Using Reflective Plastic Mulch to Enhance Plant Quality and Pest Management in Tomato

Date: September 2, 2015. **Location:** Poamoho Experimental Station

Sponsor: Western SARE

Project leaders: Leyla Kaufman, Mark Wright, Jari Sugano, Michael Melzer and Theodore Radovich,

Presenters: Leyla Kaufman and Marisol Quintanilla

Plastic mulches provide many positive advantages for farmers, such as increased yields, earlier maturing crops, crops of higher quality, enhanced insect management, and weed control. The purpose of this on-farm demonstration is to show the results of the use of black and reflective plastic in tomato production.

The trial consists of 6 plots (each plot has six rows)
Main plot treatment: Mulch type:

- 3 plots with reflective mulch, and
- 3 plots with black mulch

Subplot treatment: Tomato variety (3 rows of each variety per plot):

- Shiren (Hazera Seeds): Susceptible to TYLCV
- 72618 (Nirit Seeds): Resistant to TYLCV

The main objectives of the trial was to examine the effects of plastic mulch on:

1. Plant mortality (caused by high soil temperatures)
2. Plant growth and yield
    a. Growth rate: diameter, height, width and biomass
    b. Fruits, flowers and yield
3. Pest and disease management
    a. Virus severity index
    b. Pest densities
        i. Whitefly
        ii. Leaf miners
        iii. Mites

Timeline of events:

06/30/2015	Tomatoes transplanted
7/21/15	Start data collection on insect density, virus severity index and plant measurements
7/28/15	Trellising tomato plants
7/30/2015	At least 50 % of plants in reflective much treatment with flowers flowering
8/13/2015	At least 50% of plants in black plastic treatment with flowers

Plant mortality

Tomato plants were transplanted during the hot mid-summer months. Plants in the black plastic mulch exhibited significantly higher mortality compared to the reflective mulch (Figure 1). Dead plants were replaced within two weeks after the first transplant.

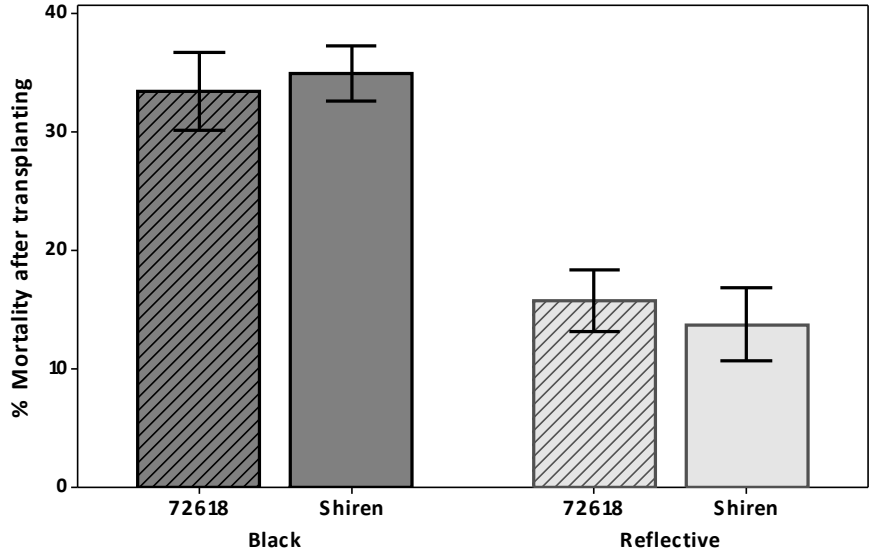

Figure 1. Percentage of plant mortality by mulch type and variety

Growth rate

Plant diameter, plant height, plant diameter and biomass were measured to assess differences in plant growth rate between treatments.

Stem diameter -Plants growing in the reflective mulch had significantly wider stem diameter compared to plants growing in the black mulch (Figure 2). Note : The variety Shiren showed a shift in performance when growing in the reflective mulch treatment.

