Using GIS Technology to Measure the Effects of Mating Disruption for Oriental Fruit Moth

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In previous years it was noticed that when mating disruption was placed over part of a large farm, trap captures in areas not under mating disruption, but near the disrupted area had low counts of OFM captures. During the following year on other parts of the farm, previously not under mating disruption, low trap captures were also seen. Mating disruption will reduce an overall population if used for 1-2 years, but what might its affect be on nearby areas not being disrupted, e.g. no dispensers being placed or sprayable pheromone being used? This project was carried out to investigate if GIS technology could be used as a tool to define the "zone" of mating disruption, if one exists for Oriental Fruit Moth (OFM). Since hand applied dispensers used for OFM mating disruption can range from $38 to $72/A, depending on the types of dispensers used, their expense often discourages its use. If mating disruption does indeed have an effect in areas of the orchard where dispensers are not placed, this may be able to be utilized for more economic use of pheromone technology.

Methods

Three commercial peach orchards were used as sites for 3 individual plots or replicates over a 2 year period. Each site consisted of at least 30 contiguous acres of various varieties. In each farm site, a 5 acre square plot was measured and marked out, so that it was positioned in the relative center of the remaining surrounding orchard. Large plastic delta traps (Scenturian) were baited with OFM pheromone. Two traps were placed diagonally in the center of each plot. Starting on each of the north, east, south , and west plot borders, additional traps were placed in a straight line transect approx. every 36-40 feet, depending on the tree spacing, such that each transect consisted of 11 traps extending out approx. 360 to 420 feet from the plot borders. A total of 143 traps were used each year for 43-50 traps per plot. Hand applied OFM mating disruption dispensers (Isomate M100, Pacific BioControl) were placed at the rate of 100 to 140 dispensers per acre during the 3rd week of May (2009), and the 3rd week of June (2010) within each of the 5 acre plots only. Traps were monitored once per week for the remainder of the season, or until the crop was removed. Both oriental fruit moth (OFM) and lesser appleworm (LAW) moth captures were recorded. Pheromone dispensers were changed every 5 weeks. Farm sites were mapped, and all traps were geo-referenced with a GeoExplorer XT prior to monitoring. Data was entered into Excel and exported to ArcView 3.3 for GIS analysis. Standard insecticide treatments were used both inside and outside the mating disrupted area, so that the entire monitored area was treated the same way. The objective was to have any differences in trap captures due to position relative to the disrupted area and not pesticide treatment.

Results

The accompanying data is from the 2010 field season. Lesser appleworm (*Grapholita prunivora*) (LAW) and oriental fruit moth (*Grapholita molesta*) (OFM) have similar pheromones. Both OFM and LAW pheromones are combinations of Z-8 and E-8 dodecenyl acetate in various ratios of *cis*

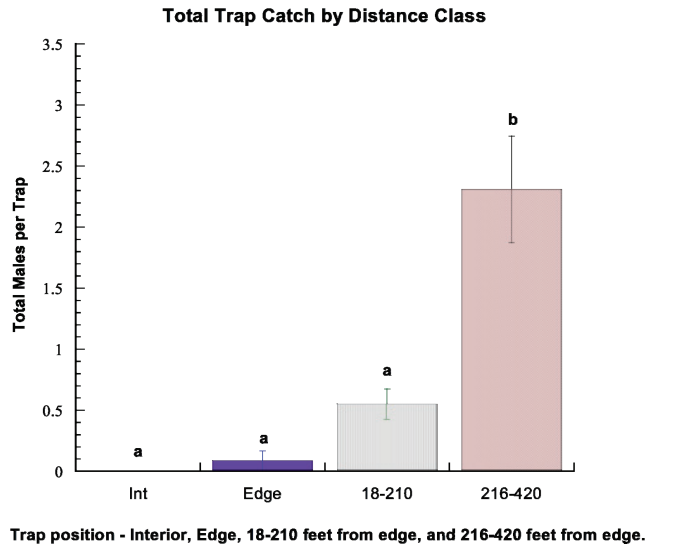

Figure 1. Total trap captures of OFM and LAW across all farms by distance class – 2010.

