Comparison of Traps and Trap Trees for Monitoring Plum Curculios: 2002 Results

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In the 2002 Winter issue of Fruit Notes, we reported on year 2001 tests in which we compared odor-baited with unbaited traps of three types (pyramid, cylinder and Circle) for monitoring plum curculios (PCs) in several commercial apple orchards. All traps were placed beneath or within canopies of perimeter-row apple trees. Results indicated that Circle traps baited with benzaldehyde (BEN, a component of host plant odor) plus grandisoic acid (GA, male-produced aggregation pheromone) captured numerically more PCs than any other baited or unbaited traps. However, no trap type showed even a moderate positive relationship between the time of occurrence of PC captures by the trap (first, second, third, etc. week after petal fall) and time of occurrence of PC injury to fruit. Even for Circle traps baited with BEN plus GA, captures fell off dramatically soon after petal fall, whereas fruit injury rose steadily. Thus, low trap captures after petal fall could not be taken as indicative of a lack of need to spray against PC.

In the 2002 Fall issue of Fruit Notes, we reported that pyramid traps and sticky-coated Plexiglas panel traps baited with BEN plus GA and placed at orchard border areas were effective in monitoring the seasonal course of immigration of overwintered PC adults into a small unsprayed orchard. This finding suggested that such traps placed in border areas might be useful for monitoring PCs in commercial orchards.

Finally, in the 2002 Winter issue of Fruit Notes, we reported on a preliminary study in a single commercial apple orchard involving the establishment of odor-baited "trap trees" as a potentially new and effective approach to monitoring PCs. This approach involves baiting the branches of a few perimeter-row trees in an orchard with BEN plus GA and examining fruit solely on these few baited trees for signs of fresh PC injury, thereby eliminating the need to examine fruit or a large number of trees to gain an accurate estimate of the degree of current threat of PC injury to fruit. Moreover, a trap tree approach might overcome various shortcomings of odor-baited traps that have afflicted our ability to rely on extent of trap captures as indicative of extent of threat of PC injury to fruit.

Here, we report results of a 2002 study in commercial apple orchards in which we compared the performance of odor-baited-sticky clear Plexiglas panels and black pyramids (both types of traps placed in orchard border areas) with the performance of odor-baited Circle traps (attached to trunks of perimeter-row apple trees) and the performance of odor-baited perimeter-row trap trees for monitoring the seasonal course of PC egglaying damage to developing apples.

Materials & Methods

The three types of traps were: (a) a clean Plexiglas panel (24 x 24 inches) attached vertically at head height to a wooden post, coated with Tangletrap on the side facing the orchard border area, (b) a black pyramid trap (24 inches wide at base x 48 inches tall), and (c) an aluminum-screen "Circle" trap, wrapped tightly around the base of a tree trunk so as to completely encircle the trunk.

Each trap and trap tree were baited with four polyethylene-vial dispensers of BEN (Aldrich Chemical Company) that together released 40 mg of BEN per day plus 1 dispenser of GA (Great Lakes IPM) that released 1 mg of pheromone per day. Each vial of BEN was suspended inside of an inverted colored, plastic drinking cup to minimize the potential negative impact of ultraviolet light on the stability of BEN. Vials of BEN were not renewed during the course of our test but dispensers of GA were renewed once (after 5 weeks). Dispensers of BEN and GA were suspended from the bottom edge of panel traps and from the branches of trap trees. For pyramid and Circle traps, dispensers of BEN were suspended in such a way that the open bottoms of the protective drinking cups were 4 inches above the inverted screen funnel (that capped each trap) to reduce close- range repellency of BEN, and the dispenser of GA was placed inside of the screen funnel. Four plots were established along a continuous 132 yard section of a perimeter row of apple trees in each of 11 commercial orchards. Each plot was 33 yards long by 7 rows of trees deep and contained one of the four trap treatment types. Traps or trap trees were positioned midway along the 33 yard length of the perimeter row of a plot. Panel and pyramid traps were placed in orchard border areas, 7 yards from the near edge of the canopy of the central perimeter-row tree of a plot. Circle traps and trap trees were assigned to the central perimeter-row tree of a plot.

