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Prominence of Seed Coating for Biotic and Abiotic Stresses

Chandrika KSVP[1]*, Anupama Singh[2], RD Prasad[1] and Praduman Yadav[1]

[1]ICAR-Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad - 500030
[2]ICAR- Indian Agricultural Research Institute, Pusa Road, New Delhi -110012
***Email of corresponding author: ksvp.chandrika@icar.gov.in**

In Indian agriculture, with increasing population and there is growing demand in food safety and security. Additional agricultural land and resources are of limited availability. The reduction of current yield losses is due to lack of quality seed which is basic input for agriculture. The seed quality plays major role. Seed quality deterioration at different phases due to biotic and abiotic stresses is a major challenge. In this context, a newer concept of seed coating plays a major role. Seed coating achieves better plant establishment and higher yields by innovation in delivery systems of active ingredients, correct use of pesticides and finally reshaping seed microenvironment.

Introduction

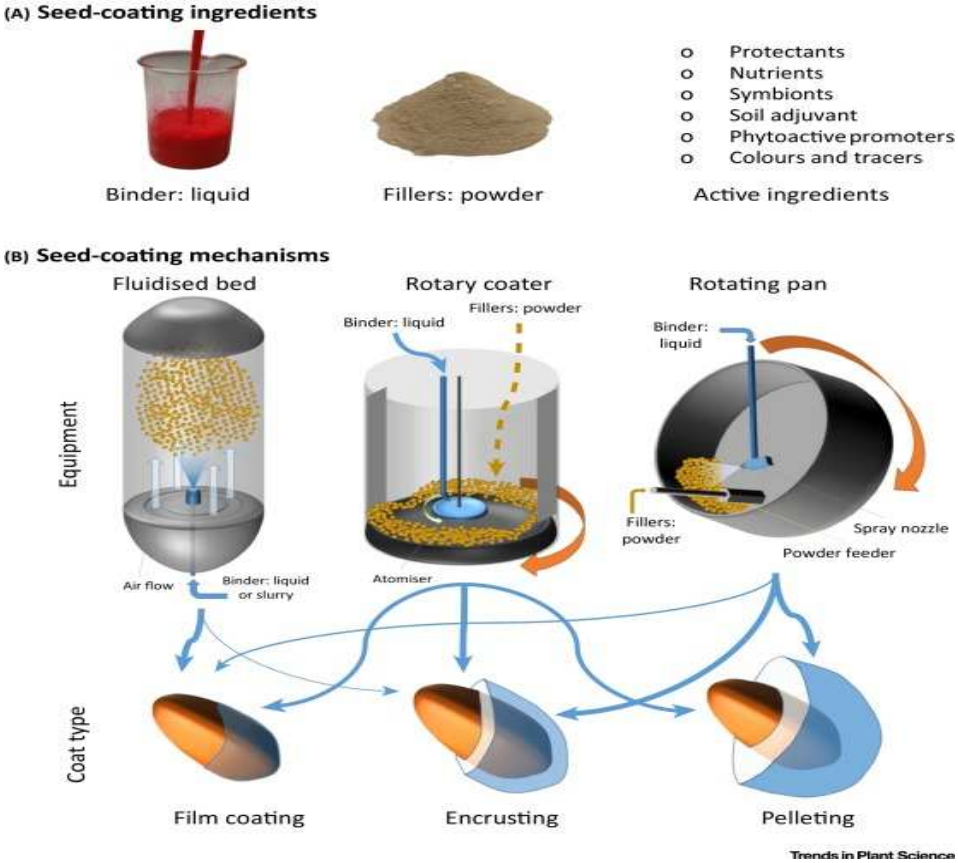
Seed being the basic input in agriculture, production and supply of quality seeds to the farmers will go a long way to achieve the goal of self-sufficiency in food crops. Growth and yield of any plant/crop with sexual reproduction, depends on quality of seeds. Seed quality mostly depends upon its genetic purity, germination and vigour, absence of pests and diseases, shelf life and longevity, good shape, size, colour, optimum moisture content etc. Seed quality comprises several physical, chemical and biological components. Seed being a biological or living entity, deterioration in its quality with time and biotic stresses are inevitable. Among them seed and seedling diseases contribute significantly to reduced seed germination and stand establishment resulting in an uneven crop density, increased weed density and reduced crop yield. The most common seed treatments with purely pesticide alleviate biotic stress by reducing the damage caused by seed or soil borne pests and pathogens (e.g., insects and fungi) on seeds and seedlings. Delivery of seed applied pesticides to provide crop protection from seed and soil-borne diseases relies on several seed treatment techniques including, seed-dressing with protectants exclusively (Sharma et al. 2015). Loss of these materials from the seed treatment is called dust-off and results in reduced crop performance and environmental contamination. Seed treatment techniques that contribute to pesticide dust-off are detrimental to non-target organisms including humans, wildlife and beneficial insects and neighboring crops. Maximum germination and seedling establishment of seed treated with pesticides, growth regulators, biologicals or micro-nutrients relies on firm attachment of these products to the seed coat during packaging, handling, and planting.

