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Effect of seed priming on seed germination and yield parameters in Urdbean (*Vigna mungo* L.)

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Keywords

Urdbean,
seed priming,
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Abstract

The experiment was conducted at PG Laboratory, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University to find out the effect of various seed priming treatments on seed germination and seed yield parameters. The seeds were subjected various treatments *viz.*, T_1 – Control, T_2 – Hydropriming, T_3 – Priming with mannitol @ 2%, T_4 – Priming with $MnSO_4$ @ 100 ppm, T_5 – Priming with $ZnSO_4$ @ 100 ppm and T_6 – Priming with GA_3 @ 100 ppm. The seed priming treatments showed significant differences in growth and seed yield parameters. The results showed that seed priming with mannitol @ 2% recorded higher germination (97.83%), root length (19.45 cm), shoot length (25.50 cm), seedling dry weight (111.72 g 10 seedlings^{-1}), vigour index (4397.82), field emergence (81.93%), number of seeds per plant (36.15), seed yield per plant (3.88 g) and seed yield (848.14 kg ha^{-1}).

Introduction

Urdbean (*Vigna mungo* L.) is the major rainy season pulse crop of India. It is native of Central Asia and originated from a wild plant *Phaseolus sublobatus*. In India it is grown in states of Maharastra, Andhra Pradesh, Uttar Pradesh, Madhya Pradesh, Tamil Nadu and Bihar. It is highly nutritious containing about 26 per cent protein, rich in vitamins like vitamins A, B_1, B_3 and rich in minerals like potassium, phosphorus, calcium and sodium. In India, it is cultivated in an area of 3.24 lakh hectares with production and productivity of 1.95 lakh tonnes and 664 kg ha^{-1} respectively. The low productivity is due to cultivation of urdbean in marginal and rainfed areas, poor soil moisture, poor soil fertility and lack of high yielding varieties and hybrids (Karivaradharaju and Ramakrishnan, 1985). The yield of blackgram is decreasing year by year which may be due to change in environmental condition with regular dry spells and less soil moisture.

The important characteristics of blackgram seed is, it loses the viability very shortly. To avoid natural deterioration of seeds and to overcome adverse environmental conditions like low rainfall and low soil moisture, which prevent the seed germination and seedling establishment, seeds are subjected to various pre-sowing seed treatments *viz.*, seed hardening, seed pelleting, seed colouring and seed priming.

Seed priming is a controlled hydration process followed by drying of seeds, that allows the seed to imbibe water and begin internal biological processes necessary for germination, but it not allowing the seed to germinate. It is the controlled hydration of seeds to initiate metabolic activity to occur, but it prevents the emergence of radicle. During seed priming various physiological and biochemical changes takes place in seeds which favours

germination and enhanced antioxidant activities and improved repair process. Hydration-dehydration of seed modifies the physiological and biochemical properties of wheat (Basu, 1976).

Hydration – dehydration treatment reduce the membrane damage and maintain mitochondrial function. The efficacy of hydration and dehydration treatment in the maintenance of vigour and viability of seed is demonstrated by Gong Ping *et al.* (2000); Finch-Savage *et al.* (2004).

The seed priming with inorganic chemicals is one such treatment to control the deterioration process. It contains antioxidants, which control the seed deterioration process. Antioxidants are the substances that protect the cell membrane against the oxidative damage induced by oxidants (Temple, 2000). Seed priming favours faster germination, uniform establishment, more vigorous plants, better drought tolerance, early flowering and more yield. Hence, the present study was undertaken to study the effect of seed priming on seed quality.

Materials and Methods

Freshly harvested genetically pure seeds of urdbean cv. VBN-4 was collected from National Pulses Research Station, Vamban, Tamil Nadu and was graded with

BSS 7 × 7 sieve to get uniform sized seeds. The experiments were conducted at Department of Genetics and Plant Breeding, Annamalai University, Annamalainagar, India. After cleaning and grading, the seeds were first pre-conditioned by keeping the seeds in between two layers of moist germination paper for 2 hours and after pre-conditioning, the seeds were soaked in respective priming solutions at $1/3^{rd}$ volume of seeds for 4 hours. Then the seeds were air dried to bring back its original moisture content and used for sowing.

The experiments consisted of 6 treatments *viz.*, T_1 – Control, T_2 – Hydropriming, T_3 – Priming with mannitol @ 2%, T_4 – Priming with $MnSO_4$ @ 100 ppm, T_5 – Priming with $ZnSO_4$ @ 100 ppm and T_6 – Priming with GA_3 @ 100 ppm. Field and laboratory experiments were conducted to study the effect of pre-sowing seed priming using various chemicals on growth and yield parameters in urdbean. Observations on growth and yield parameters *viz.*, field emergence per cent, days to 50% emergence, plant height, days to 50% flowering, number of pods per plant, number of seeds per pod, seed yield per plant, yield per hectare and 100 seed weight were recorded. The data were statistically analyzed using ANOVA.

