

Original Research Article

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Assessment of Different Priming Methods on Germination and Quality Parameters of Coriander (*Coriandrum sativum* L.)

A. Neha Reddy*, A. K. Chaurasia and Ehunme Sutnga

Department of genetics and plant breeding, Seed Testing Laboratory, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, India

*Corresponding author

ABSTRACT

Keywords

Coriander, Hydro priming, Osmo priming, Halo priming, Hormonal priming, Organic priming, GA₃, PEG 6000, KH₂PO₄, KNO₃, NaCl, Tulasi leaf extract and Moringa leaf extract

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Coriander is an important spice crop and occupies a prime position in flavouring substances and is available throughout the year providing a fragrant flavour. Seed Spices are annual herbs, whose dried seed or fruits are used as spices. They are nature's gift to mankind and add flavour to our food in addition to having preservative and medicinal value. So being considerate with the importance of Coriander, the present study emphasizes "Assessment of different priming methods on germination and quality parameters of coriander (*Coriandrum sativum* L.)" was undertaken with the objectives to assess the performance of different priming methods on improvement of germination and quality parameters in coriander and to identify the better responding priming method for coriander. The study was conducted in Department of Genetics and Plant Breeding, Seed Testing Laboratory, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, during 2019-2020. The experiment conducted was treated with different methods of priming for 12 hours and were shade dried in completely randomized design (CRD) with four replications, and analysed for germination and quality parameters. The experiment showed the organic treatment i.e Moringa Leaf Extract (MLE) attained the highest value in germination and quality parameters. Hence, the results concluded that the organic priming treatment Moringa Leaf Extract (MLE 5%) was found to be better and can be effectively used as low cost, environmentally friendly, easily adaptable priming method by farmers.

Introduction

Coriander (*Coriandrum sativum* L.) is an annual plant, possessing 2n=22 chromosomes with cross pollination as mode of reproduction which is native to the Southern Europe and North Africa to South Western Asia (Mouterde 1986) and is extensively grown in Bangladesh, India, Russia, Central

European Morocco. It belongs to the Umbelliferae (Apiaceae) family and genus *Coriandrum embrace* cultivated plant (*Coriandrum sativum*) and wild species (*Coriandrum torilyium*). Coriander is a tropical crop; it requires a cool and comparatively dry frost, free climate particularly at the time of flowering and seed formation stages, for good quality and high

yields. The optimum temperature of germination and early growth of coriander is 20-25 ° C. The germination is epigeal and the plant has a tap root.

Coriander is referred to as “kusthumbari” or “dhanayaka” in the Sanskrit literature (Prakash, 1990). Out of the total 75 spices grown in India, 20 are classified as seed spices with 44 per cent share in area and 21 per cent share in production of total spice in India. It is mainly cultivated for the seeds, whereas the leaves are used as a garnish purpose (Kiralan *et al.*, 2009). The typical staggered flowering behaviour of coriander resulted invariable fruit formation and leading to slow and uneven germination in coriander seeds (Rubatzky *et al.*, 1999).

It is mainly cultivated as a rabi crop in India as Coriander requires cool climate during growth and warm dry climate during seed maturity. It can be cultivated in all types of soils but comes up well on well drained loamy soils. Though it is cultivated across the country but production is concentrated in Madhya Pradesh, Rajasthan, Gujarat, Assam, West Bengal, Orissa, Uttar Pradesh and Andhra Pradesh. India is the largest producer and consumer of coriander seed. Spices Board data showed coriander area and production in the country reached 544240 hectares, 721390 tons in 2017-18 and 469900 hectares, 600410 tons in 2018-19 respectively.

