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Influence of Hydropriming on Physiological Aspects in Prosomillet (*Panicum Miliaceum* L.) CV. HP-4

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Abstract : A study was carried out at department of seed science, technology, College of Agriculture, Raichur during Kharif- 2018-19 to study the effect of hydropriming methods on seed quality parameters in prosomillet cv. HP-4. The hydropriming methods conducted for the study were- T_0- No soaking, T_1- 6 h of soaking, T_2 - 8 h of soaking, T_3 - 10 h of soaking, T_4 - 12 h of soaking, T_5-14 h of soaking. The seed quality parameters differed significantly between the treatments. The seeds hydroprimed for 8 h (T_2) duration recorded significantly highest seed quality parameters *viz.,* seed germination (87.8 %), shoot length (8.54 cm), root length (7.50 cm), seedling length (16.04 cm), seedling dry weight (420 mg), speed of germination (35), seedling vigour index I, II (1408, 36876), lowest electrical conductivity (0.010 dsm^{-1}) compared to other treatments.

INTRODUCTION

Millets – The Miracle Grains are a group of highly variable small-seeded grasses, widely grown around the world as cereal crops or grains for fodder, human food. Small millets are a group of grassy plants with short slender culm, small grains possessing remarkable ability to survive under adverse conditions like limited rainfall, poor soil fertility, land terrain making them an attractive crop for marginal farming environments. Seed is a basic input in agriculture in which 25 % yield increase can be achieved by quality seeds. Quality seed is the key for successful

agriculture, which demands each, every seed should be readily germinable, produce a vigorous seedling for ensuring higher yield. To provide higher quality seeds, many researchers have developed new technologies called “Seed Enhancement Techniques”.

Prosomillet (*Panicum miliaceum* L.) is locally known as Baragu or common millet is probably domesticated in Central, Eastern Asia. It was introduced into North America after the arrival of Columbus. Prosomillet traded internationally is imported by the pet-food industry in industrialized countries which is used as bird feed. In India small millet is cultivated over an area of 0.0719 million ha with total production of 0.435 million tonnes (Anonymous, 2018).

Prosomillet is grown mostly in Southern India although it is cultivated in scattered localities in central, hilly tract of North India. However combined values for minor millets have appeared in some report in which prosomillet is considered. It is commonly grown in Madhya Pradesh, Eastern Uttar Pradesh, Bihar, Tamil Nadu, Maharashtra,,hrapradesh, Karnataka. It is important minor millet being a short duration crop (70-75 days) with relatively low water requirement, it escapes drought period. The seeds are rich source of protein (12-13 %), have long storability under ambient conditions, hence suitable as famine reserve. It is rich in lysine (4.6 %) of the total proteins. In addition to protein, it also contains about 1.1 % crude fat, 68.9 % carbohydrates, 2-3 % minerals, 2.2 % crude fiber.

In the last two decades, seed priming offers an effective means for raising seed performance in many plant species. Seed priming is an seed invigouration method, that has become a common seed treatment to increase the rate, uniformity of seedling emergence, crop establishment. Seed priming is a technique for enhancing the seed quality, improving the overall germination, seed storage in a wide range of crop species (McDonald, 2000). Seed priming is a pre-sowing strategy for improving seedling establishment by modulating pre-germination metabolic activity prior to emergence of the radicle, generally enhances germination rate, plant performance (Bradford, 1986; Taylor, Harman, 1990; Ghassemi-Golezani *et al.,* 2008a, b).

Priming allows seed hydration to initiate the early events of germination, but not permit radicle emergence, followed by drying to initial moisture (Ashraf, Foolad, 2005). Seed priming permits early DNA replication, increase RNA, Protein synthesis, enhances embryo growth, repairs deteriorated seed parts, reduces leakage of metabolites.

