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Effect of priming on germination and seedling establishment of chickpea (*Cicer arietinum* L.) seeds

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Abstract
Seed priming with *Rhizobium* + *Pseudomanas* @ 10% for 12 hours recorded significantly higher germination percent (87%), speed of germination (77.11), shoot length (20.33 cm), root length (16.14 cm), seedling length (34.92 cm), seedling fresh weight (1200.3 mg), dry weight (150.4 mg), seedling vigour index – I (2225.37), seedling vigour index-II (11766.67). which is followed by seed priming with *Rhizobium* @ 10% for 12 hours (T3) and lowest was recorded in T0 (control).

Keywords: Chickpea, Hydro priming, Bio-fertilizers, Priming, Seed germination

1. Introduction
Pulse crops have a specific importance for the vegetarian population of our country because pulses are the major source of protein. However, due to population explosion and low productivity of pulse crops, per capita availability of pulses is consistently decreasing. Per capita availability of pulses per day is only 47g as against the minimum requirement of 104 g as recommended by nutritional experts of World Health Organization/Food and Agriculture Organization.

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 sub-continent accounts for 70 and 80 per cent area and production of gram crop, respectively in the world (Bharodia *et al*., 1987) [2]. In India, gram is cultivated in about 32 per cent of total area of pulse crops and it contributes 45 per cent 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 (Joshi, 2001) [10].

Gram seed contains about 17.7, 0.49, 0.11 and 0.04 per cent protein, lysine, methionine and tryptophane, respectively (Katiyar, 1982). In addition to this, it also contains 56.6 per cent carbohydrates and it has a considerable amount of ash calcium, phosphrous and iron (Thakur, 1980). Gram seed also contains Na, K, Cl, Mg, S and Auxalic acid. It is also good source of Vitamin A, thiamin, riboflavin, nicotinic acid and Vitamin C. Beside a food crop for human consumption, gram is an excellent concentrate for horses. Being a leguminous crop, it adds atmospheric nitrogen in the soil with the help of symbiotic bacteria in the root nodules.

Seed priming is a controlled hydration process that involves exposing seeds to low water potentials that restrict germination, but permits pregerminative and physiological changes to occur (Heydecker and Coolbear, 1977; Bradford, 1986; Khan, 1992) [7, 4]. Upon rehydration, primed seeds may exhibit faster rate of germination, more uniform emergence, greater tolerance to environmental stresses, and reduced dormancy in many species.

Heydecker (1973) used different terms depending upon the method adopted for priming, namely (i) Hydropriming - soaking the seeds in water, (ii) Osmopriming - soaking the seeds in osmotic solution, (iii) Halopriming - soaking the seeds in salt solutions, (iv) Biopriming - coating the seeds with biological agents like bacteria, fungi etc. and (v) Solid matric priming - mixing the seeds with an organic or inorganic carrier and water, for a specific period of time.

Material and Methods
The present study was conducted in 2016 at Sam Higginbottom University of Agriculture, Technology and Sciences, to study the effects of priming on germination and seedling

establishment of chickpea. The seeds were soaked with priming agents such as *Rhizobium, Tricoderma, Pseudomonos* and $CaCl_2$ solutions for 12 hours as accordingly with the concentrations as included in the experiment and shade dried. Germination test was conducted in between paper method and sand method.

Treatment Details

T_0- Control
T_1- Hydropriming for 12 hours
T_2- *Rhizobium* @ 10% for 12 hours
T_3- *Pseudomonas fluorescens* @ 10% for 12 hours
T_4- *Trichoderma viridae* @ 10% for 12 hours
T_5- $CaCl_2$ @ 2 % 12 hours
T_6 - *Rhizobium* + *Pseudomanas* @ 10% for 12 hours
T_7- *Rhizobium* + *Tricoderma viridae* @ 10% for 12 hours

Observation on germination percentage, speed of germination, shoot length, root length, seedling length, seedling fresh weight and seedling dry weight, seedling vigour index I and seedling vigour index II. The data related to all this parameters were subjected to analysis of variance prescribed for complete randomized design (CRD).

