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EFFECT OF SEED PRIMING ON GROWTH AND PRODUCTIVITY OF CHICKPEA (*CICER ARIETINUM* L.) UNDER RAINFED CONDITIONS OF KARNATAKA

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ABSTRACT
A field experiment was conducted during the post rainy (*rabi*) seasons of 2013 and 2014 at Agricultural Research Station, Gulbarga, University of Agricultural Sciences, Raichur (Karnataka) on medium black soils to know the effect of seed priming on growth and productivity of chickpea. The results revealed that, seed soaking in vermi wash for 8 hours resulted in early emergence (33.33 plants m^{-2}), higher plant height (36.8 cm), total dry matter production (24.8 g $plant^{-1}$), required minimum duration for fist (32.2 days) and 50% flowering (45.2 days). This treatment also exhibited maximum number of pods $plant^{-1}$ (37.3), pod weight $plant^{-1}$ (83.93 g), seed weight $plant^{-1}$ (10.48 g), 100 seed weight (19.87 g), seed yield (1341 kg ha^{-1}), haulm yield (3353 kg ha^{-1}) and harvest index (28.57). It may be inferred from the present investigation that, seed soaking in vermiwash for 8 hours may be recommended under dryland conditions as it resulted in early emergence, required minimum duration for 1st and 50% flowering, maximum number of pods $plant^{-1}$, pod weight $plant^{-1}$, seed weight $plant^{-1}$, 100 seed weight, seed yield and haulm yield.

INTRODUCTION

Chickpea is one of the most important pulse crops of India, grown both under conserved soil moisture and irrigated situations. The productivity of chickpea has fallen due to various constraints such as biotic and abiotic factors. Among the abiotic constraints drought is the major constraint in Karnataka. Poor and erratic germination, weak seedlings and less plant population are major causes of low chickpea productivity. Drought resulting from inadequate soil moisture has negative effects on seedling emergence, germination, growth, flowering, pod set and seed yield (Sugui and sugui, 2002). Rapid germination and emergence is an important factor of successful establishment. It is reported that the seed priming is one of the most important developments to help rapid and uniform germination and emergence of seeds and to increase seed tolerance to adverse environmental conditions (Harris *et al*. 1999). Seed priming with water or different osmotic solutions before sowing are an effective mechanism to increase germination, seedling establishment and uniformity by balancing available soil moisture (Parera *et al.,* 1994). Seed priming could be done either by hydro priming or osmotic priming with different salts ($CaCl_2$, KNO3 and KH2PO4). The seed priming process affects activity of different enzymes, especially amylase and increase mobilization of starch granules in cotyledons thus, stimulating germination, growth and final yield (Kaur *et al.,* 1988). Information on the effect of seed priming on growth and yield of chickpea under rainfed conditions is very meager. Considering the above factors, research work on chickpea was carried out to evaluate the effect of different seed priming on crop growth, yield contributing character and yield of chickpea.

MATERIALS AND METHODS

A field experiment was conducted during post rainy season of 2013-14 and 2014-15 at Agricultural Research Station, Gulbarga, Karnataka. The soil of the experimental field was clay loam having organic carbon 0.50 %, available nitrogen 180 kg ha^{-1}, phosphorous 25 kg ha^{-1} and potash 350 kg ha^{-1} and EC 0.41 dS/m with pH 8.80. The experiment consisting of 10 treatments *viz*., T_1: Untreated control (Control), T_2: Water soaking for 8 hours (Check), T_3: Seed hardening with CaCl2, T_4: Seed hardening in vermiwash, T_5: Seed soaking in cow urine (25%), T_6: Seed soaking in cow urine (50%), T_7: Seed soaking in cow urine (75%), T_8: Seed soaking in cow urine (100%), T_9: Seed soaking in panchagavya and T_{10}: Seed hardening with KH_2PO_4 . The experiment was laid out in randomized block design with three replications. Seed of chickpea variety A-1 was primed in plain water, 25%-100% cow urine, CaCl2, KH_2PO_4 solution and also in panchagavya for 8 hours. Dry seed (non primed) was used as a control treatment. After thorough preparation of land the treated chickpea seed was sown by adopting the spacing of 30 x 10 cm. Before sowing, entire dose of nitrogen (25 kg ha^{-1}) and P_2O_5 (50 kg ha^{-1}) was applied in the form of urea and single

