

Pruning and Mulching for Control of Spotted Wing Drosophila: Effects on Fruit Marketability and Infestation

Andrew Petran¹, Mary Rogers

Postdoctoral Associate, Department of Horticultural Science, University of Minnesota, St Paul MN 55108



Introduction

The Situation

- Spotted Wing Drosophila (*Drosophila suzukii*, SWD) is an invasive fruit fly introduced to mainland US in 2012, now present throughout the country.
- Unlike the common fruit fly, SWD can lay eggs in intact, developing and mature fruit, posing a threat to the marketable yields of commercial fruit crops.

The Problem

- The small fruit industry has suffered considerable damages since the introduction of SWD; crop losses are estimated to cost \$500 million annually in the western US alone¹.
- SWD inhabits a wide host range of wild and cultivated plants, and can cycle through 12 generations in a single field season².
- Organic growers face particular hardships, as few OMRI-approved spray regimens are effective at controlling SWD populations.

The Potential for Growth

- Organic fruit growers may be able to reduce the impact of SWD by altering their cultural practices.

Objective

In 2016 a multi-University effort funded by the USDA-OREI began a project to determine organic methods of reducing SWD infestation of small fruits. The project includes experiments examining the influence of pruning or mulching practices on SWD development and infestation rates.

Methods

Experiment 1 – Does pruning intensity alter canopy microenvironment enough to affect SWD infestation?

- 3 small fruit crops (blueberry, blackberry & raspberry) were subject to grower standard, light prune and heavy prune treatments at 6 sites throughout the US in 2016 and 2017 (photo 1).



Photo 1. Pruning treatments on Minnesota blueberry plants.

- Total marketable & cull yields were recorded for each treatment rep, in addition to weekly % SWD infestation, canopy temperature and humidity, berry temperature, and % Brix.

Experiment 2 – Do different mulches influence the development of SWD in fallen fruit?

- Blueberries artificially infested with SWD were bagged and placed in 3 mulch treatments: black landscape fabric, on top of wood mulch and buried underneath wood mulch.



Photo 2. (a) Mulch treatments, and (b) bagged berries in the field.

- After 1 week in the field, bags were removed and brought to the lab to develop for a following week. % SWD emergence from fruit was then recorded from each bagged rep. Experiment was repeated 2 times/yr.