Traps and trap trees were installed at the pink stage of bud development (April 22-24) and remained for 10 weeks (June 24-26). Weekly beginning at petal fall (May 13-15), we counted and removed all PCs from traps and examined 100 fruit per plot on perimeter trees for evidence of fresh PC egglaying scars. In all, 20 fruit were sampled on the central perimeter-row tree (directly opposite a panel or pyramid trap or containing a Circle trap or functioning as a trap tree) and 20 fruit were sampled on each of two evenly-spaced trees to the right and again to the left of the central tree. Fresh scars were those considered to have been made within the past 7 days. It is the appearance of fresh scars (not older scars) that ought to drive a grower's decision to spray against PC.

Each grower applied three sprays of azinphosmethyl or phosmet to control PC in the plots.

Results

Across the entire season, panel traps captured significantly more PCs than either pyramid or Circle traps (Figure 1). Even so, for none of these three trap types was there a significant positive correlation between total captures of PCs per plot (across all weeks from petal fall through June) and mean percent of sampled perimeter-row fruit per plot exhibiting fresh egglaying scars (across all weeks from petal fall through June) (Figure 2).

Furthermore, for none of the three traps types was there a significant positive correlation between sample-week trap captures per plot and sample–week percent of perimeter–row fruit per plot having fresh egglaying scars (Figure 3). A significant positive correlation would indicate that a week during which comparatively many trap captures occurred also was a week in which a comparatively large amount of fruit was injured by PC, whereas a week during which comparatively few

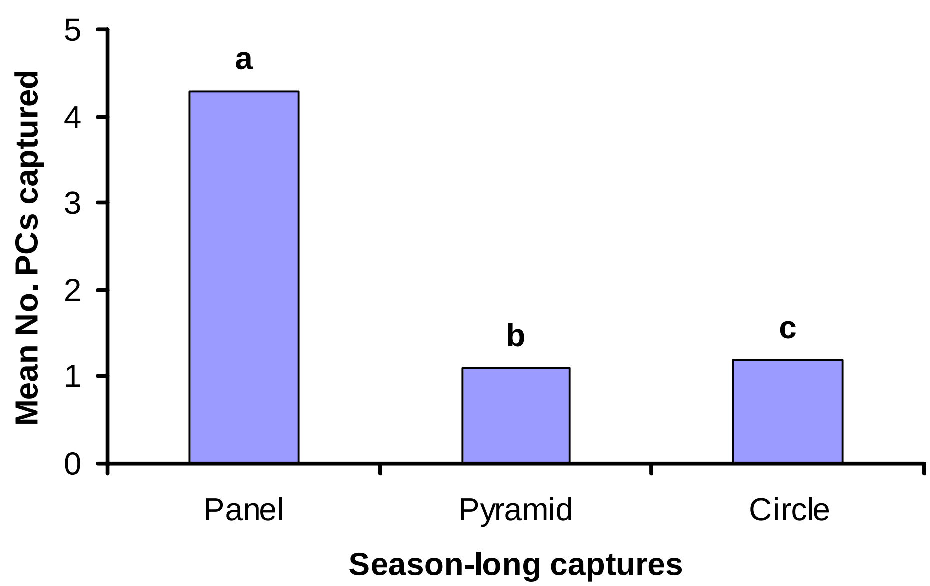

Figure 1. Season-long captures of overwintered plum curculio adults by odor-baited panel, pyramid and Circle traps placed in association with plots of perimeter-row apple trees. Means superscribed by the same letter are not significantly different at odds of 19:1.

