

ETRIDIAZOLE - EFFICACY, MODE OF ACTION AND PLANT METABOLISM

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Abstract

Field trials done with Terrazole® 4EC (4 lb. active ingredient/gal.) have demonstrated that this product can be tank mixed with Terraclor® 2E or Rovral® 4F to provide broad spectrum seedling disease control. Mode of action studies indicate that soil applied etridiazole is readily picked up by germinating cotton seedlings and moves systemically throughout the roots, stems and cotyledons. Plant metabolism studies in cotton show that in mature plants etridiazole is degraded to naturally occurring compounds.

Introduction

The common name of the active ingredient in Terrazole products is etridiazole, which is the thiadiazole compound 5-ethoxy-3-(trichloromethyl)-1,2,4 thiadiazole.

The primary activity of etridiazole as an in-furrow fungicide is to control *Pythium* soil-borne disease. It has been used for more than thirty years in combination with PCNB in the form of Terraclor Super X® granular or liquid products to provide broad spectrum (*Rhizoctonia*, *Pythium* and *Fusarium*) cotton seedling disease control. The ratio of etridiazole to PCNB in Terraclor Super X products is 1:4. At the current labeled rates for Terraclor Super X products, the etridiazole active ingredient rate is 3 to 4 ounces per acre. Commercial experience indicates that there is no significant difference in the *Pythium* control in that rate range. This suggests that the ratio of etridiazole to PCNB can be modified and still provide a high level of disease control.

In-furrow fungicide treatments provide the best opportunity to obtain disease control throughout the entire seedling development phase. This includes the seed prior to germination, the developing seedling prior to emergence and the critical early post emergence phase. It is known that PCNB preferentially binds to the outer tissue of the seedling as it grows through the treated soil. This creates a protective barrier which protects the seedling from *Rhizoctonia* infections in both the pre and post emergence phases.

The activity of etridiazole is not as well understood as that of PCNB. The demonstration of systemic activity and an understanding of its metabolism in cotton would help explain how etridiazole complements the activity of PCNB in cotton.

Discussion

In-furrow Application Rates of Terrazole 4EC

Table 1 summarizes the efficacy of etridiazole in 5 trials conducted by UCC cooperators in 1996 mid-south cotton trials. There was no significant difference in the efficacy of 1.5, 2.0, 2.5 and 3.0 ounces active ingredient per acre when applied as a tank mix with Terraclor 2E at 4 pints per acre. Table 2 was prepared from data previously reported by Rhone-Poulenc at the 1997 Beltwide Conference. In 10 university and private consultant trials, there was no difference in the stand counts when etridiazole was applied at 2.0 or 4.0 ounces active ingredient per acre in tank mixes with Rovral 4F at 6.4 or 3.25 fl. oz. per acre.

It appears that tank mixes of Terrazole 4EC at 4 fl. ounces of formulated product (2 ounces of active ingredient per acre) in combination with labeled rates of Terraclor 2E or Rovral 4F will provide effective control of *Pythium* and *Rhizoctonia* cotton seedling diseases.

Mode of Action

Seventeen days after planting cotton seeds in soil treated with ¹⁴C etridiazole, radioactivity was distributed throughout the cotton seedling (Table 3). The ¹⁴C etridiazole was added to a Terrazole 4EC formulation and applied to the soil at a rate of 8 fluid ounces/A (4 ounces a.i.) at planting. Examination of autoradiograms and the plant cotyledons under a light microscope revealed that the radioactivity was distinctly concentrated in the lysigenous (dark pigmented) glands below the palisade cells of the leaves and the hypodermal cells of the stems.

Plant Metabolism

The metabolism of etridiazole in mature cotton grown in soil treated with ¹⁴C labeled etridiazole was investigated by UCC. In contrast to the mode of action study, which resulted in significant residues of the parent compound in the young seedling, normal in-furrow application rates resulted in very low levels of radiolabeled residues in the mature plant. In order to facilitate metabolite identification, it was necessary to utilize exaggerated application rates (10 to 100X). Specialized extraction techniques were developed to recover 80% of the radiolabeled residues in mature seeds and 70% of the radiolabeled residues from the foliage.

The major radiolabeled metabolites found in mature cotton seeds were urea and the naturally occurring fatty acids - linoleic, stearic and palmitic acids. In addition, radiolabeled urea was found in the foliage. These results indicate that the cotton plant metabolizes etridiazole to naturally occurring products by dechlorination followed by a splitting of the thiadiazole ring with the release of urea.

Summary

Rate studies indicate that Terrazole 4EC can provide effective *Pythium* disease control when applied as an in-furrow combination with Terraclor 2E or Rovral 4F at 4 fluid ounces (2 ounces active ingredient) per acre. The efficacy of etridiazole appears to be related to its ability to move systemically in young seedlings. As the cotton plant matures, etridiazole is metabolized to naturally occurring compounds including urea and fatty acids.

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Table 1. Comparison of plant stand improvements resulting from in-furrow treatments to cotton with Terrazole 4E at 3, 4, 5 or 6 fl. oz./A (5 midsouth/southeast locations – 1996).

	Terrazole 4E (fl. oz./A)			
	3 oz	4 oz	5 oz	6 oz
Stand Count (% of check)	128.2	127.5	130.8	121.

Table 2. Comparison of plant stands resulting from in-furrow treatments to cotton with Terrazole 4E and Rovral 4F (10 university and private consultant locations).

	Plants per Row Foot
	1.39
Untreated Check	
Rovral 4F @ 6.4 fl oz	2.68
Terrazole 4E @ 8 fl. oz.	
Rovral 4F @ 3.25 fl oz.	2.43
Terrazole 4E @ 4 fl. oz	

Table 3. Distribution of radioactivity (ppm) in the roots, stems and leaves of cotton seedlings seventeen days after planting seeds in soil treated with ¹⁴C etridiazole.

Extract Fraction	Radioactivity (ppm)		
	Roots	Stems	Leaves
Extractable	15.1	21.6	15.3
Non-Extractable	3.5	3.5	5.1
Total	18.6	25.1	20.4