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STUDIES ON EFFECT OF PRIMING ON SPROUTING AND QUALITY OF RHIZOMES IN TURMERIC (*CURCUMA LONGA* L.)

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ABSTRACT

A laboratory experiment was conducted during 2024-25 at the Department of Seed Science and Technology, College of Agriculture, UAS, Raichur, to evaluate the effect of different priming treatments on sprouting behaviour and seedling quality of turmeric (*Curcuma longa* L.) rhizomes. The experiment was laid out in a CRD with five treatments and four replications, using the cultivar IISR Prathiba. The treatments comprised hydropriming (1 hr), *Pseudomonas fluorescens* priming (10 g L^{-1} for 1 hr), *Trichoderma viride* priming (4 g L^{-1} for 1 hr), ethephon (100 ppm for 1 hr) and gibberellic acid (GA_3) (100 ppm for 1 hr). Observations were recorded on days to 50% sprouting, sprouting percentage at 20, 30 and 40 DAS, shoot length and root length at corresponding intervals. Among the treatments, GA_3 at 100 ppm recorded the minimum days to 50% sprouting (20.12 days) and the highest sprouting percentage (46.50%, 69.25% and 92.75% at 20, 30 and 40 DAS, respectively), as well as maximum shoot length (2.21, 9.98 and 16.89 cm) and root length (1.65, 4.09 and 7.21 cm). Ethephon at 100 ppm performed comparably, while hydropriming recorded the lowest values. The results clearly indicate that priming, particularly with GA_3 and ethephon, significantly enhances early sprouting, shoot and root growth, thereby improving overall rhizome establishment in turmeric.

***Keywords*:** Ethephon, Gibberlic acid, Priming, *Pseudomonas fluorescens* and *Trichoderma.*

Introduction

Turmeric (*Curcuma longa* L.), a perennial rhizomatous species of the *Zingiberaceae* family, is a major spice crop cultivated in tropical and subtropical regions. India dominates global turmeric production, accounting for nearly 80 % of total output, with 2.97 lakh ha area and 10.42 lakh tonnes production during 2023-24, averaging 3.5 t ha^{-1} (Turmeric Outlook, 2025). Major producing states include Maharashtra, Telangana, Tamil Nadu, Karnataka, Madhya Pradesh, Odisha and West Bengal, while China, Myanmar, Nigeria and Bangladesh contribute marginally. Turmeric rhizomes serve multiple purposes in food, medicine, dye and cosmetics. Curcuminoids, especially curcumin, impart antioxidant, anti-inflammatory, antimicrobial and anticancer properties (Anusuya and Sathiyabama, 2015). Despite its importance, turmeric cultivation is often constrained by delayed sprouting, low sprouting percentage, poor vegetative growth, reduced yield and inferior quality of produce. Among most important is delayed sprouting, low sprouting percentage and quality. Various techniques are used to improve rhizome quality parameters.

Among the most frequently utilized technique is seed (rhizome) priming and priming is an effective pre-sowing technique widely used to enhance sprouting, uniform emergence and crop establishment in various crops. It involves a controlled hydration-dehydration process that activates essential metabolic pathways without allowing radicle protrusion. This treatment improves germination rate, root development, stress tolerance and overall plant vigor, leading to better flowering, yield and resilience. Rhizome priming also enhances water-use efficiency, synchronizes sprouting and strengthens resistance to environmental stresses. Rhizome priming can be accomplished through

different methods such as hydropriming (soaking in distilled water), priming with plant growth regulators (Ethephon, GA_3), biopriming (priming with bioagents like, *Trichoderma and Pseudomonas*). Considering the above facts, the present research work was under taken to evaluate the effect of priming on sprouting and quality of rhizomes in turmeric.

Materials and Methods

The laboratory experiment was conducted at the Department of Seed Science and Technology, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka, India during 2024–25 to evaluate the effect of priming on sprouting and quality of rhizomes in turmeric by using cultivar IISR Prathiba. The experiment was laid out in a Completely Randomized Design (CRD) with four replications.