super phosphate respectively, as basal as per the recommendations. The remaining cultural practices were applied uniformly. After establishment of seedlings, various intercultural operations were accomplished for better growth and development of the chickpea. The crop was harvested at full maturity from each plot. The harvested crop of each plot was bundled separately, properly tagged and brought to threshing yard. Enough care was taken for harvesting, threshing and also cleaning of chickpea seed. Fresh weight of grain and stover were recorded plot wise. The grains were cleaned and finally the weight was adjusted to a moisture content of 12%. Data were collected on emergence m^{-2}, date of 1st and 50% flowering, plant height (cm), number of branches $plant^{-1}$, total dry matter, number of pods $plant^{-1}$, pod weight (g $plant^{-1}$), seed weight (g $plant^{-1}$), 100 seed weight (g), grain yield (kg ha^{-1}), stover yield (kg ha^{-1}) and harvest index (%). The data obtained for different characters were statistically analysed to observe the significant difference among the treatment by using the MSTAT-C computer package program. The significance of the difference among the treatment means was estimated by the Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Emergence (m^{-2})

Significant variation was observed for plant emergence m^{-2} among the seed priming treatments. Seed primed in vermiwash for 8 hours resulted in the highest emergence m^{-2} (33.3) followed by seed soaked in panchagavya for 8 hours (32.8). The multi nutrients present in vermiwash has been shown to improve emergence and crop stand establishment (Harris *et al.,* 2001). These results are in agreement with Chhipa *et al.,* 1993 and Ghosh *et al.,* 1997, who reported the highest germination, improved emergence and good stand establishment in the field trials of seed priming as compared to control. Rahul and Sachin (2015) reported that soybean seeds primed with GA3 @ 100 ppm and KNO3 @ 0.5% recorded higher germination percentage over the untreated control. The minimum emergence m^{-2} (25.4) was recorded for seed soaking in cow urine (100%). Seed samples primed with cow urine (50%, 75% and 100%) showed very poor emergence. This may be due to high uric acid concentration in cow urine. Farooq *et.al.* 2012 quoted that concentration of solution is perhaps the most important factor in case of seed priming. Harris *et al.* (1999) also reported that the seed priming increased seedling emergence, plant height, number of pods, seed weight, grain yield and straw yield of chickpea and also found significantly results of seed priming in maize and rice crop.

Days of 1st flowering

Significant variation was observed for days of first flowering among the seed priming treatments. The minimum days of first flowering was observed in seed soaking in vermiwash for 8 hours (32.2 days) and seed soaked in panchagavya for 8 hours (32.8 days). Similar result was also reported by Khairul Mazed *et al.,* 2015 in chickpea primed with GA_3 225 ppm. The maximum days of first flowering (40.1 days) was observed in seed soaked in cow urine (100%).

Days of 50% flowering

Significant variation was observed for days of 50% flowering among the seed priming treatments. The minimum days of 50% flowering was observed in seed soaking in vermiwash for 8 hours (45.2 days) and seed soaked in panchagavya for 8 hours (46.8 days). Similar result was also reported by Khairul Mazed *et al.,* 2015 in chickpea primed with GA_3 225 ppm. The maximum days of first flowering (56.2 days) was observed in seed soaked in cow urine (100%).

Effect of seed priming on growth parameters of chickpea

Chickpea seed priming with vermiwash was found to be most beneficial as it significantly improved plant height, number of branches $plant^{-1}$, and total dry matter $plant^{-1}$. The tallest plants (36.8 cm), maximum number of branches $plant^{-1}$ (7.6) and highest dry matter in $plant^{-1}$ (24.8 g) were observed in the treatment of seed soaking in vermiwash for 8 hours followed by seed soaking in panchagavya for 8 hours (35.5 cm, 6.8 and 23.1 g $plant^{-1}$, respectively). Chavan *et al.* (2014) reported that soybean seeds primed with CaCl2 @ 0.5% were superior in plant height, number of branches, number of pods per plant, number of seeds per pod, seed yield per hectare over non priming. Chickpea seed priming in plain water for 4 hours is sufficient to have better germination, more number of pods $plant^{-1}$ and higher yield over control (Mukundam *et al.,* 2008). The shortest plants, minimum number of branches and lowest

Table 1: Growth and yield parameters of chickpea an influenced by different seed priming techniques (pooled data of 2 years)

