

Original Research Article

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Effect of Priming on the Growth, Seedling, Yield and its Attributing Characters of Desi Chickpea (*Cicer arietinum* L.)

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ABSTRACT

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The experiment was conducted during Rabi season 2018, in order to standardize the best method of priming specific to Chickpea (var. Desi). Four methods of priming viz- hydropriming, osmopriming, halopriming, and organic priming with control (Unprimed) were evaluated by screening a range of duration (12 hrs) and concentration viz., T₀. Unprimed Control, hydropriming- T₁- Distilled water, osmopriming- T₂- Polyethylene Glycol (PEG) 5%, T₃- Polyethylene Glycol (PEG) 7%, T₄- Polyethylene Glycol (PEG) 9%, halopriming- T₅- Sodium Chloride (NaCl) 5%, T₆- Sodium Chloride (NaCl) 7%, T₇- Sodium Chloride (NaCl) 9%, T₈- Potassium Chloride (KCl) 5%, T₉- Potassium Chloride (KCl) 7%, T₁₀- Potassium Chloride (KCl) 9%, Organic priming- T₁₁- Tulsi leaf extract (5%), T₁₂- Neem leaf extract (5%). It was found that all the priming treatment showed significance difference with the control and the highest germination percent, seedling length, seedling fresh weight, seedling dry weight, vigour indices were observed for Osmopriming with Polyethylene Glycol (PEG) 7%. Seed pre-sowing seed treatment, used as a simple method for overcoming related to a poor germination and seedling establishment and helps in sustaining agriculture and cost effective and economic, non-toxic, eco-friendly sources.

Introduction

Pulses maintain the soil fertility by fixing atmospheric nitrogen and improved soil structure. Pulses also play an important role in rainfed agriculture improving physical, chemical and biological properties of soils so considered excellent crop for natural resources management environmental crop diversification and consequently for viable agriculture (Khan *et al.*, 2006). A healthy crop of chickpea can fix up to 141 kg nitrogen

per hectare. Pulse Production, Trade, and consumption of India. Chickpea (*Cicer arietinum* L.) 2n=16, belongs to family leguminaceae. The word Cicer is a derivative from the Greek word kiros referring to a well-known roman family Cicero. Arietinum is derived from the Latin word arise meaning ram which refers to the ram's head shape of the chickpea. It is also known as Bengal gram. It is a cool season legume crop and is grown in several countries world-wide as a nutritional crop.

Chickpea contains protein (22-28 %), fat (4.8-5.5 %), carbohydrates (40-65 %), ash (48 %), moisture (4.9-15.59), vital vitamins like vitamin 'A', vitamin B1, B2 and B3, vitamin 'C', vitamin 'D', vitamin 'E', vitamin 'K', Folate and Pantothenic acid (Zohary and Hopf, 2000).

Chickpea also contain many important minerals like as, Calcium, Iron, Molybdenum, Potassium, Manganese, Copper, Zinc etc. other nutrients that are found in chickpeas are dietary fibers water, etc.

The highest productivity of 3759 kg/ha is observed in China followed by Israel, Republic of Moldova and Bosnia & Herzegovina. India's productivity was 995 kg/ha (FAO Stat. 2017).

Chickpea (*Cicer arietinum* L.) is known by different names in various countries such as gram, chana, bengalgram, kadle etc. Chickpea is an important Rabi season legume having extensive geographical distribution. Chickpea is the third most important pulse crop in the world after beans and peas.

It is cultivated on an area of 12 million hectares with 8.9 million tons of annual production. Chickpea plays an important role to improve soil fertility by fixing atmospheric nitrogen with the help of root nodules (Anabessa *et al.*, 2009). Chickpea is native of south-eastern Turkey and Syria.

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 germination rate and plant performance (Bradford, 1986).

The main Objectives of Investigation is to assess the effect of different priming methods

on growth, yield and its attributing characters of Chickpea, to determine the effect of different priming methods on seedling characters and to determine the Suitable priming method for chickpea.

