

Response of growth regulating chemicals on branching and early canopy development in mango (*Mangifera indica*)

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ABSTRACT

An experiment was conducted to enhance early canopy formation and precocity in mango (*Mangifera indica* L.), involving treating of grafted saplings with PBZ, TIBA, 6-BAP and tip pinching for hastening bearing and induction of early branching for quick canopy formation. The results showed that plant height, stem girth, number leaves and primary laterals were found non-significant in mango Dashehari, however, maximum number of primary laterals (3.67) was noted in T₈ (pinching 5 cm) and maximum chlorophyll 'a' (1.89 mg/100 g) and total chlorophyll content (2.26 mg/100 g) were recorded in T₇. Similarly in Amrapali, maximum number of leaves (61.00) and highest number of primary laterals/plant (5.00) were noticed under treatment T₈ (pinching 5 cm removing shoot apex). In Chausa, highest number of leaves (56.68) and maximum number of primary laterals (5.00) were recorded in treatment T₈ (pinching 5 cm) and minimum number of leaves/ plant (31.00) and number of primary laterals (2.00) was recorded in T₂ (6-BAP 100 ppm) and T₇ (PBZ1500 ppm) respectively.

Key words: Branching, Canopy development, Juvenility, Hormones, Pinching, Branching

Mango (*Mangifera indica* L.) is commercially most important fruit crop in India. Uttar Pradesh holds the largest share of mango production in India, accounting for approximately 23.58-25.76% of the total, with the specific percentage varying by reporting period. Juvenility in mango, characterized by an extended non-fruiting vegetative phase, poses a major challenge in commercial fruit production. Young mango trees may take 5-7 years before transitioning into the reproductive stage, during the period orchardists incur continuous expenses on irrigation, nutrition, disease and pest control, and canopy development and management without any financial gain. Production of branched nursery plants is a critical operation for quality planting material production and its potential to bring higher and earlier yield, after planting (Van Oosten, 1978; Sadowski *et al.* 2007). A good root system, strong stem, well-developed crown with abundant number of laterals are criteria for quality nursery plants.

Growers required such trees for orchard establishment (Preston, 1968). Helail and Eissa (1997) recorded that spray of Paclobutrazole or TIBA along with root shortening and stem pinching were found most effective treatment in enhancing root and shoot branching and improved growth parameters. Islam *et al.* (2006) reported that grafted mango planted at 0.75-1 m distance in hedgerow system along with pruning and pinching during February produced the abundant laterals for scion growth. For encouraging laterals by altering apical dominance, several methods have been used,

the most reliable is pinching and pruning of youngest leaves; keeping desired conical tree shape and wide crotch angle of feathers (Wertheim, 1978; Van den Berg 2003). However, mechanical pinching is labor intensive Job (Volz *et al.* 1994; Jung and Lee 2008). By modifying hormonal balance within the plant, growth regulators can help optimize canopy shape and improve the overall efficiency of light use, which ultimately contributes to higher productivity. Hence an experiment was conducted on enhance early canopy development in mango.

MATERIALS AND METHODS

The investigation was carried out during 2023-2024 at ICAR-Central Institute for Subtropical Horticulture, Lucknow (Uttar Pradesh), India, representing subtropical climate located at 26° 51' 0.0000" N and 80° 56' 59.9892" E, annual rainfall 750-800 mm. The soil is coarse sandy loam, clay content 1.6-3.1% and pH ranging 7.75. Freshly grafted mango plants were taken (6-7 months after grafting) for laying out experiment, involving 04 varieties *i.e.* Dashehari (V₁), Amrapali (V₂) and Chausa (V₃) and separately treated with different concentration of T₁, T₂, 6-Benzylaminopurines 800 & 1000 ppm, T₃, T₄-TIBA 125, 150 ppm, (Tri Iodo Benzoic Acid), T₅, T₆, T₇-pacloburazol (PBZ) 1500, 2000 & 2500 ppm, T₈-Pinching of apical portion of shoots 5 cm, T₉- 10 cm respectively and T₁₀ - control (plain water spray). Containers (30 × 30 cm) of black in color of 400 gauge thickness were taken and filled with growing media comprising garden soil FYM, vermi-compost, neem cake, bonemeal and leaf mould (50% soil, 25% FYM, 10 % each vermi compost and bonemeal and 5% leaf mould) and filled in containers for raising the mango

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Table.1: Effect of plant bio-regulators and pinching of grafted mango seedlings on lateral induction and chlorophyll contents Dashehari mango.

