

Effect of GA₃ and nutrient sprays on growth of Kokum (*Garcinia indica* Choisy) seedlings

ABSTRACT

The experiment titled "Effect of GA₃ and Nutrient Sprays on Growth of Kokum (*Garcinia indica* Choisy) Seedlings" was conducted at the College of Horticulture, Dapoli, during the year 2023-2024. The objective of the study was to evaluate the influence of GA₃ and nutrient sprays on the growth of kokum seedlings and to identify the optimal concentrations that would enhance growth and grafting success. The study was conducted using a Randomized Block Design with eight treatments, each replicated three times and the treatments included T₁- GA₃ @ 250 ppm, T₂- GA₃ @ 300 ppm, T₃- GA₃ @ 350 ppm, T₄- 19:19:19 @ 0.5%, T₅- 19:19:19 @ 1%, T₆- 19:19:19 @ 2%, T₇- 19:19:19 @ 2.5% and T₈- Control. The study revealed that among the treatments, treatment T₃ i.e. GA₃ at 350 ppm produced the most favourable results showing seedling height (28.53 cm), number of leaves (19.87), number of nodes (8.07), internodal length (2.09 cm), girth at collar region (3.44 mm), survival percentage of seedlings (96.00%), minimum number of days for obtaining 80 percent graftable seedlings (142.33 days), percentage of graftable seedlings (90.00%) and percentage of graft success (94.82%). In contrast, the control treatment (T₈) exhibited the least effectiveness across all these growth parameters.

Keywords: Kokum, GA₃, 19:19:19, graftable seedlings

1. INTRODUCTION

Kokum (*Garcinia indica* Choisy) is one of the underexploited tree spice belongs to family Clusiaceae and native to India. Kokum was also referred by various common names such as Goa butter tree, kokum butter tree, bheranda, ratamba, kokamba, bhirand and amlashaka. Kokum is primarily found in Konkan region of Maharashtra, Goa, Karnataka and Kerala. Additionally, it grows in the Surat district of Gujarat and to some extent in North Eastern states of Assam, Meghalaya and West Bengal. This tree spice having tremendous importance not only for its culinary purpose but also for its medicinal properties.

The tropical climate and consistent rainfall of the Konkan region provide ideal conditions for kokum cultivation. However, kokum is primarily propagated by seeds, which are recalcitrant, meaning they lose viability quickly, leading to challenges in propagation. Since kokum is a cross-pollinated crop, the resulting seedlings often exhibit significant variability. Additionally, kokum is dioecious, meaning that male and female flowers are on separate plants, which further complicates large-scale propagation, making grafting the preferred method. However, the slow growth rate of kokum seedlings, often taking up to a year to reach the size suitable for grafting, presents a major obstacle to commercial cultivation. To address the challenges of slow growth of kokum seedling, the application of GA₃ and 19:19:19 nutrient sprays is invaluable in horticulture for enhancing seedling growth and productivity. This study aims to identify the optimal concentrations of GA₃ and nutrient sprays to accelerate kokum seedling development. By doing so, the study seeks to enable faster production of quality rootstocks, thereby improving the efficiency of commercial propagation under the specific conditions of the Konkan region.

2. MATERIALS AND METHODOLOGY

The experiment was conducted at Nursery No. 4, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli 415 712 during the 2023-24 period. Fresh kokum seeds, collected during the fruiting season in May, were soaked in water for 24 hours before sowing. The seeds were first sown in raised beds measuring 3 m × 1 m, filled with mixture of soil and farm yard manure and watered lightly on regular basis. Germination was occurred 30 days after sowing. One month old seedlings were then transplanted into 6'' × 8'' size polybags containing a soil and FYM mixture (3:1) Treatments were applied when seedlings reached the four leaf stage *i. e.*, one month after transplanting, followed by two additional sprays at 30 day intervals. The experiment was designed in a Randomized Block Design with three replications and included eight treatments namely, T₁- GA₃ @ 250 ppm, T₂- GA₃ @ 300 ppm, T₃- GA₃ @ 350 ppm, T₄- 19:19:19 @ 0.5%, T₅- 19:19:19 @ 1%, T₆- 19:19:19 @ 2%, T₇- 19:19:19 @ 2.5% and T₈- Control. Each replication consisted of 50 seedlings, with data averaged from ten labeled seedlings per replication. Observations were recorded on seedling height (cm), number of leaves, girth at collar region (mm), number of nodes, internodal length (cm), survival percentage of seedlings (%), minimum number of days for obtaining 80 percent graftable seedlings (days), overall percentage of graftable seedlings (%) and percentage of graft success (%). The recorded data were analysed statistically using the methods outlined by Panse and Sukhatme (1995).

