GREASING THE WEEVIL: OIL DILUENTS FOR ULTRA LOW VOLUME APPLICATION IN THE ERADICATION PROGRAM

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Abstract

Three oil diluents were evaluated in application tests against the boll weevil in the laboratory and field at the USDA-ARS Research Laboratory at Stoneville, MS during 1997. The diluents used in these tests were: once-refined cottonseed oil (Yazoo Valley Oil Mill, Greenwood, MS), Orchex ® 796 and WS2908B (Exxon Research and Engineering Co., Baytown, TX).

In spray chamber tests, two rates of cyfluthrin (0.028 and 0.033 lb/A) were applied in two different carriers, water at 10 gpa and Orchex ® 796 at 16 and 32 oz/A. The 0.028 lb/A rate applied in the conventional 10 gpa volume had significantly lower percentage boll weevil mortality (76%), than the other treatments. There were no other differences in mortalities (100 - 98 %) between treatments.

Two ground application tests were conducted, the first test compared 0.012, 0.016, 0.02, 0.024, and 0.028 lb/A of cyfluthrin applied in Orchex ® 796 at a 16 oz/A total volume using an air-assisted ULV ground sprayer. There were no differences in mortality between cyfluthrin rates until 2 days after treatment. At this time, mortality was correlated with dosage. The 0.028 lb/A rate had the greatest mortality (87%), while the 0.024 and 0.02 lb/A rates had mortalities of 74 and 69%, respectively, which were not significantly different.

A second test, also applied with an air-assisted ULV ground sprayer, compared the efficacy of 0.02 lb/A of cyfluthrin, 0.02 lb/A of cyhalothrin (Karate, Zeneca), 0.025 lb/A of fipronil (Rhone Poulenc), 10 oz/A of ULV malathion (Cheminova), and 0.025 lb/A of zeta-cypermethrin (Fury, FMC). All insecticides were mixed in cottonseed oil and applied at a total volume of 16 oz/A. Results showed that fipronil and ULV malathion were more toxic to boll weevils at 0 days after treatment (DAT) than the pyrethroid insecticides. Mortalities at 3 DAT, are difficult to explain, because fipronil, Fury, and Karate had greater mortalities at 5 DAT than they did at 3 DAT. At 5 DAT, fipronil (70%) and Fury (71%) had greater mortalities than Baythroid (52%), while Karate (56%) was not different from Baythroid. Mortality from ULV malathion was significantly lower at this time than all the other treatments. At 7 DAT, all insecticides produced low mortalities that ranged from 0 to 22%. Fipronil (7%) and ULV malathion (0%) had lower mortality than Karate (22%) which was the same as Baythroid (16%) and Fury (16%). At the rates used, the pyrethroids seemed to have greater longevity than fipronil or ULV malathion.

A series of aerial application tests of cyfluthrin and ULV malathion, which compared rates and types of oil diluents, were conducted during August and September 1997. The first of these tests determined the effects of oil diluents on efficacy of ULV malathion. Three oil diluents (cottonseed oil, Orchex ® 796, and WS2908B) were used. Ten ounces of ULV malathion per acre were applied in a total volume of 37 oz/A of diluent. A 10 oz/A application of undiluted ULV malathion was used as a standard. There were no differences in mortality between treatments throughout the 3 days of the test period. At 3 DAT, the undiluted 10 oz/A application of ULV malathion was just as effective (100% mortality) as 10 oz/A of ULV malathion mixed in a total volume of 37 oz/A of WS2908B (100%) or Orchex ® 796 ((85%) or cottonseed oil (94%).
The petri dish bioassay has been almost exclusively used to evaluate treatments in my application tests because of its utility. In an effort to determine the relevance of the petri dish bioassay to efficacy occurring in the field, a caged-plant bioassay was conducted. This bioassay may be a better indicator of what is occurring in the field because in it weevils have an opportunity to behave like a weevil in the field. Mortalities were slightly lower in the caged plant bioassay than the petri dish bioassay, in which there were no differences between treatments. In the caged plant bioassay at 2 DAT, ULV malathion mixed in WS2908B and the undiluted application had higher mortality than malathion mixed in cottonseed oil or in Orchex ® 796. Lower mortality would be expected because the weevil has more opportunity to avoid insecticide deposits when caged on the plant as opposed to being confined on a leaf in a petri dish.

Tests comparing 10, 8, and 6 oz/A rates of malathion applied by aircraft were also conducted. In this rate test of ULV malathion, significant differences between rates did not occur until 2 DAT. At this time, the 10 oz/A rate had greater boll weevil mortality (100%) than the 8 (78%) and 6 (80%) oz/A rates which were not different from each other. At 3 DAT, the 10 oz/A rate again had the greatest mortality(100%); however, the 6 oz/A rate (74%) was greater than the 8 oz/A (68%).

Tests of cyfluthrin (0.02 lb/A) mixed in the three different oils were conducted in the same manner as that of the ULV malathion tests. In this test, percentage boll weevil mortalities fluctuated during the testing period. Cyfluthrin mixed in cottonseed oil produced greater mortality (83%) at 2 DAT than WS2908B (78%) and Orchex ® 796 (61%). Cyfluthrin mixed in WS2908B had mortalities equivalent to the cottonseed oil treatment in all bioassays except at 2 DAT. Cyfluthrin mixed in Orchex ® 769 had the lowest mortality at 0 (78%) and 2 (61%) DAT.

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The rainfastening ability of these diluents was determined in the field when rain (0.4") occurred during the testing period and in the laboratory in simulated rainfall (0.125") tests.

In rainfastness determinations in the field, there were no differences between treatments before rainfall at either 1 or 3 DAT. When rain (0.4") occurred between 1 and 2 DAT, boll weevil mortality was reduced the greatest (80% reduction) when ULV malathion was applied as an undiluted spray at 10 oz/A. Malathion applied at a 37 oz/A total volume with Orchex ® 796 and WS2908B as diluents produced the greatest mortalities, 85 and 71% respectively, after rain. In another test, rain (0.4") occurred between 3 and 4 DAT. Mortality after the rain was greatest (87%) when WS2908B was used as a diluent. There were no differences in mortality between the other three treatments. In these field tests, WS2908B and Orchex ® 796 showed the greatest rainfastness. Undiluted malathion has very little ability to stay on the plant during rain.

In laboratory rainfastness tests; before rainfall, there were no differences in mortality produced by three different insecticides mixed with cottonseed oil or Orchex ® 796 or as an undiluted spray with malathion. After simulated rainfall, differences in mortality for each insecticide were a result of the rates applied. Fipronil mixed in either cottonseed oil or Orchex ® 796 had the greatest mortality (93%). Cyfluthrin produced mortalities of 70 and 52 % for cottonseed oil and Orchex ® 796 respectively which were significantly different from each other. The mortality from malathion was reduced the most with values ranging from 32 to 17 %. The type of diluent had no effect on malathion rainfastness as mortalities with malathion were not significantly different from each other.

Evaluations of oil diluents in field tests did not reveal enhanced toxicity of ULV malathion or cyfluthrin. Rainfastness of ULV malathion was increased in the field when WS2908B and Orchex ® 796 were used as diluents; however, under more stringent conditions in laboratory rainfastness tests there was no enhancement of ULV malathion rainfastness through the use of either oil diluent.