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Response of Bael (*Aegle marmelos*) Seed to Hydro priming and different level of Drought and Salinity Stress

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Seed germination is one of the essential factors in the cultivation of medicinal trees. The laboratory experiment was conducted at the Department of Seed Science and Technology, Hemwati Nandan Bahuguna Garhwal University, Srinagar, Uttarakhand during 2015. Hydro priming with 24 h & 48 h, and water stress (polyethylene glycol (6000) with potential 10%, 15% and 20%) & salinity stress (seeds were soaked in solution with concentration of 5% 10% and 15% NaCl for 3 hours) on seed germination and seedling quality character of bael (*Aegle marmelos*). The results showed that the effect of hydro priming was significant on seed germination percentage; seedling length, seedling vigour and dry matter production than control and stress condition (salinity & drought) significantly decrease germination percentage, Mean daily germination, seedling length, seedling weights & vigour indexes. Mean comparison showed that control and Hydro priming and stress conditions treatments those after 25 days and the maximum germination (91.56%), Mean daily germination (3.66), seedling length (15.84cm), vigour index 1 (1450.41), were achieved by hydro priming of bael seeds for 48 h, Fresh weight of seedling (1.62g), dry matter production (0.33g), and vigour index 2 (27.79). were achieved by hydro priming of bael seeds for 24 h, but in stress, conditions failed to improve germination. Hence bael seeds can be hydro primed for 48 h and 24 h to improve the germination and vigour.

Key words: Seed priming, germination, seedling vigour and bael

Aegle marmelos (L.) Corr. is a popular medicinal tree belonging to the family Rutaceae and its various parts are used in Ayurvedic and Siddha medicines to treat a variety of ailments. Almost all parts of the tree are used in preparing herbal medicine (Kala, 2006). The roots are useful for treating diarrhea, dysentery and dyspepsia. The aqueous extracts of the stem and root bark are used to treat malaria, fever, jaundice and skin diseases such as ulcers, urticaria and eczema (Nadkarni, 1954). In pharmacological traits, both the fruit and root showed antiamoebic and hypoglycemic activities. The tree is rich in alkaloids, among which aegline, parmesan, marmin, and marmelosin are the major ones. The compounds luvangetin and pyranocoumarin, isolated from seeds showed significant antiulcer activity (Goel *et al.,* 1997). Essential oil isolated from the leaf has an antifungal activity (Rana *et al.,* 1997).

Seed priming is an efficient method for increasing seed vigour and synchronization of germination, as well as the growth of seedlings of many crops under stressful conditions. Generally priming would cause an effective invigoration of the dry seed which is the inception of metabolic processes that normally occur during imbibition and which are subsequently fixed by drying the seed.

It is reported that seed priming is one of the most important development to help rapid and uniform germination and the emergence of seeds and to increase seed tolerance to adverse environmental conditions. Earlier works showed that the success of seed priming is influenced by the complex interaction of different factors like water potentiality of the priming agent, priming time, temperature, seed vigor, dehydration. Hydro priming is a safe, simple and inexpensive method to enhance Germination. In laboratory studies, research planting and in farmer's fields, faster emergence, better stands, increased plant vigor and drought tolerance, earlier flowering and harvest, and higher grain yields were recorded. Most (>80%) farmers benefit from priming on early germination, establishment and yield and most (>95%) intended to prime in the following years. Although the effect of seed priming in other field crops is documented, no reports are available on the potential of various seed priming treatments and responses of the Bael seeds on subsequent exposure to drought stress.

Seed germination and seedling growth characters are extremely important factors in determining yield. Dhanda S *et al.* indicated that seed vigour index and shoot length are among the most sensitive to drought stress, followed by root length and coleoptiles length. Drought is one of the major abiotic stresses which are the most limiting factor for better plant performance and higher crop yield. Environmental stress during the seed production period can have a negative impact on seed quality. As polyethylene glycol can make a semi-natural environment has a wide range of application especially under laboratory conditions. So it uses for adjusting water potential in germinating laboratories. The purpose of this experiment is to consider drought stress impacts which are results of polyethylene glycol on germination of *Aegle marmelos* seeds.

Many medicinal plants need to be cultivated in order to satisfy their increasing demand, but salinity and other forms of abiotic stress represent serious threats to the growth and crop yields. In fact, salinity is a major environmental problem to crop productivity throughout the arid and semi-arid regions of the world (Foolad & Lin, 1997). So, salt tolerance at the germination stage is an important factor and has detrimental effects on the germination of seeds (Sharma *et al*., 2004).

