EFFECTIVENESS OF POLYMER FILM COATING OF COTTON SEED IN REDUCING DUSTING-OFF

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Abstract

As seed are treated with increasing amounts of chemicals, it becomes more likely that these materials may be lost during handling, a process known as dusting-off. Polymers show the potential to reduce dusting-off. In two studies involving different polymers (Dynacoat and Opacoat Red), Dynacoat generally had no effect on dusting-off and Opacoat Red demonstrated an ability to reduce dusting-off. As the rate of application increased, the Dynacoat polymer did not generally effect dusting-off. The Opacoat Red polymer reduced dusting off at all application rates and methods, but had the most prominent effect when the rate of polymer increased or the polymer was applied as a mixture with the fungicide (vs. a polymer coat over the fungicide). Both polymers did not reduce the establishment percentage in a cold chamber study at 64^0F (18^0C). The Dynacoat polymer did not decrease imbibition of water through 12 hours at 68^0F (20^0F).

Introduction

As technology advances, more materials are being placed upon seed. Pesticides, colorants, biologicals, suspending agents, and growth regulators are just a few of the substances that are being placed upon seed. As the amount of material increases, it is becoming more difficult to keep them on the seed. While these materials are intended to help germination, survival, and growth, they are not always fully effective if the bulk of the material does not remain on the seed. Material can be lost during treatment, packaging, handling, and planting of the seed. In some cases, the loss of these materials may not only be undesirable, but may pose a health hazard.

Deposition in areas other than the target site causes several problems. With the advent of precision planters, clean and dust free seed becomes important for proper operation (Burris, 1992). Although the seed industry responded by changing the seed treatment formulations to lower dust-off, it is possible that with new materials another method must be used. The dust from pesticides also poses a possible health risk to workers who handle the seed. With increased concern from the public about the possible dangers of agricultural chemicals, it is important that the agriculture industry use pesticides as efficiently as possible. Polymer coatings have the potential to cut down dusting-off from these materials.

Prompted by rising concern about chemicals, researchers have examined the use of polymers in conjunction with pesticides to increase efficiency and persistence of these chemicals (Burris, 1992; Green et al., 1993; Wilkins, 1976). Studies have examined how polymers affect pesticides, but have not largely focused on if the polymers held the pesticides on the seed itself during human and mechanical handling. The purpose of our two studies was to examine the effects of two different polymers, various polymer rates, and application methods on controlling dusting-off.

Materials and Methods

In both studies, a widely planted cotton cultivar (Paymaster HS200) was utilized. In the Polymer Rate study the seed were treated using combinations of Dynacoat (a polymer), a primary mixture (RTU Baytan- Thiram which contained Thiram at 3 oz/cwt; Apron Fl at 0.75 oz/cwt; Kodiak at 0.25 oz/cwt; calcium carbonate at 9.5 oz/cwt; blue colorant at 1.0 oz/cwt; Lorsban 30 at 0.06 oz/cwt; suspending agent at 0.19 oz/cwt); and Magnabright. The seven treatments included a control which only received the primary mixture (P), two Dynacoat treatments at 2 and 4 oz/cwt (D2 and D4, respectively), three treatments containing the primary mixture with either 2, 3, or 4 oz/cwt of Dynacoat (D2P, D3P, and D4P, respectively), and a treatment containing Dynacoat at 4 oz/cwt, Magnabright (2 oz/cwt), and the primary mixture (D4PM). All treatments were applied in a total volume of 30 oz/cwt. The seed were then evaluated for dust-off, cold room sand establishment, and water imbibition.

The Polymer Applicaton study consisted of 7 treatments. All treatments had a 2 oz/cwt application of Apron TL. The control consisted of just the seed treated with Apron TL. To evaluate the effects of varying rates and application methods Opacoat Red was applied at 1, 3, and 5% of seed weight. In three treatments, the polymer coating was applied over the fungicide, and in the other three the polymer was applied mixed with the fungicide. The polymer overcoat (O) and polymer mixtures (M) were applied using a fluidized bed seed treating machine. The treatments were tested for dust-off and cold room stand establishment.