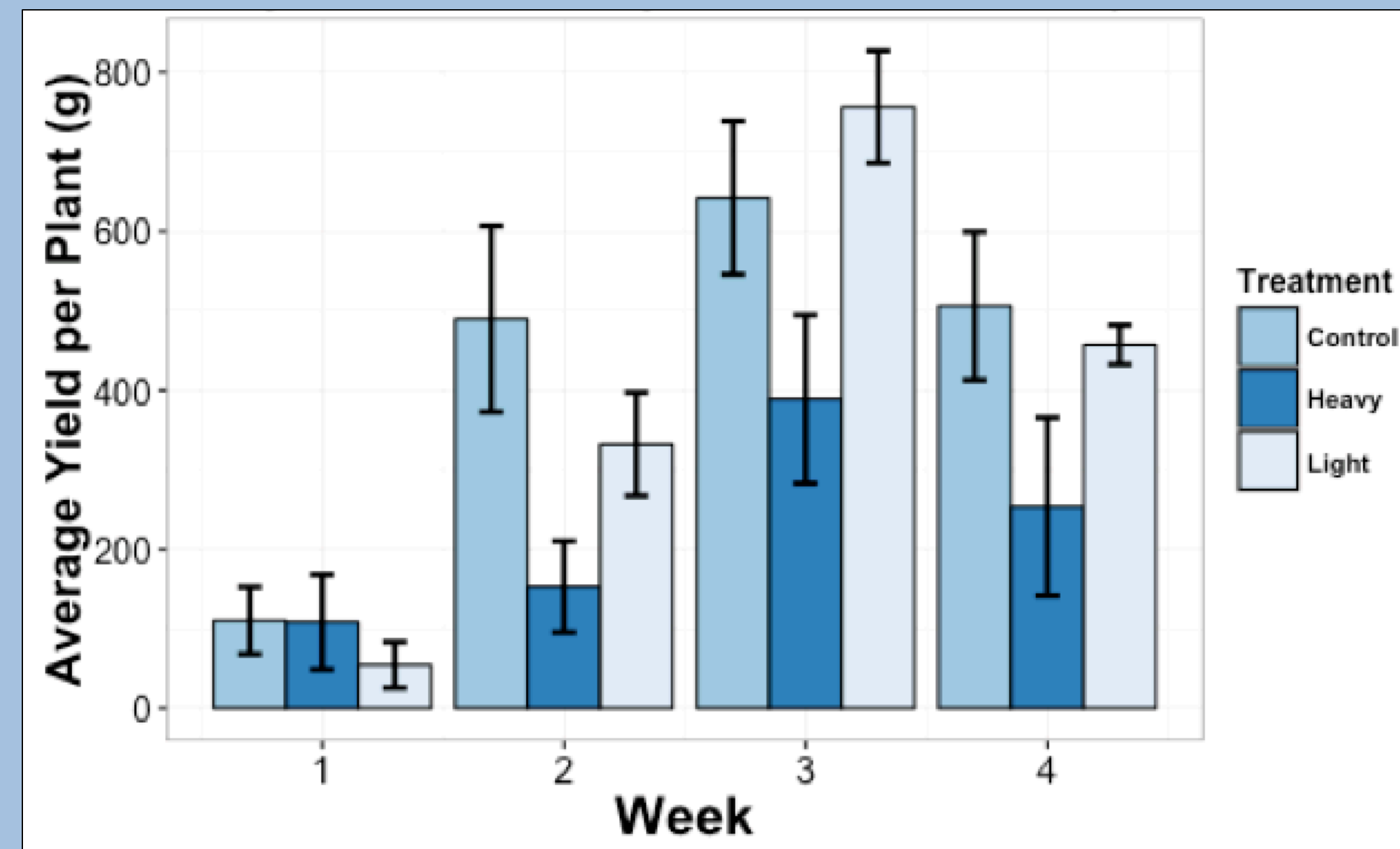


Figure 1. Average marketable blueberry yields over a 4-week harvest of standard, light and heavy-pruned plants in Northfield, MN, 2016.

