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Susmita Das

M.Sc Horticulture (Fruit Science), College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh, India

L Wangchu

College of Horticulture & Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh, India

Megha Raghavan

College of Horticulture & Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh, India

Longing Basuk Langstieh

College of Horticulture & Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh, India

Correspondence**Susmita Das**

M.Sc Horticulture (Fruit Science), College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh, India

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Effect of plant growth regulators, detopping and their combination on lateral shoots initiation in papaya (*Carica papaya*) var. vinayak

Susmita Das, L Wangchu, Megha Raghavan and Longing Basuk Langstieh

Abstract

Apical dominance is the result of the presence of auxin in the meristem zone of plant, which hinders the production of lateral shoots in papaya. An investigation to study the effect of plant growth regulators, detopping and their combination in initiation of lateral shoots in papaya (*Carica papaya*) var. Vinayak was carried out during March – June at Fruit Research Farm, Department of Fruit Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh. Among all the treatments, Detopping + (500 ppm BAP + 100 ppm GA) spray was found to significantly influence the days of 1st shoot initiation (5.6), number of shoots per plant after 15 days and 45 days (60 and 80.16 respectively) and number of lateral shoots per plant suitable of cuttings (66.17).

Keywords: papaya, plant growth regulators, detopping, laterals shoots

Introduction

Papaya (*Carica papaya* L.) belonging to family Caricaceae is regarded as the “wonder fruit” of tropics and sub tropics (Radha and Mathew, 2007) [14]. Papaya is a species with three different sex types viz. staminate, pistillate and hermaphrodite. Although propagation of the papaya for commercial production is normally by seed; as a consequence, wide variability in sex expression and fruit characters are usually observed among the individuals in the population of even small plantings, which poses problem in breeding and selection (Soomark and Tai, 1975). The viability of papaya seeds is poor. Germination percentage of seeds declined rapidly with aging and no seed germination after 3 months (Begum *et al.*, 1988) [1]. Vegetative propagation method can be an alternative to seed propagation to overcome these constraints. Unlike other horticultural crops, vegetative propagation of papaya on commercial scale is having an inherent limitation due to difficulty in obtaining sufficient number of lateral shoots. This is primarily due to the strong apical dominance that occurs as a result of the presence of auxin in the meristem zone, thereby limiting the development of lateral meristem (Taiz and Zeiger, 2004) [16]. To overcome apical dominance and to induce lateral shoot production, use of growth regulators like GA₃ and BA was employed in crop like passion fruit (Couto, 1983) [4], papaya (Norton and Norton, 1986) [11] and cherry (Lang, 1996) [9]. Cytokinin is strongly linked with the onset of growth of lateral buds and its application stimulates cell division and growth in many species. After decapitation, auxin levels in lateral buds increase, level of ABA decreases and transport of nutrients and cytokinin from roots increases the lateral bud production (Taiz and Zeiger, 2004) [16]. Generally, plants produced through vegetative propagation in papaya are known to be true to type in preserving the genotype of cultivars. Thus by vegetative propagation, there is a possibility of maintaining the original characteristics of the parent plant apart from several advantages like higher yield, lower fruiting height, early fruiting and longer cropping span.

Materials and Methods

The experiment was conducted in the research farm, Department of Fruit Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh under protected cultivation. One year old papaya of var. Vinayak was subjected to the treatments.

Decapitation, two plant growth regulators, separately and their combination at different levels viz., T₁ (Detopping), T₂ {Detopping + (500 ppm BAP + 500 ppm GA) spray}, T₃ {Detopping + (500 ppm BAP + 500 ppm GA) injection}, T₄ {Detopping + (500 ppm BAP + 100 ppm GA) spray}, T₅ {Detopping + (500 ppm BAP + 100 ppm GA) injection}, T₆ {(500 ppm BAP + 500 ppm GA) spray}, T₇ {(500 ppm BAP + 500 ppm GA) injection}, T₈ {(500 ppm BAP + 100 ppm GA) spray}, T₉ {(500 ppm BAP + 100 ppm GA) injection}, T₁₀ (Control) were tried using Randomized Block Design with three replications. Spraying of plant growth regulators was done only once, using hand sprayer. The laterals from the buds took almost 50-60 days to attain suitable size for cuttings. The observation regarding days taken for 1st shoot initiation, height of 1st shoot initiation from ground level, number of shoots per plants (after 15 and 45 days of treatment), length of shoot (cm), girth of shoot (cm), number of leaves per shoot and number of lateral shoots per plant suitable for cuttings were recorded and subjected for statistical analysis. Significance and non-significance of the variance due to different treatments were determined by calculating the respective 'F' values as the method described by Panse and Sukhatme (1985) [13].

Results and Discussion

The effect of plant growth regulators, decapitation and their combination was found to be significant on some of the shoot parameters. More number of shoots after 15 and 45 days (60.00 and 80.16 respectively) was obtained from Detopping + (500 ppm BAP + 100 ppm GA) spray and plants took minimum number of days (5.57) for 1st shoot initiation. Reuveni and Shlesinger (1990) stated that spraying of BA

(500 ppm) and GA (100 ppm) resulted in maximum number of shoots with 5-15 cm length. MacMillan (1991) also reported that injection of 500 ppm BAP + 100 ppm GA mixture into the base of the stem followed by topping of the stem induced large number of shoots per plant. In respect to height of 1st shoot initiation from ground level, injection of 500 ppm BAP + 500 ppm GA (T₃) in to the base of stem followed by detopping registered maximum height (153.83 cm). Injection of 500 ppm BAP + 100 ppm GA induced lateral shoots with maximum length (18.49 cm). Maximum of girth of shoot (2.13 cm) was obtained from treatment T₄ {Detopping + (500 ppm BAP + 100 ppm GA) spray}. According to Costa and Costa (2003), plants subjected to application of 500 ppm BAP + 100 ppm GA resulted in highest number of buds with 14-15 cm long shoots.

