



Seed Priming with Micronutrients for Quality and Yield

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Nutrient priming is a technique in which seeds are soaked in mineral nutrient solution with subsequent re-drying to the initial moisture content. It is one of the physiological methods, which improves seed performance and provide faster and synchronized germination.

Introduction

Nowadays food security is one of the major achievements by increasing crop productivity. However, crop productivity in developing world faces several constraints. One of the major constraints is unavailability of micronutrients in appropriate amount to crops. Researchers have estimated that 60% of the world's agricultural lands are suffering from food shortage caused by lack and non availability of micronutrient elements. These micronutrients are important for achieving higher yield. Normally these nutrients are provided through different methods like, soil application and foliar spray. But these are expensive and sometime plant roots are unable to absorb. So we have to develop alternative method to increase the micronutrients. One of such method is "Seed Nutripriming".

Nutrient seed priming is a technique in which seeds are soaked in a mineral nutrient solution with subsequent re-drying to the initial moisture content. The final goal is an improvement of germination rate, early seedling growth and stress resistant, acting via and improved micronutrient status and a pre activation of metabolic pathways important for germination during the pre imbibitions treatment.

Micronutrients take part in a number of biochemical and physiological processes during germination and early seedling establishment and important functions in membrane stabilization, free radical detoxification. Micronutrients are required in very small quantities. There are mainly 3 methods of micronutrient application in crops: soil application, foliar spray and seed treatment. The use of micronutrient enriched seeds (seed priming) has been reported to be a better strategy in overcoming micronutrient.

The nutrient priming has been reported to be a useful strategy in overcoming micro nutrient deficiency. It is one of the physiological methods, which improves seed performance and provide faster and synchronized germination. Nutrient seed priming has been shown to enhance the speed of germination and stress tolerance. Treating seeds with micronutrients potentially provides a simple inexpensive method for improving micronutrient plant nutrition (Farooq *et al.*, 2012).

Micronutrients

Micronutrients are those elements essential for plant growth which are needed in only very small (micro) quantities. The micronutrients are: Boron (B), Copper (Cu), Iron (Fe), Chloride (Cl), Manganese (Mn), Molybdenum (Mo), Zinc (Zn) and Cobalt (Co)

Iron: Iron is essential for chlorophyll synthesis, which is why an iron deficiency results in chlorosis. Dill seed yield was also influenced by Fe and B treatments (Mirshekari, 2012). The highest seed yield was recorded for seeds soaked for about 12 h in solutions with concentrations of 1.5% Fe + 1% B and 1.5% Fe, which had a nearly 20% and 13% greater yield than the control, respectively. The essential oil concentration of seeds was 2.62% for 1.5 % Fe and 2.78% for 1.5% B solutions.

Boron: Boron is very important in cell division and in pod and seed formation. Boron ranks third place among micronutrients in its concentration in seed and stem as well as its total amount after zinc (Robinson, 1973). Priming of rice seeds in 0.001 and 0.1%B solutions increase the germination percentage, seedling vigour and reduce the emergence time. Soybean seeds were primed with 0.5mM and 10mM boric acid has increased micro- nutrient content in the seeds upto 2 times. Increased plant height, fruiting and bean pod yield was recorded when seeds were primed in 0.5% B solution with a concomitant reduction in days to 50% flowering.

Copper: Copper is necessary for carbohydrate and nitrogen metabolism and it also is required for lignin synthesis which is needed for cell wall strength. Maize seed primed with 0.1% copper sulphate, has increased seed emergence. Watermelon seeds primed with CuSo₄ 0.1% for 4 hours, enhanced the germination percentage and seedling vigour .

Zinc: Zinc is one of the most important essential nutrients required for plant growth. It acts as an activator of several enzymes in plants and is directly involved in the biosynthesis of growth substances such as auxin which is involved in plant growth and cell division. Also, required for chlorophyll production, pollen function, fertilization and germination. Corn seeds priming with zinc expressed high dry weight (g) and seed weight per plant (g) than the molybdenum and water. Wheat seed was priming for 10 hr in 0.3% Zn significantly increased the mean shoot dry mass, Zn concentration and Zn uptake of 15 day old seedlings relative to control and hydroprimed seeds. Chickpea seeds primed with 0.05% Zn for 6 hr in has increased mean grain yield, harvest index and dry matter production. Rice seeds primed with zinc and boron increased the zinc and boron content in seeds compared to control and hydro primed seeds. Soybean seeds were primed with 15Mm ZnSO₄ has increased micro-nutrient content (Zn) of seeds upto 5 times. Wheat and chickpea seeds were primed with water and ZnSO₄. Among these Zn priming was effective in both crops. The yield of chickpea increased 19 % and wheat 14%. But water primed seeds increased the yield in wheat 6% and chickpea 7% compared to control. Priming of carrot seeds with Zn (1.5%) recorded highest emergence percentage (81), rate of emergence (5.63), vigor index (1760), hundred seedling weight (5.73) were in control (61, 3.83, 730 and 4.11, respectively).

Cobalt: Cobalt affects metabolism and plant growth and is an essential component of several enzymes and co-enzymes. In summer squash (*Cucurbita pepo* L.), seed priming with cobalt sulfate substantially increased dry matter accumulation, femaleness and fruit yield compared with water soaked seeds. In addition, priming with CoSO₄ triggered endogenous ethylene synthesis during early seedling stages (14 days after sowing), which continued until flower initiation (30 days after sowing).

Manganese: Soybean seeds were primed with 0.5mM and 10mM boric acid has increased content of micro- nutrient in the seeds upto 2 times for B.

Molybdenum: Molybdenum (Mo) is required for nitrogenase, one of the enzymes involved in nitrogen fixation, it is has been suggested that some leguminous species growing in acid soils may be Mo – deficient. It is essential to plant health. Molybdenum is used by plants to reduce nitrates into usable forms. Priming of *Brassica napus* with molybdenum increased germination and seedling growth. Mo primed maize seeds has increased dry weight of the seedlings. Nitrate reductase activity increase in wheat seedlings when seeds were primed with molybdenum.

Advantages of Seed Priming with Micro Nutrients

- Enhance the speed of germination
- Enhance the uniform germination
- Improve stand established
- Improve seedling vigour
- Increase drought tolerance.
- Reduce pest damage
- Ultimately increase crop yield
- Release of dormancy
- Alleviation of phytochrome-induced dormancy
- Less sensitive to oxygen deprivation
- Reducing the EC of seed leachates
- Faster pre emergence of uniform seedlings is achieved.
- The effect of uneven application of micronutrients to the soils are avoided
- Each seed is exposed to the nutrient; initial uptake is guaranteed.
- The nutrient is available early in the life of the plant.
- The amounts required are likely to be orders of magnitude less, and thus less costly, than for soil application.
- Eco friendly method.
- Agronomically beneficial method.
- Improving the micronutrient status of plants would increase micronutrient content of the seeds, leading to better nutrition of the progeny crop and to improved human micronutrient nutrition.

Primed seed is stored under conducive conditions (low temperature and low moisture) most of the beneficial effects of priming are retained. However, the storability of the primed seed per seed is either improved or affected, depending upon the initial physiological status of the seed.

Conclusion

Priming of seeds with micro or macro nutrient (Nutri priming) is a simple and inexpensive method. By adopting this method we can increase germination rate and seedling vigour with increase of yield.

References

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