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Standardization of Hydropriming duration and its effect on seed quality in chilli (*Capsicum annuum* L.)

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Abstract
Seed germination and subsequent seedling growth define crucial steps for entry into the plant life cycle and proper seed germination is a basic prerequisite for getting a better crop yield. In the present investigation the seeds of chilli were soaked in water for different duration *viz.*, 3, 6, 9, 12, 15 and 18 h to know the effective soaking duration which in turn will enhance the seed germination and seedling vigour. The results obtained showed that the seeds soaked for 12 h (T_5) showed significantly positive effect on seed germination (68.67%) and seedling vigour index (1065) compared to other soaking duration and control (62.00% and 664, respectively) (T_1). Likewise increase in root length (8.21 cm) and shoot length (5.86 cm) was also recorded in the same hour (12 h), compared to control (6.19 cm and 4.29 cm, respectively).

Keywords: Chilli seeds, hydropriming, soaking duration, seed germination, seedling vigour

Introduction
Chilli (*Capsicum annuum* L.) is known from pre-historic times in Peru and are believed to have originated in the South America and belongs to the genus *Capsicum*. Botanically chilli belongs to the family Solanaceae. It is an annual herb, profusely branching bushy plant. Fruits are nutritious, colourful and aromatic giving individuality to food dishes with different recipes. Its pungency factor capsaicin is an alkaloid, used in medicines. India is the leading producer and exporter of chilli in the world with the production of over 1 MT in 2020. The major chilli producing states in India are, Telangana, Karnataka, Madhya Pradesh, Orissa, Gujarat, Assam, Punjab, Rajasthan, Uttar Pradesh and Mizoram. In India area under chilli crop raised during last three decades for ripe – red – dry fruits varies from 634 to 921 thousand hectares, with total production of 364 to 895 thousand tons of dry fruits with an average yield of 574 to 957 kg per hectare. The major chilli growing districts of India are Dharwad, Nagpur, Prakasam Khammam, Guntur and Warangal.

Seed priming is seen as a viable technology to enhance rapid and uniform emergence, high vigour, and better yields in some field crops (Basra *et al*., 2002; Chiu *et al*., 2002; Harris *et al*., 1999; Murungu *et al*., 2004) [6, 8, 23]. Olouch and Welbaum (1996) [24] suggested that priming can be a valuable process for improving germination and uniformity of heterogeneously matured seed lots. 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 invigoration 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.

Many agricultural and horticultural crops have been shown to benefit from it in terms of seed germination and seedling establishment and ultimately the productivity (Sadeghian and Yavari, 2004; Basra *et al*., 2005) [30, 5]. Early and uniform germination by break down of photo- and thermo-dormancy with extended germination temperature range, higher nutrient uptake, and improved water use efficiency have all been described as advantages of seed priming (Hill *et al*., 2008; Dutta *et al*., 2018) [14, 9]. It effectively improves seed vigour and germination, which is a complicated agronomic feature influenced by various genetic and environmental factors (Jisha *et al*., 2013; Rajjou *et al*., 2012) [16, 29]. So, it has long been described as a potential way to promote crop performance (Bruce *et al*., 2002). Primed seeds also show a higher germination rate and better uniformity in emergence of seedlings which contribute to the regular establishment of crops and hence the yield.

The fast growth of primed plants is related to better plant water status regulation (Ahmed *et al*., 2016) [3] and an increased nutrient usage capacity (Muhammad *et al*., 2015) [22].

Hydro-priming is an economic and eco-friendly technique (Jamil *et al*., 2012) [15] that is done by soaking seeds either in hot or in cold water for a certain period before sowing seeds in the field or any growing/nutrient media (Tania *et al*., 2019) [32]. This facilitates water imbibition in seed and makes seed coat soft enough for enhanced easy and fast growth of seed embryo (Pandita *et al*., 2007) [26]. Moreover, the effective hydropriming treatment causes metabolic pathways triggered during germination step II, which are then briefly stopped until a desiccation problem happens that helps to improve on-field plant behaviour (Paparella *et al*., 2015) [27]. The short germination period, early emergence, and vigorous seedlings were observed when seeds were hydro-primed while experimenting series of crop species (Harris *et al*., 2002) [10]. Each crop cultivars has its critical soaking duration which is lower than the safe limit (Harris *et al*., 2002) [10]. So, knowledge of acceptable priming duration is crucial before priming seeds to achieve optimum impact. However, there is a lack of proper information on the exact duration of the seed hydro-priming. Hence, the present study was conducted to find out the optimum hydro-priming duration for chilli under the agro-climatic conditions of district Dharwad, Karnataka, India.

