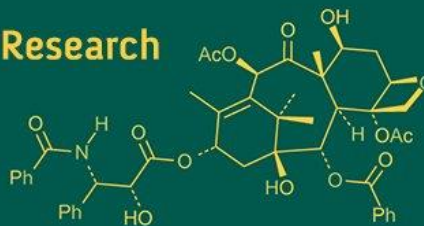


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Effect of seed priming treatment on growth and yield of coriander (*Coriandrum sativum* L.)

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Abstract

The present investigation entitled "Effect of Seed Priming treatment on growth and yield of Coriander (*Coriandrum sativum* L.)" was conducted at Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during the Rabi season 2025-26. The soil of the experimental site was loam, with a pH of 7.1. The experiment was laid out in a randomised block design (RBD) with three replications. The treatment comprised of (T₁) CaCl₂ @ 1.0% for 12 hours, (T₂) *Trichoderma viride* @ 4% for 12 hours, (T₃) GA₃ @ 50 ppm for 12 hours, (T₄) Thiourea @ 750 ppm for 12 hours, (T₅) PEG 6000 @ -1 MPa for 12 hours, (T₆) Hydropriming for 12 hours, (T₇) Control (dry seed).

The outcomes of the investigation reveals that significantly higher germination and growth attributes viz., Seed germination percentage (82.34%), seedling length (17.67 cm), seedling dry weight (12.14 mg), seed vigour index-I (1454.95), seed vigour index-II (999.24), speed of germination (18.20) in treatment (T₅) PEG 6000 @ -1 MPa for 12 hours and was at par with treatment (T₃) GA₃ @ 50 ppm for 12 hours and (T₄) Thiourea @ 750 ppm for 12 hours. However, the lowest values were recorded under (T₇) Control (dry seed). Similarly, highest plant height (95.91cm), number of branches plant⁻¹ (7.42), dry matter production harvest (7.85) & seed yield (1765.88) (was found in treatment (T₅) PEG 6000 @ -1 MPa for 12 hours and was at par with treatment (T₃) GA₃ @ 50 ppm for 12 hours and (T₄) Thiourea @ 750 ppm for 12 hours. However, the lowest values were recorded under (T₇) Control (dry seed).

Keywords: Coriander, PEG 6000, GA₃, germination, vigour index, growth

1. Introduction

Coriander (*Coriandrum sativum* L.) is an annual herb of the family Apiaceae (Umbelliferae), cultivated widely for its aromatic seeds and fresh leaves. The seeds are used as a spice, while the leaves, known as cilantro or dhanian, serve as a culinary herb. Native to the Mediterranean region. The genus *Coriandrum* comprises only two species: *C. sativum* and its wild relative, *C. tordylium*. It has a basic chromosome number of $x = 11$, and *C. sativum* is diploid ($2n = 22$). The plant varies in height from 90 to 120 cm, depending on agroclimatic conditions. It has an erect, hollow, sympodial stem with monochasial branching. Lower leaves are broad and lobed, while upper leaves are finely divided. The inflorescence is a compound umbel bearing small white or pink protandrous flowers, promoting cross-pollination. The fruit is a globular yellow-brown schizocarp (3-4 mm) that splits into two mericarps. The characteristic aroma of the seeds is due to essential oil (0.1-1.0%), mainly d-linalool. In India, it is mainly grown during the winter season (October-February). Besides its culinary importance, the seeds possess carminative, diuretic, and stomachic properties. The essential oil is used in perfumery, and oleoresin is utilised in flavouring food products. The essential oil is located in the convex longitudinal vittae of the seeds and is responsible for the plant's characteristic odour. Nutritionally, coriander seeds per 100 g contain about 11.2 g moisture, 14.1 g protein, 16.1 g fat, 4.4 g minerals, 32.6 g fibre, and 21.6 g carbohydrates, providing approximately 288 kcal of energy. They are also rich in calcium (630 mg), phosphorus (393 mg), and iron (7.1 mg), along with vitamins such as carotene (942 µg), thiamine (0.220 mg), riboflavin (0.350 mg), and niacin (1.1 mg). The fresh green leaves contain about 87.9% moisture, 3.3% protein, 0.6% fat, and 6.5% carbohydrates.

Despite having a genetic yield potential of 1, 600-2, 000 kg ha⁻¹, the average productivity of coriander seed in India during 2017-18 was only 1, 330 kg ha⁻¹, indicating a substantial yield

gap. Among Indian states, the highest productivity was 1 observed in Meghalaya (4.25 MT ha⁻¹), followed by Uttarakhand (4.20 MT ha⁻¹) and Maharashtra (2.27 MT ha⁻¹).

In Chhattisgarh, coriander is cultivated over an area of 20, 069 hectares, with an annual production of 94, 730 metric tons (Department of Horticulture, 2018-2019). Major coriander-growing districts in the state include Raipur, Mahasamund, Kondagaon, Dhamtari, Bilaspur, Raigarh, Durg, Korba, and Bemetara.

