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Seed bio-priming: Step toward disease management

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ABSTRACT

Biopriming is a procedure of seed treatment with biological means that includes integration of seed hydration and beneficial microorganism inoculation. It induces seed germination, viability, vigour, plant growth and protection against seed or soil borne pathogen and ultimately improve crop yield. Bio-priming of seed uses microbial inoculants of plant growth promoting rhizobacteria and fungi. It is an eco-friendly strategy using selected microorganism which produces substances for growth promotion and pathogen inhibition. Presently, seed treatment with biological inoculants is being used as a substitute to synthetic chemical pesticides and fertilizers in agriculture for plant and soil health improvement. Using biocontrol agents with priming agents for seed treatment over simple seed coating has potential advantages and serves as a better strategy of managing many seed and soil-borne diseases. Seed priming results under adverse condition of soil useful in uniform and rapid seedling. In this review we suggested that bio- priming can be used commercially as substitute of chemical pesticides and fertilizers for managing seed and soil borne diseases and plant growth promotion respectively.

INTRODUCTION

Bio-priming of seed is a wonderful approach to meet the demand of chemical free food and increasing population. To achieve this goal, every country is moving to organic farming or sustainable farming. Quality of seed with rapid germination, productivity and higher yield potential are most important factor in agriculture. Nutrient substances secretion from roots attract many microorganisms in their rhizosphere **(Walker et al., 2003) and** have close relationship with plant **in which** some are beneficial and other are harmful. Beneficial microbes refer to plant growth promoting agents because they have ability to induce plant growth and development. They can live as endophytes or in the surrounding area of plant roots (**Kloepper et al., 1980).**

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Biopriming provide resistance to plant against biotic and abiotic stresses while improving the production and productivity of crop with seed quality improvement. Bio-priming involve seed treatment with beneficial microorganism under controlled condition which increase the initial procedures prior to germination without the appearance of the radicle. Secretion of substance and solubilisation of mineral are directly involve in plant growth promotion activity through seed biopriming. Nitrogen is a principal ingredient of amino acid, chlorophyll and other plant structural components **(Leghari et al., 2016).** Biopriming uses different beneficial microorganisms to increase plant growth promoting activity and managing diseases. Microorganisms used for biopriming includes beneficial fungi and bacteria involve different species of *Trichoderma* and *Pseudomonas,Bacillus* respectively among others. They improve seed germination percentage, enhance seedling vigour and manage soil and seed borne pathogens. Seed biopriming with *Trichoderma harzianum* reported to reduce the incidence of root rot diseasein cowpea **(El-Mohamedy*et al*., 2006).** Biological seed treatment is promising method that enhances stress tolerance of seed before germination **(Harman and Taylor 1988; Jenson *et al*. 2004**).

SEED BIO-PRIMING METHODOLOGY

Biopriming includes 12 hours seed soaking in water. Selected microorganism product formulation at the rate of 10g/kg mixed well to pre-soaked seed. Use polythene bags for filling treated seed, heaped, covered with moist sack of jute and incubate at approximately 25-32 °C for 48 hours to maintain high humidity. Bioagent adhering to surface of seed grows and form a protective covering on seed coat during this period. These seed after biopriming can be sown directly and stored safely up to 2 months in appropriate conditions. There are several beneficial microorganisms such as *Pseudomonas fluorescence*, *Bacillus polymyxa*, *Trichoderma viride*,*T. harzianum* can be used for biopriming of seed. These bioagents already described to enhance plant growth as well as reduction in incidence of many plant diseases produce by seed and soil borne pathogens. Some studies revealed that bioagents consortium (*Trichodermaharzianum* + *Pseudomonas flourescens)* are more effective than using of single microorganism bio-priming **(Prasad *et al*., 2016).** Forbiopriming of seed prepared cell/spore suspension first mixed with 1% of Carboxy Methyl Cellulose. Seed treatment can be given with microbial culture either singly or in combination by soaking into cell/spore suspension for 2 hours. Air dry seed for 2 hours at

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room temperature and then incubate for another 2 hours in moist chamber for 24 hours **(Yadav*et al*., 2012).**

