TOPSIN® M, A POTENTIAL FOLIAR FUNGICIDE FOR COTTON Beth E. Sears, Tony Estes, Stephen D. Lee and Phil Robinson Cerexagri, Inc. King of Prussia, PA

Abstract

Over the last few years, researchers in the Southeast and Mid-South have identified Topsin M as a viable candidate for use as a foliar fungicide on cotton to suppress certain diseases and increase yields. Florida researchers have demonstrated that Topsin M suppresses *Fusarium sp.*, one of the causal disease agents of hardlock as well as other secondary foliar diseases. In 2004, Cerexagri, Inc. sponsored a regional cotton project with a standardized protocol to evaluate the efficacy and benefits of Topsin M Fungicide. Field trials throughout the cotton belt from Eastern Texas to Virginia were initiated to confirm use rate and timing for future label use.

A Crisis Exemption was granted in the state of Florida in July 2004 for Topsin M 70WSB, EPA Registration # 4581-408, for suppression of hardlock caused by *Fusarium sp.* Cerexagri, Inc. is in the process of obtaining federal Sec. 3 registration for Topsin M on cotton.

Background

Foliar fungicide use on cotton has not been a common practice in the Southeastern and Mid South cotton growing areas of the United States. Hardlock has become a significant problem in the coastal cotton producing regions where high temperatures and humidity produce conditions favorable for disease development. Until recently, the causal agent(s) of hardlock have not been completely understood. Great progress has been made by Univ. of Florida researchers David L. Wright and James J. Marois located in Quincy, FL. They have identified the fungus *Fusarium verticillioides*, as being associated with hardlock and that applications of Topsin M can increase yields when disease is present. Fungicide applications made during the bloom period had the most beneficial effect on both yield and incidence of hardlock.

Topsin M, (thiophanate-methyl a.i.), is a broad spectrum, locally systemic fungicide. It was first introduced in the late 1960's and the first agricultural crop labels were granted in 1979. Since then, Topsin has been labeled on over 25 crops.

Mode of action is through inhibition of fungal germ tubes and growth of mycelia (affecting microtubule (β -tubuline) assembly. It passes through leaf cuticles (transcuticular) and moves locally (intralaminar) throughout the leaf tissue. Once inside the plant TM (thiophanate-methyl) metabolizes into MBC (methyl benzimidazole carbamate), the primary fungitoxic compound. Conversion rate of TM into MBC is dependent on pH, light, temperature and/or moisture present at time of application.

Topsin M is a relatively stable compound and can be formulated into wettable powders, dry and aqueous flowables. It can be applied through ground or aerial application equipment. Environmental fate has been thoroughly studied (Table 1).

Topsin M is one of the three original Benzimidazole type fungicides including benomyl (Benlate®) and thiabendazole (Mertect®). All are single-site fungicides that should be rotated or tank mixed with fungicides of different chemistry for maximum disease resistance management.

Work done in the early 1970's by Hine and associates indicated that benzimidazole fungicides were not absorbed and translocated through peduncles of detached bolls enough to protect locules from infection. Therefore, Cerexagri believes the benefits from Topsin M come from protecting the blooms and leaves on the cotton plant from infection.

Topsin M is registered on several crops for use during the bloom period. These include beans (both succulent and dry), soybean, potatoes, apples, stone fruit, strawberries, almonds, and pistachios. Results from Wright and Marois have shown beneficial effects from Topsin applications beginning at first bloom and repeated at one to two week intervals throughout the primary bloom period.

Discussion

Foliar fungicide use on cotton is not currently an accepted grower practice and has to be proven. In order to commercialize Topsin M on cotton, there must be a quantifiable, economical spray program that will benefit cotton growers. In 2003 and 2004, Cerexagri, Inc. a US based agrichemical company located in King of Prussia, PA supported several efficacy trials based on the initial work done in Florida. They were placed throughout the Southeastern and Mid South cotton belt and were specifically designed to establish an acceptable grower use pattern.

Although hardlock pressure in 2003 and 2004 was significantly less than in 2002, some beneficial effects of using Topsin M were observed including higher yields and greater leaf area. Potential quality improvements to the cotton lint are also being evaluated at Cotton, Inc. located in Cary, NC.

Challenges and questions that face the whole concept of using Topsin M on cotton for reduction of hardlock caused by *Fusarium verticillioides* and other diseases are the following:

- 1. Optimum rate/timing and number of applications
- 2. Quantifying the other causes of hardlock that may include diseases, insects and physiological effects.
- 3. Separating boll rot from hardlock in certain cotton growing areas
- 4. Being able to predict hardlock (from *Fusarium verticillioides*) pressure based on weather models
- 5. Being able to quantify the economical benefits of Topsin M applications to cotton growers

Residue trials were conducted in 2003 and 2004 for a preparation of a regional label (East of the Rockies). The registration package will be submitted during 2005. Cerexagri has run a new Risk Assessment using these values and has determined the likelihood of EPA registering Topsin on cotton. Residue levels are minimal and the processing study is currently in progress.

Topsin M is in the final stages of the RED (Re-registration Eligibility Document) The draft RED was issued in December of 2004 and the 60-day public comment period ends Jan. 24, 2005. All initial crops survived the process and several additional crops have been added since the draft RED in September 2001 (canola, grapes, pears, pistachios and potatoes). The maximum rate that will be allowed on any crop appears to be 2.8 lbs a.i. All efficacy trials were done with a maximum rate of .7 lb a.i. per application.

Conclusion

Over the last 3 years, Topsin M fungicide has been shown to reduce hardlock in cotton (caused by *Fusarium verticillioides* and other diseases) in research trials done by the University of Florida. Not only were yield increases documented, but also other positive effects included seed quality (weight and germination) and improved fiber quality. Results from 2002 created a genuine interest in Topsin M in the university and cotton grower communities and Cerexagri, Inc. Although hardlock was not as severe in 2003 and 2004, positive indicators were observed as increased yield and leaf surface area.

Research in 2005 will continue to look at the effects of Topsin M on cotton for disease control, yield and leaf area, and effects on lint and seed (quality and germination).

Cerexagri, Inc. is pursuing a registration for Topsin M on cotton. As long as the risk cup will accept the residue results that cotton might add, and the use pattern needed is economically feasible, Topsin M will have bright future in cotton production. Growers in the hot, humid cotton growing areas of the US will have a tool to protect their yields that is not available today.

References

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Table 1. Thiophanate-methyl Chemical Structure

Chemical Structure

Trade Name: Topsi	n® M Fungicide
Chemical Class:	Carbamate
Chemical Group:	Thiophanates
Common Name:	Thiophanate-methyl
FRAC Code: I	
FRAC MOA Code:	BI s o
Thiophanate-methyl has a thioallophanat structure.	Re NH - C - NH - C - OCH, NH - C - NH - C - OCH, NH - C - NH - C - OCH, S O

Table 2.	Environmental	Fate	Profile of	To	psin	M F	lungici	de
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Environmental Aspect	Effect	
Soil	Rapid degradation, low water solubility, binds to soil particles	
Water	Undergoes rapid hydrolysis and photodegradation	
Air	Non volatile	
Non target organisms	Bees – not toxic	
	Birds – very low toxicity	
	Fish – toxic to fish	

Topsin is a registered trademark of Nippon Soda Company, Ltd. Benlate is a registered trademark of E. I. du Pont de Nemours and Company

Mertect is a registered trademark of Syngenta Crop Protection, Inc.