3. RESULTS AND DISCUSSION

Seedling height (cm)

The maximum seedling height was recorded in treatment (T₃) GA₃ @ 350 ppm concentration (28.53 cm) which was statistically at par with T₂ - GA₃ @ 300 ppm (26.81 cm) and T₁ - GA₃ @ 250 ppm (26.58 cm). The minimum seedling height was recorded in (T₈) control (19.10 cm) which was at par with T₄- 19:19:19 @ 0.5% and T₅- 19:19:19 @ 1% recording heights of 20.13 cm and 21.27 cm, respectively. The maximum seedling height was recorded in GA₃ might due to as it promotes cell division and cell elongation and thus facilitates rapid seedling growth and development. The present findings are in line with the findings of Gholap et al. [4] in aonla and Deshmukh [3] in kokum seedlings.

Number of leaves

Leaves are the essential organs primarily responsible for photosynthesis, transpiration and gas exchange. The maximum number of leaves (19.87) was recorded in treatment (T₃) GA₃ @ 350 ppm which was found significantly superior over the other treatments. The minimum number of leaves (13.13) was recorded in (T₈) control, which was at par with T₄- 19:19:19 @ 0.5% (14.23). The study revealed that increase in concentration of GA₃ results in increases the number of leaves per seedlings this might due to GA₃ promotes both cell division and cell elongation in plant tissues, this leads to increased growth rates, including production of new leaves, by stimulating the growth of meristematic tissues. The results confirmative with the findings of Chiranjeevi et al. [2] in aonla and Deshmukh [3] in kokum seedlings.

Girth at collar region (mm)

Girth of seedling is an important factor which provide better support to the seedling. The maximum girth of seedling (3.44 mm) was recorded in T₃- GA₃ @ 350 ppm which was found at par with T₂ - GA₃ @ 300 ppm (3.35 mm) and T₁ - GA₃ @ 250 ppm (3.36 mm). The minimum girth was recorded in (T₈) control. This may be due to positive effect of GA₃ in cell division and elongation which may promote cell wall extensibility. Similar results were recorded by Chiranjeevi et al. [2] in aonla and Deshmukh [3] in kokum seedlings.

Number of nodes

The highest number of nodes (8.07) was recorded in T₃- GA₃ @ 350 ppm which was found at par with T₁ - GA₃ @ 250 ppm (7.77). The lowest number of nodes (5.67) was recorded in control treatment. The increased in number of nodes by application of GA₃ was also reported earlier workers by Surve [9] and Deshmukh [3] in kokum seedlings.

Internodal length (cm)

The highest internodal length (3.35 cm) was observed in T₃- GA₃ @ 350 ppm which was found at par with T₂ - GA₃ @ 300 ppm (3.00 cm) and T₁ - GA₃ @ 250 ppm (2.57 cm). The lowest internodal length (1.43 cm) was recorded in control treatment which was found at par with T₇- 19:19:19 @ 2.5% (2.00 cm), T₆- 19:19:19 @ 2% (1.90 cm), T₅- 19:19:19 @ 1% (1.79 cm) and T₄- 19:19:19 @ 0.5% (1.75 cm). The results are in confirmative with Surve [9] and Deshmukh [3] in kokum seedlings.

Survival percentage of seedlings (%)

Survival percentage of seedlings (96.00%) was found highest in treatment T₃- GA₃ @ 350 ppm which was found at par with T₂ - GA₃ @ 300 ppm (92.67%), T₆ - 19:19:19 @ 2% (90.00%) and T₇ - 19:19:19 @ 2.5% (89.33%). The lowest survival percentage was recorded in T₈ (control) treatment. Similar results were noticed by Chavan [1] and Deshmukh [3] in kokum seedlings.

Minimum number of days for obtaining 80 percent graftable seedlings (days)

The data highlights that treatment T₃- GA₃ @ 350 ppm recorded minimum number of days (142.33 days) required for obtaining 80 percent graftable seedlings which was found significantly superior over all other treatments. In contrast, the maximum number of days (225.00 days) to reach graftable size was recorded in control treatment. The present findings are in line with the findings of Chiranjeevi et al. [2] in aonla and Surve [9] in kokum seedlings.

Overall percentage of graftable seedlings (%)

The overall percentage of graftable seedlings (90.00%) was found maximum in treatment T₃- GA₃ @ 350 ppm which was found at par with T₂ - GA₃ @ 300 ppm (82.00%) and T₁ - GA₃ @ 250 ppm (81.33%). The minimum percentage of graftable seedlings recorded in control treatment. This may be due to positive effect of GA₃ in enhancing growth parameters such as seedling height, number of leaves and girth at collar region, thereby enhancing overall percentage of graftable seedlings. Similar results were recorded earlier by Murlidhara et al. [6] in mango, Surve [9] and Deshmukh [3] in kokum seedlings.

