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Standardization of Seed Hydro-priming Duration in Bitter Gourd, *Momordica Charantia* L.

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Abstract

Presowing seed priming helps to improve germination and stand establishment. However, before priming the seeds, it is important to establish the safe limits of priming durations. The present study was therefore carried out to standardize seed priming durations for bitter gourd (*Momordica charantia* L.). Seeds of bitter gourd cultivar Solan Hara were hydro-primed at 20^{0}C between wet germination papers for different durations keeping unprimed seeds as control. Seeds were weighed after treatment to calculate amount of water imbibed. Further seeds were dried back to its original moisture content and evaluated for seed quality parameters. The plateau phase (Phase-II) with little change in water content from 53.3 to 57.3% (after 24 hours to 72 hours of seed priming) found as seed priming regime for bitter gourd. Significantly higher speed of germination, total% germination, seedling length, seedling dry weight, vigour index-I and II were recorded in hydro-priming for 72 hours as compared to other durations and control. Based on seed priming regime i.e. phase-II of seed germination and performance with respect to seed quality parameters it was found that 72 hours of seed priming is optimum in bitter gourd.

1. Introduction

Bitter gourd requires warm and hot climate for its optimum growth. However, this crop is more tolerant to low temperatures than other cucurbits and require optimum temperature of 24-27^{o}C for growth and development. In Himachal Pradesh, India, for early cropping season, seeds need to be sown in the month of March-April. Similarly in North Western Indian plains bitter gourd is generally sown early in the months of December or January so that crop gets ready for harvesting in March-April. The major problem during this period is poor and slow emergence of bitter gourd seedlings due to prevailing sub optimal temperatures. Germination of bitter gourd seed is adversely hampered at when temperature goes below 18^{0}C (Fonseka and Fonseka, 2011). In addition to this thick seed coat enclosing embryo, affect germination by imposing mechanical restriction on embryo growth. This problem of poor or slow seed germination can be solved through many techniques and one of them is seed priming (Pandita and Nagarajan, 2004). Hence, seed priming is of great importance in areas where low temperature affects seed emergence and uniformity (Chen et al., 2010). It reduces the germination time, increases germination percentage, seedling emergence, and increases uniformity under adverse environmental conditions.

Seed priming is a pre sowing controlled hydration treatment in which seeds are soaked in an osmotic solution or are mixed with the solid carrier with low metric potential that allows them to imbibe water and go through first stage of germination but does not permit radical protrusion through the seed coat. After priming, seeds are dried back to its original moisture content to enable normal handling, storage and planting (Varier et al., 2010). But before priming any crop seeds the knowledge of safe limits of priming duration is very important to get maximum effect. Hence, present study was planned with the objective of standardizing optimum seed priming duration for bitter gourd.

2. Materials and Methods

Seeds of bitter gourd cv. Solan Hara were obtained from Seed Sale Centre of Seed Technology and Production Centre, Dr. Y.S. Parmar University of Horticulture and Forestry Nauni, Solan, HP, India during the year 2012. 100 g seeds in each treatment were placed between two wetted germination papers

and temperature was maintained at 20^{O}C. Seeds were retrieved at 6 hours interval upto 96 hours with 0 hour as control. At the end of treatment superficial water present on seed surface was removed and seeds were weighed to determine percentage water imbibed (Wet seed weight minus initial seed weight). Thereafter, these primed seeds were dried back to their original moisture content under shade. Germination and vigour tests were conducted as per ISTA using paper towel method (ISTA, 2008). Daily radicle emergence was recorded for 14 consecutive days to calculate of speed of germination. Observations on seedling length and seedling dry weight was recorded and vigour index-I and II was calculated using formula given by Abdul-Baki and Anderson (1973).

3. Results and Discussion

Analysis of data showed significant variation for seed priming durations on% water imbibition and other seed quality parameters. Water absorption (%) by seeds ranged from 35.1-85.8 for different priming durations. Imbibition curve (Figure 1) of bitter gourd seeds followed the triphasic pattern (Bradford, 1995). Water absorption upto 51.8% was considered as phase-I of the germination as there was rapid water uptake and it lasted for 24 hours. It was followed by a plateau phase (Phase-II) with little change in water content from 53.3 to 57.3% in 48 hours i.e. after 24 hours to 72 hours of seed priming. A subsequent increase in water content coincided with radicle emergence and resumption of growth with water absorption from 62.5 to 85.5% was considered phase-III of the germination. Radicle protrusions were also observed with 62.5% and onward water imbibed seeds and hence this phase of germination was considered as phase-III. Bewley and Black (1978) concluded that in seed priming regime, seed water potential is maintained at a level sufficient to initiate metabolic events in phase-II of germination process, but prevents radical emergence. Thus the range from 53.3 to 57.3% water absorption was considered as priming regime, otherwise beyond which, the seed would germinate. As seeds also maintain their desiccation tolerance in phase-I and phase-II of germination (Figure 1), it is important to mention here that seed priming in bitter gourd should be done for 72 hours only to maintain desiccation tolerance.

