Film-coating of Horticultural Seed

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Successful stand establishment of horticultural crops depends on a combination of factors, one of which is seed treatment, Traditional seed treatments have used pesticides to protect seeds and seedlings against disease organisms, insects, and other pests. However, traditional formulations of these materials are dusty and hazardous to the operator's health. A new formulation technology for treating seeds, called film-coating, has been developed. Film-coatings provide growers with high-quality seed treatments that are safer to use, offer additional protection from pathogens, and improve flowability of the seed.

Film-coating involves deposition of a thin, but uniform, coating of tough material onto the surface of the seed. The American Seed Trade Assn. has adopted the following definition for film-coating. Film-coated seeds retain the shape and the general size of raw seeds with a minimal weight gain. The film-coating may contain polymers, pesticides, fungicides, biological, pigments or colorants, and other additives, The treatment should result in a more or less contiguous coating which eliminates or minimizes product dust-off. Benefits of film-coating are:

1) It provides uniform placement of seed treatment chemicals on the seed.

2) Film-coated seeds are essentially dust-free and safer to handle. Therefore, there is less residue in seed containers, making disposal of containers and cleanup and maintenance of equipment easier.

3) Improved flowability of seed eliminates planter plugging, creates less abrasion, and prevents clogging of planter parts.

4) Nice appearance and bright color makes for easy checking of seed placement.

5) It provides an excellent medium to carry fungicides, pesticides, biological, and micronutrients to improve stand establishment.

According to Colorcon (a division of Berwind Pharmaceuticals Services Inc., West Point, Pa.) film-coating materials form a flexible membrane that adheres to various shapes and configurations. The membrane, or film, has three major components

Polymer. Due to federal regulations, the polymer must conform to regulations for food acceptability, Various grades of polymers have different physical properties. Polymers are film-forming materials, Some of the food-approved polymers used in film-coating materials include: polyethylene glycol (PEG), hydroxypropyl cellulose, hydroxypropyl methylcellulose, and maltodextrin.

Plasticizer. The second material used in film-coating systems is the plasticizer. Plasticizers are combined with the polymers to keep the film pliable to protect the membrane against chips and cracks,

Pigment. All treated seeds must contain only approved colorants or dyes. A list of dyes or colorants cleared by the EPA for use in seed treatment materials is shown in Table 1.

Applying liquid film-coating material to untreated seeds is similar to spraying paint, A small quantity of coating material is applied each time the seed passes through the spray zone. Hot air is used to evaporate the water, resulting in a buildup of dry material on the surface of the seed. The quantity of film increases with each consecutive application of material. It is very important that the seeds dry sufficiently before a new layer of material is applied to prevent adherence of the seeds to the coating pan or to other seeds.

Basically, two types of equipment are used to apply film-coating materials to seeds:

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Use of trade names does not imply endorsement of the products named nor criticism of similar ones not named.

Table 1. ***EPA-approved dyes for seed treatment materials.***

Common name	Color	Color index name
Rhodamine B	Red with purple tint	Basic Violet #10 or D&C Red #19
Tartrazine	Yellow	Acid Yellow #23
Methyl Violet 2B	Purple	Basic Violet #1
FD&C Blue #1	Blue	Acid Blue #9
D&C Red #33 (2)	Red	Acid Red #33
D&C Red #17 (3)	Red	Solvent Red #23
D&C Violet #2 (4)	Purple	Solvent Violet #13
D&C #6 (5)	Green	Solvent Green #3
Methylene Blue (cotton only 6)	Blue	Basic Blue #9
Pigment Red 48	Red	Pigment Red 48.2
Pigment Red 40	Red	Pigment Red 40.

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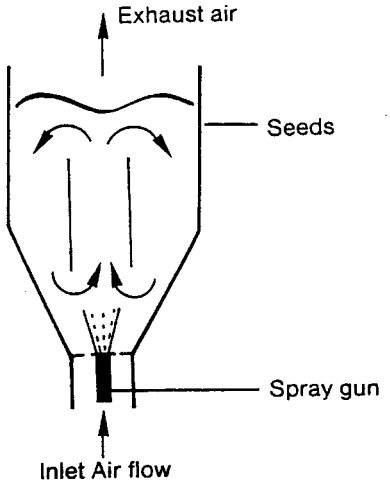

Fig. 1. The fluidized bed system can coat 100 g to 200 kg of seed in 20 to 45 min. Units cost from $40,000 to $500,000.

