**Table 1.** Insecticide applications in the border spray trials (Farm E) of ‘Liberty’ blueberry during 2012 and 2013 harvest seasons. The rate (kg AI ha-1 and liter ha-1), number of plots per cultivar, mean number of cover sprays (C) per cover spray plot, and mean number of sprays per reduced spray plot (border spray = B). Note: cover sprays were applied and integrated during the 2013 season in B plots. For example, 1.01 kg methomyl was mixed in 702 liters of water ha-1 and applied once as C and once as B.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |
| Year | Insecticide trade name | Active ingredient (AI) | Kg AI ha-1 | liter ha-1 | # plots per cultivara | Mean cover sprays (C) per C plotb | Mean sprays per reduced spray (AR or B) plotb |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| 2012 | Lannate | methomyl | 1.01 | 701.55 | 3 L | 1 h | 1 h-B |
| 2012 | Mustang Max | zeta-cypermethrin | 0.03 | 701.55 | 3 L | 1.7 h | 1.7 h-B |
| 2012 | Imidan 70W | phosmet | 1.12 | 701.55 | 3 L | 1 h | 1 h-B |
| 2012 | Admire Pro | imidacloprid | 0.70 | 701.55 | 3 L | 0.6 h | 0.6 h-C |
|  |  |  |  |  |  |  |  |
| 2013 | Mustang Max | zeta-cypermethrin | 0.03 | 701.55 | 3 L | 1 p, 2.7 h | 1 p-B, 2.3 h-B, 0.7 h-C |
| 2013 | Danitol | fenpropathrin | 0.34 | 701.55 | 3 L | 2 h | 1.3 h-B, 0.6 h-C |
| 2013 | Malathion 8 Aquamul | malathion | 1.40 | 701.55 | 3 L | 0.3 h | 1 p-B, 1 h-B, 0.3 h-C |
| 2013 | Admire Pro | imidacloprid | 0.70 | 701.55 | 3 L | - | 0.3 h-C |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

a Cultivars include: L = ‘Liberty’ blueberry.

b Means shown because of differences in number of sprays between blocks; Treatments: C = Cover spray, B = Border spray.

**Table 2**. Comparison of mean (±SE) *D. suzukii* adults throughout the harvest season and natural enemies and common pests 7 d post-harvest in 2012 and 2013 in border and cover spray plots in ‘Liberty’ blueberry. Cover spray treatment was used as reference group. Estimates represent multiplicative increase in median counts in the border spray treatment.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  | |  | |  |  |  |  |  |  |  | | | |
| Spray treatment | *Drosophila suzukii* | | |  | Natural enemies | | | | | | | |  | Common pest | | |
|  |  | | |  |  | |  | |  | | | |  |  | | | | |
|  |  | | |  |  | |  | |  | | | |  |  | | | |
|  | Adults | Malesa | Females |  | Microhymenoptera | | | *Stethorus* | | Pred. thrips | Lacewing | Pred. coccinelid |  |  | Cucumber beetle | | | | |
|  |  |  |  |  |  | | |  | |  |  |  |  |  |  | | | | |
|  |  |  |  |  |  | | |  | |  |  |  |  |  |  | | | | |
|  | 2012 | 2013 | |  | 2012 | 2013 | | 2013 | | 2012 | 2012 | 2013 |  |  | 2012 | 2013 | | | |
|  |  |  |  |  |  |  | |  | |  |  |  |  |  |  |  | | | |
|  |  |  |  |  |  |  | |  | |  |  |  |  |  |  |  | | | |
| Borderb | 0.4±0.1ac | 0.6±0.1a | 1.0±0.1a |  | 15.2±2.9a | 12.6±1.6a | | 6.0±1.0a | | 3.5±0.6a | 1.2±0.3a | 1.4±0.4a |  |  | 3.0±0.5a | 8.5±1.4a | | | |
| Cover | 0.5±0.1a | 0.7±0.2a | 0.7±0.1a |  | 18.5±3.1a | 10.9±1.9a | | 3.1±0.5b | | 3.0±0.5a | 0.3±0.2a | 0.7±0.3a |  |  | 2.5±0.6a | 5.9±1.2a | | | |
| Model | Full | Reduced | Reduced |  | Full | Reduced | | Full | | Reduced | Reduced | Reduced |  |  | Reduced | Reduced | | | |
| Transformation | Log (ln) | Log (ln) | Log (ln) |  | Log (ln) | Log (ln) | | Log(ln) | | Log (ln) | Log10(x+1) | Log10(x+1) |  |  | Log (ln) | Log (ln) | | | |
| df | 4 | 2 | 2 |  | 4 | 2 | | 4 | | 2 | 2 | 2 |  |  | 2 | 2 | | | |
| Estimate | 1.689 | 1.490 | 1.739 |  | 0.631 | 1.202 | | 3.831 | | 1.166 | 14.872 | 13.061 |  |  | 1.244 | 1.610 | | | |
| CI | 0.51, 5.56 | 0.14, 16.67 | 0.28, 11.11 |  | 0.32, 1.27 | 0.85, 1.70 | | 1.04, 14.29 | | 0.31, 4.35 | 2.97, 74.47 | 4.66, 36.57 |  |  | 0.27, 5.56 | 0.73, 3.57 | | | |
| *P*-value | 0.291 | 0.545 | 0.327 |  | 0.139 | 0.151 | | 0.045 | | 0.665 | 0.400 | 0.381 |  |  | 0.601 | 0.124 | | | |
|  |  |  |  |  |  |  | |  | |  |  |  |  |  |  |  | | | |
|  |  |  |  |  |  |  | |  | |  |  |  |  |  |  |  | | | |

a Gender were analyzed separately based on χ2 tests in 2013.

b Original mean and SE are shown with back-transformed estimates and confidence intervals (CI) (alpha = 0.05). Natural enemy and common pest samples were combined in all collection methods (sweep, vacuum, yellow sticky cards, and leaf) to assess plot level differences.

c Different letters within a column are significantly different (alpha = 0.05) based on linear-mixed effects model.

