CONTROLLED RELEASE FUNGICIDES, SOIL AMENDMENTS AND BIOFUMIGATION EFFECTS ON COTTON ROOT ROT SUPPRESSION

John E. Matocha
Texas AgriLife Research and Extension Center
Corpus Christi, TX
Terry Gentry
Texas A&M University
College Station, TX
S.M. Greenberg
J.M. Bradford
C. Yang
USDA-ARS
Weslaco, TX
James Wilborn
Texas AgriLife Research and Extension Center
Corpus Christi, TX
Robert Nichols
Cotton, Inc.
Cary, NC

Abstract

The cotton root rot pathogen (*Phymatotrichopsis ominora*) causes major losses in cotton produced in the Southwest. Granular controlled release formulations (CRF) of the fungicide, Propiconazole developed to be soil applied at planting were studied at 1.0 and 3.0 lb. a.i./ac. applications and with two rates of release. Elemental S for soil pH reduction and trace elements (Zn and Fe) were also evaluated for disease suppression in additional studies not reported here. Stem drenches with fungicides and biofumigation methods using winter cover Brassica plants were also included in this study. Four sites ranging from the lower Rio Grande Valley through the Coastal Bend and Southwest Texas regions with histories of moderate to severe root rot disease pressure were used for most treatments.

Results indicate granular CRF of Propiconazole suppressed the disease to varying degrees at all four locations. Stem drenching with a new Prothioconazole fungicide was about 90% as effective as similar treatment with Propiconazole which produced the most impressive disease suppression. Biofumigation with winter cover crop Brassica plants showed disease suppression in 2007 but produced less consistent results in 2008.

Introduction

A major disease of cotton grown on certain high pH, calcareous soils of the Southwest is cotton root rot (*Phymatotrichopsis omnivora*). The purpose of these studies was to develop economically feasible and field applicable methods to suppress PRR on cotton using plant nutrition, soil pH reduction, fungicides and possibly biofumigation.

Materials and Methods

Four treatments with specially formulated controlled release fungicide materials using Propiconazole and polymer coatings on starter fertilizer granules as carriers were studied.

Slower release - 1.0 lb a.i./ac; 3.0 lb a.i./ac
Faster release - 1.0 lb a.i./ac; 3.0 lb a.i./ac

All materials banded in seed row

Other materials as separate treatments:

Banded in seedrow < Pacific Gold, mustard seed

Fungicides: Stem drenching (15 ml/plt., 1 lb a.i./ac) for each Prothioconazole and Propiconazole, both liquid concentrates

Timing of drenches:

42 days after planting (DAP)

56 days after planting

Winter cover crop:

Pacific Gold, Mustard (Hidalgo County site only)

Statistical design: RCBD

Untreated checks (UTC) were compared with each two treatments due to the spatial variability in disease incidence.

Experimental Sites included Weslaco (USDA-ARS Research Farm, Hidalgo County), San Patricio County (Loyd and Scott Mengers Farm, Mathis, TX and Ring Brothers Farm, St. Paul, TX), and Tom Green County (John and Douglas Wilde Farm, San Angelo, TX).

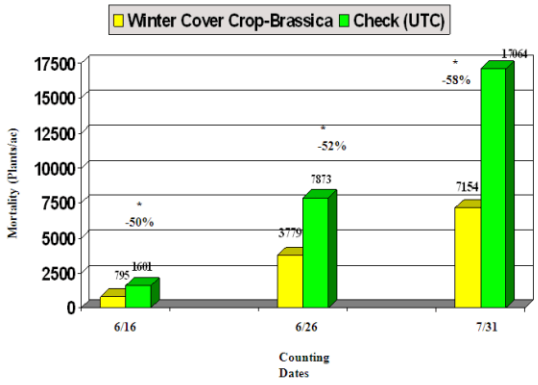

Fig. 1. Effect of biofumigation with Brassica cover crop on Phymatotrichopsis root rot on cotton (Hidalgo Co. TX-07). * Percent reduction below paired UTC.

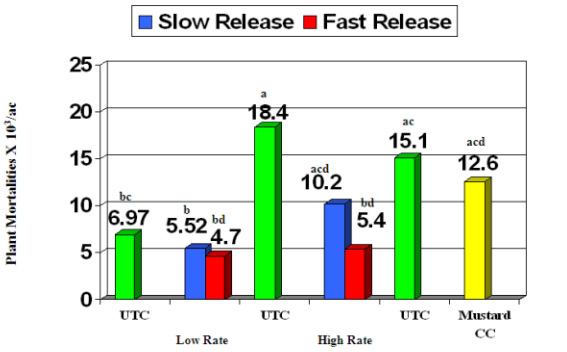

Fig. 2. Effect of control release rate and rate of controlled release fungicide and mustard cover crop on plant mortalities (Low rate = 1.0 lb.; high rate = 3.0 lb. a.i./ac; mustard = winter cover crop + 250 lb/ac of cover crop seed at planting. (USDA-ARS Center, Weslaco, TX., 2008)

Results and Discussion

Biofumigation research first started in 2006 at the Rio Grande Valley site generally showed only a slight reduction in disease from the Brassica cover crop. However, in the second year of the experiment (2007), at all three dead plant count dates, Brassica cover crop reduced disease approximately 50% or more (Fig. 1).

