altitude of 25.5 m above MSL and about 40 km away from Bay of Bengal. The soil was

sandy loam, strongly acidic in reaction and had low organic carbon (< 0.5%) and N content (< 200 kg ha^{-1}). The experiment was carried out on an 8-year-old existing bearing mango orchard (cv. Amrapali) planted under different density and uniform in vigour and canopy spread. The experiment was laid out in a Factorial Randomized Block Design with 24 treatment combinations and 2 replications. The treatment combinations consist of four levels of spacings (2.0 x 2.0 m, 4.0 x 2.0 m, 4.0 x 4.0 m, 8.0 x 2.0 m) and 6 levels of chemical treatments (Paclobutrazol @ 0.25, 0.50 and 0.75 g a.i. per meter of canopy spread and KNO_3@ 2% and 4%) and a control with water application.

The quantified amount of PBZ (Lustar- 28% w/w) was dissolved in 20 litres of water and applied around the root zone by making a ring of 20 cm width and 10-15 cm depth with a radius of 1.5 m from the trunk during 1st week of September 2018 and 2019. For preparation of KNO_3 solution @ 2 % and 4 %, 20 g and 40 g KNO_3 dissolved in one litre of water. Foliar spray of prepared solution of KNO_3 as per the treatments were done to the undersides of leaves using tractor operated sprayer because of the high numbers of stomata on the lower surface [8] during1st week of September and again in 1st week of October, 2018 and 2019. The control trees were treated with water. All the trees were provided with standard orchard management practices including nutrient and pest management.

The flowering intensity was determined on the basis of the number of panicles bearing shoots per square meter canopy area (recorded in four directions) and expressed in percentage. Flowering intensity (%) = (No. of flowering shoots/Total no. of shoots) ×100. The hermaphrodite flower percentage was determined on the basis of number of staminate and hermaphrodite (bisexual) flowers counted at full bloom (> 75% flowers were open) in twenty tagged panicles under each treatment. Fruit set percentage was recorded on the basis of number of fruits retained at pea stage (7-8 mm) and number of bisexual flowers. Fruits were harvested separately in each treatment and average was worked out to express the yield in kg $tree^{-1}$. The shelf life of fruit was noted by keeping the fruits at room temperature and noted the days taken from harvesting to optimum eating stage and expressed in days. Total Soluble Solids (TSS) were measured by digital refractometer (0-85 °Brix, Hanna) and titratable acidity was estimated by 0.1N NaOH method [8]. Ascorbic acid content was estimated in mature fruits by 2,6-dichlorophenolindophenol visual titration method [8]. Reducing sugar was estimated by titrimetric method Lane and Eynon as narrated by Ranganna [9]. The total sugar in the sample was estimated by same method as that of reducing sugar after inversion of the non-reducing sugar using dilute hydrochloric acid and expressed in percentage [9]. ß-carotene value was measured as per the procedure given by

Zhishen *et al*. [10]. The statistical analysis was carried out as per Factorial Randomized Block Design suggested by [11]. The level of significance was tested for different variables at 5 per cent level of significance.

3. RESULTS AND DISCUSSION

3.1 Effect of different plant spacing and chemical treatment on flowering and fruit set

The data pertaining to flowering intensity was significantly influenced by different plant spacing, chemicals and their interaction is presented in Table 1. Pooled data of two years revealed that the maximum flowering intensity was observed in plant spaced at 4.0 x 4.0 m (72.11 %), whereas lowest flowering intensity was observed in 2.0 x 2.0 m spacing (57.20%). These findings are in consonance with the findings reported by Singh *et al*. 2001 in high density planting system in 'Amrapali' mango. The maximum flowering intensity was observed in PBZ application @ 0.50 g a.i. (73.98%), which was followed by PBZ application @ 0.75 g a.i. (69.52%) and minimum flowering intensity was recorded in control (51.19%). Similar results were reported by Yeshitela *et al.* [7]. In interaction effect, maximum flowering intensity was observed in plant spaced at 4.0 x 4.0 m with application of PBZ @ 0.50 g a. i (82.48%) and the lowest (57.23%) was recorded in plants spaced at 2 x 2 m and not applied with any chemicals (45.36%). Similar results were earlier obtained by Yeshitela *et al*. [7].

