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Influence of different priming treatments on seedling parameters of chickpea (*Cicer arietinum* L.) seeds

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Abstract
The experiment was conducted in Post Graduate Laboratory, Department of Genetics and Plant Breeding, SHUATS, Allahabad, U.P. during rabi (2018), in order to standardize the best method of priming specific to chickpea. Three methods of priming *viz.*, osmopriming, hydropriming, halopriming, and magneto priming were evaluated by screening a range of concentrations *viz*It was found that all the priming methods showed significance difference with the control and treated with Calcium chloride ($Cacl_2$) at 1 % (T_5) recorded significantly higher values for seedling characters, viz., seed germination percentage (95.67), speed of germination (33.75), root length (12.22), shoot length(15.03), seedling length (27.25), seedling fresh weight (1.08), seedling dry weight (0.23), seed vigour index-I (2606.89), seed vigour index-II (21.36),in compared with other treatments, and lowest recorded in control This study helps to improve quality of seeds with help of seed priming treatments which are effective and economic, nontoxic and ecofriendly sources.

Keywords: Chickpea, osmo priming, halo priming, hydro priming, magneto priming, calcium chloride

1. Introduction
Gram (*Cicer arietinum* L.) is important pulse crop occupying third position among the grain legumes in the world. Among the pulses grown in country, gram occupies a predominant position and is considered as a king of pulses. An Indian subcontinent accounts for 70and 80 percent area and production of gram crop, respectively in the world. In India, gram is cultivated in about 32 percent of total area of pulse crops and it contributes 45 percent to total production of pulses. Statistically, it occupies about 65 to 70 lakh hectares with a production of 50 to 55 lakh tonnes every year. The average productivity is about 823 kg ha^{-1}.
There is a vast scope for increasing productivity of gram by adopting agro-techniques. For achieving the potential crop yield per unit area, higher yielding varieties should be coupled with proper agronomic practices. Of the various factors known to augment the crop production, fertilizers added with suitable agronomic practices play a pivotal role to boost up the crop yield. Currently, 40-50 percent increase in agricultural production can be credited to fertilizers alone. However, judicious use of fertilizers is of vital importance to achieve higher yield.
Seed priming is a controlled hydration process that involves exposing seeds to low water potentials that restrict germination, but permits-germinative and physiological changes to occur. Upon rehydration, primed seeds may exhibit faster rate of germination, more uniform emergence, greater tolerance to environmental stresses, and reduced dormancy in many species. Hence, present studies were undertaken to assess

Objectives
1. To determine the effect of different Priming methods of seed treatments on seedling parameters and
2. To identify the suitable treatments of Priming for Chickpea seeds.

Materials and Methods
The present investigation was conducted at Post Graduate Laboratory of at Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P). using Chickpea var., PUSA-362.

The Treatments used at different concentrations for priming were T_0 – Control, T_1 -Distilled water (Hydro priming), T_2- Calcium nitrate (Ca $(NO_3)_2$) 1% (Osmo priming), T_3- Potassium chloride (KCl) 100ppm (Halo priming), T_4- Potassium nitrate (Kno_3)1% (Halopriming),T_5- Calcium chloride.
($CaCl_2$) 1% (Halopriming)T_6-Temperature 30^0C (Thermo priming), T_7- Temperature 40^0C (Thermo priming), T_8 – Electromagnetic water for 8 hours, T_9- Electromagnetic water for 12 hours.
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 flasks containing chemicals was covered with muslin cloth to avoid any contamination. For the preparation of Potassium chloride (KCL 100ppm) solution 1 gram KCL was taken in a measuring flask and made up to 1000 ml. distilled water, while (1 %) Calcium nitrate (Ca $(NO_3)_2$) solution 10 (gm) was taken in a measuring flask and made up to 1000 ml with distilled water and Potassium nitrate (Kno_3)1% solution was taken in a measuring flask and made upto 1000 ml. distilled water, and Calcium chloride ($CaCl_2$)1% solution was taken in a measuring flask and made upto 1000 ml. distilled water.
After the preparation of solutions of Chickpea seeds were soaked of each solution separately for 12 hour at 25^0 C temperature. After 12 hour soaking the solution the solution was drained out from the beaker and pre-soaked air dried to original weight and then placed three replications in Completely randomized design (CRD) in between paper method for germination in laboratory under controlled condition.*viz.*,Germination percent (ISTA 2004), Speed of germination, Energy of emergence(%), Root length (cm), Shoot length (cm), Seedling length (cm), seedling Fresh weight (g), seedling dry weight (g), Seedling vigour index I, Vigor index II (Baki and Anderson 1973) [5] were recorded. The experimental data recorded were subjected to statistical analysis for calculating analysis of variance, range, mean, critical difference and coefficient of variation (Fisher 1936).

