

Assessing plastic & biodegradable mulches for managing spotted-wing drosophila

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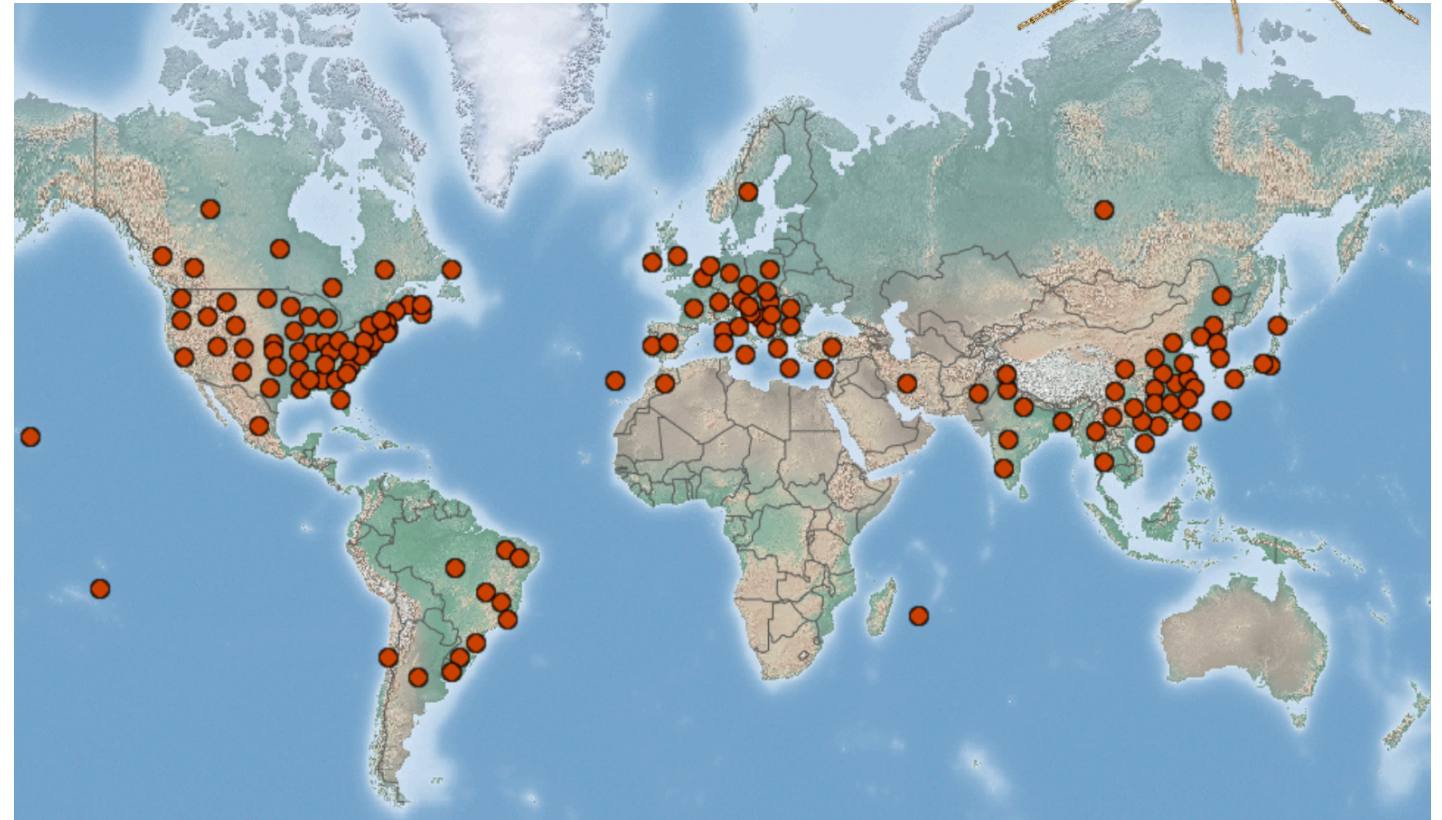