The effect of seed priming durations on seed quality parameters were also found significant. The speed of germination (Figure 2) increased with increase in priming duration form 0 hour (23.3) upto 72 hours (35.9), thereafter it decreased rapidly with increase in priming duration (18.1 after 96 hours). The total germination% also increased with the increase in priming time from 0 hour (78.9%) to 72 hours (92.5%) and thereafter there was a sharp decline in germination% age (Figure 3). The seed priming duration of 72 hours was found significantly superior for other seed quality characters (Figures 4, 5, 6 and 7) like seedling length (18.8 cm), seedling dry weight (265.3 mg), vigour index-I (1739.0) and vigour index-II (24540.2). However minimum quality was observed for 96 hours of priming (14.0 cm, 190.2 mg, 344.4 and 4678.9 respectively).

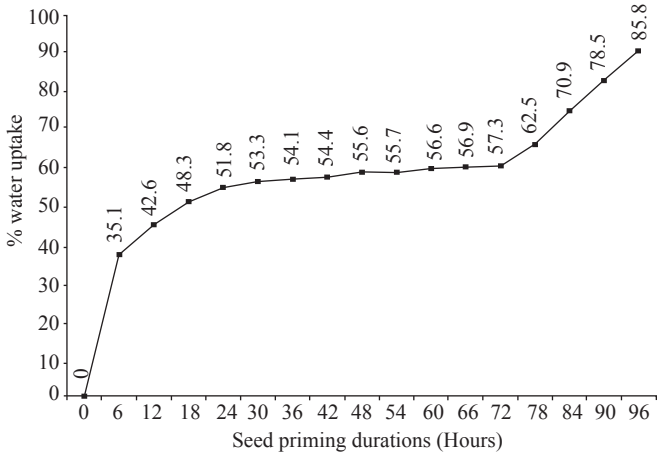

Figure 1: Water uptake by bitter gourd seeds at different priming durations

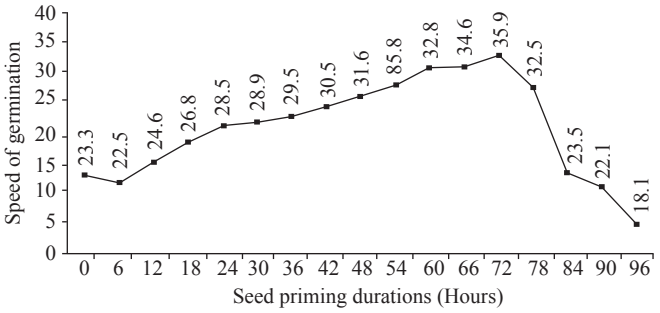

Figure 2: Speed of germination of bitter gourd seeds as affected by different priming durations

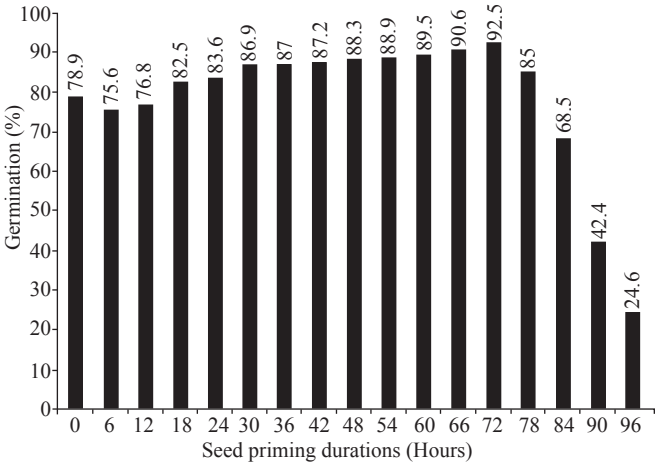

Figure 3: Germination of bitter gourd seeds as affected by different priming durations

