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Studies on effect of GA₃ and biostimulants on growth of tirphal (*Zanthoxylum Rhetsa* Roxb) seedlings

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ABSTRACT

The present investigation entitled “Studies on effect of GA₃ and biostimulants on growth of tirphal (*Zanthoxylum rhetsa* Roxb.) Seedlings” was carried out during 2025–2026 at the, Department of Plantation, Spices, Medicinal and Aromatic Crops, College of Horticulture, Dr. B.S.K K.V., Dapoli. The experiment was laid out in RBD with eleven treatments and replicated thrice. The experiment comprised of treatments, T₁ - Absolute control, T₂ - GA₃ 100 ppm (Spraying), T₃ - GA₃ 100 ppm (Drenching), T₄ - Cow urine 5% (Spraying), T₅ - Cow urine 5% (Drenching), T₆ - Vermiwash 20% (Spraying), T₇ - Vermiwash 20% (Drenching), T₈ - Jeevamrut 10% (Drenching), T₉ - Humic acid 0.4% (Spraying), T₁₀ - Humic acid 0.4% (Drenching) and T₁₁ - Chitosan 0.01% (Drenching). Among the treatments, Jivaamrut 10% drenching (T₈) proved the most effective in enhancing the growth of tirphal seedlings. This treatment recorded the highest values for seedling height (37.23 cm), collar girth (5.22 mm), number of leaves (117.43), leaf area (17.60 cm²), root length (12.66 cm). Moreover, it recorded the highest survival (93.66%) percentage of seedlings. Furthermore, T₈ recorded the highest gross return (₹7,025), net return (₹3,152) and Benefit: Cost ratio (1.84), indicating its economic superiority. On the basis of results of present study, it can be concluded that monthly drenching of Jivaamrut at 10% concentration was found to be the most effective treatment for producing healthy, vigorous seedling.

Keywords: Tirphal, GA₃, Jeevamrut, Biostimulants, Seedling growth

1. Introduction

Tirphal (*Zanthoxylum rhetsa*) is one of the important underexploited tree spice belonging to Rutaceae family and is found in Konkan region. In seed-propagated tree spices, it shows slow juvenile growth and also prolong nursery occupancy and delay grafting, increasing the cost and time required to produce field-ready plants. The plant exhibits distinct seasonal growth patterns. Vegetative growth mainly occurs during the monsoon season. Flowering generally takes place from February to April, followed by fruit development from May to July. The fruits are small, globose capsules that turn reddish-brown upon maturity and split open to expose a single black seed. The pericarp of the fruit is the economically important part, possessing a characteristic pungent and lemony flavor.

Tirphal fruits are widely used as a spice in traditional cuisines, especially in coastal regions, where they are used in fish curries, chicken/mutton curries and other local dishes. In addition to its culinary importance, the plant has significant medicinal value. Different parts of the plant such as fruits, bark and leaves are used in traditional medicine for treating toothache, digestive disorders, fever, inflammation and skin diseases. Tirphal is rich in alkaloids, flavonoids, phenolics, terpenoids, coumarins, lignans, glycosides and essential oils, with sabinene, limonene, terpinolene, terpinen-4-ol, α -pinene and γ -terpinene being among its important volatile constituents.

The species also shows slow initial growth, which prolongs the nursery period and delays field establishment. Moreover, the dioecious nature of the plant, where male and female flowers are borne on separate plants, further complicates cultivation as only female plants produce fruits.

2. Materials and Methods

The experiment was conducted during 2025–26 at Nursery No. 4, College of Horticulture, Dapoli, District Ratnagiri, Maharashtra, India. Eleven treatments were evaluated in RBD with 3 replications. The experimental material comprised 3,300 tirphal seedlings. The uniform package of practices (Irrigation, weeding etc.) as per treatments were imposed according to the experimental schedule from 30 days onward up to six months; whereas chitosan was applied at 15 days interval upto six months.