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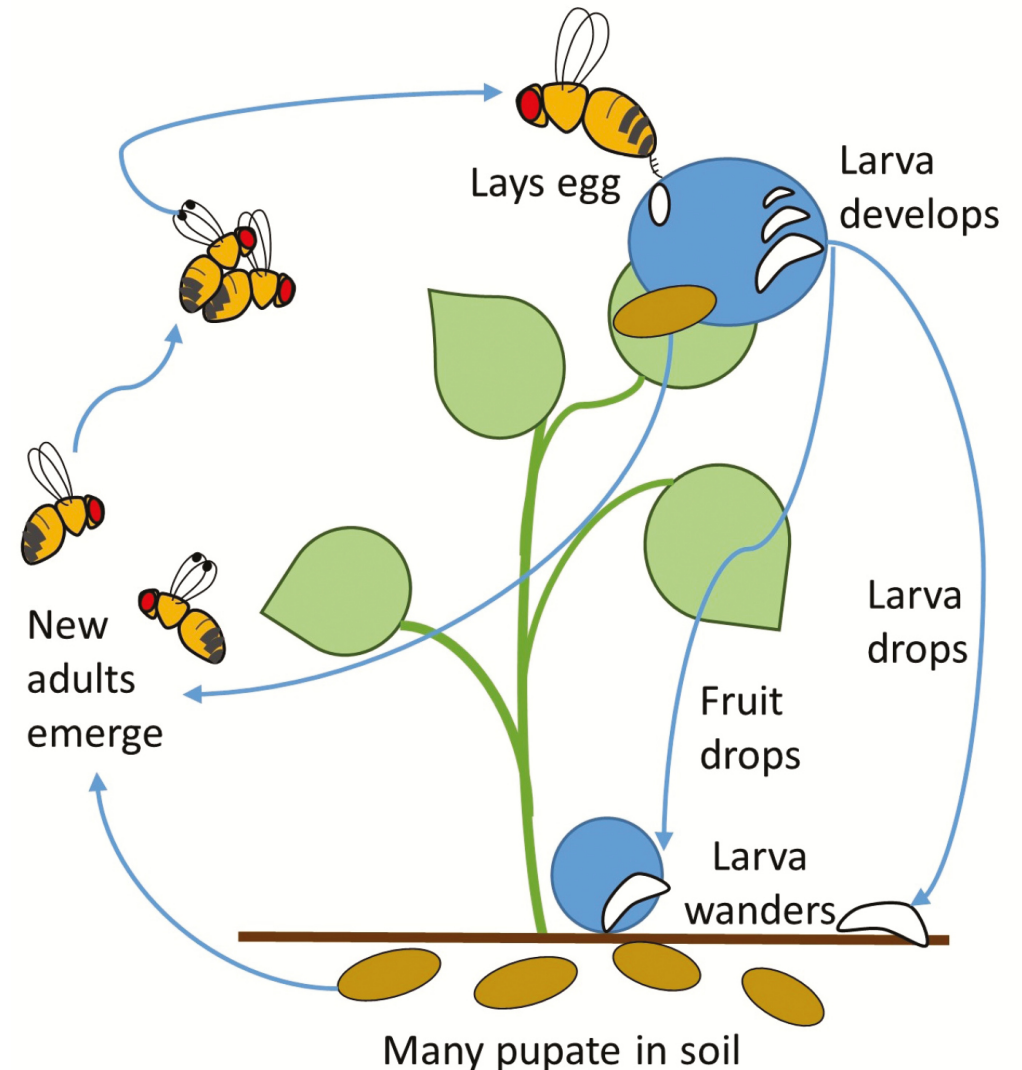
SPOTTED WING DROSOPHILA IMPACTS SMALL FRUIT CROPS WORLDWIDE

