EFFECTS OF POLYMER FILM COATINGS OF COTTON SEED ON DUSTING-OFF, IMBIBITION, AND GERMINATION

K.D.Williams
Texas Tech University
Lubbock, TX
N.W.Hopper
Texas Tech University and Texas Agricultural Experiment Station
Lubbock, TX

Abstract

As the amount of treatments placed on cottonseed increases, this material has a greater potential of coming off the seed in a process referred to as dusting-off. This dust-off material can be composed of pesticides, other seed treatments, or seed coat fragments that do not reach the target site. Some polymers can have a significant effect on dusting-off. The Opacoat Red polymer reduced dusting-off at all applications. The polymer had the most prominent effect when the rate of polymer increased or the polymer was applied as a mixture with the fungicide compared to a polymer coat over fungicide. The Opacoat Red polymer did reduce water imbibition at 68^{0}F (20^{0}C) through 8 hours at all rates and methods of polymer application, by twelve hours the treatments with a 1% by weight coating were not significantly different from the control. However, the polymer did not effect the establishment percentage in an environmental chamber study at 64^{0}F (18^{0}C). No significant differences between the control and other treatments were noted using the cool warm vigor index, establishment in the field, and yield.

Introduction

As material placed on cottonseed increases, it is becoming more difficult to keep them on the seed. Pesticides, colorants, biologicals, suspending agents, and growth regulators are a few of the substances that are currently being placed upon 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. In addition, seed coats can chip during various handling procedures and contribute to this problem by adding to the lost mass and carrying seed treatments with them. 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 as dusting-off can cause several problems, including a potential health risk.

There are several undesirable effects caused by dusting-off. Using precision planters, dust free seed becomes important for proper operation (Burris, 1992). While the seed industry responded by changing the seed treatment formulations to lower dusting-off, it may be possible to reduce dusting-off without changing treatment formulas. With increasing amounts of new materials added to seed treatment formulas it is probable that another method must be used. Pesticide can also pose a possible health risk to workers who handle the seed and inhale the material as it becomes airborne. 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. If polymers do not have adverse effects on imbibition, germination, or emergence they may be effectively used to cut down dusting-off.

Public concern about chemicals have prompted researchers to examine the use of polymers with pesticides to increase efficiency and persistence of these chemicals (Burris, 1992; Green et al., 1993; Wilkins, 1976). Studies to this date have examined how polymers affect pesticides and other possible uses, but have not focused mainly on preventing dusting-off during human and mechanical handling. The purpose of our study was to examine the effects of the Opacoat Red polymer at controlling dusting-off at various polymer rates and application methods, while determining if it had any possible negative effects on seedling performance.

Materials and Methods

In our study, a widely planted cotton cultivar (Paymaster HS200) was utilized. All 7 treatments had a 2 oz/cwt application of Apron TL. The control consisted of the seed treated with Apron TL and no polymer coating. 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. Retaining screen placed in bottom.) rotating at 60 rpm at a 65 degree angle. The seed were subjected to an airflow 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.

In order to determine imbibition rates, 75 seed from each treatment were weighed and placed upon 32 x 44 x 1 cm foam mats. The foam mats were then rolled up and placed in PVC tubes. The towels were saturated with 68^{0}F (20^{0}C) water. Excess water was allowed to drain from the foam pads and they were placed into a chamber set at a constant

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1380-1382 (1998)
National Cotton Council, Memphis TN

68^0F. The seed were removed after 8hrs, weighed and resaturated. After being placed in the chamber for an additional 4 hours the seed were weighed again. Imbibition is expressed as percent seed moisture based on the initial seed weight.

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.

Results and Discussion

The 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 environmental chamber 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. 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.

References

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Wilkins, R.M. 1976. Aspects of the chemical and physical control of persistence with special reference to the use of polymers. British Crop Protection Council Symposium on Persistence of Insecticides and Herbicides. P201-216.

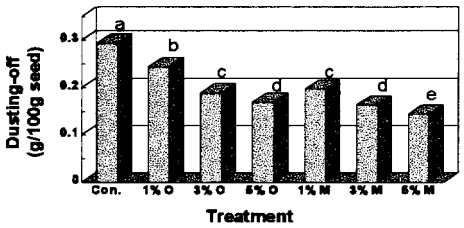

Figure 1. Dusting-off as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 5% O, Opacoat Red mixture @ 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].

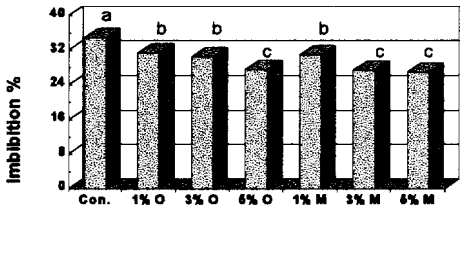

Figure 2. Imbibition percent at eight hours as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 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].

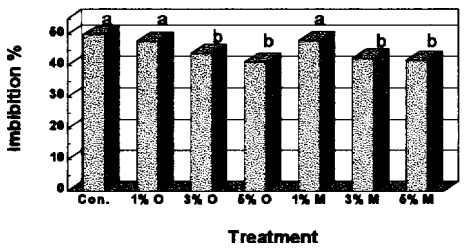

Figure 3. Imbibition percent at twelve hours as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 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].

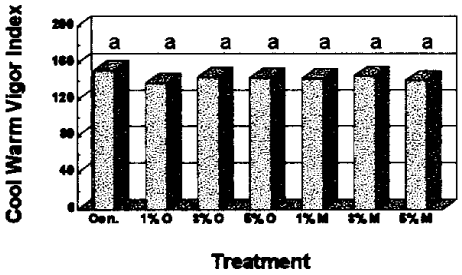

Figure 4. Cool Warm Vigor as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 5% O, Opacoat Red 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].

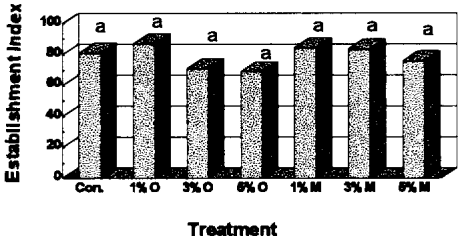

Figure 5. Cold room establishment index (21 days) as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed 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].

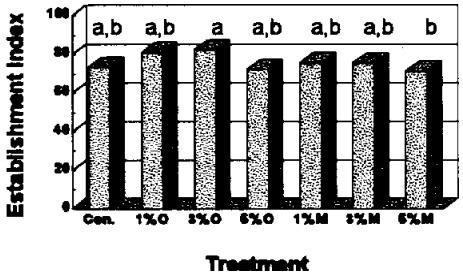

Figure 6. Field establishment index (4 weeks after planting) as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 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].

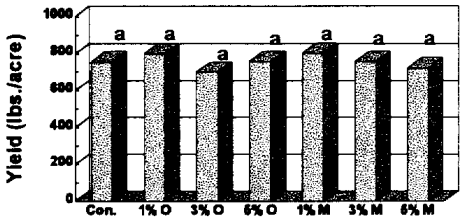

Figure 7. Yield in lbs/acre as affected by Opacoat Red polymer overcoating (O) and Opacoat Red polymer mixing (M) of a fungicide. [Control = Con., Opacoat Red overcoat @ 1% of seed weight = 1% O, Opacoat Red overcoat @ 3% of seed weight = 3% O, Opacoat Red overcoat @ 5% of seed weight = 5% O, Opacoat 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].