

## Section II.

### Bee Poisoning, Environmental Toxicology, Regulatory Issues

#### BEE PESTICIDE SAFETY TRIALS ON ALFALFA SEED, 2007

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The alkali bee, *Nomia melanderi*, and the alfalfa leafcutter bee, *Megachile rotundata*, are significant pollinators of the alfalfa seed crop in Washington State. It is imperative that we know whether the pesticides used on alfalfa seed to control Lygus bug, aphids, and mites are toxic to these pollinating bees. Dan Mayer of Washington State University was one of very few entomologists who conducted safety trials on these bees. Since his retirement in 2000, there had been no studies on the newly registered and registration-pending pesticides until 2005, when we developed a protocol to conduct pollinator safety bioassays to enable resumption of this important research.

Preliminary trials were conducted in 2005 with fenpyroximate (Fujimite) and bifenthrin (Capture 2EC) to develop the experimental protocol. Bifenthrin is known to be very toxic to bees. Fenpyroximate along with 13 other compounds were tested in 2006 (reported last year). In 2007, spinosad was added to the list of tested compounds against leafcutter bees and abamectin and thiacloprid were dropped. Products were applied at either the maximum label rate or the maximum recommended rate for control of certain insects or mites on alfalfa seed using a CO<sub>2</sub> pressurized sprayer with a hand-held boom at a rate of 26 gallons per acre over 0.01 acre plots of first- or second-growth alfalfa. Alfalfa samples were collected at 1 hour and 8 hours after treatment for the bee bioassays, with treatment and age of residue replicated four times. For each sample, about 400 cm of alfalfa foliage were placed into a 15-cm Petri dish cage with tops and bottoms separated by a wire screen insert. In 2007, leafcutter bee pupae were emerged in specially designed boxes; this method allowed for a large number of similarly young-aged, healthy bees to be available for testing. Approximately 20 leafcutter bees were placed into each cage; they were fed 50% sucrose solution in a wad of cotton. Leafcutter bees were exposed to the aged residues for 24 hours at which time mortality was scored. In addition, acetamiprid, flonicamid, and novaluron were tested against

field-collected alkali bees using a slightly different protocol. Scores were corrected for control mortality using Abbott's formula.

When the leafcutter bees were exposed to 1-hour residues, only four compounds showed reasonably low toxicity (10% and lower): bifenazate, flonicamid, novaluron, and etoxazole (Table 1). When bees were exposed to 8-hour residues, all the pesticide treatments but thiamethoxam, spiromesifen, and spinosad caused less than 25% mortality to bees (Table 1). Dan Mayer had concluded from his research that rates of materials that cause less than 25% mortality with 2-hour residues can probably be applied during the early morning with little or no hazard to bees, and those materials that cause less than 25% mortality with 8-hour residues can probably be applied during late evening with little or no hazard to bees.

Alkali bees were evaluated about an hour after exposure to 8-hour residues, and low mortalities were recorded (Table 1). However, we noted that some of the bees in the acetamiprid treatments were exhibiting neuro-intoxication; no bees behaving like that were found in the flonicamid, novaluron, and control chambers.

Table 1. Mortalities (%)\* of alfalfa leafcutter bees and alkali bees exposed to field-aged residues of pesticides applied to 0.01 acre plots of alfalfa seed, Prosser, WA, 2007.

Treatment			Leafcutter Bees		Alkali Bees
			Age of Residue		Age of residue
Formulation	Active Ingredient	Rate/acre	1 hr	8 hr	8 hr
Acramite 4SC	bifenazate	1.5 pt	0.00	3.17	
Actara	thiamethoxam	4 oz	81.42	100	
Assail 70WP	acetamiprid	1.1 oz	14.47	0.00	9.82
Beleaf	flonicamid	3 fl oz	3.56	0.65	2.29
Comite	propargite	1.25 pt	33.94	0.00	
Dibrom	naled	1 pt	93.77	0.90	
Fujimite	fenpyroximate	3 pt	55.64	0.00	
Oberon	spiromesifen	1 pt	87.30	40.37	
Provado	imidacloprid	3.8 fl oz	20.30	0.00	
Rimon	novaluron	12 fl oz	0.00	0.00	2.99
Success	spinosad	8 fl oz	72.17	67.18	
Zeal	etoxazole	3 oz	10.16	4.05	

\*Corrected for control mortality using Abbott's formula.