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Combined effect of different levels of pruning, nutrition and paclobutrazol on growth and flowering in mango (*Mangifera indica* L.) cv. Alphonso

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Abstract
Favored for its sweetness, richness and flavor, the Alphonso has been called the king of mangoes. Due to its inherent physiological disorders like alternate bearing we have not been able to achieve the expected export of the fruit. Keeping this in view, a field experiment was conducted to find out the effect of pruning, nutrition and plant growth regulators on vegetative growth and flowering in mango (*Mangifera indica* L.) cv. Alphonso for two consecutive years (2017-18 and 2018-19) in the established mango orchard on 7 years old Alphonso mango trees and maintained at 5 X 5 m spacing at Regional Horticultural Research and Extension Centre, Bengaluru. The highly significant observations were made on panicle character like less days to panicle emergence (17.07) recorded in treatment T11, while more number of panicles per tree (205.96), maximum length of the panicle (37.05cm), more number of secondary branches of panicle (33.47) and also maximum chlorophyll content (2.55mg/g) were recorded in treatment T4.

Keywords: Mango cv. alphonso, pruning, nutrition, paclobutrazol and AMC (Arka microbial consortium)

Introduction
A better understanding of the nature of flowering induction in mango is necessary not only for yield sustainability but also for yield increase. Flower initiation is very important because it is the first step and decisive factor towards attaining fruit and it is very complex phenomena in mango (Murti and Upreti, 2000) [14]. Reliable flowering is necessary to obtain consistent mango production in the tropics (Nagao and Nishina, 1993) [15]. Tropical climates are conducive to year-round vegetative growth of perennial tropical fruit crops, but flowering and fruit set are usually seasonal. Mango is a tropical evergreen fruit crop having a strong tendency towards alternate or biennial bearing habit. Alternate bearing is one of the major problems in mango production all over the world including India (Silva *et al.*, 2010) [3].
The flower bud formation has a strong link to the maturity of the terminal resting shoots (Davenport, 2007) [4]. The regulation of vegetative growth is important for regulation of flowering. Through training, pruning, use of chemicals *etc*. may eventually leads to synchronous rhythmic growth and terminal flowering (Damberville *et al.*, 2014) [3]. Pruning not only caused an uniform flush of growth throughout the canopy, but also removed the growth and flower inhibiting factors in stems derived from previous seasons of flowering and fruiting panicles (Davenport, 2006) [5]. The improvements in crop productivity in modern agricultural systems are increasingly dependent on manipulation of the physiological activities of the crop by chemical means. The first use of paclobutrazol (PBZ) in mango came from India where Kulkarni (1988) [12] tested concentrations of 1.25 to 10 g a.i per tree on Dashehari and Banganapally. Paclobutrazol (PBZ) is widely used in mango and its application inhibits the synthesis of gibberellins, alters the phloem/xylem ratio, and affects the redistribution of metabolic substances necessary for the processes of flowering and fruiting (Paulas and Shanmugavelu, 1988) [20]. In mango, favourable effect due to PBZ application has been reported on for induction of flowering and fruiting (Sharma *et al.*, 2011) [29] and an increase of flowering percentage (Vijaykrishna *et al*., 2016) [38].

INM can be achieved by adopting practices such as application of organic manure like FYM, vermicompost, use of bio-fertilizers, in addition to inorganic fertilizers. The integrated nutrient management is the most appropriate approach for managing the nutrient input. INM system ensures high yields and sustains the available nutrients in the soil at optimum level (Boora, 2016) [1]. An integrated use of the organic manures and chemical fertilizers in combination at appropriate time could help in achieving the goal of obtaining high fruit yield and pave the way for sustainable fruit production. In current scenario of organic horticulture, biofertilizers more commonly known as microbial inoculants are choice of the farmers (Srivastava *et al.*, 2009) [32]. These are artificially multiplied cultures of certain soil microorganisms that can improve soil fertility and crop productivity. Bio-fertilizers not only provide growth promoting activity to the plant by enhancing the nutrient uptake but also provide strength against soil borne diseases. In mango, favourable effect of INM system has been reported in increased the yield (Satapathy and Banik, 2002; Boora, 2016) [27, 1].