Materials, methods

Seeds of Prosomillet cv. HP-4 were soaked in water with the seed to solution ratio (w/v) of 1:1 under ambient conditions. One of the treatment was kept as control (T_0 : non-primed), five other samples were soaked in distilled water for T_1 : 6 h of soaking, T_2 : 8 h of soaking, T_3 :10 h of soaking, T_4 : 12 h of soaking, T_5 :14 h of soaking. Then the seeds were dried back to initial moisture content at room temperature of 28-30°C. The control, treated seeds were evaluated for following physiological seed quality parameters.

Speed of Germination

Four replicates of twenty five seeds in each of the treatments were germinated in petriplates adopting the top of the paper method as per ISTA (2007). The seeds showing radicle protrusion were counted daily from the date of sowing upto the completion of cumulative germination. Based on the number of seeds germinated in percentage on each of the day, the speed of germination was calculated using the following formula, the results were expressed as number (Maguire, 1962).

$$\text{Speed of germination} = \frac{X_1}{Y_1} + \frac{X_2 - X_1}{Y_2} \ldots\ldots + \frac{X_n}{Y_n}$$

X_1: Percentage of seeds germinated at first count

X_2: Percentage of seeds germinated at second count

X_n: Percentage of seeds germinated on nth day

Y_1: Number of days from sowing to first count

Y_2: Number of days from sowing to second count

Y_n: Number of days from sowing to nth count

Germination

The germination test was carried out in roll towel medium using 4 x 100 seeds (ISTA, 2007) in a germination room maintained at 25 ± 2°C temperature, 95 ± 3 % RH. After the germination period of 7 days the seedlings were evaluated as normal seedling, abnormal seedling, hard seed, dead seed. Based on normal seedlings, the germination was calculated adopting the following formula, the mean expressed as percentage.

$$\text{Normal seedlings} = \frac{\text{Number of normal seedlings}}{\text{Total number of seedlings}} \times 100$$

Root Length

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

Shoot Length

The seedlings used for measuring root length were also used for measuring shoot length. The shoot length was measured from the collar region to the tip of the primary leaves, the mean values were expressed in centimetre.

Seedling dry weight

Ten normal seedlings were selected randomly from each of the crops, dried in shade for 24 h, were kept in an oven maintained at 70^0C for 24 h. After the drying period, the seedlings were cooled in closed desiccator for 30 minutes, were weighed in a top pan balance, the mean expressed as g seedlings^{-10} (Gupta, 1993).

Seedling Vigour Index I, II

Vigour index (VI) was calculated using the method suggested by Abdul–Baki,,erson (1973), expressed

in whole number.

SVI I =Germination (%) x [Root length (cm) + Shoot length (cm)].

SVI II = Germination (%) x Seedling dry weight.

Electrical conductivity

Five grams of seeds in four replications were soaked in acetone for half a minute, thoroughly washed in distilled water three times. Then, the seeds were soaked in 25 ml distilled water, kept in an incubator maintained at 25°C ± 1°C for 12 hours. The seed leachate was collected, the volume was made up to 25 ml by adding distilled water. The electrical conductivity of the seed leachate was measured in the digital conductivity bridge (ELICO) with a cell constant 1.0, the mean values were expressed in deci simons per meter (dSm^{-1}) (Milosevic *et al.*, 2010).

Results, Discussion

The laboratory experiment were carried to standardize the soaking duration for priming in prosomillet cv. HP-4. The seed quality studies were conducted, the results obtained are presented in Table 1, 2.

Among the treatments studied, the seed hydro-primed for 8 h (T_2) duration recorded significantly highest seed quality parameters *viz.,* seed germination (87.8 %), shoot length (8.54 cm), root length (7.50 cm), seedling length (16.04 cm), seedling dry weight (420 mg), speed of germination (35), seedling vigour index I, II (1408, 36876), lowest electrical conductivity (0.010 dsm^{-1}). While in control all the seed quality parameters recorded lowest (77.5 %, 6.96 cm, 6.75 cm, 13.71 cm, 380 mg, 24, 1067, 29564 , 0.018 dsm^{-1} respectively) as presented in table 1, 2.

