THE USE OF MALATHION ULV IN TEXAS BOLL WEEVIL ERADICATION PROGRAMS

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Abstract

Malathion ULV has been used as an essential tool for boll weevil, *Anthonomus grandis* Boheman, eradication programs in the United States. The primary objective of this report is to present guidelines currently implemented in the Texas boll weevil eradication program relative to the use of malathion ULV application rates, methods of application, application threshold, and application intervals under different weather conditions.

Introduction

The insecticidal efficacy of malathion ULV applied by aircraft to cotton fields for control of the boll weevil, *Anthonomus grandis* Boheman, was demonstrated by Burgess (1965) and Cleveland et al., (1966).

Area-wide late season applications of insecticide targeting diapausing populations before entering hibernation sites resulted in a significant reduction in the following spring emerging populations (Brazzel, 1959). The timing of the late-season diapause applications was later modified to reproduction diapause applications (Adkisson et al., 1965), (Lloyd et al., 1966), and (Rummel et al.,1971, 1973, and 1975). Key environmental and agronomic factors responsible for diapause induction in boll weevils were summarized in 1973 (Carter and Phillips, 1973).

Field evaluation, modification, and improvement of the boll weevil pheromone trap added an important detection devise in boll weevil control strategies (Cross and Hardee 1968), (Hardee et al., 1972), (Cross et al., 1974), and (Leggett et al., 1971). Further investigations of the effectiveness of the pheromone trap led to the establishment of treatment thresholds based on trap captures currently used by the boll weevil eradication program (Rummel et al., 1977 and 1980), (Merkl and McCoy 1978), (Leggett et al., 1980 and 1988), (Benedict, et al., 1985), and (Slosser, et al., 1991).

Results produced by the implementation of boll weevil eradication programs in the southeastern and southwestern U.S. can be attributed to the use of boll weevil pheromone traps and malathion ULV as essential tools in the eradication effort (Cunningham and Grefenstette, 1998). Field trials conducted in San Angelo, Texas, confirmed superior efficacy of malathion ULV for boll weevil control when compared with other insecticides (England et al., 1997).

Malathion ULV was used at a rate of 16.0 fl oz/ac (Fyfanon® ULV) in 1994, when the Texas boll weevil eradication program was first initiated in the Southern Rolling Plains (El-Lissy et al., 1996). Fields trials conducted in 1995 in Hidalgo County Texas, under actual eradication program conditions, demonstrated no significant differences in the efficacy provided by malathion ULV when applied by air at 12.0 or 16.0 fl oz/ac (Jones et al., 1996). Similar findings were reported based on trials conducted in Mississippi (Villavaso et al., 1996). In 1995, the Texas boll weevil eradication technical advisory committee made the recommendation to begin using malathion ULV at12 fl oz/ac instead of 16fl oz/ac, when applied by air in all eradication zones in Texas.

Slosser et al., (1987) reported significantly higher number of adult weevils and weevil damage at field edges compared with damage at 3 m and 15.2 m from the margin. This emphasized the importance of treating field borders with mist blower sprayers in reducing the overall weevil populations, particularly in the later part of the growing season.

The level of boll weevil mortality in cotton fields treated with malathion ULV was significantly reduced when fields were subjected to rainfall as low as 0.13" within 1-6 hours of application (El-Lissy et al., 1997).

Materials and Methods

Treatment Threshold

The boll weevil eradication program in Texas begins in the first year with the diapause phase, followed by 3-4 season-long phases and then the post-eradication phase. The diapause phase is designed to reduce weevil populations in an eradication zone prior to hibernation, thus reducing the spring emerging populations the following year. The season-long phases are designed to systematically further reduce the population until eradication is achieved. The post-eradication phase is designed to prevent the reintroduction of the boll weevil to a zone where boll weevils were eradicated.

a. Diapause phase: A single aerial application of Fyfanon® ULV or Atrapa™ ULV (malathion ULV) is made on a weekly basis to fields exhibiting the early open boll stage. The early open boll stage is defined as a crop stage exhibiting one open boll per plant on approximately 25-50% of all plants in a cotton field. All cotton fields in an eradication zone begin to receive weekly applications when approximately 50% of all fields in each zone exhibit the early open boll stage. The weekly applications continue until the hostable parts of

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the cotton plant and food sources, including squares, blooms, and green bolls, are eliminated by defoliation, harvesting, or a killing freeze.

b. Season-long phase: A single aerial application of malathion is made beginning at a pinhead square crop phenology to fields that reach the treatment criteria (action threshold). In the first season-long phase of the program, the action threshold is a total of two adult boll weevils per 40-acre field. The action threshold is increased to five adult weevils per 40-acres during the mid-season period of the crop year, then reduced to two weevils beginning at the early open boll stage. In the second season-long phase, the action threshold is two weevils per 40-acres for the entire growing season. In the third season-long phase the action threshold is reduced to one weevil per field (any size) for the entire season. In the post-eradication phase, a capture of one weevil triggers the treatment of all adjoining fields to the trap where a weevil is captured.

