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Standardization of Seed Priming Techniques in Bitter Gourd (*Momordica charantia* L.)

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ABSTRACT: The present investigation was laid to standardize the seed priming durations for bitter gourd (*Momordica charantia* L.). Bitter gourd seed coat is hard. So it needs seed priming as it reduces the germination time, enhances the seedling emergence, germination percentage (%) and uniformity under normal as well as adverse climatic conditions. By keeping this in view, seeds of bitter gourd variety Kahalgaon Local were subjected to various seed priming treatments with different soaking durations keeping unprimed seeds as control. In case of hydro priming, increased soaking duration (18 hours) enhanced the seed germination and quality parameters compared to less soaking duration (12 hours). Among various osmo priming treatments, low concentration of PEG (2%) with less soaking duration (12 hours) gave good results at the same time increase in concentration of PEG (4%) with high soaking period (18 h) results in poor germination. In halo priming, increased in the concentration of KNO_3 (4%) with more soaking duration (18 hours) enhanced the seed germination and seed quality parameters. Among hormonal treatments, GA_3 500 ppm with 18 hours soaking period gives the best results in terms of seed germination, vigour index-I and Vigour index-II.

Keywords: Bitter gourd, halo-priming, hormonal treatment, hydro-priming and osmo-priming.

INTRODUCTION

Bitter gourd (*Momordica charantia* L.) prefers warm season for its growth and development. It is a viny vegetable crop comes under cucurbitaceae family. It is locally called as karela, bitter cucumber, bitter melon and balsam pear. Reports said to be *Momordica charantia* var. *abbreviata* is the probable ancestor of cultivated bitter gourd. It is monoecious in nature and native to South Asia (Pathak *et al.*, 2014). Bitter gourd is rich in ascorbic acid and iron content (2 mg/100 g). Fruit juice of bitter gourd has anti-diabetic properties which aid in retaining sugar levels in human body (Sreejayan and Rao 1991). In India the area under bitter gourd is 1,07,000 hectares with the production of 12,92,000 MT (NHB, 2020) whereas Bihar constitute an area of 10,002 hectares with the production of 83, 444 MT (Anonymous, 2018). The productivity of bitter gourd when compared with national average (12.07 t/ha) is low at Bihar (8.34 t/ha). So there is a need to develop the techniques which enhances the yield of bitter gourd. Generally the bitter melon seed germination is disturbed at suboptimal temperatures i.e. below 18°C and one more reason for slow rising of bitter gourd seedlings is thick seed coat enclosing embryo. So that thicker seed coat affects the germination by striking the mechanical strength on embryo growth. This problem of slow or poor germination of bitter gourd seeds can be overcome by plenty of practices and one of them is seed priming (Pandita and Nagarajan, 2004). Seed priming is a skillful hydration method in which seeds are dripped in water or low osmotic potential solution to a point where germination linked metabolic events initiate in the seeds but radical emergence does not occur (McDonald, 2000). Seed priming has its great importance in regions where the low temperatures affect the seedling germination and its uniformity. It reduces the germination time, enhances the seedling emergence, germination percentage (%) and uniformity under normal as well as adverse climatic conditions.

Seed priming can be achieved in several ways namely; imbibition in distilled water (Hydropriming), imbibition in osmotic solution (Osmopriming), imbibition in salt solution (Halopriming) and imbibition in hormonal solution (Hormonal treatment). The key process involved in seed priming are, quick start of RNA synthesis, protein synthesis and finally polyribosome formation. Enzymes present in storage reserves have been triggered. During the process of seed priming, the water percent of the seed enhances up to 35 to 45% of its weight, it is adequate to trigger the biological actions

and progressing seed germination process without radicle emergence. The result of these fluctuations persistent and subsequent desiccation and are available re- imbibition of water during seed sowing, it leads to accomplishment of seed germination speedily and uniformly with synchronized flowering/fruiting in filed.

MATERIAL AND METHODS

Location of experiment: The present investigation was carried out in BAU, Sabour. This place is situated in North Eastern India with the coordinates of longitude of 87° 2' 42" East and latitude of 25° 15' 40'' North and is situated at an altitude of 45.57 m above mean sea level. The prevalent soil type is sandy loam.

Experimental details: Experiment was done by using bitter gourd variety Khahalgaon Local. Experiment was laid out in randomized block design with three replications and fifteen treatments including control as shown in Table 1. Experiment was conducted during the summer season i.e in the month of March, 2021.