**Table 3**. Comparison of mean (±SE) *D. suzukii* adults throughout the harvest season and natural enemies 7 d post-harvest in 2012 and 2013 collected from border (~5 m into the field) and interior (40 – 60 m into the field) trap positions of border and cover spray plots in ‘Liberty’ blueberry. The reduced model applied in 2013 microhymenoptera did not permit treatment separation. Border trap was used as reference group. Estimates represent multiplicative increase in median counts in the interior traps.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | |  |  |  |  |
| Trap position | *Drosophila suzukii* | |  | Natural enemies | | | | | | |
|  |  | |  |  | |  | | | | |
|  |  | |  |  | |  | | | | |
|  | Adults | |  | Microhymenoptera | | | |  | *Stethorus* | |
|  |  | |  |  | | | |  |  | |
|  |  | |  |  | | | |  |  | |
|  | 2012 | |  | 2012 | | | 2013 |  | 2013 | |
|  |  | |  |  | | |  |  |  | |
|  |  | |  |  | | |  |  |  | |
|  | Border | Cover |  | Border | Cover | |  |  | Border | Cover |
|  |  |  |  |  |  | |  |  |  |  |
|  |  |  |  |  |  | |  |  |  |  |
| Border trapa | 0.4±0.1ab | 0.7±0.2a |  | 15.9±3.9a | 25.3±5.3a | | 15.3±2.0a |  | 4.8±1.1a | 4.3±0.8a |
| Interior trap | 0.4±0.1a | 0.2±0.1b |  | 14.5±4.4a | 11.6±2.0b | | 8.2±1.1b |  | 7.2±1.6a | 2.0±0.4a |
| Model | Full | Full |  | Full | Full | | Reduced |  | Full | Full |
| Transformation | Log (ln) | Log (ln) |  | Log (ln) | Log (ln) | | Log (ln) |  | Log (ln) | Log (ln) |
| df | 4 | 4 |  | 4 | 4 | | 5 |  | 4 | 4 |
| Estimate | 1.172 | 0.319 |  | 0.874 | 0.494 | | 0.522 |  | 1.775 | 0.465 |
| CI | 0.42, 3.24 | 0.12, 0.88 |  | 0.67, 1.14 | 0.38, 0.64 | | 0.42, 0.64 |  | 0.56, 5.64 | 0.15, 1.48 |
| *P*-value | 0.615 | 0.017 |  | 0.147 | 0.0007 | | 0.0005 |  | 0.157 | 0.081 |
|  |  |  |  |  |  | |  |  |  |  |
|  |  |  |  |  |  | |  |  |  |  |

a Original mean and SE are shown with back-transformed estimates and confidence intervals (CI) that were Bonferroni adjusted for two comparisons (alpha = 0.025). Natural enemy samples were combined in all collection methods (sweep, vacuum, yellow sticky cards, and leaf) to assess plot level differences.

b Different letters within a column are significantly different (alpha = 0.05) based on linear-mixed effects model.

**Table 4.** Economic analysis of border spraying compared to the cover spray method on 4.05 ha.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| Spray treatmenta | Insecticide costb ($) | Machine timec (hr) | Sprayer costd ($) | Fruit knockdown losse ($) | Money savedf ($) |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| Border | 300.00 | 0.46 | 94.86 | - | 1601.60 |
| Cover | 1,000.00 | 5.49 | 368.90 | 628.00 | - |
|  |  |  |  |  |  |
|  | | | | | |

a Table calculations for border and cover sprays based on berry economics.

b Estimated cost of insecticide material to treat 4.05 ha twice. Savings are 70% in border applications based on area sprayed by each method.

c Machine time to treat 4.05 ha with an airblast sprayer based on travel speed of 4.8 km h-1 and 0.74 ha treated per hour and the time to treat the same area at 10.9 ha per hour for border sprays with a cannon sprayer traveling at the same speed. Hectare per hour is the product of tractor speed (4.8 km h-1), row width (3 m), and efficiency (50%) over a conversion factor of 8.25 (Seavert CF, 2014, pers. comm.). Efficiency is the actual time spent spraying.

d Airblast sprayer (cover spray) and cannon sprayer (border spray) costs to treat 4.05 ha for labor, variable machine cost (repairs and maintenance) and fixed machine cost (depreciating interest and insurance). The airblast and cannon sprayers were a 757 liter unit and 398 liter unit with power-take-off (PTO), respectively.

e Based on difference in fruit knockdown between border and cover sprays of 41.9 kg ha-1 and blueberry value of $3.30 kg-1 (average 2012 fresh and processed value) in 2012.

f Money saved is the difference in sprayer and insecticide cost between treatments (border spray trial includes fruit knockdown savings).