In the third year (2008) of the Hidalgo County site, slow and faster release formulations of granular Propiconazole were compared (Fig. 2).

Slow release formulation compared well with faster release. Small differences between release rates were non-significant; but at high rate, a larger difference occurred. High rate of fast release significantly reduced mortality below UTC. Cover crop mustard only slightly reduced disease severity.

Plant mortality and yield data for the Ring Brothers Farm in San Patricio County followed somewhat the same trend as in Hidalgo County (Figs. 3-4). A non-significant difference in disease was measured between release rates of fungicide. However, at both low rates significant reductions in mortalities below UTC occurred. At the high rate (3 lb/a.i./ac), there was a greater reduction in dead plants below UTC than at lower rate when the slower release fungicide was used. In both cases (high and low rates) the suppression of the root rot disease was statistically significant with mortalities below those reported for UTC's. Yields of cotton were significantly higher than the UTC's for both rates of CR-fungicide. However, no differences in yield due to rate of application or rate of fungicide release (Fig. 4).

Controlled release Propiconazole granules at 3.0 lb. a.i./ac on left. UTC on right two rows (Wilde Farm, Tom Green County).

Prothioconazole stem drench at 1.0 lb.a.i./ac on right two rows. UTC on left two rows (Wilde Farm, Tom Green County)..

Plant mortality data for the Wilde farm site, Tom Green County (Fig. 5) showed excess of 20,000 dead plants/ac for UTC in the low rate portion of the plots. The slow release formulation at low rate (1.0 lb a.i./ac) produced some suppression but it required the faster release material to give substantial reduction in disease. At the high rate (3 lb a.i./ac) significantly less disease pressure occurred and therefore the substantial lower mortality counts for both the treated and UTC. Seed cotton yields (Fig. 6) showed a significant increase only from slower release fungicide. Some yield difference between release rates was noted, but the response was not significant. At the higher rate of application, there was no difference in yield due to release rate but a significant increase over the UTC was recorded for both materials.

Results of stem drenching with fungicides at the Tom Green County site are presented in Figs. 7-8. Stem drenching data for the October 2nd mortality counts (Fig. 7) were substantially higher than for August 21st counts (data not shown). The disease progressed very rapidly increasing from 25-30,000 late August to 50-63,000 dead plant/ac in early October (Fig. 7). UTC results for the late drenching figured approximately 95% plant loss from the original stand. The progression of the root rot disease was slightly faster for Prothioconazole when drenches were made earlier (42 DAP) while higher mortalities were recorded for Propiconazole at the later drenches (56 DAP). These differences were non-significant between fungicides but were significantly lower than both UTC's. Seed cotton yields showed approximately 300 to 400% increases in yield from stem drenching (Fig. 8.). Propiconazole produced a non-significant 16% yield advantage over Prothioconazole when applied at 42 DAP and a non-significant 7% advantage when applied at 56 DAP.

Summary

Thus far, our results from this study indicate limited success in suppression of this serious disease on cotton. Previous research on fertilizer N source, use of certain trace elements and soil amendments to reduce soil pH, has shown promising results. Also, use of controlled release dry formulations of Propiconazole at planting has shown good results at most locations. Stem drenching with Prothioconazole or Propiconazole produced excellent results. Biofumigation via Brassica winter cover crop showed less consistent results. Additional research is definitely needed combining the most promising treatments in suppressing this disease.

References

Matocha, J.E., S. Mostaghimi and F.L. Hopper, 1986. Effect of soil and plant treatments on phymatotrichum root rot. Proc. Beltwide Cotton Prod. Res. Conf., Cotton Disease Council p. 24-26.

Matocha, J.E., S.G. Vacek and M.P. Richardson, 2004. Effect of selected fungicides and other treatments on cotton root rot suppression. Plant Disease Council. CD-ROM Proc. of Beltwide Cotton Prod. Res. Conf., San Antonio, TX.

Matocha, J.E., M. Richardson, J.C. Wilborn, 2006. Suppression of phymatrotrichopsis root rot on cotton with improved nutrition and chemical fungicide. CD-ROM. Proc. of Cotton Soil Management and Plant Nutrition Technical Conf., San Antonio, TX.

Matocha, J.E., J.D. Wilborn, S.M. Greenburg, J.M. Bradford, C. Yang, 2008. Biofumigation and soil amendment effects on cotton root rot suppression. CD-ROM Proc. Beltwide Cotton Prod. Res. Conf., Nashville, TN.

Acknowledgments

We thank the following for their support and cooperation in conduct of this research:

1. Texas State Support Committee, Cotton Inc.
2. USDA-ARS, Weslaco, Richard Minzenmeyer, IPM Specialist, Texas AgriLife Extension
3. G. Hargrove, Pursell Technologies
4. Producer – Cooperators: Loyd and Scott Mengers, Charles and Brian Ring, John and Douglas Wilde