Table 1: Details of experiment.

Variety	Kahalgaon Local
Design	Completely randomized design
Replication	03
Treatments	15
Total degree of freedom	{(t x r) – 1} = ({15 x 3) – 1} = 44

Preparation of chemical/hormonal solutions: 2% Polyethylene Glycol 8000 (PEG) solution is made by adding 4g of PEG 8000 into 200 ml of distilled H_2O and 4% solution is made by adding 8g of PEG 8000 into 200 ml of distilled H_2O.2% Potassium nitrate (KNO_3) solution is made by adding 4g of KNO_3 into 200 ml of distilled H_2O and 4% solution is made by adding 8g of KNO_3 into 200 ml of distilled H_2O.500 ppm solution of gibberellic acid (GA_3) is made by adding 100mg of GA_3 into 200 ml of distilled H_2O and 1000 ppm solution is made by adding 200mg of GA_3 into 200 ml of distilled H_2O.

Methods used: For germination test, sufficient quantity of germination papers and dipped in water for three hours. Then place the seed on paper and covered by another paper then fold it by using film cover then kept in germinator. Temperature maintained in germinator for first two days is 26°C at 75% relative humidity and later 28°C at 70% relative humidity until seedlings are fully emerged.

For drying of seedlings, we taken ten normal seedlings from each treatment and fold it in film paper. Then kept in hot air oven and dried at 75°C for 24 hours. It is done to calculate seedling dry weight. Germination percentage (%) is calculated by percent ratio of total number seeds sown to number of seedlings germinated was calculated.

To calculate seedling dry weight, ten normal seedlings were dried at 75°C for 24 hours and weighed for determining weight. For determining seedling length (cm), ten normal seedlings from each replication were taken at random and root and shoot length was measured.

The vigour index I was calculated as per the following formula suggested by Abdul Baki and Anderson (1973). Vigour index I = Germination (%) × Seedling length. The vigour index-II was calculated as per the following formula suggested by Abdul Baki and Anderson (1973). Vigour index I = Germination (%) × Seedling dry weight.

Analysis of variance (ANOVA) for completely randomized design (CRD): The data was subjected to statistical analysis as per the methods out lined by Panse and Sukhatme (1985) using the mean values of random arrangement in each replication from all the treatments to find out the significance of treatment

Source of variation	Degree of freedom	Sum of squares	Mean squares	Computed F^b	Tabular F (0.01)
Treatment	t-1	TrSS	$\text{TrSS} = \frac{TrSS}{df}$	$\frac{TrMS}{EMS}$	
Error	t(r-1)	ESS	$\text{EMS} = \frac{ESS}{df}$		
Total	rt-1	TSS			

The following formulae were used for the standard error, critical difference and coefficient of variation.

a) $\text{S.Em}\pm = \sqrt{EMS/r}$

b) $\text{C.D.} = \text{S.Em} \times \sqrt{2} \times t$ (p=0.01) at error d.f

c) $\text{C.V.} = \sqrt{EMS/GM} \times 100$

Where,
r = Number of replications
M.S.SS = Mean sum of squares
t = Number of treatments
S.Em± = Standard error of mean
d.f. = Degree of freedom
EMS = Error mean squares
S.S. = Sum of square
C.D. = Critical difference

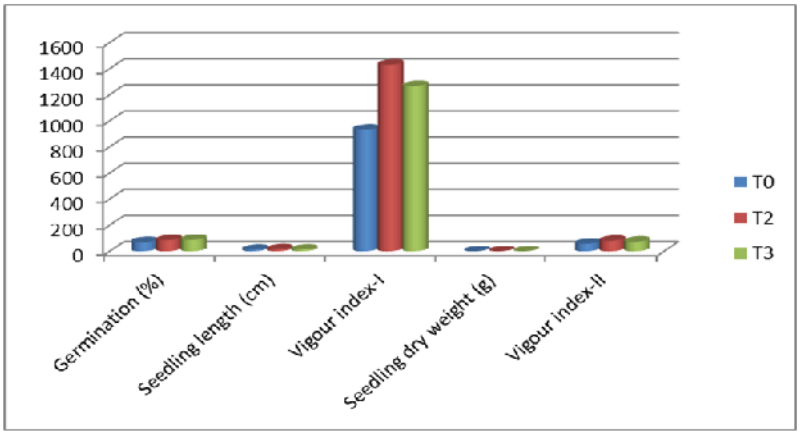
RESULTS AND DISCUSSION

Standardization of hydro priming treatments: Seeds of bitter gourd cv. Kahalgaon Local were hydro primed for 12 hrs and 18 hrs at room temperature as shown in