- Invaded fruit-producing regions world-wide¹
- Management relies on chemical control
- Cultural practices common & effective²
- Biological control agents being tested



WHERE DO ALL THE LARVAE GO?

- SWD lay eggs in ripening fruit
- Larvae develop inside fruit
- Over 82% of larvae drop out of fruit onto ground¹
- Larvae also fall to ground inside compromised fruit
- Larvae more likely to leave fruit if crowded²
- Larvae crawl less than 3" in the soil³
- 87% pupate in top 0.2" of soil²



(1) Woltz & Lee (2017). *Biological Control*. (2) Bezerra Da Silva et al. (2019). *Scientific Reports*. (3) Ballman et al. (2017). *Journal of Economic Entomology*.

(4) Ballman & Drummond (2019). *Journal of Kansas Entomological Society*. Figure: J. Lee.

CULTURAL CONTROLS ON THE GROUND

- Shortened harvest intervals, field sanitation
- Black weedmat and sawdust tested in blueberry in OR, GA, MD, MI, MN¹
 - Weedmat did not impact mortality of larvae and pupae on mulch surface
 - At one site, found fewer adults emerged from pupae on weedmat compared to sawdust
 - Greatest effect on small plants when canopy did not shade mulch



TESTING PLASTIC MULCHES IN WISCONSIN RASPBERRIES

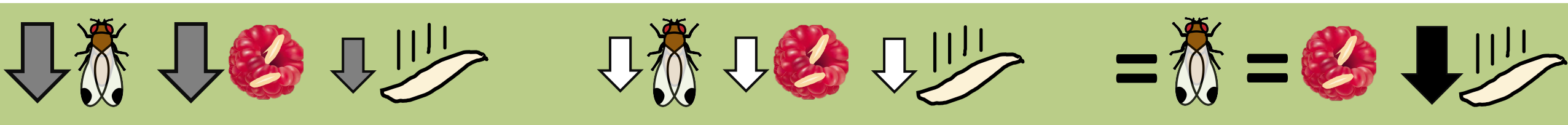
- Plastic mulches may be more effective than weedmat
- May be more effective in raspberry due to canopy shape / trellising
- Testing impact on SWD management, fruit yield and quality, soil health in fall-bearing raspberry