Result and Discussion

Table 1 revealed that Seed priming with *Rhizobium* + *Pseudomanas* @ 10% for 12 hours T6 recorded higher germination percentage (87%) it may due to completion of pregermination metabolic activities during seed priming, making the seed ready for soon germination after planting and the highest germination percentage The variation in seed germination percentage and seedling length may be attributed to plant growth promotional effect of seed primers especially bioagents that may produce growth regulatory substances (hormones) upon seed imbibition. These findings are in agreement with the findings of Bapurayagouda (2010) [1] and Jin and Tylkowska (2005) [9]. Speed of germination (77.11) it may because of the accelerated germination of primed seeds might be due to increased rate of cell division (Bose, *et al* 1992), shoot length (20.33 cm), root length (16.14 cm), seedling length (34.92 cm) These chemicals must have promoted the apical dominance or cell division at shoot and root apex. Increased shoot and root length may be due to early emergence induced by priming treatment as compared to unprimed seeds. Stofella *et al.* (1992) [11]. Seedling fresh and dry weight 1200.3 mg and 140.16 mg respectively This result might be due to an increase of the synthesis of the hormone gibberellin, which Trigg the activity of α-amylase and other germination specific enzymes like protease and nuclease involved in hydrolysis and assimilation of the starch (Gholami *et al.,* 2009) [6]. Seeding vigour index I and II of 2223.57 and 13093.3 the treatment which is primed with biofertilizer increases may due to increased supply on nutrition. These results of these experiment shows that, the seed vigour index mass increased by *Rhizobium* due to bacteria inoculation depending on the type of bacteria. This result is cerebrated with (Farnia *et al*., 2014) [5] The probable reason for recording the highest vigour index might be due to photosynthetic capacity treated with bio fertilizers increases due to increased supply of nutrition. This result is in conformity with **(**farnia and shafie, 2014) [5].

Table 1: Analysis of variance for 8 seedling characters in chickpea.

S. No.	Characters	Mean sum of squares	
		Treatments (df=7)	Error (df=24)
1.	Germination	137.47*	4.19
2.	Root length	15.77*	0.22
3.	Shoot length	18.00*	0.46
4.	Seedling length	34.42*	0.45
5.	Seedling fresh weight	102175.69*	5194.28
6.	Seedling dry weight	345.27*	5.10
7..	Seed vigour index I	693807.49*	2612.46
8.	Seed vigour index II	12563569.33*	173080.04

* Significant at 5% level of significance

Table 2: effect of priming of germination and seedling establishment of chickpea.

Treatment	Germination %	Speed of Germination	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Seedling fresh weight (mg)	Seedling dry weight (mg)	Vigour index I	Vigour index II
T_0	65.33	66.93	12.82	9.36	24.50	663.33	116.66	1665.38	6818
T_1	69.00	67.34	13.68	10.33	26.44	733.50	121.66	1833.58	7946.66
T_2	75.66	72.51	16.11	13.23	29.42	1003.33	135.23	2456.76	9425
T_3	80.00	75.37	18.26	15.04	32.93	1118.50	140.16	2833.83	11766.67
T_4	71.00	71.43	14.80	14.02	27.58	863.40	127.06	2030.50	8850
T_5	74.33	70.57	15.70	12.63	28.4	910.03	132.80	2225.37	10106.67
T_6	87.00	77.11	20.33	16.14	34.92	1200.36	150.40	3026.10	13093.33
T_7	77.33	73.51	17.06	14.15	30.02	1033.8	137.13	2605.30	10880
G mean	74.95	71.82	16.09	13.11	29.27	940.78	132.64	2334.60	9860.79
SEM+	1.18	0.55	0.39	0.27	0.38	41.61	1.30	29.50	240.19
CD@5%	4.97	2.33	1.65	1.15	1.63	175.17	5.49	124.23	1011.19

Conclusion

Based on the present study, it can be concluded that the seed priming with, *Rhizobium* + *Pseudomanas* @ 10% for 12 hours (T6) recorded higher germination per cent (87.00%), speed of germination (77.11%), shoot length (20.33333cm), root length (16.14cm), seedling length (34.92cm), fresh (1200.367mg) and dry weight (150.4mg) of seedling, vigour index I (3026.1) and II (13093.33), it was the best treatment combination.

Bio-priming could be a suitable, cheap and easy seed invigoration treatment for chickpea and thus can easily be adopted by resource-poor farmers in marginal areas of

developing countries. It is therefore recommended that AVRODHI chickpea variety. Further study is required to investigate the effects of long duration and condition after Bio-priming.

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