International Journal of Advanced Biochemistry Research

ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2025): 5.29
IJABR 2025; SP-9(9): 1419-1423
www.biochemjournal.com
Received: 18-06-2025
Accepted: 21-07-2025

Anshu Tiwari
M.Sc. Scholar, Department of Plantation Spices Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Anita Kerketta
Assistant Professor, Department of Vegetable Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Sevan Das Khunte
Professor, Department of Fruit Science, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Richa Sao
Assistant Professor, Department of Soil Science and Agri-Chemistry, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Soman Singh Dhruw
Assistant Professor, Department of Soil Science and Agri-chemistry, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Tanuja Verma
M.Sc. Scholar, Department of Plantation Spices Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Lokesh k Fekar
M.Sc. Scholar, Department of Plantation Spices Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Corresponding Author:
Anshu Tiwari
M.Sc. Scholar, Department of Plantation Spices Medicinal and Aromatic Crops, College of Horticulture and Research Station, MGUVV, Durg, Chhattisgarh, India

Influence of soaking time and PGR on seed germination and seedling growth of tamarind (*Tamarindus indica* L.)

Anshu Tiwari, Anita Kerketta, Sevan Das Khunte, Richa Sao, Soman Singh Dhruw, Tanuja Verma and Lokesh K Fekar

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i9Sr.5700

Abstract
The study investigated effect of different soaking and PGRs on seed germination and growth of Tamarind and was conducted at college of horticulture and research station, Sankara, Patan, Durg (C.G). The experiment was laid out in Factorial Completely Randomized Design with two factors, factorial arrangement having three replications. Data were recorded for days of initiation of seed germination, days required for 50% germination, germination percentage, number of leaves per seedling, seedling length, stem girth, survival percentage and mortality percentage of the seedling. Seeds with soaking time 24 hours + 200 ppm GA_3 (S_3P_2) showed earliest germination (6.9 DAS), while control took maximum days (17.8 DAS). Maximum germination percentage (95.0) was recorded for Seeds with soaking time 24 hours + 200 ppm GA_3 (S_3P_2) along with maximum no. of leaves per seedling (17.1), maximum stem length (60.1), more stem thickness (2.98) and maximum survival percentage (91.3) at 90 DAS. In conclusion, seeds soaked for 24 hours in GA_3 200 ppm have out perform all the germination attributes, plant growth attributes and survival parameters whereas control (S_0 p_0) had shown the poorest of them all.

Keywords: Tamarind, GA_3, NAA, soaking time, germination

Introduction
Tamarind (*Tamarindus indica* L.) is a diploid species (2n = 24) classified under the dicotyledonous family Fabaceae and the subfamily Caesalpinoideae (formerly Caesalpiniaceae) (Purseglove, 1987) [8]. The word "tamarind" originates from the Arabic phrase *Tamarind-E-Hind*, which translates to "Date of India," earning it the popular nickname "Indian Date." This evergreen, tropical tree serves multiple purposes—while it is primarily grown for its fruit, it is also valued for its timber. In India, tamarind is extensively cultivated, especially in states like Chhattisgarh, Madhya Pradesh, Telangana, parts of Maharashtra, Tamil Nadu, Odisha, Bihar, and West Bengal. It is regarded as a significant cash crop in the country, holding the sixth position in export revenue (Muzaffar & Kumar, 2017) [5]. The tree is of medium height, characterized by a sturdy, short trunk and pinnately compound leaves bearing 10-20 pairs of small leaflets. Its flowers are small, fragrant, and visually appealing—usually yellow with red markings. Tamarind pods are flat and vary widely in shape and size. Upon ripening, the fruit becomes hard and brittle, with the brown, sweet-sour pulp being the most desirable part. Among the different varieties, those with a reddish pulp are considered superior

Tamarind is commonly propagated through seeds, which are relatively large, flat, and shiny brown to black in colour, with a hard, water-impermeable seed coat. These seeds generally take a long time to germinate after sowing, sometimes requiring up to a month to do so (Joker, 2000) [2]. A major drawback of seed propagation is that freshly harvested tamarind seeds often show poor germination, even under favourable conditions, due to seed dormancy. However, studies have shown that pre-sowing treatments using chemicals such as GA_3, KNO_3, NAA, and thiourea can enhance seed germination and seedling development in various crops. Therefore, the present study was conducted to evaluate the effect of soaking duration and plant growth regulators (PGRs) on the germination and growth of tamarind.