MULCHES MODIFY THE MICROENVIRONMENT

METALLIC

WHITE

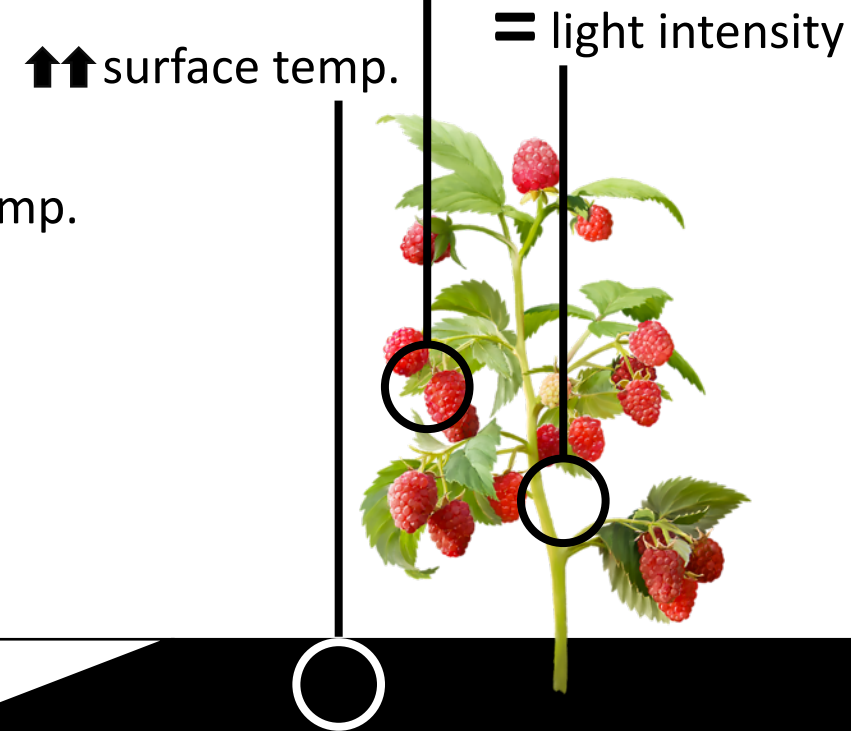
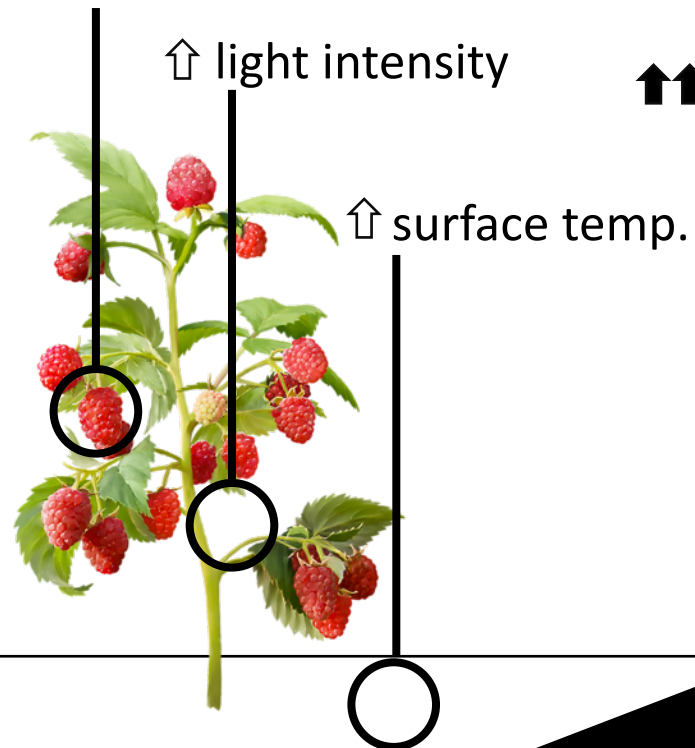
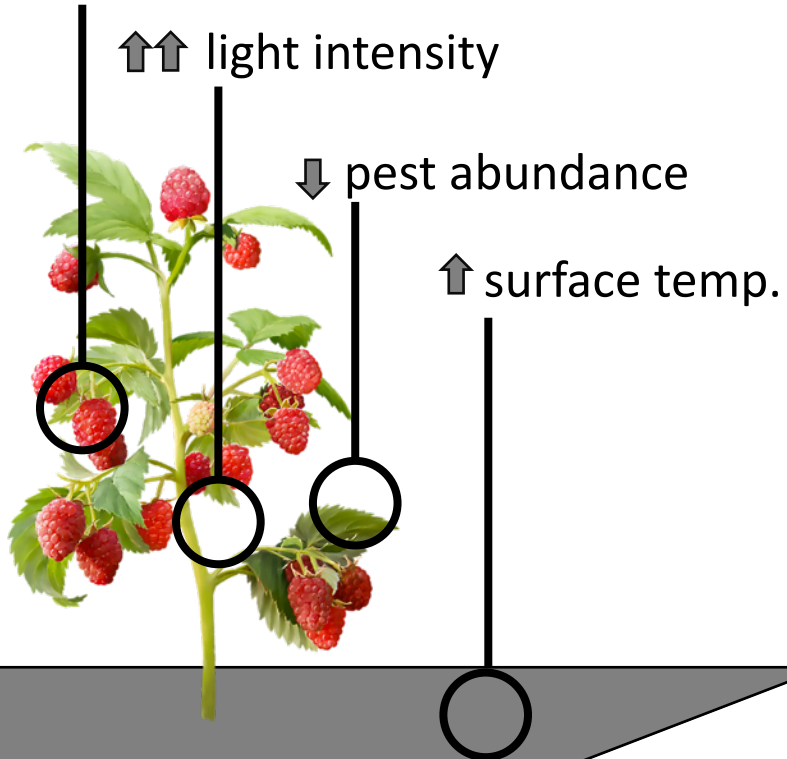
BLACK