The minimum percentage of flowering shoots was observed in high density planting because smaller the canopy area available to plants, the higher the tendency to decrease the number of flowering shoots as reported by Sarker and Rahim [12]. Ramírez and Davenport [13] observed that, in closure spacings, plants encounter competition for water, nutrients, and more importantly light which reduces the synthesis of carbohydrates necessary for flowering. Application of paclobutrazol inhibit synthesis of kaurene oxidase in the gibberellin-synthesis pathway, stimulates production of flowering shoots during these weakly inductive conditions [7].

Effect of plant spacing on percentage of hermaphrodite flower was found to be non-significant. Chemical treatments had non-significant effect on % of hermaphrodite flower. In contrast to our observations Kishore *et al*. [14] reported highest percentage of bisexual flowers when PBZ was applied at 0.50 g a.i. m^{-1} canopy spread. Singh [15] reported that apart from enhancing flowering intensity, PBZ was also effective in increasing sex ratio in mango. It may be presumed that reduction in level of GAs due to PBZ could have stimulated the biosynthesis of ethylene, which is responsible for induction of femaleness in many plants.

Moreover, ethylene signalling pathway also mediates the arrest of stamen primordia and in turn reduces the production of male flowers [16, 17]. The interaction effect of spacing and chemical treatment showed non-significant effect on hermaphrodite flower %.

The data relating to fruit set (%) as influenced by the plant spacing, different concentrations of paclobutrazol and KNO_3 and their interaction effect is presented in Table 1. The highest fruit set % was recorded in plants planted at a spacing of 4.0 x 4.0 m (6.01 %) which was at par with the spacing of 8.0 x 2.0 m (5.90 %) and the lowest per cent fruit set was recorded in 2.0 x 2.0 m (5.17 %) spacing. The above findings are in line with that of Singh *et al*. [18] and Sagar *et al*. [19]. Higher fruit setting in plants under wider spacing seems to be due to greater photosynthetic activity, because of exposure of a greater number of leaves to sun light, that availability of proper sunlight to the lower branches of the trees at close spacing becomes a limiting factor and it adversely affects the flowering and fruiting [18]. Similarly, the chemical treatment without considering the effect of planting densities had significantly affected fruit set %. In the present study, the highest fruit set % (6.06%) was observed in PBZ @ 0.50 g a.i. which was at par with PBZ @ 0.25 g a.i. and 0.75 g a.i. /m of canopy area and KNO3@ 4% (5.82%). Fruit set is primarily determined by the transfer of viable pollens on the stigma, pollen germination and fertilization and in all the physiological events gibberellins play an important role. It has been reported that fruit set is reduced significantly if biosynthesis of gibberellins is inhibited by gibberellins inhibiters like paclobutrazol, Serrani *et al.* [20] Interaction of planting density and chemical content had significant effect on fruit set (%) in mango. Highest fruit set % was recorded in plant spaced at 4.0 x 4.0 m with application of PBZ @ 0.50 g a. i. (6.47%).

3.2 Effect of different plant spacing and chemical treatment on fruit yield and shelf life

The data pertaining to yield per plant (kg) was influenced by different plant densities, chemical treatments and their interaction effects are presented in Table 1. Yield per plant in different spacing was found maximum in 4.0 x 4.0 m (9.36 kg) spacing which was followed by 8.0 x 2.0 m (8.45 kg) and the minimum yield per plant was recorded in the treatment 2.0 x 2.0 m (4.16 kg). These findings are in consonance with the findings reported by Singh *et al*. [18] in high density planting system in 'Amrapali' mango. Higher yield per plant in wider spacing might be due to larger canopy volume, higher number of flower bearing shoot and higher fruit set percentage, which ultimately increased the yield per plant [18]. Among the different paclobutrazol and KNO_3 applications, the maximum yield per plant was recorded in

the paclobutrazol at 0.50 g a.i. (8.61 kg) and the minimum yield per plant was recorded in the treatment control (5.67kg). The above finding is similar to those noted by Yeshitela *et al*. [7] and Kishore *et al*. [14]. The interaction of plant spacing and chemicals indicated that the plant spaced at 4.0 x 4.0 m with application of PBZ @ 0.50 g a. i (11.12 kg) recorded maximum yield per plant which was at par with plant spaced at 4 x 4 m and treated with PBZ @ 0.25 g a. i. (9.88 kg) and plant spaced at 8 x 2 m and treated with PBZ @ 0.25 g a. i. (10.10 kg). These results are in line with Upreti *et al.* [21]. Increased fruit yield owing to paclobutrazol treatment was due to increased number of flowering shoots and reduced vegetative / dormant shoots, compared to the control. This is in line with the work done by Burondkar *et al.* [22]. Tandel and Patel [23] reported that application of paclobutrazol increased the yield in all cultivars *viz.,* Alphonso, Kesar and Rajapuri.