Table 1 and Fig. 1. The results revealed that seed germination percentage was significantly higher in 18 hrs soaking period compared to 12 hrs soaking period as shown in Fig. 1. Similarly, seedling length, seedling vigour index I, seedling dry weight and vigour index II also significantly higher in 18 hrs soaking period compared to 12 hrs soaking period as shown in table 1 and Fig. 1. Increased soaking duration offered the better results. Similar results were found in experiment conducted by Mehta *et al.* (2014). They concluded that an increase in time period of hydro priming increases the germination percentage (%), length of seedlings, dry weight of seedlings, seed vigour index-I and vigour index-II compared to other seed priming durations and control. Shrama *et al.* (2014) investigated the presowing impact of seed priming treatments on some physiological parameters and biochemical parameters of okra. He concluded that, physiological parameters i.e., germination%, vigour, mean germination time along with marketable fruit yield were significantly improved by hydropriming method for 12 hrs. Similar results were obtained in research conducted by Wang *et al.* (2003) and Tania *et al*. (2020).

Table 1: Effect of various seed priming treatments on Seed germination, Seedling length, Vigour index-I, Seedling dry weight and Vigour index-II of bitter gourd cv. Kahalgaon Local:

Treatments	Germination (%)	Seedling length (cm)	Vigour index-I	Seedling dry weight (g)	Vigour index-II
T_0 (Un primed seed)	71.33	13.10	933.97	0.81	58.00
Hydro priming					
T_1 (Dist. water for12 h)	83.33	14.25	1186.50	0.89	74.15
T_2 (Dist. water for18 h)	86.00	16.65	1431.23	0.95	81.39
Osmo priming					
T_3 (2% PEG for 12 h)	88.00	14.40	1266.20	0.85	74.76
T_4 (2% PEG for 18 h)	84.67	12.85	1087.97	0.83	70.53
T_5 (4% PEG for 12 h)	47.33	9.40	444.60	0.79	37.38
T_6 (4% PEG for 18 h)	41.33	9.05	374.21	0.90	37.19
Halo priming					
T_7 (2% KNO_3 for 12 h)	61.33	14.30	876.73	0.86	52.73
T_8 (2% KNO_3 for 18 h)	64.00	13.02	832.30	0.93	59.49
T_9 (4% KNO_3 for 12 h)	85.33	15.07	1285.17	0.81	69.11
T_{10} (4% KNO_3 for 18 h)	88.00	17.27	1518.43	0.91	79.75
Hormonal treatments					
T_{11} (500 ppm of GA_3 for 12 h)	90.67	18.17	1646.07	1.10	99.71
T_{12} (500 ppm of GA_3 for 18 h)	95.33	21.49	2048.91	1.25	18.84
T_{13} (1000 ppm of GA_3 for 12 h)	90.00	17.60	1583.00	0.95	85.75
T_{14} (1000 ppm of GA_3 for 18 h)	88.00	17.20	1512.87	0.90	79.16
C.D. (P=0.05)	**2.96**	**1.17**	**75.41**	**0.04**	**1.71**
CV	2.27	4.68	3.73	2.62	1.41

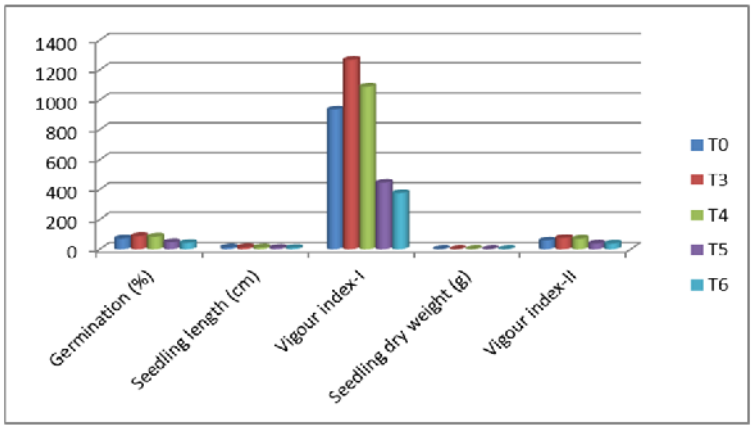


T_0 - Unprimed seed, T_1- Seeds soaked in dist. water for 12 hours, T_2 - Seeds soaked in dist. water hours18 hours

Fig. 1. Standardization of hydro priming treatments.