In order to promote growth of lateral buds which were held under apical dominance, different treatments have been applied to different plants (Hillman, 1984). Tipping may cause an increase in the activity of hormones responsible for shoot growth, thus increasing their number and length (Mika, 1986). Removal of only apical bud (tipping) did not induce increased formation of buds, but promoted the growth in diameter and length (Ono *et al.*, 2004). Traditional techniques to promote branching not always give satisfactory results, so application of bio-regulators may be necessary (Csiszar and Buban, 2004). Chemical branching stimulation usually involves application of either cytokinins (benzyladenine, BA) with or without gibberellins (Veinbrants and Miller, 1981; Jacyna and Puchala, 2004). Use of cytokinin and gibberellins associated with pruning of apical segment promote side shoots in papaya (Fabiola *et al.*, 2009) [6].

Table 1: Effect of plant growth regulators and detopping on shoot parameters

Treatment	Number days taken for 1 st shoot initiation	Height of 1 st shoots initiation from ground level (cm)	Number of shoots/plant		Length of shoots (cm)	Girth of shoots (cm)	Number of leaves per shoot
			After 15 days	After 45 days			
T ₁	7.16	131.83	337.33	55.16	17.31	2.13	9.66
T ₂	6.16	140.33	334.16	61.66	16.72	1.93	8.86
T ₃	6.50	153.83	441.00	76.16	14.16	1.41	9.44
T ₄	5.66	145.66	660.00	80.16	13.07	1.74	12.10
T ₅	6.50	135.33	442.00	71.83	14.94	1.77	11.10
T ₆	10.66	91.83	115.66	23.16	15.38	1.08	10.11
T ₇	10.16	114.50	99.33	33.16	12.83	0.93	11.44
T ₈	15.16	100.50	111.83	19.33	12.73	0.98	11.44
T ₉	13.83	116.83	55.16	15.33	18.49	1.25	10.66
T ₁₀	14.66	84.83	55.00	7.50	17.72	0.93	10.22
SEd±	0.96	18.45	6.04	4.76	1.60	0.31	NS
CD@5%	2.03	38.47	12.70	10.01	3.36	0.66	NS

Note: T₁= Detopping, T₂= Detopping + (500 ppm BAP + 500 ppm GA) spray, T₃= Detopping + (500 ppm BAP + 500 ppm GA) injection, T₄= Detopping + (500 ppm BAP + 100 ppm GA) spray, T₅= Detopping + (500 ppm BAP + 100 ppm GA) injection, T₆= (500 ppm BAP + 500 ppm GA) spray, T₇= 500 ppm BAP + 500 ppm GA) injection, T₈= 500 ppm BAP + 100 ppm GA) spray, T₉= (500 ppm BAP + 100 ppm GA) injection, T₁₀= Control.

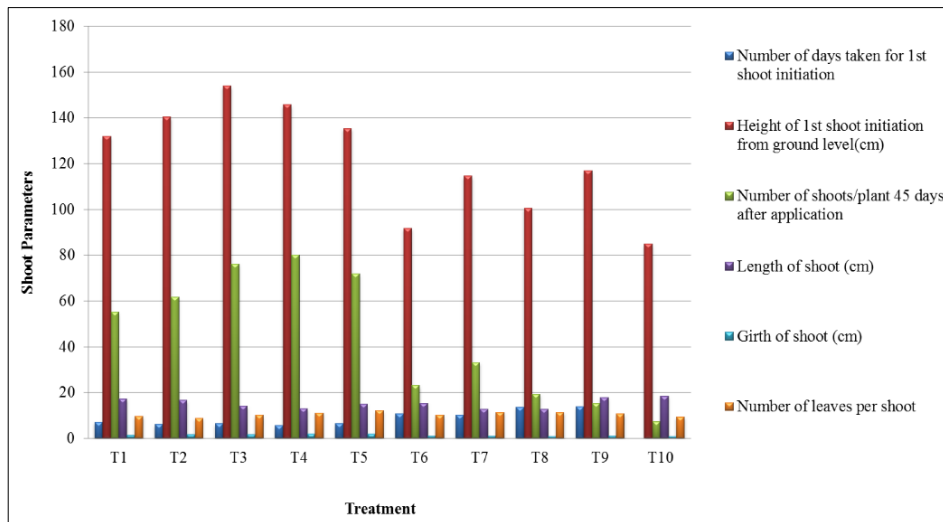


Fig: Effect of treatment on shoot parameters



Fig : Plants before treatment



Fig : Plants after treatment

Conclusion

From the results of the present study, it has been observed that different treatments of plant growth regulators and decapitation significantly influenced the number of days taken for 1st shoot initiation, number of shoots per plant, length of shoot, girth of shoot and number of lateral shoots suitable for cuttings. Detopping with application of 500 ppm BAP + 100 ppm GA spray (T₄) took minimum number of days for shoot initiation and gave maximum number of shoots per plant with optimum length and girth suitable for cuttings. Hence, from the evidence recorded, it can be concluded that the best plant growth regulators combination for lateral shoots development in papaya under North Eastern region of India is Detopping + (500 ppm BAP + 100 ppm GA) spray.

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