

Chemical Control/New Products

Effect of *Bt* Product Residue on Leafroller Larvae

Jay F. Brunner and Mike Doerr

Washington State University Tree Fruit Research and Extension Center, Wenatchee, WA

*Keywords:* pandemis leafroller, obliquebanded leafroller, *Bt*, Dipel, Troy *Bt*, Konsume, Coax, apple

A single *Bt* product (Dipel 2X) was applied at bloom and three times during the summer, and residues were evaluated using a leaf-disk bioassay for effects on PLR and OBLR neonate larvae. Dipel 2X was applied to Red Delicious trees at one lb formulated product per acre with a handgun sprayer at 300 psi to the point of drip, simulating a dilute spray of approximately 400 gal/acre. At bloom, the treatment was replicated five times with two trees in each replication. Five fruiting spurs were collected from the interior canopy of each replicate at 1, 4, 6 and 8 days post-treatment. Three to four of the largest leaves were selected at random from spurs and placed in a petri dish (Falcon 1006, 50 x 9 mm). Petri dishes were chosen randomly, and five one- to two-day-old leafroller larvae were placed on the leaves. Ten petri dishes were prepared for each treatment and leafroller species (50 larvae/treatment). The petri dishes were placed inside a food storage container and kept at 20°C constant temperature and 16:8 photoperiod. Petri dishes were examined after seven days and larval survival recorded. During summer the Dipel 2X treatment was applied as described above to three replicates, one tree in each. Ten leaves were collected from the interior canopy of each tree at 1, 4, 6 and 8 days post-treatment. Two punches (2.3 cm diameter) were taken from each leaf. Four punches were placed in a petri dish (Falcon 1006, 50 x 9 mm), keeping the leaves from each replication separate. Petri dishes were chosen randomly, and five one- to two-day-old leafroller larvae were placed on the leaves. Five petri dishes were prepared for each replicate and each leafroller species (75 larvae/treatment). The petri dishes were placed inside a food storage container and kept at 20°C constant temperature and 16:8 photoperiod. Petri dishes were examined after seven days and larval survival recorded. See the tables for application dates.

Dipel residues resulted in higher levels of leafroller mortality in spring compared to the summer with the exception of the 1 Aug application. The 14 Apr application showed little or no degradation over eight days on PLR and only a slight notice of degradation at 8 DAT on OBLR (Tables 1 and 2). During the summer, especially the 30 Jun and 22 Sep applications, initial mortality at 1 DAT was similar to the spring application. However, mortality declined more rapidly in the summer tests.

The unusually high levels of leafroller larval mortality following the 1 Aug application could have been due to one of two factors, drift of insecticide onto test trees or unusual environmental conditions which coincided with the test. Serious forest fires were active in the Wenatchee region at the time of the test, and during the period from 1-10 Aug a heavy inversion resulted in a dense smoke layer in the valley. It is possible that the smoke provided a screen of UV radiation, thus reducing *Bt* degradation to a minimum.

Using a leaf-disk bioassay, *Bts* (Dipel and Troy *Bt*), and *Bts* plus feeding stimulants (Konsume and Coax) were evaluated for residue effects on PLR and OBLR neonate larvae using the methods described above for the summer field-aged residue bioassay.

The Troy *Bt* treatment resulted in significantly less PLR larval mortality than Dipel through four days after treatment (DAT) (Table 3). At 6 DAT, neither Troy *Bt* nor Dipel provided mortality different from the check. None of the Troy *Bt* treatments on OBLR larvae produced mortality different from the check (Table 4). The feeding stimulant Coax maintained the effectiveness of Dipel at 4 and 6 DAT against both PLR and OBLR larvae. Konsume did not appear to be as effective as Coax. The check mortality in the 8 DAT for PLR was high and therefore no data are presented. The *Bt* products appear to be slightly less effective against OBLR larvae than PLR larvae.

**Table 1.** Percent mortality of PLR larvae exposed to residues of a *Bt* product applied at different timings using a leaf-disk bioassay method.

Product	DAT <sup>1</sup>	Average corrected % mortality			
		14 Apr	30 Jun	1 Aug	22 Sep
Dipel 2X	1	73.2b	73.0c	100.0b	81.5d
Dipel 2X	4	53.2b	43.5b	100.0b	55.4c
Dipel 2X	6	51.0b	31.9b	100.0b	32.8bc
Dipel 2X	8	64.6b	29.0b	94.2b	11.6ab
Check		0.1a	0.0a	0.0a	0.0a

Means in the same column followed by the same letter not significantly different (Fisher's Protected LSD, P=0.05).

<sup>1</sup>DAT=days after treatment.

**Table 2.** Percent mortality of OBLR larvae exposed to residues of a *Bt* product applied at different timings using a leaf-disk bioassay method.

Product	DAT <sup>1</sup>	Average corrected % mortality			
		14 Apr	30 Jun	1 Aug	22 Sep
Dipel 2X	1	76.2c	60.0c	100.0c	30.2b
Dipel 2X	4	84.1c	33.8b	100.0c	37.2b
Dipel 2X	6	74.4c	19.6b	100.0c	23.6b
Dipel 2X	8	43.8b	0.0a	86.9b	5.7a
Check		0.1a	0.0a	0.0a	0.0a

Means in the same column followed by the same letter not significantly different (Fisher's Protected LSD, P=0.05).

<sup>1</sup>DAT=days after treatment.

**Table 3.** Percent mortality of PLR larvae exposed to residues of different products using a leaf-disk bioassay method.

Treatment	Rate form/100	Average corrected % mortality			
		1 DAT <sup>1</sup>	4 DAT	6 DAT	8 DAT
Dipel	4 oz	95.0c	52.3c	2.7ab	---
Troy <i>Bt</i>	8 fl oz	52.5b	12.3ab	0.0a	---
Dipel + Konsume	4 oz 16 fl oz	80.0c	29.3b	23.7b	---
Dipel + Coax	4 fl oz 8 fl oz	97.5c	76.9d	68.4c	---
Check	---	0.0a	0.0a	0.0a	---

Means in the same column followed by the same letter not significantly different (Fisher's Protected LSD, P=0.05).

<sup>1</sup>DAT=days after treatment.

**Table 4.** Percent mortality of OBLR larvae exposed to residues of different products using a leaf-disk bioassay method.

Treatment	Rate form/100	Average corrected % mortality			
		1 DAT <sup>1</sup>	4 DAT	6 DAT	8 DAT
Dipel	4 oz	51.0bc	17.0a	16.2ab	9.3ab
Troy <i>Bt</i>	8 fl oz	27.5ab	6.2a	7.4a	4.0ab
Dipel + Konsume	4 oz 16 fl oz	56.9bc	10.8a	29.4b	10.7ab
Dipel + Coax	4 fl oz 8 fl oz	82.4c	58.5b	47.1c	13.3b
Check	---	0.0a	0.0a	0.0a	0.0a

Means in the same column followed by the same letter not significantly different (Fisher's Protected LSD, P=0.05).

<sup>1</sup>DAT=days after treatment.