Kazem *et al.* (2010) and Das *et al.* (2018) also reported that effect of soaking period on speed of germination indicated that higher duration of soaking period had better effect as compared to lower duration of soaking period.

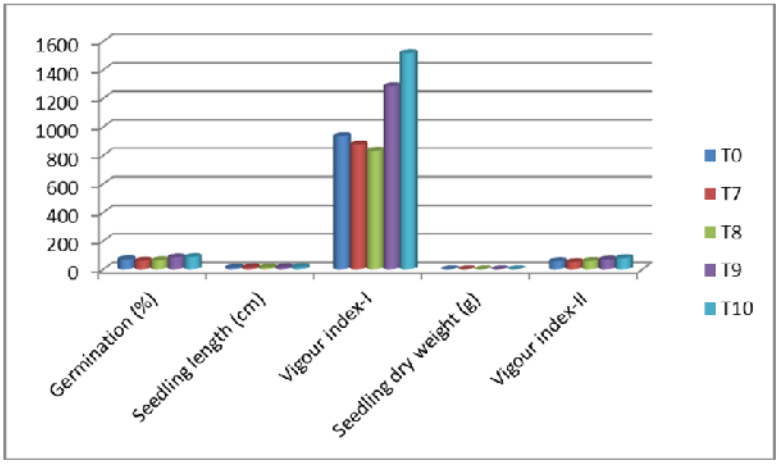
Standardization of osmo priming treatments: In osmo priming treatments, PEG (6000) at different concentrations and durations viz., PEG @ 2% for 12 hrs, PEG @ 2% for 18 hrs, PEG @ 4% for 12 hrs and PEG @ 4% for 18 hrs were evaluated as shown in Table 1 and Fig. 2. Results showed that seeds soaked in PEG @ 2% solution for 12 hrs gave significantly higher germination percentage compared to other concentrations and duration as shown in Fig. 2. Similarly, germination percentage, seedling length, vigour index I, seedling dry weight and vigour index II also significantly higher in PEG @ 2% for 12 hrs soaking period in comparison with remaining treatments. Increased in the concentration of PEG decreases the germination percentage along with seedling length, vigour index-I and vigour index-II as shown in table 1 and figure 2. Similar results were found in experiment conducted by Sadeghi *et al.* (2011).



T_0 - Unprimed seed, T_3 Seeds soaked in 2% PEG for 12 hours, T_4 - Seeds soaked in 2% PEG for 18 hours, T_5 - Seeds soaked in 4% PEG for 12 hours, T_6 - Seeds soaked in 4% PEG for 18 hours.

Fig. 2. Standardization of osmo priming treatments.

Standardization of halo priming treatments: In halo priming treatments, KNO_3 (Potassium nitrate) at different concentrations and durations viz., KNO_3 @ 2% for 12 hrs, KNO_3 @ 2% for 18 hrs, KNO_3 @ 4% for 12 hrs and KNO_3 @ 4% for 18 hrs were evaluated as shown in Table 1 and Fig. 3. Results showed that seeds soaked in KNO_3 @ 4% solution for 18 hrs gave significantly higher germination percentage compared to other concentrations and duration as shown in Table 1 and Fig. 3. Similarly, seedling length, seedling vigour index I, seedling dry weight and vigour index II also significantly higher in KNO_3 @ 4% solution for 18 hrs soaking period compared to remaining treatments as shown in table 1 and figure 3.Similar results were found in the experiment conducted by Demir and Oztokat (2003). They found that, seed priming with KNO_3 (3% at 20°C) for 6 days increased seed germination in watermelon i.e increase in the concentration of KNO_3 enhanced the seed germination. Results were also similar to experiment conducted by Tiryaki *et al.* (2005). He conducted seed priming experiment by using amaranthus seeds.