Plant spacing and interaction effect of spacing and chemical treatment had no significant effect on shelf life of mango cv. Amrapali planted under different spacing. Whereas chemical treatment had significant effect on shelf life of mango. Highest shelf life was recorded in PBZ treatment @ 0.75 g a.i. (16.97 days) and was at par with PBZ @ 0.50 g a.i. (16.97 days). Minimum shelf life was recorded in control (12.71 days). These finding are in line with Sarker and Rahim [13]. The PBZ can affect the electronic transport which could promote the accumulation of NADH + and H+ in fruit cell, being able to reduce the activity of isocitrate dehydrogenase, allosteric enzyme involved in the regulation of Krebs cycle and diminished the CO_2 production. These effects demonstrate that PBZ has a suppressor effect on fruit ripening and an important effect on postharvest life. Similar conformational statements were also being given by Naleo *et al.* [24].

3.3 Effect of different plant spacing and chemical treatment on fruit quality parameters

The fruit quality parameters like TSS, titrable acidity, reducing sugar, total sugar, ß carotene and ascorbic acid were not influenced by the planting density, chemical treatments and their interaction effect. Kurian and Iyer [25] had made similar observations in their study on Alphonso mango. Singh *et al*. [15] reported that there was no significant effect of different planting systems on TSS and acidity of fruits of ‘Amrapali' mango (*Mangifera indica* L.) planted under five different planting systems. Similarly, Kumawat *et al*. [26] also studied the effect of different spacing on newly planted guava cv, L-49 under ultra high-density planting system and found that planting density did not change significantly most variables related to fruit quality such as TSS, acidity, ascorbic acid, sugar content and organoleptic score of fruits. Lolaei *et al*. [27] and Arzani *et al*. [28] also reported that there was no improvement in

fruit quality with the application of PBZ. However, Arora *et al*. [29] and Martinez *et al*.[30] noticed significant improvement in fruit quality of mango with application of KNO_3.

4. CONCLUSION

In high density planting of Amrapali mango, plants spaced at 4.0 x 4.0 m produced more numbers of flowering shoot, percentage of hermaphrodite flower, fruit set and yield in comparison to plant spaced at 8.0 x 2.0 m, 4.0 x 2.0 m, 2.0 x 2.0 m. Among chemical treatments, PBZ @ 0.50 g a.i. application recorded highest flowering intensity, hermaphrodite flower percentage, fruit set and yield. The interaction of plant spacing of 4.0 x 4.0 m and application of PBZ @ 0.50 g a.i. recorded maximum fruit yield per plant. The fruit quality parameters like TSS, acidity, reducing sugar, total sugar, ß carotene content are not influenced by either due to plant spacing or flower inducer such as paclobutrazol and potassium nitrate.

COMPETING INTRESTS

Authors have declared that there is no competing interests exist in this publication.

REFERENCES

1. Muhammad U, Fatima B and Muhammad JJ. Review: Breeding in mango. International journal of Agricultural Biology.2001; 3:522–526.
2. Muhammad A, Muhammad U, Muhammad JJ, Muhammad MK. Comparative study of flower sex ratio in different cultivars of mango (*Mangifera indica*L.). International journal of Agricultural Biology.2002; 4: 220–222.
3. Chacko EK. Mango flowering-still an enigma. Acta Horticulture.1991; 291, 12–21.
4. Ramirez F, Davenport TL. 2010. Mango (*Mangifera indica* L.) flowering physiology. Scientia. Horticulturae.2010; 126: 65–72.
5. Protacio CM, Bugante RD, Quinto J, Molinyawe G and Paelmo G. Regulation of flowering in Carabao mango tree by paclobutrazol. Philippines Journal of Crop Science.2000;25:27–33.
6. Burondkar MM, Rajan KK, Reddy YTN, Singh VK, Sabale SN, Naik MM, Ngade PM and Saxena P. Advancing Alphonso mango harvest season in lateritic rocky soils of Konkan region through manipulation in time of paclobutrazol application. Journal of Applied Horticulture.2013; 15:178–82.
7. Yeshitela T, Robbertse, PJ, and Stassen PJC. Paclobutrazol suppressed vegetative growth and improved yield as well as fruit quality of ‘Tommy Atkins’ mango

(*Mangifera indica*) in Ethiopia. New Zealand Journal of Crop and Horticultural Science.2004;32(3):281-293.

