SHORT COMMUNICATION Indian Journal of Agricultural Research, Volume 57 Issue 2: 266-269 (April 2023)

Standardization of Seed to Solution Ratio and Soaking Duration for Priming of Brinjal Seeds

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10.18805/IJARe.A-5585

ABSTRACT

Studies were conducted to standardize seed to solution ratio and soaking duration for priming of brinjal seeds. The seeds were soaked in three different seed to solution ratios *viz*., 1:1, 1:1.5 and 1:2 both as weight by volume and volume by volume basis with the priming durations of 6 and 9h. The results revealed that seed priming with seed to solution ratio of 1:1 as volume by volume basis for 6h increased the germination by 4 per cent along with seedling quality characters.

Key words: Brinjal seeds, Soaking duration, Soaking volume, Seed quality parameters.

Vegetables are considered as essential building blocks of any diet, provides good source of vitamins, minerals, high dietary fiber and complex carbohydrates with low fat content. But per capita consumption of fruits and vegetables in India is very low (160 to 184 g/person/day) against world health organization standards of 400 g/person/day (Minocha *et al*., 2018). So, we are in the stage of increasing the production and productivity of vegetable crops.

To provide higher quality seeds, many researchers have developed new technologies called seed quality enhancement techniques. In the last two decades, seed priming, an effective seed invigouration method, has become a common seed treatment to increase the rate and uniformity of emergence and crop establishment in most vegetable and flower crops especially in advanced countries.

The priming is influenced by several factors. Among them the most important factors are selection of priming agent, its concentration, the method of priming and duration of priming. As a first step studies were initiated to standardize the method of priming by evolving seed to solution ratio to be adopted for priming and the duration of priming using water, the universal priming agent suitable for all kinds of seed.

Keeping these in view, the present experiment was conducted in brinjal cv. CO 2 to standardize the seed to solution ratio and soaking duration for priming and its influence on seed quality characters.

Genetically pure seeds of brinjal (*Solanum melongena* L.) cv. CO 2 obtained from the Department of Vegetable Crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore formed the base material for this study. The experiments and laboratory evaluations were carried out at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore during 2018-2019. The data obtained were analysed by adopting completely randomised design (CRD).

The brinjal seeds were graded for uniformity and were primed with water adapting three different seed to solution ratios *viz*., 1:1, 1:1.5 and 1:2 both as weight by volume and volume by volume basis with the priming durations of six and nine hours. After hydropriming, seeds were shade dried for 24 h at room temperature and dried back to initial moisture content and evaluated for the following physiological seed quality parameters along with non primed (control) seeds.

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How to cite this article: Malarkodi, K., Jeyavelan, M. and Ananthi, M. (2023). Standardization of Seed to Solution Ratio and Soaking Duration for Priming of Brinjal Seeds. Indian Journal of Agricultural Research. 57(2): 266-269. doi: 10.18805/IJARe.A-5585.

Submitted: 16-04-2020 **Accepted:** 31-12-2020 **Online:** 24-3-2021

Germination (%)

Four replicates of 100 seeds each were germinated by using paper (between paper) medium under the test conditions of 25±2°C temperature and 90±3% RH maintained in a germination room illuminated with fluorescent light. After the test period of 14 days the number of normal seedlings in each replication was counted and expressed in percentage (ISTA, 2007).

Root length (cm)

At the time of germination count, ten normal seedlings were selected at random from each replication and used for measuring the root length of seedlings. Root length was measured from the point of attachment of seed to the tip of primary root. The mean values were calculated and expressed in centimetre.

Shoot length (cm)

The seedlings used for measuring root length were also used for measuring shoot length. The shoot length was measured

from the point of attachment of seed to tip of the leaf and the mean values were expressed in centimetre.

Drymatter production (mg seedlings^{-10})

Ten normal seedlings from the germination test were selected at random, dried in shade for 24 h and then, in a hot air oven maintained at 85°C for 48 h and allowed to cool in a desiccator for 30 minutes. The dried seedlings were weighed in an electronic digital balance and the mean values were expressed in mg seedlings^{-10} (Gupta, 1993).

Vigour index

Vigour index value was computed using the following formula and the mean values were expressed in whole number (Abdul-Baki and Anderson, 1973).

Vigour index = Germination (%) × Seedling length (cm)

Statistical analysis

The data obtained from various experiments were analysed for the 'F' test of significance adopting the procedure described by Panse and Sukatme, (1985). Wherever necessary, the per cent values were transformed to angular (Arc-sine) values before analysis. The critical difference (CD) was calculated at 5 per cent (P=0.05) probability level and wherever 'F' value is non-significant it is denoted by 'NS'.

The evaluated physiological seed quality parameters were highly influenced by the seed to solution ratio rather the soaking duration. The analysis of variance showed significant difference in physiological seed quality parameters *viz.,* germination (%), root length (cm), shoot length (cm), drymatter production (mg seedlings^{-10}) and vigour index due to seed to solution ratio (S). Whereas, soaking duration (D) and interaction between seed to solution ratio and soaking duration (S × D) showed non significant difference.

Among the treatments, seeds soaked in 1:1 ratio adapting volume by volume basis recorded the highest germination per cent (86%, Fig 1 and Table 1), followed by seeds soaked in 1:1.5 and 1:2 ratio as volume by volume of water (85%). However, the seeds soaked in water on weight by volume of seed and water showed lesser germination (82-83%), irrespective of seed to solution ratio. Whereas, the nonprimed seeds recorded the lowest germination per cent (82%). The improvement in germination noticed with optimum seed to solution ratio was 4.0 per cent over the nonprimed seed.

