**Short Communication**

*Bangladesh Agron. J. 2024, 26(2): 100-103*

# OPTIMIZATION OF THE PRIMING TIME OF MANNITOL SOLUTION FOR MUNGBEAN SEED TREATMENT

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**(Received:** 27 June 2023, **Accepted:** 30 June 2024)

**Keywords:** pre-sowing, mannitol, priming, mungbean

Mungbean (*Vigna radiata* L.) is an important grain legume in Bangladesh belonging to the family Fabaceae. As an excellent source of vegetable protein. Its edible grain is characterized by good digestibility, flavor, high protein content, and absence of any flatulence effect. The lysine content makes mungbean a good complementary food for rich-based diets because lysine is usually the first limiting amino acid. Besides, the crops can enrich soils through nitrogen fixation (Sharma and Behera, 2009). Plant growth and productivity are affected by nature's wrath in the form of various abiotic stress factors. Plants are frequently exposed to a plethora of stress conditions such as salt, drought, oxidative stress, and others. All these stress factors are a means for plants and prevent them from reaching their full genetic potential and limit crop productivity worldwide. Lack of adequate soil moisture in the seedbed is a major obstacle to the establishment of the crop because inadequate soil moisture can reduce germination, slow down seedling growth and decrease yield. There are many strategies have been adopted to overcome the negative effects of drought. A good strategy for overcoming drought stress is seed pre-sowing treatments (Ghiyasi *et al*., 2008). Seed priming was defined as pre-sowing treatments in water or in an osmotic solution that allows the seed to imbibe water to proceed to the first stage of germination, but prevents radical protrusion through the seed coat (Yari *et al*., 2012). Seed priming techniques have been used to accelerate the emergence of more vigorous plants. Primed seeds usually to exhibit an increased germination rate, greater germination uniformity, and greater total germination percentage. Increased germination rate and uniformity have been attributed to metabolic repair during imbibitions build-up of germination-enhancing metabolites. In Bangladesh, little is known about hydro priming and information regarding seed priming with osmotic priming agents for inducing drought tolerant capability in mungbean in Bangladesh. Hence, the study is conducted to evaluate the effect of pre-sowing seed treatment with mannitol on the germination behavior of mungbean concerning drought tolerance and to optimize the priming time of the best priming solution concentration on the germination behavior of mungbean.

The experiment was conducted at the Agronomy Laboratory, Department of Agronomy, Sher-e-Bangla Agricultural University (SAU), Sher-e-Bangla Nagar, Dhaka-1207. The experiment was conducted during the period from 13 May 2014 to 15 July 2014 to optimize the priming time of mannitol for enhancing drought tolerance capability in mungbean (*V. radiata*) under drought stress. The temperature and relative humidity of the laboratory room were recorded daily basis during the study period with a digital thermo hygrometer (TERMO, TFA, Germany). The average minimum and maximum temperature during the study months of the culture room was 17.40 °C to 38.20 °C, respectively and the average minimum and maximum relative humidity were 40% and 89.20%, respectively. A completely randomized design (CRD) with five replications used in this experiment. Two mungbean varieties namely BARI Mung-3 and BARI Mung-6 were used for this experiment. Different equipment such as an electric balance, Electrical Conductivity (EC) meter, petri dish, filter paper, micropipette, forceps, etc. were used for this study. Mannitol ($C_6H_{14}O_6$) and distilled water were utilized for osmo and hydro-priming in this experiment. The experiment comprises of (a) Six levels of priming time viz. 3, 6, 9, 12, 15, 18 hours and (b) Five levels of priming agent concentration viz. water, 0, 2, 4,

6, and 8% mannitol ($C_6H_{14}O_6$). There are thirty-one treatments *viz*, $T_0$=Seeds without priming (control), $T_1$= Seeds primed with water for 3 hours $T_2$= Seeds primed with water for 6 hours,$T_3$= Seeds primed with water for 9 hour, $T_4$= Seeds primed with water for 12 hours,$T_5$= Seeds primed with water for 15 hours,$T_6$= Seeds primed with water for 18 hours,$T_7$= Seeds primed with 2% mannitol solution for 3 hours,$T_8$= Seeds primed with 2% mannitol solution for 6 hours,$T_9$= Seeds primed with 2% mannitol solution for 9 hours,$T_{10}$= Seeds primed with 2% mannitol solution for 12 hours,$T_{11}$ = Seeds primed with 2% mannitol solution for 15 hours,$T_{12}$= Seeds primed with 2% mannitol solution for 18 hours,$T_{13}$= Seeds primed with 4% mannitol solution for 3 hours,$T_{14}$= Seeds primed with 4% mannitol solution for 6 hours,$T_{15}$=Seeds primed with 4% mannitol solution for 9 hours,$T_{16}$=Seeds primed with 4% mannitol solution for 12 hours,$T_{17}$=Seeds primed with 4% mannitol solution for 15 hours,$T_{18}$=Seeds primed with 4% mannitol solution for 18 hours,$T_{19}$=Seeds primed with 6% mannitol solution for 3 hours,$T_{20}$= Seeds primed with 6% mannitol solution for 6 hours,$T_{21}$=Seeds primed with 6% mannitol solution for 9 hours,$T_{22}$=Seeds primed with 6% mannitol solution for 12 hours,$T_{23}$=Seeds primed with 6% mannitol solution for 15 hours,$T_{24}$=Seeds primed with 6% mannitol solution for 18 hours,$T_{25}$=Seeds primed with 8% mannitol solution for 3 hours, $T_{26}$ = Seeds primed with 8% mannitol solution for 6 hours,$T_{27}$=Seeds primed with 8% mannitol solution for 9 hours,$T_{28}$=Seeds primed with 8% mannitol solution for 12 hours,$T_{29}$ = Seeds primed with 8% mannitol solution for 15 hours and $T_{30}$=Seeds primed with 8% mannitol solution for 18 hours 2%, 4%, 6%, and 8% of mannitol solution and distilled water were used as priming solutions. Priming is done in different plastic containers covered with lids to prevent evaporation loss. Seeds were removed from the priming solution at the required time. The primed seeds were rinsed thoroughly with distilled water for three times and dried lightly using blotting paper and finally, air dried near to the original weight (Umair *et al*., 2011) at room temperature for 24 hours back to the original moisture level. A sample of 50 seeds was taken from each treatment, and placed in a 250 mL flask with 200 mL of distilled water. The flasks were stirred to remove air bubbles and floating seed, covered with aluminum foil, and kept at room temperature for 24 hours. After soaking, seeds were gently swirled and the conductivity of the soaked water was measured with a dip-type cell (Cell Constant of 1.0) conductivity meter. Conductivity was expressed on a weight basis in dS $m^{-1}$ $g^{-1}$ of seed (ISTA, 1993). The data were statistically analyzed to observe the significant difference among the treatments and the mean was estimated by the least significant difference (LSD) test at 5% level of significance. Computer software MSTAT-C was used to carry out the statistical analysis.