8. AOAC. Official methods of analysis. Published by Association of Agricultural Chemists, Washington, D.C., U.S.A.12th (Ed.).1975; 1-120.
9. Ranganna, S.1986. Handbook of Analysis and quality control for fruit and vegetable products.
10. Zhishen J, Mengcheng, T and Jianming W. The determination of flavonoid contents in mulberry and their scavenging effects on superoxide radicals. Food Chemistry.1999; 64: 555−559.
11. Gomez KA and Gomez AA. Statistical procedures for agricultural Research.1983; pp 1-120.
12. Sarker BC and Rahim MA. Vegetative growth, harvesting time, yield and quality of mango (*Mangifera indica* L.) as influenced by soil drench application of paclobutrazol. Bangladesh Journal of Agrilcultural Research.2013; 37(2): 335-348
13. Ramirez, F. and Davenport, T. L.Mango (*Mangifera indica* L.) flowering physiology. Scientia Horticulturae. 2010; 126(2): 65–72.
14. Kishore K, Singh HS, Sharma D, Rupa TR, Kurian RM and Samant D. Influence of paclobutrazol on vegetative growth, nutrient content, flowering and yield of Mango (*Mangifera indica* L.) and its residual dynamics.Journal of Agricultural Science and Technology.2019;21(6): 1557-1567.
15. Singh Z. Effect of (2RS, 3RS) Paclobutrazol on Tree Vigour, Flowering, Fruit Set and Yield in Mango. Acta Horticulture.2000;525: 459–462.
16. Weiss D and Ori N. Mechanisms of Cross Talk between Gibberellins and Other Hormones. Plant Physiology. 2007;144: 1240–1246.
17. Yamasaki S, Fujii N and Takahashi H. 2005. Hormonal Regulation of Sex Expression in Plants. Popular Horticulture. 2005; 72: 79-110.
18. Singh S, Yadav GS, Singh, J, Hoda, MN. 2001. High density planting system in 'Amrapali' mango *(Mangifera indica*). Indian Journal of Agricultural Sciences.2001; 71(6): 381-3.
19. Sagar BS, Athani SI, KulapatiHipparagi, Allolli TB, RevanappaGopali JB, Mallikarjun Awati and Raghavendra S. Effect of high-density planting and paclobutrazol on growth and yield of mango (*Mangifera indica* L.) cv. Alphonso.International Journal of Chemical Studies.2019; 7(1): 1846-1851.
20. Serrani JC, Sanjuan R, Ruiz-Rivero O, Fos M and Gracia- Marinez JL. Gibberlin regulation of fruit set and growth in Tomato. Plant physiology.2007; 145**:**246-257

21. Upreti KK, Reddy YTN, Prasad SR, Bindu GV, Jayaram HL and Rajan S. 2013, Hormonal changes in response to paclobutrazol induced early flowering in mango cv. Totapuri. Scientia Horiculturae.2013;150**:** 414-418.

22. Burondkar MM, Rajput JC and Waghmare GM. Recurrent flowering: A new physiological disorder in 'Alphonso' mango. Acta Horticulture.2000; 509: 669-673.

23. Tandel YN and Patel NL.Effect of chemicals on growth, yield and economics of mango (*Mangifera indica* L.). Karnataka Journal of Agricultural Science.2011; 24 (3): 362-365.

24. Naleo S, Sema A, Mait CS. Effect of plant growth regulators and packaging on flowering, fruit quality and shelf life in mango cv. Amrapali. Journal on Experimental Agriculture International. 2018; 20(6):1-8.

25. Kurian RM and Iyer CPA. Chemical regulation of tree size in mango *(Mangifera indica* L.) cv. Alphonso. II. Effects of growth retardants on flowering and fruit set. Journal of Horticultural Science, 1993;68: 355-360.