↑↑ canopy temp.
↓↓ canopy humidity

↑ canopy temp.
↓ canopy humidity

= canopy temp.
= canopy humidity



TESTING PLASTIC MULCHES IN WISCONSIN

- Tested 3 mulches at collaborator's farm in Caroline and Polana raspberries

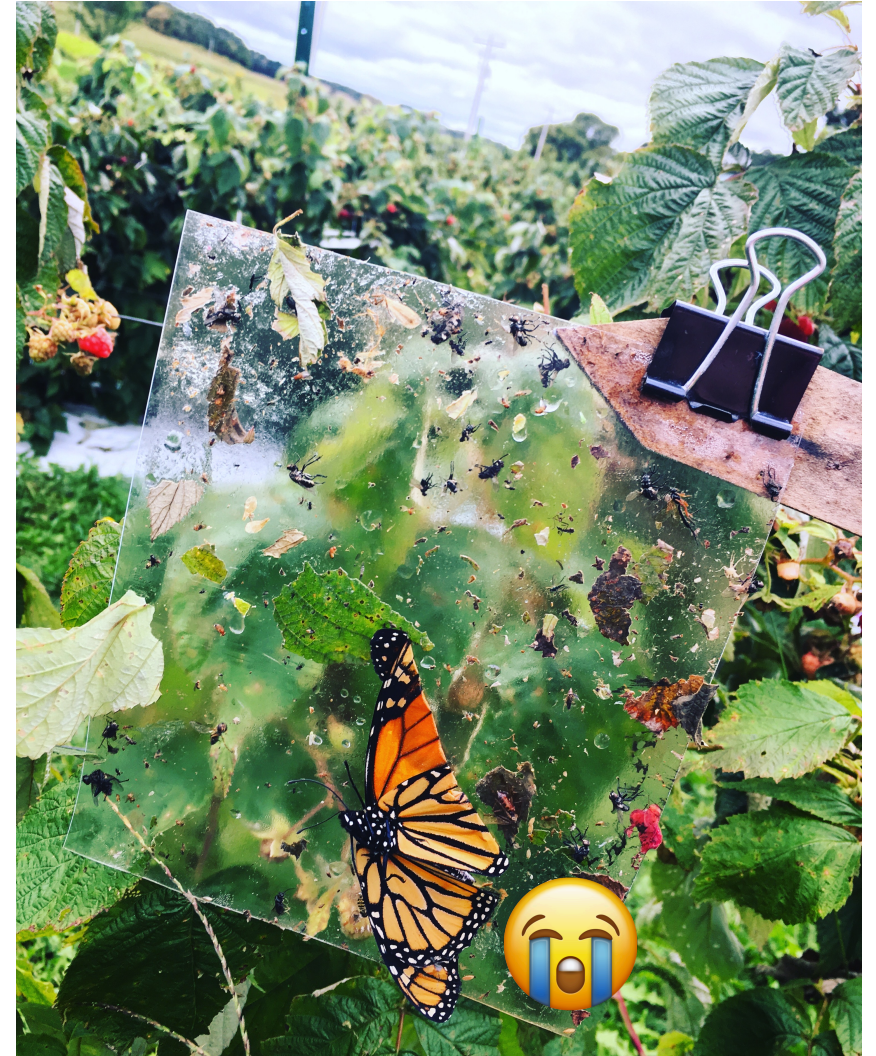
METALLIC (polyethylene)	BLACK (biodegradable)
WHITE (biodegradable)	CONTROL (grower stand.)

