Evaluation of Mulches as Methods to Control Cucumber Mosaic Virus of Bell Peppers

2009-10 Annual Report

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Bell peppers and chili peppers in Kern County have been afflicted by cucumber mosaic virus (CMV) for the past several years. Some fields have had over 50% yield reduction due to CMV. There is no pattern as to when it or how severe the infection will be. However earlier in the season that CMV appears, the more severe the yield loss will be.

CMV is a cucumovirus that is vectored by several different species of aphids, but most efficiently by *Aphis gossypii* and *Myzus persicae*, the cotton aphid and the green peach aphid respectively. It is transmitted in a non-persistent manner, meaning the aphid vector acquires the virus after only a few minutes of feeding on an infected plant and that it can transmit the virus for a few hours afterward.

Even though the plants are being treated with a systemic insecticide from the time they are young seedlings, fields are still being infected with CMV. The reason for this is most likely because once an aphid lands on a plant surface it immediately begins to probe the plant to see if it is a suitable host plant. Once this probing begins the virus is transmitted to the plant. Even if the aphid is killed by the insecticide, it is not killed quickly enough to prevent the vectoring of the virus. Although treating pepper fields with imidacloprid does reduce the buildup of aphids in field, it does not prevent viruses from being introduced to a field.

Materials and Methods

A trial was conducted in spring of 2009 with bell peppers to determine if CMV can be controlled by the use of various mulches. In 2008 it was determined that silver reflective mulch and float row covers could reduce the number of aphids landing on pepper plants which then resulted in lower CMV incidence. For 2009 more types of plastic mulches were tried along with a floating row cover. Also a spray on white mulch was tried along with a whitewash of the pepper canopy. The spray on mulch and whitewash was composed of Surround, a commercially available form of kaolin clay. Each plot was one bed by 100ft. Transplant bell peppers where planted by hand on a 12 in row spacing. Each treatment was replicated 4 times. The trial was planted in a commercial bell pepper field which also had several adjacent chili and other bell pepper fields.

The trial was evaluated for aphid counts on a weekly basis by placing yellow sticky cards just above the plant canopy. The traps were moved up slightly each week as the canopy grew taller. Thrips were also counted this year on a weekly basis on the same traps.

The peppers were harvested by one picking of 20 feet of row. All marketable peppers were harvested within those 20 feet.

The treatments were as follows:

1. Control
2. Row Cover
3. Silver reflective Mulch
4. Green Mulch
5. Red Mulch
6. Black Mulch
7. Silver Mulch
8. Surround Mulch
9. Surround Whitewash
10. White Mulch

Results

The aphid pressure was very low for spring 2009 in the Mettler area of Kern County (figure 1 and 3). Aphid counts were generally less than 5 per week as compared to 10 times that number in 2008. As a result of the low aphid pressure there was not any CMV present in the plot area or in the field. Figure 3 does show however that the control still had the highest number of aphids trapped while the floating row cover did the best in preventing aphids from landing on the pepper plants. All the other colored mulches had lower counts compared to the control with the silver reflective and silver mulch performing the best of the other treatments.

Thrips were in abundance as shown in figures 2 and 4. The white mulch and green mulch increased the thrips found in the canopy as compared to the control. Again the floating row cover reduced the insect populations the greatest amount with the silver reflective mulch and the silver mulch reducing the thrip numbers as compared to the control.

The floating row cover reduced the number and weight of the fruit harvested (tables 1 and 2). These plants were much taller with very little fruit on the plants (data not shown). The red and green mulches significantly increased the number and weight of the peppers harvested as compared to the control (table 1 and 2). Although not significant, all the other mulches also increased the total number of peppers compared to the control (table 1b). The black and silver mulches along with the white sprayed on mulch and the white wash also had higher yields than the control.

Conclusions

Aphid pressure was essentially nonexistent in spring 2009 which resulted in CMV not being present in the test plot area. Thrips were in high numbers and could be reduced by the silver reflective and silver mulch as well as by the floating row cover.

Without CMV pressure, green and red mulches increased the number and weight of the harvested bell peppers. The other colored mulches appear to benefit the yields also. The use of the floating row cover had a negative impact on fruit yields. This may be due to the shading effect of the floating row cover. Although these plants were very vigorous and healthy they did not set many fruit.

In the presence of CMV these results may have been different. The silver reflective and silver mulch did reduced aphid numbers and if CMV was being vectored then these treatments would likely have performed the best.

Red, silver, control and white mulches.

White wash, white sprayed on and black mulch.

Sprayed on white mulch.

Figure 1a. Number of pepper fruit harvested in 20 feet of row.