26. Kumawat KL, Sarolia DK, Kaushik RA, Jodha AS. Effect of different spacing on newly planted guava cv. L-49 under ultra high-density planting system. African Journal of Agricultural Research.2014; 9(51): 3729-3735.

27. Lolaei A, Rezaei M, Khorrami RM and Kaviani B. Effect of Paclobutrazol and Zinc Sulfate on Vegetative Growth, Yield and Fruit Quality of Strawberry (*Fragaria×ananassa* Duch. cv. Camarosa). Annals of Biological Research.2012;3: 4657–4562.

28. Arzani K. and Roosta HR. 2004. Effects of Paclobutrazol on Vegetative and Reproductive Growth and Leaf Mineral Content of Mature Apricot (*Prunus armeniaca*L.) Trees. Journal of Agricultural science and technology. 2004;6: 43–55.

29. Arora R, Singh N and Kaur S. Influence of foliar feeding of KNO_3 on fruit yield and quality parameters of mango. Agricultural Research Journal.2021; 58(5):828-834.

30. Martinez MM, Ramirez PAM, Estrada M and Oliva A. Effect of nitrates alone or with paclobutrazol on flowering induction and production in mango cv. Tommy Atkins. Biotenica.2020; 12(2):20-27.

Table 1. Influence of flower inducer on flowering and yield parameters of mango cv. Amrapali planted under different spacing (Pooled mean of 2018-19 and 2019-2020)

Treatments	Flowering intensity (%)	Hermaphrodite flower (%)	Fruit set at pea stage (%)	Fruit yield (kg/tree)	Shelf life of fruit (Days)
Spacing (S)					
S_1	57.20	10.39	5.17	4.16	14.98
S_2	62.37	13.11	5.44	6.93	15.05
S3	72.11	15.80	6.01	9.36	15.82
S_4	66.60	15.53	5.90	8.45	15.40
S.E m±	0.14	1.31	0.12	0.17	0.46
C.D. at 5%	**0.40**	**NS**	**0.35**	**0.48**	**NS**
Chemical(C)					
C_1	63.82	13.85	5.90	7.69	15.62
C_2	73.98	14.56	6.06	8.61	16.97
C_3	69.52	13.54	5.67	7.26	17.92
C_4	61.78	13.44	5.48	6.83	13.99
C_5	67.13	13.99	5.82	7.31	14.65
C_6	51.19	12.84	4.85	5.67	12.71
S.E m±	0.17	1.61	0.15	0.21	0.56
C.D. at 5%	**0.48**	**NS**	**0.43**	**0.59**	**1.61**
Interaction: Spacing (S) x Chemical (C)					
S_1C_1	56.57	10.51	5.43	4.54	15.29
S_1C_2	65.62	11.00	5.56	4.97	16.64
S_1C_3	61.35	10.27	5.20	4.17	17.59
S_1C_4	54.76	10.18	5.02	3.97	13.66
S_1C_5	59.51	10.66	5.36	4.19	14.32
S_1C_6	45.36	9.70	4.45	3.15	12.38
S_2C_1	61.66	13.21	5.71	7.38	15.36
S_2C_2	71.53	13.95	5.85	8.25	16.71
S_2C_3	67.10	12.97	5.48	7.00	17.66
S_2C_4	59.69	12.87	5.29	6.52	13.73
S_2C_5	64.87	13.34	5.62	7.04	14.39
S_2C_6	49.34	12.30	4.68	5.37	12.45
S_3C_1	71.24	15.96	6.31	9.88	16.13
S_3C_2	82.48	16.86	6.47	11.12	17.48
S_3C_3	77.82	15.51	6.05	9.38	18.43
S_3C_4	68.96	15.51	5.84	8.84	14.50
S_3C_5	74.94	16.08	6.21	9.46	15.16
S_3C_6	57.23	14.87	5.17	7.51	13.22
S_4C_1	65.79	15.71	6.16	8.96	15.71
S_4C_2	76.27	16.44	6.36	10.10	17.06
S_4C_3	71.82	15.42	5.95	8.49	18.01
S_4C_4	63.69	15.21	5.75	7.99	14.08
S_4C_5	69.20	15.88	6.10	8.56	14.74
S_4C_6	52.82	14.49	5.09	6.63	12.80
S.E m±	0.34	3.21	0.16	0.19	1.12
C.D. at 5%	**0.97**	**NS**	**0.45**	**0.54**	**NS**