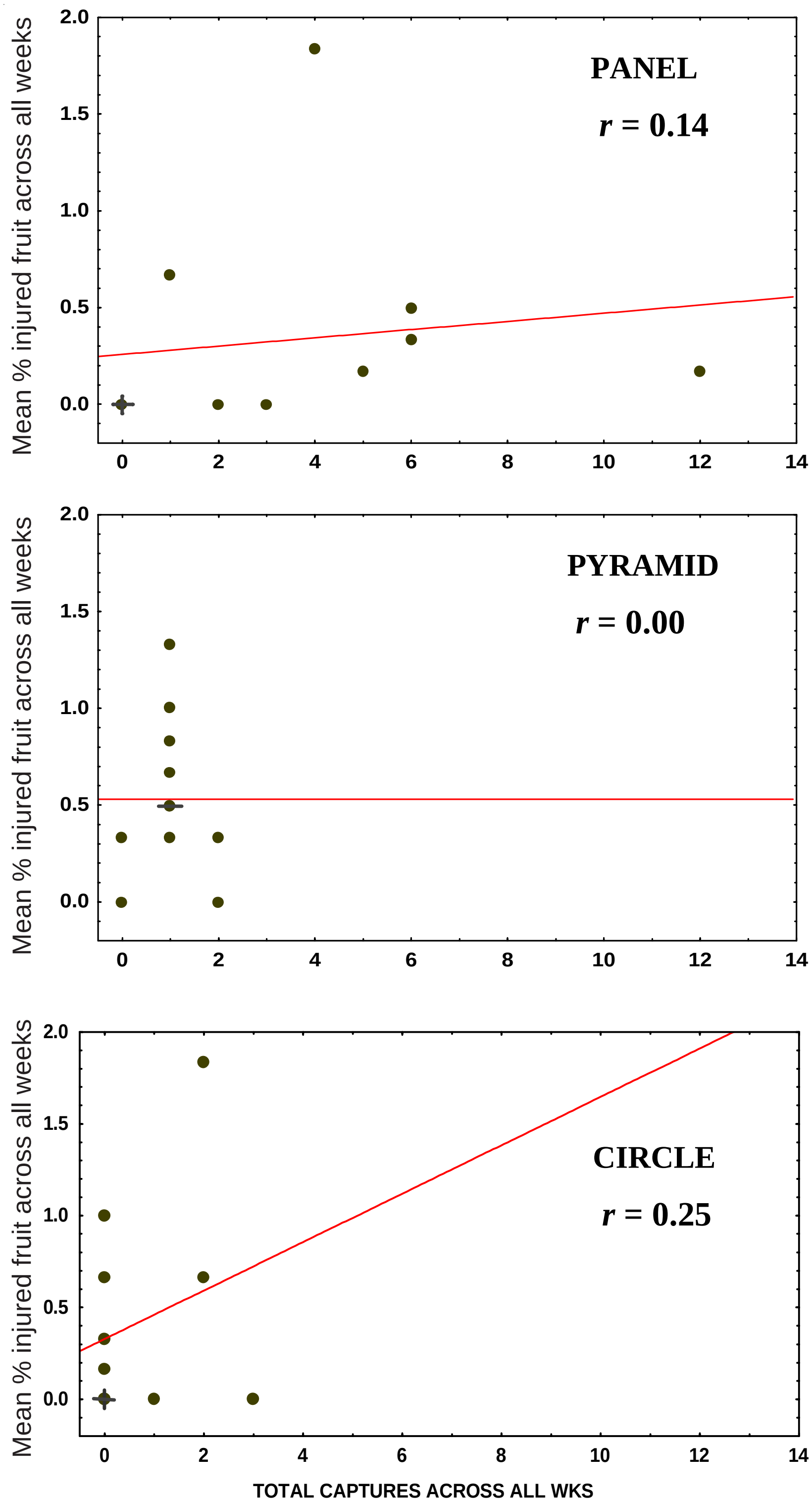

Figure 2. For panel pyramid and Circle traps, relationship between total captures of plum curculio adults per plot (across all weeks from petal fall through June) and mean percent of sampled perimeter-row fruit per plot having fresh ovipositional injury (across all weeks from petal fall through June). N=11 plots (hence 11 data points) per trap type. ? = two overlapping data points.

= three overlapping data points.