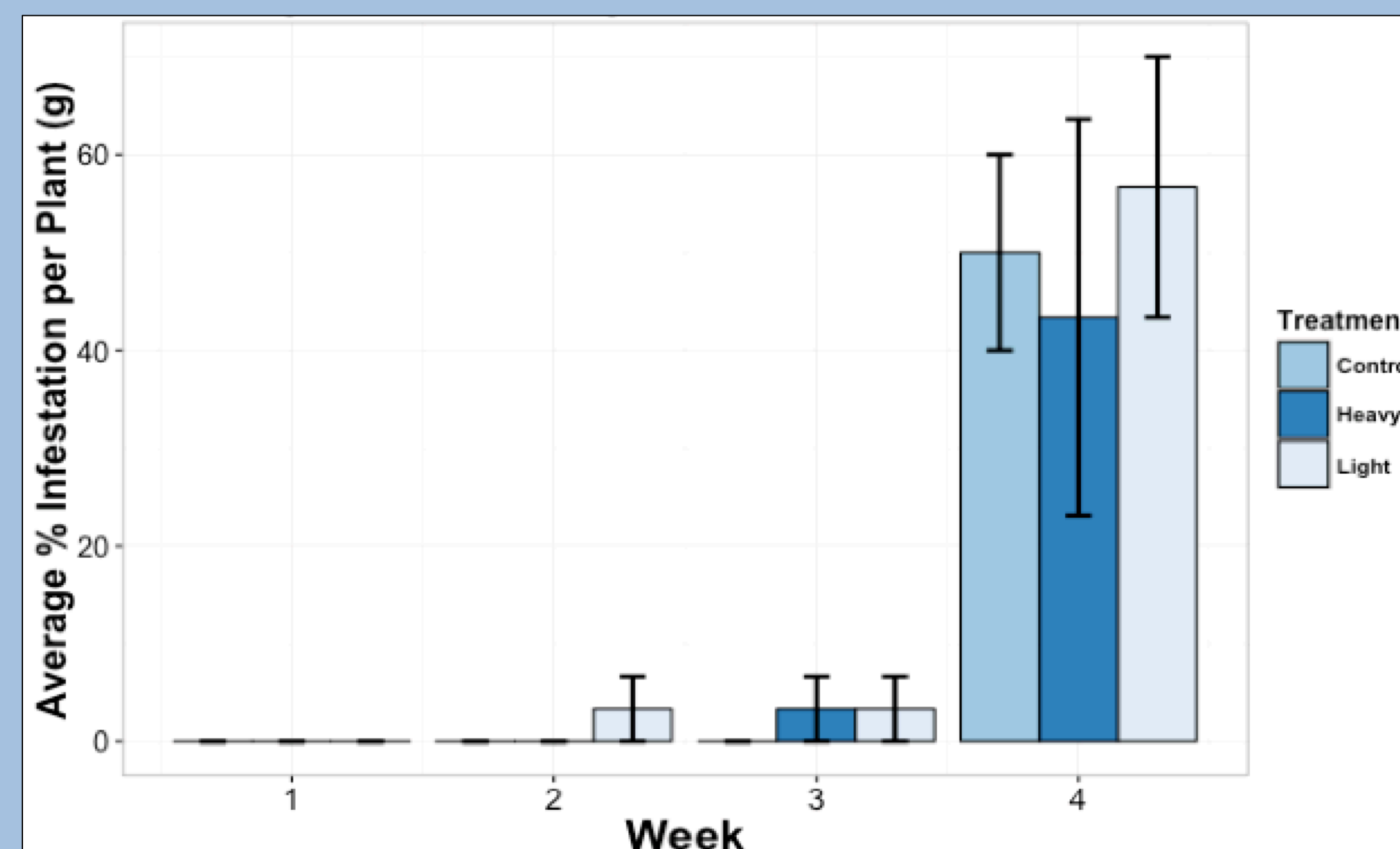


Figure 2. % SWD infestation of blueberries harvested on standard, light and heavy-pruned plants over a 4-week period in Northfield, MN, 2016.

Results

Experiment 1

- Heavy-pruned plants were observed to have **lower marketable yields** than standard or light-pruned plants (Figure 1).
- There were **no differences in SWD infestation** among the 3 pruning treatments in 2016 (Figure 2).
- Year 1 data does not appear to indicate a relationship between pruning level and lower rates of SWD infestation.
- However, preliminary data from 2017 indicates **heavy-pruned plants may ripen faster**, shifting a higher proportion of harvestable fruit to the beginning of harvest window.

Experiment 2

- Average maximum temperatures were **significantly lower beneath wood mulch**, compared to the top of wood mulch and landscape fabric (Figure 3).
- Similarly, a higher proportion of SWD eggs developed into larvae or pupae in beneath wood mulch conditions (Table 1).
- Suitability of beneath-mulch microenvironment for SWD development suggests the use of **non-permeable floor management options**, such as landscape fabric.