Material and methods

The experiment was carried out on an uniform trees (7 years) of cultivar Alphonso during 2017-18 and 2018-19 which are maintained at 5 X 5 m spacing at Regional Horticultural Research and Extension Centre, UHS campus, GKVK, Bengaluru.

Treatment details of the experiment

T1 = control (No pruning and only RDF); T2 = Shoot pruning at 10cm length + RDF; T3 = Shoot pruning at 10cm length + PBZ @ 0.75g a.i./ m canopy diameter + 75% of RDF + 5kg vermicompost +20g of AMC + Mango special(spray); T4 = Shoot pruning at 10cm length + PBZ @ 0.75g a.i./ m canopy diameter + 75% of RDF + 10kg vermicompost + 2 g of AMC + Mango special(spray); T5 = Shoot pruning at 10cm length + PBZ @ 1.25g a.i./ m canopy diameter + 75% of RDF + 5kg vermicompost +20g of AMC + Mango special(spray); T6 = Shoot pruning at 10cm length + PBZ @ 1.25g a.i./ m canopy diameter + 75% of RDF + 10kg vermicompost + 20g of AMC + Mango special(spray); T7 = Shoot pruning at 20cm length + RDF; T8 = Shoot pruning at 20cm length + PBZ @ 0.75g a.i./ m canopy diameter + 75% of RDF + 5kg vermicompost + 20g of AMC + Mango special(spray); T9 = Shoot pruning at 20cm length + PBZ @ 0.75g a.i./ m canopy diameter + 75% of RDF + 10kg vermicompost + 20g of AMC + Mango special(spray); T10 = Shoot pruning at 20cm length + PBZ @ 1.25g a.i./ m canopy diameter + 75% of RDF + 5kg vermicompost + 20g of AMC + Mango special(spray); T11 = Shoot pruning at 20cm length + PBZ @ 1.25g a.i./ m canopy diameter + 75% of RDF + 10kg vermicompost + 20g of AMC + Mango special(spray).

Treatment imposition for experiment

This investigation was laid out in randomized complete block design (RCBD) with three replications. Two years data was statistically analysed and pooled data is interpreted here. Pruning was carried out in 3rd week of July of year 2017 and 2018, application of paclobutrazol in the last week of September of year 2017 and 2018 and fertilizer application in 2 split doses (first half dose in July of year 2017 and 2018 along with FYM and AMC, second half dose in October of year 2017 and 2018), mango special 3 sprays (before flowering, after flowering, during fruit setting) in year 2017 and 2018. The observations were recorded on three trees for each treatment. The data on the morphological characters like plant height and canopy spread were measured before initiation of experiment and after six months of PBZ application and difference increase between each parameter was calculated. After the emergence of new shoots, 10 shoots were tagged in all the directions of tree, and the girth and length of new shoots produced were recorded during the month of December. Fully developed ten leaves were randomly detached from shoots six months after PBZ application and their chlorophyll content was estimated by using DMSO (Dimethyl Sulphoxide) method (Hiscox and Israelstam, 1979) [10]. The total number of panicles per tree were counted in all four directions of the tree and the total number of panicles was expressed by adding all those taken values.

Results and discussion

Vegetative Parameters

Plant spread (N-S) (m), Plant spread (E-W) (m), Tree height (m) and Tree volume (m^3)

The pooled mean of different treatments of two years are presented in Table 1. The maximum increase in spread 0.59m (N-S) and 0.51m (E-W) was recorded by T7. The treament T10 recorded least increase in tree height (0.11m) followed by T5 (0.12m). The maximum increase in tree height (0.15m) was recorded by control. The maximum increase in tree volume (6.44m^3) was recorded with T7 which was found statistically at par with T2 (6.30m^3) and T4 (6.26m^3) while minimum increase in tree volume (4.82m^3) was found in (T10).