Tamarind originates from tropical Africa but is now extensively cultivated and naturalized throughout tropical regions. It is widely grown across tropical and subtropical areas of the Indian subcontinent and is commonly planted along roadsides, in parks, and similar areas. In India, tamarind is cultivated over an area of 58.11 hectares, with an annual production of 201.82 tonnes. The fruit is widely used in Indian cuisine due to its high tartaric acid content (8%). Tamarind seeds yield a gum used as a binding agent, and the wood is valued for its quality timber.

Materials and Methods

The present investigation was carried out during 2025 at College of Horticulture and Forestry, Mahatma Gandhi Udyanikee Evam Vanikee University, Durg. The treatment comprised of four soaking time viz., control (zero hours) (S_0), 12 hours (S_1), 18 hours (S_2) and 24 hours (S_3) and different seed treatment chemicals viz., control (without-PGRs) (P_0), GA_3 @ 100 ppm (P_1), GA_3 @ 200 ppm (P_2), NAA @ 100 ppm (P_3), NAA @ 200 ppm (P_4), were evaluated in Factorial completely randomized design with three repetitions. Uniform and healthy seeds were selected and used for the experiment. After imposing treatments, seeds were sown in polythene bags size of 6" × 8" size of 50 micron, previously filled with prepared medium of red soil + FYM + sand + cocopeat (2:1:1:1) at 1-1.5 cm deep and kept in net house. To maintain proper moisture throughout the experimental period, regular watering was done. Observations were recorded daily for germination parameters. Whereas other growth parameters such as number of leaves per seedling, stem girth, stem length, survival percentage of seedling, and mortality percentage were recorded at 30, 60, 90 days after sowing. The data recorded during the course of investigation were subjected to statistical analysis following standard procedure described by Panse and Sukhatme (1967) [7].

Results and Discussion

Germination attribute

Days required for initiation of germination

The minimum number of days for seed germination 9.51and 8.10 respectively was recorded when tamarind seeds soaked for 24 hours and treated with 200 ppm while the interaction was found significant (Table No 1). It might be due to the involvement of GA_3 in the activation of cytological enzymes along with increase in cell wall plasticity and better water absorption (Stewart and Freebairn, 1969) [11]. Similar results were reported by Vasantha *et al*. (2014) [12] in tamarind.

Days required for 50% germination

The minimum number of days for 50% germination 14.13and 12.49 respectively was recorded when tamarind seeds soaked for 24 hours and treated with 200 ppm (Table No 1).

Germination percentage (%)

Among the soaking time, 24 hours soaking time and GA_3 200 mgl-1 showed significantly highest germination percentage (78.52% and 86.93%, respectively). The minimum germination percentage was recorded in 0 hrs soaking time and without chemical-control 29.21% and 64.43% (Table No 1). It might be due to the GA_3 acts directly on embryo relieving them from dormancy through promoting protein synthesis and elongation of coleoptiles and leaves also helps in the production of ethylene. This ethylene invokes the synthesis of hydrolases, especially amylase, which favours the seed germination. Thus, the enhanced enzymatic reactions along with the suppression of inhibitors by these growth substances might have acted in faster germination (Stewart and Freebairn, 1969) [11]. The results of study are in close agreement with the findings of Muralidhara *et al*. (2015) [4] and Venkatrao and Reddy (2005) [13] in mango.

