2002 BELTWIDE COTTON CONFERENCES, ATLANTA, GA – JANUARY 8-12

REVIEW OF SOIL FUNGICIDE TREATMENTS USED AT PLANTING TIME IN COTTON

Julius Fajardo
Crop Protection Division
Crompton Corporation
Middlebury, CT
Kathy McLean
Department of Entomology & Plant Pathology
Auburn University
Auburn, AL

Abstract

Seedling diseases averaged 3.1% in yield loss from 1992-2001 (Blasingame & Patel, 2001). This accounts to an estimated average loss of $242 million. Majority of the cotton-growing states surveyed reported *Rhizoctonia solani* and *Pythium* spp. as the predominant pathogens followed by *Fusarium* spp. and *Thielaviopsis basicola*.

Published data from 1992-2000 were surveyed to determine the efficacy of commercial soil fungicides in their ability to improve early and late seedling emergence and lint yield under non-inoculated and inoculated conditions. Soil-applied fungicides include Rovral 4F, Quadris SC, Ridomil Gold PC, Ridomil Gold EC, Terraclor 2E, Terraclor Super X EC, and Terraclor Super X 18.8G. Treatment costs and economic returns were determined.

Under non-inoculated trials, all fungicides applied at labeled rates improved early and late seedling survival (70-85%) compared to the control (66%). Terraclor Super X 18.8G and Terraclor Super X EC increased lint yield compared to the control and other fungicides. Treatment benefits of $16.88/A and $24.30/A were obtained with Terraclor Super X 18.8G and Terraclor Super X EC, respectively.

Under inoculated trials, soil fungicides improved late seedling survival (42-55%) compared to the control (38%). Terraclor 2E, Terraclor Super X 18.8G and Terraclor Super X EC increased lint yield compared to the control and other fungicides. Treatment benefits of $90.88/A, $99.80/A, and $87.04/A were obtained with Terraclor Super X 18.8G, Terraclor Super X EC, and Terraclor 2E, respectively.

Using these net returns it was calculated that a grower should apply an in-furrow fungicide, assuming conditions favored development of seedling diseases one year in five (Carlson & Main, 1976; Bowen, 1997).

Introduction

Based on a report by the Cotton Disease Loss Estimate Committee (Blasingame & Patel, 2001), seedling diseases averaged 3.1% in yield loss from 1992-2001. This accounts to an estimated average loss of $242 million. Seedling diseases are caused by an array of fungal pathogens notably by *Pythium* spp., *Rhizoctonia solani*, *Fusarium* spp., and *Thielaviopsis basicola*. Majority of the cotton-growing states surveyed reported *Rhizoctonia solani* and *Pythium* spp. as the predominant pathogens followed by *Fusarium* spp. while *Thielaviopsis basicola* as the least occurring.

The use of soil fungicides applied either as an in-furrow spray or granular application to control seedling diseases is determined by the presence and intensity of several factors. These factors include soil temperature, 5-day forecast, seed quality, field history, tillage practice, seeding rate, insecticide/nematicide use, soil moisture, and planting date (Rothrock, 1998). These factors were also the bases of creating a point system for growers and consultants to assess the economics of applying a soil fungicide. The outcome from the point system depends on the field location, year of production, cultural practices, and environment.

Since seedling diseases are dynamic and change over time, uncertainty in crop production is associated. While the weather may not be predicted accurately for the future, the historical frequency or probability of occurrence of seedling diseases can be accounted for in deciding if the grower would be better off economically in applying an in-furrow fungicide.

A nine-year survey from 1992-2000 was conducted to determine the efficacy of soil fungicides that are still in the market in their ability to improve early and late seedling emergence in addition to increasing lint yield under inoculated and non-inoculated conditions. Treatment costs and returns were estimated and based on the net returns and the probability of seedling diseases occurrence, the decision to use a soil fungicide was estimated to account for uncertainty.