MANAGEMENT OF BIOTIC STRESS THROUGH BIO-PRIMING

Seed treatment is an effective strategy toward disease management. Seed treatment by synthetic chemical pesticide are widely using from past decades. Because of their harmful effect on human and environmental health promotes biological management of seed and soil borne pathogens. Currently biopriming is a most popular method for seed treatment includes beneficial microorganism inoculation and hydration of seed to manage seed and soil borne diseases **(Bisen*et al*., 2015).** This method of seed treatment protect seed from pathogen as well as increase uniformity and rate of germination and observed best technique to manage plant disease and growth promotion **(Müller and Berg 2008).** Nowadays, plant growth-promoting rhizobacteria use in biopriming is a basic ingredient of agricultural practice **(Glick, 2012).** Release of malic acid from plant attract bacteria while infection with pathogens. PGPR form biofilm on roots of plant and also compete with other soil microorganism in rhizosphere for nutrition and colonization to protect from harmful pathogens (Rudrappa*et al*., 2008; **Walker *et al*. 2003).** They also limit plant pathogens growth through secretion of siderophores and lytic enzymes **(Compant and Sessitsch 2010).** Seed biopriming with *Pseudomonas flourescens* @ 1×10^7cfu/seed provide better protection against damping off disease in maize plant which is caused by fungal pathogen *Pythiumultimum* (**Callan*et al*., 1990**). In pearl millet biopriming with different isolates of *Pseudomonas fluorescens*showed enhanced germination, seedling vigour and elicited resistance against downy mildew disease **(Raj *et al*., 2004).** Biopriming of seed with *Trichoderma* spp. is also a better option which manages pathogen through antimicrobial compound secretion and also induces plant tolerance level against abiotic stresses **(Ahmad *et al*., 2015; Mastouri*et al*., 2012).** Seed biopriming with *Trichoderma* spp. activate reactive oxygen species detoxification system and induce pathogenesis related proteins accumulation at initial stage of root colonization (De Palma *et al*., 2019; **Yedidia*et al*., 2000).** Many studies suggested that treatment with beneficial microbes enhance resistance of plant through lignification and generation of ROS **(Meshram*et al*., 2019; Patel *et al*., 2017).**

CONCLUSION

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Use of beneficial microorganism in agriculture for increasing crop yield and plant disease management now in trend because of unwanted serious health issues associated with the use of synthetic chemical pesticides and fertilizers. Seed treatment is wonderful technique to manage seed and soil borne diseases. Biopriming is also seed treatment strategy in which beneficial microorganism used with a priming agent. That is eco-friendly approach reduces the effect of biotic and abiotic stresses while inducing plant growth in different ways.

STATEMENT OF SIGNIFICANCE

This study will help the researcher to uncover the critical areas of minimal dose of chemicals to overcome fear of environmental toxicity to humans, animals and plants itself since living organisms are used alongside of a priming agent that lessens the risk of air and water pollution.It becomes a healthy approach for the management and improvement in qualitative and quantitative yield of the plants.

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REFERENCES

Walker, T. S., Bais, H. P., Grotewold, E., &Vivanco, J. M. (2003). Root exudation and rhizosphere biology. *Plant physiology*, *132*(1), 44-51.

Kloepper, J. W., Leong, J., Teintze, M., &Schroth, M. N. (1980). Enhanced plant growth by siderophores produced by plant growth-promoting rhizobacteria. *Nature*, *286*(5776), 885.

Leghari, S. J., Wahocho, N. A., Laghari, G. M., HafeezLaghari, A., MustafaBhabhan, G., HussainTalpur, K., ... & Lashari, A. A. (2016). Role of nitrogen for plant growth and development: A review. *Advances in Environmental Biology*, *10*(9), 209-219.

El-Mohamedy, R. S. R., AbdAlla, M. A., &Badiaa, R. I. (2006). Soil amendment and seed bio-priming treatments as alternative fungicides for controlling root rot diseases on cowpea plants in Nobaria Province. *Research Journal of Agriculture and Biological Science*, *2*(6), 391-398.

Harman, G. E., & Taylor, A. G. (1988). Improved seedling performance by integration of biological control agents at favorable pH levels with solid matrix priming. *Phytopathology*, *78*(5), 520-525.

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ISSN:0971-1260
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Jensen, B., Knudsen, I. M., Madsen, M., & Jensen, D. F. (2004). Biopriming of infected carrot seed with an antagonist, Clonostachysrosea, selected for control of seedborne Alternaria spp. *Phytopathology*, *94*(6), 551-560.