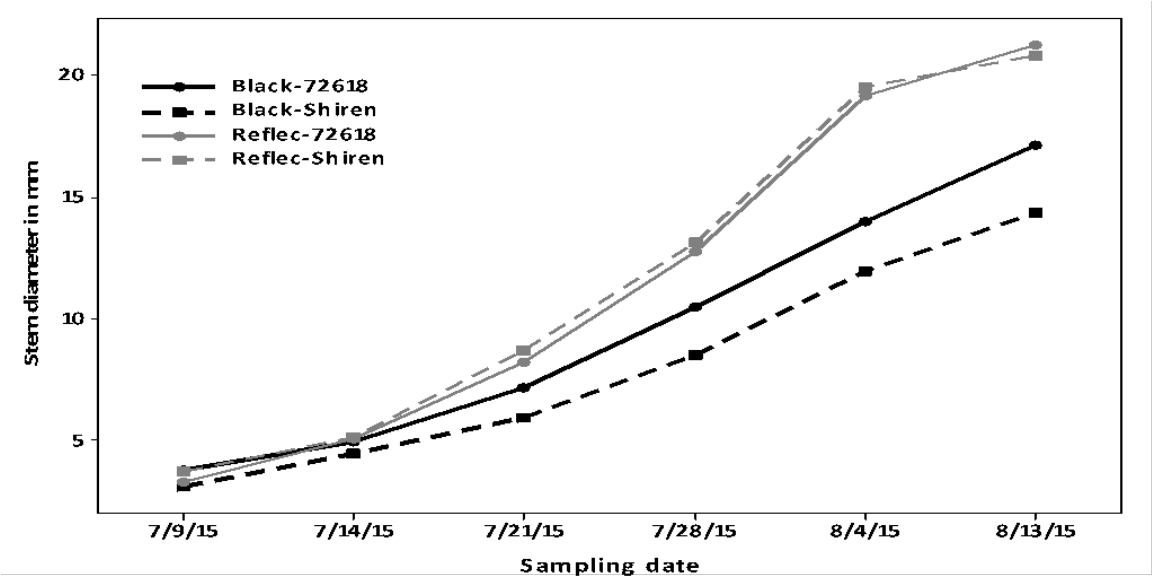

Figure 2. Mean stem diameter (mm) by sampling date

Plant biomass **-** A subset of plants were harvested 5 weeks after transplant and oven dried. Plants from both varieties had significantly higher dry biomass in the reflective mulch compared to the black mulch.

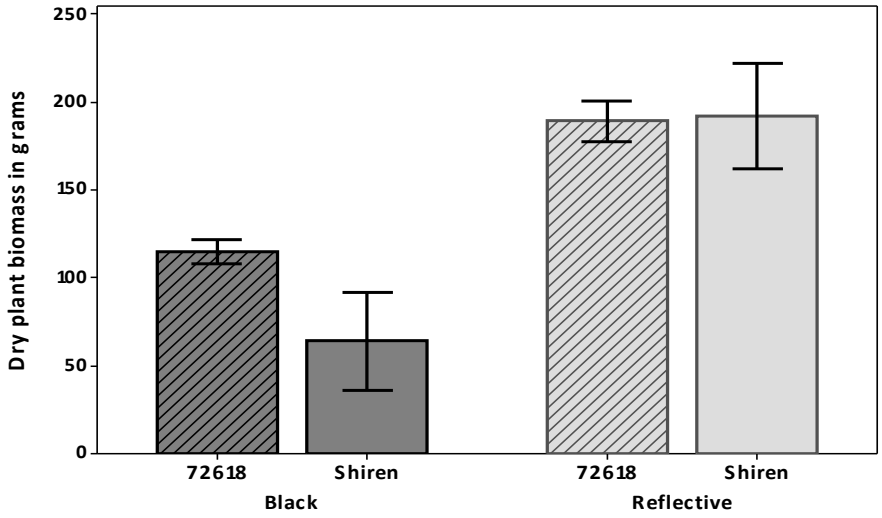

Figure 3. Dried biomass (grams) by mulch treatment and variety

Flower and fruit production **-** Plants in the reflective mulch flowered and set fruit earlier and more vigorously than plants in the black mulch. Note: The variety Shiren showed a dramatic shift in performance when growing in the reflective mulch treatment (Fig 4).

