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Seed Priming and Enhancing Germination in Vegetable Crops

Riya Jakhwal[1], Subhash Verma[2], Ashutosh Kumar[3], Charu Shekhawat[4]

[1]Assistant Professor, Shri Ram College, Muzaffarnagar
[2]Assistant Professor, School of Agriculture, Eklavya University Damoh (M.P.)-470661
[3]SMS, Department of Horticulture, Vegetable Science, KVK, Narkatiyaganj, RPCU, Pusa Bihar
[4]SRF, SKRAU, Rajasthan

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INTRODUCTION

What is Seed Priming?

Seed priming is a seed treatment prior to sowing whereby seeds are partially hydrated under controlled conditions. The controlled hydration enables seeds to start the initial metabolic processes needed for germination. But the seeds are not watered to the point where the radicle, or the embryonic root, comes out. After these early processes are initiated, the primed seeds are re-dried to their original moisture levels. This renders the seeds into storage, handling, and mechanical sowing fit.

Germination of the seed is a very important process in the development cycle of vegetable crops. It has an essential role in plant establishment at the early stage, which finally determines the yield and quality of the crop. To produce vegetables successfully, it is crucial to obtain rapid and uniform germination under different and sometimes adverse environmental conditions. Of the many techniques employed to accelerate germination and initial seedling vigor, seed priming is one of the most efficient and feasible methods.

Seeds are more prepared for germinating fast and uniformly when sown by seed priming. Seed priming not only enhances the germination percentage but also allows for uniform emergence of the seedlings and establishment of a better stand in the crop. Primed seeds, therefore, have the potential to perform better in the field, particularly under less than ideal conditions like drought, salinity, or temperature stress. Seed priming has therefore become an effective instrument in contemporary vegetable farming, enabling farmers to produce more regular and better-quality crops.

Types of Seed Priming

A number of seed priming techniques are widely applied to vegetable crops for improved germination, seedling strength, and stress tolerance. These techniques vary depending on the priming substance applied and the purpose of the treatment. The most important types of seed priming are explained below:

Hydropriming

Hydropriming is the cheapest and most straightforward method of priming. In hydropriming, seeds are water-soaked for a controlled period of time and then dried to the same moisture content as originally prior to sowing. Hydropriming induces the initial metabolic processes needed for germination with the help of no costly chemicals or special equipment.

Osmopriming

Osmopriming includes the seeds being soaked in osmotic agents like polyethylene glycol (PEG), mannitol, or salts like potassium nitrate (KNO_3) or potassium chloride (KCl) contained in solutions. These control the absorption of water by the seeds so that the process is done gradually and radicle emergence in advance is inhibited. Osmopriming is especially useful in enhancing seed performance in stressful environmental conditions.

Halopriming

Halopriming is a technique where seeds are primed in inorganic salt solutions like sodium chloride (NaCl), potassium nitrate (KNO_3), or calcium chloride ($CaCl_2$). Besides enhancing germination, this priming also aids in the tolerance of seedlings to salinity and other abiotic stresses and can prove beneficial for planting in saline or marginal soils.

Hormonal Priming

In hormonal priming, seeds are subjected to treatment with plant growth regulators (PGRs) like gibberellic acid (GA_3), kinetin, or salicylic acid. These hormones activate seed metabolism, enhance germination percentages, and encourage simultaneous emergence of seedlings. Hormonal priming is also useful in the breaking of seed dormancy and enhancing seedling vigor.

Biopriming

Biopriming refers to a seed treatment technique in which seeds are immersed in water or a nutrient solution with the presence of helpful microorganisms, e.g., Trichoderma species or Pseudomonas species. Biopriming is a combination of seed hydration and biological defense against soil-dwelling disease-causing pathogens. Biopriming not only enhances germination and plant growth but also suppresses disease in the initial stages of crop growth.

Nutripriming

Nutripriming is the process of soaking seeds in solutions of essential nutrients, particularly micronutrients like zinc (Zn) or molybdenum (Mo). This technique is used to overcome micronutrient deficiency at the beginning of germination and seedling establishment, resulting in healthier, more vigorous plants.

Benefits of Seed Priming in Vegetable Crops

Seed priming is endowed with various important benefits that help ensure the successful growth of vegetable crops. These benefits enhance better germination, robust plant development, and increased resistance to harsh environmental stresses. The major benefits of seed priming are discussed below:

Better Speed and Uniformity of Germination

Seed priming increases the rate and uniformity of germination substantially. Primed seeds can carry out the initial phase of germination at a faster rate following sowing, which results in a more even crop stand. Uniformity is important for effective field management and harvesting.

Improved Seedling Vigor

Priming enhances robust and healthy early seedling development. It enhances the growth of the roots and shoots at the early stage of plant establishment. Consequently, primed seedlings are more vigorous and have the ability to tolerate environmental stresses better.