Material and Methods

The seed material of chilli variety Byadgi dabbi obtained from UAHS, Bagalkot was used in standardization of soaking period and concentration in order to choose the optimum soaking period and to follow in the further experiments. The seeds were surface sterilized with sodium hypochlorite (0.5%) for five minutes and washed two times with deionized distilled water. The seeds were soaked in water with seed to solution ratio of 1:2 vol/vol in different durations ranging from 3 to 18 hours in three replications of 100 seeds each. After completion of the soaking period the seeds were drained from water and subsequently dried back to optimum moisture content and then used for further testing of seed quality parameters by following standard germination test procedure by ISTA (Anon., 2011) [4].

Treatment details

T_1: Control (without soaking)
T_2: Seed soaking in water for 3 hour
T_3: Seed soaking in water for 6 hour
T_4: Seed soaking in water for 9 hour
T_5: Seed soaking in water for 12 hour
T_6: Seed soaking in water for 15 hour
T_7: Seed soaking in water for 18 hour

Design and Layout

The experiment was laid out in CRD (Completely Randomized Design) with three replication and the seeds were soaked in water at respective duration.

Observations recorded

Seed Germination

Germination test was conducted using four replicates of 100 seeds each in rolled paper towel and incubated in the walk-in seed germination room at 25 ± 2 °C temperature and 90 ± 5 per cent RH. Seedling evaluation was done when seedlings have reached a stage with all the essential structures were fully expressed. Sufficient time was given for the seeds to germinate and produce all essential structures showing potentiality to develop into normal plant under favourable conditions. Such seedlings were considered as normal seedlings and counted to compute the germination percentage. The number of normal seedlings in each replication was counted at the end of 14th day and the germination percentage was calculated and was expressed in percentage as given by ISTA (Anon, 2011) [4].

$$\text{Normal seedlings (\%)} = \frac{\text{Number of normal seedlings}}{\text{Total number of seeds}} \text{ x } 100$$

Root Length

From the germination test, ten normal seedlings were selected randomly in each treatment from each replication on 14th day. The root length was measured from the tip of the primary root to hypocotyl and mean root length was expressed in centimetre.

Shoot Length

From the germination test, ten normal seedlings were selected randomly in each treatment from each replication on 14th day. The shoot length was measured from the base of the primary leaf to hypocotyl and mean shoot length was expressed in centimetre.

Seedling Vigour Index (SVI)

Vigour index was computed by using the following formula and expressed in number (Abdul-Baki and Anderson, 1973).
Seedling vigour index = Germination% × [Shoot length + Root length].

Results and Discussion

Standardization of the soaking duration is an important aspect to be considered to get optimum duration for soaking of seeds to increase speed and uniformity of germination and improve final stand. Data in Table 1 revealed that soaking of chilli seeds in water for 12 h significantly improved seed germination (68.67%) (Fig. 1) followed by 9 h (66.33%) when compared to control (62.00%). Also significant difference in root length, shoot length and vigour index was recorded in seeds primed with water for 12 h (8.21 cm, 5.86 cm and 1065, respectively) (Plate 1) compared to control (6.19 cm, 4.29 cm and 664, respectively). Such possible result were obtained as soaking duration directly effects the seed quality, wherein, lower and optimum hour of soaking causes the start and completion of pre-germinative metabolic processes *i.e.*, activation and synthesis of a number of enzymes and nucleic acids repair and build up, ATP synthesis and the cytoplasmic membrane repair in hydro-primed seed, whereas increase in soaking duration, decreases the seed germination which might be due to membrane disintegrity of seed coat and increased movement of seed leachates resulting in low germination and vigour and also because of higher porosity where water filled pores restricted oxygen access to the seeds. Priming has also been demonstrated to be involved in increase in gene expression pattern, abscissic acid (ABA), gibberellins (GA), etc. (Schwember and Bradford 2010) [31]. These results are in conformity with Tiwari *et al.* (2014) [33] in

amaranthus, Kamithi *et al.* (2016) [18], Kazem *et al.* (2012), Abebe (2014) [2] and Kulsumbi *et al.* (2020) [20] in spinach, Shakuntala *et al.* (2020) [20] in cucumber, Jyoti *et al.* (2021) in wheat. Heydecker *et al.* (1971) [12] in beetroot reported that the germination was negatively affected by excess water treatment, which might be due to excess imbibition resulting in reduced activity of hydrolytic enzymes required for reserve mobilization of storage food (Perry and Harrison, 1974). Similar results were given by Orzeszko-Rywka and Podlaski (2003) [25] in palak and Heydecker (1967) [13] in *Beta vulgaris*.