The experiment consisted of five treatments with four replications to identify effect of different priming agents on sprouting and quality of turmeric rhizomes. The treatments included hydropriming for 1 hour (T_1), priming with *Pseudomonas fluorescens* at 10 g L^{-1} of water for 1 hour (T_2), priming with *Trichoderma viride* at 4 g L^{-1} of water for 1 hour (T_3), priming with ethephon at 100 ppm for 1 hour (T_4) and priming with gibberellic acid (GA_3) at 100 ppm for 1 hour (T_5). Rhizomes measuring 2–3 cm in length, each containing a bud, were cut into pieces and soaked in the respective priming solutions according to the treatment specifications. After the priming period, the rhizome pieces were removed from the solutions, shade-dried and placed in protrays filled with cocopeat until sprouting. Observations were recorded on days to 50 percent sprouting, sprouting percentage (%), shoot length (cm) and root length (cm).

Effect of priming on Days to 50 % sprouting

The number of days taken from sowing to 50% sprouting was recorded as days to 50% sprouting. Regular observations were made. The observations were taken following the standard evaluation procedures described in the Turmeric Production Technology Manual (IISR, Kozhikode) and the Package of Practices for Turmeric (DASD, Kozhikode).

Effect of priming on sprouting percentage (%)

Sprouting percentage was recorded by observing each rhizome for visible sprouting and recording the number that have sprouted at 20, 30 and 40 days after sowing and the mean percentage was calculated. The observations were taken following the standard evaluation procedures described in the Turmeric Production Technology Manual (IISR, Kozhikode) and the Package of Practices for Turmeric (DASD, Kozhikode).

Effect of priming on Shoot length (cm)

Shoot length was recorded from the sprouted rhizome. The average value of ten seedlings was taken for analysis at 20, 30 and 40 days after sowing. Shoot length was expressed in centimetre. The observations were taken following the standard evaluation procedures described in the Turmeric Production Technology Manual (IISR, Kozhikode) and the Package of Practices for Turmeric (DASD, Kozhikode).

Effect of priming on Root length (cm)

Root length was recorded from the sprouted rhizome. The average value of ten seedlings was taken for analysis at 20, 30 and 40 days after sowing. Root length was expressed in centimetre. The observations were taken following the standard evaluation procedures described in the Turmeric Production Technology Manual (IISR, Kozhikode) and the Package of Practices for Turmeric (DASD, Kozhikode).

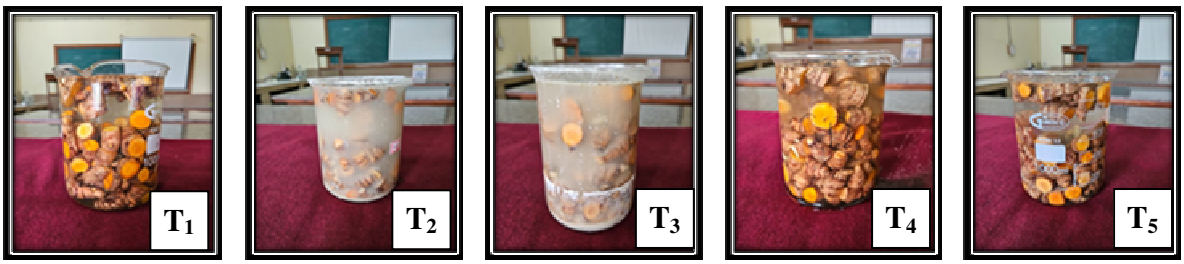

Fig. 1 : Preparation of priming solutions for turmeric rhizome priming

Legend

T_1: Hydropriming for 1 hr
T_2: *Pseudomonas fluroscens* (10g/L of water for 1hr)
T_3: *Trichoderma viridae* (4gm/L of water for 1 hr)
T_4: Ethephon @ 100 ppm for 1 hr
T_5: Gibberellic acid 100 ppm for 1 hr

Result and Discussion

The results indicated that the different priming treatments significantly affected days to 50% sprouting, sprouting percentage (%), shoot length (cm) and root length (cm), as presented in Tables 1, 2 and 3.