Moisture deficit and temperature stress are major factors limiting rapid and uniform crop establishment under field conditions. Recent research has indicated a relationship between seed moisture content and the occurrence of hard-seededness. The concept of seed priming was first introduced by Heydecker (1973) as a pre-sowing treatment to enhance seed performance. Choudhary *et al.* (2008) [14] defined seed priming as a controlled hydration process that prevents radicle emergence while allowing essential pre-germinative physiological and biochemical processes to proceed. In general, seed priming involves treating seeds with specific agents to improve germination, seedling vigour, plant growth, and flowering. This process activates several enzymes responsible for the mobilisation of stored food reserves. However, determining the optimum duration of priming is critical to achieve maximum benefits without causing damage to the seeds. Primed seeds typically demonstrate improved germination rate, greater uniformity, faster emergence, and in some cases, higher overall germination percentage (Basra *et al.*, 2005b) [6].

2. Materials and Methods

The present investigation entitled “Effect of Seed Priming Treatment on Growth and Yield of Coriander (*Coriandrum sativum* L.)”, was conducted at the Horticulture Research cum Instructional Farm, BTC College of Agriculture and Research Station, Bilaspur (Chhattisgarh) during the Rabi season of 2025-26. The experiment was carried out in RBD design with three replications and seven treatments viz. (T₁) CaCl₂ @ 1.0% for 12 hours, (T₂) Trichoderma viride @ 4% for 12 hours, (T₃) GA₃ @ 50 ppm for 12 hours, (T₄) Thiourea @ 750 ppm for 12 hours, (T₅) PEG 6000 @ -1 MPa for 12 hours, (T₆) Hydropriming for 12 hours, (T₇) Control (dry seed). The seeds were primed using different priming agents for 12 hours on 04/11/25 and sown on 05/11/25. The recording of observations was done in the laboratory & Field. Seed germination percentage and other seed quality parameters were recorded on the 21st day. Field observations were recorded after every 30 DAS interval. The field was ploughed using a tractor-drawn plough, followed by harrowing and planking. Stubbles were removed, and plots were laid out using manual labour according to the experimental design.

Seed priming treatments were carried out using different priming agents to evaluate their effects on the germination, growth and yield performance of coriander. The soaking solutions for the coriander seeds were prepared at the respective treatment concentrations. For Halopriming, seeds were soaked in a 1.0% CaCl₂ solution prepared by dissolving 10 g of CaCl₂ per litre of water. Biopriming was performed using Trichoderma viride at 4%, where 40 g of the powder was mixed per litre of water and stirred thoroughly before soaking. Hormonal priming involved soaking seeds in a GA₃ solution at 50 ppm, prepared by

dissolving 50 mg of GA₃ per litre of water. Chemical priming was conducted using thiourea at 750 ppm, with the solution prepared by dissolving 0.75 g per litre of water. Osmopriming was carried out using PEG 6000 at -1 MPa, prepared by dissolving 188 g per litre of water. Hydropriming involved soaking seeds in distilled water without any additives. All priming treatments were conducted for a duration of 12 hours. A control treatment consisting of unprimed dry seeds was maintained without any soaking. The recommended dose of NPK was applied at the time of sowing, urea (80 kg/ha) was applied in split doses along with phosphorus (60 kg/ha) and potassium (40 kg/ha) was applied for all the treatments. The treated seeds were sown in furrows at a depth of 2-2.5 cm, lightly covered with soil and watered for germination. Thinning was done 25-30 days after germination to maintain proper spacing (30 X 10) and achieve an optimum plant population. Essential intercultural practices, including hand weeding and intercultivation, were performed as required. Appropriate plant protection measures were also adopted to manage pests and diseases effectively. Observations were taken at 30, 60, 90, and 90 days after sowing and harvest. The statistical analysis of the investigation involved comparing the calculated ‘F’ variance ratio to the table value at a 5% level of significance. If the calculated value exceeded the table value, the effect was considered significant difference between means was tested against the critical difference at the same level of significance.

3. Results and Discussion

The results of the present investigation revealed a significant influence of seed priming on Seed germination percentage, seedling length, seedling dry weight, seed vigour index-I, seed vigour index-II, speed of germination, plant height, number of branches plant⁻¹, dry matter production, i.e. Seed Quality & Growth Attributes of coriander (*Coriandrum sativum* L.). Among the different treatments, PEG 6000 @ -1 MPa for 12 hours (T₅) & GA₃ @ 50 ppm for 12 hours (T₃) consistently performed better than other treatments.