When seeds are imbibed, the lag period before radicle emergence is considerably reduced, improved the rate, uniformity of germination. Rapid seedling emergence, improved field stand due to hydro-priming was also noticed by Nagar *et al.*, (1998) in Maize. In all the primed treatments seed primed for 8 hours enhanced germination percentage markedly compared to seed priming with other treatments.

Hydro-primed seeds had the rapid, high seedling emergence in the field. (Kibite, Harker, 1991). They also reported that seed hydration of wheat, barley, oats seeds improved the uniformity, rate of seedling emergence. Harris *et al*. (1999) found that hydro-priming enhanced seedling establishment, early vigour of upland rice, maize, chickpea resulting in faster development, earlier flowering, maturity, higher yields. The improved stand establishment was due to increase drought tolerance, reduce pest damage, increased crop yield (Harris *et al.*, 1999). These results suggest that hydro-priming is a useful method for improving seedling vigour, establishment, yield of corn in the field.

Seed priming increases the free radical scavenging enzymes to improve plant viability, strength. Priming decreases the resistance of the endosperm envelope to expansive growth allowing the turgor threshold for germination to be reached faster than in non-primed seeds thereby resulted in higher seedling length (Prasad *et al*., 2012)..

Rapid germination of seeds due to hydropriming ultimately could lead to the production of larger seedlings. The results presented confirmed that primed seed exhibit early vigour, produce significantly taller root, shoot length, thereby heavier seedlings due to enhanced activity of α-amalyse as reported by Harris *et al.* (1999) in Maize, rice, chickpea. Moreover significant improvement in the growth, development of seedlings due to priming can be ascribed to the presence of range of plant nutrients including N, P, K, micronutrients which might had accelerated the germination, growth of seedlings.

The seeds subjected to the longer duration of hydro-priming showed negative effect on speed of germination, standard germination, it is notices that lower value of speed of germination. The faster rate of germination was obtained by soaking seeds in water, probably due to quick water uptake, earlier initiation of metabolic processes which determine radicle protrusion. Generally

earlier germination might be due to higher synthesis of DNA, RNA, protein during priming. This result is conformity with the finding of Bray *et al.* (1989) in leek seeds.

The reason for poor seed vigour of unprimed seed may be due to slower rate of imbibition. The better seedling vigour is due to significant improvement in germination, length of the seedlings. Germination is an enzymatic reaction, is strongly correlated with enzymatic activities present in the seed. Hydro-priming might be increased the enzymatic activities during seed germination, enhance seedling vigour (Prasad *et al*., 2012) in rice.

The increased seed physiological parameters observed in the present study may be due to the fact that priming contains physiologically active substances viz., growth regulators, nutrients (Ambika, Balakrishnan, 2015).

Conclusion

The seeds soaked for eight hours found to be better for enhancing the seed quality parameters compared to other treatments in prosomillet cv. HP-4.

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References

S. Ambika and K. Balakrishnan. Enhancing germination, seedling vigour in cluster bean by organic priming, *Scientific Research, Essays* (academic Journals), Vol. 10(8), pp298-301, 2015

Anonymous (2018) Published on Food, Agriculture Organization Web site. http: // www.fao.org

M. Ashraf and M. R. Foolad, Pre-sowing seed treatment-a shotgun approach to improve germination, plant growth, crop yield under saline, non-saline conditions, *Adv. Agron.*, Vol. 88, pp. 223-271,2005

Bradford, K. J. Manipulation of seed water relations via osmotic priming to improve germination under stress conditions, *Hort. Sci.*,Vol. 21,pp.1105-1112, 1986

C. M. Bray, P. A. Davison, M. Ashraf and R. M.Taylor. Biochemical change during osmopriming of leek seeds. *Ann. Bot.,*Vol. 63, pp.185-93,1989.