The effectiveness of the priming with simple salt solution, perhaps, depends both on the osmotic potential and the chemical nature of the salt species used. It is reported that nitrate containing compounds may function more efficiently than other salts as priming agents. It has been found many salts can be used very effectively for priming.

Materials and Methods

The experiment was conducted in post graduate Seed Testing Laboratory, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.) on Chickpea (var.Desi).

The treatments used at different concentrations viz., T₀. Unprimed Control, hydropriming- T₁- Distilled water, osmopriming- T₂- Polyethylene Glycol (PEG) 5%, T₃- Polyethylene Glycol (PEG) 7%, T₄- Polyethylene Glycol (PEG) 9%, halo priming- T₅- Sodium Chloride (NaCl) 5%, T₆- Sodium Chloride (NaCl) 7%, T₇- Sodium Chloride (NaCl) 9%, T₈- Potassium Chloride (KCl)5%, T₉-Potassium Chloride (KCl)7%, T₁₀- Potassium Chloride (KCl) 9%, Organic priming- T₁₁- Tulsi leaf extract (5%), T₁₂- Neem leaf extract (5%).

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.

Symbol	Treatments	Concentrations	Duration
T ₀		-	-
T ₁	DH ₂ O	-	12hrs
T ₂	PEG	5%	12hrs
T ₃	PEG	7%	12hrs
T ₄	PEG	9%	12hrs
T ₅	NaCl	5%	12hrs
T ₆	NaCl	7%	12hrs
T ₇	NaCl	9%	12hrs
T ₈	KCl	5%	12hrs
T ₉	KCl	7%	12hrs
T ₁₀	KCl	9%	12hrs
T ₁₁	Tulsi leaf extract	5%	12hrs
T ₁₂	Neem leaf extract	5%	12hrs

Preparation of solution

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 was finally constituted to one liter, then it became 1000 ppm stock solution of each chemical. The flasks containing chemicals was covered with muslin cloth to avoid any contamination.

For the preparation of (5%)Polyethylene glycol (PEG) solution 50 (g) PEG was taken in a measuring flask and made up to 1000 ml. distilled water, while Sodium chloride (NaCl-5%) solution 50 (g) NaCl was taken in a measuring flask and made up to 1000 ml. distilled water and (5%) Potassium chloride (KCl) solution 50 (g) KCl salt was taken in a measuring flask and made up to 1000 ml with distilled water. Preparation of Neem leaf extract (5%), 50 (g) powder of Neem leaf extract was taken in a measuring flask and made up to 1000 ml distilled water and so on.

Soaking of the seed solution

After preparation of solution of Polyethylene glycol (PEG), Sodium chloride (NaCl),

Potassium chloride (KCl), Tulsi Leaf Extract and Neem Leaf Extract, chickpea seeds were soaked in required solution for 12 hour at 25⁰C temperature. After 12 hr of soaking the solution was drained out from the beaker and pre-soaked air dried to original weight and then placed for germination in laboratory under controlled condition. After the seed treatment seed was sown in field for occurring field observation. The observation on all growth and yield parameters *viz.*, Field emergence percentage, days to 50% flowering, plant height at 30 and 60 DAS, number of branches per plant, number of pods per plant, seed yield per plant, seed yield per plot, biological yield and harvest index.

Field emergence (%)

The field emergence count will be taken on the 4,7 and 10 days after the date of sowing and the emergence percentage was calculated, taking into account the number of seedlings emerged three centimetres above the soil surface.

Days to 50% flowering

It will measure from DAS to half flowering, in which observe select five plants in a plot

and check flowering status when 50 % flower open in field.

Plant height (cm)

It was measured from ground level to the base of the top most fully opened leaf on 30 and 60 DAS. Average height of five plants was recorded in centimeters.

Number of branches per plant

In this method observe the total numbers of branch per plant from five randomly selected plants were counted manually from each plot.

Number of pods per plant

The total number of pods from five randomly selected plants was counted manually from each plot.

Seed yield per plant (gm)

The seed weight of five randomly select plants will be recorded of each plant in each plot.

Seed yield per plot (gm)

The seed weight of five randomly select plants will be recorded of each plot.