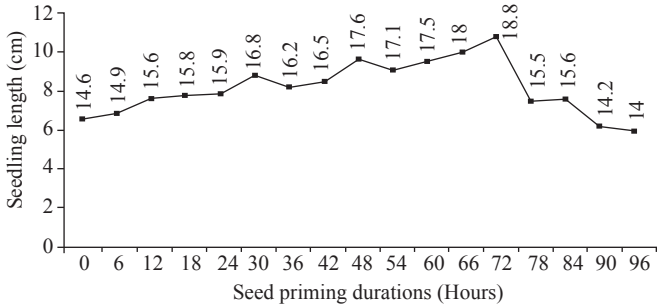

Figure 4: Seedling length of bitter gourd seeds as affected by different priming durations

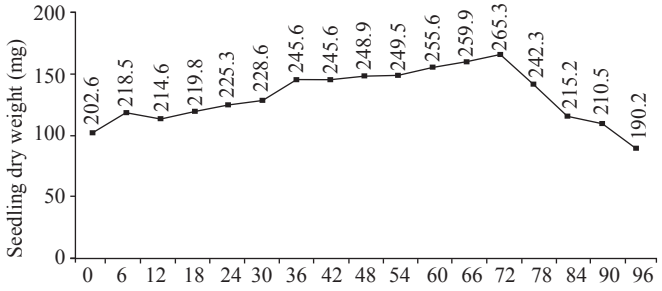

Figure 5: Seedling dry weight of bitter gourd seeds as affected by different priming durations

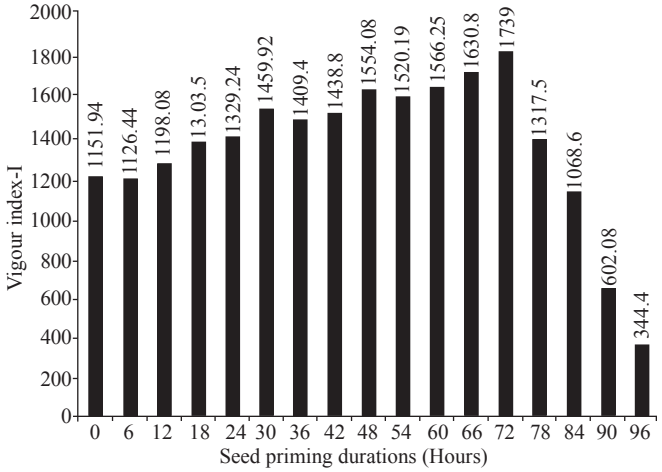

Figure 6: Vigour index-I of bitter gourd seeds as affected by different priming durations

The possible reason for early and enhanced germination at 72 hours of seed priming lies in the fact that there is completion of pre-germinative metabolic processes which gives a primed seed a head start over the un-primed seed making the seed ready for radicle protrusion (Varier et al., 2010). Hence seed germinated soon after incubating for germination test compared to other priming durations and unprimed control. Germination enhancement can also be attributed to metabolic repair processes during 72 hours of priming (Mehta et al., 2010). Seed priming also stimulates the formation of enzymes which are important in the early phases of germination which helps for a fast

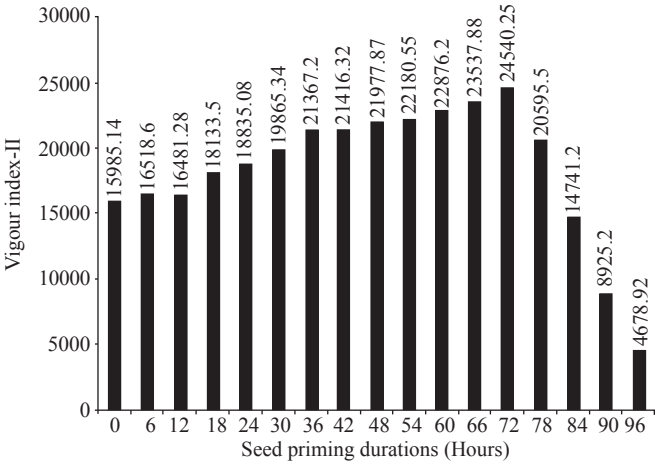

Figure 7: Vigour index-II of bitter gourd seeds as affected by different priming durations

radicle protrusion and hypocotyl elongation. However, after 72 hours of seed priming there is radicle protrusion and hence seeds become desiccation sensitive. Similar results were also obtained by Bijanzadeh et al. (2010) in rapeseed, Shah et al. (2011) in okra and Mehta et al. (2013) in cucumber.

4. Conclusion

Based on seed priming regime i.e. phase-II of seed germination and performance with respect to seed quality parameters, it can be concluded that 72 hours of seed hydro-priming at 20^{O} C temperature is optimum for increasing seed quality parameters under sub-optimal conditions of soil temperature.

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