A Threshold for Spraying Against Plum Curculio Using Odor-baited Trap Trees

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In the preceding article, we established several characteristics that an odor-baited trap tree ought to have in order to qualify as a site for monitoring fruit injury by plum curculio (PC).

Here, we present results of a 2003 experiment aimed at determining a tentative threshold of PC injury to fruit on a trap tree that would justify insecticide application to rows 1 and 2 of an orchard block following a whole-block spray at petal full.

Materials & Methods

We selected 12 blocks of trees in commercial orchards in Massachusetts. Each block was comprised of at least eight rows of trees and was bordered along its entire 200 yard perimeter by continuous woods or hedgerow. Each block was located in a different orchard and was divided into three equal-size plots. A trap tree baited with 1 dispenser of grandisoic acid plus four dispensers of benzaldehyde (see preceding article) was established at the center of the perimeter row of each plot, 33 yards from either edge. Each of the three plots per block was pre-assigned at random a threshold of either 1, 2 or 4 freshly injured fruit out of 50 fruit sampled on the trap tree. Each trap tree was sampled for freshly injured fruit three times per week (Monday, Wednesday, Friday), beginning 7 days after a petal fall spray of insecticide. We presumed that residual activity of insecticide extended at least 7 days after application. Sampling involved examining 50 haphazardly chosen fruit per tree at head height: 25 in the outer half of the canopy, 25 in the inner half. Sampling was terminated on June 30, when no fresh injury was detected in samples on any trap tree for two consecutive sampling periods.

All 36 plots received a grower-applied treatment of Guthion or Imidan across the entire plot within 4 days after petal fall. Thereafter, only the first (= perimeter) and second rows of a plot received insecticide as applied by growers, who sprayed both sides of first-row trees and the perimeter-facing side of second-row trees. In all cases, such treatments were made within 24 hours of our sampling a trap tree and our determination that the proportion of sampled fruit showing injury had reached the pre-established threshold of 1, 2, or 4 freshly injured fruit. Once a plot had received an insecticide treatment to rows 1 and 2, we allowed 6-7 days before resuming examination of fruit on trap trees for injury. Then, for each plot, we waited until fresh injury to sampled fruit on a trap tree again reached the pre-established threshold for that plot before calling for the next insecticide application to rows 1 and 2. To guard against invasion of PCs into plots from an exposed lateral side or from rows deeper than the seventh row, growers applied insecticide at 7-to-10-day intervals to orchard trees abutting trees in test plots.

To evaluate the plot-wide outcome of insecticide application against PC as driven by varying thresholds of allowable injury on trap trees, during the first week of July we examined 20 fruit at head height in the outer half of the canopy on each of five trees in each of rows 1, 2, 3, 5, and 7 of each plot for evidence of any injury caused by PC (total of 100 fruit per row per plot). Fruit on the trap tree were excluded from consideration, because such fruit would normally comprise a very low percentage of all fruit in an orchard block. For example, for a 2.5 acre square block of medium-size trees on M.26 rootstock, fruit from a trap tree at the center of a 110 yard perimeter row would constitute less than 0.2% of the total amount of fruit in the block.

Results

The mean number of insecticide applications made by growers to trees in rows 1 and 2 declined successively (though not significantly) from 1.56 to 1.44 and 0.89 sprays as the pre-assigned threshold calling for spray application increased successively from 1 to 2 and 4 freshly injured fruit out of 50 fruit sampled on trap trees (Table 1). Conversely, the mean proportion of fruit injured by PC in samples taken during the first week of July (i.e., at the conclusion of the injury season) on

Table 1. For apple orchard plots that received insecticide application on rows 1 and 2 whenever a pre-set threshold of 1, ,2 or 4 freshly injured fruit out of 50 fruit sampled on a trap tree was reached 7 days or more after the preceding application, mean number of insecticide applications and mean percent fruit injured by plum curculio in samples of 100 fruit per row taken during the first week of July.

Pre-set injury threshold on trap tree	Mean no. insecticide applications	Mean % fruit injured*		
		Rows 1 + 2	Rows 3-7	Rows 1-7
1	1.56 a	1.61 a	0.43 a	0.77a
2	1.44 a	2.33 a	0.71 a	1.17a
4	0.89 a	2.39 a	0.82 a	1.27a

*Means in each column followed by the same letter are not significantly different at odds of 19:1.

rows 1 and 2 combined increased successively (though not significantly) from 1.61 to 2.33 and 2.39% as the pre-assigned threshold calling for spray application increased successively from 1 to 2 and 4 freshly-injured fruit out of 50 fruit sampled on trap trees (Table 1). The same was true for fruit sampled from rows 3-7 combined (Table 1), where injury increased successively from 0.43 to 0.71 and 0.82% with increasing pre-assigned threshold. Combined injury from all rows in a plot shows that whole-plot injury averaged 0.77, 1.17, and 1.27%, respectively, for plots having pre-assigned thresholds of 1, 2, or 4 injured fruit out of 50 fruit sampled on a trap tree.

Conclusions

Findings from the first article in this issue indicate that a whole-block spray against PC is needed at petal fall to control PCs that many have overwintered within or immigrated into interior rows. Findings from that article also suggest that effective control of PC after a whole-block petal fall spray can be attained by applying insecticide only to perimeter rows 1 and 2.

There appears to be no need to continue spray all rows in a block against PC after an all-row spray shortly after petal fall.

To know where and when to apply post-petal-fall spray to control PC, findings here suggest that a threshold of 1 freshly injured fruit per 50 fruit sampled on an odor-baited perimeter-row trap tree may be used provisionally as an indicator of the need to apply an insecticide spray to all trees on rows 1 and 2 to prevent block-wide damage from exceeding an injury level of 1%. Further, our data suggest that a spray-driven threshold of 2 or more freshly injured fruit per 50 fruit sampled on a trap tree may be too great to prevent block-wide damage from exceeding 1%.

Further studies are needed to confirm the provisional threshold suggested from results here. Special attention should be paid to assessing effects of orchard architecture (size of blocks, spacing of trees, arrangement of cultivars, size, and pruning of trees, etc.) on candidate thresholds.

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