Fluidized bed. The movement of seed and evaporation of moisture are accomplished by providing hot air from the bottom of the vessel (Fig. 1). Film-coating material is sprayed through a nozzle placed inside the vessel, The fluidized bed system is gentle to the seed, but the procedure is slow and the equipment is very expensive.

Pan or drum. Film-coating material also may be applied using a pan or a drum in a batch or continuous system. The basic application method is to rotate the seed inside a drum while applying film-coating material through one or several spray nozzles (Fig. 2). The great advantage of the continuous flow method is the ability to coat large quantities of seed per hour using a very large drum.

Film-coating of seeds is a rather recent development. Most available data on film-coating are presented by manufacturers of film-coating materials, so information on storage and viability of film-coated seed is very limited. Table 2 contains a list of companies that sell film-coating equipment and materials. Studies conducted by vegetable seed companies indicate that film-coating materials are generally not phytotoxic to the seed. The continued use of film-coating materials by European companies is further proof of this claim. However, some materials have affected germination of certain crops. Therefore, it is recommended that any film-coating material be thoroughly tested before use. If film-coated seed is stored under a controlled environment with low humidity (<40%), germination and vigor will not be affected by the film-coating material, Some studies indicate possible improved control of *Pythium* and other pathogens with film-coated seeds (J. Burris, personal communication).

Table 2. ***Manufacturers of film-coating materials and machinery.***

Manufacturers of film-coating materials
Colorcon, New Jersey
Crompton Knowles, New Jersey
Wilbur Ellis, Iowa
Gustafson, Texas
Seppic France
Ceres Rhoe Poulenc, France
Sarea, Austria
Machinery manufacturers
Vector, Iowa
Driam, Germany and North Carolina
Glatt, Germany
Airomatic, New Jersey
Thomas Engineering, Illinois
Dumoulin, France
Diamond Coating Equipment, Arizona
Thai Coater, Thailand
O'Hara Manufacturing, Canada
Pharma Equipment, Michigan
Coating Machinery Inc., Iowa
Gustafson, Minnesota
Spray Dynamic, California

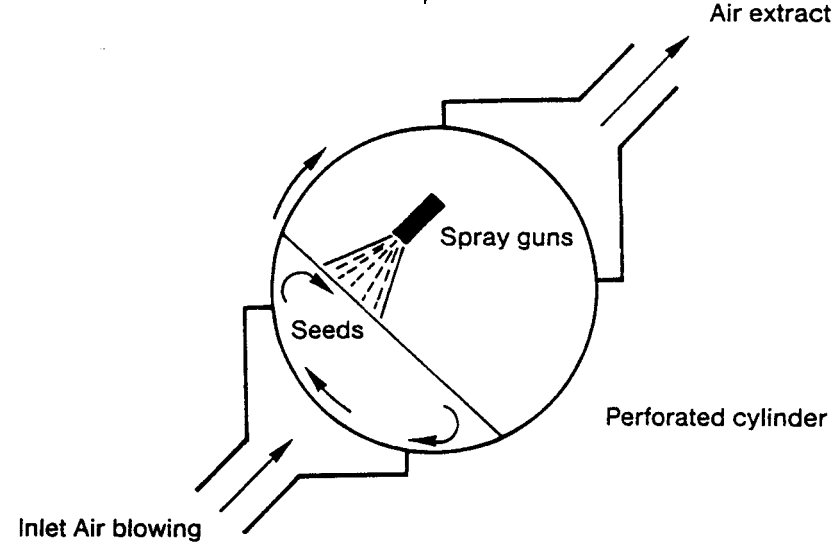

Fig. 2. The pan or drum system can coat 2 to 2700 kg of seed in 30 to 60 rein, depending on unit size. Pan or drum units cost from $60,000 to $1,000,000.

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