In the present study, different concentration of NaCl and PEG-6000 was used for salinity and drought stress induction, respectively in seed germination and vigour of *Aegle marmelos,* an ethnobotanical highly medicinal plant.

MATERIALS AND METHODS

The study was conducted in the seed testing laboratory of H.N.B. Garhwal, University Srinagar Garhwal, and Uttarakhand, India to determined the effect of hydro priming on germination and vigour of bael (*Aegle marmelos*) seeds. To conduct the experiment seeds were soaked in water for 24 h & 48 h to find out the germination and to determined the critical drought and salinity tolerance capacity of bael (*Aegle marmelos*) seeds were tested by using solutions of O, 10, 15, 20%

and 0, 5, 10, 15% solution respectively of Polyethylene glycol (PEG-6000) and NaCl concentrations. Four replicates of 100 seeds for each treatment were used. Seeds were placed for germination in 10 cm glass Petri dishes and were put into the germinator at 25±1°C. In the case of PEG 6000, a 10 ml solution was used to wet the filter paper and wrapped them with paraffin film while in case of NaCl seeds were dipped for three hours in NaCl solution and after that NaCl spray was used the time to time to wet the filter paper.

To observe the germination performance of seeds, a daily observation was recorded. After completion of germination to determine the critical drought potential, some germination indexes were evaluated such as germination percentage (GP) and normal seedling percentage (NSP)

Seed source & collection.

The freshly ripped fruits of *Aegle marmelos* were collected from a healthy well-growing tree from the Chauras campus of HNBG University Srinagar in the month of may-June, 2014. Then the collected fruits were breakdown to remove the outer shell of fruits and to get the seeds. Removed seeds were macerated with water for 48 hours, to remove the pulp and after that seeds were dried properly at room temperature (25 ±1^{0}C) for 3-4 days.

Treatment Preparation.

This study was performed in a randomized factorial method with 4 replications with 100 seeds from each treatment are separated and were sterilized with 1% Naocl solution for five minutes followed by three times wash with double distilled water.

For control, 100 seed per replicate were put into the Petri dishes containing Whatman No.1.filter paper and water was used as a wetting agent.

For hydro priming seeds were soaked in distilled water for 24hour & 48 hours at room temperature. Soaked seeds, 100 per replicate were transferred to Petri dishes containing Whatman No.1.filter paper.

For stress conditions.

A. For salinity stress, seeds were soaked in solution with the concentration of 5% 10% and 15% NaCl for 3 hours separately, then, the Soaked 100 seeds per replicate were transferred to Petri dishes for salinity stress on Petri dishes, containing Whatman No.1 filter papers.

B. For drought stress, four replicate 100 seeds per replicate, were transferred to Petri dishes containing Whatman No.1.filter paper and apply polyethylene glycol (6000)(with potential),10%, 15% 20%) to 10 ml per Petri dish was used. The Lids of Petri dishes were closed completely with paraffin and located in germinator at 25 ±1^{0}C for 25 days.

Observations:- After the final day of testing (the 25th day).

Germination %: Number of Germinated seed out of total seeds.

Seedling length: the seedling length was obtained by adding root and shoot length (cm).

Fresh weight of seedling: Weight of seedling grown in blotter paper (g).

Dry weight of seedling: Weight of dried seedling (g). 25 days old seedlings grown in blotter paper; seedling dried in an oven at 72^o C for 12 hours and weighed.

Seedling vigour index-1: Seedling length × Germination %

Seedling vigour index-2: Seedling dry weight × Germination %

Mean Daily Germination (MDG)- MDG is an indicator of daily germination rate calculated from the following equation (Scott & Willams, 1984)

$$MDG = \frac{\mathrm{FGP}}{\mathrm{d}}$$

FGP – Final germination percentage, D –Experiment period.

RESULTS AND DISCUSSION

Effect of seed hydro priming on the germination percentage of bael seedlings (Table 1) showed significant effect of seed priming and salinity and drought stress on germination and other parameters of Bael seeds with seed primed for 48 h which recorded significantly higher germination percentage (91.56%) in 48 h, than control (76.76%) and salinity (12.71%) and drought stress (19.54). This was due to hydration of the seeds during which hydrolytic enzymes were activated

in the endosperm converting complex stored food materials into metabolically useful chemicals that resulted in the growth of the embryo. These results are in accordance with the results of other researchers who reported improvement of germination percentage. Wang *et al.* (2003) also reported that hydro primed seeds showed a 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 a priming medium.