Prasad, S. R., Kamble, U. R., Sripathy, K. V., Bhaskar, K. U., & Singh, D. P. (2016). Seed bio-priming for biotic and abiotic stress management. In *Microbial inoculants in sustainable agricultural productivity* (pp. 211-228). Springer, New Delhi.

Bisen, K., Keswani, C., Mishra, S., Saxena, A., Rakshit, A., & Singh, H. B. (2015). Unrealized potential of seed biopriming for versatile agriculture. In *Nutrient Use Efficiency: from Basics to Advances* (pp. 193-206). Springer, New Delhi.

Yadav, S. K., Dave, A., Sarkar, A., Singh, H. B., &Sarma, B. K. (2013). Co-inoculated biopriming with Trichoderma, Pseudomonas and Rhizobium improves crop growth in Cicerarietinum and Phaseolus vulgaris. *International Journal of Agriculture, Environment and Biotechnology*, *6*(2), 255.

Müller, H., & Berg, G. (2008). Impact of formulation procedures on the effect of the biocontrol agent Serratiaplymuthica HRO-C48 on Verticillium wilt in oilseed rape. *BioControl*, *53*(6), 905-916.

Glick, B. R. (2012). Plant growth-promoting bacteria: mechanisms and applications. *Scientifica*, *2012*.

Rudrappa, T., Czymmek, K. J., Paré, P. W., &Bais, H. P. (2008). Root-secreted malic acid recruits beneficial soil bacteria. *Plant physiology*, *148*(3), 1547-1556.

Walker, T. S., Bais, H. P., Grotewold, E., &Vivanco, J. M. (2003). Root exudation and rhizosphere biology. *Plant physiology*, *132*(1), 44-51.

Compant, S., Clément, C., &Sessitsch, A. (2010). Plant growth-promoting bacteria in the rhizo-and endosphere of plants: their role, colonization, mechanisms involved and prospects for utilization. *Soil Biology and Biochemistry*, *42*(5), 669-678.

Callan, N. W., Mathre, D., & Miller, J. B. (1990). Bio-priming seed treatment for biological control of *Pythiumultimum*preemergence damping-off in sh-2 sweet corn. *Plant Disease*, *74*, 368-372.

Raj, S. N., Shetty, N. P., & Shetty, H. S. (2004). Seed bio-priming with Pseudomonas fluorescens isolates enhances growth of pearl millet plants and induces resistance against downy mildew. *International Journal of Pest Management*, *50*(1), 41-48.

Mastouri, F., Björkman, T., & Harman, G. E. (2012). *Trichoderma harzianum* enhances antioxidant defense of tomato seedlings and resistance to water deficit. *Molecular plant-microbe interactions*, *25*(9), 1264-1271.

Copyright ⓒ 2019Authors

ISSN:0971-1260
Vol-22-Issue-34-December -2019

Ahmad, P., Hashem, A., Abd-Allah, E. F., Alqarawi, A. A., John, R., Egamberdieva, D., &Gucel, S. (2015). Role of *Trichoderma harzianum* in mitigating NaCl stress in Indian mustard (*Brassica juncea* L) through antioxidative defense system. *Frontiers in plant science*, *6*, 868.

Yedidia, I., Benhamou, N., Kapulnik, Y., & Chet, I. (2000). Induction and accumulation of PR proteins activity during early stages of root colonization by the mycoparasite*Trichoderma harzianum* strain T-203. *Plant Physiology and Biochemistry*, *38*(11), 863-873.

Patel, J. S., Kharwar, R. N., Singh, H. B., Upadhyay, R. S., &Sarma, B. K. (2017). *Trichoderma asperellum* (T42) and *Pseudomonas fluorescens* (OKC)-enhances resistance of pea against Erysiphepisi through enhanced ROS generation and lignifications. Frontiers in microbiology, 8, 306.

Meshram, S., Patel, J. S., Yadav, S. K., Kumar, G., Singh, D. P., Singh, H. B., &Sarma, B. K. (2019). Trichoderma mediate early and enhanced lignifications in chickpea during *Fusarium oxysporum* f. sp. *ciceris* infection. Journal of basic microbiology, 59(1), 74-86.

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