Experimental details

1	Crop	:	Tirphal
2	Year of commencement	:	2025-2026
3	Design	:	Randomized block design (RBD)
4	No. of treatments	:	11
5	No. of replication	:	3
6	Total no. of seedlings/replication	:	100
7	Total no. of plots	:	33
8	Total no. of seedlings	:	3300
9	Size of polythene bag	:	6" × 8"
10	Planting date	:	25 th June 2025

3. Results and Discussion

3.1. Effect of GA₃ and biostimulants on different growth parameters of tirphal seedling at 180 (DAP)

The data pertaining to the effect of GA₃ and biostimulants on different growth parameters of tirphal seedlings at 180 DAP are presented in Table 1. The treatments showed considerable variation in seedling

height, collar girth, number of leaves, leaf area and root length. Among the different treatments, T₈ (Jeevamrut 10% drenching) recorded the highest values for all the parameters studied, whereas the lowest values were generally recorded in T₁ (absolute control).

Seedling height (cm)

In present investigation, the tirphal seedling height at 180 DAP, treatment T₈ (Jeevamrut 10% drenching) recorded the maximum seedling height (37.80 cm). However, it was at par with treatments T₉ - Humic acid 0.4% spraying (30.65 cm) and T₆ - Vermiwash 20% spraying (30.60 cm). The untreated control (T₁) recorded the lowest seedling height (19.12 cm).

Collar girth (mm)

The results of the study revealed that the collar girth of tirphal seedling increased with progressive increase in age of the seedling. In present investigation, later growth stage *i.e.* at 180 DAP, Jeevamrut 10% drenching recorded the highest collar girth this may be attributed to its beneficial influence on the rhizosphere, nutrient availability and microbial activity. At 180 DAP, treatment T₈ - Jeevamrut 10% drenching recorded significantly the highest collar girth of 6.03 mm and superior over the rest of treatments while, the lowest collar girth was recorded in the treatment T₁ (4.00 mm), indicating the positive impact of Jeevamrut on collar girth of tirphal seedling.

Table 1. Effect of GA₃ and biostimulants on different growth parameters of tirphal seedling at 180 (DAP)

Treatments	Seedling height(cm)	Collar girth(mm)	Number of leaves	Leaf area(cm ²)	Root length(cm)
T ₁ - Absolute Control	19.12	4.00	99.73	6.45	3.21
T ₂ - 100 ppm GA ₃ (Spraying)	22.06	4.67	110.40	7.62	5.04
T ₃ - 100 ppm GA ₃ (Drenching)	21.98	4.68	111.90	13.96	6.50
T ₄ - Cow Urine 5 % (Spraying)	22.70	4.72	107.73	9.72	5.93
T ₅ - Cow Urine 5% (Drenching)	28.13	4.86	111.73	15.67	7.37
T ₆ - Vermiwash 20% (Spraying)	30.60	5.02	111.70	16.27	8.92
T ₇ - Vermiwash 20% (Drenching)	28.50	5.13	112.33	17.52	10.11
T ₈ - Jivaamrut 10% (Drenching)	34.80	6.03	119.10	18.60	12.66
T ₉ - Humic Acid 0.4 % (Spraying)	30.65	4.96	111.73	16.33	9.50
T ₁₀ - Humic acid 0.4% (Drenching)	24.32	4.81	111.43	15.25	6.74
T ₁₁ - Chitosan 0.01% (Drenching)	27.19	4.86	110.87	10.70	6.27
Mean	27.22	4.91	110.64	13.37	7.48
S.Em. (±)	1.82	0.102	2.37	1.87	0.11
C.D @ 5%	5.37	0.300	7.01	5.51	0.33

Number of leaves per plant

In present research, it was observed that number of leaves increased with increase in age of the tirphal seedling in all the treatments. The difference in production of leaves in treatments due to different concentration of GA₃ and biostimulant. The highest number of leaves in later stage (180 DAP) was noticed in Jeevamrut 10% drenching (T₈) recorded significantly the highest number of leaves (119.10) and superior over rest of the treatments, while the untreated control (T₁) recorded the lowest number of leaves (99.73). The results demonstrated that Jeevamrut drenching consistently produced a greater number of leaves during the later stages of seedling growth.

