# FIELD RESIDUAL ACTIVITY OF SELECTED FORMULATIONS OF MALATHION AGAINST *CATOLACCUS GRANDIS*

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## Introduction

Eradication programs have eliminated boll weevil as an economic pest from 4.5 million acres in 8 states (Cunningham and Greffenstette 1998). Eradication program protocols have relied heavily on the use of malathion to eliminate boll weevil. *Catolaccus grandis* (Burks) has been extensively evaluated for suppression of boll weevil in cotton and may be used in eradication programs where synthetic insecticide applications are problematic (King et al. 1995, Morales-Ramos 1995, Summy et al. 1995). However, if used in conjunction with malathion applications, more understanding of residual activity of malathion against *Catolaccus grandis* is needed. Malathion was the most toxic insecticide to an in-vivo strain of *C. grandis* of 10 insecticides tested in laboratory bioassays (Elzen et al. 1999). The objective of this study was to evaluate residual activity against *C. grandis* in the field, using standard and microencapsulated formulations of malathion.

## Materials and Methods

The study was located in Eddy County, in southeastern New Mexico with all fields provided by the same grower. The general location and specific fields were selected because of the recent history of boll weevils, and the existence of fields scheduled to receive no insecticide treatments. This study was conducted in conjunction with a study to evaluate boll weevil activity reported elsewhere in these proceedings (Foster et al. 2000).

Nine square plots, 3.2 acres in size (375 ft. x 375 ft.) each located in separate fields were utilized for the study. This plot size accommodated 5 full aerially applied swaths. Plots were of sufficient separation to ensure no contamination from test treatments or from any crop treatments to nearby fields. All fields containing plots were under the general management of the same grower. All test plots were planted in non-Bt upland cotton, Acala 1517. No insecticides other than those in the study were applied to the plots.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1266-1268 (2000)
National Cotton Council, Memphis TN

Each of the plots was sprayed with 1 of 8 treatments. One plot was left untreated as a control. Assignment of treatments was random. The Cheminova encapsulated formulation was aerially applied at 0.77 lbs. AI/acre, 0.62 lbs. AI/acre and 0.46 lbs AI/acre, 18 oz/acre respectively. These rates are equivalent to 10 fl oz/acre, 8 fl oz/acre, and 6 fl oz/acre, respectively of the currently used malathion standard, Fyfanon ULV. Depending on the individual eradication effort, the traditional program standards are 12 fl oz/acre and 10 fl oz/acre of Fyfanon ULV. While the encapsulated formulation may be mixed with water, all treatments in this study were applied undiluted. These encapsulated treatments were compared to aerial treatments of Fyfanon ULV applied at 12 fl oz/acre (0.93 lb. AI/acre), 10 fl oz/acre (0.77 lb. AI/acre), 8 fl oz/acre (0.62 lb. AI/acre), and 6 fl oz/acre (0.46 lb. AI/acre). Also included for comparison was the Griffin formulation of malathion, Atrapa ULV, applied at 12 fl oz/acre (0.93 lb. AI/acre).

All treatments were applied with a Cessna Ag Truck aircraft owned by the USDA, Animal and Plant Health Inspection Service (APHIS), and equipped with winglets (DBA-Ag Tips; Clack Oberholtzer, Alberta, Canada), (Fig. 1). Winglets are added to spray aircraft to reduce the production of fine droplets and to improve handling characteristics. The aircraft was operated by a USDA-APHIS pilot. The aircraft was equipped with a standard commercial spraying system and was operated at 5-10 ft (broom height above plant canopy) during application. Ground personnel provided guidance and ensured acceptable operating parameters during treatments. The aircraft and spraying system were calibrated for a 75 feet wide swath for all treatments. Prior to application, the aircraft spray system was calibrated to operate under parameters, which resulted in delivery of spray within 1 percent of the desired rate per acre, for each of the 8 treatments. Calibration was accomplished for each of the treatments by collecting the measuring the amount of material sprayed through each nozzle for each treatment set up for a predetermined amount of time, and making adjustments in pressure until the desired output was achieved.

All treatments were applied through Flat Fan Tee Jet stainless steel nozzle tips oriented straight down. Encapsulated treatments, 0,77 lb. AI/acre, 0.62 lb. AI/acre and 0.46 lb. AI/acre were applied at 125 mph and 39 psi, 41 psi, 45 psi, and 39 psi, respectively through 10, 8, 6, and 5 (8002 size) tips, respectively. The single Atrapa ULV treatment, 0.93 lb. AI/acre, was applied at 125 mph and 39 psi through 10 (8002 size) tips. Winds during application were less than 2 mph for all plots, except for one plot where winds ranged from 2-3 mph.

