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# Seed Priming: Types and Importance

**Bhanu Verma[1*] and Payal Mathur[1]**

[1]ICAR- Division of Seed Science and Technology,

Indian Agriculture Research Institute, New Delhi

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Seed enhancement refers to the post harvest seed treatment aiming at improved germination, seedling growth and facilitates seed delivery during sowing. Various seed enhancement techniques aim at improving the performance of seeds owing to better yield. It comprises of priming, seed coating and seed conditioning technologies. Seed priming is an old experimental tactic employed by farmers since eras to improve germination activities in crop plants. Seed priming increases the vigour of seeds and seedlings through metabolic and biochemical processes occurring during controlled hydration, followed by dehydration. Suitable policy intervention to strengthen the extension services to encourage priming of seeds in rural masses shall be encouraged.

## INTRODUCTION

One of the most essential factors in enhancing agricultural production in any farming system is the use of high-quality seeds. This factor is now more important than ever in ensuring adequate food security for the world's growing population, which is estimated to reach nine billion people by 2050. High-yielding cultivars that are suitable to the production area, have disease, pest, lodging, and shatter resistance, as well as other desired features, are essential for optimum crop performance and yield. Any effective agriculture programme relies on the production of high-quality seed. It's also a good marketing strategy for boosting crop sales potential, especially in today's competitive industry. Seed quality can be defined in a variety of ways. For a farmer, it is the high-quality seed that produces rapid uniform plants with high yielding capacity under a wide range of field conditions.

In spite of the promotion of high-yielding cultivars, the majority of tropical land fails to provide optimal growing conditions for these high-yielding crops, resulting in low yields even after the use of necessary agrochemicals. The indiscriminate use of these pesticides

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pollutes the environment, degrades soil, and places a financial strain on farmers. Providing restorative solutions to fragile ecosystems is difficult for agricultural researchers. In this context, to curtail the effects of climate change and continue cultivation practices under fragile ecosystems, the adoption of eco-friendly and economical techniques such as seed priming, low-input sustainable agriculture, conservation agriculture, etc., are a key. In commercial agriculture, rapid and uniform seed germination is critical for proper crop establishment, economic sustainability, and efficient use of production resources. Seed priming is a cost-effective and practical method for achieving consistent seed growth in field crops. Seed priming is a low-cost, high-effective hydration method for promoting seed germination. Seeds go through a physiological process during priming, such as controlled hydration and drying, which results in a better pregerminative metabolic process for faster germination.

## FACTORS AFFECTING SEED PRIMING

Priming period, priming agent, and oxygen delivery to seed all have an impact on the seeds of different crops. Following the preceding elements, physical and chemical characteristics such as osmotic potential, temperature, presence or absence of light, aeration, and seed condition can influence priming and impact germination rate and time, seedling vigour, and subsequent plant development.

## TYPES OF SEED PRIMING

### Hydro priming

Hydro-priming is one of the oldest and cost-effective pre-sowing seed priming method in which seeds are treated with water. This technique relies on seed soaking in water followed by re-drying to original moisture content. This approach allows seeds to imbibe water and aids in obtaining the germination phases in which pregermination metabolic processes begin, while the subsequent two phases of germination are blocked.

### Osmo priming

In hydropriming, entry of water in seed is very fast due to the high water potential of pure water, which may not be congenial for germination and other metabolic activities under diverse agro-ecologies. Seeds are soaked in an osmotic solution such as sugar, polyethylene glycol (PEG), glycerol, sorbitol, and mannitol, then air dried to overcome this barrier. Osmosis regulates the amount of water that enters the seed during imbibition, lowering ROS

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levels and protecting the cell from oxidative damage. In both saline and non-saline situations, osmopriming promotes crop performance.

**Drum priming**

In this technique, seeds are gently rotating in drum and gradually hydrated by addition of water in vapor form. Drum priming allows seed imbibition in a controlled manner. The drum was mounted on an electronic balance, linked to a computer which monitored the seed water content, and controlled the production of water vapour. Specially designed apparatus enables monitoring of the seed weight, precise regulation of time, and water amount during hydration process, what ultimately results in an appropriate and uniform moisture level of the seeds

**Halo priming**

Different chemical solutions are also used as priming agents. Soaking of seeds in the solution with inorganic salts, viz. NaCl, $KNO_3$, $CaCl_2$, and $CaSO_4$, is known as halopriming. It stimulates the crop to raise robust even under soil salinity.

**Hormonal priming**

Hormonal-priming is the process of priming seedlings using hormone solutions. Seed imbibition during this process is aided by plant growth regulators, which have a direct effect on seed metabolism. It is typically done with growth regulators such as abscisic acid, salicylic acid, ascorbic acid, cytokinins, auxins, gibberellins, kinetin, ethylene, and polyamines.

**Solid Matrix Priming**

Solid matrix priming (Matri-conditioning) is a pre-seed treatment process in which seeds are mixed with known proportions of a solid material and water. In SMP, the seed and matrix compete for available water. Seeds that absorb water reach an equilibrium point, which is exactly where priming takes place. After that, the seeds are separated from the matrix and thoroughly washed and dried.

**Bio priming**

Seeds that have been bio primed with microorganisms promote plant growth and development by regulating many biochemical and physiological processes, as well as stress tolerance and resistance mechanisms. During the early stages of plant phenology, bio priming activates certain signalling pathways, resulting in faster plant defence responses. It has

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various advantages over chemical treatments, including being cost-effective, time-saving, and environmentally friendly, as well as providing desired qualities to treated seeds.

**Nutripriming**

Broad spectrum nutrient seed priming (BSN), is based on imbibing seeds in mixture of minerals, such as zinc, copper, manganese, molybdenum, and phosphorus, which has been proved to fertilize the seed and provides the nutrients for early growth, which positively affects germination, seedling vigor, and root system development.

**EFFECTS OF PRIMING**

A benefit–cost (B:C) ratio study, which may be defined as an evaluation of expenditure by comparing economic benefit with the economic cost of an activity, can be used to determine the economic profit of a crop using any technology. Seed priming techniques reduce chemical input requirements of the crop by increasing efficiency which helps in enhancing the B:C ratio.

To obtain a critical MC that will trigger metabolic activity in a controlled environment, all priming strategies rely on the controlled absorption of water. Increased germination rate and percentage seedling emergence (particularly at suboptimal temperatures for germination) as well as decreased photosensitivity are well studied advantages of priming. It also increases water efficiency, making it suited for usage in drought-prone areas.

It can be applied to seeds in order to provide protection for seeds during storage, improve germination, germination synchronization, and plant growth, as well as to increase the resistance of crops to abiotic or biotic stress conditions, which can help to reduce the required quantities of pesticides and fertilizers.

In plant defence, priming is used as a physiological process by which a plant prepares to respond to imminent abiotic stress more quickly or aggressively.

**CONCLUSION**

Seed priming is emerging as a very efficient technology to boost crop performance in areas more prone to climate change. Plants raised from primed seeds show sturdy and quick cellular defence responses even in adverse climatic conditions. Government should encourage suitable policy intervention to strengthen the extension services so that such technologies can reach farmers at suitable time and place.