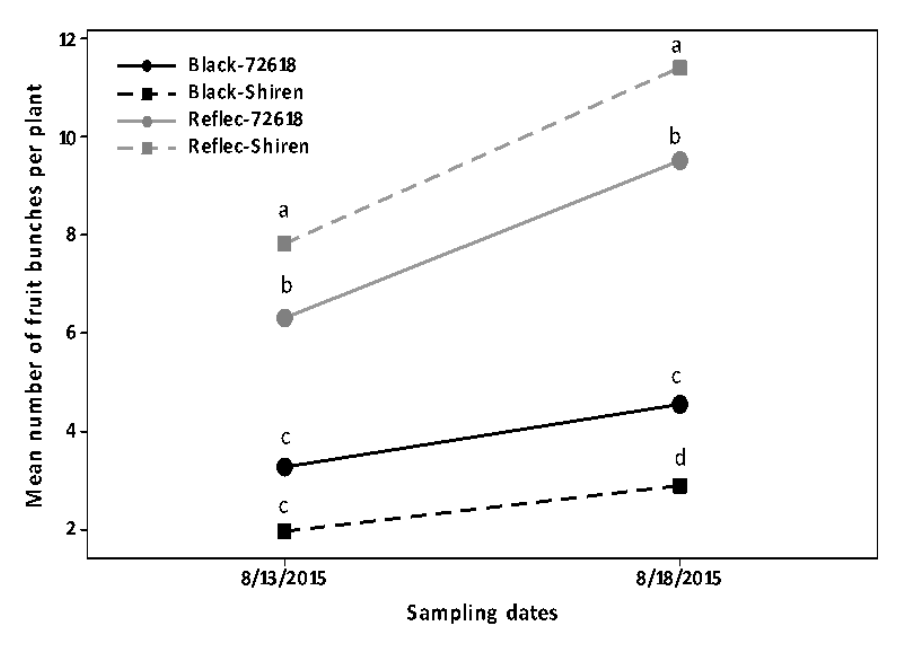

Figure 4. Mean number of fruit bunches per plant

Plants were harvested for the first time on August 28. Plants growing in the reflective mulch had significantly more marketable yield compared to the black mulch irrespective of the variety (Figure 5).

