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Effect of organic priming on seed germination behaviour and vigour of chickpea (*Cicer arietinum* (L.))

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Abstract
The experiment was conducted at Post Graduate Laboratory, Seed Science and Technology, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini Agricultural Institute, Allahabad, Uttar Pradesh during *Rabi* season of 2018, to study the effect of organic priming on seed germination behaviour and vigour of chickpea *Cicer arietinum* (L.) of Gaurav variety. The design applied statistical analysis was carried out with Complete Randomized Design (CRD) with 4 replication and 9 treatments comprised of Control, Distilled water, Vermi wash (2% solution), Vermi wash (6% solution), Cow urine (2% solution), Cow urine (6% solution), Curry leaf extract (2% solution) and Curry leaf extract (6% solution) found that all the Organic priming methods showed significance difference with the control and the highest germination (%), seedling length, fresh weight of seedling (g), dry weight of seedling (g), seedling vigour index length and seedling vigour index mass were observed in (T_3) for Vermi wash at 6% and followed by (T_5) Cow urine 6%. The study helps to improve the quality of seeds with the help of seed organic priming treatments which are cost effective, economic, non-toxic and eco-friendly sources.

Keywords: chickpea, organic priming, hydropriming, vermi wash, cow urine, curry leaf extract

Introduction
Chickpea (*Cicer arietinum* (L.)) is commonly known as bengalgram, gram, channa, kadle *etc.* and is the third most important pulse crop in the world after beans and peas. Anatolia in Turkey was the area where chickpea was believed to have originated (Van Der Maesen, 1984) [22]. Chickpea is popularly cultivated in sub-tropical and semi-arid to warm temperate regions under dry season. Chickpea is predominantly consumed in the form of whole grain dhal, sprouted grain, and green or matured dry seeds and is used in the preparation of variety of snacks, sweets and condiments. It has highly digestible protein (21.1%), carbohydrate (61.5%), and fat (4.5%), relatively free from anti nutritional factors and is rich in phosphorous, iron, niacin and calcium compared to other pulses (Saxena, 1990) [18]. Its tender leaves are used as vegetable while, its acid exudates (mainly oxalic and malic acid) as a popular refreshing drink and medicinally for blood purification (Bahl and Salimath, 1996) [5]. Soaked grains and husk are fed to animals as concentrate and roughage respectively. Further, it also accounts for efficient soil enrichment by symbiotic nitrogen fixation, it has ability to meet more than 70 per cent of its nitrogen requirement from symbiotic nitrogen fixation, besides being drought tolerant.

Chickpea is the fifth most important food legume crop in the world. India is the largest chickpea producer as well as consumer in the world. It's grown on about 8.11 million ha, area with a production of 9.0 million tones which accounts for 63.01% of the world chickpea production. Source; (Directorate of Economics and Statistics, Ministry of Agriculture and Farmer Welfare, Government of India, 2015-16).

Priming may be helpful in reducing the risk of poor stand establishment under nursery conditions. Priming in improved seed performance might be attributable in part to the decreased lipid peroxidation and increased ant oxidative activities during seed imbibitions. These results are in accordance with the results of other researchers who reported improvement of germination percentage also reported that, hydro primed seeds showed significant increase in germination performance. The resultant effect of priming depends on the adopted method and duration of treatment. Hydro priming is a simple method of priming treatment. It does not require any special technical equipment owing to the use of distilled water as priming medium. It is probably the cheapest priming method.

Vermiwash is the watery extract of vermicompost, extracted in the presence of rich population of earthworms. It contains several enzymes, plant growth hormones like, auxin, cytokinine, vitamins along with micro and macronutrients like, phosphorus, potassium, calcium *etc.* and mucus of earthworms and microbes which increases the resistance power of crops against various diseases and enhances the growth and productivity of crops (Sivasubramanian and Ganeshkumar, 2004, Rai and Bansiwal, 2008) [19, 16].