The germination improvement with hydropriming might be due to hydrolysis of complex nutrients into simple sugars that are readily utilized in the synthesis of auxins and proteins. The auxins so produced help to soften cell walls to facilitate growth and the proteins readily utilized in the production of new tissues (Sabongari and Aliero, 2004). These findings were also supported by Ponnuswamy and Vijayalakshmi, (2011) where brinjal and chilli seeds soaked in equal volume with 12 h soaking duration recorded the highest germination of 82% and 83%, respectively (10% and 9% over the control seeds) due to activation of embryo to commence the process of cell division, differentiation and multiplication to grow into a seedling.

The influence of seed to solution ratios in expression of seed and seedling characters might be due to the imbibition capacity of the seed, which is mostly decided by the chemical composition and structure of seed (Bewley and Black, 1982). In the present study, the seed has a thick seed coat which controls the imbibition rate and expresses best results at the seed to solution ratio of 1:1.

Between the soaking durations of 6 and 9 h, the evaluated physiological seed quality parameters showed on par results hence, recommending the soaking duration of 6 h for brinjal seed priming. The expressed efficacy of lesser durations of priming might be due to composition of the seed, which has more protein that are hydrophilic in nature (Galla, 2011).

The results on evaluation of root length (cm), shoot length (cm), drymatter production (mg seedlings^{-10}) and vigour index are inline with germination percentage and revealed that seed priming with seed to solution ratio of 1:1 as volume by volume for 6 h found to increase the root length by 2.7%, shoot length by 5.9%, drymatter production by 5.4% and vigour index by 7.7% over the nonprimed seeds (Table 1).

The enhancement in the seedling growth noticed in this study could be attributed to the stimulation and production of plant growth regulators such as gibberellins, cytokinins and indole acetic acid; increased availability of minerals and other ions and more water uptake in primed seeds (Ramamoorthy *et al.*, 2001) than non primed seeds.

Heydecker and Coolbar, (1977) explained hydro priming as the imbibition of water that activates the

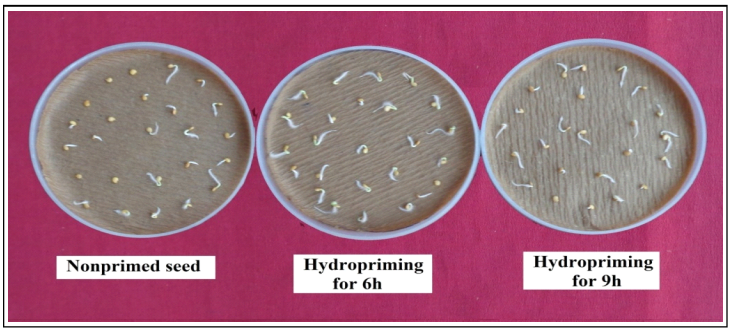

Fig 1: Influence of hydropriming and soaking duration on seed germination.

Table 1: Influence of seed to solution ratio and soaking duration on physiological seed quality parameters of brinjal cv.CO 2.

Parameters / Seed to solution ratio (S)	Germination (%)			Root length (cm)			Shoot length (cm)			Drymatter production (mg seedlings^{-10})			Vigour index		
	Duration (D)		Mean	Duration (D)		Mean	Duration (D)		Mean	Duration (D)		Mean	Duration (D)		Mean
	6 h	9 h		6 h	9 h		6 h	9 h		6 h	9 h		6 h	9 h	
Nonprimed seed	82 (64.90)	82 (64.90)	82 (64.90)	7.2	7.2	7.2	3.4	3.4	3.4	1.12	1.12	1.12	869	869	869
1:1 wt/ vol	82 (64.90)	82 (64.90)	82 (64.16)	7.2	7.2	7.2	3.4	3.3	3.4	1.12	1.13	1.13	869	861	865
1:1.5 wt/vol	82 (64.90)	81 (64.16)	82 (64.53)	7.3	7.4	7.4	3.4	3.4	3.4	1.13	1.13	1.13	877	875	876
1:2 wt/vol	82 (64.90)	83 (65.65)	83 (65.27)	7.4	7.3	7.4	3.5	3.4	3.5	1.15	1.14	1.15	894	888	891
1:1 vol/ vol	86 (68.03)	85 (67.21)	86 (67.62)	7.4	7.4	7.4	3.6	3.5	3.6	1.18	1.17	1.18	946	927	936
1:1.5 vol/vol	85 (67.21)	84 (66.42)	85 (66.82)	7.3	7.4	7.4	3.4	3.5	3.5	1.16	1.17	1.17	910	916	913
1:2 vol/vol	85 (67.21)	84 (66.42)	85 (66.82)	7.4	7.2	7.3	3.4	3.4	3.4	1.16	1.15	1.16	918	890	904
Mean	83 (63.76)	83 (63.43)		7.3	7.3		3.4	3.4		1.15	1.14		889	893	
	S	D	S×D	S	D	S×D	S	D	S×D	S	D	S×D	S	D	S×D
SEd	0.52	0.28	0.73	0.07	0.04	0.09	0.03	0.019	0.051	0.008	0.005	0.01	8.58	4.59	12.13
CD (P=0.05)	1.041	NS	NS	0.13	NS	NS	0.07	NS	NS	0.017	NS	NS	17.32	NS	NS

Wt- Weight; Vol- Volume. Figures in parentheses indicates arcsine values.

physiological process, mitochondrial activity, formation of vital molecule protein that resulted in release of energy. Researchers exposed hydro priming as a simple seed management technique that had proven invigourative effect in crop seeds (Dipika *et al*., 2019 and Mohamed Ali *et al*., 2019).

CONCLUSION

Brinjal seeds primed with water by adopting seed to solution ratio of 1:1 as volume by volume basis and the soaking duration of six hours improved the seed and seedling quality characters.

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