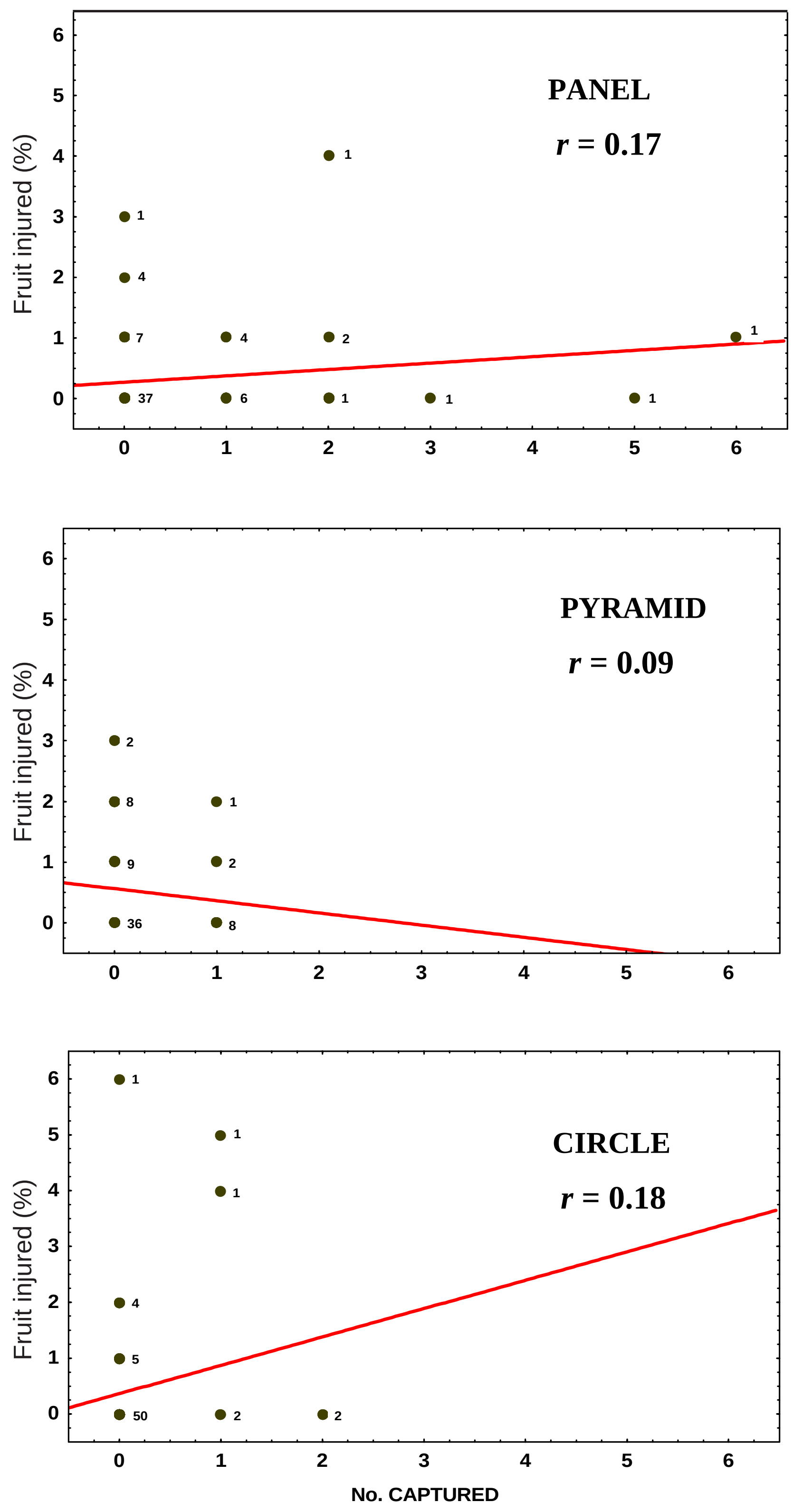

Figure 3. For panel, pyramid and Circle traps, relationship between number of plum curculio adults per plot captured each week (from petal fall through June) and percent of sampled perimeter-row fruit in corresponding plots and weeks having fresh ovipositional injury. N= 66 data points per trap type (11 plots x 6 wk). The number alongside of each ? indicates the number of data points corresponding to that position on the graph.