Dust-off was determined by weighing 375 seed from each treatment and placing them in a glass container (Fisher Custom Glass Shop, Filter Holder #34-1551, with a seed retaining screen placed in bottom.) rotating at 60 rpm at a 65 degree angle. The seed were subjected to an air flow of 5.6 scfm for 10 minutes. They were then weighted again and dust-off was determined by the difference between the initial and final seed weight. Dust-off was then expressed as the amount of material lost from 100 grams of seed.

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The establishment index (%) was calculated in a cold chamber set at 64^0F (18^0C). Fifty seed from each treatment were placed in 8.25 in. x 13.5 in. x 3.5 in. containers on saturated sand (equilibrated to 64^0F) and covered with approximately 1 inch dry sand. Each day emerged seedlings were counted through 21 days for the Polymer Application study and 18 days for the Polymer Rate study. The number of surviving seedlings were expressed as a percentage of the total number of seed planted.

In order to determine imbibition rates for the Polymer Rate study, 8 grams of seed from each treatment were placed upon 32 x 44 x 1 cm foam mats. The foam mats were then rolled up and saturated with 68^0F (20^0C) water. Excess water was allowed to drain from the foam pads and they were placed into a chamber set at a constant 68^0F. The seed were removed after 12 hours and weighed. Imbibition is expressed as percent seed moisture based on the initial seed weight.

Results and Discussion

In the Polymer Rate study, no differences among the treatments were observed in the amount of dusting-off with the exception that a higher amount was generally noted from the D4P treatment (Figure 1). Dynacoat did not appear to reduce dust-off, as the amount was generally uniform except for the D4P treatment. The treatments did not reduce the Establishment Index after 18 days, indicating that the Dynacoat mixtures did not reduce seedling emergence (Figure 2). In addition, none of the treatments reduced the amount of water imbibed by the seed when measured after 12 hours in the Polymer Rate study (Figure 3).

The Polymer Application study data indicated that polymers can reduce dusting-off (Figure 4). The data also suggests that the polymer is more effective as the rate was increased from 1 to 3 to 5% of seed weight. In all cases at equivalent polymer rates, less dusting-off was noted when the polymer was mixed with the fungicide as opposed to being applied as an overcoat treatment. No differences in the Establishment Index after 21 days were noted due to the treatments- i.e. polymer rates or methods of coating had no effect in reducing seedling emergence (Figure 5).

Some polymers can reduce dusting-off. However, the data indicated that the Dynacoat polymer appeared to have no significant effect (except for the D4P treatment where it was actually higher). The Opacoat Red Polymer was effective in reducing dust-off at all application rates studied and methods of application. This polymer appeared to be more effective in reducing dusting-off when applied in a mixture with pesticides vs. an overcoat treatment over pesticides. Polymers had no effect on reducing the establishment percentage in either study. Dynacoat (polymer) did not decrease the imbibition of water at 68^0F (20^0C) through 12 hours.

Acknowledgments

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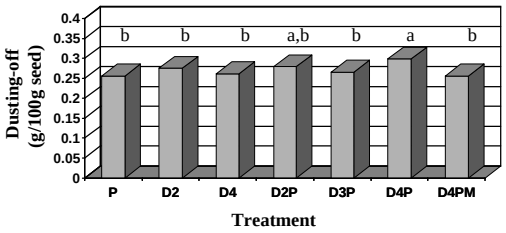

Figure 1. Dusting-off in grams of dust per 100 grams of seed for the Polymer Rate study. [Primary Mixture = P, Dynacoat (2 oz/cwt)= D2, Dynacoat (4 oz/cwt)= D4, Dynacoat (2 oz/cwt) + P= D2P, Dynacoat (3 oz/cwt) + P= D3P, Dynacoat (4 oz/cwt) + P= D4P, and Dynacoat (4 oz/cwt) + P + Magnabright (2 oz/cwt)= D4PM.]

