Fully-metalized and Metallized-stripe Plastic Mulch Films Increase Strawberry Yields of Bare-root and Plug Transplants

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Summary

Fully-metalized or metallized-stripe plastic mulch films are recommended for strawberry production in Florida, particularly when transplanting is earlier than Oct 10. The reflective property of these mulch films reduces canopy and soil temperatures during the establishment period, while increasing photosynthesis, both of which can help promote fruit development. These reflective mulch films increased early (Nov-Jan) and total (Nov-Feb) yields by up to 83% and 37%, respectively. The magnitude of yield increases was greater for bare-root transplants than for plug transplants, and for 'Florida Radiance' than for 'Florida Brilliance', suggesting that the effectiveness of the reflective mulch films depends on the stress sensivity of plant materials.

Fully metalized and metallized-stripe plastic mulch films

Plastic mulch films tested during the 2018-2019 season are shown in Fig. 1. Both fully-metalized and metalized-stripe mulch films were manufactured by IMAFLEX Inc. (Qubec, Canada). Thermographic images demonstrated the reflective property and the resulting cooling effect of the two metalized mulch films. It is also demonstrated that black shoulders of metalized-stripe mulch are effective in warming the soil. Soil warming can increase heat stress in strawberry transplants during the establishment, whereas it is beneficial for fruit production during cool winter months. The main purpose of metalized-stripe plastic mulch is to have dual beneficial effects of black and reflective colors in one plastic mulch.

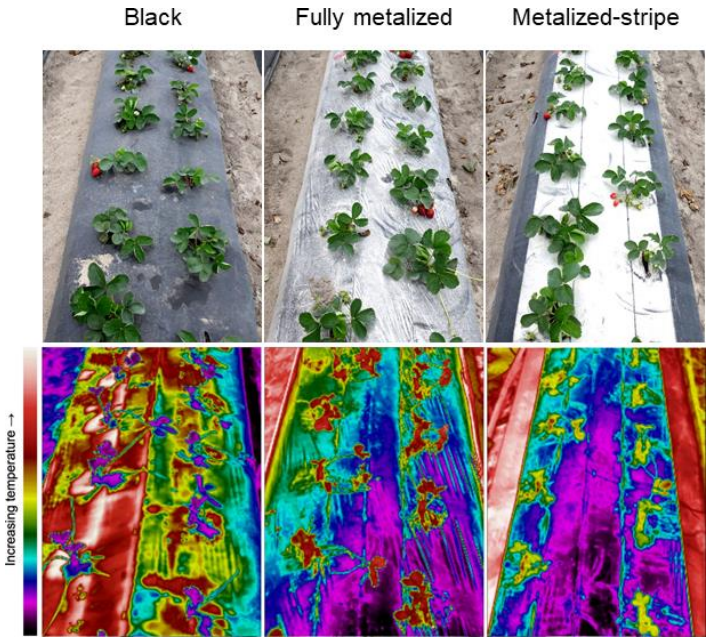


Figure 1. Photographs and thermographic images of plastic mulch films tested during the 2018-2019 strawberry season.

Methods

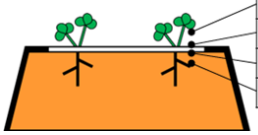
Three types of plastic mulch films, black, fully-metalized, and metalized-stripe, were evaluated using bare-root and plug transplants of 'Florida Radiance' and 'Florida Brilliance' at GCREC. The plastic mulch films are shown in Figure 1. Transplants were planted in the field on September 27, 2018. Each treatment had five replicated plots with 20 plants per plot. The plots were arranged in a split-split plot design, with plastic mulch films, transplant

types, and cultivars assigned to main plots, sub-plots, and sub-subplots, respectively. Plants were harvested 26 times between Novemver 15, 2018 and February 28, 2019. Commercial standard fertilization, irrigation, and pest management were used.