Sl.No	Treatments	Emergence m^{-2}	Days to first flowering	Days to 50% flowering	Plant height (cm)	No. of branches $plant^{-1}$	Total dry matterg $plant^{-1}$
1	Untreated (Control)	27.5	38.4	55.7	27.6	4.8	16.7
2	Water soaking for 8 hrs (Check)	28.0	37.6	54.1	28.9	5.0	17.5
3	Seed hardening with $CaCl_2$	30.0	35.4	51.2	33.7	6.0	20.3
4	Seed soaking in vermiwash for 8 hrs.	33.3	32.2	45.2	36.8	7.6	24.8
5	Seed soaking in cow urine (25%) for 8 hrs.	30.2	34.5	49.6	34.2	6.3	21.5
6	Seed soaking in cow urine (50%) for 8 hrs.	28.1	37.1	53.8	30.2	5.2	17.8
7	Seed soaking in cow urine (75%) for 8 hrs.	26.2	39.2	55.8	26.8	4.5	16.6
8	Seed soaking in cow urine (100%) for 8 hrs.	25.4	40.1	56.2	25.5	4.2	15.2
9	Seed soaking in panchagavya for 8 hrs.	32.8	33.3	46.8	35.5	6.8	23.1
10	Seed hardening with KH_2PO_4 for 8 hrs.	29.4	36.4	52.4	31.8	5.4	19.1
	S.Em $\pm$	1.1	1.0	1.8	1.0	0.2	0.6
	C.D (0.05)	3.1	3.0	5.4	3.0	0.6	1.8

Table 2: Yield parameters of chickpea an influenced by different seed priming techniques pooled data of 2 years)

Sl. No	Treatments	Grain yield (kg ha^{-1}) 2013	2014	Pooled	No. of pods plant^{-1}	Pod weight g plant^{-1}	Seed weight g plant^{-1}	100 seed weight(g)	Straw yield (kg ha^{-1})	Harvest index (%)
1	Untreated (Control)	942	988	965	24.6	55.35	5.98	16.95	2913	24.88
2	Water soaking for 8 hrs (Check)	1019	1091	1055	25.8	58.05	6.07	17.12	3038	25.78
3	Seed hardening with $CaCl_2$	1134	1213	1174	29.4	66.15	7.82	18.35	3338	26.02
4	Seed soaking in vermiwash for 8 hrs.	1295	1386	1341	37.3	83.93	10.48	19.87	3353	28.57
5	Seed soaking in cow urine (25%) for 8 hrs.	1202	1329	1265	30.4	68.40	8.29	18.80	3263	27.94
6	Seed soaking in cow urine (50%) for 8 hrs.	1070	1145	1108	26.3	59.18	7.11	17.58	3077	26.48
7	Seed soaking in cow urine (75%) for 8 hrs.	895	958	927	24.5	55.13	5.72	16.75	2718	25.43
8	Seed soaking in cow urine (100%) for 8 hrs.	827	885	856	21.7	48.83	5.34	16.44	2540	25.21
9	Seed soaking in panchagavya for 8 hrs.	1242	1329	1286	35.9	80.78	8.96	19.22	3315	27.95
10	Seed hardening with KH_2PO_4 for 8 hrs.	1112	1190	1151	27.4	61.65	7.18	18.11	3278	25.99
	S.Em ±	34	43	38	0.9	2.7	0.25	0.69	127	0.58
	C.D (0.05)	101	126	115	2.8	8.0	0.72	2.05	380	1.74

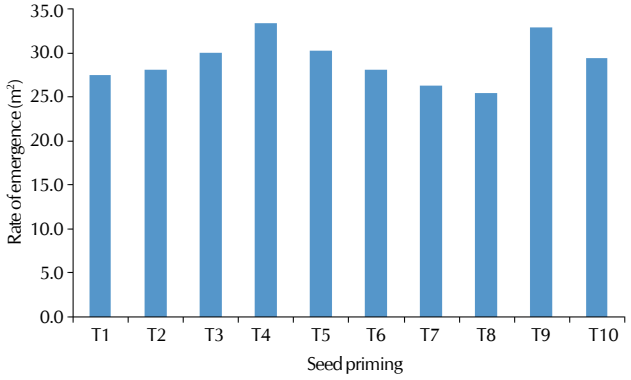

Figure 1: Effect of seed priming on emergence (m2)