The cow urine, besides providing nutrients like potassium and substances beneficial to the plants, is a cheap input and easy to acquire by the rural producer. It is known to have beneficial effect on germination, growth components *viz.,* plant height, number of leaves, leaf area and yield components like number of grains, tiller number, grain weight and yield of crops. This has been attributed to the fact that cow urine contains physiologically active substances *viz.,* growth regulators, nutrients (Joseph and Nair, 1989) [11], (Chawla, 1986) [7] and trace elements (Munoz, 1988) [13].

Objectives

1. To assess the effect of organic priming treatments on seed vigour & germination in chickpea.
2. To find out the effect of organic seed priming at different concentrations.

Materials and Methods

The investigation was carried out in Post Graduate Laboratory, Seed Science and Technology, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Naini Agricultural Institute, Allahabad, U.P. The experiment was laid out in Complete Randomized Design with 4 replications and 8 treatments *viz*., T_0: Control, T_1: Distilled water, T_2: Vermi wash (2% solution), T_3: Vermi wash (6% solution), T_4: Cow urine (2% solution), T_5: Cow urine (6% solution), T_6: Curry leaf extract (2% solution) and T_7: Curry leaf extract (6% solution) with the soaking durations of 12 hrs along with water. The unfortified seed served as control. The soaked seeds were surface dried for one day under laboratory conditions and were evaluated for the seed quality parameters *viz.*, germination (%), speed of germination, shoot length (cm), root length (cm), seedling length (cm), fresh weight of seedling (g), dry weight of seedling (g), seedling vigour index length and seedling vigour index mass.

The seeds were tested for the standard germination test adopting Between Paper (BP) method as per the ISTA rules (Anon., 1996) [2]. Hundred seeds were placed in between paper using four replications and per cent germination was recorded after eight days (final count) and speed of germination was recorded daily up to the day of final count. The seedling length (root and shoot length) was measured for 10 seedlings selected at random from germination test and fresh weight of seedlings was recorded. Further, seedlings were dried and seedling dry weight was recorded. Same data were used to determine seedling vigour index length using the formula (germination (%) x (shoot + root length) and seedling vigour index mass using the formula (germination (%) x (dry weight of seedlings) according to Abdul Baki and Anderson (1973) [1].

Results and Discussion

The present study on seed priming with organics showed beneficial effect on various seed quality parameters. Significantly maximum germination was observed in seeds treated with vermiwash in all the chickpea varieties followed by seed soaking in cow urine and curry leaf extract compare to control. The beneficial influence on germination of seeds may be due to increase of growth promoting substances in both vermiwash and cow urine. Vermiwash is known to contain considerable amounts of growth promoting substances and hence might have brought this positive effect on the seed germination.

Among various of treatments significant differences were also observed T_3 for Vermi wash at 6% showed maximum germination (94.50 %), speed of germination (23.25), shoot length (16.15 cm), root length (21.03 cm), fresh weight of seedling (8.02 g), dry weight of seedling (2.04 g), seedling vigour index length (3513.04) and seedling vigour index mass (192.78) followed by T_5 for Cow urine at 6%, minimum readings were recorded in T_0 (Control). The reasons for increased seed physiological parameters may be due to the fact that vermi wash is coelomic fluid extraction contains several enzyme, plant growth, hormones like, cytokinins, gibberlines and vitamins along with micro and macro nutrients (Buckerfield *et al.,* 1999) [6]. The vermicompost and vermiwash had an almost neutral pH whilst the electrical conductivity was 21% higher in the vermicompost. The nitrogen and potassium content was 57% and 79.6% richer in the vermicompost respectively compared to the vermiwash. However, the vermiwash was 84% richer in phosphorous as compared to vermicompost. Furthermore, the vermiwash was 89.1% and 97.6% richer in Ca and Mg respectively and was 97.8% richer in Na salts compared to the vermicompost. The vermiwash also indicated a significantly higher amount of micronutrients. Both bio-fertilizers were rich in nutrients specification for fertilizers (Manyuchi *et al.*, 2013) [12]. The results in terms of germination and seedling are in conformity with the findings of Arjun Sharma and Deshpande (2006) [3] in pigeon pea and Deshpande, V.K. *et al.*, (2008) [8] in bengalgram.