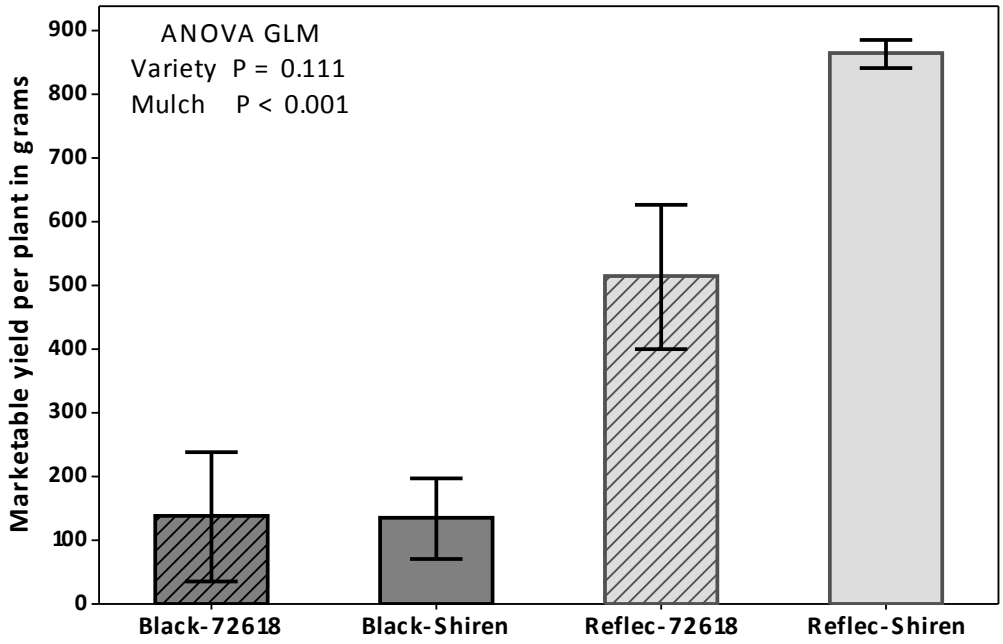

Figure 5. Mean marketable yield by treatment and by variety

Pest and disease management

Pest densities and virus severity index data were collected from three weeks after transplant through fruiting. Pest density data were collected for whiteflies (eggs and nymphs), mites (red, russet and predatory mites), aphids, thrips and leafminers.

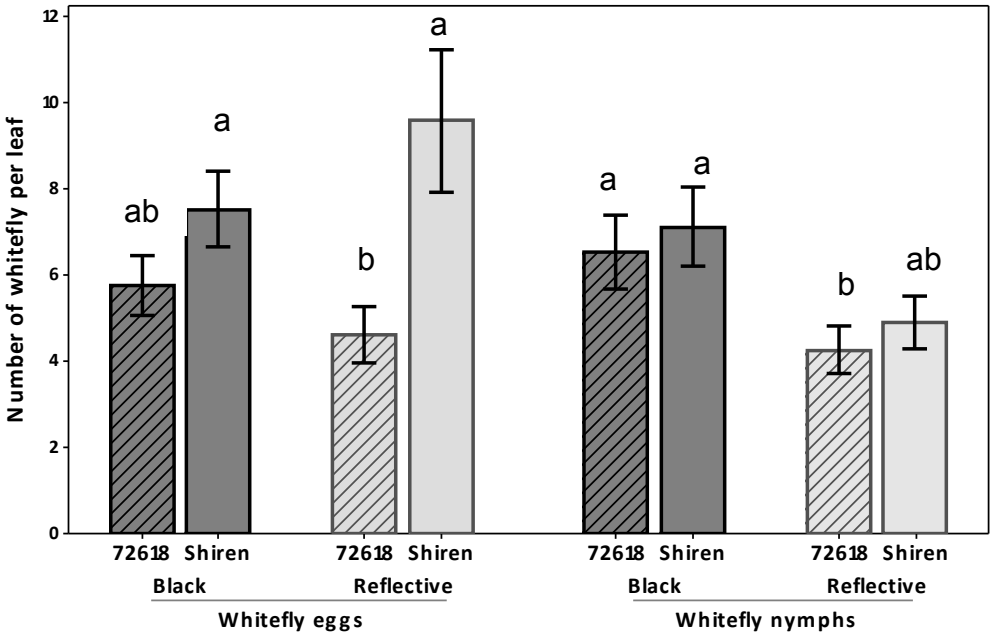

Figure 6. Mean number of whitefly eggs and nymphs per leaf

Plants in the reflective mulch had significantly less whitefly eggs compared to plants in the black mulch only for the variety 72618 (Figure 6). Both varieties had less whitefly nymphs in the reflective mulch compared to the black mulch (Figure 67).