Methodology

In order to calculate the Germination (%), Vigour Index (I and II), Root and Shoot length, Seedling Dry Weight, formula (1), formula (2), formula (3), formula (4) were used:

$$1.\text{Germination } (\%) = \frac{\text{Total number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

(ISTA-2010)

2. **V.I. (I)** = Germination percentage X Seedling length (cm) -Abdul Baki and Anderson (1973) [5].

VI. (II) = Germination percentage X Dry weight of the seedling (gm) -Abdul Baki and Anderson (1973) [5].

3. **Root and shoot length**: Root and shoot length of five fresh seedlings was measured in centimeters up to one decimal. Total seedling length was calculated by adding root and shoot length. (ISTA-2010)

4. **Seedling dry weight**: The seedlings used for recording were dried in an oven at 1030C+10C. Measurement of dried samples was record on an electronic balance. (ISTA-2010)

Results and Discussion

According to the results, all studied traits were affected by the treatments and there was completely significant difference between control (non primed seeds) and primed seeds (Table1).
All seedling characters viz. Germination percent, Speed of germination, Energy of emergence (%), Root length (cm), Shoot length (cm), Seedling length (cm), seedling fresh weight (g), seedling dry weight (g), Seedling vigour index I, Vigor index II were affected by ($CaCl_2$)1% concentration and significantly recorded maximum. Significantly higher germination percent (85) reported in treatment T5 ($CaCl_2$)1% followed by T3 primed with Potassium nitrate (Kno_3) 1% Minimum germination percent recorded by T0 with unprimed control (Table 2)

Table 1: Analysis of variance for 10 seedling characters in chickpea.

S. No	Characters	Mean sum of squares	
		Treatments (df= 9)	Error (df= 20)
1	Germination percent	156.42*	4.04*
2	Speed of germination	27.74*	1.24*
4	Energy of emergence	139.739*	0.556*
5	Root length	14.41*	0.50*
6	Shoot length	18.53*	0.28*
7	Seedling length	63.63*	0.39*
8	Seedling fresh weight	0.24*	0.02*
9	Seedling dry weight	0.001*	0.001*
10	Seed vigour index - I	868545.86*	9.56*
11	Seed vigour index - II	9.56*	2.899*

*Significant at 5% level of significance

Table 2: Mean values of seedling parameters of chickpea

Treatment	Germination %	Speed of Germination	Energy of emergence %	Shoot length (cm)	Root length (cm)	Seedling Length (cm)	Seedling Fresh weight (g)	Seedling Dry weight (g)	Vigour index I	Vigour index II
T_0	64.05	65.68	52.84	12.31	9.19	21.50	0.65	0.08	1374.10	7.00
T_1	68.24	68.48	57.89	13.60	11.28	24.91	1.01	0.9	1699.57	8.19
T_2	69.97	71.56	68.36	15.27	13.28	28.55	0.66	0.10	1997.77	8.63
T_3	75.00	71.17	63.20	15.98	14.05	30.02	1.08	0.12	2250.16	9.75
T_4	81.92	74.05	67.28	17.94	15.05	33.00	1.11	0.14	2703.13	11.07
T_5	85.00	75.94	71.61	20.59	16.45	34.04	1.62	0.15	3119.73	12.63
T_6	72.22	70.94	67.06	15.99	13.33	29.32	0.93	0.11	2117.70	9.60
T_7	66.49	69.36	55.33	14.46	12.65	28.26	0.88	0.8	1880.88	8.03
T_8	76.38	71.88	69.53	16.95	14.18	31.13	1.02	0.13	2372.32	10.34
T_9	64.20	67.49	54.02	12.99	10.39	23.38	0.72	0.9	1500.60	7.46
MEAN	72.36	70.65	62.17	15.61	12.99	28.72	0.97	0.343	2101.56	9.27
SEM	1.155	0.64	0.431	0.276	0.13	0.365	0.10	0.014	46.872	0.983
CD@5%	3.408	1.90	1.291	0.813	0.39	1.076	0.316	0.40	138.27	2.900