Growth attributes

Seedling height (cm)

The Maximum seedling height was observed with 24 hours soaking time (11.26 cm, 33.18 cm, and 50.26 cm, respectively) and GA_3 @ 200 ppm (12.45 cm, 35.79 cm and 54.23 cm respectively) at 30, 60 and 90 DAS which was at par with the treatments GA_3 @ 100 ppm, NAA @ 200 ppm and NAA @ 100 ppm. While minimum seedling height was recorded in without chemical-control (Table No 2). It might be due to soaking tamarind seeds for 24 hours may have accelerated the hydrolysis of complex sugar into simple sugars which are than utilized in the synthesis of auxins and proteins. It is a well known fact that proteins are utilized in the production of new tissues and that auxins promote growth. This probably explains the higher values recorded for various growth parameters under 24 hours soaking time. The increase in seedling height with GA_3 treatment was due to the fact that this hormone increased osmotic uptake of nutrients, causing cell elongation and thus increased height of the plant (Shanmugavelu, 1966) [10]. Such type of findings are also reported by Nimbalkar, *et al*. 2012 [6] in karonda.

Number of leaves/seedlings

Among the soaking time and different seed treatment chemicals, 24 hours soaking time (4.2, 9.3 and 13.8, respectively) and GA_3 @ 200 ppm (2.7, 9.9 and 14.8, respectively) recorded the maximum number of leaves per seedling at 30, 60 and 90 DAS (Table No. 2). The increase in number of leaves per seedling might be due to activity of GA_3 at the apical meristem resulting in more synthesis of nucleoprotein responsible for increasing leaf initiation (Sen and Ghunti, 1976) [9]. The observation analogues to these findings were reported by Jadhav *et al*. (2015) [1] in custard apple.

Stem diameter (mm)

The Maximum stem diameter was observed in 24 hours soaking time (1.33 mm, 2.00 mm and 2.36 mm) and GA_3 200 ppm (1.12 mm, 2.22 mm and 2.58 mm) at 30, 60 and 90 DAS which were significantly superior over all the remaining treatments (Table No. 2). This result is in agreement with the finding of Manekar *et al*. (2011) in aonla.

Seedling Growth Parameters

Survival percentage

The highest survival percentage (Table No.1) was observed in 24 hours soaking time (84.91%), GA_3 200 ppm (88.10%) at 90 DAS which was at par with the treatment NAA @ 200 ppm and NAA @ 100 ppm. This might be due to the overall performance in relation to growth parameters were good in same treatment which ultimately increased the survival percentage.

Table 1: Effect of soaking time and PGR on germination and survival parameter of Tamarind

Treatment	Days taken for initial germination	Days taken for 50% germination	Germination%	Survival%
Soaking time				
S_0	24.04	50.83	29.21	76.41
S_1	15.18	28.41	50.60	78.79
S_2	13.05	18.08	67.01	82.16
S_3	9.51	12.49	78.52	84.91
SEM	1.09	1.15	0.99	1.65
CD	3.13	3.28	2.83	4.72
PGRs				
P_0	13.19	21.41	64.43	74.33
P_1	9.25	15.86	77.81	81.61
P_2	8.10	14.13	86.93	88.10
P_3	10.96	18.28	68.46	77.83
P_4	10.16	17.18	75.12	80.97
SEM	0.92	0.96	3.22	1.85
CD	2.64	2.76	9.19	5.28
Interaction (S*P)				
$S_{0\ p0}$	17.8	27.6	60.5	73.6
$S_{0\ p1}$	10.0	16.6	71.0	77.1
$S_{0\ p2}$	9.4	16.5	74.6	77.5
$S_{0\ p3}$	17.1	23.0	63.1	74.3
$S_{0\ p4}$	13.4	21.3	64.8	74.7
S_1P_0	17.3	26.6	62.2	73.9
S_1P_1	8.6	15.8	74.9	80.9
S_1P_2	7.3	14.8	84.3	81.7
S_1P_3	10.2	17.5	68.8	76.3
S_1P_4	9.3	16.0	69.6	79.4
S_2P_0	10.2	18.1	66.5	74.7
S_2P_1	8.6	15.2	82.6	81.2
S_2P_2	7.1	12.7	93.8	95.9
S_2P_3	9.3	16.2	69.6	78.2
S_2P_4	8.6	15.7	77.1	80.9
S_3P_0	10.3	17.6	68.4	75.2
S_3P_1	8.5	15.2	82.8	81.3
S_3P_2	6.9	12.5	95.0	96.8
S_3P_3	9.0	16.0	72.2	80.1
S_3P_4	7.1	12.8	89.0	91.9
SEM	1.17	1.30	6.43	2.57
CD	3.36	3.71	18.38	7.34
(SxP)	S	S	S	S