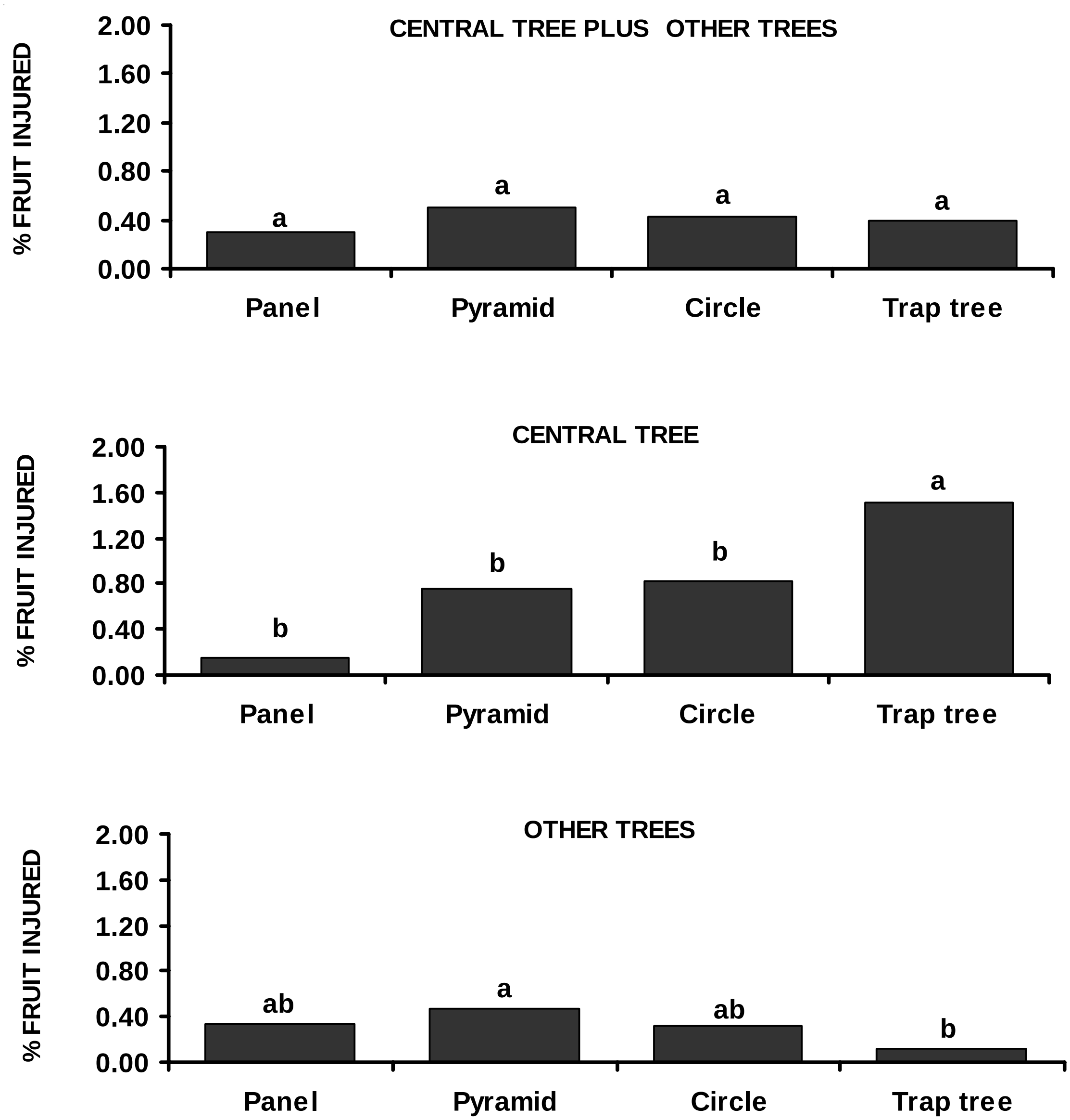

Figure 4. Percentages of freshly-injured fruit (averaged across all six sampling weeks) on central and four other sampled perimeter-row trees of treatment plots. Means superscribed by the same letter are not significantly different at odds of 19:1.

