

Original Research Article

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Assessment of Different Seed Priming Methods on Quality Parameters of Lentil (*Lens culinaris* Medik.)

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ABSTRACT

Keywords

Lentil, Hydro priming, Osmo priming, Halo priming, Hormonal priming, organic priming, GA₃, PEG 6000, KH₂PO₄, KNO₃, KCl, ZnSO₄, Neem Leaf Extract, Tulasi Leaf Extract and Moringa Leaf Extract

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The study was conducted at the Seed Testing Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, during 2019-2020. The lentil of variety K-75 was treated with different methods of priming viz. control, distilled water (hydro priming), GA₃ (hormonal priming), PEG 6000 (osmo priming), KH₂PO₄, KNO₃, KCl, ZnSO₄ (halo priming), Tulasi Leaf Extract, Moringa Leaf Extract and Neem Leaf Extract (organic priming) for 12 hours and were shade dried for further experiment. The experiment conducted was analysed by completely randomized design (CRD) with four replications. The quality parameters which were analysed for different treatments was 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 and seedling vigour index II. The experiment showed the organic treatment i.e. Neem Leaf Extract (NLE) attained the highest value in germination percentage, speed of germination, root length, shoot length, seedling length, seedling fresh weight, seedling dry weight, seedling vigour index I and seedling vigour index II. Hence, the results concluded that the organic priming treatment (NLE) was found to be better and can be effectively used as low cost, environmentally friendly, easily adaptable priming method by farmers.

Introduction

Lentil (*Lens culinaris* Medik.) is a member of the Leguminaceae (Fabaceae) family, recognized as the most nutritious amongst Rabi pulses and rank next to chickpea. Lentil is a diploid (2n=2x=14), self pollinated (autogamy) and annual species of grain legume. Lentils probably originated in the Near East and rapidly spread to Egypt, central

and southern Europe, the Mediterranean basin, Ethiopia, Afghanistan, India and Pakistan, China and later to the New World including Latin America (Cubero, 1981; Duke, 1981; Ladizinsky, 1979). It is grown throughout the Northern and Central India for grains, which are used as dal and other preparation as soups and casseroles. It is generally grown as rainfed crop during Rabi season after rice, maize and pearl millet.

In India (2017-2018), Lentil contribute to the Pulse cultivation in area is 15.54 lakh ha, production is 16.07 lakh tones, and productivity is 1034 kg/ha. About 98% has been realized from 07 states of Madhya Pradesh (5.96 Lha and 6.79 Lt), Uttar Pradesh (4.84 Lha and 4.98 Lt), West Bengal (1.58 Lha and 1.55 Lt), Bihar (1.50 Lha and 1.39 Lt), Jharkhand (0.69 Lha and 0.60 Lt), Rajasthan (0.31 Lha and 0.34 Lt) and Assam (0.27 Lha and 0.20 Lt). (Source:

The botanical features of *Lens culinaris* (cultivated lentil) can be described as annual bushy herb, slender almost erect or sub erect, much-branched, softly hairy; stems slender, angular, 15-75 cm height (Duke, 1981; Muehlbauer *et al.*, 1985). Ten to sixteen leaflets are subtended on the rachis (40-50 mm); upper leaves have simple tendrils while lower leaves are mucronate (Muehlbauer *et al.*, 1985). "The leaves are alternate, compound, pinnate, usually ending in a tendril or bristly; leaflets 4-7 pairs, alternate or opposite; oval, sessile, 1-2 cm long; stipules small, entire; stipules absent; pods oblong, flattened or compressed, smooth, to 1.3 cm long, 1-2-seeded; seed biconvex, rounded, small, 4-8 mm × 2.2-3 mm, lens-shaped, green, greenish-brown or light red speckled with black; the weight of 100 seeds range from 2 to 8 g; cotyledons red, orange, yellow, or green, bleaching to yellow, often showing through the testa, influencing its apparent colour" (Kay, 1979; Duke, 1981; and Muehlbauer *et al.*, 1995). Flowers are small, pale blue, purple, white or pink, in axillary 1-4-flowered racemes; 1-4 flowers are borne on a single peduncle and a single plant can produce upto 10-150 peduncles each being 2.5-5 cm long (Muehlbauer *et al.*, 1985). Flowering proceeds acropetally. Germination is hypogeal and this keeps the developing seedlings below ground level which reduces the effects of freezing and other desiccating environmental conditions (Muehlbauer *et al.*, 1985).