3.1 Seed Germination (%)

Mean performance of seed germination due to PEG 6000 @ -1 MPa for 12 hours (T₅) recorded the significantly highest germination percentage (82.34%), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (81.58%) & Thiourea @ 750 ppm for 12 hours (T₄) with (79.92%). The minimum (71.12%) was observed in the control (T₇). It may be due to osmotic pre-sowing treatment with polyethylene glycol (PEG), which can enhance seed germination, partly due to the substantial accumulation of nucleic acids. Similar observations were reported by Fu *et al.* (1988) in peanut, where PEG priming led to increased activity of key enzymes such as isocitrate lyase, involved in the glyoxylate pathway, along with ATPase, acid phosphatase, and RNA synthetase in both embryonic axes and cotyledons compared to the control. This enhanced enzymatic activity may have contributed to improved seed germination (Coolbear and Grierson, 1979) [13]

3.2 Seedling Length (cm)

Mean performance of seedling length (cm) due to PEG 6000 @ -1 MPa for 12 hours (T₅) recorded the significantly highest seedling length (17.67 cm), over other treatments,

i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (17.24 cm) & Thiourea @ 750 ppm for 12 hours (T₄) with (16.82 cm). The minimum (14.23 cm) was observed in the control (T₇). Priming of seeds with PEG 6000 at -1 MPa for 12 hours may have enhanced the activity of key enzymes such as catalase, peroxidase, amylase, and invertase. The increased levels of proteins, sugars, and RNA may also have contributed to improved seedling length by facilitating faster germination and better overall growth. In addition, gibberellic acid (GA₃) is known to promote water uptake in seedlings, which may activate enzymes responsible for mobilising stored food reserves in the embryo. This process ultimately results in the development of taller and more vigorous seedlings (McDonald, 1980) ^[19].

3.3 Seedling Dry Weight (mg)

Mean performance of Seedling Dry Weight (mg) due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest Seedling Dry Weight (mg) (12.14 mg), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (11.86 mg) & Thiourea @ 750 ppm for 12 hours (T₄) with (11.58). The minimum (8.60 mg) was observed in the control (T₇).

3.4 Seed Vigour Index-I

Mean performance of Seed Vigour Index-I due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest Seed Vigour Index-I (1454.95), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (1406.44) & Thiourea @ 750 ppm for 12 hours (T₄) with (1344.25). The minimum (1012.04) was observed in the control (T₇). The enhancement in Seed Vigour Index (SVI) may be attributed to the mobilisation of stored food reserves, along with the activation and re-synthesis of metabolic processes during osmotic priming (Nascimento and West, 1998) ^[21].

3.5 Seed Vigour Index-II

Mean performance of Seed Vigour Index-II due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest Seed Vigour Index-II (999.24), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (967.21) & Thiourea @ 750 ppm for 12 hours (T₄) with (925.71). The minimum (611.60) was observed in the control (T₇).

3.6 Speed of germination

Mean performance of germination speed due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest germination speed (18.20), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (17.78) & Thiourea @ 750 ppm for 12 hours (T₄) with (17.37). The minimum (12.90) was observed in the control (T₇). During the priming process, seeds undergo the initial two phases of germination; therefore, upon rehydration at the time of sowing, primed and subsequently dried seeds directly enter phase III of imbibition (Bradford, 1986), leading to an increased rate of germination.

3.7 Plant height (cm)

Mean performance of plant height (cm) due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest plant height (cm) (95.91), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (93.45) & Thiourea @ 750 ppm for 12 hours (T₄) with (91.51). The minimum (74.73) was observed in the control (T₇). Sadavarthe and Gupta (1963) also associated increased plant height in brinjal with early seedling emergence and accelerated cell division in the meristematic regions, along with enhanced auxin metabolism, improved cell wall plasticity, increased membrane permeability, higher photosynthetic activity, cell enlargement, and rapid cell elongation. The present findings are also consistent with those reported by Akter *et al.* (2007) ^[3] in mustard.

3.8 Number of branches plant⁻¹

Mean performance of the number of branches per plant⁻¹ due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest number of branches per plant (7.42), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (7.13) & Thiourea @ 750 ppm for 12 hours (T₄) with (6.93). The minimum (5.08) was observed in the control (T₇). Seeds primed with PEG 6000 at -1 MPa for 12 hours may have enhanced the activity of enzymes such as catalase, peroxidase, amylase, and invertase. Manigopa *et al.* (2007) ^[18] reported that seed priming in chickpea resulted in an increased number of branches per plant. Similar findings were also documented by Pradhan *et al.* (2014) ^[22], who observed that PEG 6000 priming led to an increase in the number of branches in tomato plants.

3.9 Dry matter production at 30, 60, 90 DAS & at harvest

Mean performance of dry matter production due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest dry matter production (8.75), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (8.64) & Thiourea @ 750 ppm for 12 hours (T₄) with (8.56). The minimum (6.33) was observed in the control (T₇).