Results and Discussion

In the present study, urdbean seed was primed with various inorganic chemicals and used for sowing. Significant differences in growth and yield parameters were observed due to seed priming in urdbean (Table 1). Significantly higher field emergence (81.93%) was recorded with mannitol @ 2%, GA_3 @ 100 ppm (79.12%) over control (75.10%) and other treatments. Similarly, significantly minimum number of days to 50% flowering (38.28) was recorded with mannitol 2%, GA_3 @ 100 ppm (39.46) over control (41.55) and other treatments. Significantly minimum number of days to 50% emergence (6.99) was recorded with GA_3 @ 100 ppm, mannitol @ 2% (7.38) over control and other treatments. Significantly highest plant height at 30 DAS (27.15) was recorded with GA_3 @ 100 ppm, mannitol @ 2% (25.16) over control (23.76) and other treatments. Increased plant height may be due to translocation of GA_3 to the aerial parts of the part which perhaps to an extent that is enough to increase hypocotyl size and the consequent increase in first nodal height and it may be due to early availability of high energy compounds and vital biomolecules to the growing seedling (Renugadevi and Vijaya Geetha, 2006). GA_3 favours formation of enzymes which are important in the early phase of germination and helps for radicle protrusion and hypocotyl elongation (Kumar and Neelakandan, 1992).

Table 1. Effect of seed priming treatments on seed germination (%), root length (cm), shoot length (cm), vigour index, seedling dry weight (mg), electrical conductivity (dsm^{-1}) in urdbean

Treatments	Germination (%)	Root length (cm)	Shoot length (cm)	VI	Seedling dry weight (mg)	EC (dsm^{-1})
Priming Treatment (T)						
T_1	97.30 (80.55)	18.28	24.68	4180.99	108.55	0.353
T_2	97.47 (80.86)	18.33	24.80	4204.55	109.20	0.324
T_3	97.83 (81.54)	19.45	25.50	4397.82	111.72	0.300
T_4	97.16 (80.30)	18.35	24.68	4181.31	109.08	0.344
T_5	97.49 (80.88)	18.50	25.13	4254.09	109.25	0.312
T_6	97.49 (80.85)	18.50	25.46	4285.68	110.97	0.301
SEd	0.02	0.07	0.05	9.11	0.28	0.00
CD at 5 %	NS	0.15	0.11	18.87	0.59	0.00

Seed yield and yield contributing factors differed significantly with priming treatments over control (Table 2).

Table 2. Effect of seed priming treatments on field emergence (%), days to 50 per cent emergence, plant height, days to 50 per cent flowering, no. of pods $plant^{-1}$ and no. of seeds pod^{-1} in urdbean

Treatments	Field emergence (%)	Days to 50% emergence	Plant height (cm)	Days to 50 per cent flowering	No. of pods $plant^{-1}$	No. seeds pod^{-1}	Seed yield (g $plant^{-1}$)	Seed yield (kg ha^{-1})	100 Seed weight (g)
Priming Treatment (T)									
T_1	75.10 (60.06)	8.49	23.76	41.55	31.83	5.89	3.23	668.90	4.99
T_2	77.10 (61.40)	8.06	23.75	40.76	31.82	5.49	3.28	704.62	5.19
T_3	81.93 (64.84)	7.38	25.16	38.28	36.15	6.24	3.88	848.14	5.23
T_4	72.10 (58.11)	9.55	22.15	42.22	30.82	5.32	3.21	662.93	5.00
T_5	76.93 (61.29)	7.89	24.31	40.06	33.33	6.10	3.37	783.04	5.26
T_6	79.12 (62.80)	6.99	27.15	39.46	32.33	6.50	3.67	821.10	5.31
SEd	0.97	0.12	0.04	0.49	0.52	0.15	0.04	10.74	0.09
CD at 5 %	2.01	0.25	0.08	1.02	1.09	0.31	0.09	22.24	0.19

Significantly higher number of pods per plant (36.15) was observed with mannitol @ 2%, $ZnSO_4$ @ 100 ppm (33.33) over control (30.82) and other treatments. Significantly higher seed yield per plant was observed with mannitol @ 2% (3.88 g), GA_3 @ 100 ppm (3.67 g) over control (3.23 g) and other treatments. Similarly, significantly higher seed yield per hectare was observed (848.14 kg) in mannitol @ 2%, GA_3 @ 100 ppm (321.10 kg) over control (662.93 kg) and other treatments. The significant variation in seed yield

contributing factors is attributed to plant growth promotional effects of seed primers that may produce growth regulatory substances upon seed imbibition. Seed priming has differential influence on the allocation of assimilates between vegetative and reproductive organs. In the present study, it was revealed that the seed priming with mannitol @ 2% resulted significantly increased the number of pods, seed yield per plant and 100 seed weight which have contributed for higher yield per plot compared to control and other treatments. Significantly higher root length and shoot length (19.45 cm) (25.550) was recorded with mannitol @ 2%, GA_3 @ 100 ppm (18.50 cm) (25.46 cm), over control (18.28 cm) & (24.46 cm) respectively and other treatments. Significantly higher vigour index (4397.82) was recorded with mannitol @ 2%, GA_3 @ 100 ppm (4285.68) over control (4180.99) and other treatments. Effects of seed treatments with chemicals on electrical conductivity differed significantly. In all the treatments the seeds treated with mannitol @ 2% recorded the lowest electrical conductivity (0.300 dSm^{-1}), GA_3 @ 100 ppm (0.301 dSm^{-1}) over control (0.353 dSm^{-1}) and other treatments. The chemical treatments keep the seed intact and acts a binding materials and it covers the minor cracks and aberrations on the seed coat blocking the fungal invasion. The low electrical conductivity may be due to removal of deleterious free radicals and seed leachates during seed treatments.

Conclusion

It is concluded that seed priming with mannitol @ 2% found to have improved germination and other yield and growth contributing factors of urdbean under laboratory and field conditions.

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