Table 1: Standardization hydropriming durations and its effect on seed quality of chilli

Treatment	Seed germination%	Root length (cm)	Shoot length (cm)	Seedling vigour index - I
T_1- Control	62.00 (51.97) *	6.19	4.28	649
T_2 - 3 h	63.67 (52.96)	6.54	4.88	727
T_3 - 6 h	64.67 (53.56)	8.11	5.27	865
T_4 - 9 h	66.33 (54.56)	8.15	5.62	913
T_5 - 12 h	68.67 (55.99)	8.21	5.86	966
T_6 - 15 h	64.00 (53.17)	7.83	5.13	829
T_7 - 18 h	61.00 (51.38)	6.46	4.76	684
SE.(m) ±	0.590	0.036	0.029	7.086
C. D. (0.01)	2.488	0.151	0.122	29.831
C. V. (%)	1.591	2.296	2.215	1.517

* values in the parenthesis are Arcsin transformation

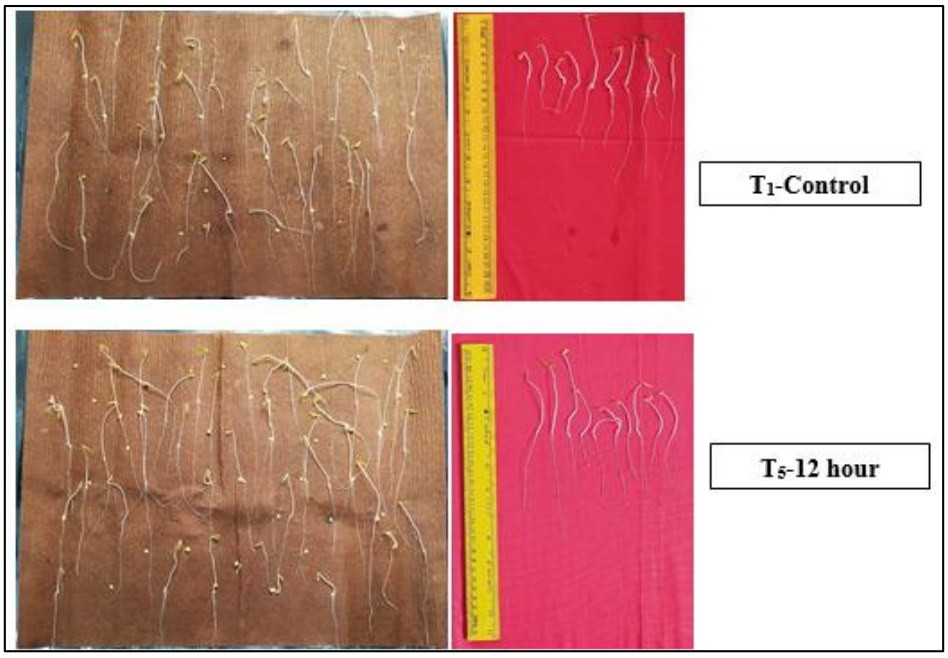

Plate 1: Standardization of hydropriming durations and its effect on seed germination (%) and seedling length (cm) of chilli