Methods of Application and Rates

a. Aerial application: Aerial applications of malathion ULV are made by airplanes equipped with a spray system designed and calibrated to deliver 12.0 fl oz/ac (0.92 lb [AI]/ac) (El-Lissy et al., 1999). Each aircraft is equipped with a differentially corrected Global Positioning System (GPS) unit. The GPS provides information about the exact position of aircraft during flight, flight pattern, time and date of application, speed, swath width, spray on/off, and flight time for each field as well as total flight time for each airplane (El-Lissy et al., 1999).

b. Ground application: Fields located within close proximity to environmentally sensitive sites, i.e., schools, residences, child care centers, wildlife refuges, rivers, or fields near obstacles where aerial application is not possible, are treated with ground equipment. The high-clearance, ground-spray equipment (SPRA-COUP and John Deere) are equipped with a spray system calibrated to deliver a 1:1 mixture of malathion ULV and once-refined cottonseed oil at a total volume of 32oz/ac.

c. Mist blower application: Mist blowers mounted on pickup trucks are also used to provide accurate placement of insecticide on corners and edges of fields and under power lines or other obstacles where airplanes have less accessibility. Each mist blower is calibrated to deliver 16 oz/ac of malathion ULV covering approximately a 40-50 foot swath.

Rainfall

Treated fields subjected to approximately 0.13 inches of rainfall within 24 hours from the time of the application are retreated as soon as conditions permit.

Results and Discussion

In the Texas program malathion ULV has shown superiority in efficacy compared with other weevil materials. In fact, the use of malathion as the primary tool of the eradication program has resulted in consistent and significant reduction in boll weevils in every eradication zone in Texas. Weevil populations in the Southern Rolling Plains zone have been reduced by 99.98% (Figure 1), in the Rolling Plains Central zone by 99.1% (Figure 2), and in the South Texas/Winter Garden zone by 92.8% (Figure 3)(El-Lissy et al., 1999).

In addition to its efficacy, the ULV formulation of malathion resulted in maximizing aircraft productivity by increasing the number of acres treated per load and minimizing ferry time between airports and fields when compared with water-based formulations of insecticides. This has translated into a substantial saving in the cost of applications.

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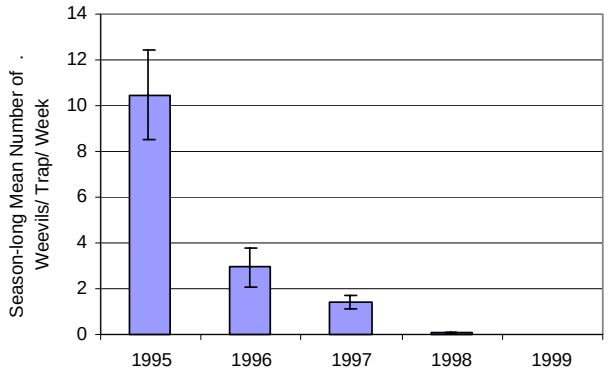

Figure 1. Season-long mean number of adult boll weevils captured per trap per week by year and standard error in the Southern Rolling Plains Zone of Texas.

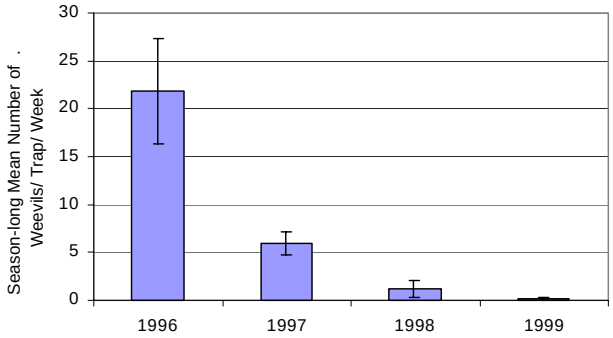

Figure 2. Season-long mean number of adult boll weevils captured per trap per week by year and standard error in the Rolling Plains Central Zone of Texas.

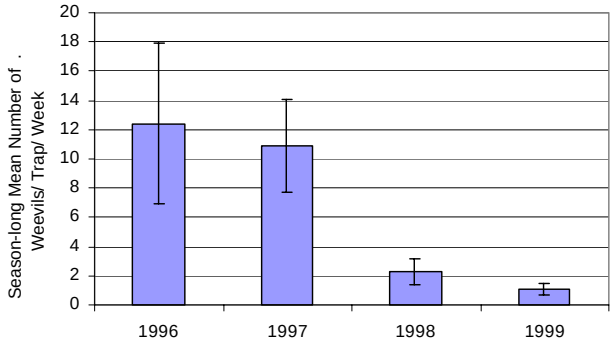

Figure 3. Season-long mean number of adult boll weevils captured per trap per week by year and standard error in the South Texas/Winter Garden Zone of Texas.