



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, DC 20460

OFFICE OF  
PESTICIDES AND  
TOXIC SUBSTANCES

March 31, 1989

MEMORANDUM

SUBJECT: Biological Evaluation of Public Interest Documentation Submitted by Merck Sharp & Dohme Research Laboratories in Support of Conditional Registration of Avermectin B<sub>1</sub> on Cotton and Citrus.

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INTRODUCTION

I have reviewed the Public Interest Documentation submitted by Merck Sharp & Dohme Research Laboratories in support of conditional registration of avermectin B<sub>1</sub> on cotton and citrus and am offering the following discussion and conclusions for your consideration.

Avermectin B<sub>1</sub> is a natural product containing macrocyclic lactone glycoside and is a product of the fermentation by the soil microorganism Streptomyces avermitilis. Avermectin B<sub>1</sub> is a slow acting toxicant which exhibits both contact and stomach poison activity (Thomson, 1985) and acts by stimulating the release of gamma aminobutyric acid (GABA), an inhibitory neurotransmitter in arthropods and vertebrates (CDFA, 1987). Avermectin B<sub>1</sub> is also known as abamectin, Avid®, Agri-Mek®, Zephyr®, Affirm®, and MK-936. The applicant is proposing conditional registration of a two percent (0.15 pound per gallon) formulation of Avermectin B<sub>1</sub> on cotton and citrus for the control of mites.

COTTON

The proposed label specifies an application rate of 0.01 to 0.02 pounds ai per acre for controlling spider mites on cotton. The applicant claims that because of its unique mode of action, this product will be a useful alternative to dicofol and propargite for control of resistant spider mite populations.

The applicant also claims that avermectin B<sub>1</sub> does not disrupt natural enemies in the cotton ecosystem, provides long residual control of spider mite populations, and reduces the number of acaricidal applications made annually.

The documentation submitted to support these claims was, in a word, non-existent. The application was totally devoid of any efficacy data, efficacy summaries, or even a bibliography. Perusal of the 1986 through 1988 issues of Insecticide & Acaricide Tests revealed six comparative efficacy studies which evaluated the efficacy of avermectin B<sub>1</sub> against spider mites on cotton. These studies, which are summarized in Table 1, suggest that avermectin B<sub>1</sub> is at least as effective in controlling spider mites as propargite, dicofol, curacron, and bifenthrin and in some situations may be slightly more efficacious and possess slightly better residual activity than propargite. According to Croft et al. (1987) avermectin B<sub>1</sub> is moderately selective to phytoseiid mite predators. I was unable to locate any information regarding the effect of avermectin B<sub>1</sub> on other natural enemies. Localized resistance of spider mites to dicofol, and to a lesser extent propargite, seems to be fairly well established in the literature (e.g. Grafton-Cardwell et al, 1987; Dennehy et al, 1987).

#### CITRUS

The proposed label specifies an application rate of 0.006 to 0.023 pounds ai per acre (or 0.00117 to 0.00234 pounds ai per 100 gal water with 500 to 2000 gallons of water applied per acre) for controlling citrus rust mite, broad mite, or twospotted spider mite on citrus. The applicant claims that because of its unique mode of action, this product may prevent or delay the onset of acaricide resistance in the citrus rust mite when used in alternate sprays with currently registered acaricides (e.g. fenbutatin-oxide, dicofol, ethion). The applicant also claims that avermectin B<sub>1</sub> is the only selective acaricide that can be used as a summer spray because it is compatible in oil sprays (which are often used in the control of the fungal disease greasy spot) and it is not detrimental to the natural enemies of the citrus rust mite or the citrus snow scale. Ethion cannot be tank mixed with more than 0.5% oil (insufficient concentration for greasy spot control) and the effectiveness of fenbutatin-oxide is reduced when mixed with oil. Dicofol causes flare-ups of the citrus snow scale and should not be used in orchards infested with this insect unless a scalcicide is added. Lastly, the applicant claims that single, well timed applications of avermectin B<sub>1</sub> can provide long residual control (up to 120 days) of citrus rust mites at rates as low as 0.0125 pounds ai per acre (plus oil).