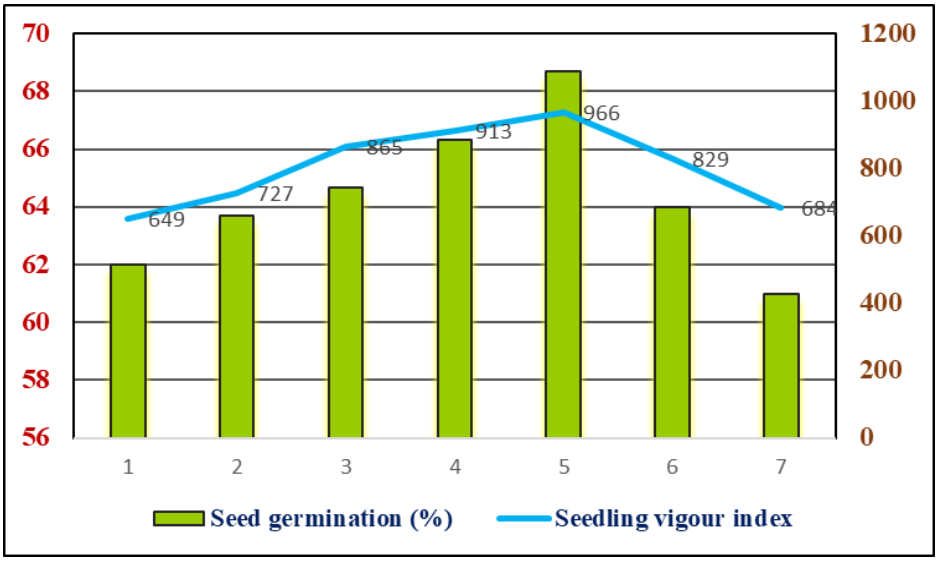

Fig 1: Standardization of hydropriming durations and its effect on seed germination (%) and seedling vigour of chilli

Conclusion

Based on present investigation it is concluded that seed quality parameters *viz.* germination, root length, shoot length, and seedling vigour index of chilli seeds can still be enhance with 12 hour of hydro-priming which could be exploited for successful chilli cultivation under normal and stress condition.

