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Influence of halopriming and organic priming on germination and seed vigour in blackgram (*Vigna mungo* L.) Seeds

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Abstract
The experiments were conducted to study Influence of halopriming and organic priming on germination and seed vigour in Black gram (*Vigna mungo* L.) the during 2016-2017 in the post-graduation experiment laboratory of Seed Science at the Department of Genetic and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh. The seeds were treated with un-soaked seed (control), Hydro-priming (soaked with distill water for 12 hrs), Organic priming (Cow urine, Coconut water), Halopriming with KNO_3, KCl, and $CaSO_4$ (1% solution) soaked for 12 hrs, on seed of Blackgram. KCl @1% primed seed recorded higher germination per cent (83.25%),energy of emergence (78.75), seedling length (40.30 cm), seedling dry weight (0.452 gm/10 seedlings), vigour index I (3358.93) & vigour index II (37.66). The treatment interactions were significant & the seeds treated with KCl followed by KNO_3 recorded numerically higher values compared to control.

Keywords: Blackgram, hydropriming, halopriming, organic priming, duration.

Introduction
Pulses are important source of vegetable protein. Pulses are the second most important source of human food. These plants fix nitrogen, and improve soil fertility, prevent soil erosion and play an important role in sustainability of agricultural systems (Parsa and Bagheri, 2009) [19]. Blackgram (*Vigna mungo* L.) is one of the major rainy season pulse crop of India. Urdbean or Blackgram is a native of India and originated from *Phaseolus sublobatus* a wild plant. In India Blackgram is very popularly grown in Maharashtra, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Tamilnadu, Bihar. Among these blackgram or urd (*Vigna mungo* L.) is pulse crop of many Asian countries and it belongs to tribe phaseolus family leguminoseae with chromosome number 2n=22. The food values of Blackgram lie in its high and easily digestible protein. Its seeds contain approximately 25-28% protein, 1.0 -1.5% oil, 3.5 – 4.5% fiber, 4.5 – 5.5% ash and 62 – 65% carbohydrates on dry weight basis. Methionine concentration is larger in Blackgram than in mungbean. Blackgram contains trypsine and other growth inhibitor but these are denatured by heating. It is technique for controlling seed slow adsorption and post dehydration (Heydecker and Coolbear, 1977) [10]. Seed priming has been successfully demonstrated to improve germination and emergence in seeds of many crops specially vegetables and small seeded grasses. Seed priming has presented promising, and even surprising result, for many seed including the legume seeds (Bradford, 1986) [4]. The few studies on Green gram and Black gram are not overemphasized and are encouraging, but information is required before its use as a routine practice in seed technology (Knypl and khan, 1981) [16]**.** Short time hydration treatment, e.g. hydro priming, humidification (incubating seed at high relative humidity) have been widely used to increase seed vigour and extend longevity in many plant species (Powell *et al.,* 2000) [21]. Potassium chloride is the most widely used source of potassium for agricultural crops, and Cl is considered an essential micronutrient for optimal growth (Fixen, 1993) [8]. Potassium chloride has been introduced as the osmoticum to enhance germination, emergence and growth of Poaceae plants (Misra & Dwivedi, 1980) [18]. Halo-priming of seeds in pre-sowing treatments in an osmotic solution allows seeds to absorb water, but restricts radicle occurrence through testa until the primed seeds are sown for germination under salt stress conditions. Primed seeds usually show improved germination parameters (Hardegree & Van Vactor, 2000) [11]. Nutrient priming has the additive advantage of improving K supply to plants (Al-Mudaris & Jutzi, 1999) [3]. The present study was done under objective of to assess the effect of different priming methods on seedling characters of

blackgram seeds to identify the suitable method of priming for blackgram seeds.