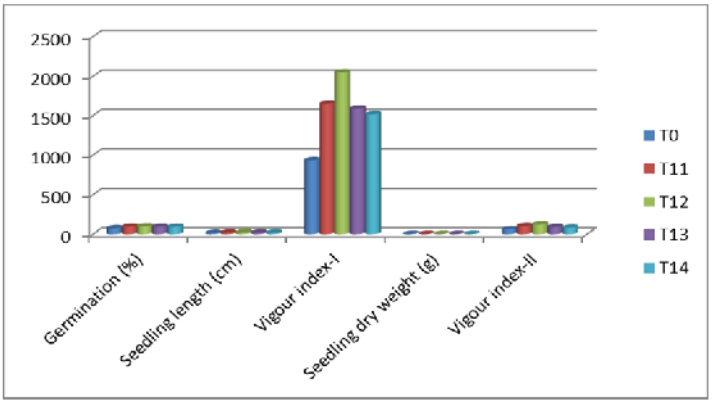
T_0 - Unprimed seed, T_7 - Seeds soaked in 2% KNO_3 for 12 hours, T_8 - Seeds soaked in 2% KNO_3 for 18 hours, T_9 - Seeds soaked in 4% KNO_3 for 12 hours, T_{10} - Seeds soaked in 4% KNO_3 for 18 hours

Fig. 3. Standardization of halo priming treatments.

Priming in KNO_3 at 20°C improved the germination of *A. cruentus* and seeds treated with 3% KNO_3 have obtained the highest final germination percentage (FGP) of 37% whereas untreated seeds have recorded only 10%. Similar results were obtained in research conducted by Afzal *et al.* (2009) and Robledo (2020).

Standardization of hormonal (GA_3) treatments

In hormonal treatments, GA_3 (Gibberellic acid) at different concentrations and durations viz., GA_3 @ 500 ppm for 12 hrs, GA_3 @ 500 ppm for 18 hrs, GA_3 @ 1000 ppm for 12 hrs and GA_3 @ 1000 ppm for 18 hrs were evaluated as shown in Table 1 and Fig. 4. Results showed that seeds soaked in GA_3 @ 500 ppm solution for 18 hrs gave significantly higher germination percentage compared to other concentrations and duration. Similarly, seedling length, seedling vigour index I, seedling dry weight and vigour index II also significantly higher in GA_3 @ 500 ppm solution for 18 hrs soaking period compared to remaining treatments as shown in table 1 and figure 4.Results were similar to experiment conducted by Das *et al*. (2014). They reported that treating of bottle gourd seeds with 500 ppm of GA_3 gives the significantly maximum seed germination, vigour index-I, vigour index-II and seedling dry weight compared to dry seeds. Similar results were obtained by investigation conducted by Nisha *et al*. (2016).



T_0 - Unprimed seed, T_{11} - Seeds soaked in 500 ppm of GA_3 for 12 hours, T_{12} - Seeds soaked in 500 ppm of GA_3 for 18 hours, T_{13} - Seeds soaked in 1000 ppm of GA_3 for 12 hours, T_{14} - Seeds soaked in 1000 ppm of GA_3 for 18 hours

Fig. 4. Standardization of hormonal treatments.

CONCLUSION

From this investigation it is concluded that, in case of hydro priming increased soaking duration (18 h) enhanced the seed germination and quality parameters compared to less soaking duration (12 h). Among various osmo priming treatments it is concluded that low concentration of PEG (2%) with less soaking duration (12 h) gives good results and increase in concentration of PEG (4%) with high soaking period (18 h) results in poor germination percentage. In case of halo priming, increased in the concentration of KNO_3(4 %) with more soaking duration (18 h) enhanced the seed germination and seed quality parameters compared to remaining treatments. Among hormonal treatments, GA_3 500 ppm with 18 h soaking period gives the best results in terms of seed germination, vigour index-I and Vigour index-II.

FUTURE SCOPE

We optimize the concentration of various chemicals for seed priming treatment of bitter gourd to enhance the germination percentage and uniformity under normal as well as adverse climatic conditions. Farmers may go for the cultivation of bitter gourd through optimized seed priming treatments under unfavorable conditions.

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REFERENCES

Abdul-Baki, A. A. & Anderson, J. D. (1973). Vigour determination in soybean seeds by multiple criteria. *Crop Science,13*: 630-633.

Afzal, I., Munir, F., Ayub, C.M., Basra, S. M. A., Hammed, A. & Nawaz, A. (2009). Changes in antioxidant enzymes, germination capacity and vigour of tomato seeds in response of priming with polyamines. *Seed Science and Technology, 387*: 765-770.