Seeds will germinate at temperatures above freezing but best at the range of 18-21°C; temperatures above 27°C are harmful; optimum temperatures for growth and yields are around 24°C. Lentils are grown as a cool weather or winter crop in the semi-arid tropics, cultivated from sea level to 3,800 m, but are not suited to the humid tropics. They are less damaged by drought than by water logging. Lentils thrive on a wide range of soils from light loams and alluvial soil to black cotton soils, best on clay soils; tolerate moderate alkalinity. Salt tolerance is higher during germination than during subsequent development. Lentils are quantitative long-day plants, some cultivars tending to be day-neutral. Lentil is reported to require environments ranging from cool temperate steppe to wet through subtropical dry to moist forest life zones. It tolerates annual precipitation of 2.8-24.3 dm annual mean temperature of 6.3-27.3°C and pH of 4.5-8.2" (Kay 1979; Duke, 1981).

Seed priming can be defined as "it is a seed treatment that involve the controlled hydration of seed to allow pre-germinative metabolic events to take place, but insufficient to allow radicle protrusion through the seed coat (Heydcker *et al.*, 1973)". Seed priming is a pre-sowing strategy for influencing seedling development by modulating pre-germination metabolic activity prior to emergence of the radicle and generally enhances rapid, uniform emergence and plant performance to achieve high vigour and better yields (McDonald, 2000).

All priming treatments were effective in reducing the mean emergence time, while enhancing final emergence percentage, as compared to that of unprimed seed which had low vigour and poor seed performance; it has also noted that seed priming resulted in improved seedling growth as indicated by increased root and shoot length, seedling fresh and dry weight. It also enhances germination

and early seedling growth in cucumber (Oluwagbenga *et al.*, 2016). Priming is one of the most physiological methods which improves the seed performance and provides faster and synchronized germination. The primed seed give earlier, more uniform and sometime greater germination and seedling establishment and growth (Ashok *et al.*, 2017). The ancient Greek farmers found that the seed of cucumber soaked in water or milk and honey before sowing results in increase germination rate and emergence (Evenari, 1980).

Materials and Methods

The experiment was conducted in Seed Testing Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) in order to check the best priming method of Lentil (K-75).

The treatments used at different concentrations for priming were, T₀- control, T₁- distilled water (hydro priming), T₂- GA₃ (100ppm) (hormonal priming), T₃- PEG 6000 (20%) (osmo priming), T₄- KH₂PO₄ (1.0%), T₅- KNO₃ (1.0%), T₆- KNO₃ (2.0%), T₇- KCl (1.0%), T₈- KCl (2.0%), T₉- ZnSO₄ (0.5%) (halo priming), T₁₀- Neem Leaf Extract (5%), T₁₁- Tulasi Leaf Extract (5%), T₁₂- Moringa Leaf Extract (5%) and (organic priming). After cleaning and grading, the seeds were soaked in respective priming solutions at different volume of seeds for twelve hours. Then the seeds were air dried under the shade to bring back to their original moisture content and used for sowing on laboratory. 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 parameters were 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.

Preparation of solutions

Hydro priming: A 100ml of distilled water was taken in a clean beaker.

Hormonal priming: For the preparation of solution of the growth hormone GA₃ 100mg of chemical were taken in one beaker. This chemical was added in 1000 ml. of distilled water with constant stirring. The volume of solution will finally constitute to one litter and then it became 100 ppm solution of chemical. The flasks containing chemicals will be covered with muslin cloth to avoid any contamination.

Halo priming: For the preparation of solution one gram of each chemical was taken in a beaker. These chemicals were added separately in 1000 ml. of distilled water with constant stirring. The volume of solution will finally constitute to one litter, and then it becomes 1000 ppm stock solution of each chemical.

The flasks containing chemicals was covered with muslin cloth to avoid any contamination For the preparation of KH₂PO₄ 1%, KNO₃ 1% KCl 1% solution 10(g), KNO₃ 2% , KCl 2% solution 20(g), and ZnSO₄ 0.5% solution 0.5gm was taken in a measuring flask made up to 100ml distilled water while for PEG 1% solution 10(g). PEG 2% solution 20(g).