- Mulches laid on both sides of emerging canes in late April
- Secured with sod staples
- 6" gap between mulch strips
- Each plot 5' wide x 25' long



TESTING PLASTIC MULCHES IN WISCONSIN

- Took measurements when flies present
 - July to mid-October
- Adult population measured with clear sticky cards
- Fruit infestation assessed using salt float method



TESTING PLASTIC MULCHES IN WISCONSIN

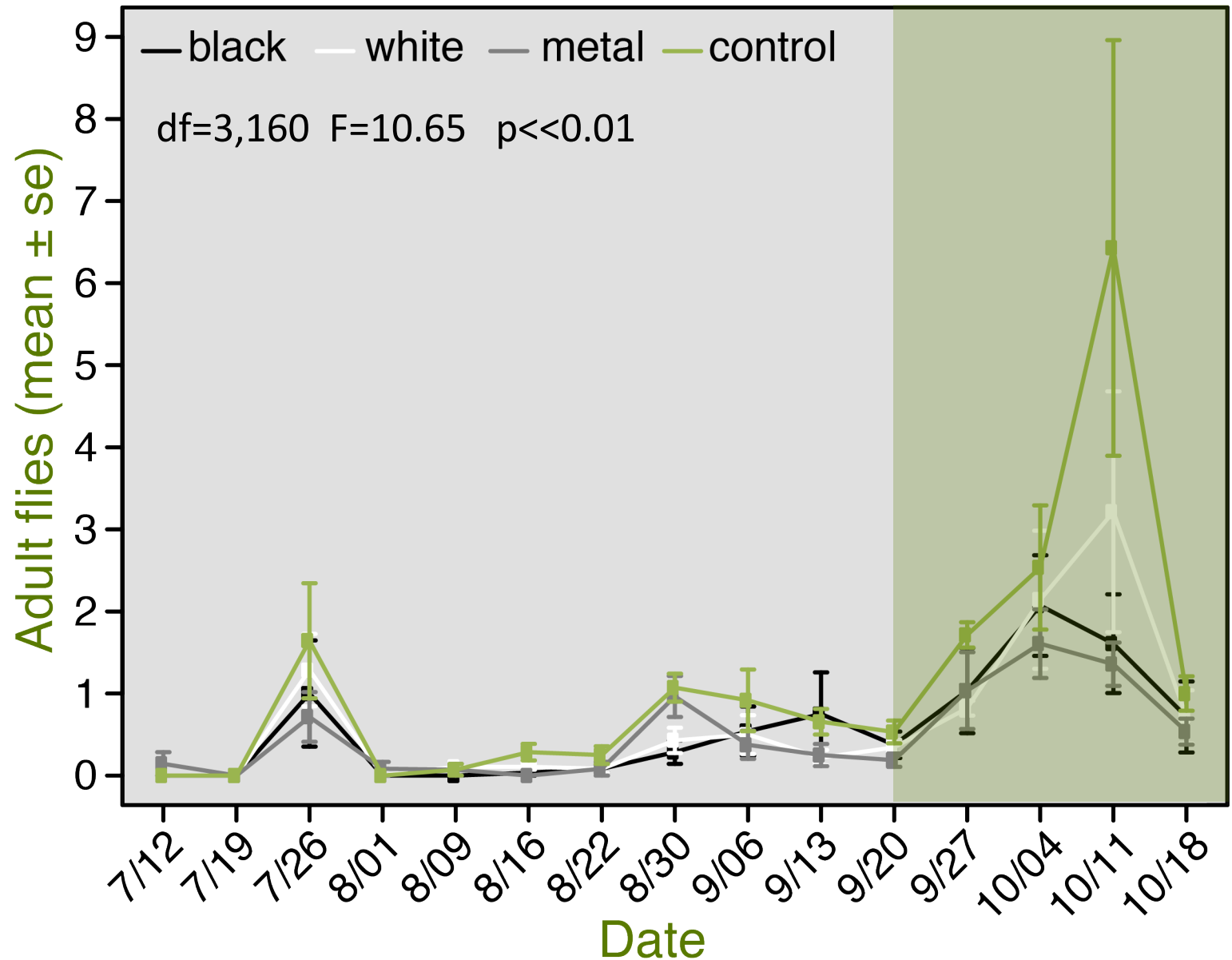
- Took measurements when flies present
 - July to mid-October
- Adult population measured with clear sticky cards
- Fruit infestation assessed using salt float method
- Tested larval mortality on mulch using 'corrals' made from plastic containers