Table 2: Effect of soaking time and PGR on plant growth parameter of Tamarind

	No. of leaves per seedling			Stem length (cm)			Stem Girth (mm)		
Treatment	**30 DAS**	**60 DAS**	**90 DAS**	**30 DAS**	**60DAS**	**90DAS**	**30 DAS**	**60 DAS**	**90 DAS**
Soaking time									
S_0	1.10	5.21	7.99	6.29	25.02	37.89	0.56	1.07	1.73
S_1	2.32	7.25	10.92	8.31	28.07	42.57	0.78	1.43	1.97
S_2	3.09	8.73	12.67	9.98	31.19	47.25	1.04	1.63	2.22
S_3	4.17	9.28	13.77	11.26	33.18	50.26	1.33	2.00	2.36
SEM	0.01	0.34	0.50	0.77	0.74	1.59	0.14	0.20	0.09
CD	0.04	1.01	1.48	2.27	2.12	4.68	0.41	0.60	0.26
PGRs									
P_0	2.70	4.74	7.57	4.57	22.34	33.87	0.82	0.92	1.54
P_1	2.78	8.67	12.76	11.28	32.68	49.50	0.92	1.71	2.27
P_2	2.65	9.89	14.77	12.45	35.79	54.23	1.12	2.22	2.58
P_3	2.53	6.44	9.68	7.23	26.44	40.05	0.92	1.25	1.87
P_4	2.70	8.34	11.91	9.28	29.58	44.83	0.85	1.56	2.10
SEM	0.01	0.27	0.56	0.86	0.83	1.77	0.15	0.23	0.10
CD	0.03	0.77	1.66	2.54	2.37	5.23	0.46	0.67	0.29
Interaction (S*P)									
$S_{0\ p0}$	1.2	3.2	6.2	3.4	20.8	31.1	0.70	0.78	1.32
$S_{0\ p1}$	1.1	6.3	8.9	9.6	25.6	45.6	0.67	1.22	1.86
$S_{0\ p2}$	0.9	6.7	9.7	9.9	27.6	46.3	0.63	1.24	1.93
$S_{0\ p3}$	1.1	4.3	7.2	4.2	21.7	33.2	0.42	0.79	1.54
$S_{0\ p4}$	1.2	5.7	7.9	4.3	21.8	33.3	0.38	0.81	1.56
S_1P_0	2.3	3.4	7.0	4.2	21.7	33.0	0.63	0.79	1.44
S_1P_1	2.5	9.5	12.9	11.0	32.4	48.8	0.82	1.44	2.25
S_1P_2	2.5	10.2	15.4	12.8	35.1	53.0	0.83	2.14	2.52
S_1P_3	2.1	6.3	9.4	6.7	25.5	38.9	0.82	1.20	1.78
S_1P_4	2.2	7.3	9.9	6.8	30.3	39.2	0.79	1.33	2.08
S_2P_0	3.1	6.0	8.1	5.0	22.8	34.8	0.74	0.84	1.67
S_2P_1	3.2	9.7	14.5	12.2	33.8	51.6	0.89	1.72	2.31
S_2P_2	3.3	10.8	16.8	13.0	38.5	57.5	1.32	3.07	2.83
S_2P_3	2.8	7.0	10.3	8.2	30.3	42.2	1.26	1.33	2.07
S_2P_4	3.0	9.6	13.6	11.6	33.3	50.1	1.01	1.51	2.31
S_3P_0	4.2	6.1	8.9	5.7	23.7	36.5	1.21	1.11	1.70
S_3P_1	4.3	9.7	14.7	12.4	33.9	52.0	1.31	1.82	2.35
S_3P_2	3.9	11.9	17.1	14.1	39.7	60.1	1.71	3.32	2.98
S_3P_3	4.0	7.7	11.9	9.8	30.4	45.9	1.19	1.40	2.11
S_3P_4	4.5	10.8	16.2	14.4	38.3	56.7	1.22	2.99	2.82
SEM	0.02	0.47	1.13	1.7	1.4	2.5	0.22	0.3	0.1
CD	0.05	1.33	3.32	5.1	4.1	7.2	0.63	0.8	0.3
(SxP)	S	S	S	NS	S	S	0.70	0.78	1.32