The major leading state wise in area (hectare) and production (tons) are Madhya Pradesh (279980,378230) Rajasthan (68784,89306) Gujarat (30136,45418) Assam (29749,30790) West Bengal (11803,15055) Orissa (19610,10863) Uttar Pradesh (6635,5259) Andhra Pradesh (1569,360) in 2018-19 respectively. (www.indianspices.com)

Coriander seeds have a health-supporting reputation that is high on the list of the

healing spices. In parts of Europe, coriander has traditionally been referred to as an "anti-diabetic" plant. In some parts of India, it has traditionally been used for its anti-inflammatory properties. In the United States, coriander has recently been studied for its cholesterol lowering effects. The seeds are used in medicine as a carminative, diuretic and also used in the preparation of many house hold medicines to cure bed cold, seasonal fever, nausea, and stomach disorders. *Coriandrum sativum* is effective as both a treatment and preventive agent for several chronic diseases. Being aromatic and medicinal plant can be used as anti-spasmodic, appetite stimulant, stomachic, diuretic, anti-inflammatory and anti-diarrheic agent (Zargari, 1991; Mir Heidar, 1992).

The primary quality determinant of the spice is the content and composition of its steam-volatile oil. The volatile oil content of the spice can vary considerably according to the type and source and usually ranges from 0.1 to 1.7% and, in some cases, up to 2.7%. During storage, some of the volatile oil can be lost by evaporation, but the rate of loss and the extent of organoleptic deterioration are dependent on the physical form of the spice and on the conditions and duration of storage.

Seed germination is one of the most salt-sensitive plant growth stages and is severely inhibited with increasing salinity (Bouda and Haddioui, 2011). For this reason, several approaches including hardening, seed priming, seed soaking and seed coating have been employed to improve germination under salt stress.

Priming is simply process done prior to conventional seed germination which allows the inhibiting mechanism to be broken and the metabolic speed increase to begin leading to increase germination percentage by germinating seeds at much higher speed.

There are several different methods for seed priming including the osmo priming, halo priming, hydro-priming and organic priming and matric priming (Esivand *et al.*,). Special priming treatments such as osmopriming, hydropriming, matric priming and hormonal priming have been tested (Basra *et al.*, 2003). Seed priming is the imbibition of seeds in water sufficient for pre germinative metabolic activity to occur while preventing radical emergence (Basra *et al.* 2003). The seeds are then dried and will generally exhibit more rapid rates of radical emergence upon subsequent imbibition (Khan *et al.*, 1992) which lead to acceleration of seed germination and seedling establishment under both normal and stressful environments (Ashraf and Foolad, 2005). The technique is simple, cheap and does not require expensive chemicals or sophisticated equipment. It could be recommended to farmers to achieve higher germination and uniform emergence under field conditions. Both ionic (Cayuela *et al.*, 1996) and non-ionic (Atherton and Farooque 1983) compounds have been used effectively as priming agents (Bradford 1986). This technique can cause more rapid appearance of roots and stems, production of plants with stronger stamina, higher tolerance to drought, earlier flowering, early harvesting, and to obtain crop in bad conditions (Kaur *et al.*).

Materials and Methods

The research study was conducted in the Department of genetics and plant breeding, Seed Testing Laboratory, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj during 2019- 2020 to know the best priming method for Coriander.

The seeds of coriander were treated with methods of priming viz. T₀-control, T₁-distilled water (hydro priming), T₂-GA₃(100 ppm) (hormonal priming), T₃-GA₃ (250 ppm)

(hormonal priming), T₄ & T₅-KNO₃ (1% & 3%), T₆&T₇ -NaCl (1% & 3%), T₈ &T₉-KH₂PO₄ (1% & 3%) (halo priming) T₁₀-Tulasi Leaf Extract (TLE 5%), T₁₁- Moringa Leaf Extract (MLE 5%) (organic priming) and T₁₂-PEG 6000 (osmo priming), for 12 hours and were shade dried. Hundred seeds of each treatment were placed for germination in four Replications in Complete Randomized Design (CRD). The between paper method used for samples and place for germination in germination chamber at 25 °C temperature. Germination and quality parameters i.e. Germination Percentage (%), Speed of germination, Root length (cm), Shoot length (cm), Seedling length (cm), Fresh weight of seedling (g), Dry weight of seedling (g), Seed vigour index I and Seed vigour index II was analysed.

Preparation of solutions (halo priming, osmo priming and hormonal priming)

For the preparation of solution of the growth hormone GA₃, 100mg and 250mg of chemical were taken in each of two beakers. These chemicals were added in 1000 ml. of distilled water with constant stirring in each beaker. The volume of solution will finally constitute to one liter and then it became 100 ppm and 250ppm solution of each chemical. The flasks containing chemicals will be covered with muslin cloth to avoid any contamination.