Improved Stress Response

Primed seeds have exhibited enhanced germination and seedling establishment even under sub-optimal or stressful conditions like drought, salinity, or low temperature. This renders seed priming especially valuable in regions with a high risk of abiotic stresses or where optimal sowing conditions are hard to achieve.

Enhanced Nutrient Uptake

Since priming leads to early and superior root development, seedlings can better draw water and nutrients from the soil. With improved

nutrient uptake, there is healthier growth and potential overall enhanced crop performance.

Disease Resistance

In the instance of biopriming, where seeds are coated with helpful microorganisms, primed seeds tend to be more resistant to soil-borne diseases. The plant-protecting properties of such microbes reduce the incidence of seedling diseases and provide for improved plant health in the important early growth stages.

Application of Seed Priming in Vegetable Crops

Seed priming has been effectively utilized in a great variety of vegetable crops, for which it has enhanced germination, seedling strength, and resistance to environmental stresses. The type of priming and its advantage may differ in accordance with the crop and the desired growing conditions. A few examples of seed priming applications in vegetable crops are mentioned below:

Tomato (*Solanum lycopersicum*)

In tomato, osmopriming with chemicals like polyethylene glycol (PEG) or potassium nitrate (KNO_3) has been shown to improve germination substantially, especially under water-deficient or drought conditions. This serves to improve crop establishment even in situations where moisture supply is poor.

Onion (*Allium cepa*)

Onion, in hydropriming by soaking the seeds in water, has been effective in enhancing uniform germination and seedling emergence. This low-cost and simple priming technique is useful for securing a uniform crop stand.

Carrot (*Daucus carota*)

In carrot, hormonal priming with gibberellic acid (GA_3) facilitates enhanced seedling emergence, particularly where sowing takes place in cooler soils. The treatment assists in overcoming low-temperature challenges during germination.

Cucumber (*Cucumis sativus*)

In cucumber, salt solution-induced halopriming has been found to exhibit beneficial impacts in enhancing seed germination in saline soils. This process enables the seedlings to handle salt stress more effectively during the vulnerable initial growth period.

Chili and Capsicum (*Capsicum* spp.)

On chili and capsicum, biopriming with desirable microorganisms like Trichoderma species was effective in increasing both seedling vigor and disease resistance. This practice gives biological protection against pathogens in the soil while inducing healthier early growth.

Limitations and Considerations

Although seed priming has many benefits to improve germination and seedling establishment, there are some limitations and aspects that must be thoroughly taken into consideration before implementing this method.

Species and Variety Response

Various species of vegetables and even within a species, varieties respond differently to seed priming. What is effective for a particular crop or variety may not be the same for another. One must, therefore, perform initial trials or refer to guidelines found in research recommendations prior to applying the priming treatments on a large scale.

Storage of Primed Seeds

One of the important things to consider with seed priming is that primed seeds tend to have a reduced shelf life in comparison to untreated seeds. Any physiological changes that are triggered during priming can lower seed storability, and therefore, it is critical to utilize primed seeds within a certain time frame following treatment to avoid viability loss.

Cost and Practicality

Although techniques such as hydropriming are cheap and easy, some priming chemicals—e.g., osmotic solutions (e.g., polyethylene glycol) or plant growth regulators—are costly and not economically viable for small farmers or those with limited resources. Some priming methods also need technical expertise or the availability of specific materials, which might not always be at hand.

CONCLUSION

Seed priming is a cost-effective and effective method for enhancing germination, seedling quality, and seedling establishment in vegetables.

By adopting appropriate priming techniques specific to the crop, variety, and location, farmers can have more homogeneous crop stands, higher productivity, and improved resistance to abiotic stresses like drought, salinity, or low temperatures. Looking forward, forthcoming developments in seed priming technology-involving the incorporation of biostimulants, beneficial microorganisms, and nanotechnology-foster very high hopes for further promoting the sustainability and effectiveness of vegetable production systems.

REFERENCES

Corbineau, F., Taskiran-Özbingöl, N., & El-Maarouf-Bouteau, H. (2023). Improvement of seed quality by priming: concept and biological basis. *Seeds*, *2*(1), 101-115.

Dhal, P., Sahu, G., Dhal, A., Mohanty, S., & Dash, S. K. (2022). Priming of vegetable seeds: a review. *The Pharma Innovation Journal*, *11*(2), 519-525.

Maiti, R. K., Vidyasagar, P., Rajkumar, D., Ramaswamy, A., & Rodriguez, H. G. (2011). Seed priming improves seedling vigor and yield of few vegetable crops. *International Journal of Bio-resource and Stress Management*, *2*(1), 125-130.

Thakur, M., Tiwari, S., Kataria, S., & Anand, A. (2022). Recent advances in seed priming strategies for enhancing planting value of vegetable seeds. *Scientia Horticulturae*, *305*, 111355.

Zulfiqar, F. (2021). Effect of seed priming on horticultural crops. *Scientia horticulturae*, *286*, 110197.