Results are in confirm with Uddin *et al.* (2014) [36] in mango cv. BARI Aam-3 and Rawat and Rajbhar (2018) [24] in *cvs.* Dashehari, Bombay Green, Banarasi Langra and Chausa, who reported increased plant spread, reduced plant height and increased tree volume with pruning. These studies support the findings of our research that increased plant spread with pruning. This increased growth due to the high rate of biosynthesis of gibberellic acid with pruning as evident from the results of Srilatha *et al.* (2015) [31]. In the present study the results recorded in combination of pruning, PBZ and INM are on par with control and pruning treatments. This may be due to the nutrient present in vermicompost, AMC and micronutrient spray may suppress the effects of PBZ in reducing the vegetative growth. Our results are in conformity with Cooke (1967) [2] who found that plant height is enhanced significantly by FYM levels due to its characteristics of improving soil physical properties, releasing nitrogen slowly and to facilitate the wider absorption of macro and micro nutrients which helps in better growth and development of plants (Kononova, 1966) [11]. Phenolic compounds formed from organic matter also have favourable effect on plant height. Application of organic manures has been shown to enhance Zn content in leaves (Rathi, 2004) [23]. Zn has been shown to be involved in the biosynthesis of IAA (Taiz and Zeiger, 1998). Better growth in the plants treated with organic manures may be because of more IAA biosynthesis in the plants. And also in confirm with findings of Gautam *et al.* (2012) [8] in mango cv. Sunderja and Boora (2016) [1] in mango cv. Dashehari who reported that the vegetative growth parameters, *viz.* plant height, canopy height, plant spread as well as tree volume were influenced significantly by the application of integrated nutrient management and registered the maximum plant height, canopy height, plant spread and tree volume.

Number of new shoots and shoot length (cm)

Observation recorded on number of new shoots and shoot length are presented in Table 2. The data of pooled mean revealed that maximum number of new shoots (3.10) was found with T7, while minimum number of new shoots (1.63) was recorded with control. Minimum shoot length (17.72cm) was observed with T10, while maximum shoot length (26.92cm) was recorded with T2. Increased growth due to pruning was probably due to diversion of enormous nutrients to pruned shoots. This results are in confirmatory with Shaban (2009) [28] in mango *cvs.* Zebda and Rawat and Rajbhar (2018) [24] in mango cv. Dashehari. The most pronounced effect of PBZ is reduction in shoot length as a consequence of reduced internodal elongation through its anti-gibberellins activity. Similar results are obtained by Tandel and Patel (2011) [34] in mango cv. Alphonso, Kesar, Rajapuri and Pal *et al.* (2017) [16] in mango cv. Himsagar, also in confirmatory with the results of Poonia *et al.* (2018) [21] in mango cv. Dashehari with respect to INM.

Shoot girth (mm)

The data recorded in Table 2 reflect the two years observation for shoot girth. The higher value for girth of the shoot (8.29mm) was found in control, while least value for shoot girth (6.08mm) was recorded in T10. Reduced shoot girth with pruning is in confirm with Srilatha *et al.* (2015) [31] who reported reduced shoot girth with previous seasons growth pruning in mango. Such growth reduction responses of pruning might be result of decline in photosynthate production and changes in phytohormonal production and their translocation from roots to shoot. Suppression of vegetative growth by PBZ could be the enhancement of total phenol content of terminal buds and alters the xylem to phloem ratio of the stem (Kurian and Iyer, 1992) [13]. This results are in confirmation with Sarkar and Rahim (2012) [26] in mango cv. Amrapali and Pal *et al.* (2017) in mango cv. Himsagar.

Internodal length of shoot (cm), number of leaves per shoot and leaf area (cm^2)