Percentage of graft success (%)

The treatment T₃- GA₃ @ 350 ppm recorded the highest percentage of graft success (94.82%) which was found at par with T₂ - GA₃ @ 300 ppm (94.12%) and T₁ - GA₃ @ 250 ppm (92.64%). The lowest percentage of graft success (85.88%) was recorded in T₈ (control) treatment which was found at par with T₆- 19:19:19 @ 2% (85.90%), T₇- 19:19:19 @ 2.5% (86.77%), T₄- 19:19:19 @ 0.5% (87.18%) and T₅- 19:19:19 @ 1% (89.52%).

Table 1: Effect of GA₃ and nutrient on seedling height (cm), number of leaves, girth at collar region (mm), number of nodes and internodal length (cm) of kokum seedlings

Treatments	Seedling height (cm)	No. of leaves	Girth at collar region (mm)	No. of nodes	Internodal length (cm)
	150 Days after transplanting				
T ₁ - GA ₃ @ 250 ppm	26.58	18.13	3.36	7.77	2.57
T ₂ - GA ₃ @ 300 ppm	26.81	17.57	3.35	7.50	3.00
T ₃ - GA ₃ @ 350 ppm	28.53	19.87	3.44	8.07	3.35
T ₄ - 19:19:19 @ 0.5%	20.13	14.23	3.16	6.63	1.75
T ₅ - 19:19:19 @ 1%	21.27	15.53	3.11	6.97	1.79
T ₆ - 19:19:19 @ 2%	22.35	16.07	3.07	7.27	1.90
T ₇ - 19:19:19 @ 2.5%	23.30	15.07	3.06	6.37	2.00
T ₈ - Control	19.10	13.13	2.56	5.67	1.43
Mean	23.51	16.20	3.14	7.03	2.23
F test	SIG	SIG	SIG	SIG	SIG
S. Em. (±)	1.02	0.47	0.05	0.12	0.30

C. D. @ 5%	3.11	1.43	0.14	0.35	0.92
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Table 2: Effect of GA₃ and nutrient on survival percentage of seedlings (%), minimum no. of days required for obtaining 80% graftable seedlings (days), percentage of graftable seedlings (%) and percentage of graft success (%) of kokum seedlings

Treatments	Survival percentage of seedlings (%)	Minimum no. of days required for obtaining 80% graftable seedlings (days)	Percentage of graftable seedlings (%)	Percentage of graft success (%)
T ₁ - GA ₃ @ 250 ppm	88.00 (69.77)	167.33	81.33 (64.41)	92.64 (74.39)
T ₂ - GA ₃ @ 300 ppm	92.67 (75.24)	162.00	82.00 (66.18)	94.12 (76.12)
T ₃ - GA ₃ @ 350 ppm	96.00 (78.72)	142.33	90.00 (71.94)	94.82 (76.90)
T ₄ - 19:19:19 @ 0.5%	86.00 (68.30)	185.00	74.00 (59.43)	87.18 (69.27)
T ₅ - 19:19:19 @ 1%	85.33 (67.63)	176.67	76.00 (60.85)	89.52 (71.17)
T ₆ - 19:19:19 @ 2%	90.00 (72.02)	173.33	80.00 (63.60)	85.90 (67.98)
T ₇ - 19:19:19 @ 2.5%	89.33 (70.95)	170.00	80.67 (63.92)	86.77 (68.69)
T ₈ - Control	76.00 (60.72)	225.00	66.00 (54.34)	85.88 (71.56)
Mean	87.92	175.21	78.75	89.61
F test	SIG	SIG	SIG	SIG
S. Em. (±)	2.52	2.95	3.05	1.41
C. D. @ 5%	7.64	8.95	9.26	4.27
<i>*Figures in parenthesis are arcsine transformed values</i>				

4. CONCLUSION

The foliar application of (T₃) gibberellic acid (GA₃) at 350 ppm, administered in three sprays spaced 30 days apart from transplanting, significantly enhanced kokum seedling growth and graft success. This treatment resulted in seedling height (28.53 cm), number of leaves (19.87), number of nodes (8.07), internodal length (2.09 cm) and girth at collar region (3.44 mm). It also resulted in high survival percentage of seedlings (96.00%), minimum number of days for obtaining 80 percent graftable seedlings (142.33 days), total percentage of graftable seedlings (90.00%) and percentage of graft success (94.82%). The investigation concluded that a GA₃ at a concentration of 350 ppm is optimal for maximizing both seedling growth and graft success in kokum.

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