Reflective mulch for integrated pest management of chilli thrips in strawberries

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Summary

Reflective mulch reduced chilli thrips numbers and increased marketable fruit yield when compared to black plastic mulch. Cultivars grown on black plastic mulch had higher rating of leaf damage compared to the cultivars grown on reflective mulches. Brilliance planted on black plastic mulch had higher chilli thrips numbers compared to Medallion.

Objective

The objective of this proposal is to determine differences in chilli thrips infestation and fruit yield in 'Florida Brilliance', Sweet Sensation® 'Florida127', Medallion™ strawberry cultivars planted on white and metalized reflective mulches vs. black mulch.

Methods

Field trials were conducted at the University of Florida, Gulf Coast Research and Education Center. In September 2021, twelve strawberry beds (91cm X 81cm X 25cm) were prepared, and mulches were laid. Four replicates of three main treatments and three sub-plot treatments were evaluated in a randomized split plot design. The main treatments were black plastic mulch, white mulch, and metalized mulch (Can-Block XSB v-TIF silver; Imaflex, Inc., Thomasville, NC) and the sub-plot treatments were Florida Brilliance', Sweet Sensation® 'Florida127', Florida Medallion™ strawberry cultivars. Strawberry plots were maintained following the local crop production protocol. No synthetic insecticide was applied during the experiment.

Each of the twelve beds were divided randomly into equal-length sections of black, white, and metalized mulch. Of the twelve strawberry beds, three adjacent beds were considered as a single replication and sampling was initiated only in the middle rows. During the season, 48 plots with a plot size of 18 strawberry plants per plot were used to evaluate three cultivars on three mulch types across four beds. On October 12, 2021, transplants of Florida Brilliance', Sweet Sensation® 'Florida127', Medallion™ were planted in their respective plots.

From each plot, five randomly selected young leaves and open flowers were collected once in two weeks. Marketable fruit yield was collected weekly and weighed in grams on the same day of collection. Additionally, five random plants at each sampling point were visually rated to evaluate the leaf damage index (0-4 scale). The tissue samples were brought to the lab and washed with 70% ethanol to count chilli thrips adults and larvae. To characterize the micro-environment created by the plastic mulch, soil temperature was measured by a sensor (GS3; Meter Group, Inc. Pullman, WA) at 0-5 cm depth, and air temperature was measured by another sensor (RT1; Meter Group, Inc. Pullman, WA) at 5 cm above the mulch. Reflectance of plastic mulch at different wavelengths was measured by a spectrumradiometer (SS-110; Apogee Instruments, Inc. Logan, UT).

Canopy projected area of each plot was measured to characterize plant vegetation and growth. Overhead picture of a plot was taken by a digital camera (DSC-WX350; Sony, Tokyo, Japan) and imported into ImageJ (National Institutes of Health, Bethesda, MD) to be converted into a binary image. The image was then processed by the software to calculate the total canopy area of the strawberry plants of a plot.

Results

Mulch type had a significant effect on chilli thrips number, yield, leaf damage and canopy projected area. Different plastic mulch colors created different micro-environments, including soil temperature and light reflectance.

Chilli thrips number and leaf damage index

Chilli thrips population was significantly higher in cultivars grown on black plastic mulch than reflective mulch (Fig. 1). Moreover, cultivars grown on black plastic mulch had significantly higher leaf damage index compared to the cultivars grown on white and metalized reflective mulches (Fig. 2). While comparing with the cultivars grown on black plastic mulch, white and metalized reflective mulches reduced chilli thrips population by ~ 2 times. Among cutivars grown on black plastic mulch, Medallion had lowest number of chilli thrips population (Fig. 1). However, chilli thrips population did not differ significantly among cultivars grown on white and metalized reflective mulches.

Yield

Marketable fruit yield was significantly higher on reflective mulch than black plastic mulch. The marketable yield production in all the three cultivars gown on white and metalized reflective mulches was more than 2 times compared to the cultivars grown on black plastic mulch. However, there was no significant difference in marketable yield production between white and metalized reflective mulches. Among cultivars grown on reflective and black plastic mulches, no significant difference in marketable yield production was observed (Fig 3).