Materials and Methods

Published data on the evaluation of soil fungicides for control of seedling diseases were collected from the Fungicide and Nematicide Tests and the reports by the Soil Fungicide Committee in the Proceedings of the Beltwide Cotton Conferences from 1992-2000. Data were separated into non-inoculated from inoculated (artificially infested with *Rhizoctonia solani* and *Pythium* spp.) trials. Early (7-21 days after planting) and late (28-42 days after planting) seedling emergence counts were converted into percent early and late seedling survival based on the number of seeds per row foot and length of row plots used. Seed cotton yield was expressed in lint (38% lint) yield.

The soil fungicides that were applied, their active ingredients and labeled rates of application are presented in Table 1. A total of 27 tests in the non-inoculated trials were represented by the states of AL, AR, GA, LA, MS, and TN. In the inoculated trials, 28 tests were represented by the states of AL, GA, LA, and MS.

Benefits of soil fungicide treatments were calculated from the average of lint yield, net returns and treatment costs relative to the control. Because of the recent volatility and downward pressure on the price of cotton lint, cotton price of $0.50/lb was used in the economic return analysis.

To account for uncertainty in cotton production due to seedling diseases, a 20% occurrence of the disease was predicted based on the 1992-2001 Beltwide percent yield loss (Blasingame & Patel, 2001). Expected value (EV) of each action with and without in-furrow was calculated based on the probabilities, net returns and disease occurrence. The following formula was used (Carlson & Main, 1976; Bowen, 1997):

$$EV_{\text{in-furrow}} = (P)\,(NR_{\text{in-furrow, inoculated}}) + (1\text{-}P)\,(NR_{\text{in-furrow, non-inoculated}})$$
$$EV_{\text{no in-furrow}} = (P)\,(NR_{\text{no in-furrow, inoculated}}) + (1\text{-}P)\,(NR_{\text{no in-furrow, non-inoculated}})$$

Results and Discussion

Under non-inoculated trials, all soil fungicides improved early and seedling stand (70-85%) compared to the control (66%). Increased lint yield was obtained with Terraclor Super X 18.8G and Terraclor Super X EC compared to other fungicides and the control (Table 2). Economic return analysis indicated treatment benefits of $16.88/A and $24.30/A with Terraclor Super X 18.8G and Terraclor Super X EC, respectively compared to the other in-furrow fungicides and the control (Table 3).

Under inoculated trials, all soil fungicides improved early and late seedling survival (39-55%) compared to the control (38%). Increased lint yield was observed with Terraclor 2E, Terraclor Super X 18.8G and Terraclor Super X EC compared to other fungicides and the control (Table 4). In addition, treatment benefits of $87.04/A, $99.80/A, and $90.88/A were obtained with Terraclor 2E, Terraclor Super X 18.8G and Terraclor Super X EC, respectively (Table 5).

As shown in Table 6, the grower would be better off economically in applying Terraclor Super X 18.8G and Terraclor Super X EC. Hence, the use of such in-furrow fungicides was justified based on a 20% probability of seedling diseases occurrence and the net returns of the control and the in-furrow fungicides under non-inoculated and inoculated conditions.

The decision to apply an in-furrow fungicide to control seedling diseases optimizes production and maximizes profit for the grower based on the expected costs or losses.

References

Blasingame, D. and M.V. Patel. 2001. Cotton disease loss estimate committee report. Proc. Beltwide Cotton Conf. p. 102-103.

Bowen, K.L. 1997. Economics and decision analysis. Pages 175-182 in: Exercises in Plant Disease Epidemiology, L.J. Francl and D.A. Neher eds. APS Press, St. Paul, MN.

Carlson, G.A. and C.E. Main. 1976. Economics of disease-loss management. Annu. Rev. Phytopathol. 14: 381-403.

Rothrock, C.S. 1998. Developing decision-making aids for the use of in-furrow fungicides. Ark. Expt. Sta. Rept. 188: 49-54.

Table 1. Selected soil fungicides, active ingredients and their labeled rates of application.

Soil Fungicide	Active Ingredient	Labeled Rate
Terraclor Super X 18.8G	PCNB + etridiazole	5.5-8 lb/A
Terraclor Super X EC	PCNB + etridiazole	48-96 fl oz/A
Terraclor 2E	PCNB	48-96 fl oz/A
Ridomil Gold EC	Mefenoxam	1-2 fl oz/A
Ridomil Gold PC	Mefenoxam + PCNB	7-10 lb/A
Quadris SC	Azoxystrobin	5.2-7.8 fl oz/A
Rovral 4F	Iprodione	3.2-6 fl oz/A

Table 2. Percent early and late seedling survival and lint yield on the use of selected soil fungicides in non-inoculated trials, 1992-2000.