In the present study, priming treatments significantly influenced the days to 50% sprouting (Table 1). The shortest sprouting duration was recorded with gibberellic acid (GA_3) @ 100 ppm for 1 hour (20.12 days), which is on par with ethephon @ 100 ppm for 1 hour (20.68 days), while hydropriming showed the longest duration (23.14 days). Priming with *Pseudomonas fluorescens* (10 gL^{-1} for 1 hour) and *Trichoderma viride* (4 g L^{-1} for 1 hour) resulted in 21.27 days and 22.22 days, respectively, indicating that both hormonal and biological priming accelerated sprouting. The superior performance of GA_3 is attributed to its ability to promote cell elongation, activate enzymes such as α-amylase and mobilize stored reserves to break dormancy and stimulate bud emergence, while ethephon, as an ethylene-releasing compound, enhances metabolic activity and triggers physiological processes for sprout initiation. Microbial priming with *Pseudomonas fluorescens* and *Trichoderma viride* further improved early sprouting by producing growth-promoting metabolites and inducing systemic resistance, supporting better seedling vigour and establishment. Similar results were reported by Chien *et al*. (2023) and Chittaragia *et al*. (2020) in ginger. Baby *et al*. (2020) also reported improved survival rates above 84% in ginger with microbial and hydropriming treatments, highlighting their eco-friendly potential.

Sprouting percentage was significantly influenced by priming treatments at 20, 30 and 40 DAS (Table 1, Fig. 2). Rhizomes treated with gibberellic acid (GA_3) @ 100 ppm exhibited the highest sprouting (46.50%, 69.25% and 92.75%), which is on par with ethephon @ 100 ppm (45.75%, 67.75% and 90.50%), while *Pseudomonas fluorescens* (10 gL^{-1} for 1 h) achieved 40.50%, 63.75% and 87.25%, respectively. *Trichoderma viride* (4 gL^{-1} for 1 h) also performed better than hydropriming, demonstrating that both chemical and biological priming effectively accelerated sprout emergence and improved stand establishment. The superior effect of GA_3 is attributed to its ability to stimulate hydrolytic enzyme production, enhance α-amylase activity, mobilize stored food reserves, increase respiration and promote cell elongation, facilitating dormancy breaking and bud emergence, as observed in ginger by Melati *et al*. (2016). Ethephon, an ethylene-releasing compound, enhanced sprouting by promoting cell wall loosening, activating enzymes and stimulating protein and nucleic acid synthesis required for sprout growth, thereby reducing dormancy and improving sprouting percentage, similar effects were reported by Dharini (2018) in ginger. Microbial priming with *Pseudomonas fluorescens* and *Trichoderma viride* improved sprouting through the production of growth-promoting metabolites and stronger rhizome-soil interactions, consistent with Menon *et al*. (2016) in ginger. Hydropriming, though comparatively less effective, enhanced water uptake and initiated early metabolic activity, aligning with Thomas and Jisha (2023) in ginger.

Priming treatments significantly influenced shoot length at 20, 30 and 40 DAS (Table 2, Fig. 3). GA_3 @ 100 ppm for 1 hour recorded the highest shoot lengths (2.21 cm, 9.98 cm and 16.89 cm), followed by ethephon @ 100 ppm (1.99 cm, 9.55 cm and 16.31 cm) and *Pseudomonas fluorescens* (1.81 cm, 8.92 cm and 15.13 cm). *Trichoderma viride* and hydropriming were less effective but still improved shoot growth over the control. GA_3 enhanced shoot elongation by promoting cell elongation, stimulating α-amylase activity, increasing chlorophyll synthesis, respiration and nutrient translocation, supporting vigorous early growth, as reported in turmeric by Gawande *et al*. (2021) and in onion by Bhusal and Luitel (2023). Ethephon, an ethylene-releasing compound, accelerated dormancy release, metabolic activity and growth-regulating pathways, similar to its effects on ginger emergence and survival (Chittaragia *et al*., 2020). Microbial priming with *Pseudomonas fluorescens* and *Trichoderma viride* improved shoot length through enhanced nutrient uptake, growth-promoting metabolites and systemic resistance, consistent with findings in ginger by Baby *et al*. (2020). Hydropriming also improved shoot growth by facilitating water imbibition and early metabolism, as observed in turmeric and ginger by Thomas and Jisha (2023). Overall, GA_3 and ethephon were most effective, while microbial priming provided sustainable benefits for early vigour, establishment and productivity in turmeric.