References

1. Abdul-Baki AA, Anderson JD. Vigour Determination In Soybean Seeds By Multiple Criteria. Crop Sci. 1973;13:630-633.
2. Abebe S. Effect of Hydro and Osmo Priming On Quality of Chickpea (*Cicer Arietinum* L.) Seeds. Int. J Pl. Breeding And Crop Sci. 2014;1(2): 028-037.
3. Ahmed M, Qadeer U, Ahmed ZI, Hassan FU. Improvement Of Wheat (*Triticum Aestivum*) Drought Tolerance By Seed Priming With Silicon. Archives of Agronomy And Soil Science. 2016;62(3):299-315.
4. Anonymous. ISTA (The International Seed Testing Association), International Rules For Seed Testing. *Seed Sci. Technol*., Switzerland. 2011.
5. Basra SMA, Farooq M, Tabassam R, Ahmad N. Physiological And Biochemical Aspects Of Pre-Sowing Seed Treatments In Fine Rice (*Oryza Sativa* L.). Seed Sci. Technol. 2005;33(3):623-628.
6. Basra SMA, Zia MN, Mehmood T, Afzal I, Khaliq A. Comparison Of Different Invigoration Techniques In Wheat (*Triticum Aestivum* L.) Seeds. Pakistan Journal of Arid Agriculture (Pakistan). 2002.
7. Bruce TJ, Matthes MC, Napier JA, Pickett JA. Stressful "Memories" Of Plants: Evidence and Possible Mechanisms. Plant Science. 2007;173(6):603-608.
8. Chiu KY, Chen CL, Sung JM. Effect of Priming Temperature On Storability Of Primed Sh-2 Sweet Corn Seed. Crop Science. 2002;42(6):1996-2003.
9. Dutta P. Seed Priming: New Vistas and Contemporary Perspectives. In Advances In Seed Priming. Springer, Singapore, 2018, 3-22.
10. Harris D, Tripathi RS, Joshi A. On-Farm Seed Priming To Improve Crop Establishment And Yield In Dry Direct-Seeded Rice. Direct Seeding: Research Strategies And Opportunities, International Research Institute, Manila, Philippines. 2002, 231-240.
11. Harris DBSR, Raghuwanshi BS, Gangwar JS, Singh SC, Joshi KD, Rashid A *et al*. Participatory Evaluation By Farmers Of On-Farm Seed Priming In Wheat In India, Nepal And Pakistan. Experimental Agriculture. 2001;37(3):403-415.
12. Heydecker W, Chetram RS, Heydecker JC. Water Relations of Beetroot Seed Germination II: Effects of the Ovary Cap and of the Endogenous Inhibitors. Annals of Botany. 1971;35(139):31-42.
13. Heydecker W, Higgins J, Urner YJ. Invigoration of Seeds. Seed Science and Technology. 1967;3:881-888.
14. Hill H, Bradford KJ, Cunningham J. Taylor AG. Primed Lettuce Seeds Exhibit Increased Sensitivity to Moisture During Aging. Acta Hortic. 2008;782:135-41.
15. Jamil M, Bashir S, Anwar S, Bibi S, Bangash A, Ullah F, *et al*. Effect of Salinity On Physiological And Biochemical Characteristics Of Different Varieties Of Rice. Pak. J Bot. 2012;44(1):7-13.
16. Jisha KC, Vijayakumari K, Puthur JT. Seed Priming For Abiotic Stress Tolerance: An Overview. Acta Physiologiae Plantarum. 2013;35(5):1381-1396.
17. Jyoti RDS, Yadav SC, Vimal. Standardization of Hydro-Priming For Enhancing Seed Quality Parameter In Wheat (*Triticum Aestivum* L.). Pharma Innovation. 2021;10(4):332-335.
18. Kamithi KD, Wachira F, Kibe A. Effects of Different Priming Methods and Priming Durations on Enzyme Activities in Germinating Chickpea (*Cicer Arietinum* L.). American J. Natural And Applied Sci. 2016;1:1-9.
19. Kazem MI, Tadash I. The Effects of Ethanol on the Germination of Seeds Of Japonica And Indica Rice (*Oryza Sativa* L.) Under Anaerobic and Aerobic Conditions. Annals Bot. 1997;79:391-395.
20. Kulsumbi AK, Sangeeta IM, Shakuntala NM, Vasudevan SN, Kisan B. Study On The Effect Of Seed Priming On Physiological And Biochemical Changes In Seed Quality Of Spinach (*Spinacia Oleracea* L.). Research Journal of Pharmacognosy and Phytochemistry. 2020;12(2):65-70.
21. Mcdonald MB. Seed Priming, Black, Seed Technology and Its Biological Basis In: Bewley MJD (*Ed*.). Sheffield Academic Press, Sheffield, UK. 2000, 287-325.
22. Muhammad I, Kolla M, Volker R, Gunter N. Impact Of Nutrient Seed Priming On Germination, Seedling Development, Nutritional Status And Grain Yield Of Maize. Journal Of Plant Nutrition. 2015;38(12):1803-1821.
23. Murungu FS, Chiduza C, Nyamugafata P, Clark LJ, Whalley WR, Finch-Savage WE. Effects Of 'On-Farm Seed Priming' On Consecutive Daily Sowing Occasions On The Emergence And Growth Of Maize In Semi-Arid Zimbabwe. Field Crops Research. 2004;89(1):49-57.
24. Oluoch MO, Welbaum GE. Effect of Postharvest Washing and Post-Storage Priming on Viability and Vigour of Six-Year-Old Muskmelon (*Cucumis Melo* L.) Seeds from Eight Stages of Development. In Proceedings of The International Seed Testing Association. International Seed Testing Association. 1996.
25. Orzeszko-Rywka A, Podlaski S. The Effect of Sugar Beet Seed Treatments on Their Vigour. Plant Soil Environ. 2003;49(6):249-254.
26. Pandita VK, Anand A, Nagarajan S. Enhancement of Seed Germination In Hot Pepper Following Presowing Treatments. Seed Sci. Technol. 2007;35(2):282-290.
27. Paparella S, Araújo SS, Rossi G, Wijayasinghe M, Carbonera D, Balestrazzi A. Seed Priming: State Of The Art And New Perspectives. Plant Cell Reports. 2015;34(8):1281-1293.
28. Perry DA, Harrison. Seed Vigour and Seedling Establishment. In J.R. Thompson (Eds.) - Advances In Research And Technology Of Seeds. Centre for Agricultural Publishing and Documentation, Wageningen. 1976;2:62-85.
29. Rajjou L, Duval M, Gallardo K, Catusse J, Bally J, Job C, *et al*. Seed Germination And Vigor. Annual Review of Plant Biology. 2012;63:507-533.
30. Sadeghian SY, Yavari N. Effect of Water-Deficit Stress on Germination and Early Seedling Growth in Sugar Beet. J Agron. Crop Sci. 2004;190(2):138-144.
31. Schwember AR, Bradford KJ. Quantitative Trait Loci Associated With Longevity Of Lettuce Seeds Under Conventional And Controlled Deterioration Storage Conditions. Journal of Experimental Botany. 2010;61:4423-4436.

32. Tania SS, Hossain MM, Hossain MA. Effects of Hydropriming on Seed Germination, Seedling Growth and Yield of Bitter Gourd: Hydropriming of Bitter Gourd Seeds. Journal of the Bangladesh Agricultural University. 2019;17(3):281-287.
33. Tiwari TN, Dipti K, Rajiv KS, Rajendra PS. Relative Efficacy of Seed Priming With Potassium Nitrate And Tap Water In Relation To Germination, Invigoration, Growth, Nitrate Assimilation and Yield of Amaranthus. Ann. Agri. Res. New Series. 2014;35(2):164-170.