Soil Fungicide	Percent Early Seedling Survival[1]	Percent Late Seedling Survival[2]	Lint Yied (lb/A)
Terraclor Super X 18.8G	72	70	968
Terraclor Super X EC	74	74	981
Terraclor 2E	78	80	804
Ridomil Gold EC	73	72	807
Ridomil Gold PC	77	78	897
Quadris SC	73	72	778
Rovral 4F	85	85	850
Control	66	66	910

[1]Percent early seedling survival evaluated at about 7-21 days after planting
[2]Percent late seedling survival evaluated at about 28-42 days after planting

Table 3. Economic return analysis of selected soil fungicides in non-inoculated trials, 1992-2000[1].

Soil Fungicide	Treatment Cost ($/A)	Gross Return ($/A)	Net Return ($/A)	Treatment Benefit ($/A)
Terraclor Super X 18.8G	12.12	484.00	471.88	16.88
Terraclor Super X EC	11.20	490.50	479.30	24.30
Terraclor 2E	5.46	402.00	396.54	-58.46
Ridomil Gold EC	5.40	403.50	398.10	-56.90
Ridomil Gold PC	12.60	448.50	435.90	-19.10
Quadris SC	12.65	389.00	376.35	-78.65
Rovral 4F	7.85	425.00	417.15	-37.85
Control	0.00	455.00	455.00	-

[1]Market price of cotton lint at $0.50/lb

Table 4. Percent early and late seedling survival and lint yield on the use of selected soil fungicides in inoculated trials, 1992-2000.

Soil Fungicide	Percent Early Seedling Survival[1]	Percent Late Seedling Survival[2]	Lint Yield (lb/A)
Terraclor Super X 18.8G	54	55	1040
Terraclor Super X EC	51	52	1056
Terraclor 2E	45	50	1019
Ridomil Gold EC	39	45	835
Ridomil Gold PC	40	42	824
Quadris SC	44	49	785
Rovral 4F	45	49	813
Control	38	38	834

[1]Percent early seedling survival evaluated at about 7-21 days after planting
[2]Percent late seedling survival evaluated at about 28-42 days after planting

Table 5. Economic return analysis of selected soil fungicides in inoculated trials, 1992-2000[1].

Soil Fungicide	Treatment Cost ($/A)	Gross Return ($/A)	Net Return ($/A)	Treatment Benefit ($/A)
Terraclor Super X 18.8G	12.12	520.00	507.88	90.88
Terraclor Super X EC	11.20	528.00	516.80	99.80
Terraclor 2E	5.46	509.50	504.04	87.04
Ridomil Gold EC	5.40	417.50	412.10	-4.90
Ridomil Gold PC	12.60	412.00	399.40	-17.60
Quadris SC	12.65	392.50	379.85	-37.15
Rovral 4F	7.85	406.50	398.65	-18.35
Control	0.00	417.00	417.00	-

[1]Market price of cotton lint at $0.50/lb

Table 6. Expected values of selected soil fungicides and the decision to use an in-furrow fungicide for seedling diseases control[1].

Soil Fungicide	Expected Value ($/A)	Decision to Use In-Furrow Fungicide[2]
Terraclor Super X 18.8G	479.08	Yes
Terraclor Super X EC	486.80	Yes
Terraclor 2E	418.04	No
Ridomil Gold EC	400.90	No
Ridomil Gold PC	428.60	No
Quadris SC	377.05	No
Rovral 4F	413.45	No

[1]Based on a 20% probability of occurrence of seedling diseases in one of five years and net returns of no in-furrow and with in-furrow fungicide in inoculated and non-inoculated trials

[2]Based on the expected value of $447.40 with no in-furrow fungicide, thus if $EV_{\text{no in-furrow}} < EV_{\text{with in-furrow}}$, the decision to use an in-furrow fungicide is justified