'Outside the Box' Options for SWD Management

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Native to Southeast Asia, the spotted-wing drosophila (SWD), ***Drosophila suzukii*** (Matsumura 1931), was widely observed throughout parts of Korea, and China prior to its identification in Japan in 1913. Its 1980 arrival into the United States as an invasive pest began in Hawaii, appearing in central California by August of 2008, spreading into Washington, Oregon and Florida the following year. By 2011 the SWD has become widespread, captured in Utah, Louisiana, Arkansas, Kentucky, Tennessee, North and South Carolina, Wisconsin, Michigan, West Virginia and Virginia, Maryland, Pennsylvania, New Jersey, New York and all of the New England States (Image 1). The pest has also been found in Europe, including the countries of Italy, France, and Spain. In NY the SWD flies were first captured in apple cider vinegar traps in the experimental vineyard at the Hudson Valley Laboratory in Highland late in August of 2011. Damage to small fruit was first reported by Laura McDermott, a Regional CCE Specialist in the Capital District with traps placed in late raspberry, grown organically in Ancram, NY.

The SWD female differs from other vinegar flies in possessing a unique ovipositor, capable of inserting eggs into un-ripened fruit, which gives them a biological advantage over other *Drosophila*. Thus the SWD can reproduce on fruit earlier in the season to outcompete other fly species, producing as many as 13 generations per year in Asia, with 6-9 generations predicted for NY depending on the season. Another advantage this fly has is its use of multiple hosts including *Cornus kousa*, dogwood, *Eugenia uniflora*, Surinam cherry, *Fragaria ananassa*, strawberries, *Morus spp*., mulberry, *Murraya paniculata*, orange jasmine , *Myrica rubra*, Chinese bayberry , *Prunus spp.* - *P. avium*, sweet cherries; *P. domestica*, plums; *P. persica*, peaches, *Pyrus pyrifolia*, Asian pears, *Ribes spp*., currants, *Rubus spp.* - *R. armeniacus*, Himalayan blackberries; *R. loganobaccus*, loganberries; *R. idaeus,* raspberries; *R. laciniatus,* evergreen blackberries; *R. ursinus,* marionberries, *Vaccinium spp.*, blueberry, cranberry, *Vitis vinifera*, wine grape. In NY it has been reared from The tartarian honeysuckle, *Lonicera tatarica*, is an invasive plant that also hails from Asia and Siberia. It grows along the wooded edges of agricultural crops, carrying red berries in pairs that become heavily infested with SWD by early July. In the Hudson Valley, SWD developed in very high numbers on this host in the spring of 2013, providing an ideal reproductive site for the fly to disperse to small fruit later in the month as fruit became available (Image 2). The black cherry*, Prunus serotina*, Awoodland tree species, is also a preferred wild host for SWD. This tree grows in forests and landscapes throughout the Northeast and is native to North America. On Long Island, recent observations by Faruque Zaman, Suffolk County Cornell Cooperative Extension, showed 90% infested fruit with SWD. On average, 112 adult SWD emerged after incubating 4 oz. samples of black cherry fruit in the lab. In Long Island, it appears that black cherry is the earliest wild host utilized by SWD. Pokeweed, *Phytolacca*

acinosa, another known wild host of SWD, is found to have 80% infested fruit in late August. Fruit of these two wild hosts appear to be the most preferred in late summer and early fall, providing an additional point source of SWD along agricultural edge late into the growing season.

Over the past two years we have seen SWD spread throughout the fruit growing regions of the Hudson Valley and Lake Champlain in western NY in 26 NY counties (http://www.fruit.cornell.edu/spottedwing/dist.html). Across the Hudson Valley of NY, Suffolk County of Long Island and Hampshire County, Massachusetts, the first SWD captures occurred during the week of June 10th. Through the use of yeast and vinegar baited traps we have observed the fly nearly one month earlier then in 2012. Traps hung on 1 May in small fruit plantings of raspberry and blackberry throughout the lower Hudson Valley captured SWD 2 weeks prior to fruit infestations. The sustained capture of SWD flies prior to egg laying provided growers with a pest management start date to initiate preventative treatment. However, under the best of pest management programs in raspberry and blackberry, following a 3 to 4 day application schedule, rain events combined with pick-your-own weekend schedules forced application delays of up to 7-days, allowing SWD to infest fruit beyond rescue. All growers in the programs monitored by the ENY Fruit Team had infestation levels exceeding 17% using the best materials under tight treatment protocols.