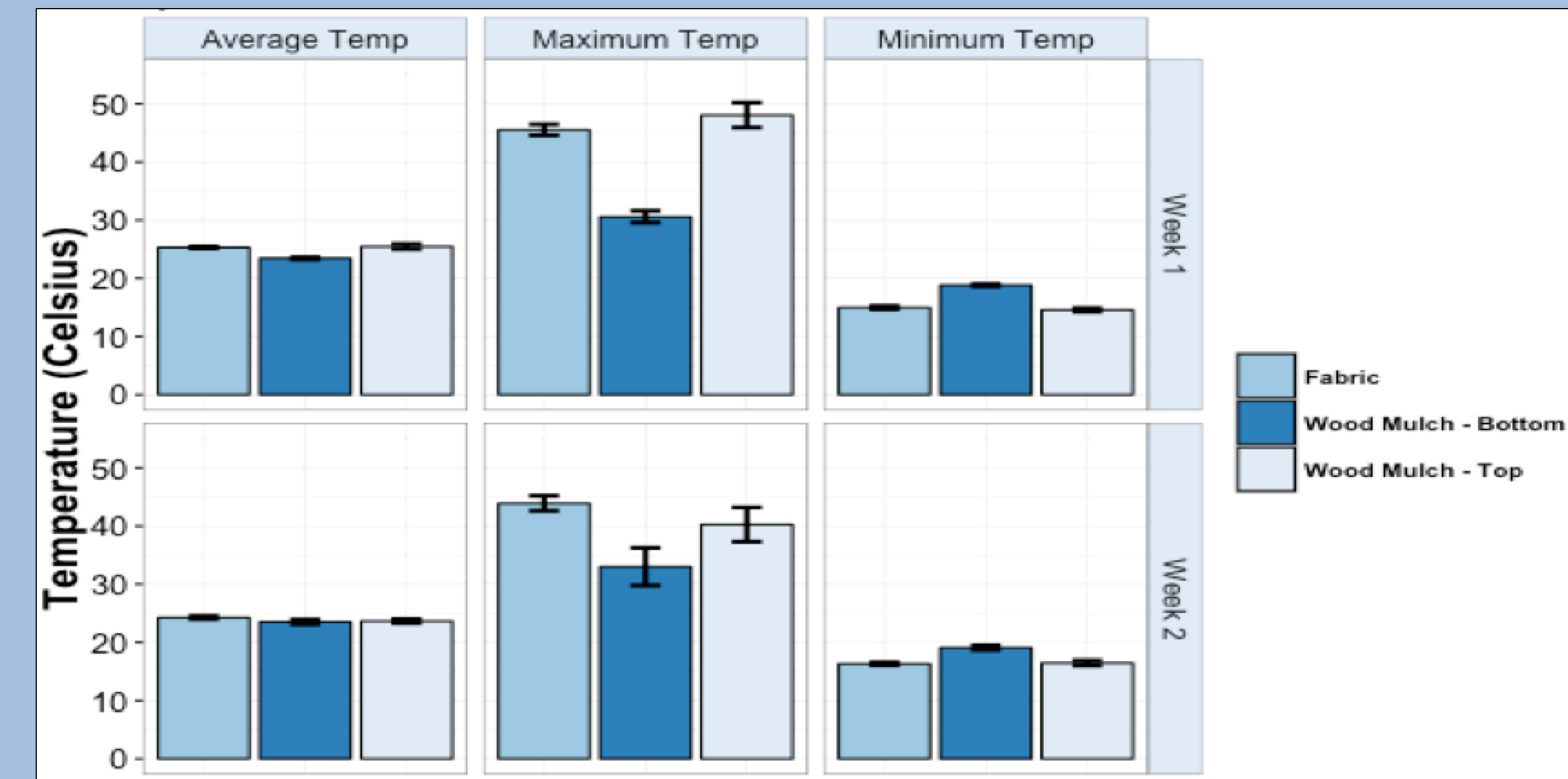


Figure 3. Average, maximum and minimum daily temperatures of floor management treatments over 2, 1-week mulch trials in Northfield, MN 2016.

	Avg. % Egg Development		
	Into Larvae ²	Into Pupae ²	
Week 1	Landscape Fabric	26.7 b	0 b
	Wood Mulch - Bottom	52.4 a	37.1 a
	Wood Mulch - Top	20.8 b	0 b
Week 2	Landscape Fabric	41.8	0
	Wood Mulch - Bottom	46.1	13.95
	Wood Mulch - Top	34.4	0

²Pairwise comparisons determined by Tukey's Honest Significant Difference test at $p < 0.05$.

Table 1. SWD egg development within fruit placed in mulch treatments over 2, 1-week mulch trials in Northfield, MN 2016.

Discussion and Conclusions

Experiment 1

While pruning does not appear to alter blueberry canopy microenvironment enough to influence SWD infestation, the observed shift in harvest load for heavy-pruned plants may prove valuable. Blueberry growers who practice 'phenology management' can utilize this information, attempting to maximize harvests of vulnerable fruit during times when SWD has low presence in the field (Figure 4).

