Tart Cherry

Moderator: Mark Evans, MSHS Board, Frankfurt, MI

9:00 am — Impact of Cover Crops on Cherry Orchard Development and Yield
- George Bird, Michigan State University

9:25 am — Ethephon for Fruit Removal in Tart Cherries
- Dr. Todd Einhorn, Michigan State University Department of Horticulture

9:50 am — Tart Cherry Disease Update
- Dr. George Sundin, Michigan State University - Plant Soil & Microbial Sciences

10:20 am — Developing Attract-and-Kill Management Tactics for Spotted Wing Drosophila
- Juan Huang, Michigan State University

10:45 am — Varietal and Development Susceptibility of Tart Cherry to SWD
- Christelle Guedot, University of Wisconsin - Madison

Impact of Cover Crops on Cherry Orchard Development and Yield

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Tree fruit orchard research is often a long and complex process. It can involve three distinct stages: orchard site development, tree establishment and orchard maintenance. In orchard replant situations, various soil-borne pathogens, including the Penetrans root-lesion and American dagger nematodes, can be key limiting factors. During the past 60 years, soil fumigants and cover crops have been used in reduce risk to these pathogens. In 2009, research was initiated at thee Michigan State University, Northwest Horticulture Research Center to identify a cover crop system that would eliminate the need for soil fumigation in cherry orchard site development.

In this research, six cover crop systems were maintained in 2010 and 2011 for analysis of Benton sweet cherry tree growth and development in 2013 through 2018 and machine-harvested cherry yield in 2019. The two-year cover crop systems included:

1. Conventional System: Rye in 2010 followed by oats and rye in 2011,
2. Nematode Non-host System: Buckwheat followed by winter peas in 2010 and pearl millet followed by Essex rape in 2011,
3. Two-year Bio-fumigation System: Oats and peas followed by oilseed radish in 2010 and oats and peas followed by Ida and Pacific Gold Mustard in 2011.
4. Second-year Bio-fumigation System: Oats followed by winter pears in 2010 and Ida mustard followed by Pacific Gold mustard in 2011.
5. Compaction Buster System: Oilseed radish in 2010 and oats and peas followed by oilseed radish in 2011.
6. Legume System: Oats and red clover in 2010 and red clover in 2011.

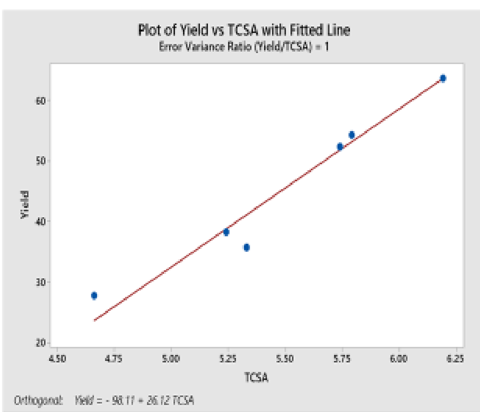
Each of the six cover crop systems was replicated four times in a randomized block design of four trees per plot. The original intent was to fumigate the Conventional System in the fall of 2011. Unfortunately, however, the entire block was fumigated. The orchard was planted in the spring of 2012 to 84 Benton sweet cherry trees and maintained in this experimental design through the first mechanical harvest in 2019. Tree growth measurements (Trunk Cross Section Area, Trunk Diameter, Limb Growth and Canopy Volume) were made on an annual basis. Because of the soil fumigation error, a tart cherry research orchard was established in 2015 following two years of site preparation. The objective of the tart cherry orchard research is to evaluate tree development and fruit yield under conventional, non-fumigant nematicide and biological-based systems. In 2019, the original orchard was converted to an orchard floor research trial and responsibility for both projects was transferred to Dr, Marisol Quintanilla, MSU applied Research and Extension Nematologist.

In 2015, cherry tree cross section area, limb growth and canopy volumes were greatest for the trees planted following the nematode non-host cover site development system and lowest following the legume system (Table 1.). The same was true for limb growth and canopy volume. In 2019, cherry yields associated with the nematode non-host system were significantly (P = 0.05) greater than those associated with the legume system.

Table 1. Impact of two-year (2010-2011) pre-orchard tree planting cover crop systems on four 2015 cherry tree growth parameters and 2019 cherry yield.

Cover Crop System	Cherry Yield (lbs)	Trunk X Sec. Area (cm^2)	Limb Growth (cm)	Canopy Volume (m^3)
Nematode Non-Host	**63.7 a**	**6.19**	**20.44**	**6.02**
Biofumigation (2011)	**54.3 ab**	**5.79**	**19.59**	**6.93**
Biofumigation (2010 & 2011)	**52.4 ab**	**5.74**	**19.49**	**4.53**
Conventional	**38.3 ab**	**5.24**	**19.50**	**3.12**
Compaction Buster	**35.7 ab**	**5.33**	**19.39**	**4.76**
Legume	**27.7 b**	**4.66**	**19.32**	**4.18**

RELATIONSHIP BETWEEN CHERRY TREE GROWTH PARAMETERS AND FRUIT YIELD.