Seedling growth and vigour index Effect of hydro priming on the growth of the Bael seedlings showed a significant effect of hydro priming and negative effect of salinity and drought stress on the Seedling length, Fresh weight, dry matter production and vigour (Table 1). Significantly, fresh weight (1.62), dry matter production (0.33 g) and vigour index II (27.79) was recorded in seeds that were primed for 24h than control seeds and under salinity lowest seedling length recorded (0.93cm), Similarly higher Seedling length (15.84 cm), and vigour index I (1450.41), that were primed for 48 h were superior to the control and salinity and drought stress.

Priming may be helpful in reducing the risk of poor stand establishment under nursery conditions. The seed germination, vigour indexes, seedling fresh weight, seedling dry weight, and seedling length were significantly affected by salinity in the case of NaCl treatment in the experiment. Seedling fresh weight and seedling length were significantly decreased with the increasing salinity stress.

Earlier studies have shown that NaCl treatment decreased some growth parameters such as fresh weight of shoot and root of plants (Yildirim *et al.,* 2008; Mori *et al.,* 2011). In this study, we found that the presence of NaCl reduced the shoot fresh weight and root length of the bael (*Aegle marmelos*) compared to the control as a consequence of salt osmotic effects, which reduced water availability.

Table 1 Effect of hydro priming and salinity & drought stress different levels on germination and vigour of Bael (*Aegle marmelos*.).

S.N	Treatment	Germination %	MDG	Seedling L	Seedling F W	Seedling D W	Vigour-I	Vigour-II
1	Control	76.76±0.06	3.07±0	13.63 ±0.12	1.07±0.01	0.20±0.02	1,046.57 ±8.65	15.86±1.68
2	T1 W.S. 24 h	83.50±0.26	3.34 ±0.01	14.63 ±0.07	1.62±0.19	0.33±0.09	1,221.62 ±8.26	27.79±7.01
3	T2 W.S. 48 h	91.56±0.28	3.66 ±0.01	15.84 ±0.08	1.59±0.14	0.23±0.02	1,450.41 ±8.31	21.67±1.62
4	T3 NaCl 5%	70.54±0.19	2.82 ±0.01	2.56 ±0.09	0.54±0.14	0.05±0.01	180.63 ±7.23	3.99 ±0.62
5	T4 NaCl 10%	30.54±0.19	1.22 ±0.01	1.72 ±0.11	0.21±0.01	0.03±0.01	52.65 ±3.55	1.02 ±0.27
6	T5 NaCl 15%	12.71±0.03	0.51 ±0	0.93 ±0.02	0.13±0.01	0.01±0.003	11.86 ±0.25	0.17 ±0.04
7	T6 PEG 10%	41.59±0.29	1.66 ±0.01	7.69 ±0.11	0.68±0.09	0.09±0.003	320.02 ±6.73	3.87 ±0.11
8	T7 PEG 15%	28.52±0.26	1.14 ±0.01	4.80 ±0.09	0.49±0.06	0.10±0.01	137.06 ±3.54	2.85 ±0.17
9	T8 PEG 20%	19.54±0.19	0.78 ±0.01	6.85 ±0.10	0.08±0.003	0.02±0.01	133.91 ±3.00	0.39 ±0.12
	C.D.	0.50	0.02	0.29	0.297	0.087	19.60	6.98
	SE(m)	0.16	0.007	0.09	0.098	0.029	6.49	2.30
	SE(d)	0.23	0.01	0.13	0.139	0.041	9.17	3.26
	C.V.	0.57	0.57	2.20	23.786	40.868	2.22	46.34

This implies that hydro priming is the key factor to enhance germination, uniform emergence plants, and resistance to unfavourable environmental factors that inherit seed germination (light, temperature and water). In the present investigation, the PEG concentration (10, 15 & 20%) significantly prevented germination, seedling

length, seedling fresh weight, seedling dry weight, respectively. Turk *et al.,* (2004) found that one of the reasons that can reduce or delay or even prevent germination is water stress. It also decreases the germination rate and seedling growth rate. There were some studies that using local sesame from Nigeria which found that low level of drought stress hadn't any significant effect on germination, by increasing levels of drought germination and seedling growth reduced, on the other hand, drought stress level has negative correlation with germination and seedling growth (Heikal *et al.*, 1982; Mensah *et al*., 2006).

CONCLUSION

The final conclusion was found that the water soaking treatment for 48 hours and 24 hour significantly increased the germination percentage, seedling weight & vigour indexes than control and stress condition (salinity& drought) significantly decrease germination percentage, seedling weights & vigour indexes in Bael (*Aegle marmelos).* Priming may be helpful in reducing the risk of poor stand establishment under nursery conditions. In order to growth strategies for conservation of this endangered tree, hydro priming is helpful for regeneration and salinity and drought are harmful to germination and growth.

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