The data on internodal length of shoot and number of leaves per shoot are presented in Table 3. The pooled data revealed that maximum value for internodal length (3.62cm) was recorded with control. The minimum value for internodal length of the shoot (2.02cm) was recorded with T10. The number of leaves per shoot observed maximum (19.47) with T7 while minimum (16.67) was recorded with T11. The pooled mean data presented in Table 3 with respect to leaf area showed that its maximum value (62.25cm^2) was observed in control, while minimum value for leaf area (49.72cm^2) was recorded with T10. The most pronounced effect of PBZ is reduction in shoot length as a consequence of reduced internodal elongation through its anti-gibberellins activity. Reduction in gibberellins synthesis leads to reduced cell elongation which inturn reduces the leaf area. Further, suppression of vegetative growth by PBZ could be the enhancement of total phenol content of terminal buds and alters the xylem to phloem ratio of the stem (Kurian and Iyer, 1992) [13]. The growth inhibitory response of PBZ observed in the study are in line with earlier findings of Teferi *et al.* (2010) [35] in mango cv. Tommy atkins and Sarkar and Rahim (2012) [26] in mango cv. Amrapali.

Thus the combination of pruning, PBZ and INM treatments were expected to maintain the tree vegetative growth as evident from our results as against growth inhibitory action of PBZ.

Chlorophyll content (mg/g)

The data related to chlorophyll content is presented in Table 3. The pooled mean of 2 year data on chlorophyll content reflected that its maximum value (2.55mg/g) was registered with T4 while minimum (1.38mg/g) was recorded with control. There are two possible explanations for this response. One is that paclobutrazol mainly interfering with the biosynthesis of gibberellin causing inhibition of cell elongation thereby chlorophyll gets more concentrated in reduced cell volume. Secondly there is evidence that the amount of chlorophyll actually increased because of phytyl, an essential component of chlorophyll molecule is produced via the same terpenoid pathway as gibberellins. Paclobutrazol treatment, which blocks the production of gibberellins, results in the shunting of the intermediate compounds from gibberellin synthesis to the production of even more phytyl. However, whether the increased chlorophyll content of paclobutrazol treated leaves is a result of enhanced chlorophyll synthesis or is simply a result of a "concentrating effect" due to reduced leaf expansion is worthwhile to study (Wang *et al.*, 1985) [40]. Our results are in accordance with Venkatasubbaiah *et al.* (2018) [37] who reported that with application of PBZ there is increased content of chlorophyll in Banginapally mango leaves. Eiada *et al.* (2013) [6] in pomegranate and Nithinkumar *et al.* (2017) [16] in mandarin reported that there is increase in chlorophyll content with micronutrient spray. These studies are in confirm with our results which are obtained in our investigation that micronutrient sprayed trees showed more chlorophyll content compared to non-sprayed trees.

Flowering parameters

Days taken to panicle emergence

Minimum duration for panicle emergence (17.07 days) was observed with T11, while maximum duration for panicle emergence (20.72 days) was recorded in control and data is presented in Table 4. Pruning removed the growth and flower inhibiting factors in stems derived from previous seasons of flowering and fruiting panicles (Davenport, 2006) [4]. Yeshitela *et al.* (2005) [42] used pruning for flowering synchronization of keit and Tommy Atkins mango trees. Pruning besides better light penetration, forces the early initiation of newshoots causing them to reach maturity which have the sufficient time for accumulation of photosynthates that are promotory for flowering (Oosthuyse, 1997) [17]. Soil drenching of paclobutrazol given to regulate cropping tended to reduce the vegetative growth by antagonize the action of gibberellins may be the reason of advancement in flowering and reduction in duration of final harvest. 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) [12]. In general, triazoles, owing to its anti-gibberellin activity, could induce or intensify flowering by blocking the conversion of kaurene to kaurenoic acid (Voon *et al.*, 1991) [39]. Early flowering in paclobutrazol treated trees was also reported by Kulkarni (1988) [12] and (Gopu *et al.*, 2017) [9]. Application of paclobutrazol encouraged early reduction of endogenous gibberellins levels within the shoots which in turn resulted in earlier maturity than untreated control and induce early and intense flowering. Similar confirmational results are recorded with Protacio (2013) in mango cv. Carabao, Sarker and Rahim (2012) [26] in mango cv. Amrapali and Patel *et al.* (2016) in mango cv. Alphonso.

Table 1: Effect of combination of different levels of pruning, nutrition and PBZ on the extent of changes in morphological attributes of mango cv. Alphonso.