Experiment 2

Growers who utilize wood mulch for floor management risk providing SWD in fallen fruit more suitable conditions for development. Burying infested fruit is also not advised, as this purported control technique may actually increase SWD levels.

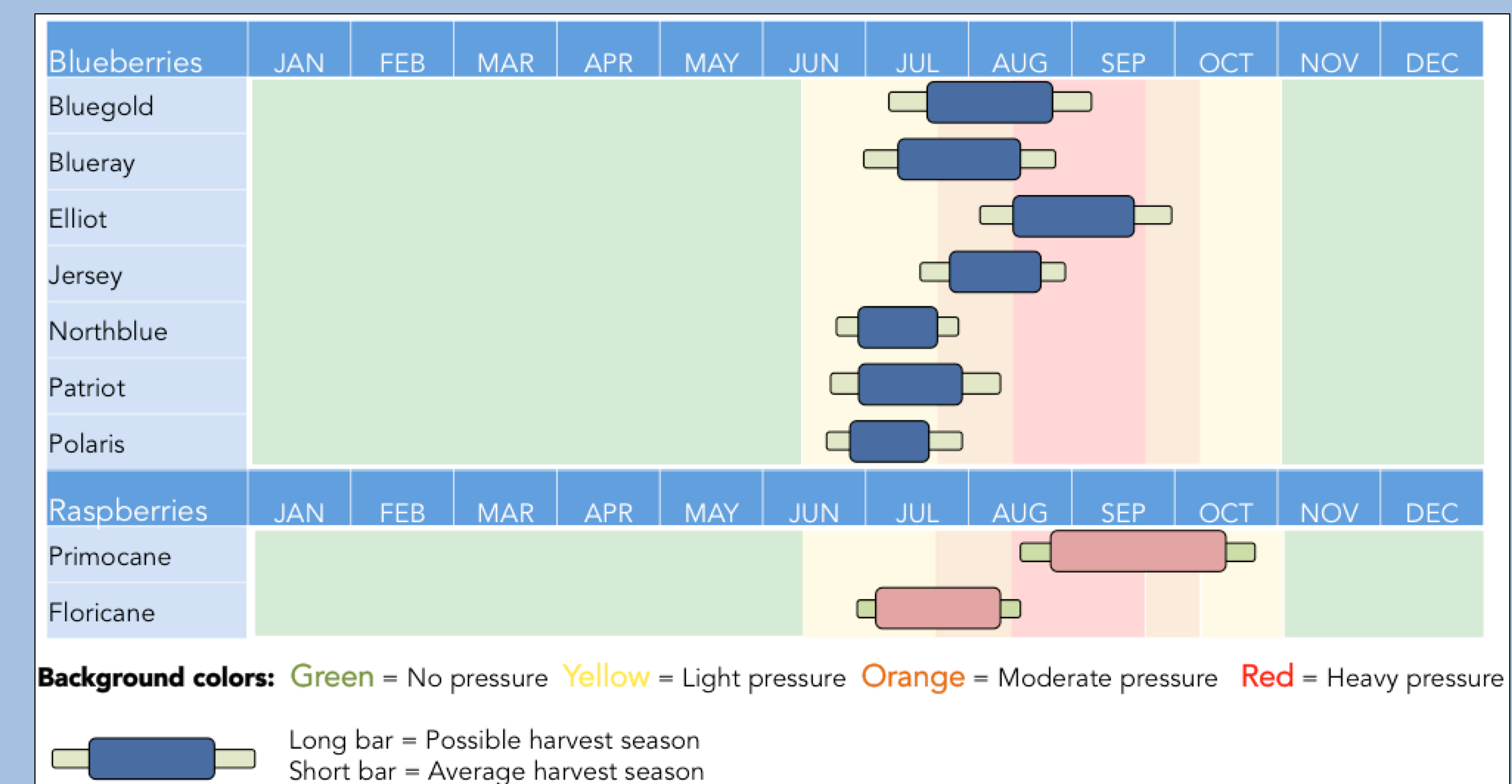


Figure 4. SWD presence & severity for common blueberry cultivars and raspberry types. Presence & severity determined from 3 years of trapping data taken from sites throughout MN. Harvest windows are accurate only for Upper Midwest US.