Treatment	Tree height (cm)	Trunk dia. (mm)	No. of leaves/ plant	No. of primary laterals	Chlorophyll 'a' mg/ 100 g	Chlorophyll 'b' mg/ 100 g	Total chlorophyll mg/ 100 g
T ₁	72.37	16.93	30.67	1.67	0.93	0.28	1.27
T ₂	59.38	20.01	34.00	3.33	0.93	0.33	1.27
T ₃	65.7	22.84	34.00	3.00	1.63	0.47	2.06
T ₄	78.35	23.48	28.33	4.00	1.69	0.53	2.19
T ₅	73.37	18.89	36.67	3.33	0.86	0.36	1.23
T ₆	86.07	23.13	31.67	1.67	1.43	0.46	1.87
T ₇	71.39	20.77	46.00	3.33	1.89	0.37	2.26
T ₈	65.77	18.08	42.67	3.67	1.75	0.44	2.19
T ₉	72.03	18.45	50.00	3.33	1.56	0.43	1.99
T ₁₀	86.37	16.14	34.33	1.33	0.93	0.33	1.26
C.D. (p=0.05)	NS	NS	NS	NS	0.15	0.14	0.2
SE(d)	10.58	2.85	9.78	1.3	0.07	0.05	0.09
C.V.	17.62	17.29	32.56	55.44	6.45	15.32	6.61

T₁, T₂, 6-Benzylaminopurines 800 & 1000 ppm, T₃, T₄-TIBA 125, 150 ppm, (Tri Iodo Benzoic Acid), T₅, T₆, T₇- Pacloburazol (PBZ) 1500, 2000& 2500 ppm, T₈-Pinching of apical portion of shoots 5 cm, T₉- 10 cm respectively and T₁₀ - Control

Table. 2: Effect of plant bio-regulators and pinching of grafted mango seedlings on lateral induction and chlorophyll contents of Amrapali

Treatment	Plant height (cm)	Stem dia. (mm)	No. of leaves/ plant	No. of primary laterals	Chlorophyll 'a' mg/ 100 g	Chlorophyll 'b' mg/ 100 g	Total chlorophyll mg/ 100 g
T ₁	93.69	24.57	50.33	3.33	1.75	0.38	2.14
T ₂	96.37	18.9	41.68	3.67	1.71	0.27	1.98
T ₃	96.68	20.77	24.33	2.33	1.46	0.31	1.77
T ₄	95.37	21.33	47.00	4.67	1.47	0.34	1.81
T ₅	86.07	26.27	39.68	2.67	1.41	0.34	1.75
T ₆	83.02	22.57	45.00	3.67	1.39	0.34	1.7
T ₇	95.38	21.3	30.00	1.00	1.44	0.3	1.74
T ₈	86.7	20.93	61.00	5.00	0.9	0.33	1.22
T ₉	88.05	22.07	38.33	3.67	0.97	0.25	1.22
T ₁₀	82.36	23.7	42.68	2.67	0.65	0.25	0.88
C.D. (p=0.05)	NS	NS	13.06	1.84	0.12	NS	0.15
SE(d)	11.17	2.89	6.17	0.87	0.05	0.05	0.07
C.V.	15.19	15.91	17.99	32.64	5.07	22.27	5.29

plants. BAP and TIBA was dissolved in 1N sodium chloride and final volume was made with adding distilled water. The ethenol was used for dissolving the Paclobutrazol (PBZ) and final concentration was made adding distilled water. Five plants each were taken per replication for spraying of growth regulating hormones and each spray were carried in the mid- May and again in September. To avoid the drifting of chemicals from one treatment to other treatment polythene sheet was spread around the rows of the plants and each time the polythene sheet was washed with fresh water before use in next treatments. The pinching treatment was carried out by removing 5 cm and 10 cm apical portion in each variety during mid-June. The experiment was carried out in randomized block design with three replications. Observations on plant height was recorded with measuring tape in cm, stem girth 5 cm above union was recorded with the help

of digital vernier caliper of model Mitutoyo Digital Vernier Caliper 0-150 mm 500-196, no of primary branches and no of leaves were counted from 5 treated plants of each replications. The experiments were laid out in randomized block design with 3 replications. Data recorded in triplicate and analyzed using OP stat software of HAU, Hisar, Haryana.