Biological yield

The biological yield refers to the total dry matter accumulation of a plant system. The biological yield of five randomly select plants will be recorded of each plot.

Harvest index

For grain crops, harvest index (HI) is the ratio of harvested grain to total shoot dry matter, and this can be used as a measure of reproductive efficiency. The HI of five

randomly select plants will be recorded of each plot.

$$\text{HARVEST INDEX(\%)} = \frac{\text{GRAIN YIELD}}{\text{BIOLOGICAL YIELD}}$$

Results and Discussion

A field experiment was conducted to study Effect of priming on the growth, yield, field attributing traits and seedling parameters on Desi Chickpea (*Cicer arietinum L.*) are as follows. The experiment was carried out during *Rabi* season 2018-19, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and science, Prayagraj (U.P). The area is situated on the right side of the river Yamuna by the side of Allahabad Rewa Road about 5 km away from Allahabad city. The results are given and discussed under following headings.

Analysis of variance
Mean performance

Analysis of variance

The analysis of variance for growth and seed yield characters was presented in Table 1. Analysis of variance revealed that the differences among thirteen treatments were significant for growth and yield, *viz.*, field emergence percentage, days to 50% flowering, plant height at 30 and 60 DAS, number of branch per plant, number of pods per plant, seed yield per plant, seed yield per plot, biological yield, harvest index.

Mean performance

Mean value is defined by the ratio of the sum of the observations to the total number of observations. On other hand, range is the simplest measurement in mathematical calculation and simple to understand. It avoids variation of over all data and depends

only on extreme values. The data presented in Table 1 shows mean performance of 13 treatments for 10 growth and yield parameters (quantitative). The grand mean for all the traits are also depicted in Table 1 and Table 2, respectively.

Mean performance of growth and yield parameters

Effect of different priming methods on field emergence percent

The mean performance of field emergence percent ranged from 79.67 to 92.67 with mean value of 86.38. Significantly highest field emergence percent (92.67) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (91.33) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (90.00) with application Potassium chloride (KCl) 9%. Minimum field emergence percent was recorded by T₀ (79.67) with control.

Effect of different priming methods on days to 50% flowering

The mean performance of days to 50% flowering ranged from 63.67 to 76.00 with mean value of 70.51. Significantly highest days to 50% flowering (76.00) was reported in T₀ with control and it was followed by T₁ (75.67) primed with distilled water and T₇ (75.00) with application of Sodium chloride (NaCl) 9%. Minimum days to 50% flowering was recorded by T₃ (63.67) with application of Polyethylene Glycol (PEG) 7%.

Effect of different priming methods on plant height at 30 DAS

The mean performance of plant height at 30 DAS ranged from 16.46 cm to 24.10 cm with mean value of 20.77 cm. Plant height at 30

DAS observed significant, found to be highest (24.10 cm) in priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (23.46 cm) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (22.92 cm) with application of Potassium chloride (KCl) 9%. Minimum plant height at 30 DAS was recorded by T₀ (16.46 cm) with control.

Effect of different priming methods on plant height at 60 DAS

The mean performance of plant height at 60 DAS ranged from 26.49 cm to 40.15 cm with mean value of 33.39 cm. Plant height at 60 DAS observed non-significant, found to be highest (40.15 cm) in priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (38.90 cm) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (37.65 cm) with application of Potassium chloride (KCl) 9%. Minimum plant height at 60 DAS was recorded by T₁₂ (26.49 cm) with application of Neem leaf extract @ 5%.

Effect of different priming methods on number of branches per plant

The mean performance of number of branches per plant ranged from 4.03 to 7.60 with mean value of 5.72. Significantly highest number of branches per plant (7.60) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (7.17) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (6.93) with application Potassium chloride (KCl) 9%. Minimum number of branches per plant was recorded by T₀ (4.03) with control.

Effect of different priming methods on number of pods per plant

The mean performance of number of pods per plant ranged from 24.63 to 40.13 with mean value of 32.77. Significantly highest number

of pods per plant (40.13) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (38.67) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (37.40) with application Potassium chloride (KCl) 9%. Minimum number of pods per plant was recorded by T₀ (24.63) with control.