Treatments	Plant spread (E-W) (m)			Plant spread (N-S) (m)			Tree height (m)			Tree volume (m^3)		
	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean
T1(control)	0.46	0.47	0.47	0.53	0.54	0.53	0.15	0.14	0.15	5.96	5.09	5.53
T2(P1+RDF)	0.50	0.49	0.50	0.56	0.57	0.57	0.14	0.14	0.14	6.41	6.20	6.30
T3(P1+PBZ1+N1)	0.43	0.42	0.43	0.46	0.45	0.45	0.13	0.12	0.13	5.28	5.17	5.23
T4(P1+PBZ1+N2)	0.49	0.47	0.47	0.57	0.59	0.58	0.14	0.13	0.14	6.33	6.18	6.26
T5(P1+PBZ2+N1)	0.41	0.40	0.40	0.43	0.41	0.42	0.12	0.11	0.12	4.96	4.77	4.87
T6(P1+PBZ2+N2)	0.43	0.41	0.42	0.47	0.47	0.47	0.13	0.13	0.13	5.36	5.25	5.31
T7(P2+RDF)	0.51	0.50	0.51	0.60	0.59	0.59	0.15	0.14	0.14	6.63	6.25	6.44
T8(P2+PBZ1+N1)	0.42	0.41	0.41	0.44	0.44	0.44	0.12	0.12	0.12	5.07	4.99	5.03
T9(P2+PBZ1+N2)	0.46	0.46	0.46	0.54	0.57	0.55	0.14	0.14	0.14	5.87	5.98	5.93
T10(P2+PBZ2+N1)	0.42	0.39	0.41	0.43	0.43	0.43	0.11	0.11	0.11	4.88	4.77	4.82
T11(P2+PBZ2+N2)	0.42	0.41	0.41	0.46	0.44	0.45	0.13	0.12	0.13	5.25	5.17	5.21
S. Em±	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.14	0.10	0.10
CD at 5%	0.06	0.04	0.03	0.03	0.05	0.02	0.04	0.04	0.03	0.41	0.31	0.27

P1 - Shoot pruning at 10cm length; P2 - Shoot pruning at 20cm length.
PBZ1 - @ 0.75 g a.i. / m canopy diameter; PBZ2 - @ 1.25 g a.i. / m canopy diameter.
N1 -75% of RDF + 5Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray);
N2 -75% of RDF + 10Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray).

Table 2: Effect of combination of different levels of pruning, nutrition and PBZ on vegetative growth parameters of mango cv. Alphonso.

Treatments	Number of new shoots			Shoot length (cm)			Shoot girth (mm)		
	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean
T1(control)	2.37	0.90	1.63	24.37	25.03	24.70	8.20	8.38	8.29
T2(P1+RDF)	2.97	2.97	2.97	26.50	27.33	26.92	7.33	7.40	7.37
T3(P1+PBZ1+N1)	2.73	2.57	2.65	21.40	20.63	21.02	6.57	6.63	6.60
T4(P1+PBZ1+N2)	2.85	2.87	2.86	21.63	20.53	21.08	6.87	6.93	6.90
T5(P1+PBZ2+N1)	2.64	2.37	2.50	18.33	18.10	18.22	6.17	6.07	6.12
T6(P1+PBZ2+N2)	2.70	2.63	2.67	18.80	18.40	18.60	6.40	6.47	6.43
T7(P2+RDF)	3.13	3.07	3.10	26.73	26.17	26.45	7.40	7.27	7.33
T8(P2+PBZ1+N1)	2.70	2.63	2.67	19.50	17.27	18.38	6.40	6.30	6.35
T9(P2+PBZ1+N2)	2.73	2.80	2.76	20.40	19.17	19.78	6.57	6.33	6.45
T10(P2+PBZ2+N1)	2.53	2.57	2.55	18.23	17.20	17.72	6.12	6.03	6.08
T11(P2+PBZ2+N2)	2.57	2.63	2.60	19.10	17.80	18.45	6.22	6.17	6.19
S. Em±	0.05	0.07	0.11	0.94	0.51	0.52	0.16	0.19	0.11
CD at 5%	0.14	0.20	0.30	2.78	1.51	1.47	0.47	0.55	0.32

P1 - Shoot pruning at 10cm length; P2 - Shoot pruning at 20cm length.
PBZ1 - @ 0.75 g a.i. / m canopy diameter; PBZ2 - @ 1.25 g a.i. / m canopy diameter.
N1 -75% of RDF + 5Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray);
N2 -75% of RDF + 10Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray).