S_1: 2 x 2 m (2500 plants/ ha), S_2: 4x 2 m (1250 plants/ ha), S_3: 4 x 4 m (625 plants/ ha), S_4: 8 x 2m (625 plants/ ha)

C_1: PBZ @ 0.25 g a. i /m of canopy area, C_2: PBZ @ 0.50 g a. i /m of canopy area, C_3: PBZ @ 0.75 g a. i /m of canopy area, C_4: 2% KNO_3, C_5: 4% KNO_3, C_6: Control.

Table 2. Influence of flower inducer on fruit quality of mango cv. Amrapali planted under different spacing (Pooled mean of 2018-19 and 2019-2020)

Treatments	Total Soluble Solid (^{0}B)	Titrable acidity (%)	Reducing sugar (%)	Total sugar (%)	ß carotene (mg/100g pulp wt.)
Spacing (S)					
S_1	21.08	0.162	4.56	16.81	16.93
S_2	21.58	0.153	4.85	17.16	17.12
S3	21.96	0.128	5.16	17.75	17.32
S_4	21.72	0.138	4.99	17.65	17.26
S.E m±	0.18	0.008	0.15	0.36	0.43
C.D. at 5%	**NS**	**NS**	**NS**	**NS**	**NS**
Chemical(C)					
C_1	21.58	0.146	5.04	17.39	17.12
C_2	21.80	0.123	5.15	17.62	17.54
C_3	21.62	0.136	4.99	17.45	17.29
C_4	21.57	0.156	4.75	17.32	17.04
C_5	21.74	0.147	4.88	17.52	17.33
C_6	21.20	0.165	4.54	16.76	16.63
S.E m±	0.22	0.010	0.18	0.45	0.53
C.D. at 5%	**NS**	**NS**	**NS**	**NS**	**NS**
Interaction: Spacing (S) x Chemical (C)					
S_1C_1	21.07	0.160	4.71	16.85	16.90
S_1C_2	21.49	0.140	4.82	17.13	17.31
S_1C_3	21.10	0.153	4.66	16.94	17.06
S_1C_4	21.06	0.173	4.42	16.78	16.82
S_1C_5	21.37	0.163	4.55	17.02	17.10
S_1C_6	20.35	0.183	4.21	16.16	16.41
S_2C_1	21.57	0.153	5.00	17.22	17.09
S_2C_2	21.99	0.133	5.11	17.40	17.50
S_2C_3	21.60	0.143	4.95	17.27	17.25
S_2C_4	21.56	0.163	4.72	17.14	17.00
S_2C_5	21.87	0.153	4.84	17.32	17.29
S_2C_6	20.85	0.173	4.50	16.61	16.59
S_3C_1	21.95	0.130	5.31	17.79	17.28
S_3C_2	21.97	0.107	5.42	18.02	17.70
S_3C_3	22.00	0.117	5.26	17.85	17.45
S_3C_4	21.94	0.137	5.02	17.72	17.20
S_3C_5	21.96	0.130	5.15	17.91	17.51
S_3C_6	21.91	0.147	4.81	17.18	16.78
S_4C_1	21.71	0.140	5.14	17.69	17.22
S_4C_2	21.73	0.113	5.25	17.92	17.64
S_4C_3	21.76	0.130	5.09	17.75	17.39
S_4C_4	21.70	0.150	4.85	17.62	17.14
S_4C_5	21.74	0.140	4.98	17.81	17.43
S_4C_6	21.69	0.157	4.64	17.08	16.72
S.E m±	0.43	0.019	0.37	0.89	1.05
C.D. at 5%	**NS**	**NS**	**NS**	**NS**	**NS**

S_1: 2 x 2 m (2500 plants/ ha), S_2: 4x 2 m (1250 plants/ ha), S_3: 4 x 4 m (625 plants/ ha), S_4: 8 x 2m (625 plants/ ha)

C_1: PBZ @ 0.25 g a. i /m of canopy area, C_2: PBZ @ 0.50 g a. i /m of canopy area, C_3: PBZ @ 0.75 g a. i /m of canopy area, C_4: 2% KNO_3, C_5: 4% KNO_3, C_6: Control.