

II. Pome Fruits

d. Chemical control with Bt

1. *Pandemis pyrusana* Kearfott on apple leaves

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Using a leaf-disk bioassay, Bt products applied in different amounts of water per acre were evaluated for their effect on PLR larvae. Treatments were applied at their recommended field rates (see table) carried in water of 400, 100 and 50 gallons per acre (gpa) using a conventional speed sprayer operating at 200 psi. Each treatment was replicated three times with four trees in each. Leaves were collected from the interior canopy of treated trees at 1, 3, and 7 days post-treatment. One punch (2.3 cm diameter) was taken from each of 20 leaves per treatment on each date. Four punches were placed in each petri dish (Falcon 1006, 50x9 mm). Petri dishes were chosen randomly, and five one- to two-day-old leafroller larvae were placed on the leaf disks. The petri dish lids were put in place, and dishes were placed inside a food storage container with a moist paper towel to maintain high humidity and kept at 75°F ($\pm 2^\circ\text{F}$) constant temperature and 16:8 photoperiod. Petri dishes were examined after 7 days and larval survival recorded. Five dishes were set up in each replicate (75 larvae per treatment).

There was no consistent pattern associated with spray concentration and efficacy of Bt products on PLR larvae (Table 1).

Table 1. Percent mortality of PLR larvae exposed to residues of Bt products applied at different concentrations of water per acre using a leaf-disk bioassay method.

Product	Rate form. /acre	Conc. (gpa)	Percent larval mortality - DAT ^{1,2}		
			1	3	7
Dipel 2X	1 pound	400	89c	77b-f	56def
Dipel 2X	1 pound	100	93c	58bc	54c-f
Dipel 2X	1 pound	50	85c	47b-f	41b-e
Javelin	1 pound	400	89c	85def	57def
Javelin	1 pound	100	96c	94f	77f
Javelin	1 pound	50	92c	89ef	77f
MVP	3 quarts	400	92c	85def	62def
MVP	3 quarts	100	80c	61bcd	42b-e
MVP	3 quarts	50	90c	81c-f	66ef
Cutlass	1 pound	400	65b	64b-e	30abc
Cutlass	1 pound	100	76bc	60bcd	37bcd
Cutlass	1 pound	50	78bc	54b	26ab
Check	NONE	-----	16a	30a	12a

¹ DAT = days after treatment.

² Means in the same column followed by the same letter not significantly different (Student-Newman-Keuls, P=0.05).

Using a leaf-disk bioassay, Bt products applied alone or in combination with a spreader-sticker (Triton B-1956®) were evaluated for their effect on PLR larvae. The same methods described above were used. There was no consistent pattern to mortality of PLR larvae in treatments with Bt alone or Bt+wetting agent combinations (Table 2). Check mortality was high, primarily due to leaf quality. To determine the effect of leaf quality on check

mortality an additional bioassay was conducted. PLR larval mortality was compared using leaves of trees in the untreated control from the orchard where the Bt+wetting agent test was conducted and leaves from an orchard at the WSU-TFREC. Mortality was significantly higher on untreated leaves from the orchard where the Bt+wetting agent test was conducted, 32.0% compared to 6.7%. Leaves in this orchard were damaged by feeding of white apple leafhoppers and aphids. Leaves in the TFREC orchard were in good condition, with little leafhopper feeding.

Table 2. Percent mortality of PLR larvae exposed to residues of Bt products alone or in combination with a wetting agent using a leaf-disk bioassay method.

Product	Rate form. /acre	Conc. (gpa)	Percent larval mortality - 7 days ^{1,2} (days after treatment)		
			1	3	7
Dipel 2X	1 pound	100	77.3bcd	98.7c	58.7bcd
Dipel 2X Triton B-1956	1 pound + 8 ounces	100	93.3d	92.0c	74.7de
Javelin	1 pound	100	84.0bcd	96.0c	70.7cde
Javelin Triton B-1956	1 pound + 8 ounces	100	92.0cd	89.3c	81.3e
MVP	3 quarts	100	76.0bc	89.3c	82.7e
MVP Triton B-1956	3 quarts + 8 ounces	100	73.3b	68.0b	56.0bc
Cutlass	1 pound	100	49.3a	65.3b	66.7bcde
Cutlass Triton B-1956	1 pound + 8 ounces	100	45.3a	73.3b	52.0b
Check	NONE	-----	42.7a	42.7a	26.7a

Leaf quality bioassay test			
Orchard A	NONE	-----	32.0b
TFREC	NONE	-----	6.7a

¹ DAT = days after treatment.

² Means in the same column followed by the same letter not significantly different (Student-Newman-Keuls, P=0.05).

Dipel was applied alone or in combination with a feeding stimulant, Coax®. The same methods described above were used. PLR mortality was slightly higher in the Dipel+Coax treatment at all three samples following application, but differences were not significant except on day 3 when treatments were applied as dilute sprays (400 gpa) (Table 3).

Table 3. Percent mortality of PLR larvae exposed to residues of Bt products alone or in combination with a Coax® using a leaf-disk bioassay method.

Product	Rate form. /acre	Conc. (gpa)	Percent larval mortality - 7 days ^{1,2} (days after treatment)		
			1	3	7
Dipel 2X	1 pound	400	70.7b	53.3a	53.3b
Dipel 2X Coax	1 pound + 1 quart	400	80.0b	78.7b	60.0b
Dipel 2X	1 pound	100	73.3b	81.3b	57.3b
Dipel 2X Coax	1 pound + 1 quart	100	85.3b	86.7b	73.3b
Check	NONE	-----	45.3a	56.0a	30.7a