Organic priming: The fresh neem leaves were collected separately. The leaves were washed thoroughly in tap water and crushed into fine paste by using mortar and pestle, 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% Neem, Tulasi and Moringa Leaf Extract.

Results and Discussion

Analysis of variance

The analysis of variance for seedling characters was presented in Table 1. Analysis of variance revealed that the differences among seven treatments were significant for seedling characters, viz., germination per cent, speed of germination, root length, shoot length, seedling length, seedling fresh weight, seedling dry weight, seed vigour index I and seed vigour index II.

Mean performance

The data presented in the table showed mean performance and range of 13 treatments for 9 seed quality parameters in table 2.

Germination (%)

Mean performance of seed germination percentage ranged from 96.5% to 77.75% with grand mean value of 88.05769%. The significantly highest seed germination percentage (96.5%) was recorded by seed priming treatment T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming followed by KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (94.75%), and the minimum (77.75%) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014.

Speed of germination

Mean performance of speed of germination ranged from 91.693 to 77.05 with grand mean value of 84.42135. The significantly highest speed of germination (91.693) was recorded in T₁₀ (Neem Leaf Extract) (5%) i.e. speed of germination followed by KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (91.653) and the minimum (77.05) was observed in control i.e.

unprimed (T₀) similar finding results reported by Anisa Ruttanaruangboworn *et al.*, (2017) and Bassi *et al.*, (2011).

Root length (cm)

Mean performance of root length (cm) ranged from 15.225cm to 9.185cm with grand mean value of 12.42212cm. The significantly highest root length (15.225cm) was recorded in T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming followed by KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (14.143cm) and the minimum (9.185cm) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014.

Shoot length (cm)

Mean performance of shoot length (cm) ranged from 24.430cm to 15.758cm with grand mean value of 21.23404cm. The significantly highest shoot length (24.430cm) was recorded in T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming followed by KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (23.913cm) the minimum (15.758cm) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014

Seedling length (cm)

Mean performance of seedling length (cm) ranged from 38.555cm to 24.943cm with mean value of 33.57154cm. Seed treated with Neem Leaf Extract (5%) i.e. organic priming (T₁₀) attained the highest length of seedling with (38.555cm) followed by KH₂PO₄ (1%) i.e. halo priming (T₄) with (38.055cm) and the minimum (24.943cm) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014.

Seedling fresh weight (g)

Mean performance of seedling fresh weight (g) ranged from 3.175g to 2.45g with grand mean value of 2.880769g. The significantly highest seedling fresh weight (3.175g) was recorded in T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming and KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (3.175g). followed by Moringa Leaf Extract (5%) i.e. organic priming (T₁₂) with (3.1g) the minimum (2.45g) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014

Seedling dry weight (g)

Mean performance of seedling dry weight (g) ranged from 0.248g to 0.208g with grand mean value of 0.231346g. The significantly highest seedling dry weight (0.248g) was recorded in T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming followed by KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (0.243g) the minimum (0.208g) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014

Seedling Vigour Index I

Mean performance of seedling vigour index I ranged from 3718.952 to 1939.370 with grand mean value of 2971.338. The significantly highest Seedling Vigour Index I (3718.952) was recorded by seed priming treatment in T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming followed by KH₂PO₄ (1.0%) i.e. halo priming (605.395) the minimum (1939.370) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, 2015 and Gayatri Nahak *et al.*, 2014.

Seedling Vigour Index II

Mean performance of seedling vigour index II ranged from 23.888 to 16.123 with grand mean value of 20.41154. The significantly highest seedling vigour index II (23.888) was recorded in T₁₀ (Neem Leaf Extract) (5%) i.e. organic priming followed by KH₂PO₄ (1.0%) i.e. halo priming (T₄) with (22.978) the minimum (16.123) was observed in control i.e. unprimed (T₀) similar finding results reported by Serferbe Signaboubo *et al.*, (2015) and Gayatri Nahak *et al.*, (2014).