(or no) trap captures occurred was a week in which comparatively little (or no) fruit injury was initiated. Correlation values were only 0.17, 0.09, and 0.18 for panel, pyramid and Circle traps, respectively, indicating weak correspondence in time between rises in levels of fruit injury and rises in levels of trap captures.

Mean percentages of perimeter-row fruit with fresh injury were not significantly different among trap tree plots and plots having panel, pyramid or Circle traps when fruit from all sampled trees (the central tree plus the four other sampled trees per plot) were combined (Figure 4). This finding indicates that presence of a trap tree in a plot did not lead to any greater amount of plot-wide injury to fruit than would have occurred in the absence of a trap tree in a plot.

Importantly, for central trees in a plot, percentages of fruit with fresh injury were significantly greater in trap tree plots than in any other plots (Figure 4). Furthermore, for all other (non-central) sampled trees in a plot, percentages of fruit with fresh injury were less in trap tree plots than in any other plots (Figure 4). These results indicate that freshly injured fruit were significantly concentrated on trap trees and were not significantly concentrated on central trees associated with a panel, pyramid or Circle trap.

Conclusions

Our findings show that even though panel traps placed in border areas adjacent to perimeter rows of apples trees captured significantly more PCs than similarly–placed pyramid traps or Circle traps placed on trunks of perimeter-row trees, none of these trap types (all baited with BEN plus GA) exhibited amounts of captures that correlated significantly and positively with either weekly or season-long amounts of fresh ovipositional injury to fruit. How can the unsatisfactory performance of these traps be explained?

In the case of panel and pyramid traps placed in orchard border areas, immigrant PCs may continue to be captured but fail to cause injury because of sufficient residual effectiveness of a previous insecticide application. Indeed, in 13 (=20%) of the 66 instances (6 weeks x 11 plots) in which weekly captures of PC adults by panel traps were compared with weekly percentages of freshly injured fruit, at least one PC was captured but no fresh injury was detected. Thus, based on captures by these traps, insecticide might have been applied needlessly.

In the case of Circle traps attached to tree trunks, we know from our previous studies that when temperature reaches 70 degrees Fahrenheit or more, progressively more adults tend to enter tree canopies by flight rather than by crawling up tree trunks. The warmer the temperature, the greater the probability of PC injury to fruit. In 12 (=18%) of the 66 instances (6 weeks X 11 plots) in which weekly captures of PCs by Circle traps were compared with weekly percentages of freshly injured fruit, 1 % or more of fruit was found injured but no captures occurred At a failure rate of 18% to detect injury-causing PCs using Circle traps, such traps can not be recommended for grower use.

Our new approach of using trap trees baited with BEN plus GA circumvents the above shortcomings associated with use of captures of PCs by panel, pyramid or Circle traps as a guide for degree of threat of damage by PCs and goes directly to the assessment of damage itself. Our findings here indicate that odor baited trap trees established on perimeter rows act to congregate immigrant PCs, resulting in a 15-fold level of aggregation of egglaying injury. No greater amount of orchard-wide PC injury to fruit occurs as a consequence of establishing trap trees than occurs in the absence of trap trees. The establishment of a few trap trees on perimeter rows in an orchard would appear to be a simple and effective way of aggregating PC injury and allowing growers and consultants to focus exclusively on trap trees to gain an estimate of the current status of PC damage to fruit.

Results of a further 2002 experiment on a trap-tree approach to monitoring PCs are given in the next article in this issue of Fruit Notes.

Acknowledgements

We are grateful to the following growers for participating in this study: Keith Arsenault, Gerry Beirne, Bill Broderick, Dave Chandler, Don Green, Tony Lincoln, Joe Sincuk, Mo Tougas, and Steve Ware. This work was supported by funds from a USDA Northeast Regional IPM grant, a USDA Northeast Regional SARE grant, and a USDA Crops at Risk grant.

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