Seed Coating

Seed enhancements may be defined as post-harvest treatments that improve germination or seedling growth, or facilitate the delivery of seeds and other materials required at the time of

sowing. Enhancements include seed coating, priming and conditioning. Coating includes three techniques routinely used for seeds: film coating, encrusting and pelleting. Coating plant seeds prior to planting is a common practice in modern agriculture. Seed coating is the most applicable technique provides an opportunity to package effective quantities of materials such that they can influence micro environment of each seed which supplies not only micro and macro nutrients but also protects the crop from pests and diseases from the earlier stages due to the inclusion of agrochemicals for sustained crop growth and development (Upadhyaya 2013).

The term "coated seed" has been applied to a seed, which was either pelleted, coated or covered with an adhesive film. Coated seed may, in some circumstances, be produced by a dry powder process, which can have several disadvantages, such as poor adherence, non-uniform application, generation of significant amounts of dust, etc. Coating with wet powder method such as polymer is a successful technology which can be used either singly or in combination of other pesticides as formulation to protect the seeds from biotic stresses like insect-pests and also reduce losses and protect from environmental concerns. Seed coating for biotic stress in combination with pesticides and bioagents acts as a carrier which can coated and release the active ingredient in controlled manner throughout of crop duration and at the time of plant establishment. Seed coating alone also protects the seed from biotic stress acts as a barrier for soil and seed borne pathogens by destroying cues of pathogen which are required for pathogen growth on surface. Seed coating with polymers is more advantageous than conventional techniques which require complex application systems (Picture 1).



Picture 1: Seed coat Materials (A), Seed coat Mechanisms (B) and Type of seed coat (C) **(**Pedrini et al. 2016)

Seed coating not only provides protection to biotic stresses but also to abiotic stresses which is needed in storage time in order to increase shelf life without much affecting germination. The presence of the thin film coat over the natural hygroscopic seed coat was found to form a physical barrier for absorption of moisture in the vapour phase and hence the film coated seeds remained protected from equilibration with higher relative humidity to a significant extent. However, when brought in direct contact with water the hydrophilic film coat facilitated uniform and higher rate of imbibition of water by individual seeds. At the time sowing, seed coating material in combination with other modifiers, chemicals and pesticides helps to provide environment for better germination, plant establishment and to protect against seedling diseases etc. To discriminate between seed coated and non-coated seeds artificial and natural colors are being used in seed coated materials at the time coating. The main advantage of this technology includes better adherence of active ingredients, uniform coating and improved seed flow through planter. Coating with a hydrophilic polymer has been reported to regulate the rate of water uptake, reduce imbibition damage and improve the emergence of seeds. Stability of polymers depends on nature of materials used for seed coating. Biopolymeric origin degrades faster in nature compared to synthetic ones.

Conclusion

Seed coating is an important area in which plant materials could be widely used against almost all biotic and abiotic stresses during storage and planting. Conventional seed treatments with only chemicals at the time presowing is in major way among all farmers but seed coating have not come into practice among farmers because of the lack of awareness to the marginal and small farmers, research work which is being carried out in minor way and the materials for seed coating which are now available in market are expensive.

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