Table 3: Effect of combination of different levels of pruning, nutrition and PBZ on vegetative attributes of mango cv. Alphonso.

Treatments	Internodal length of the shoot (cm)			Number of leaves per shoot			Leaf area (cm^2)			Chlorophyll content (mg/g)		
	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean
T1(control)	3.53	3.70	3.62	19.23	19.10	19.17	62.58	61.91	62.25	1.23	1.52	1.38
T2(P1+RDF)	3.10	3.27	3.18	19.40	19.13	19.27	58.51	59.69	59.10	1.34	1.63	1.48
T3(P1+PBZ1+N1)	2.77	2.80	2.78	17.97	17.13	17.55	54.31	53.74	54.02	1.82	1.85	1.83
T4(P1+PBZ1+N2)	2.61	2.53	2.57	18.20	18.47	18.31	54.07	54.78	54.43	2.56	2.66	2.61
T5(P1+PBZ2+N1)	2.20	1.87	2.03	16.93	16.47	16.70	50.29	50.18	50.23	2.18	2.26	2.22
T6(P1+PBZ2+N2)	2.33	1.93	2.13	17.57	16.23	16.90	52.27	52.17	52.22	2.38	2.43	2.41
T7(P2+RDF)	3.07	3.13	3.10	19.60	19.33	19.47	59.30	58.28	58.79	1.52	1.58	1.55
T8(P2+PBZ1+N1)	2.43	2.37	2.40	17.43	16.63	17.03	51.54	52.49	52.02	2.02	2.12	2.06
T9(P2+PBZ1+N2)	2.53	2.30	2.42	18.23	17.40	17.82	52.43	51.10	51.77	2.51	2.61	2.55
T10(P2+PBZ2+N1)	2.07	1.97	2.02	17.23	16.43	16.83	49.55	49.89	49.72	2.24	2.31	2.28
T11(P2+PBZ2+N2)	2.17	2.00	2.08	16.93	16.40	16.67	51.24	50.57	50.90	2.39	2.46	2.45
S. Em±	0.06	0.11	0.07	0.22	0.57	0.28	0.57	0.53	0.39	0.08	0.11	0.07
CD at 5%	0.19	0.32	0.20	0.66	1.67	0.80	1.70	1.55	1.12	0.24	0.33	0.20

P1 - Shoot pruning at 10cm length; P2 - Shoot pruning at 20cm length.
PBZ1 - @ 0.75 g a.i. / m canopy diameter; PBZ2 - @ 1.25 g a.i. / m canopy diameter.
N1 -75% of RDF + 5Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray);
N2 -75% of RDF + 10Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray).

Table 4: Effect of combination of different levels of pruning, nutrition and PBZ on flowering parameters of mango cv. Alphonso.