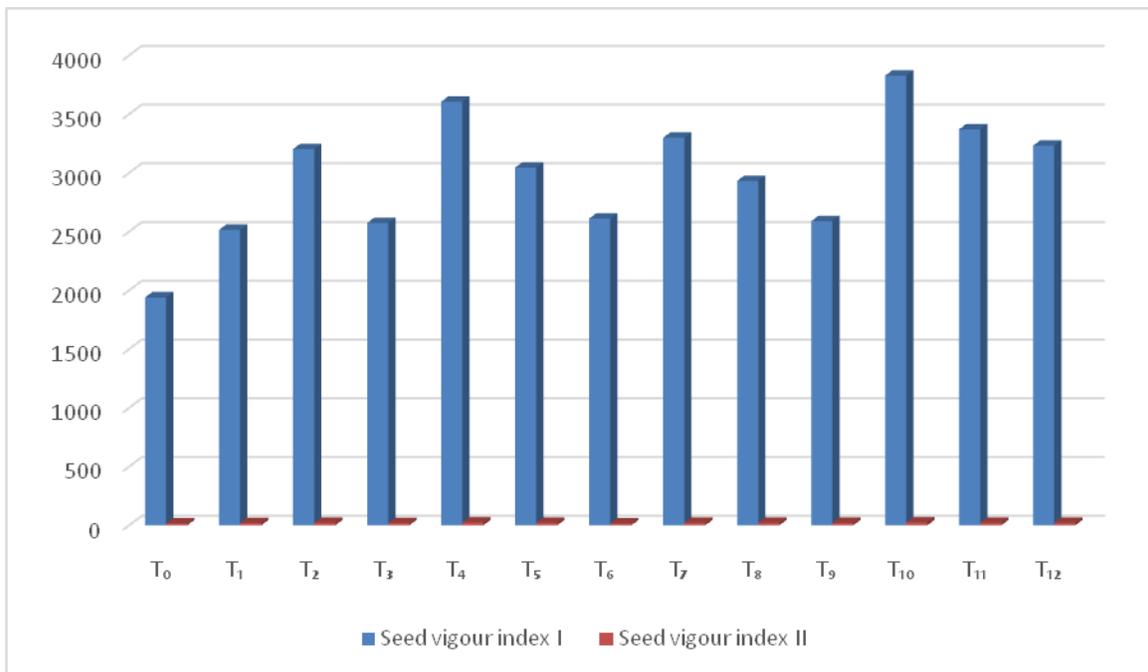
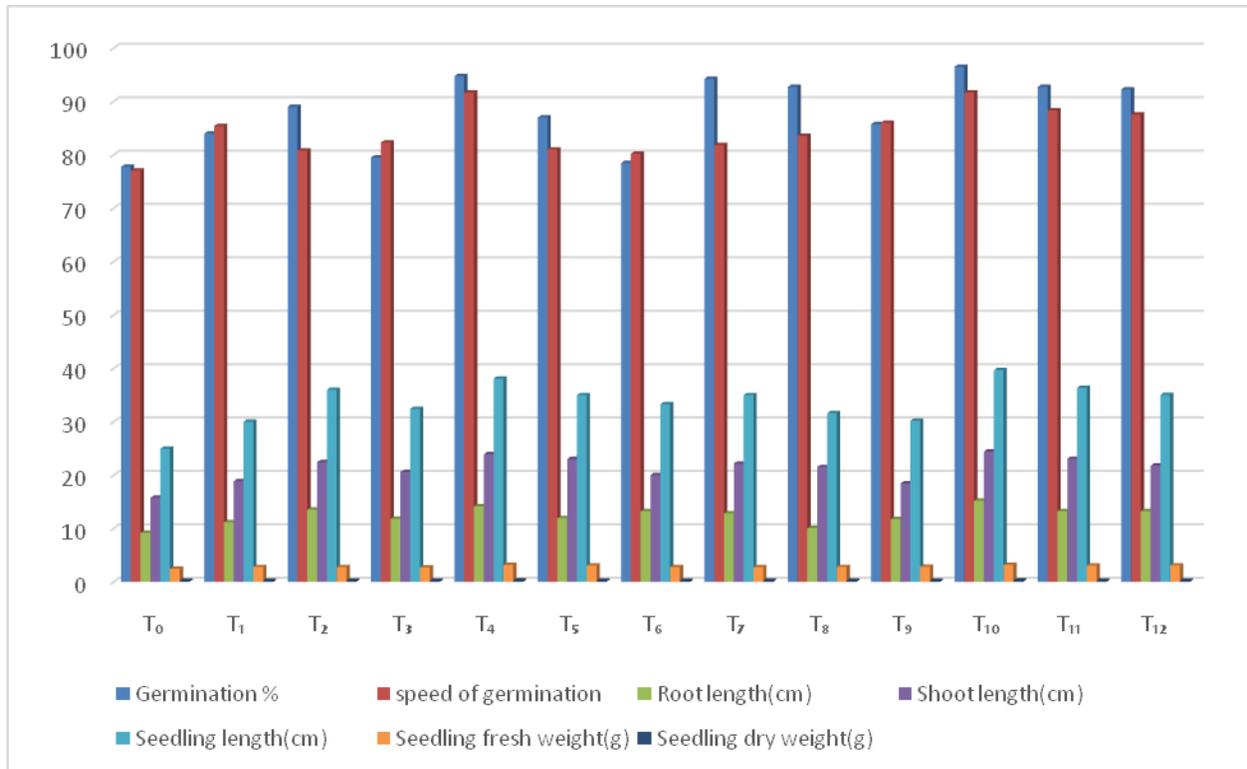
Table.1 Analysis of variance for seed quality character of Lentil (K-75)