Regression Statistics	R^2
Trunk Cross Section Area	95.05%
Limb Growth	60.98%
Canopy Volume	49.80%

The above indicates that TCSA is a better predictor of future fruit yield than limb growth or canopy volume.

In summary, the non-host and biofumigation systems resulted in superior Benton sweet cherry tree growth and fruit yield compared to the conventional, compaction buster and legume systems. This took place even though the soil was fumigated in the fall of 2011.

Varietal and developmental susceptibility of tart cherry to spotted-wing drosophila

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Spotted-wing drosophila (SWD) is an invasive species of vinegar fly that infests soft-skinned and stone fruits. Since its first detection in the United States, SWD has become a prominent economic threat in fruit crop industries, particularly affecting caneberry and cherry growers. We examined the susceptibility of tart cherries to SWD and sampled for larvae and adult during the tart cherry growing season. Four tart cherry cultivars (Montmorency, Balaton, Carmine Jewel, and Kántorjánosi) were tested at three different ripeness stages (unripe, ripening, and ripe), in no-choice laboratory bioassays. Lab assays indicated that tart cherry cultivars generally became more susceptible to SWD as they ripened. As the fruit developed, °Brix (sugar content) increased and firmness generally decreased. Tart cherry °Brix and firmness were not correlated with the number of SWD eggs per gram of fruit, but showed a significant interaction effect with the number of larvae and adults per gram of fruit. This study shows that tart cherries are largely not susceptible to SWD when unripe and become susceptible as soon as the fruits change color, with some differences among cultivars. As SWD populations increasingly overlap with tart cherry harvest, monitoring SWD populations will be essential to time management strategies with fruit ripening.

We also conducted field monitoring of SWD adult and larval populations. We established a predictive generalized linear mixed model (GLMM), and a generalized additive mixed model (GAMM) of the dynamic seasonal phenology of SWD based on four years of adult monitoring trap data in Wisconsin tart cherry orchards collected throughout the growing season. The models incorporate year, field site, relative humidity, and degree days (DD); and relate these factors to trap catch. The GLMM estimated a coefficient of 2.21 for DD/1000, meaning for every increment of 1000 DD, trap catch increases by roughly 9 flies. The GAMM generated a curve (Figure 1) which approximates critical DD points of first adult SWD detection at 1276 DD, above average field populations at 2019 DD, and peak activity at 3180 DD. By incorporating four years of comprehensive seasonal phenology data from the same locations, we introduce robust models capable of using DD to forecast changing adult SWD populations in the field leading to the application of more timely and effective management strategies.

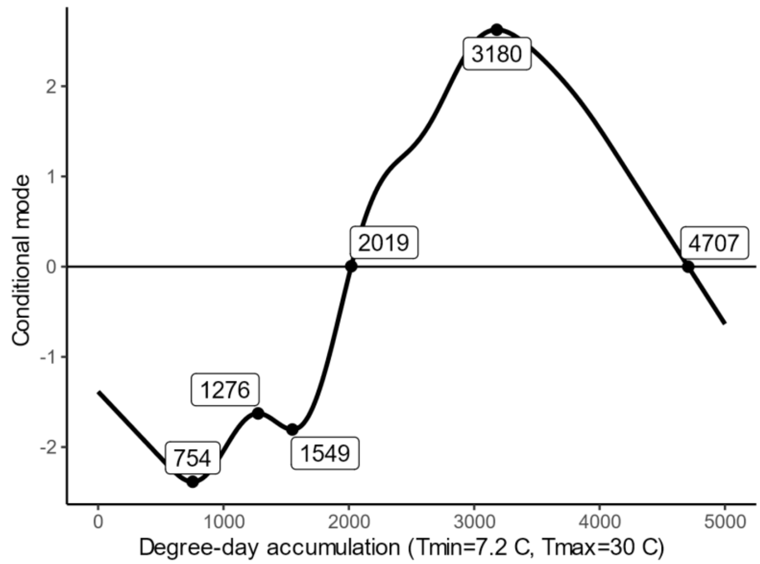

Figure 1: GAMM generated smooth curve plot of adult *D. suzukii* trap catch total for each site in relation to degree day accumulation (DD) over the four year trapping period. Critical DD values are labelled and boxed on the curve. Conditional modes (CM) measure the population level estimations given the effects (positive CM = higher than average, negative CM = lower than average).