

Chemical Control/New Products

Lethal and Sublethal Effects of Tebufenozide and Ecdysone Agonist on Life Stages of Codling Moth

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*Keywords:* tebufenozide, Rohm & Haas, ecdysone activity, codling moth, apple

Tebufenozide (RH-5992) is an amplifier of ecdysone activity and is primarily active on lepidopterous insects. It is presently being developed by Rohm & Haas for control of codling moth and other lepidopterous pests. France was the first country to register tebufenozide for codling moth control.

Tebufenozide has been field tested for codling moth control at the Mid-Columbia Experiment Station since 1987. Results of these field tests were ambiguous as to the best timing strategy with this new product. Therefore, laboratory experiments were initiated in 1994 to evaluate the toxicity of tebufenozide to different life stages of the codling moth (egg, larva, adult) and investigate possible sublethal effects on development and oviposition behavior.

#### **Materials and Methods**

The different life stages for the laboratory experiments were obtained from an OP-susceptible laboratory colony which has been in culture since 1991. Larvae were maintained on apple thinnings in an insectary at 75°F (±4) and a photoperiod of 16:8 (L:D) h.

Formulated tebufenozide (RH-5992) 2F was used in all tests without additional surfactants and was supplied by Rohm & Haas. A Potter spray tower fitted with a final nozzle was used for all applications. Each treatment consisted of 2 ml of various tebufenozide concentrations (water in the control) applied at 15 lb/in<sup>2</sup> (103 kPa) with a 5 s settling time. Waxed paper, plastic petri dishes (50 by 9 mm, Dickinson, NJ), and leaves or small apples from unsprayed Red Delicious trees were used as substrates in tests with eggs and neonates.

#### **Results**

Tebufenozide has primarily larvicidal and some ovicidal activity against codling moth. The oral LC<sub>50</sub> for neonates on fruit was 12.1 ppm. Tebufenozide also has contact activity against neonates. Contact toxicity was dependent on exposure time. Mortality was low if the exposure to residue was less than 4 hours.

Eggs in the red ring stage were more susceptible to topically applied tebufenozide than freshly laid eggs. Older eggs in the black head stage were not affected. There were significant differences in residual toxicity between surfaces on which eggs were laid. Tebufenozide had greater residual toxicity on leaves than on fruit. The LC<sub>50</sub> for eggs on treated leaves was 6.35 ppm but was considerably higher on treated fruit (50.28 ppm).

Tebufenozide applied topically to eggs in the white stage and the ring stage prolonged the incubation period and delayed egg hatch. No preference was observed in the oviposition when moths were allowed to choose between treated and untreated surfaces.

### **Conclusions**

These results suggest that tebufenozide should be timed as a larvicide similar to azinphosmethyl and applied in relation to egg hatch since neonates are considerably more susceptible than eggs.

The ovicidal activity of tebufenozide contributes to the overall mortality and allows some flexibility with the timing of early sprays.