The documentation submitted to support these claims was, in my opinion, unsatisfactory. It consisted of 3 letters from industry, academic, and extension experts, and a laboratory efficacy study. The documentation also cited sections from the Florida State Recommendations which were useful in verifying the validity of the first two claims. Except for the testimonials, no support was provided to establish the efficacy of avermectin B<sub>1</sub> against mites under actual use conditions. According to Ekart and Marino (1989), fenbutatin-oxide is considered the most effective acaricide currently in use on Florida citrus. Propargite, dicofol, and oxythioquinox are also considered effective but are of limited use due to phytotoxicity problems (propargite, oxythioquinox), resistance, and short residual effectiveness (dicofol). Perusal of the 1987 and 1988 issues of Insecticide & Acaricide Tests revealed 7 comparative efficacy

studies evaluating the efficacy of avermectin B<sub>1</sub> against mites on citrus. These studies, which are summarized in Table 2, suggest that avermectin B<sub>1</sub> is equal or slightly inferior to fenbutatin-oxide and oxythioquinox and equal or slightly superior to dicofol or propargite for the control of mites on citrus.

#### CONCLUSIONS

The documentation submitted to support the claims made by the applicant was unsatisfactory for the purpose of making a public interest finding. I was, however, able to glean enough information from my personal files to make a determination. From a biological perspective, the conditional registration of avermectin B<sub>1</sub> on cotton and citrus appears to be in the public interest. Avermectin B<sub>1</sub> has demonstrated satisfactory efficacy against spider mites on cotton and, due to its unique mode of action, should be a useful alternative to dicofol and propargite for the control of resistant spider mite populations. While citrus growers have not experienced the same mite resistance problems as cotton growers, the registration of avermectin B<sub>1</sub> would provide growers a much needed alternative in their spray program to prevent or delay the onset of acaricide resistance. Avermectin B<sub>1</sub>'s most useful attribute will be its ability to be used in the summer because of its compatibility with oil sprays and because it does not cause flare-ups of citrus snow scale populations. Avermectin B<sub>1</sub> also appears to meet the criteria for a presumption of public interest for the citrus and cotton uses due to the former special review of dicofol, the current review of propargite, and the section 18 exemption granted on cotton.

Table 1. Efficacy Ratings of Cotton Acaricides Relative to Avermectin.

Reference 1/	Mite	EFFICACY RATING				
		Propargite	Dicofof	Curacron	Bifenthrin	
Wynolds et al, 1988 (111F)	PSM, TSM, SSM	2				
Robinson et al, 1987 (289)	Carmine SM	4	4		4	
Royer et al, 1987 (292)	Spider mites	1			2	
Fitt et al, 1986 (448)	Carmine SM		2		3	
Luttrell et al, 1986 (371)	Spider mites	3	3		3	
Wynholds et al, 1986 (387)	Spider mites	<u>1.5</u>				
AVERAGE		2.3	3	3	3	

1/ Source: Insecticide/Acaricide Tests (Paper Number in parentheses)

2/ Rating System: 1 = inferior to Avermectin  
 2 = slightly inferior to Avermectin but differences are not statistically significant  
 3 = equivalent to Avermectin  
 4 = slightly superior to Avermectin but differences are not statistically significant  
 5 = superior to Avermectin

Table 2. Efficacy Ratings of Primary Citrus Acaricides Relative to Avermectin.

Reference 1/	Crop/Mite	EFFICACY RATING 2/			
		Fenbutatin-oxide	Dicofol	Propargite	Oxythioquinox
Story et al, 1988 (2D)	Orange/Citrus red	4			
Childers et al, 1988 (6D)	Orange/Citrus rust	3			
Childers et al, 1988 (7D)	Orange/Citrus rust	4	2		
" " " "	Test 2	3		2	
Knapp et al, 1988 (15D)	Orange/Citrus rust	5			4
Story et al, 1987 (85)	Orange/C. red	4			
Hare et al, 1987 (89-A)	Lemon/C. red	3	3		3
French, 1987 (92)	Orange/TCM	4			
Average		3.75	2.5	2	3.5

1/ Source: Insecticide/Acaricide Tests (Paper Number in parentheses)

2/ Rating System: 1 = inferior to Avermectin  
 2 = slightly inferior to Avermectin but differences are not statistically significant  
 3 = equivalent to Avermectin  
 4 = slightly superior to Avermectin but differences are not statistically significant  
 5 = superior to Avermectin

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