Priming treatments significantly influenced root length at 20, 30 and 40 DAS (Table 3, Fig. 4). GA_3 @ 100 ppm for 1 hour produced the longest roots (1.65 cm, 4.09 cm and 7.21 cm), followed by ethephon @ 100 ppm (1.53 cm, 3.80 cm and 6.91 cm), *Pseudomonas fluorescens* (1.42 cm, 3.55 cm and 6.63 cm) and *Trichoderma viride* (1.35 cm, 3.47 cm and 6.45 cm), while hydropriming recorded the lowest values (1.27 cm, 3.28 cm and 6.13 cm). The superior root elongation in GA_3 primed rhizomes may be attributed to its role in stimulating α-amylase activity, enhancing starch hydrolysis, mobilizing stored reserves

and promoting cell division and elongation, as reported in turmeric by Gawande *et al*. (2021). Ethephon, through ethylene release, enhanced cell wall loosening and dormancy breaking, leading to greater root initiation, similar to the findings of Chittaragia *et al*. (2020) in ginger. Bio-priming with *Pseudomonas fluorescens* and *Trichoderma viride* improved root growth through the production of phytohormones such as indole-3-acetic acid and cytokinins, phosphorus solubilization and beneficial rhizosphere activity, in agreement with Baby *et al*. (2020) in ginger. Hydropriming, though less effective, still improved root growth by facilitating water imbibition and early metabolic activation, as noted by Thomas and Jisha (2023) in turmeric. Overall, GA_3 and ethephon were most effective in enhancing root elongation, while microbial and hydropriming provided sustainable and eco-friendly alternatives for better root establishment and yield improvement in turmeric cultivation.

Table 1 : Effect of priming on days to 50 % sprouting and sprouting % at 20, 30 and 40 DAS on turmeric rhizome

Treatments	Days to 50 % sprouting	Sprouting %		
		20 DAS	30 DAS	40 DAS
T_1: Hydropriming for 1 hr	23.14	36.25	60.25	82.25
T_2: *Pseudomonas fluroscens* (10g/lit. of water for 1hr)	21.27	40.50	63.75	87.25
T_3: *Trichoderma viridae* (4g/lit. of water for 1 hr)	22.22	39.25	62.00	84.50
T_4: Ethephon @ 100ppm for 1 hr	20.68	45.75	67.75	90.50
T_5: Gibberellic acid @ 100ppm for 1 hr	20.12	46.50	69.25	92.75
Mean	21.49	41.65	64.60	87.45
S.E m ±	0.31	0.61	0.98	1.26
CD 1%	1.29	2.56	4.10	5.28

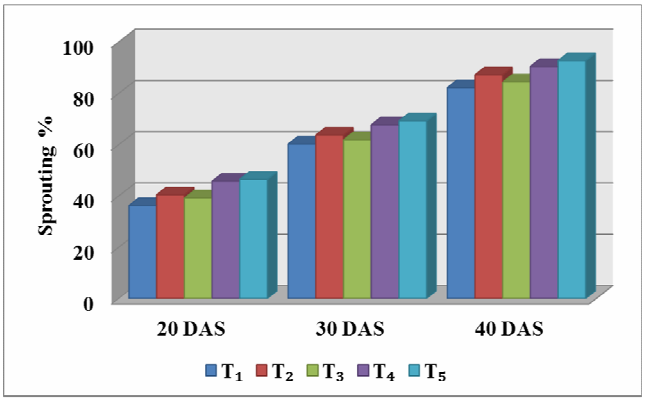

Fig. 2 : Effect of priming on sprouting % at 20 and 40 DAS on turmeric rhizome

Legend

T_1: Hydropriming for 1 hr
T_2: *Pseudomonas fluroscens* (10g/L of water for 1hr)
T_3: *Trichoderma viridae* (4g/L. of water for 1 hr)
T_4: Ethephon @ 100 ppm for 1 hr
T_5: Gibberellic acid 100 ppm for 1 hr