Effect of different priming methods on seed yield per plant (gm)

The mean performance of seed yield per plant ranged from 4.57 gm to 8.70 gm with mean value of 6.35 gm. Significantly highest seed yield per plant (8.70 gm) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (8.11 gm) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (7.70 gm) with application

Potassium chloride (KCl) 9%. Minimum seed yield per plant was recorded by T₀ (4.57 gm) with control.

Effect of different priming methods on seed yield per plot (gm)

The mean performance of seed yield per plot ranged from 673.16 gm to 1158.27 gm with mean value of 857.50 gm. Significantly highest seed yield per plot (1158.27 gm) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (1075.31 gm) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (1023.65 gm) with application Potassium chloride (KCl) 9%. Minimum seed yield per plot was recorded by T₀ (673.16 gm) with control.

Table.1 Analysis of variance for 9 quantitative characters in chickpea

S.No.	Characters	Mean sum of square		
		Replications (df=2)	Treatments (df=12)	Error (df=24)
1.	Field Emergence percentage	23.15	50.05*	0.93
2.	Days to 50% Flowering	38.03	57.48*	7.91
3.	Plant height at 30 DAS	1.04	16.65*	0.14
4.	Plant height at 60 DAS	42.91	53.58	26.92
5.	Number of Branch Per Plant	0.41	3.65*	0.04
6.	Number of Pods Per Plant	57.69	70.96*	3.99
7.	Seed yield per plant (g)	0.01	5.04*	0.17
8.	Seed yield per plot (g)	1561.21	70981.65*	531.36
9.	Biological yield	935.43	139875.42*	4754.69
10.	Harvest index	0.37	46.11*	0.73

* significant at 5% level of significance

Table.2 Mean performance of chickpea for 10 quantitative chickpea

S.NO.	Treatments	Field Emergence percentage	Days to 50% Flowering	Plant height at 30 DAS	Plant height at 60 DAS	Number of Branch Per Plant	Number of Pods Per plant	Seed yield per plant (g)	Seed yield per plot (g)	Biological yield	Harvest index
1	T ₀	79.67	76.00	16.46	30.37	4.03	24.63	4.57	673.16	2311.12	29.12
2	T ₁	80.33	75.67	17.87	31.50	4.50	26.43	4.90	697.97	2304.13	30.25
3	T ₂	91.33	64.33	23.26	38.90	7.17	38.67	8.11	1075.31	2672.47	40.15
4	T ₃	92.67	63.67	24.10	40.15	7.60	40.13	8.70	1158.27	2791.20	41.38
5	T ₄	89.33	67.00	22.67	36.50	6.57	36.77	7.31	968.46	2469.95	39.11
6	T ₅	86.00	70.33	21.20	27.63	5.47	32.60	6.07	810.67	2176.83	37.21
7	T ₆	84.67	73.67	19.74	33.71	5.07	30.80	5.62	762.60	2160.93	35.17
8	T ₇	82.33	75.00	18.34	32.43	4.77	27.70	5.08	738.33	2253.52	32.66
9	T ₈	87.67	69.33	21.73	30.00	5.90	34.60	6.40	814.79	2116.48	38.46
10	T ₉	89.00	68.67	22.20	35.80	6.13	35.20	6.76	897.40	2297.01	38.92
11	T ₁₀	90.00	66.00	22.92	37.65	6.93	37.40	7.70	1023.65	2566.48	39.86
12	T ₁₁	84.33	74.67	18.75	32.90	4.90	29.50	5.36	754.13	2245.81	33.44
13	T ₁₂	85.67	72.33	20.77	26.49	5.30	31.53	5.91	772.80	2119.62	36.28
Grand Mean		86.38	70.51	20.77	33.39	5.72	32.77	6.35	857.50	2345.04	36.31
C.D.(5%)		1.63	4.74	0.63	8.75	0.35	3.37	0.69	38.85	116.20	1.44
SE(m)		0.56	1.62	0.22	3.00	0.12	1.15	0.24	13.31	39.81	0.49
SE(d)		0.79	2.30	0.31	4.24	0.17	1.63	0.33	18.82	56.30	0.70
C.V.		1.12	3.99	1.81	15.55	3.66	6.10	6.45	2.69	2.94	2.35
F.Test		S	S	S	NS	S	S	S	S	S	S