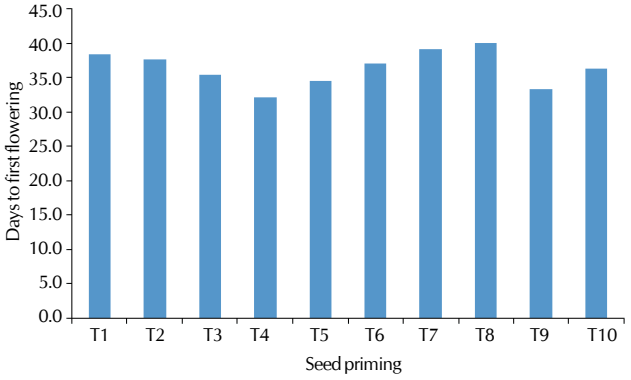

Figure 2: Effect of seed priming on days to 1st flowering

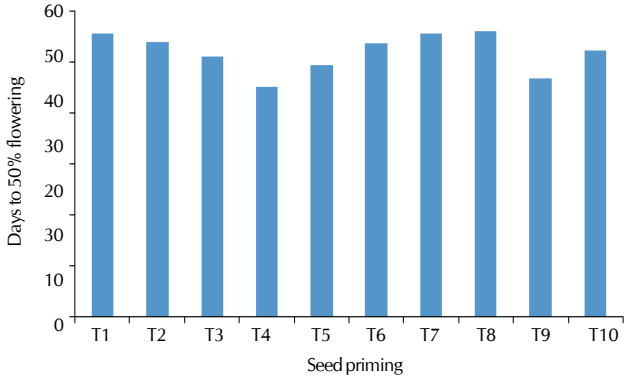

Figure 3: Effect of seed priming on days to 50% flowering

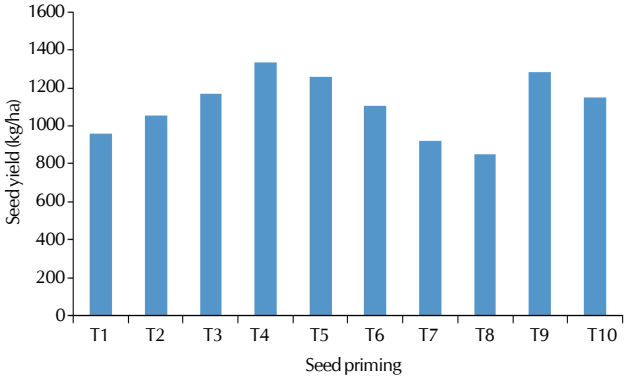

Figure 4: Effect of seed priming on seed yield (kg/ha) of chickpea

dry matter plant^{-1} were observed in the treatment of seed soaked in cow urine (100%). This may be due to high uric acid concentration in cow urine.

Effect of seed priming on yield parameters of chickpea

Seed priming with different treatments exhibited significant differences between them in respect of number of pods plant^{-1}, pod weight plant^{-1}, seed weight plant^{-1} and 100 seed weight. The maximum number of pods plant^{-1} (37.3), pod weight plant^{-1} (83.93), seed weight plant^{-1} (10.48 g) and 100 seed weight (19.87) were recorded in the treatment of seed soaking in vermiwash for 8 hours followed by seed soaking in panchagavya for 8 hours, where as the lowest number of pods, pod weight, seed weight and 100 seed weight were recorded in seed soaking in cow urine (100%) for 8 hours. These results are in conformity with the findings of Khairul Mazed *et al.*, 2015 who reported that chickpea primed with GA_3 225 ppm recorded maximum number of pods, pod weight, seed weight plant^{-1} and 100 seed weight.

Influence of seed priming on grain and straw yield

Grain and straw yield of chickpea varied significantly due to

seed priming with different treatments. The highest grain (1341 kg ha^{-1}) and straw (3353 kg ha^{-1}) yield was observed in the treatment of seed soaking in vermiwash for 8 hours which was at par with seed soaking in panchagavya for 8 hours (1286 kg ha^{-1}) and seed soaking in 25% cow urine for 8 hours (1265 kg ha^{-1}). The nutrient priming has been shown to improve drought tolerance, reduce pest damage, increase crop yield (Harris *et. al,* 2001). Similarly Singh Sher et al (2014) reported that seed priming of chickpea with 500 ppm of Molybdenum resulted in to 18-9% higher grain yield over control. Minimum grain (856 kg ha^{-1}) and straw yield (2540 kg ha^{-1}) was recorded in seed soaking in cow urine (100%) for 8 hours. The increase in grain and straw yield might be due to better early seedling growth, higher pod number, pod weight, seed weight and also 100 seed weight. These results endorse the findings Chhipa *et.al*. (1993) who reported that priming treatment significantly increased the grain and straw yield of wheat as compared with the control. Soaking of seeds in 5% solution of KCl for 12 hiurs increased the grain and straw yields of chickpea over without soaking of seeds. (Kumar Ravi *et al.,* 2006).

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