Materials and Methods

The present study entitled "Effect of halopriming and organic priming on germination and seed vigour in Black gram (*Vigna mungo* L.)" under Post graduate laboratory of Seed Science and Technology was conducted in the Department of genetics and plant breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad during 2016-2017. Allahabad is located in South Eastern part of Uttar Pradesh, India. The side of experiment is located at 25.57^{0}N latitude, 81.56^{0}N longitude and 98 meters above mean sea level. The lab experiment was analyzed by using C.R.D. (Complete Randomized Design) with four replications and 7 treatments under laboratory condition with control, one hydropriming, two organic priming and three halopriming. Seed Treated with control, distilled water, cow urine (5%),coconut water(5%),potassium nitrate (1%),potassium chloride(1%),and calcium sulphate (1%) soaking for 12 hrs. Afterward, primed seeds were allowed to dry back to their original moisture content under shade to assess the parameters. Seed quality parameters include speed of germination, Energy of emergence, Germination percentage, root length, shoot length, seedling length, seedling dry weight, seedling vigour index length and seedling vigour index mass.

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 will finally constituted to one litter, 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 Potassium chloride (KCL 1%) solution 10 (gm) KCL was taken in a measuring flask and made up to 1000 ml. distilled water, while for (1%) Calcium sulphate ($CaSO_{4)}$ solution 10 (gm) $CaSO_4$ salt was taken in a measuring flask and made up to 1000 ml with distilled water and Potassium nitreat (KNO_3) solution 10 (gm) was taken in a measuring flask and made up to 1000 ml with distilled. Preparation of coconut water (5%), 50 ml solution of coconut water was taken in a measuring flask and made up to 1000 ml distilled water. Cow urine (5%), 50 ml solution of Cow urine was taken in a measuring flask and made up to 1000 ml distilled water.

After preparation of solutions wheat seeds were soaked of each solution separately for 12 hour at 25 ^{0}C temperature. After 12 hour of soaking the solution was drained out from the beaker and air dried to original weight and then placed four replication in completely randomized design (CRD) in between paper method and sand method for germination in laboratory under controlled condition.

The observation on the characters *viz.*, Germination percent (ISTA 2004) [12], Speed of germination, Energy of emergence (%) (Ruan *et al*., 2002) [23], Root length (cm), Shoot length (cm), Seedling length (cm), seedling Fresh weight (g), seedling dry weight (g), Seedling vigour index I^{st}, Vigor index II^{nd} (Baki and Anderson 1973) [1] 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) [8].

Results and Discussion

According to the results, all studied traits were affected by the treatments and there was completely significant difference between control (unprimed seeds) and primed seeds (Table-1). 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^{st}, Vigor index II^{nd} were affected by KCL 1% concentration and significantly recorded maximum.

Significantly higher germination percent (83.25) reported in treatment T_5 KCI 1% followed by T_4 (82.25) primed with KNO_3 1%. Minimum germination percent recorded by T_0 (77.75) with unprimed control (Table 2)

Table 1: Analysis of variance for seedling characters in wheat.

Characters	Mean Square	
	Treatments (df=6)	Error (df=21)
Germination Percentage	17.654**	4.5
Speed of germination	14.714**	3.53587
Energy of emergence	389.2857**	58.25
Root Length	8.7954**	0.7326
Shoot Length	12.24445**	1.41586
Seedling Length	37.69414**	2.239348
Seedling Fresh Weight	2.878**	0.09702
Seedling Dry Weight	0.02536**	0.001166
Seed Vigour Index I^{st}	400369.361**	24098.738
Seed Vigour Index II^{nd}	202.1535**	7.8352131

.* And ** significant at 5% and 1% level of significance, respectively.

Higher speed of germination (26.88) reported in treatment T_4 KNO_3 1% followed by T_5 (83.25) primed with Potassium cloride. Minimum speed of germination recorded by T_0 (21.79) with unprimed control (Table 2). Maximum energy of emergence (78.75%) recorded by T_5 primed with KCI 1% followed by T_4 (68.25%) primed with KNO_3 1%. Minimum recorded in T_3 coconut water (52%) (Table 2). (Misra & Dwivedi, 1980; Al-Mudaris and Jutzi, 1997; Elouaer *et al.*, 2012) [18, 3, 7]. Was also found similar result for germination%,speed of germination and energy of emergence. Potassium chloride has been introduced as the osmoticum to enhance germination, emergence and growth of Poaceae plants (Misra & Dwivedi, 1980) [18]. Maximum root length (17.01cm) recorded by T_5 treatment KCI 1% followed by T_4 (15.41cm) primed with KNO_3 1%. Minimum root length recorded by T_0 (12.89cm) primed with control. Maximum shoot length (23.33cm) recorded by T_5 treatment primed with KCI 1% and it followed by T_4 (21.46cm) primed with KNO_3 1%. The shortest shoot length founded in T_0 unprimed control (19.10cm). Maximum seedling length (20.30cm) recorded by T_5 primed with KCI 1% followed by T_4 (36.87cm) primed with KNO_3 1%. Shortest seedling length recorded in T_0 unprimed control (32cm) (Table 2). (Demir and Oztokat 2003) [6] also found that root and shoot lengths increased in seeds due to salt priming as compared to non-primed seeds. Halo-priming of seeds in pre-sowing treatments in an osmotic solution allows seeds to absorb water, but restricts radicle occurrence through testa until the primed seeds are sown for germination under salt stress conditions. Primed seeds usually show improved germination parameters (Hardegree & Van Vactor, 2000) [11].

