



## Review on effect of seed priming in vegetable crops

Pankaj Kumar Ray<sup>1</sup>, Raj Narain Singh<sup>2</sup>, Anjani Kumar<sup>3</sup>

<sup>1</sup> Subject Matter Specialist (Horticulture), Krishi Vigyan Kendra, Saharsa, Bihar, India

<sup>2</sup> Associate Director Extension Education, Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India

<sup>3</sup> Director, ICAR-ATARI, Zone-IV, Patna, Bihar, India

### Abstract

Vegetable crops comprise a major part in Indian agriculture in terms of providing food and nutritional security. Recommended per day consumption of vegetables is 300 g. In recent past, Indian agriculture has witnessed a tremendous progress in vegetable production, due to the advent of high yielding varieties and new technologies. Vegetables are important sources of vitamins, minerals and other nutrients of medicinal and therapeutic value. Due to the percent of low germination rate and seedling emergence yield of the crops decreasing day by day. Poor seed germinations and inappropriate crop stand are the main constraints in the production of vegetable crops. Farmers are not having sufficient resources for seedbed preparation for sowing and they are at more risk as compared to progressive farmers. On the other hand good establishment increases competitiveness against weeds, increases tolerance to drought period, increase yield and avoids the time consuming need for re-sowing that is costly too. Seed priming increase the percent of germination and reduce the time of seedling emergence side by side improve the crop stand. A method to improve the rate and uniformity of germination is the priming or physiological advancement of the seed lot. Seed priming is the method of improve germinations and uniform emergence of seedlings in field conditions. Although, it will improve the vigour and crop establishment and finally enhance the yield. It is a very low cost hydration technique in which seeds are treated with various chemicals or sometimes with normal water also. After treating the Seeds are re-dried and show in the field. Seed priming is generally adopted for better crop stand, germination and yield of various vegetable crops.

**Keywords:** seed priming, vegetable crops

### Introduction

Vegetables crops are important in human nutrition and its importance in daily nutrition is getting increases all around the world. Rapid germination and emergence of seedlings are essential for successful crop establishment, importance of good and high crop establishment is recognized by researchers and as well as by farmers they are major challenges in successful crop production (Murungu *et al.*, 2004) [5]. Main reasons for the successful crop stand are high germination percent and good vigor of seedlings (Noor *et al.*, 2013) [6]. Modern strategic approaches are however necessary for sustainable development of crops so as to meet increasing demand in both domestic and export market. Research on techniques for improving the germination, growth and yield of crop species has been done for many years. For successful crop establishment seed priming could play a vital role in crop production. Seed priming was first proposed by Heydecker in year 1973. It is a cost effective technique to ensure uniform emergence and high vigourity of seeds which is leading to better crop establishment and yield. It is a simple, effective and low cost technique in which seeds are partially hydrated to a point where pre-germination metabolic activities start without actual germination by treating with different chemicals or growth regulators, and then redried until close to the original dry weight. In crop production, stand establishment determines plant density, uniformity, and management options. For expensive hybrid vegetable seeds, it is particularly important that seeds germinate rapidly and

uniformly, tolerate adverse germination conditions, and produce normal seedlings. Seed vigor has been proved to be the primary factor governing seed quality, in the context of successful stand establishment. Hence seed invigouration or Enhancement of seed vigor has been a major area of interest for researchers, owing to its high industrial and economic implications. Seed invigouration is a post-harvest, pre-sowing technique for improvement of seedling emergence and stand establishment. The most promising invigouration technique for improving the rate and uniformity of plant stand is seed priming (Pandey *et al.*, 2017) [7].

### Type of seed priming

**Hydro-priming:** Soaking the seeds in water before sowing which may or may not be followed by air drying of the seeds. Hydro-priming may enhance seed germination percentage and seedling emergence under saline and non-saline conditions (Roy and Srivastava, 1999) [8].

**Halo-priming:** In this technique seeds are soaking in solution of inorganic salts i.e. NaCl, KNO<sub>3</sub>, CaCl<sub>2</sub> and CaSO<sub>4</sub> etc. A number of studies have shown a significant improvement in seed germination, seedling emergence and establishment and final crop yield in salt affected soil in response to halo-priming (Khan *et al.*, 2009) [4].

**Osmo-priming:** It is a technique where seeds are soaked in sugar solution in PEG for a certain period followed by air drying of seeds before sowing. This technique improves

germination under non-saline or saline conditions (Salehzade *et al.*, 2009)<sup>[9]</sup>.

**Hormonal priming:** In hormonal priming seeds are treated with different plant growth hormones like GA<sub>3</sub>, kinetin, NAA and ascorbate etc. This is basically a presoaking treatment which promotes the growth and development of the seedlings.