Conclusion

Conclusion From the findings of the present study, it may be concluded that among different treatments, soaking time 24 hours (S_2) recorded better seed germination, seedling growth survival parameters whereas, among different concentrations of PGRs, GA_3 200 ppm (P_2) recorded better seed germination and seedling growth parameters in Tamarind. Among the interaction, the treatment S_3P_2 (soaking time 24 hours + GA_3 200 ppm) recorded better seed germination, seedling growth and survival parameters as compared to other treatment combinations of soaking time and PGRs.

References

1. Jadhav AC, Bhagure YL, Rajeswari MR. Effect of PGR, chemicals and plant extract on seed germination and seedling growth of custard apple (*Annona squamosa*). Asian Journal of Horticulture. 2015;10(1):184-186.
2. Joker D. Seed Leaflet: *Tamarindus indica* L. Humlebaek: Danida Forest Seed Centre; 2000.
3. Meshram PC, Joshi PS, Bhoyar RK, Sahoo AK. Effect of different plant growth regulators on seedling growth of acid lime. Research in Environment and Life Sciences. 2015;8(4):725-728.
4. Murlidhara BM, Reddy YTN, Akshitha HJ, Srilatha V. Effect of presowing treatments on germination, growth and vigour of polyembryonic mango seedlings. Environment and Ecology. 2015;33(3):1014-1018.
5. Muzaffar K, Kumar P. Tamarind: A mini-review. MOJ Food Processing & Technology. 2017;5(3):0012.
6. Nimbalkar SD, Jadhav YS, Adat SS, Savvashe AY. Effect of different seed treatments on germination and growth of karonda (*Carissa congesta* W.) seedlings. Green Farming. 2012;3(3):340-342.
7. Panse VC, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: ICAR; 1967.
8. Purseglove JW. Tropical crops: Dicotyledons. London: Longman Scientific and Technical; 1987. p. 204-206.
9. Sen SK, Ghunti P. Effect of pre-sowing seed treatment on germination and seedling growth in papaya. The Orissa Journal of Horticulture. 1976;4:38-43.
10. Shanmugavelu KG. Studies on the effect of plant growth regulator on the seedling of some tree plant species. South Indian Journal of Horticulture. 1966;14:24-25.

11. Stewart ER, Freebairn HT. Ethylene, seed germination and epinasty. Plant Physiology. 1969;44:955-958.
12. Vasantha PT, Vijendrakumar RC, Guruprasad TR, Mahadevamma M, Santhosh KV. Studies on effect of growth regulators and biofertilizers on seed germination and seedling growth of tamarind (*Tamarindus indica* L.). Plant Archives. 2014;14(1):155-160.
13. Venkatrao, Reddy YTN. Effect of osmopriming on germination, seedling growth and vigour of mango (*Mangifera indica* L.) stones. Karnataka Journal of Agricultural Sciences. 2005;1(4):29-35.