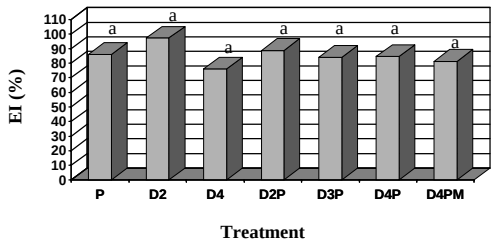

Figure 2. Cold room establishment index percentages for Polymer Rate study. [Primary Mixture = P, Dynacoat (2 oz/cwt)= D2, Dynacoat (4 oz/cwt)= D4, Dynacoat (2 oz/cwt) + P= D2P, Dynacoat (3 oz/cwt) + P= D3P, Dynacoat (4 oz/cwt) + P= D4P, and Dynacoat (4 oz/cwt) + P + Magnabright (2 oz/cwt)= D4PM.]

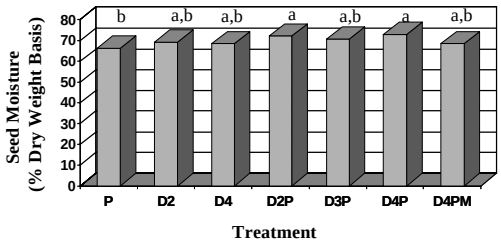

Figure 3. Percent seed moisture for polymer rate study. [Primary Mixture = P, Dynacoat (2 oz/cwt)= D2, Dynacoat (4 oz/cwt)= D4, Dynacoat (2 oz/cwt) + P= D2P, Dynacoat (3 oz/cwt) + P= D3P, Dynacoat (4 oz/cwt) + P= D4P, and Dynacoat (4 oz/cwt) + P + Magnabright (2 oz/cwt)= D4PM.]

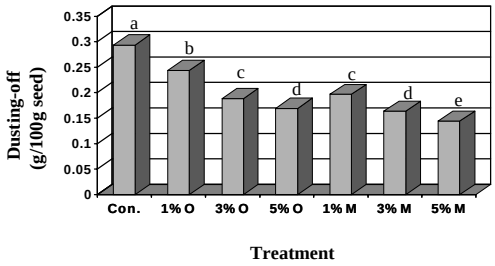

Figure 4. Dusting-off as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixture (M) of a fungicide. (Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 5% O, Opacoat Red mixture @ 1% of seed weight = 1% M, Opacoat Red mixture @ 3% of seed weight = 3 % M, and Opacoat Red mixture @ 5% of seed weight = 5% M. All treatments contained a 2 oz/cwt of Apron TL)

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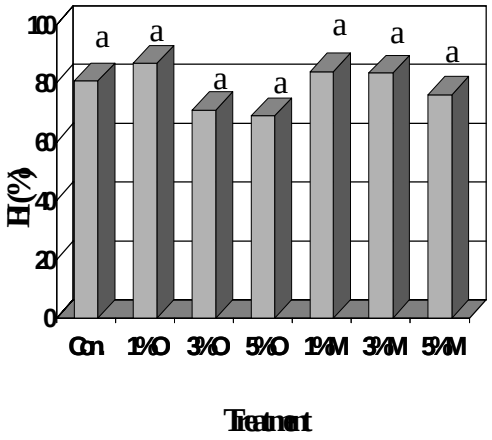

Figure 5. Cold room establishment index percentages as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixture (M) of a fungicide. (Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 5% O, Opacoat Red mixture @ 1% of seed weight = 1% M, Opacoat Red mixture @ 3% of seed weight = 3 % M, and Opacoat Red mixture @ 5% of seed weight = 5% M. All treatments contained a 2 oz/cwt of Apron TL).