Given the need for very tight insecticide schedules, insecticide labeled constraints and the need for resistance management strategies, it is likely that complete control of the SWD is unlikely, even under the most diligent of management programs. The perpetual regenerations and presence of all stages of the SWD life cycle provides insulation, in the form of egg, larva and pupa within the host fruit, to escape most insecticide applications. Under the best scenario, infestations can be significantly reduced by tight management intervals, with commitment to using a 3-4 day pest management program being the essential component to success. To improve on this strategy, cultural management considerations should also be undertaken. Creating a less favorable environment for SWD reproduction should begin by maintaining an open canopy through pruning to increase sunlight and reduce humidity while improving spray coverage. Drip lines should be installed ‘in-ground’ instead of using overhead irrigation when possible. Removal of infested fruit through cane and ground sanitation will reduce SWD emergence, reducing fly populations. Harvesting frequently and completely will prevent the buildup of ripe and over-ripe fruit. Unmarketable fruit should be removed from the field and either frozen, "baked" in clear plastic bags placed in the sun, or disposed of in bags off-site, killing the larvae and preventing adult emergence. Insecticide sprays directed at the SWD adults will reduce egg laying. Begin insecticide treatments at the first SWD trap catch prior to fruit ripening. Treatments should be applied on a 3 to 4 day schedule, repeated after 1 inch of rain. During July and August the insect can reproduce quite quickly, every 10 to 14 days. Select only the most effective insecticides, rotating insecticide modes of action on a 10-14 day interval during peak flight periods.

A 2013 farm success story: SWD was first found in Orange county, NY on 10 June, 2013. A successful pick-your-own operation in that county was able to keep infestation levels down to levels below 2% through to the end of July, then below 17% to the end of the season using a 3 to 7 day spray interval (as weather and pick-your-own scheduling would allow). Management was combined with near daily picking, often clean picking on weekends reducing the SWD

population potential. Products were employed in 14-day rotational scheduling beginning with Malathion, and followed using alternations of Delegate, Danitol 2.4 EC, Triple Crown and Brigade WSB. His recommendation to the consumers, upon harvesting berries, was to keep fruit cold during storage, which successfully retained fruit quality. Success in this case was not defined by achieving complete control of the pest but by achieving costumer satisfaction in fruit quality and an enjoyable farm / tourism experience.

Lab studies of fruit emersion in 1% oil (≥ 5 minutes held at room temperature (22°C)) has been shown to kill SWD eggs within the fruit (Fig. 3). Post harvest treatments employing cold temperature (1.1°C for 72 hours) significantly reduces live larva (Fig. 4). It may prove of value to small fruit growers to consider funding post harvest research to determine the viability of these approaches to SWD management.

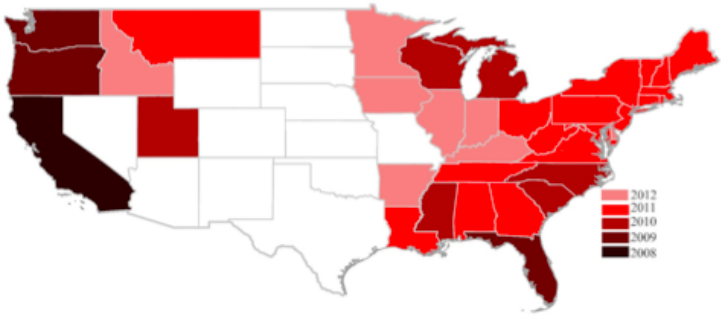

Figure 1. State level SWD in the United States. Burrack, et al. 2012. Journal of Integrated Pest Management.

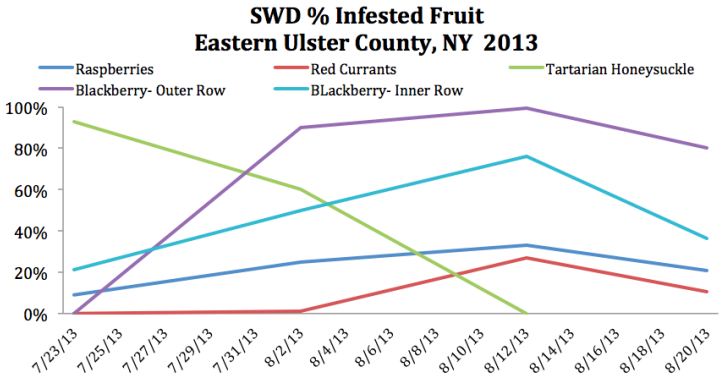

Figure 2. Chart representing field collected small fruit and the border host Tartarian Honeysuckle, *Lonicera tatarica*, from a commercial berry patch in Marlboro, NY 2013.

SWD Larva Survival in Raspberry Post 1% Oil Drench
HVLab, Highland, NY 2012

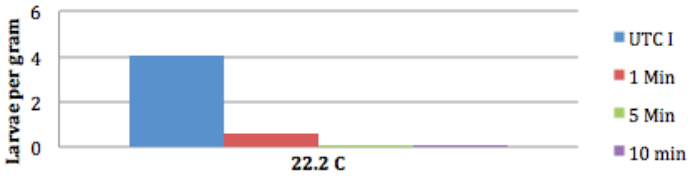

Figure 3. Post harvest evaluation of Amigo (methylated soybean oil) and temperature for controlling SWD.

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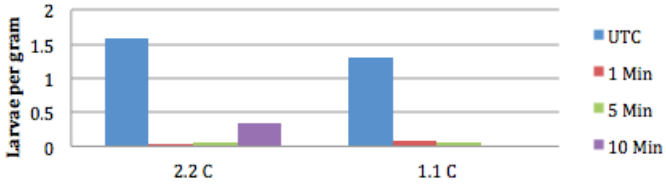

Figure 4. Post harvest evaluation of Amigo (methylated soybean oil) and 2 refrigerated temperatures for controlling SWD.