**Solid matrix priming:** This is techniques 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. When seeds are gone through this process natural imbibitions process of the soil stimulated and seeds are hydrate slowly. Vermiculite, peat moss, charcoal, sand, clay and some exemplary solid carries applied in solid matrix priming.

**Bio-priming:** In this method seeds are mainly inoculated with bacterial inoculation. The seed bio priming is not only involves in germination and seedling emergence of crop plants but also involves in protection of seeds against soil borne pathogens. Seed hydration may occur during priming and seeds are infected by pathogens it may results in a stronger microbial growth and consequently impairment of plant health. The best ecological approaches to overcome this kind of problems are applying antagonistic microorganism during seed priming. Even some bio control agents or bacteria can support the seeds or plant after germination by colonizing rhizosphere. It can be consider that bio priming is the effective method approach of disease management than other techniques such as film coating and pelleting. Bio-priming with rhizobacteria improved germination parameters of radish seeds under saline conditions. In recent days the use of bio-priming with plant growth-promoting bacteria (PGPB) as an integral component of agricultural practices.

#### Effect of hydro-priming on vegetable crops

Hydro-priming is most commonly used method of seed priming. Hydro-priming is achieved by continuous or successive addition of a limited amount of water to the seeds. Hydro-priming is a very important technique which results in rapid germination, improved seed growth and uniform stand establishment in various crops. Sikhondze and Ossom (2011)<sup>[12]</sup> conducted an experiment to determine how long okra seeds should be primed in order to influence seedling growth and development. Four time durations (6, 12, 24, or 36 hours) were taken for hydro priming okra seeds. The results showed that seedlings grown from seeds that are primed for 24 hours had the greatest mean stem length and diameter, as compared to other durations and control. Tajbakhsh *et al.*, (2004)<sup>[13]</sup> conduct experiment on onion carried different treating methods. The results indicated that hydro-priming in high humidity leads to shortening the average germination time. Kaur *et al.*, (2002)<sup>[3]</sup> found that priming of pea by water and mannitol (4%) for 12 hours at 25°C increased the number and biomass of plants knots. The positive effect of hydro priming may be due to the maintenance of tissue water content, increase in antioxidant activities and carbohydrate metabolism (Farooq *et al.*, 2005)<sup>[2]</sup>. Hydro-priming of bean seeds in water for 7-14 hours can improve the plant performance. Sharma *et al.*,

(2013)<sup>[11, 15]</sup> reported that he has taken four different priming methods like hydro-priming, osmopriming, halo-priming and solid matrix along with control. The hydro-priming technique for 12 hour duration and SM priming with calcium aluminum silicate for 24 hour significantly increased the seed germination, seedling vigour, mean germination time and marketable fruit yield. Priming in seed improve seed germination, seedling vigour and fruit yield in okra.

#### Effect of halo-priming on vegetable crops

Halo-priming- soaking the seeds in salt solutions. Yadav *et al.*, (2012)<sup>[15]</sup> conducted an experiment on 15 genotypes of okra plant where seeds were treated with three priming solutions in three replications. Three primers used for seed treatments were hydro priming, halo priming with calcium chloride and halo priming with potassium nitrate. The results showed that all seed priming treatments enhance the synchronous germination and speed of germination in genotypes IC411698 and IC89936. KNO<sub>3</sub> increases yield, fruit size and improves the quality in field and vegetables crops.

#### Effect of osmo-priming on vegetable crops

Araby and Hegazi (2004)<sup>[1]</sup> studied osmopriming effect of PEG in tomato seeds and observed the best results with a priming duration of 7 days and direct sowing. Pre-sowing treatments such as osmopriming and hydro priming in the bitter gourd seeds before sowing overcame sub-optimal environmental effects on germination and subsequent seedling establishment.

The effect of osmo-priming duration on germination, emergence and early growth of cowpea in Nigeria. Treatment consisted three osmo-priming duration (soaking in 1 % KNO<sub>3</sub> salt for 6, 8 and 10 hrs) and one hydroprimed control (10hr). The results showed that osmo-priming with KNO<sub>3</sub> for different durations were superior to unprimed treatment in term of seed germination, emergence, plant height and dry matter accumulation in cowpea. Primed seeds (both osmopriming and hydro-priming) increased performance of cowpea. However, osmo-priming with KNO<sub>3</sub> salt (soaked in 1 % KNO<sub>3</sub> salt solution and dried before sowing) for 6 hours could result in greater seed germination and seedling height than hydro-priming.