Similar results are also observed by Surendra *et al.* (2005) [21] in greengram and cowpea, Arumugam Shakila and Rajeswari (2008) [4] in okra, Surindra Suthara (2010) [20] in cluster bean, Narayana Reddy and Biradar Patil (2012) [15] in sunflower and Rajan and Murugesan (2012) [17] in cowpea wonder due to seed priming. Thus from the results of present study, it can be concluded that seed quality could be improved through pre-soaking organic priming treatments with cheap, non-toxic and ecofriendly organic sources. These results have great practical significance, since it indicates the possibility of upgrading the quality of seed with help of simple seed treatment like vermiwash, cow urine and curry leaf extract. Looking at the cost of organic substances, these organics are cheaper and easy to be practiced by everyone at rural area.

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

Sl. No.	Characters	Mean sum of squares		
		Treatments (d.f.=7)	Replication (d.f.=3)	Error (d.f.=21)
1	Germination (%)	348.75*	54.37	403.00
2	Speed of germination	82.56*	9.12	37.44
3	Shoot length (cm)	158.16*	5.51	30.69

4	Root length (cm)	153.49*	15.84	60.18
5	Seedling length (cm)	615.32*	5.51	81.15
6	Fresh weight of seedling (gm)	26.91*	0.19	6.95
7	Dry weight of seedling (gm)	1.60*	0.10	0.56
8	Seedling vigour index length	7659536.72*	45903.77	652014.51
9	Seedling vigour index mass	20232.96*	781.59	4354.10

* Significant at 5% level.

Table 2: Mean performance comparison of seedling characters in chickpea seeds.

Treatments			Germination (%)	Speed of germination	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Fresh weight of seedling (gm)	Dry weight of seedling (gm)	Seedling vigour index length	Seedling vigour index mass
T_0	Control		84.00	18.63	9.28	14.63	23.90	5.89	1.27	2007.60	106.89
T_1	Distilled water		85.00	18.98	10.93	15.30	26.23	6.27	1.63	2229.13	138.34
T_2	Vermi wash 2 %		89.50	21.20	14.20	18.83	33.03	7.84	1.81	2955.74	162.22
T_3	Vermi wash 6%		94.50	23.25	16.15	21.03	37.18	8.62	2.04	3513.04	192.78
T_4	Cow urine 2%		88.50	20.85	14.15	18.30	32.45	7.69	1.77	2871.83	156.87
T_5	Cow urine 6%		92.50	23.05	15.93	20.63	36.55	8.30	1.97	3380.88	181.99
T_6	Curry leaves extract 2%		87.50	19.85	12.28	17.03	29.30	6.87	1.67	2563.75	146.13
T_7	Curry leaves extract 6%		90.00	21.55	13.63	19.45	33.08	7.96	1.88	2976.75	169.20
	Grand Mean		88.94	20.92	13.32	18.15	31.46	7.43	1.76	2812.34	156.80
	Range	Minimum	84.00	18.63	9.28	14.63	23.90	5.89	1.27	2007.60	106.89
		Maximum	94.50	23.25	16.15	21.03	37.18	8.62	2.04	3513.04	192.78
	C.V. (%)		4.60	5.97	8.49	8.72	5.84	7.24	8.70	5.86	1.59
	S.E(m)		2.04	0.62	0.56	0.79	0.91	0.26	0.07	82.41	6.73
	C.D. at 5 %		5.98	1.82	1.65	2.31	2.68	0.78	0.22	240.54	19.65

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