Bioassay: *C. grandis* were provided by the Mission Plant Protection Center, Mission, Texas. Adult wasps were maintained in cages and fed honey until used for testing . All wasps used for testing were females, age 2-4 days. Leaves were collected from treated plots on day 1, 6 and 8. In each plot, leaves were collected from 3 subplots used as replications in the bioassay. Ten leaves were used per replication, with each leaf placed in a 50ml plastic vial. Five wasps were placed in each vial, for a total of 150 *C. grandis* per treatment. Mortality was recorded after 24 hours. The average mortality per replication was used for data analysis using SAS JMP (SAS 1997).

## Results

All formulations tested produced unacceptably high mortality. Since there was an interaction between residual period and formulation, each day was analyzed separately. Although rate responses were evident, no rates were low enough to reduce mortality to acceptable levels. (Table 1). The Chemnova encapsulated formulation, had greater residual activity than Fyfanon or Atrapa, with 67% mortality at 0.62 lb AI/A on day 8, compared to 12% and 8% mortality in the Fyfanon and Atrapa treatments (Fig. 1). Fyfanon and Atrapa had significantly higher mortality than the encapsulated formulation on day 0. (Fig. 2) (df 1,18 F=473, $P<0.0001$).

## Conclusions

Current field rates of malathion are highly toxic to *C. grandis*. Adjusting rates down will not reduce mortality to acceptable levels. The use of a microencapsulated formulation delayed mortality in *C. grandis*, but was also highly toxic.

It may be possible to use *C. grandis* in conjunction with malathion in eradication programs if *C. grandis* is used primarily in-season with no malathion applications during that period. However, more testing will be needed to ensure that there are no adverse effects affecting *C. grandis* performance within the time frame needed.

## Acknowledgments

Provision of *C. grandis* by the USDA Mission Plant Protection Center is gratefully acknowledged. We appreciate identification and use of field plots by D. McDonald and R. Waltersheid. Special thanks are extended to R. Ballard, S. Liesner, S. Talbot and C. Hair for technical assistance. The authors would like to thank John Bruce and Chris Bowley, Cheminova, Inc. (USA) for providing Fyfanon ULV and Lars-Erik K. Pedersen, Cheminova Agro A/S (Denmark) for providing the encapsulated malathion.

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Table 1. Percent Mortality of *C. grandis* after 24 hours exposure to leaves from fields treated with selected formulations of malathion.

| Formulation | Rate | Days after Treatment 1 | 6 | 8 |
|---|---|---|---|---|
| | lb ai/A | Mortality (%) | | |
| Encapsulated | 0.77 | 24 b | 17 a | 40 cd |
| | 0.62 | 11 a | 6 a | 67 d |
| | 0.46 | 3 a | 2 a | 21 bc |
| Fyfanon | 0.93 | 91 b | 20 a | 11 ab |
| | 0.77 | 87 b | 14 a | 1 a |
| | 0.62 | 81 b | 20 a | 12 ab |
| | 0.46 | 70 b | 34 a | 9 ab |
| Atrapa | 0.93 | 80 b | 10 a | 8 ab |

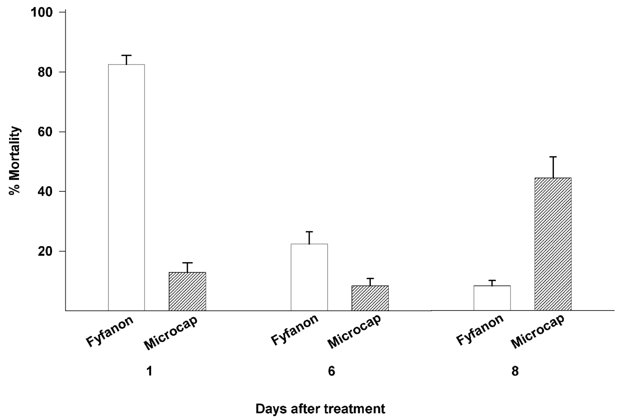


Figure 1. Activity of Fyfanon and microencapsulated malathion formulations against *C. grandis*, 1-8 days after treatment.

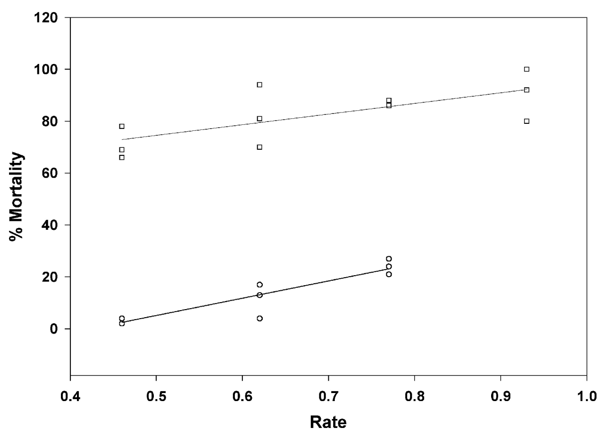


Figure 2. Percent mortality of *C. grandis* exposed at day 1 for 24 hours to Fyfanon and to microencapsulated malathion. N, microencapsulated malathion; R, Fyfanon.