MULCHES REDUCED ADULT FLY POPULATION

- Fewer adult flies in mulch treatments
- Greatest effect when fly populations highest
 - Black & metallic mulches reduced flies 6-fold
 - White reduced flies 2-fold

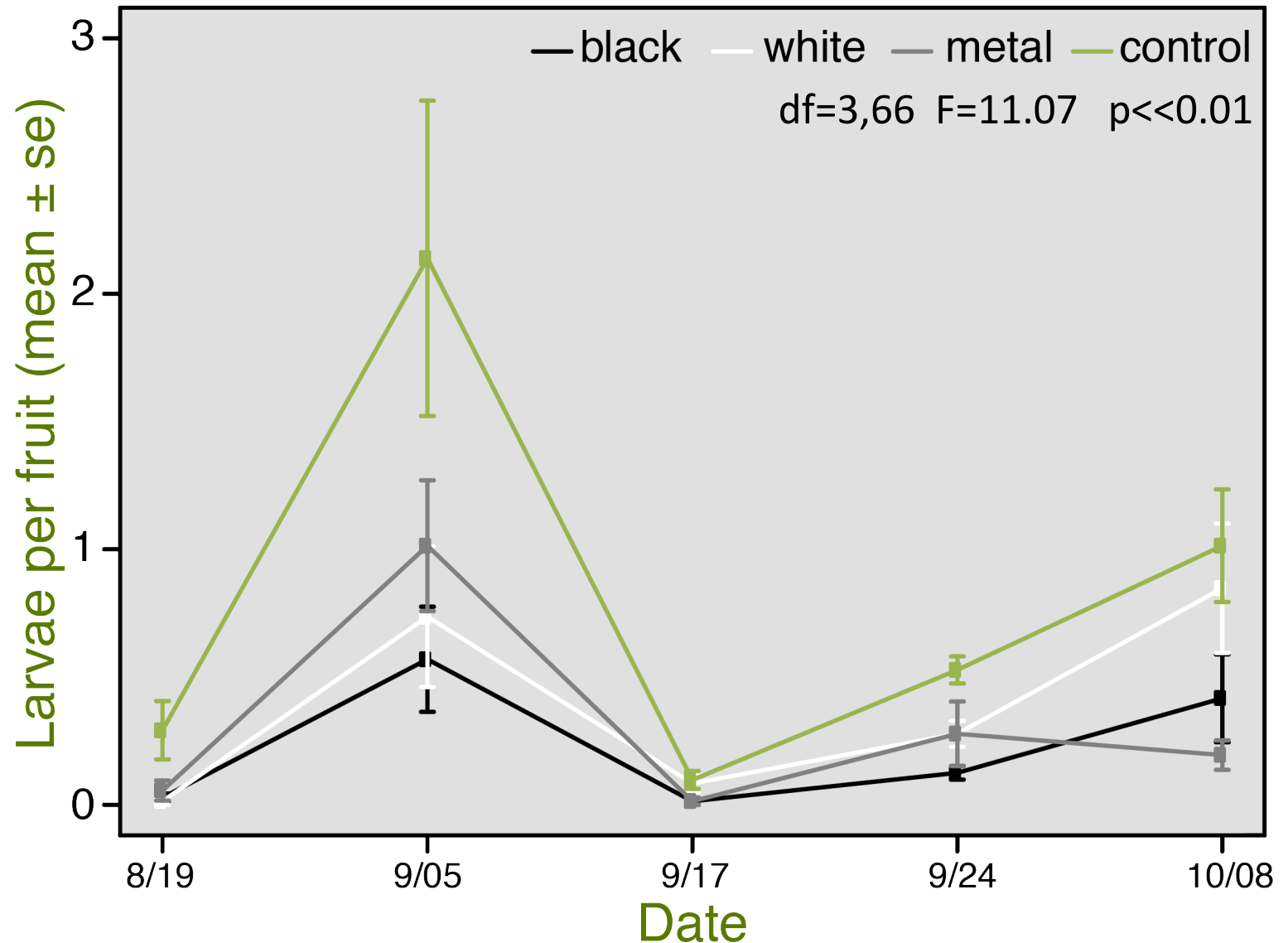


Linear mixed model: $\sqrt{\text{adults}} \sim \text{treatment} * \text{cultivar} + \text{treatment} * \text{date} + \text{date} * \text{cultivar} + (1 | \text{block})$