The solution of KH₂PO₄ (1.0%& 3%) was prepared by dissolving 1gm and 3gm of KH₂PO₄ in distilled water to make the volume up to 100ml.

The solution of KNO₃ (1%&3%) was prepared by dissolving 1gm and 3gm of KNO₃ in distilled water to make the volume up to 100ml. The solution of NaCl (1% & 3%) was prepared by dissolving 1gm and 3gm of NaCl in distilled water to make the volume up to 100ml.

Preparation of plant leaf extract (Organic priming)

Tulasi leaves and Moringa leaves were collected from the Horticulture research fields, SHUATS. The leaves were washed thoroughly in tap water and crushed into fine paste by using mortar and pestle, each 5g of the sample was ground by a blender with 100ml of distilled water. The ground mixture is filtered through a fine cotton cloth which constitutes 5% Tulasi Leaf Extract and 5% Moringa Leaf Extract.

Results and Discussion

Analysis of variance

The analysis of variance for seed quality characters was presented in Table 1. The analysis of variance revealed the significant difference of priming methods for all characters studied like germination percentage, speed of germination, root length(cm), shoot length(cm), seedling length(cm), seedling fresh weight(g), seedling dry weight(g), seed vigour index I and seed vigour index II.

Mean performance

Mean performance of various priming methods on different characters was showed in the Table 2.

Germination %

Germination percentage was significantly influenced by different seed treatments. Mean performance of seed germination ranged from 97.25% to 76.25% with mean value of 89.5%. Seed treated with Moringa Leaf Extract (5%) (T₁₁) recorded significantly highest germination percentage (97.25%) followed by distilled water i.e hydro priming (T₁) with (96.75%). The minimum (76.25%) was

observed in control (T₀). similar finding results reported by H.A. Wajid *et al.*, (2018), Afzal *et al.*, (2012), Azra Yasmeen *et al.*, (2013), Hala *et al.*, (2017) and Wasif Nouman *et al.*, (2012).

Speed of germination

Speed of Germination was significantly influenced by different seed treatments. Mean performance of speed of germination ranged from 41.485 to 28.465 with mean value of 36.00904. Seed treated with Moringa Leaf Extract (5%) (T₁₁) recorded significantly highest speed of germination (41.485) followed by distilled water i.e. hydro priming (T₁) with (40.0825). The minimum (28.465) was observed in control (T₀). Alike evident of speed of germination was observed by Anisa Ruttanaruangboworn *et al.*, (2017).

Root length (cm)

Root length (cm) was significantly influenced by different seed treatments. Mean performance of root length ranged from 9.245cm to 6.1325cm with mean value of 7.885769cm. Seed treated with Moringa Leaf Extract (5%) (T₁₁) recorded significantly highest root length (9.245 cm) followed by distilled water i.e. hydro priming (T₁) with (8.7175cm). The minimum (6.1325) was observed in control (T₀). Similar results of root length were discussed as Afzal *et al.*, (2012), Azra Yasmeen *et al.*, (2013) and Hala *et al.*, (2017).

Shoot length (cm)

Shoot Length (cm) was significantly influenced by different seed treatments. Mean performance of shoot length ranged from 17.24cm to 11.8375cm with mean value of 15.32846. Seed treated with Moringa Leaf Extract (5%) (T₁₁) recorded significantly highest length of shoot (17.24cm) followed by

distilled water i.e., hydro priming (T₁) with (16.275cm). The minimum (11.8375) was observed in control (T₀). Similar results of shoot length were discussed by Afzal *et al.*, (2012), Azra Yasmeen *et al.*, (2013) and Hala *et al.*, (2017) recommended that soaking pepper seeds in MLE solution at concentrate of 4% for 6hours enhanced the seedling characters.