Micro-environment

Different mulch colors created different micro-environments. Soil temperature was significantly higher under black mulch than other mulch types during early season (Fig. 4). No significant difference was observed in air temperature throughout the season (data not shown). Metalized mulch had the highest reflectance of sunlight, reaching around 50-75%, whereas black mulch and white mulch had around 10-20% and 30-45% reflectance of sunlight, respectively (Fig 5).

Canopy projected area

Canopy projected area of all treatments increased throughout the season. Medallion had significantly higher canopy area than other cultivars in early season but significantly lower canopy area during the middle and late season (Fig. 6)

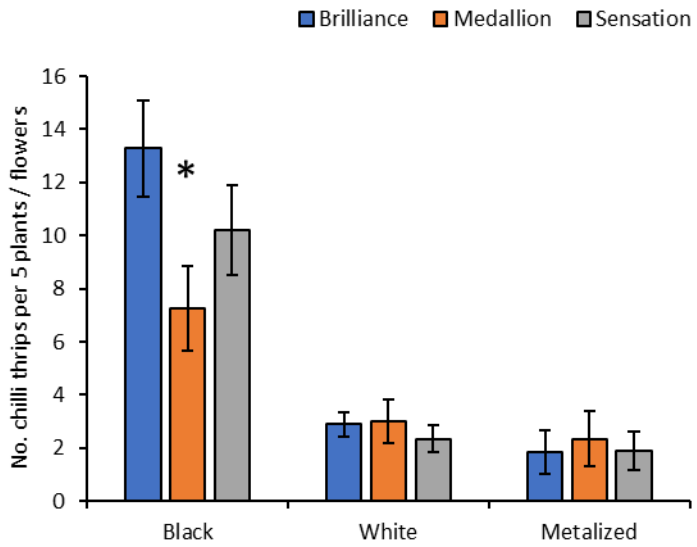

Figure 1. Mean (±SE) number of chilli thrips on three strawberry cultivars grown on black, white, and metalized mulch.

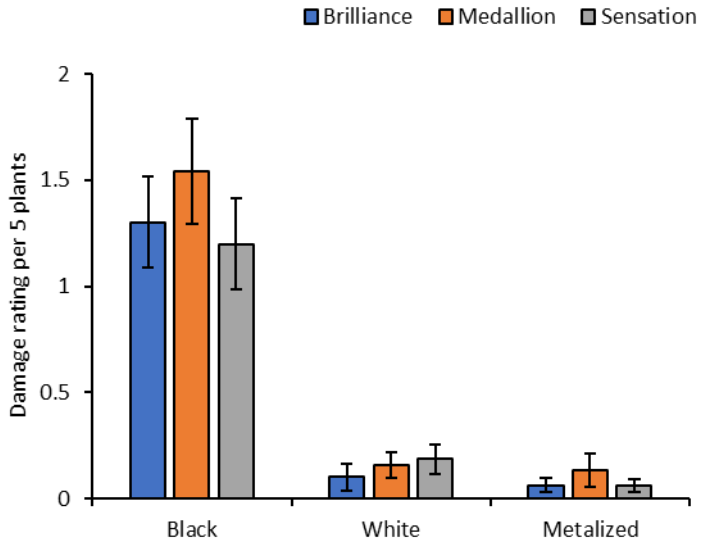

Figure 2. Mean (±SE) leaf damage rating of three strawberry cultivars grown on black, white, and metalized mulch.