The electrical conductivity was significantly influenced by priming (water and mannitol) time (Table 1). Electrical conductivity gradually decreases up to 9 hours in both water and mannitol priming seeds and gradually increases after 9 hours for both water and mannitol priming seeds. Results revealed that the lowest EC 0.0660 dS $m^{-1}$ was recorded from $T_9$ treatment at 9 hours for BARI Mung-3, on the other hand, the lowest EC 0.1110 dS $m^{-1}$ was observed from $T_{21}$ treatment at 9 hours for BARI Mung-6. The highest EC 0.3636 dS $m^{-1}$ and 0.5953 dS $m^{-1}$ was recorded in the control treatment for both varieties. The probable reason for the reduction of EC value of the hydro-primed and mannitol-primed seed may be priming might have enhanced the repair of cell membranes that were disrupted during aging (Senaratna *et at.*, 1988). The repair of the membrane could initiate there-activation or re-synthesis of membrane-bound enzymes and enhanced germination (Rao *et al.*, 1987). Similarly in canola seeds, EC from the leachate of osmo-primed and hydro-primed seeds was lower than that of non-primed seeds. Seed priming was effective in decreasing the EC of seed leachates, which show membrane stability. Decreased leakage of solute from primed seed may be because of better membrane repair during hydration (Fu *et al.*, 1988).

Table 1**.** Effect of different priming times on electrical conductivity of primed (mannitol and water) and non-prime (control) seeds

| Treatments | Electrical conductivity (dS $m^{-1}$) | |
|---|---|---|
| | BARI Mung-3 | BARI Mung-6 |
| $T_0$ | 0.3636 a | 0.5953 a |
| $T_1$ | 0.1010 m | 0.2220 kl |
| $T_2$ | 0.0909 n | 0.1816 m |

| | | |
|---|---|---|
| $T_3$ | 0.0707 p | 0.1514 no |
| $T_4$ | 0.1111 l | 0.2321 k |
| $T_5$ | 0.1212 k | 0.2725 i |
| $T_6$ | 0.1313 j | 0.2926 h |
| $T_7$ | 0.0909 n | 0.2119 l |
| $T_8$ | 0.0808 o | 0.1614 n |
| $T_9$ | 0.0606 q | 0.1413 o |
| $T_{10}$ | 0.1010 m | 0.2321 k |
| $T_{11}$ | 0.1111 l | 0.2725 i |
| $T_{12}$ | 0.1313 j | 0.2926 h |
| $T_{13}$ | 0.1010 m | 0.1816 m |
| $T_{14}$ | 0.0909 n | 0.1614 n |
| $T_{15}$ | 0.0757 op | 0.1413 o |
| $T_{16}$ | 0.1111 l | 0.2220 kl |
| $T_{17}$ | 0.1212 k | 0.2523 j |
| $T_{18}$ | 0.1414 i | 0.2825 hi |
| $T_{19}$ | 0.1515 h | 0.1816 m |
| $T_{20}$ | 0.1414 i | 0.1614 n |
| $T_{21}$ | 0.1515 h | 0.1110 p |
| $T_{22}$ | 0.1717 g | 0.2220 kl |
| $T_{23}$ | 0.1717 g | 0.2321 k |
| $T_{24}$ | 0.1717 g | 0.2725 i |
| $T_{25}$ | 0.1818 f | 0.3229 g |
| $T_{26}$ | 0.1717 g | 0.3635 f |
| $T_{27}$ | 0.2121 e | 0.3834 e |
| $T_{28}$ | 0.2424 d | 0.4238 d |
| $T_{29}$ | 0.2525 c | 0.4843 c |
| $T_{30}$ | 0.2626 b | 0.5054 b |
| $LSD_{(0.05)}$ | 0.0079 | 0.012 |
| CV (%) | 4.54 | 4.07 |

From the results of the study, it may be concluded that priming with 2% mannitol concentration for BARI Mung-3 and 6% mannitol concentration for BARI Mung-6 with 9 hours priming time increases the germination behavior of mungbean seeds. Reduction in germination parameters and seedling growth was more profound in control seeds than primed seeds under drought stress conditions. Thus, optimized priming time may be an effective method to meet the demands of farmers during the installation of the culture in the field and especially in conditions of drought stress.

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