K. Ghassemi-Golezani and R. Mazloomi-Oskooyi. Effect of water supply on seed quality development in common bean (*Phaseolus vulgaris*). *Intl. J. Pl. Prod.*, Vol. 2, pp. 117-124, 2008.

Gupta, P. C., Seed vigour testing. Hand book of seed testing, quality control, *Res. dev.*, New Delhi. pp. 243, 1993

A. S. Hanegave, R. Hune, H. L. Nadaf, N. K. Biradarpatil and D. S. Uppar. Effect of seed priming on seed quality of maize (*Zea mays* L.). *Karnataka J. Agric. Sci.,*vol. 24 (2) pp. 237-238, 2011.

D. A. Harris, P. A. Joshi, P. Khan, Gothkar and P. S. Sodhi. On-farm seed priming in semiarid agriculture: Development, evaluation in maize, rice, chickpea in India using participatory Methods. *Exp. Agric.*, Vol. 35, pp.15-29,1999.

ISTA, International Rules for Seed Testing Edition. International Seed Testing Association, Switzerland, 2007.

S. Kibite and K. N. Harker, Effects of seed hydration on agronomic performances of wheat, barley, oats in central Alberta. *Can. J. Plant Sci.* Vol. 71, pp.515 – 518, 1991.

Maguire, J. D. Speed of germination – Aid in selection, evaluation of seedling emergence, vigour. *Crop. Sci*., Vol. 2, pp. 176-177, 1962.

M. B. Mc Donald, Seed priming. In: Black M, Bewley J D, eds. Seed Technology, Biological Basis. *Sheffield Academic Press,* England, pp. 287-325, 2000.

M. M. Milosevic, D. Vujakovic and Karagic, 2010, Vigour tests as indicators of seed viability. *Genetika,* 42(1): 103-118.

R. P. Nagar, M. Dadlani and S. P. Sharma, Effect of hydro-priming on field emergence, crop growth of maize genotypes. *Seed Res*., 26(1): 1-5, 1998.

S. Prasad, B. Prasad and R. K. Singh. Effect of hydro-priming duration on germination, seedling vigour of rice, *J. Crop, Weed,* 8(1): 65-71,2012.

Table 1. Influence of hydropriming on physiological traits in prosomillet cv. HP-4

Treatment	Germination (%)	Shoot length (cm)	Root length (cm)	Seedling length (cm)	Seedling dry weight (mg)
T_0 - Control	77.8	6.96	6.75	13.71	380
T_1- Soaking for 6 hours	82.5	7.60	7.15	14.75	410
T_2 - Soaking for 8 hours	87.8	8.54	7.50	16.04	420
T_3 - Soaking for 10 hours	82.8	7.95	7.48	15.43	410
T_4 - Soaking for 12 hours	82.5	7.91	7.47	15.38	400
T_5 - Soaking for 14 hours	81.2	7.90	6.78	14.58	390
Mean	**80.125**	**8.308**	**7.22**	**14.99**	**400**
S.Em±	**1.5844**	**0.2828**	**0.2914**	**0.4246**	**13.06**
C.D at 1%	**6.4498**	**1.1592**	**1.1860**	**1.7285**	**21.00**

Table 2. Influence of hydropriming on physiological traits in prosomillet cv. HP-4

Treatment	Speed of germination	Seedling Vigour Index I	Seedling Vigour Index II	Electrical conductivity (dSm^{-1})
T_0 - Control	24.00	1067	29564	0.018
T_1- Soaking for 6 hours	28.00	1217	33825	0.010
T_2 - Soaking for 8 hours	35.00	1408	36876	0.010
T_3 - Soaking for 10 hours	29.50	1270	34668	0.016
T_4 - Soaking for 12 hours	28.50	1249	33825	0.016
T_5 - Soaking for 14 hours	27.00	1219	33120	0.017
Mean	**28.50**	**1238**	**33646**	**0.087**
S.Em±	**1.2472**	**22.01**	**91.061**	**0.0004**
C.D at 1%	**5.0771**	**45.23**	**104.318**	**0.0014**