Table 2: Mean Comparison of Germination and Vigor Traits in Blackgram

Treatment	Germination %	Speed of germination	Energy of emergence (%)	Shoot length(cm)	Root length (cm)	Seedling length (cm)	Seedling fresh weight(gm)	Seedling dry weight (gm)	Vigour index 1	Vigour index 2
T0	77.75	21.79	61	19.102	12.897	32	1.625	0.241	2489.14	18.841
T1	79	25.19	69	20.062	14.005	34.06	2.725	0.312	2734.77	24.669
T2	81.5	24.27	54.25	22.495	15.9	38.39	3.65	0.367	3176.81	29.943
T3	80	23.39	52	20.922	15.202	36.125	3.225	0.347	2942.86	27.730
T4	82.5	**26.88**	68.25	21.46	15.417	36.87	3.825	0.419	3016.42	34.606
T5	**83.25**	26.51	**78.75**	**23.332**	**17.012**	**40.30**	**4.025**	**0.452**	**3358.93**	**37.667**
T6	78.5	22.75	54.5	19.28	13.385	32.56	2.55	0.251	2580.92	19.727
G mean	**80.357**	**24.408**	**62.535**	**20.951**	**14.817**	**35.768**	**3.0892**	**0.341**	**2899.98**	**27.597**
SE(d)	1.5	1.3296	5.396758	0.841388	0.605	1.0581	0.15574	0.02415	109.7696	1.979294
SEM+	1.06066	0.9402	3.8160	0.5945	0.42797	0.7482	0.22025	0.0170	77.6188	1.3995
CD@5%	3.1194	2.765	11.223	1.744	1.2586	2.2005	0.45804	0.050228	228.278	4.116

Maximum seedling fresh weight (4.02gm) reported by T_5 treatment primed with KCL 1% followed by T_4 (3.82gm) primed with KNO_3 1%. Lowest value of seedling fresh weight founded in T_0 unprimed control (1.62gm). Maximum seedling dry weight (0.452gm) recorded by T_5 primed with KCL 1% followed by T_4 (0.419) primed with KNO_3 1%. Lowest value of seedling dry weight founded in T_0 unprimed control (0.241gm) (Table 2). Jafar *et al.* 2012; Ashraf and Rauf 2001; Toklu *et al*., 2015 [13, 2, 24] 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 Ist (3358.93) recorded by T_5 primed with KCI 1% followed by T_4 (3016.42) primed with KNO_3 1%. Minimum seedling vigour index Ist recorded by T_0 unprimed (2489.14) in control (Unprimed) (Table 2) The osmo-priming, halopriming has positive effect on the seed germination and their consequences. They help to release in enzymes and accelerate seed metabolism and physiological activities (Jie *et al*., 2002) [14]. Maximum seedling vigour index IInd (37.667) recorded by T_5 primed with KCL 1% and it was followed by T_4 (34.60) primed with KNO_3 1%. Minimum seedling vigour index IInd recorded by unprimed T_0 (18.84) 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) [23]

Conclusion

It is concluded from the present study that the different concentration of priming treatment showed significant effect on seed germination and seed vigour parameters. Priming with KCl (1%) increased germination (%) and seed vigour in blackgram. second best priming is KNO_3 in all priming method halopriming showed best result in comparison to organic priming.

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