OPTIMIZATION OF FIPRONIL APPLICATION

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Abstract

Research was conducted to evaluate several oil adjuvants for use in ultra-low-volume (ULV) application and several drift retardants for use in low-volume (LV) application of fipronil by aircraft for boll weevil control.

The efficacy of fipronil in different oil adjuvants was determined. The three oil adjuvants tested were: once refined cottonseed oil from Yazoo Valley Oil Mill, Greenwood, MS., Orchex® 796, and WS2908. Orchex® 796 and WS2908 are horticultural mineral oils developed by Exxon Chem. Co., Baytown, TX. WS2908 is a blend of Orchex® 796 and EX-100, a drift retardant.

Sprays were applied ULV, 1.17 L/Ha (16 oz/A), with Air Tractor 402 aircraft on July 7 and 20, 1998 at Stoneville, MS. Fipronil was applied at 0.056 kg (AI)/Ha (0.05 lb/A) in each of the oils.

Leaves were collected at 0, 1, 2, and 3 days after treatment for bioassay in petri dishes. Mortality readings were taken at 48 h after placing the weevils on treated leaves.

Immediately after treatment, there were no differences in percentage mortalities, which ranged from 98 to 100. At 1 day after treatment, mortality was lowest (92%) when Orchex[7] 796 was used at an adjuvant compared to that of cottonseed oil (98%) and WS2908 (100%). Mortality from the cottonseed oil treatment was greater than that of WS2908 for the remainder of the test and greater than that of Orchex[7] 796 at days 2 and 4.

A test was conducted to determine the ability of the oils used in these field tests to transfer fipronil from cotton leaves to boll weevils. Leaves were collected from plants grown in the field. Fipronil (0.056 kg/Ha, 0.05 lb/A) mixed in the different oils was applied to excised cotton leaves using a spray chamber equipped with an air-assisted spraying system. Application was made at a 1.17 L/Ha (16 oz/A) volume. Boll weevils were placed on the leaves one weevil at a time. The distance traveled by the weevil over the leaf surface was measured using a VideoMex-V motion analysis system (Columbia Instruments, Columbus, Ohio). After a weevil had walked across the leaf, it was transferred to a 35 ml plastic diet cup containing a diet plug. Mortality was recorded 48 h after exposure to the treated leaf.

Cumulative mortality was regressed on distance traveled. The Weibull function,

cumulative mortality =

$$Max - \frac{Max}{\exp\left(\left(\frac{x}{Mu}\right)^{Rate}\right)}$$

was found to best fit the data. The parameters from the Weibull function produce estimates of the following:

Max - maximum cumulative mortality
Mu - distance at which half of the maximum mortality occurs
Rate - shape or slope of the curve.

F tests were used to compare these parameters for each treatment.

Maximum mortality was greatest for cottonseed oil (38%), while mortalities for Orchex® 796, WS2908, and water were 20, 16, and 8% respectively. Mu is defined as the distance at which half of the maximum mortality occurs. The value of Mu for the cottonseed oil treatment was 7.04 cm. This means that a level of 16% mortality, one half the maximum mortality of 38%, would occur if weevils traveled 7.04 cm over a cotton leaf treated with 0.056 kg/ha (0.05 lb/A) of fipronil mixed in cottonseed oil. The shortest Mu occurred when weevils walked over cotton leaves treated with fipronil mixed in water; however, this Mu only resulted in 4% mortality.

The lowest rates among the treatments were those of cottonseed oil (2.39) and Orchex® 796 (4.64). However, cottonseed oil and Orchex[7] 796 had higher Max=s than the other treatments. Rate is relative to Max and therefore comparisons of rates between treatments are not direct.

Three experimental drift retardants, developed by Helena Chemical Co., were used in these tests. The drift retardants and their use rates were: HM 9733-A (6 oz/100 gal), HM9810 (1.0 % v/v), and HM9850 (1.0 lb/100 gal). Fipronil was mixed with each drift retardant in an aqueous mixture at a 0.003 kg/Ha (0.0167 lb/A) rate and applied in a 9.6 L/ha (1.0 gal/A) total volume. Applications were made with an Air-Tractor 402 aircraft on July 27, August 4, and August 25. Leaves were collected at 0, 1, 2, and 3 days after treatment for bioassay in petri dishes. Mortality readings were taken at 48 h after placing the weevils on treated leaves.

Except for HM9810, mortalities from fipronil mixed with drift retardants were higher, 99 and 95% respectively, than that of the standard application in water (91%) on day 0. However, at 1 day after treatment, the standard treatment with water had a higher mortality (94%) than all of the drift

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retardant treatments (65 - 84%). At 2 days after application there was no difference in mortality of the standard water treatment (71%) and HM9733-A (63%). Both of these treatments had higher mortalities than HM9810 and HM9850. At 3 days after treatment, HM9733-A had a mortality (50%) that was higher than all the other treatments (26 - 30%).

Fipronil at the low rate of 0.0167 lb/A, which is one-third the recommended rate of 0.05 lb/A, produced mortalities comparable to those observed in the oil adjuvant test in which fipronil was applied at 0.05 lb/A.