#### Effect of hormonal priming on germination of vegetable crops

Tomato seeds were primed with GA<sub>3</sub> in Utkal Kumari germination was increased by 30.56%. Venkatasubramanian and Umarani (2010)<sup>[14]</sup> conducted storage studies to compare four different methods of priming *viz.*, hydropriming, halopriming, sand matrix priming and osmopriming accomplished for two durations. The results revealed that viability of primed seeds were dependent on the method as well as duration of priming. Among the protocols studied, hydropriming (48 hours) for tomato and sand matrix priming (80% water holding capacity, 3 days) for eggplant and chilli were established as best methods of seed priming. Treatment capable of improving seed vigour as well as viability.

#### Effect of seed priming on flowering of vegetable crops

Satish kumar (2005)<sup>[10]</sup> reported that when brinjal seed treated with osmopriming solution increase the number of

leaves, plant height, fruit yield, fruit length and days of 50% flowering also minimize.

It can be concluded that from this review Seed priming controls the hydration level of seed and also controls the metabolic activity within the seed which is necessary for seed germination. Seed priming not only done with chemical and plant growth regulators it also can be done with antagonistic microorganisms which can be reduce soil and seed borne pathogens. Seed priming is not only adopted to improve uniform seed germination of different vegetable crops under no supporting conditions but also used to reduce the different diseases.

## References

1. Araby MM, Hegazi AZ. Response of tomato seeds to hydro- and osmopriming, and possible relations of some antioxidant enzymes and endogenous polyamine fractions. *Egyptian Journal Biology*,2004:6:81-93.
2. Farooq M, SMA Basra, BA Saleem, M Nafees, SA Christi. Enhancement of tomato seed germination and seedling vigor by osmopriming. *Pakistan J. Agri. Sci.*,2005:42: 34.
3. Kaur S, Gupta AK, Kaur N. Effect of osmo and hydropriming of chickpea seeds on the performance of crop in the field. *International Chickpea and Pigeonpea Newsletter*,2002:9:15-17.
4. Khan HA, Ayub CM, Pervez MA, Bilal RM, Shahid MA, Ziaf K. Effect of seed priming with NaCl on salinity tolerance of hot pepper (*Capsicum annum L.*) at seedling stage. *Soil Environ*,2009:28:81-87.
5. Murungu ES, Chiduza C, Nyamugafata P, Clark LJ, Whalley WR. Effect of on farm seed priming on emergence, growth and yield of cotton and Maize in a semi-arid area of Zimbabwe. *Experimental Agriculture*,2004:40(1):23-36.
6. Noor-un-nisamemon, Moulabuxgandahi, VajantimalaPahoja and Nasimshar. Response of seed priming with boron on germination and seedling sprouts of broccoli. *International Journal of Agricultural Science*,2013:3(2):183-194.
7. Pratima Pandey, Bhanuprakash K, Umesh. Effect of Seed Priming on Seed Germination and Vigour in Fresh and Aged Seeds of Cucumber. *International Journal of Environment, Agriculture and Biotechnology (IJEAB)*,2017:2(4):2261-2264.
8. Roy NK, Srivastava A. Effect of presoaking seed treatment on germination and amylase activity of wheat (*Triticum aestivum L.*) under salt stress conditions. *Rachis*,1999:18:46-51.
9. Salehzade H, Shishvan MI, Ghiyasi M, Forouzin F, Siyahjani AA. Effect of seed priming on germination and seedling growth of wheat [*Triticum aestivum(L.)*] *Res J Biol. Sci*,2009:4:629-31.
10. Satish kumar L. Influence of presoaking seed treatment and seed pelleting on storability in brinjal (*Solanum melongena L.*). *Ind. Hort*,2005:32:78-82.
11. Sharma AD, Rathore SVS, Srinivasan K, Tayagi R. Comparison of various seed priming method for seed germination, seedling vigour and fruit yield in okra [*Abelmoschus esculentus (L.) Moench*]. *Scientia Horticulturae*,2013:165:75-81.
12. Sikhondze DK, Ossom EM. Impact of priming okra (*Abelmoschus esculentus L.*) seeds on seedling performance in Swaziland. *Advances in Environment Biology*,2011:5:1221-1228.
13. Tajbakhsh M, Brown PH, Gracie AJ, Spurr CJ, Donovan N. Mitigation of stunted root abnormality in onion (*Allium cepaL.*) using seed priming treatments. *Seed Science and Technology*,2004:32(3):686-692.
14. Venkatasubramanian A, Umarani R. Storability of primed seeds of tomato (*Lycopersicon esculentum*), eggplant (*Solanum melongena*) and chilli (*Capsicum annum*). *Madras Agricultural Journal*,2010:97:117-124.
15. Yadav SK, D Kumar, V Kumar, Z Hussain, AD Sharma, Kumar A. Seed priming effects on diverse germplasm of okra [*Abelmoschus esculentus (L.) Moench*]. *Vegetos*,2012:25:202-209.