Treatments	Days taken to panicle emergence			Number of panicles per tree			Length of the panicle (cm)			Number of secondary branches of panicle		
	2017-18	2018-19	Mean	2017-18	2017-18	2017-18	2017-18	2018-19	Mean	2017-18	2018-19	Mean
T1(control)	20.93	21.50	20.72	4.37	117.85	61.11	28.10	29.43	28.77	26.77	27.80	27.28
T2(P1+RDF)	19.00	18.83	18.92	50.32	132.65	91.49	31.47	32.68	32.07	29.03	28.70	28.87
T3(P1+PBZ1+N1)	17.90	17.67	17.78	76.49	180.68	128.59	34.77	33.77	34.17	32.87	33.20	33.03
T4(P1+PBZ1+N2)	17.23	17.27	17.25	190.33	221.58	205.96	37.63	36.47	37.05	33.37	33.57	33.47
T5(P1+PBZ2+N1)	17.33	17.30	17.32	80.41	140.68	110.55	32.63	35.35	34.14	32.83	32.33	32.58
T6(P1+PBZ2+N2)	17.07	17.13	17.10	88.65	144.68	116.66	34.13	32.69	33.41	32.70	32.30	32.50
T7(P2+RDF)	18.47	18.53	18.50	60.41	134.41	97.41	32.78	31.46	32.12	29.40	29.07	29.23
T8(P2+PBZ1+N1)	17.30	17.30	17.30	57.67	178.38	118.03	32.15	33.34	32.74	33.17	32.53	32.85
T9(P2+PBZ1+N2)	17.30	17.20	17.25	130.70	196.49	163.60	34.17	35.56	34.86	33.30	33.27	33.28
T10(P2+PBZ2+N1)	17.17	17.27	17.22	86.55	140.49	113.52	33.45	30.89	32.17	32.23	32.83	32.53
T11(P2+PBZ2+N2)	17.08	17.07	17.07	75.67	136.62	106.14	32.50	34.53	33.51	32.87	33.10	32.98
S. Em±	0.14	0.18	0.11	6.34	1.15	7.04	0.57	0.55	0.37	0.43	0.79	0.42
CD at 5%	0.42	0.54	0.31	19.65	3.39	19.98	1.70	1.62	1.05	1.28	2.32	1.19

P1 - Shoot pruning at 10cm length; P2 - Shoot pruning at 20cm length.
PBZ1 - @ 0.75 g a.i. / m canopy diameter; PBZ2 - @ 1.25 g a.i. / m canopy diameter.
N1 -75% of RDF + 5Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray);
N2 -75% of RDF + 10Kg Vermi compost + 20 g Arka microbial consortium + Mango special (spray).

Length of the panicle (cm) and number of secondary branches of panicle

Observations recorded on length of the panicle are presented in Table 4 showed maximum length of the panicle (37.05cm) was obtained with the treatment T4, while minimum value (28.77cm) for length of the panicle recorded with control. It is evident from the data presented in Table 4 that number of secondary branches of panicle were observed higher (33.47) with T4. The lower number of branches per panicle (27.28) was obtained in control. The similar results obtained by Shaban (2009) [28] in mango cv. Zebda, Srilatha *et al.* (2015) [31] in mango cultivars Raspuri, Dashehari, Amrapali and Rodge and Pujari (2017) [25] in mango cv. Alphonso. Who reported pruning results higher panicle length and more number of branches per panicle compared with control in mango. Removal of apical buds by pruning stimulates the initiation of axillary shoots in lateral buds. According to Uddin *et al.* (2014) [36] pruning also effective in diverting organic substances, mineral nutrients and water to productive branches. Consequently, the mango trees have earlier and more uniform flushing, faster flush maturation, better response to flower induction, better fruit set and fruit yield.

PBZ can considerably enhance the total phenolic content of terminal buds and alter the phloem to xylem ratio of the stem. Such alterations could be important in enhancing flowering by altering assimilate partitioning and patterns of nutrient supply for new growth. The above results are in agreement with Sarkar and Rahim (2012) [26] in mango cv. Amrapali and Vijaykrishna *et al.* (2016) [38] in mango cv. Banganapally. The results are in agreement with Yadav *et al.* (2011) [41] in mango cv. Amrapali reported that panicle length was increased with INM. It could be due to timely supply of all nutrients resulted in increased panicle growth of plant. Evergreen, unlike deciduous trees, do not normally store large reserves of manufactured foods and the growth is more closely related to currently available status of nutrients. Moreover application of FYM, vermicompost and biofertilizer help in development of the physical, chemical and biological properties of soil which helps in better nutrient absorption and utilization by plant, ultimately led to increased growth and production.

Conclusion

On the basis of experimental findings, it can be concluded that among the different treatment combinations the treatment pruning at 10cm length in association with the soil drenching of PBZ @ 0.75g a.i./ m canopy diameter and application of 75% of RDF, 10kg vermicompost, 20g of AMC and mango special spray was most promising for regulating flowering in high density orchard of mango cv. Alphonso.

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