Anonymous. (2018). Area and Production of Vegetable Crops in India.Indian Horticulture Database. National Horticulture Board.

Das, S., Dash, F. M., Nandi, A. K., Senapati, N., Sarkar, S. & Pandey, G. (2014). Seed quality index an estimate used to predict response of bottle gourd seeds (*Lagenaria siceraria* L.) to hydro and osmopriming. *Advances in Applied Agricultural Sciences, 02*(12): 2383-4234.

Das, S., Sahu, G. S., Nandi, A., Jagadev, P. N., Sarkar, S., Dash, S. K., Samal, K. & Pattanaik, A. (2018). Effect of soaking periods and concentrations of priming agents in improving field emergence and fruit yield in bottle gourd. *International Journal of Chemical Studies, 6*(2): 1179-1186.

Demir, I. & Oztokat, C. (2003). Effect of salt priming on germination and seedling growth at low temperatures in watermelon seeds during development. *Seed Science and Technology, 31*: 765-770.

Kazem, G. G., Afsaneh, C. J., Safar, N. & Moghaddam, M. (2010). Influence of hydro-priming duration on field performance of pinto bean (*Phaseolus vulgaris* L.) cultivars. *African Journal of Agricultural Research, 5*(9): 893-897.

McDonald, M. B. (2000). Seed priming, In: Black, M., Bewley, J. D. (eds.) Seed technology and its biological basis. Sheffield Acad. Press, Sheffield, U.K, p. 287–325.

Mehta, D. K., Kanwar, H. S., Thakur, A. K., Seema, T. & Thakur, K. S. (2014). Standardization of Seed Hydro-priming Duration in Bitter Gourd, *Momordica charantia* L. *International Journal of Bio-resource and Stress Management, 5*(1): 098-101.

National Horticulture Board. (2020). Area and Production of Vegetable Crops in India. Indian Horticulture Database.

Nisha, S., Shukla, Y. R. & Mehta, D. K. (2016). Seed Priming and its Consequences on Seedling Vigour of Bell Pepper (*Capsicum annuum* L.) under Low Temperature Condition. *International Journal of Bio-resource and Stress Management, 6*(6): 759-764.

Pandita, V. K. & Nagarajan, S. (2004). Effect of pre-sowing treatments in improving emergence of bitter gourd seedlings. *Indian Journal of Horticulture, 61*(3): 280-281.

Panse, V.G. & Sukhatme, P.V. (1985). Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research Publication. 87-89

Pathak, M., Manpreet. & Kanchan, P. (2014). Genetic Variability, Correlation and Path Coefficient Analysis in Bittergourd (*Momordica charantia* L.). *International Journal of Advanced Research, 2*(8): 179-184.

Robledo, D. A. R. (2020). Effects of Halopriming on Seed Germination and Seedling Emergence of *Capsicum frutescens*. *Journal of Botanical Research, 3*(1): 114-118.

Sadeghi, H., Khazae, F., Yari, L. & Sheidaei, S. (2011). Effect of osmo priming on seed germination behaviour and vigour of soya bean (*Glycine max* L.). *ARPN Journal of Agricultural and Biological Science, 6*: 39-43.

Sharma, A. D., Rathore, S. V. S., Srinivasan, K. & Tyagi, R. K. (2014). Comparison of various seed priming methods for seedgermination, seedling vigour and fruit yield in okra (*Abelmoschus esculentus* L. Moench). *Scientia Horticulturae, 165*: 75–81.

Sreejayan. & Rao, M. N. A. (1991).Oxygen free radical scavenging activity of M. charantia fruits.*Fitoterapia, 62*: 344-346.

Tania, S.S., Rhaman, M.S. & Hossain, M.M. (2020). Hydro-priming and halo-priming improve seed germination, yield and yield contributing characters of Okra (*Abelmoschus esculentus* L.). *Tropical plant research, 7*(1): 86–93.

Tiryaki, I., Korkmaz, A., Nas, M. N. & Ozbay, N. (2005). Priming combined with plant growth regulators promotes germination and emergence of dormant *Amaranthus cruentus* L. seeds. *Seed Science and Technology, 33*: 571-579.

Wang, H. Y., Chen, C. L. & Sung, J. M. (2003). Both warm water soaking and solid priming treatments enhance anti - oxidation of bitter gourd seeds germinated at sub – optimal temperature. *Seed Science and Technology, 31*: 47-56.

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