Higher speed of germination (75.94) reported in treatment Calcium chloride ($Cacl_2$) at 2 % (T_5) followed by T4 (74.05) primed with Potassium nitrate (KNO_3). Minimum speed of germination recorded by T0 (65.68) with unprimed control (Table 2). Maximum energy of emergence (71.61%) recorded by T_5- Calcium chloride ($Cacl_2$) 2% followed by T4 (67.28%) primed with Potassium chloride (KCl) 100ppm. Minimum recorded in T0 unprimed control (52.84%) (Table 2). Maximum root length (16.45cm) recorded byT_5- Calcium chloride ($Cacl_2$) 2% followed by T4 (15.05cm) primed with Potassium nitrate (KNO_3) 100PPM Minimum root length recorded byT0 (9.19cm) primed with control. Maximum shoot length (20.59cm) recorded by Calcium chloride ($Cacl_2$) 2% and it followed by T4 (17.94cm) primed with Potassium nitrate (KNO_3) 100PPM. The shortest shoot length founded in T0 unprimed control (12.31cm). Maximum seedling length (37.04cm) recorded by Calcium chloride ($Cacl_2$) 2% followed by T4 (33.00cm) primed with Potassium nitrate (KNO_3) 100PPM Shortest seedling length recorded in T0 unprimed control (21.50cm) (Table 2). (Demir and Oztokat 2003) also found that root and shoot lengths increased in seeds due to salt priming as compared to non-primed seeds.

Maximum seedling fresh weight (1.62gm) reported in T_5- Calcium chloride ($Cacl_2$) 2% followed by T4 (1.11gm) primed with (KCl) 100ppm lowest value of seedling fresh weight founded in T0 unprimed control (0.65gm). Maximum seedling dry weight (0.15gm) recorded byT_5- Calcium chloride ($Cacl_2$) 2% followed by T4 (0.13gm) primed with (KCl) 100ppm. Lowest value of seedling dry weight founded in T0 unprimed control (0.09gm) (Table 2). Ashraf and Rauf (2001) also reported to the results regarding root and shoot fresh weights are in agreement with those of who reported that fresh and dry weights of seedlings from haloprimed seeds were significantly higher, as compared to other unprimed seeds.

Maximum seedling vigour index I (3119.73) recorded by T5 Calcium chloride ($Cacl_2$) 2% primed with followed by T4 (2703.13) primed with KCL 100 ppm. Minimum seedling vigour index is recorded by T0 unprimed (1374.10) in control (Unprimed) (Table 2) Maximum seedling vigour index II (12.63) recorded by Calcium chloride ($Cacl_2$) 2% T4 primed with and it was followed by T4 (11.07) primed with KCL 100 ppm. Minimum seedling vigour index 11 recorded by unprimed T0 (7.00) in control (Table 2). It has been reported that primed seeds showed better germination pattern and higher vigour level than non- primed (Ruan *et al*., 2002).

Conclusion

It is considered from the present investigation that the different concentration of priming treatment showed significant effect on seed germination and physiological seedlings were treated with Calcium chloride ($Cacl_2$) at 2 % (T_5) recorded significantly higher values for seedling characters, viz., seed germination percentage (85%), speed of germination (75.94), root length (16.45), shoot length(20.59), seedling length (37.04), seedling fresh weight (1.67), seedling dry weight (0.15), seed vigour index-I (3119.73), seed vigour index-II (12.63), followed by Potassium nitrate (KNO_3).

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