RESULTS AND DISCUSSION

The maximum plant height (86.37 cm) was in treatment T₁₀ (untreated plants). However, effect of treatments on plant height, stem girth, number of leaves/ plant and number of primary laterals were not found significant. Although, maximum laterals were recorded (3.67) in T₈ (pinching 5 cm from tip). The maximum chlorophyll 'a' (1.89 mg/ 100 g) was noted in treatment T₇ (PBZ 2500 ppm). Similarly

Table. 3: Effect of PGR chemicals and pinching of grafted mango seedlings on lateral induction and chlorophyll contents of plants variety Chausa.

Treatment	Tree height (cm)	Trunk dia. (mm)	No. of leaf/plant	No. of primary laterals	Chlorophyll 'a' mg/ 100 g	Chlorophyll 'b' mg/ 100 g	Total chlorophyll mg/ 100 g
T ₁	61.74	18.61	31.68	3.00	1.44	0.36	1.80
T ₂	98.94	22.73	31.00	4.00	1.68	0.33	2.03
T ₃	81.04	19.45	34.68	3.33	1.46	0.38	1.84
T ₄	77.39	22.98	43.68	3.00	1.20	0.26	1.49
T ₅	62.01	23.00	35.68	2.33	0.87	0.32	1.19
T ₆	66.69	22.78	34.00	2.33	0.83	0.25	1.08
T ₇	67.38	22.50	37.68	2.00	1.04	0.33	1.34
T ₈	71.73	23.04	56.68	5.00	1.82	0.26	2.08
T ₉	89.36	27.40	47.00	4.00	1.79	0.31	2.10
T ₁₀	79.35	19.37	29.00	1.33	0.90	0.33	1.23
C.D. (p=0.05)	NS	NS	14.27	1.84	0.18	NS	0.14
SE(d)	12.42	2.32	6.74	0.85	0.08	0.05	0.065
C.V.	20.13	12.78	21.66	34.41	8.12	20.78	4.95

highest chlorophyll 'b' (0.53 mg/100g) was noticed in treatment T₄, followed by in T₃ (0.47 mg/100g) and T₆ (0.46 mg/100g). Maximum total chlorophyll content (2.26 mg/100 g) was recorded in T₇, followed by (2.19 mg/ 100 g) in T₄ and T₈.

The plant height and stem girth were not found significant in Amrapali. While maximum number of leaves plant (61.00) was recorded in treatment T₈ (pinching 5 cm), followed by treatment T₁ (50.33) and T₄ (47.00) respectively. The number of primary laterals which was maximum (5.00) in treatment T₈ (pinching 5 cm), followed by 4.67 in T₄ (PBZ 2000 ppm). The data showed that highest amount of chlorophyll 'a' (1.75 mg/100g) was noticed in treatment T₁ (BAP 800 ppm), followed by 1.71 in T₂ (BAP 1000 ppm), whereas the lowest chlorophyll 'a' content 0.65 mg/100g was noticed in T₁₀ (control). Similarly, highest total chlorophyll content (2.14 mg/100 g) was noticed in T₁ followed by T₂, i.e. 1.98 mg/100 g while minimum total chlorophyll content (0.88 mg/100 g) was recorded in T₁₀. However, effect of hormones on chlorophyll 'b' was found non-significant.

Similarly, in Chausa variety, different treatment effects on plant height, stem girth and chlorophyll 'b' were found non-significant. Whereas maximum number of leaves plant (56.68) and maximum number of primary laterals (5.00) were recorded in T₈ (pinching 5 cm) while minimum number of leaves (29.00) and number of primary laterals (1.34) were noticed in T₁₀ (control). Similarly highest chlorophyll 'a' (1.82 mg/100 g) was recorded under T₈ and lowest in T₆ (0.83). Total chlorophyll content was recorded (2.08 mg/100 g) was under treatment T₈ (pinching 5 cm), while the minimum total chlorophyll (1.08 mg/100 g) was noticed in treatment T₆.

CONCLUSION

The findings indicated that shoot pinching is an effective practice for promoting early canopy development and improving precocity in grafted mango plants. The process shortens the pre-bearing duration, and early and balanced canopy development.

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