

Upcoming Technique to Boost Farmers Income- Seed Priming

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Definition:

Seed priming is defined as a pre sowing treatment in which seeds are soaked in an osmotic solution that allows them to imbibe water and go through the first stage of germination, but does not permit radicle protrusion (Heydecker and Coolbear, 1977)

Purpose:

- Priming exhibits uniform and faster germination rate, seedling vigour and crop establishment under adverse conditions.
- Priming overcomes thermodormancy. High temperatures (35°C) inhibit accumulation of free amino acids and esterase activity required for radicle protrusion, which can be reversed by seed priming with kinetin leading to germination (Cantliffe, 1981).
- It reduces the soil borne destructive diseases.
- Priming also enhances viability of low vigour seeds. (Pawar and Laware, 2018)

Disadvantages:

- Prolonged seed treatment during priming may cause loss of seed tolerance to desiccation and some priming treatment can determine contamination with fungi and bacteria.
- The longevity of primed seeds is reduced, compared to non primed seeds.
- Seed priming with advanced methods such as priming with nano-particles may have deleterious effects on plant, human health as well as on the environment.

- All priming protocols may not lead to significant germination and growth where inappropriate priming conditions may cause degradation of the protective proteins.

Phases of germination:

- **Phase 1:** First phase is called as Imbibition phase, which involves quick water uptake through forces driven by seeds.
- **Phase 2:** Second phase is the lag phase where there is less water uptake resulting in minor increase in fresh weight of seeds. This phase is also called as Activation phase
- **Phase 3:** The third phase is germination phase. In this phase, germination is completed and seedling growth starts by recommencement of radicle and quick water uptake. (Pawar and Laware, 2018)

Types of Seed Priming:

- **Hydro priming:** Hydro priming is most commonly used method of seed priming. It is achieved by continuous or successive addition of a limited amount of water to the seeds. It is a very important technique which results in rapid germination, improved seed growth and uniform stand establishment in various crops (Adebisi *et al.*, 2013)
- **Halo priming:** Halo priming is soaking seeds in inorganic salt solutions such as NaCl, KCl etc. Even under adverse environmental conditions *viz.*, temperature extremes, oxygen deprived condition, it promotes uniform germination and better crop performance. (Anju and Sheeja, 2019).
- **Osmo priming:** Osmo priming also called osmo conditioning, is the soaking of seeds in osmotic solutions containing chemicals such as mannitol, polyethylene glycol (PEG), sorbitol, glycerol etc. Due to the low water potential of osmotic solutions, seed uptakes water slowly which permits seed imbibition and activation of early phases of germination but hinder radicle protrusion.
- **Hormonal priming:** Priming of seeds using hormone solutions is referred to as hormonal priming. Plant growth regulators used for seed imbibition during hormonal priming have direct effect on seed metabolism. Regulators such as abscisic acid, salicylic acid, ascorbic acid, cytokinins, auxins, gibberellins, kinetin, ethylene, polyamines are commonly used for hormonal priming (Mohammad *et al.*, 2020).

- **Solid Matrix priming:** This is a technique or method in which seeds are mix with wet solid water basically water uptake by seeds can be controlled. Afterward, seeds are separated from matrix and washed thoroughly and dried. Vermiculite, peat moss, charcoal, sand, clay and some exemplary solid carries applied in solid matrix priming (Dipika *et al.*, 2019).
- **Bio-priming:** Bio-priming is an ecological approach which combines biological aspects such as seed inoculation with beneficial organism to protect the seed to control diseases and physiological aspects as hydrating seed. (Mohammad *et al.*, 2020)

Advanced methods of seed priming:

- **Seed priming through Nanoparticles:** In agriculture the excessive use of chemical fertilizers can be reduced by utilizing nanomaterials. (Upadhyaya *et al.*, 2017)
- **Seed priming through Physical agents:** Different physical agents used for seed priming are as the magnetic field, UV radiation, gamma radiation, X-rays and microwaves (Bilalis *et al.*, 2012)
- **Seed priming through macronutrients:** Primed seeds usually have better and more synchronized germination (Farooq *et al.*, 2009) In micronutrient seed priming (nutripriming), micronutrients are used as osmotica.

Factors affecting seed priming:

The major factors influencing seed priming are light, aeration, temperature, time and seed quality-

- **Aeration:** Aeration influences the seed respiration and viability which contributes to synchronize germination and assures a safer seed habitat.
- **Light:** Light effect is varied widely with species. Beneficial effect of seed priming could be modified by light quality.
- **Time:** Duration of the priming process varies according to the type of osmotica, osmotic potential of the solution and temperature during priming.
- **Temperature:** If the soaking temperature is maintained below the optimum range then the radicle growth during priming may be restricted. Haigh *et al.*, (1987) reported that

seed priming for 14 days at 15° C was found more effective in improving the seed germination of tomato, carrot and onion than that at 25° C.

- **Osmotic potential:** Osmotic potential of the solution is another factor affecting the effectiveness of priming. Ali *et al.*, (1990) reported that germination of tomato seeds primed in a solution having an osmotic potential of -0.58 to -0.86 MPa was found to be more compared to solution having an osmotic potential of -1.19 or -1.49 Mpa.

