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EFFECT OF SEED PRIMING DURATION ON SEED QUALITY IN URD BEAN

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ABSTRACT

In order to evaluate the effect of seed priming duration on germination and seed quality parameters, an experiment was conducted at Department of Genetics and Plant Breeding, Annmamalai University, Tamil Nadu. Seeds of blackgram cv. VBN 4 were primed in water for 2 hrs, 4 hrs, 6 hrs, 8 hrs, 10 hrs, 12 hrs, 14 hrs, 16 hrs, 18 hrs, 20 hrs, 22 hrs and 24 hrs to determine the effect of priming duration on seed quality parameters. The results revealed that seed primed for 14 hrs exhibited higher germination per cent and other seed quality parameters.

KEY WORDS

seed priming, blackgram, priming duration

INTRODUCTION

Blackgram (*Vigna mungo* L.) is the third most important pulse crop belongs to the family Leguminoceae. It is also cultivated in many other tropical and sub - tropical countries of the world. It contains about 26% protein, which is almost three times that of cereals and other minerals and vitamins and also used as nutritive fodder, especially for mulch animals. It is cultivated in an area of 2.9 million hectares with the production and productivity of 1.24 million tones and 451 kg per hectare (FAO, 2011). It gives low seed yield mainly due to poor management and low soil fertility. There is therefore a need to improve its production to meet the demand of the consumers. Among the various seed enhancement methods, seed priming has been identified as the simplest method to improve establishment and subsequent performance of the crops. Seed priming is a process in which seeds imbibe either in water or in osmotic solution or combination of solid matrix carrier and water in specific proportion followed by drying before radical emergence. It is the soaking of seeds in a solution of any priming agent followed by drying of seeds that initiates germination related processes without radicle emergence (McDonald, 1999). Seed priming prior to planting enhances germination and seedlings growth by controlling the imbibition and reducing the vagaries of adverse weather and soil condition. There are different types of seed priming techniques *viz.*, hydro-priming (soaking in water), halo-priming (soaking in inorganic salt solutions), osmo-priming (soaking in solutions of different organic osmotica), thermo-priming (treatment of seeds with low or high temperatures), solid matrix priming (treatment of seed with solid matrices) and bio-priming (hydration using biological compounds) (Ashraf and Foolad, 2005). Seed priming has been used to improve germination, reduce seedling emergence time and improve stand establishment and yield (Khan, 1992). Priming causes the repairing and building up of nucleic acids, increased synthesis of proteins as well as the repairing of membranes (McDonald, 2000). It also enhances the activities of anti-oxidative enzymes in treated seeds

(McDonald, 1999; Wang *et al*., 2003). However, positive effects of seed priming on seed invigoration depends on priming duration (Ashraf and Foolad, 2005); Ghassemi-Golezani *et al.,* 2008b). When seeds imbibe, the water content reaches a plateau and changes little until radicle emergence (Bradford, 1986). Priming up to this point can have a positive effect, while extended priming duration will negatively affect germination. The objective of this study is to investigate the effects of duration of hydro-priming on seed quality parameters of urdbean.

MATERIALS AND METHODS

Genetically pure and six months old seeds of blackgrakm cv. VBN-4 were obtained from National Pulses Research Station, Vamban, Tamil Nadu which had an initial germination per cent of 74.00. The experiment was conducted in a completely randomized design with twelve treatments and three replications. Each treatment consisted of a priming duration of two hours interval with in a test period of 24 hours. 100 grams of blackgram seeds were subjected to imbibition on two layers of wet blotter paper in petri dishes at room temperature. Equal volume of distilled water is used to wet the blotters in all the treatments. The seeds were allowed to imbibe water up to 48 hours taking samples at every two hours intervals to determine priming duration. At the end of each priming duration seeds were blotted to remove surface moisture and weighed to record the final weight after imbibition. After subjecting the seeds to required priming duration, the seeds were spread in a thin layer on dry filter paper for two days at room temperature to allow the seeds to dried back to its original moisture content and then evaluated for their seed quality.

Germination (%)

Germination test was conducted in four replications each of 100 seeds by adopting between paper method as described by (ISTA, 1999). A temperature of 25±10^{0}C and relative humidity of 95 per cent was maintained during germination test. The first and final germination counts were made on seven and fourteenth days of germination test, respectively for normal seedlings and the germination was expressed in percentage.

Root Length (cm)

The normal seedlings were taken at random at the end of the germination test and the length between collar region to tip of the primary root were measured in centimeter. The mean value was recorded as root length in centimeter.

Shoot Length (cm)

Ten normal seedlings taken for measuring root length were used for shoot length measurement. The length between the collar region to tip of the primary shoot was measured in centimeter of the mean value recorded as shoot length in centimeter.

Vigour index

Vigour Index (VI) was computed from the germination percentage and the total seedling length (root length + shoot length) as suggested by Abdul - Baki and Anderson (1973) and expressed as whole number.

Vigour Index = Germination (%) x Seedling length (cm).

Seedling dry weight

Ten seedlings after measurement of root and shoot length were kept in a butter paper packet and dried in hot air oven maintained at 70°±10^{0}C for 24 h. Later they were cooled in a desiccator for 30 minutes and then the dry weight of seedling was recorded in an electronic balance and average weight was computed and expressed in milligram per ten seedlings.

Field emergence (%)

One hundred seeds in three replications were taken randomly from each treatment and hand dibbled in well prepared raised seed bed. Seeds

were sown equidistantly and watered to maintain the optimum soil moisture for emergence. The number of seedlings emerged three centimeters above the soil surface on 15th day after sowing were counted and expressed as field emergence in percentage.