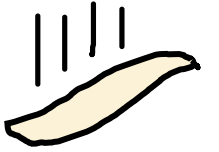
MULCHES REDUCED LARVAE IN FRUIT



- Fewer larvae in fruit above mulch
- Greatest effect when fly populations highest
 - Black and white mulch reduced larvae 4-fold
 - Metallic mulch reduced larvae 2-fold



LARVAE DIE QUICKLY ON MULCH SURFACE

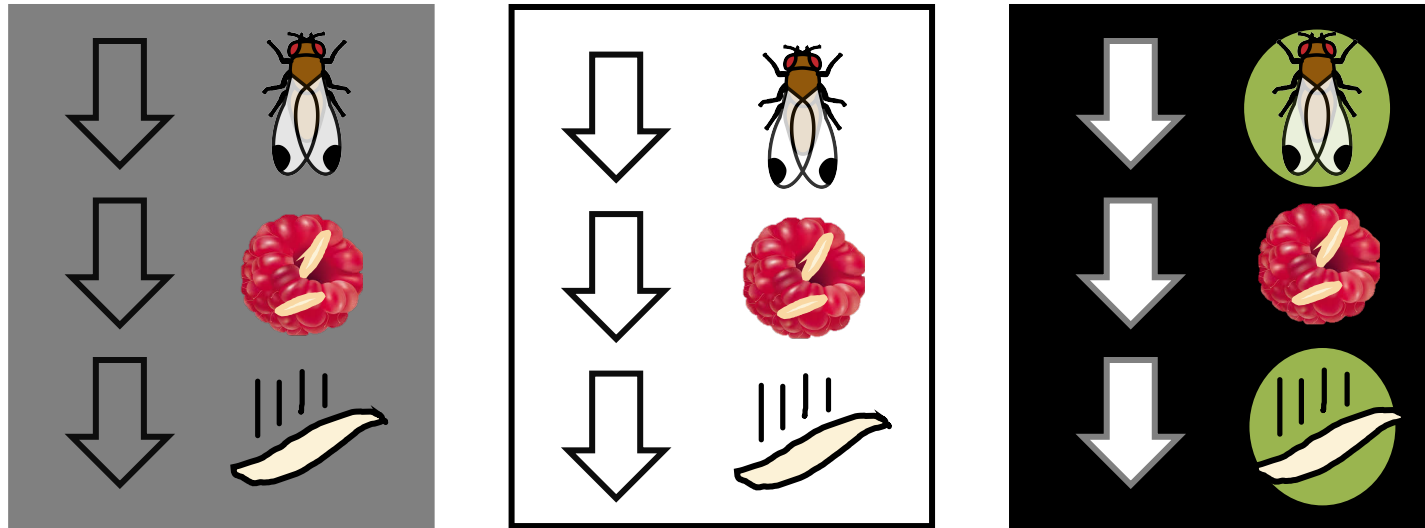


- Larvae die quickly on all mulches, especially black

Mortality		
1 HOUR	2 HOURS	3 HOURS
11%	50%	99%
27%	86%	100%
100%	100%	100%

MULCHES REDUCE SWD ADULTS AND LARVAE

- Mulches provide three layers of protection for raspberry plants



- Mulches reduce adults in the area, reducing larval infestation in fruit
- Mulch surface kills fallen larvae
- Microclimate data may explain results

SWD BIOCONTROL UPDATE

- Predators variably effective in low-input fields¹, 1-4% predation in WI²
- Native parasitoids not very effective, 0% parasitism in WI²
- Parasitoids from native range highly effective, testing in quarantine
- Testing fungal pathogen sprays or lure-and-infect traps
- Some *Bt* strains effective in lab trials