3.10 Seed yield kg ha⁻¹

Mean performance of seed yield kg per hectare due to PEG 6000 @-1 MPa for 12 hours (T₅) recorded the significantly highest seed yield kg per hectare (1765.88), over other treatments, i.e. T₁, T₂, T₃, T₄, T₆, T₇ but was at par with GA₃ @ 50 ppm for 12 hours (T₃) with (1693.83) & Thiourea @ 750 ppm for 12 hours (T₄) with (1646.67). The minimum (1184.24) was observed in the control (T₇). Furthermore, seed priming has been reported to enhance stand establishment by improving drought tolerance, reducing pest incidence, and ultimately increasing crop yield (Harris *et al.*, 1999). Harris *et al.* (2004) also observed higher seed yield in wheat following seed treatment. The present results are consistent with the findings of Arif *et al.* (2008) in soybean.

Table 1: Mean performance of seed quality and growth parameters

Treatments	Seed germination (%)	Seedling length (cm)	Seedling dry weight (mg)	Seed vigour index-I	Seed vigour index-II	Speed of germination
T ₁ -CaCl ₂ @ 1.0% for 12 hours	76.42	16.14	10.49	1233.42	801.72	15.74
T ₂ -Trichoderma viride @ 4% for 12 hours	75.85	15.98	10.39	1212.08	787.85	15.58
T ₃ -GA ₃ @ 50 ppm for 12 hours	81.58	17.24	11.86	1406.44	967.21	17.78
T ₄ -Thiourea @ 750 ppm for 12 hours	79.92	16.82	11.58	1344.25	925.71	17.37
T ₅ -PEG 6000 @-1 MPa for 12 hours	82.34	17.67	12.14	1454.95	999.24	18.20
T ₆ -Hydropriming for 12 hours	74.96	15.61	10.15	1170.13	760.58	15.22
T ₇ -Control (dry seed)	71.12	14.23	8.60	1012.04	611.60	12.90
SEm (±)	0.96	0.21	0.24	42.37	39.91	0.58
CD (5%)	2.92	0.64	0.72	128.52	121.06	1.76

Table 2: Mean performance of growth and yield parameters of coriander.

Treatment details	Plant height (cm)				Number of branches (plant ⁻¹)	Dry matter production (g plant ⁻¹)				Seed yield (kg ha ⁻¹)
	30 DAS	60 DAS	90 DAS	At harvest		30 DAS	60 DAS	90 DAS	At harvest	
T ₁ -CaCl ₂ @ 1.0% for 12 hours	11.34	51.26	80.35	84.57	6.36	1.27	4.49	6.71	7.54	1511.74
T ₂ -Trichoderma viride @ 4% for 12 hours	11.15	50.40	79.00	83.16	6.15	1.23	4.42	6.60	7.42	1473.75
T ₃ -GA ₃ @ 50 ppm for 12 hours	12.03	56.64	88.78	93.45	7.13	1.47	5.14	7.71	8.64	1693.83
T ₄ -Thiourea @ 750 ppm for 12 hours	11.87	55.46	86.93	91.51	6.93	1.45	5.09	7.64	8.56	1646.67
T ₅ -PEG 6000 @-1 MPa for 12 hours	12.26	58.13	91.11	95.91	7.42	1.46	5.25	7.85	8.75	1765.88
T ₆ -Hydropriming for 12 hours	10.92	49.36	77.37	81.44	6.02	1.23	4.32	6.48	7.26	1430.52
T ₇ -Control (dry seed)	10.14	45.29	70.99	74.73	5.08	1.02	3.77	5.62	6.33	1184.24
SEm (±)	0.16	1.43	2.09	2.25	0.27	0.05	0.19	0.30	0.32	84.72
CD (5%)	0.49	4.42	6.45	6.92	0.84	0.16	0.57	0.91	0.99	261.06

Conclusion

The results of the present study indicate that, among the different treatment combinations, seed priming with PEG 6000 @ -1 MPa for 12 hours (T₅), GA₃ @ 50 ppm for 12 hours (T₃), and thiourea @ 750 ppm for 12 hours (T₄) proved to be the most effective in improving seed germination (%), seedling length (cm), seedling dry weight (mg), seed vigour index-I, seed vigour index-II, and speed of germination when compared with the other treatments under laboratory conditions. Under field conditions, seed priming with PEG 6000 @ -1 MPa for 12 hours (T₅), GA₃ @ 50 ppm for 12 hours (T₃), and thiourea @ 750 ppm for 12 hours (T₄) exhibited significant improvement in growth and yield parameters. Among these treatments, T₅ (PEG 6000 @ -1 MPa for 12 hours) recorded superior performance with respect to seed yield (kg ha⁻¹) and number of branches plant⁻¹. Therefore, T₅ was found to be the most effective treatment among all, as well as T₃, and it can be recommended for achieving higher yield and improved quality seed production.

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