Effect of different priming methods on biological yield

The mean performance of biological yield ranged from 2311.12 to 2791.20 with mean value of 2345.04. Significantly highest biological yield (2791.20) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (2672.47) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (2566.48) with application Potassium chloride (KCl) 9%. Minimum biological yield was recorded by T₀ (2311.12) with control.

Effect of different priming methods on harvest index

The mean performance of harvest index ranged from 29.12% to 41.38% with mean value of 36.31%. Significantly highest harvest index (83.50) was reported in the priming with T₃ Polyethylene Glycol (PEG) 7% and it was followed by T₂ (40.15%) with application of Polyethylene Glycol (PEG) 5% and T₁₀ (39.86%) with application Potassium chloride (KCl) 9%.

Minimum harvest index was recorded by T₀ (29.12%) with control.

Summary

An investigation was carried out to evaluate the “Effect of priming on the growth, seedling, yield and its attributing characters on Desi Chickpea (*Cicer arietinum* L.)”

All growth and yield parameters *viz.*, Field emergence percentage, days to 50% flowering, plant height at 30 and 60 DAS, number of branches per plant, number of pods per plant, seed yield per plant, seed yield per plot, biological yield and harvest index.

The results obtained from the present investigation are summarized below.

Field emergence, growth and yield attributes

Field emergence percent (92.67%) were highest in T₃- Polyethylene Glycol (PEG) @ 7% followed by T₂- Polyethylene Glycol (PEG) @ 5% (91.33%) and found to be lowest in T₀- Control (79.67%). Days to 50% flowering (76.00) were highest in T₀- Control followed by T₁- Distilled water (75.67) and found to be lowest in T₃- Polyethylene Glycol (PEG) @ 7% (63.67). Plant height at 30 DAS (24.10 cm) were highest in T₃- Polyethylene Glycol (PEG) @ 7% and found to be lowest in T₀- Control (16.46 cm). Plant height at 60 DAS (40.15 cm) were highest in T₃- Polyethylene Glycol (PEG) @ 7% and found to be lowest in T₀- Control (30.37 cm). Number of branches per plant (7.60) were highest in T₃- Polyethylene Glycol (PEG) @ 7% and found to be lowest in T₀- Control (4.03). Number of pods per plant (40.13) were highest in T₃- Polyethylene Glycol (PEG) @ 7% followed by T₂- Polyethylene Glycol (PEG) @ 5% (38.67) and found to be lowest in T₀- Control (24.63). However yield attributes were also positively influenced by osmoprimed seed treatment and highest seed yield per plant and seed yield per plot (8.70 gm, 1158.27 gm) respectively were highest in T₃- Polyethylene Glycol (PEG) @ 7% and found to be lowest in T₀- Control (4.57 gm, 673.16 gm) respectively. Biological yield (2791.20 gm) was highest in T₃- Polyethylene Glycol (PEG) @ 7% and found to be lowest in T₀- Control (2311.12 gm). Harvest index (41.38 %) was highest in T₃- Polyethylene Glycol (PEG) @ 7% followed by T₂- Polyethylene Glycol (PEG) @ 5% (40.15%) and found to be lowest in T₀- Control (29.12%).

In conclusion the priming increases the germinability and vigour of chickpea seeds, significantly all the field parameters. Osmopriming with PEG significantly

increased the germination per cent and other seedling characters of chickpea. Osmopriming with PEG @ 7% showed maximum increase in germ inabily and vigour and showed maximum increase in germination. Priming of the chickpea seeds for 12 hrs, in which PEG @ 7% best result to enhanced germinability, vigour and seedling characters. These conclusions are based on the results of six months investigation and therefore further investigation is needed to arrive at valid recommendations.

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