Seedling length (cm)

Seedling Length (cm) was significantly influenced by different seed treatments. Mean performance of seedling length ranged from 26.485cm to 17.97cm with mean value of 23.21423. Seed treated with Moringa Leaf Extract (5%) (T₁₁) attained significantly highest length of seedling (26.485cm) followed by distilled water i.e., hydro priming (T₁) with (24.9952cm). The minimum (17.97)

was observed in control (T₀). Similar results of seedling length were discussed by Afzal *et al.*, (2012), Azra Yasmeen *et al.*, (2013) and Hala *et al.*, (2017).

Seedling fresh weight (g)

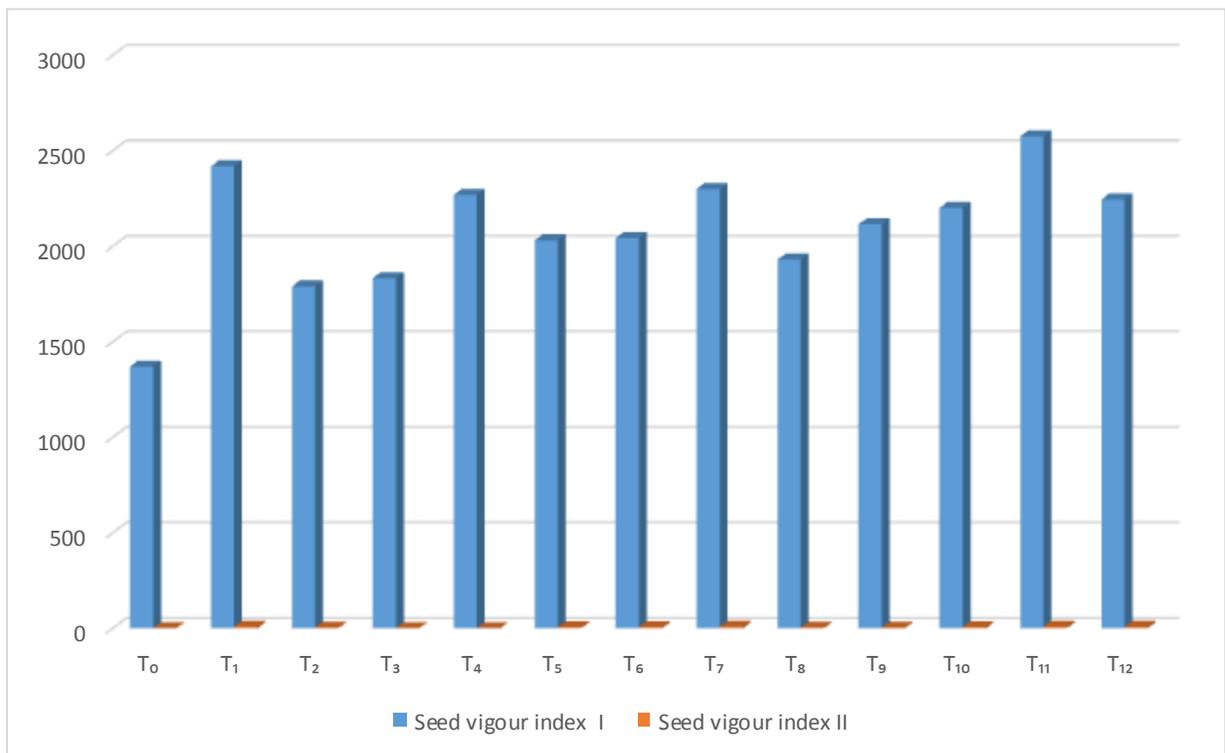
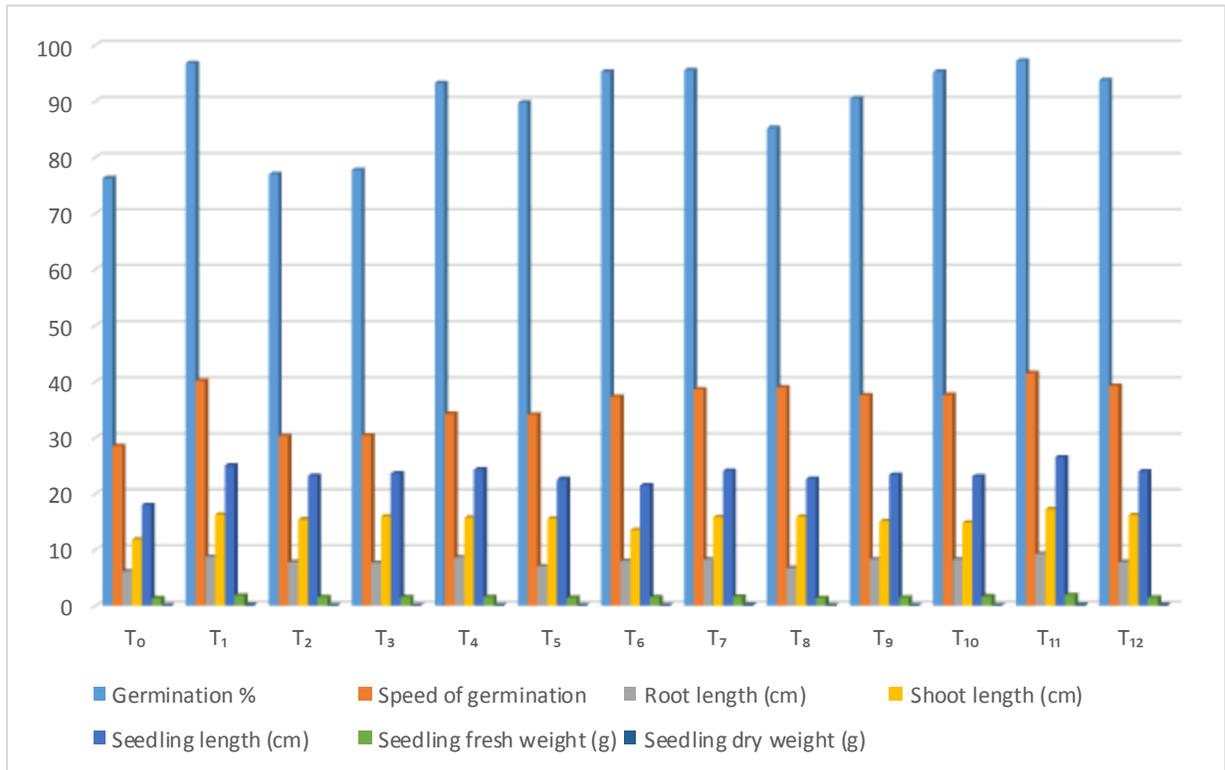
Seedling Fresh Weight (g) was determined by different seed treatments. Mean performance of seedling fresh weight ranged from 1.907g to 1.375g with mean value of 1.554308. Seed treated with Moringa Leaf Extract (5%) (T₁₁) accomplished significantly highest Fresh weight of seedling (1.907g) followed by distilled water i.e., hydro priming (T₁) with (1.825g). The minimum (1.375) was observed in control (T₀). Similar results of seedling fresh weight were discussed by Afzal *et al.*, (2012), Azra Yasmeen *et al.*, (2013) and Hala *et al.*, (2017).