S. No.	Parameters	Mean Sum of Squares	
		Treatment	Error
1.	Seed Germination	170.215*	6.776
2.	Speed of Germination	80.844*	12.032
3.	Root Length	10.967*	1.388
4.	Shoot Length	23.939*	3.317
5.	Seedling Length	56.060*	3.507
6.	Seedling Fresh Weight	0.181*	0.009
7.	Seedling Dry Weight	0.001*	0.000
8.	Seed Vigour Index I	1,021,619.717*	22,193.763
9.	Seed Vigour Index II	20.284*	0.641

***Significant at 5% level of Significance**

Table.2 Mean performance of various seed treatments 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	77.750	77.050	9.185	15.758	24.943	2.450	0.208	1,939.370	16.123
2.	T ₁	84.000	85.408	11.160	18.860	30.020	2.800	0.235	2,514.695	19.755
3.	T ₂	89.000	80.815	13.555	22.430	35.985	2.775	0.235	3,202.165	20.915
4.	T ₃	79.500	82.290	11.833	20.583	32.415	2.725	0.235	2,572.990	18.685
5.	T ₄	94.750	91.653	14.143	23.913	38.055	3.175	0.243	3,605.395	22.978
6.	T ₅	87.000	81.023	11.968	23.028	34.995	3.050	0.233	3,044.430	20.230
7.	T ₆	78.500	80.197	13.258	20.025	33.283	2.775	0.215	2,610.133	16.865
8.	T ₇	94.250	81.845	12.823	22.175	34.998	2.750	0.215	3,298.395	20.260
9.	T ₈	92.750	83.580	10.083	21.520	31.603	2.800	0.230	2,931.280	21.330
10.	T ₉	85.750	86.028	11.748	18.473	30.220	2.825	0.233	2,587.670	19.923
11.	T ₁₀	96.500	91.693	15.225	24.430	38.555	3.175	0.248	3,718.952	23.888
12.	T ₁₁	92.750	88.335	13.265	23.073	36.338	3.050	0.240	3,370.195	22.265
13.	T ₁₂	92.250	87.563	13.245	21.778	35.023	3.100	0.240	3,231.730	22.135
14.	Grand Mean	88.05769	84.42135	12.42212	21.23404	33.57154	2.880769	0.231346	2971.338	20.41154
15.	C.D (5%)	3.737	4.980	1.691	2.615	2.689	0.139	0.009	213.878	1.150
16.	SE (m)	1.302	1.734	0.589	0.911	0.936	0.048	0.003	74.488	0.400
17.	SE (d)	1.841	2.453	0.833	1.288	1.324	0.068	0.005	105.342	0.566



It is concluded that Lentil (K-75) seeds treated with Neem Leaf Extract (5%) (Organic priming) was recorded significantly higher in respect of seed germination and

quality parameters. Neem is cheap source available with farmers and is nature friendly to use. The experimental on the observation on the increase in the germination of the

Lentil is indicative to the priming with Neem leaf Extract have the effect on the physiological processes of the seeds.

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