Table 2 : Effect of priming on shoot length at 20, 30 and 40 DAS on turmeric rhizome

Treatments	Shoot length (cm)		
	20 DAS	30 DAS	40 DAS
T_1: Hydropriming for 1 hr	1.44	7.81	14.21
T_2: *Pseudomonas fluroscens* (10g/lit. of water for 1hr)	1.81	8.92	15.13
T_3: *Trichoderma viridae* (4g/lit. of water for 1 hr)	1.61	8.22	14.72
T_4: Ethephon @ 100ppm for 1 hr	1.99	9.55	16.31
T_5: Gibberellic acid @ 100ppm for 1 hr	2.21	9.98	16.89
Mean	1.81	8.89	15.44
S.E m ±	0.03	0.16	0.27
CD 1%	0.14	0.66	1.12

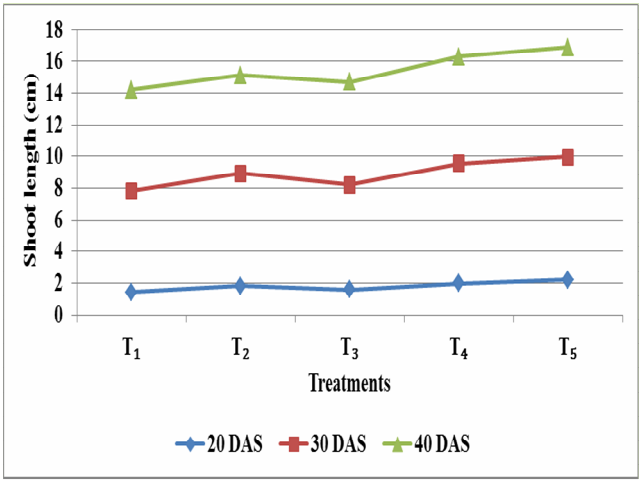

Fig. 3 : Effect of priming on shoot length (cm) at 20, 30 and 40 DAS on turmeric rhizome

Legend

T_1: Hydropriming for 1 hr
T_2: *Pseudomonas fluroscens* (10g/L of water for 1hr)
T_3: *Trichoderma viridae* (4g/L. of water for 1 hr)
T_4: Ethephon @ 100 ppm for 1 hr
T_5: Gibberellic acid 100 ppm for 1 hr

Table 3 : Effect of priming on root length at 20, 30 and 40 DAS on turmeric rhizome

Treatments	Root length (cm)		
	20 DAS	30 DAS	40 DAS
T_1: Hydropriming for 1 hr	1.27	3.05	6.13
T_2: *Pseudomonas fluroscens* (10g/lit. of water for 1hr)	1.42	3.55	6.63
T_3: *Trichoderma viridae* (4g/lit. of water for 1 hr)	1.35	3.31	6.45
T_4: Ethephon @ 100ppm for 1 hr	1.53	3.80	6.91
T_5: Gibberellic acid @ 100ppm for 1 hr	1.65	4.09	7.21
Mean	1.44	3.56	6.66
S.E m ±	0.02	0.06	0.11
CD 1%	0.11	0.28	0.45

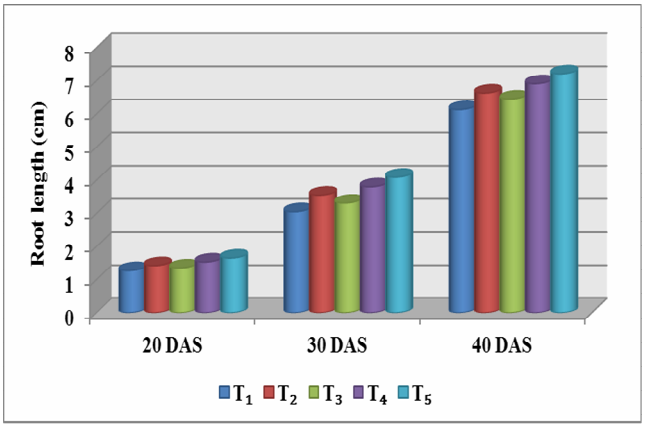

Fig. 4 : Effect of priming on root length (cm) at 20, 30 and 40 DAS on turmeric rhizome