Table.1 Analysis of variance for seed quality characters in coriander

Mean Sum of Squares			
S.No	Parameters	Treatment	Error
1	Seed Germination	245.292	7.987
2	Speed of Germination	69.047	7.296
3	Root Length	2.897	0.567
4	Shoot Length	7.409	0.875
5	Seedling Length	15.907	1.783
6	Seedling Fresh Weight	0.122	0.011
7	Seedling Dry Weight	0.003	0.001
8	Seedling Vigour Index I	387328.890	21446.025
9	Seedling Vigour Index II	28.828	4.676
*Significant at 5% level of significance.			

Table.2 Mean performance of various priming methods on different characters

S.No	Treatments	Germination Percentage	Speed of Germination	Root Length (cm)	Shoot Length (cm)	Seedling Length (cm)	Seedling Fresh Weight (g)	Seedling Dry Weight (g)	Seedling vigour Index I	Seedling Vigour Index II
1	T ₀	76.25	28.465	6.1325	11.8375	17.97	1.375	0.0175	1371.18	1.3025
2	T ₁	96.75	40.0825	8.7175	16.275	24.9925	1.825	0.085	2418.72	8.2125
3	T ₂	77	30.2425	7.7925	15.4175	23.21	1.525	0.0575	1789.618	4.4325
4	T ₃	77.75	30.3975	7.6625	15.9225	23.585	1.575	0.0175	1833.41	1.355
5	T ₄	93.25	34.215	8.6	15.705	24.305	1.575	0.015	2269.275	1.395
6	T ₅	89.75	34.09	7.045	15.55	22.595	1.403	0.0575	2031.115	5.165
7	T ₆	95.25	37.28	7.99	13.495	21.485	1.5375	0.0625	2042.945	5.9475
8	T ₇	95.5	38.6275	8.2625	15.83	24.0925	1.656	0.0775	2300.638	7.395
9	T ₈	85.25	38.9325	6.73	15.9175	22.6475	1.3275	0.04	1930.198	3.4075
10	T ₉	90.5	37.5025	8.2825	15.095	23.3775	1.4125	0.0375	2114.94	3.395
11	T ₁₀	95.25	37.5825	8.2675	14.8325	23.1	1.675	0.0625	2201.205	5.9475
12	T ₁₁	97.25	41.485	9.245	17.24	26.485	1.907	0.095	2576.435	9.238
13	T ₁₂	93.75	39.215	7.7875	16.1525	23.94	1.4125	0.0775	2244.903	7.275
14	Grand Mean	89.5	36.00904	7.885769	15.32846	23.21423	1.554308	0.054038	2086.506	4.959077
15	C.D (5%)	4.057	3.878	1.081	1.343	1.917	0.149	0.032	210.244	3.104
16	SE(m)	1.413	1.351	0.376	0.468	0.668	0.052	0.011	73.222	1.081
17	SE(d)	1.998	1.910	0.532	0.661	0.944	0.073	0.016	103.552	1.529



Seedling dry weight (g)

Seedling Dry Weight (g) was determined by different seed treatments. Mean performance of seedling dry weight ranged from 0.095g to 0.015 with mean value of 0.054038. Seeds treated with Moringa Leaf Extract (5%) (T₁₁) accomplished significantly highest dry Weight of seedling (0.095g) followed by distilled water i.e., hydro priming (T₁) with (0.085). The minimum (0.015) was observed in KNO₃ (1%) (T₄). Similar results of seedling dry weight were discussed by Afzal *et al.*, (2012), Azra Yasmeen *et al.*, (2013) and Hala *et al.*, (2017).

Seedling vigour index I

Seedling Vigour Index I was significantly influenced by different seed treatments. Mean performance of vigour index ranged from 2576.435 to 1371.18 with mean value of 2086.506. Seeds treated with Moringa Leaf Extract (5%) (T₁₁) recorded significantly highest vigour index I (2576.435) followed by distilled water i.e., hydro priming (T₁) with (2418.72). The minimum (1371.18) was observed in control (T₀). Similar results of seed vigour index I were discussed as Afzal *et al.*, (2012), Wasif Nouman *et al.*, (2012), Azra Yasmeen *et al.*, (2013), Hala *et al.*, (2017) and H.A. Wajid *et al.*, (2018).

Seedling vigour index II

Seedling vigour Index II was determined by different seed treatments. Mean performance of vigour index ranged from 9.238 to 1.3025 with mean value of 4.95907. Seeds treated with Moringa Leaf Extract (5%) (T₁₁) accomplished significantly highest vigour index II (9.238) followed by distilled water i.e, hydro priming (T₁) with (8.2125). The minimum (1.3025) was observed in control (T₀). Similar results of seed vigour index 2

were discussed by Afzal *et al.*, (2012), Wasif Nouman *et al.*, (2012), Azra Yasmeen *et al.*, (2013) and H.A. Wajid *et al.*, (2018).

From the present investigation it was concluded that all the seed priming methods performed better but treatment with Moringa Leaf Extract (MLE) (5%) (organic priming) was found to be best over all the other treatments in respect of germination and quality parameters. The extract of Moringa (5%) i.e. organic priming method was very effective alternatives to popular priming strategies and are not only organic but are also cheap, easily adapted, and environmentally friendly. However, there is a need to explore more deeply of these sources to find out their importance in comparison with synthetic priming sources.

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