and *trans* isomers (Roelofs and Cardé, 1974). As a result, LAW are attracted to OFM pheromone traps, but OFM are rarely attracted to LAW traps. In the orchards we worked in, OFM populations were suppressed due to repeated use of insecticides. The resulting captures were approximately 50:50 ratios of OFM to LAW. Total trap captures were divided into two distance classes outside the mating disrupted area: 18-210 feet distance from the disrupted area and 216-420 feet from the disrupted area. Total trap captures were analyzed with ANOVA and separated with LSD. While the interior and edge captures were all "0", the first distance class of 18-210 feet trended slightly higher, but was not statistically different from interior or edge traps. Traps in the far distance class, 216-420 feet captured more males (Figure 1). Most trap captures were late in the season (Figure 2). Total trap captures can be represented by an Arcview surface interpolation (Figure 3), which shows that the further the distance from the mating disruption dispensers, there is a trend to higher trap captures.

Conclusion

Since lower trap captures were present near the mating disrupted area, further work could be done where insecticide applications are reduced to make use of the actual pheromone placement. Consistent trap shut-down close to the

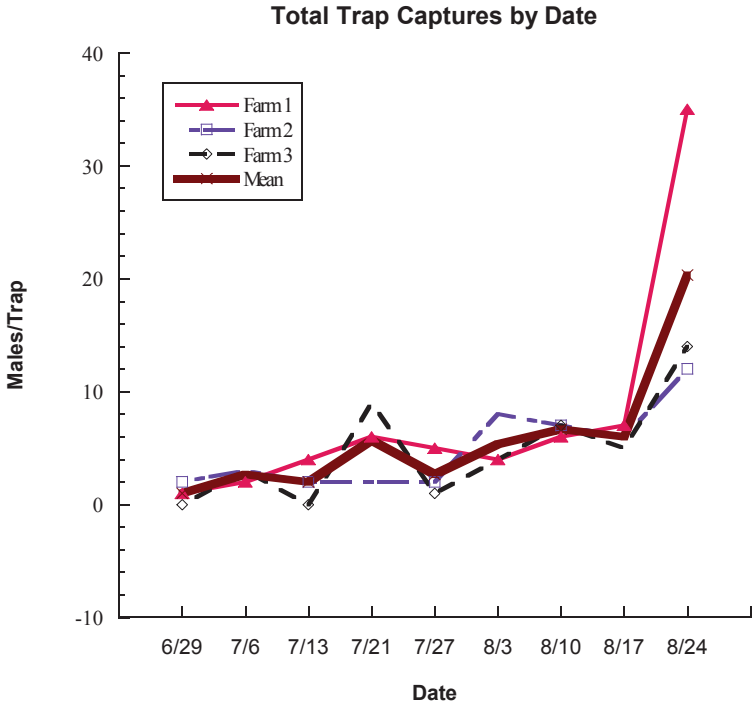

Figure 2. Total trap captures by date with average. Increased captures recorded at the end of the season when insecticide applications stopped and fruit is harvested.

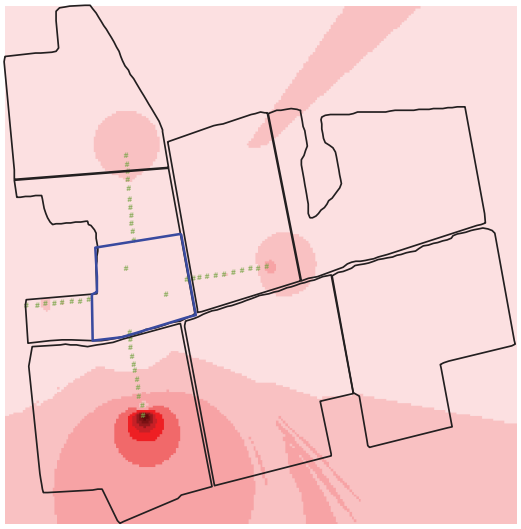

Figure 3. Interpolation of total trap captures in Elk Twp. Blue outline denotes mating disrupted area where dispensers were placed. Darker red denotes higher total seasonal trap captures classified by color in key.

disrupted area may reflect a low population influenced by specific mating disruption blocks. Making use of a mating disruption "zone" could reduce costs in a whole farm approach, both in terms of total insecticide as well as pheromone use.

Reference Cited

Roelofs, W. L. and R.T. Cardé. 1974. Oriental fruit moth and lesser appleworm attractant mixtures refined. Environ. Entomol. 3: 586-588.