Legend

T_1: Hydropriming for 1 hr
T_2: *Pseudomonas fluroscens* (10g/L of water for 1hr)
T_3: *Trichoderma viridae* (4g/L. of water for 1 hr)
T_4: Ethephon @ 100 ppm for 1 hr
T_5: Gibberellic acid 100 ppm for 1 hr

Conclusions

Priming treatments significantly improved sprouting, shoot and root growth in turmeric. T_5 (GA_3 @ 100 ppm for 1 hr) recorded the earliest sprouting (22.32 days), highest sprouting percentage (92.86% at 40 DAS) and maximum shoot and root lengths, followed by T_4 (Ethephon @ 100 ppm). Control (T_1) consistently showed the lowest performance across all stages.

GA_3 and ethephon priming effectively enhanced days to 50% sprouting, sprouting percentage, shoot and root elongation through hormonal activation, while microbial and hydropriming offered eco-friendly, economical options that improved establishment and yield in turmeric.

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References

Anusuya, S. and Sathiyabama, M. (2015). Induced chitinase and chitosanase activities in turmeric plants by application of β-D-glucan nanoparticles. *Notulae Sci. Biol.*, **7**(3), 295-298.

Baby, A.S., Menon, J.S. and Ashwini, S. (2023). Yield improvement in transplanted ginger by seed priming and foliar spray of chitosan. *Med. Plant Int. J. Phytomed.*, **15**(2), 361-368.

Bhusal, Y. and Luitel, B.P. (2023). Influence of gibberellic acid and bulb priming on growth and seed yield of onion. *Int. J. Res. Publ. Rev.*, **4**(1), 670-674.

Chien, C.S., Chen, W.L. and Sung, Y. (2023). Effects of growth regulators on forced sprouting and growth of ginger. *Hortic. J.*, **92**(1), 56-65.

Chittaragia, D., Menonb, J.S. and Francisc, R.M. (2020). Priming ginger (*Zingiber officinale* Rosc.) seed rhizomes for better survival of transplants in nursery multi-dimensional approaches in transforming agriculture, 41.

DASD (Directorate of Arecanut and Spices Development). 2020, *Package of Practices for Turmeric*. Ministry of Agriculture and Farmers Welfare, Government of India, Kozhikode, Kerala.

Dharini, C. (2018). Priming seed rhizome to enhance growth and yield of transplanted ginger (*Zingiber officinale* Rosc.) (Doctoral dissertation, Department of Plantation Crops and Spices, College of Horticulture, Vellanikkara).

Fischer, R.A. (1950). Statistical methods for research workers. Oliver and Boyd, Edinburgh.

Gawande, S.S. (2021). Response of turmeric to planting materials and plant growth regulators (Doctoral dissertation, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola).

IISR (Indian Institute of Spices Research) (2019). *Turmeric Production Technology*. ICAR–Indian Institute of Spices Research, Kozhikode, Kerala, India.

Melati, I.S., Palupi, E.R. and Susila, A.D. (2016). Growth, yield and quality of ginger from produced through early senescence. *Int. J. Appl. Sci. Technol.*, **6**(1), 21-28.

Menon, J.S., Karippai, R.S. and Shaji, J. (2016). Bio priming seed material to enhance yield in offseason green ginger (*Zingiber officinale* Rosc.) cultivation. *Neera*, **21**, 137.

Panse, V.G. and Sukhatme, P.V. (1954). Statistical methods for agricultural workers. ICAR, New Delhi.

PJTSAU (2025). *Turmeric Outlook – May 2025*. Agricultural Market Intelligence Centre, Professor Jayashankar Telangana State Agricultural University.

Thomas, S. and Jisha, K.C. (2023). Efficiency of priming methods in crop establishment of ginger (*Zingiber officinale* Rosc.). *J. Stress Physiolog. Biochem.*, **19**(4), 96-101.