Electrical conductivity of seed leachate (dSm^{-1})

Five grams of seeds were taken at random from each treatment and were soaked in $HgCl_2$ (0.10 per cent) solution for a minute and washed with distilled water for five times. Then the seeds were soaked in 25 ml of distilled water for 24 h at room temperature. The seed leachate was collected by decanting and the volume was made up to 25 ml by adding distilled water and then the electrical conductivity of seed leachate was measured in an electrical conductivity bridge (ELICO) with cell constant of 1.00. The estimations were done in four replications and mean value was expressed in dsm^{-1} (Presley, 1958).

RESULTS AND DISCUSSION

The results obtained from the present investigation and relevant discussion had been summarized below.

The data revealed that there were significant variation for priming durations for all the seed quality characters studied *viz.,* imbibition percentage, germination percentage, speed of germination, root length, shoot length, seedling dry weight and seed vigour index.

The data revealed that there was a significant variation for priming duration in germination. Significantly higher germination per cent was recorded for the seeds primed for 14 h (80.00%) followed by 12 h (77.00%), 16 h (75.00) and seeds primed for 24 h recorded the least germination of 50.00 per cent. The increased germination per cent is due to higher levels of nucleic acid, enhanced ribonucleic acid (RNA) synthesis, accumulation of 4 C nuclei in the radicle meristem (Coolbear and Grieson, 1979) and occurrence of metabolic changes such as cell cycle related events (De Castro *et al.,* 2000). Significant difference for priming duration on root and shoots lengths were recorded. The seeds primed for 14 h recorded higher root and shoot lengths of 16.06 cm & 23.86 cm while, the seeds primed for 24 h recorded the least root and shoot lengths of 12.93 cm & 21.36 cm respectively. The increase in root and shoot lengths with hydro priming treatments may be attributed to priming induced nuclear replication in root tips of fresh seeds (Stofella *et al*. 1992). The results showed that there was significant difference among the priming durations for seedling dry weight. The seeds primed for 14 h recorded highest seedling dry weight of 105.99 g followed by 12 h (96.99 g) while, the seeds primed for 24 h recorded the least seedling dry weight (72.99 g). These results are in accordance with Ghassemi *et al*. (2010) reporting that hydro priming significantly improved water imbibition rate, shoot, root and seedling dry weights, seed vigour index and reduced electrical conductivity of seed leachate in lentil. Maximum field emergence was recorded from seeds primed for 14 h (Table-1). Priming duration seeds for 14 h recorded higher vigour index and field emergence of 3232.70 & 92.36 per cent while seeds primed the for 24 h recorded the least vigour index and field emergence of 3131.38 & 88.94 per cent respectively. This may be attributed to the physiological and biochemical changes occurred and increased physiological activity of the embryo and mobilization of food reserves into the growing seedlings (Doijode and Raturi, 1987) that led to development of stronger and efficient root and shoot system and effectively reduced physiological deterioration (Rudrapal and Nakumura, 1988). This might have resulted in repair of DNA, proteins, membranes and enzymes during imbibition (Finch and Mcquistano, 1991). Better emergence of seedlings from hydro-primed seeds for 14 h and

16 h suggested that proper priming duration can ensure optimum plant establishment.

Table 1. Influence of seed priming duration on seed quality parameters in blackgram

Priming duration	Germination percentage	Root length (cm)	Shoot length (cm)	Seedling dry weight (mg)	Vigour index	Field emergence (%)
control	74.0	12.53	22.36	94.99	3635.21	89.12
2 hrs	61.0	13.63	21.33	88.22	3344.81	88.06
4 hrs	63.0	14.03	22.26	81.99	3484.64	88.36
6 hrs	67.0	13.96	22.13	87.32	3453.73	88.39
8 hrs	72.0	13.03	23.13	83.99	3448.04	88.53
10 hrs	70.0	14.26	23.33	84.09	3519.30	88.02
12 hrs	77.0	15.23	23.43	96.99	3660.52	91.02
14 hrs	80.0	14.06	23.86	105.99	3232.70	92.36
16 hrs	75.0	15.13	23.56	96.15	3676.13	90.69
18 hrs	72.0	13.83	23.90	86.67	3521.00	88.69
20 hrs	68.0	15.06	23.23	76.32	3537.35	88.01
22 hrs	64.0	14.33	22.46	76.99	3444.75	87.23
24 hrs	55.0	12.93	21.36	72.99	3131.38	88.94
SEd	2.41	0.28	0.64	1.91	95.26	0.04
CD at 5%	4.55	0.57	1.30	3.84	191.47	3.59

These results are in accordance with the findings of Ghassemi-Golezani et al. (2008b) reported that hydropriming of chickpea seeds for 8, 16 and 24 hours enhanced seedling emergence, biological yield, grains per m^2 and grain yield per unit area, but the best improvement was achieved with 16 hours priming duration. Beneficial effects of hydro-priming on grain yield were also reported in wheat (Kahlon et al., 1992) and rice (Farooq *et al.,* 2006).

The results revealed that seed priming duration of 14 h recorded significantly higher root length (16.06 cm), shoot length (23.86 cm), seedling dry weight (105.99 mg), seedling vigour index (3232.70) and field emergence (92.36%). It may be attributed to completion of pre-germinative metabolic activities making the seeds ready for radicle protrusion consequently the seed germinated soon after incubating for germination test compared to other priming durations and to the unprimed control.

CONCLUSION

It is concluded from the present study that the seeds of blackgram were treated with water for priming duration of 14 hrs was found to be the best priming treatment compared to control in all seedling parameters followed by 16 hrs in respect to speed of germination, seedling length, fresh weight, dry weight and vigour index.

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