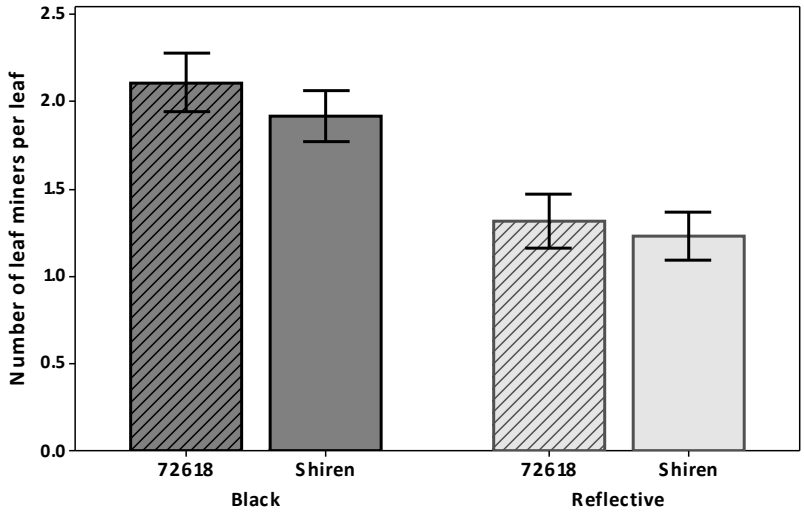

Figure 7. Mean number of leafminers per leaf

Plants growing in the reflective mulch had significantly less leafminers compared to plants growing in the black mulch irrespective of the variety (Figure 7).

The variety 72618 was more susceptible to red spider mites compared to Shiren (Figure 8). Plants of the variety 72618, growing in the reflective mulch had significantly less number of red spider mites compared to plants of the same variety growing in black mulch (Figure 8). The russet mite population was significantly lower in plants growing in the reflective mulch compared to plants growing in the black mulch (Figure 8).

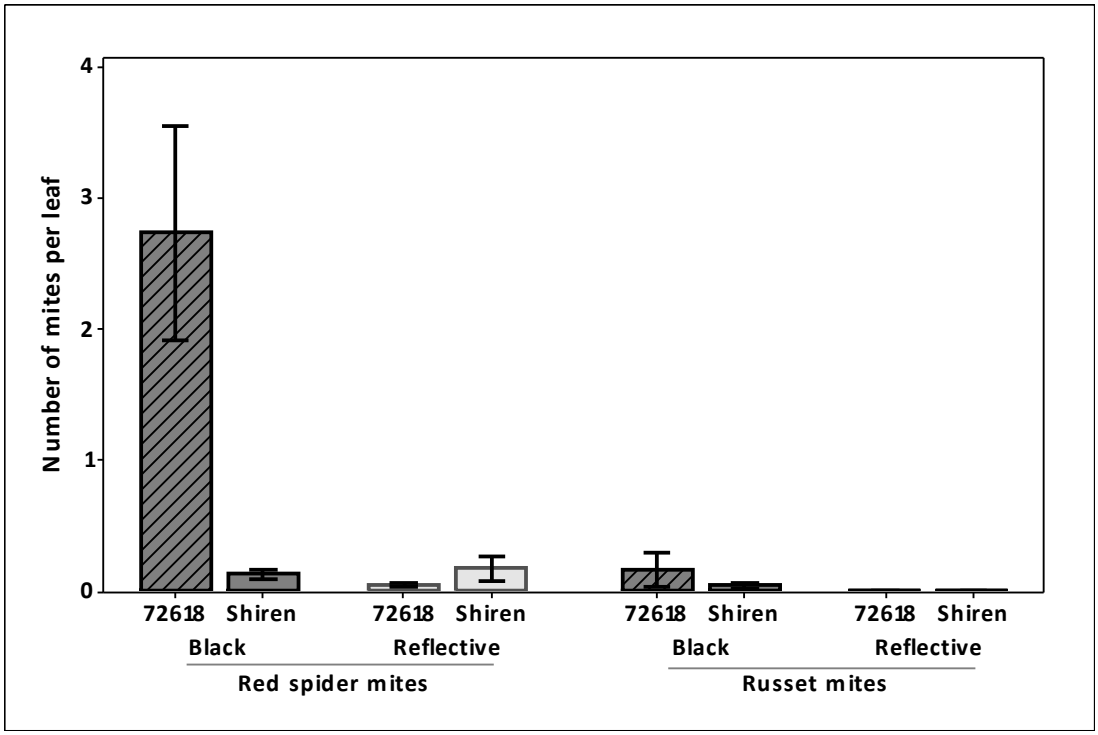

Figure 8. Mean number of red spider mites and russet mites per leaf.