Leaf area (cm²)

The present study revealed that the progressive increased of leaf area from 30 DAP to 180 DAP. Further, Jeevamrut 10% drenching application recorded the largest leaf area may be attributed to enhanced rhizospheric microbial activity, nutrient mobilization and phytohormonal regulation. At 180 DAP, treatment of Jeevamrut 10% drenching (T₈) recorded significantly the highest leaf area (17.60 cm²), and superior over rest of the treatments, whereas the untreated control (T₁) recorded the lowest leaf area (6.45 cm²). Thus, it evident from

the results, Jeevamrut drenching significantly increased leaf expansion and produced larger leaves throughout the experimental period.

Root length (cm)

In present investigation, Jeevamrut 10% drenching (T₈) recorded the maximum root length. Jeevamrut was found the best treatment which produced maximum number of primary roots, number of secondary roots and length of primary roots. Data cited under Table 1. revealed that Jeevamrut 10% drenching (T₈) recorded the highest root length (12.66 cm) in tirphal seedling and was found significantly superior over rest of the treatments. However, the shortest root length (3.21 cm) was recorded in the untreated control (T₁).

3.2 Economics

Tirphal seedling price: 25 Rs. /-

The economics of tirphal seedling production as influenced by different GA₃ and biostimulant treatments are presented in Table 2. The analysis revealed considerable variation in the cost of production, gross return, net profit and benefit: cost (B:C) ratio among the different treatments.

Among the treatments, Jeevamrut 10% drenching (T₈) recorded the highest gross return (₹7,025), maximum net return (₹3,152) and the

highest benefit: cost ratio (1.84), indicating that it was the most economically superior treatment at 180 DAP. The cost of production under this treatment was ₹3,873. The lowest B:C ratio (1.20) was

recorded in treatment T₃ GA₃ 100 ppm drenching. Overall, Jeevamrut 10% drenching (T₈) proved the most profitable treatment for tirphal seedling production.

Table 2. Economics (For 1000 seedlings of tirphal) at 180 DAP

Treatments	Survival percent- age of seedlings (%)	Cost of produc- tion (Rs.)	Gross return (Rs.) (survived seedling)	Net Profit (Rs.)	B:C Ratio
T ₁ - Absolute control	71.30	3595	4500	905	1.25
T ₂ -100 ppm GA ₃ (Spraying)	75.00	4035	5625	1590	1.39
T ₃ -100 ppm GA ₃ (Drenching)	78.00	4845	5850	1005	1.20
T ₄ -Cow Urine 5 % (Spraying)	76.00	3531	5700	2169	1.61
T ₅ -Cow Urine 5%(Drenching)	81.00	3675	6075	2400	1.65
T ₆ -Vermiwash 20% (Spraying)	85.00	3742	6150	2403	1.64
T ₇ -Vermiwash 20% (Drenching)	85.12	4755	6375	1620	1.34
T ₈ -Jivaamrut 10% (Drenching)	93.66	3873	7025	3152	1.84
T ₉ -Humic Acid 0.4 % (Spraying)	80	3610	6225	2614	1.72
T ₁₀ -Humic acid 0.4% (Drenching)	81	4071	6075	2004	1.49
T ₁₁ -Chitosan 0.01% (Drenching)	78.16	3504.43	5850	2345	1.66

4. Conclusion

In the present investigation Among all the treatments studied, treatment T₈ (Jeevamrut 10% drenching) recorded the best performance with respect to seedling height (37.80 cm), collar girth (6.03 mm), number of leaves (119.10), leaf area (18.60 cm²), root length (12.66 cm), survival percentage (93.66%). The same treatment also recorded the highest net return (₹3,152) and the maximum Benefit: Cost ratio (1.84).

Hence, on the basis of the results obtained from the present study, it can be concluded that monthly drenching of Jeevamrut at 10% concentration (T₈), to enhance the growth, produce healthy, vigorous tirphal seedling under nursery condition.

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