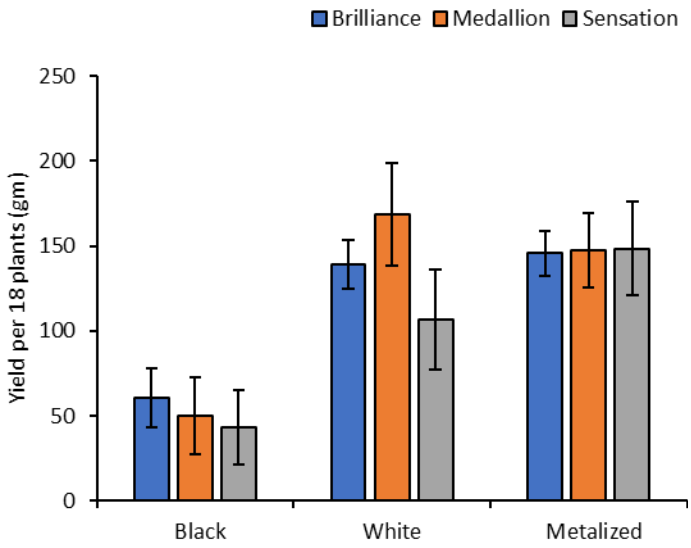

Figure 3. Mean (±SE) marketable fruit yield of three strawberry cultivars grown on black, white, and metalized mulch.

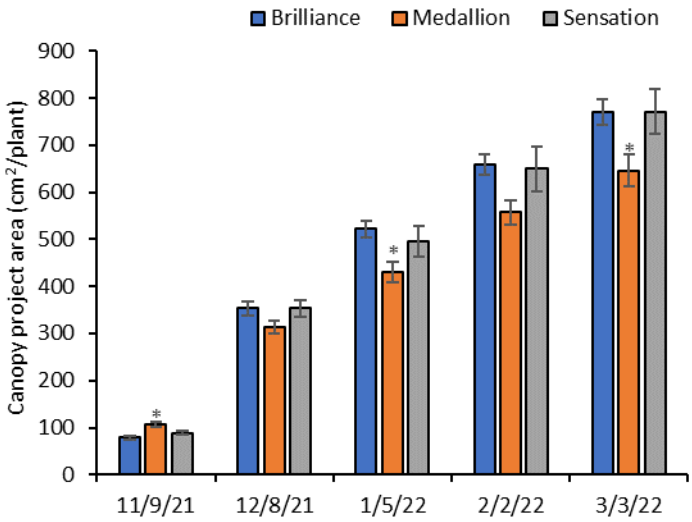

Figure 6. Mean (±SE) canopy projected area of three strawberry cultivars grown on black, white, and metalized mulch.

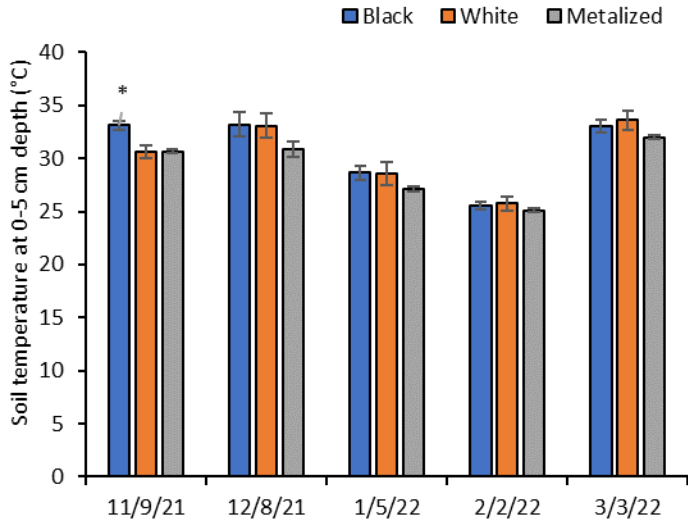

Figure 4. Mean (±SE) soil temperature at 0-5 cm depth under black, white, and metalized mulch.

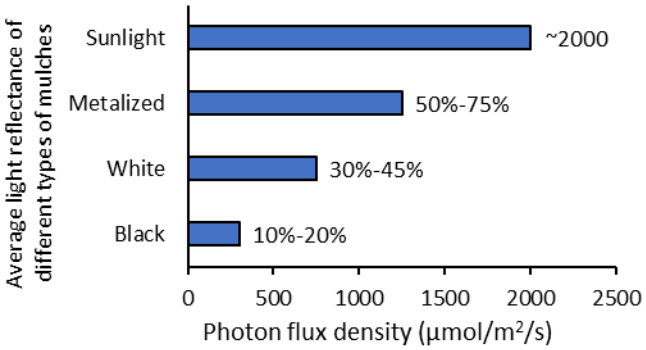

Figure 5. Average light reflectance of black, white, and metalized mulch.

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