The reflective plastic mulch did not prevent transmission and spread of TYLCV in the reflective treatment. The resistant variety, 72618, did not show visual symptoms of TYLCV (Figure 9).

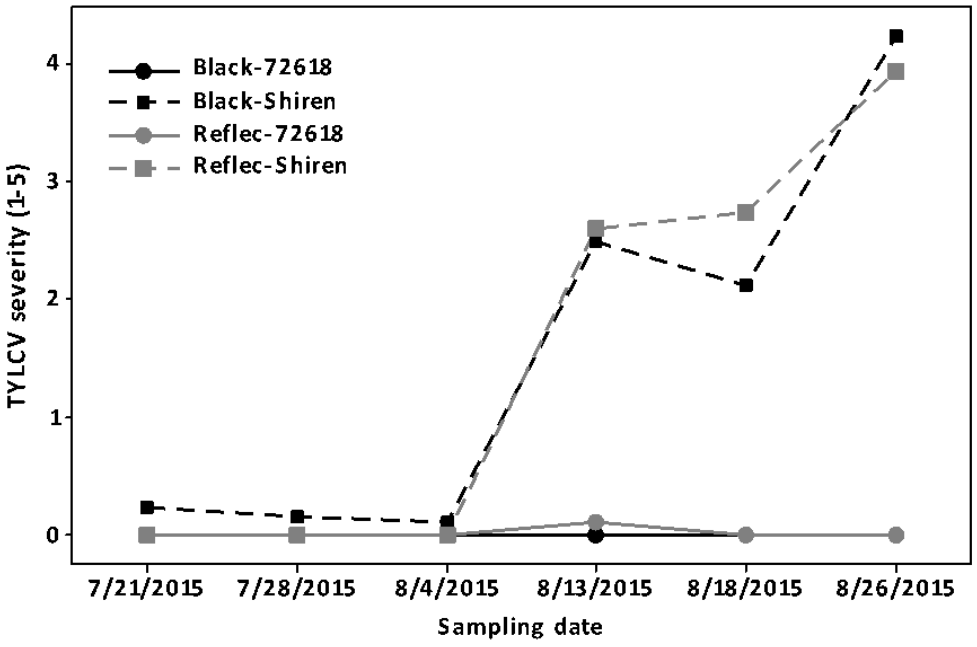

Figure 9. Virus severity index by treatment and variety

Conclusions

1. Plants growing in the reflective plastic mulch experienced significantly less mortality soon after transplanting compared to the black mulch. This can important during the hot summer months.
2. The reflective mulch significantly improved plant growth rate for both varieties. Plants in the reflective mulch grew faster and more vigorously compared to plants in the black mulch
3. Plants in the reflective mulch started flowering and fruiting sooner, and had greater yield than plants growing in the black mulch.
4. Pest density was significantly lower in the reflective mulch compared to the black mulch
5. The reflective plastic mulch did not prevent the transmission and spread of TYLCV in tomato plants in the susceptible variety (Shiren).

Acknowledgments

- Camila Gerez and Christian Mathias are thanked for their help in the field and in the laboratory.
- Pamoho Experimental Station personnel for their help with the field installation and management
- This research was funded by the Sustainable Agriculture Research and Education Program (Western SARE).

Grant title: Low-input integrated management of tomato viruses.
Grant number: SW12-040

* If you have follow up questions you can contact Leyla Kaufman at Leyla@hawaii.edu, phone 808-956-2450

WESTERN SARE
Sustainable Agriculture Research & Education