Results

Optimization of growing conditions by fully metalized and metalized-stripe mulch films

Thermographic imaging demonstrated the changes in microenvironment temperature by metalized-stripe plastic mulch – the cooled bed center and warmed bed shoulders. Cooling effects of the metalized stripe were observed not only in the soil but also at the canopy level (Figure 2). Compared to black mulch, the maximum temperature was reduced by metalized-stripe mulch 2.3 to 2.4 °C at 0 to 2" above the mulch surface and 3.9 to 4.0 °C at 0 to 2" below the mulch surface. As a result, both the extent and duration of heat stress in strawberry plants were significantly reduced by fully metalized or metalized-stripe mulch films compared to black mulch.



Position	Max temp diff vs. black mulch
2" above mulch	2.3 °C ↓
0" above mulch	2.4 °C ↓
0" below mulch	4.0 °C ↓
2" below mulch	3.9 °C ↓

Figure 2. The maximum canopy and soil temperature reductions by metallized-stripe plastic mulch compared to black mulch.

Another beneficial effect of fully metalized and metalized-stripe mulch films was an increase in light reflection from the mulch surface (Figure 3). Black mulch absorbed most of sunlight, whereas the two metalized mulch films reflected more than 90% of sunlight. The increased light reflection can increase light capture by both canopy and fruit, which in turn, can promote photosynthesis and fruit development. Strawberry leaves can capture light on both upper and lower sides (data not shown). Compared to black mulch, fully-metalized and metalized-stripe mulch films increased photosynthesis rate by up to 60% because of the increased light reflection from the mulch surface.

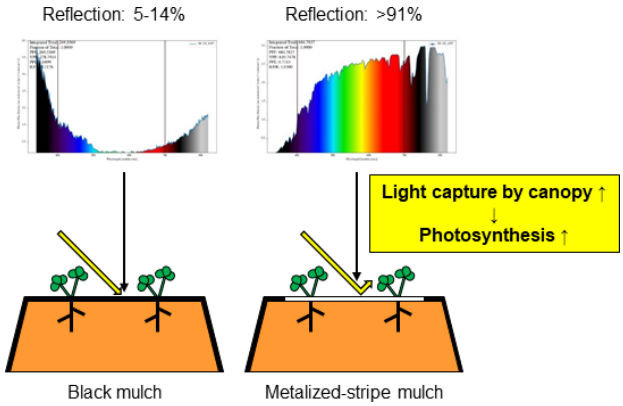


Figure 3. Light reflective properties of black and metalized-stripe mulch films.

Yield

These reflective mulch films increased early (Nov-Jan) and total (Nov-Feb) yields by up to 83% and 37%, respectively (Tables 1&2). The magnitude of yield increases was greater for bare-root transplants than for plug transplants, and for 'Florida Radiance' than for 'Florida Brilliance', suggesting that the effectiveness of the reflective mulch films depends on the stress sensivity of plant materials.

Table 1. Marketable yield of 'Florida Radiance' strawberry as affected by transplant type and plastic mulch.

Transplant type	Plastic mulch	Marketable yield (lb/acre) Nov-Jan	Feb	Total
Bare-root	Black	4,127	19,990	24,117
	Metalized	7,489 (81%↑)	25,545 (28%↑)	33,034 (37%↑)
	Metalized-stripe	7,568 (83%↑)	22,531 (13%↑)	30,099 (25%↑)
Plug	Black	4,826	24,834	29,660
	Metalized	6,655 (38%↑)	24,407 (2%↓)	31,062 (5%↑)
	Metalized-stripe	8,286 (72%↑)	27,106 (9%↑)	35,392 (19%↑)

Table 2. Marketable yield of 'Florida Brilliance' strawberry as affected by transplant type and plastic mulch.

Transplant type	Plastic mulch	Marketable yield (lb/acre) Nov-Jan	Feb	Total
Bare-root	Black	7,556	17,954	25,510
	Metalized	8,872 (17%↑)	19,094 (6%↑)	27,965 (10%↑)
	Metalized-stripe	9,803 (30%↑)	17,785 (1%↓)	27,589 (8%↑)
Plug	Black	8,382	22,233	30,614
	Metalized	10,591 (26%↑)	23,373 (5%↑)	33,963 (11%↑)
	Metalized-stripe	10,923 (30%↑)	20,647 (7%↓)	31,570 (3%↑)

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