	Jumbo Marketable #	Jumbo Processing #	Large Marketable #	Large Processing #
1.Control	2.75 BC	1.00	13.00 AB	2.50
2. Row Cover	0.00 C	0.00	1.75 C	1.50
3. Silver Reflective Mulch	2.00 BC	0.25	9.50 BC	2.00
4. Green Mulch	4.00 ABC	3.00	18.50 A	8.75
5. Red Mulch	4.75 AB	1.00	17.75 A	3.75
6. Black Mulch	8.00 A	0.50	12.00 AB	3.75
7. Silver Mulch	4.25 AB	1.00	9.50 BC	6.00
8. Surround Mulch	3.00 BC	5.00	12.25 AB	8.00
9. Surround Whitewash	3.74 BC	0.59	13.69 AB	4.80
10. White Mulch	3.25 BC	1.25	9.00 BC	5.25
P=0.05	0.0761	0.5530	0.0152	0.0902
% CV	80.62	237.83	47.60	75.55
LSD, P=0.05	4.188	NS	8.091	NS

	Medium Marketable #	Medium Processing #	Small Marketable #	Small Processing #
1. Control	10.25 BCD	5.25 ABC	13.50 BCD	6.50
2. Row Cover	3.25 D	2.50 C	12.50 CD	6.50
3. Silver Reflective Mulch	14.00 AB	5.25 ABC	24.00 A	9.25
4. Green Mulch	10.00 BCD	7.25 A	11.00 D	5.50
5. Red Mulch	12.50 ABC	6.50 AB	23.00 AB	10.00
6. Black Mulch	11.00 ABC	3.75 BC	21.00 ABCD	9.50
7. Silver Mulch	17.50 A	3.00 C	24.25 A	4.75
8. Surround Mulch	13.75 AB	7.25 A	11.00 D	9.25
9. Surround Whitewash	15.36 AB	6.45 AB	16.67 ABCD	8.37
10. White Mulch	6.00 CD	4.25 ABC	22.75 ABC	11.75
P=0.05	0.0142	0.0576	0.0341	0.6005
% CV	43.74	45.33	39.58	60.37
LSD, P=0.05	7.222	3.389	10.335	NS

Figure 1b. Number of pepper fruit harvested in 20 feet of row.

	BB's Marketable #	Cull #	Total Marketable #	Total Processing #
1. Control	21.50	0.25	61.25	15.25
2. Row Cover	34.75	0.00	52.25	10.50
3. Silver Reflective Mulch	27.00	0.00	76.50	16.75
4. Green Mulch	23.50	1.50	68.50	24.50
5. Red Mulch	19.25	2.00	79.25	21.25
6. Black Mulch	30.00	2.50	84.50	17.50
7. Silver Mulch	21.25	0.50	77.25	14.75
8. Surround Mulch	20.75	0.75	61.50	29.50
9. Surround Whitewash	24.49	0.50	74.44	20.20
10. White Mulch	22.75	1.25	65.00	22.50
P=0.05	0.5053	0.2385	0.1166	0.1009
% CV	58.80	157.07	21.30	41.49
LSD, P=0.05	1.246	2.110	21.688	11.620

	Total #
1. Control	76.50 BC
2. Row Cover	62.75 C
3. Silver reflective Mulch	93.25 AB
4. Green Mulch	93.00 AB
5. Red Mulch	100.50 A
6. Black Mulch	102.00 A
7. Silver Mulch	92.00 AB
8. Surround Mulch	91.00 AB
9. Surround Whitewash	94.65 AB
10.White Mulch	87.50 AB
P=0.05	0.0471
% CV	17.25
LSD, P=0.05	22.387

Figure 2a. Weight in pounds of pepper fruit harvested in 20 feet of row.

	Jumbo Marketable Wt	Jumbo Processing Wt	Large Marketable Wt	Large Processing Wt
1.Control	1.70	0.64	7.15 AB	1.29
2. Row Cover	0.00	0.00	0.83 C	0.68
3. Silver Reflective Mulch	1.23	0.15	4.74 BC	1.01
4. Green Mulch	2.44	1.91	9.30 A	4.44
5. Red Mulch	3.01	0.56	8.95 A	1.89
6. Black Mulch	4.69	0.31	5.80 AB	1.78
7. Silver Mulch	2.54	0.58	4.78 BC	2.99
8. Surround Mulch	1.95	2.64	6.11 AB	3.86
9. Surround Whitewash	2.54	0.44	5.07 AB	2.42
10. White Mulch	2.11	0.73	4.65 BC	2.80
P=0.05	0.1081	0.5413	0.0174	0.0984
% CV	80.52	220.17	50.00	76.96
LSD, P=0.05	NS	NS	4.171	NS

	Medium Marketable Wt	Medium Processing Wt	Small Marketable Wt	Small Processing Wt
1. Control	3.96 AB	2.13	2.55 AB	1.48
2. Row Cover	1.18 C	0.96	1.76 B	1.03
3. Silver Reflective Mulch	5.08 A	1.83	4.34 A	1.79
4. Green Mulch	3.66 ABC	2.44	1.69 B	0.84
5. Red Mulch	4.69 AB	2.19	4.55 A	1.85
6. Black Mulch	4.05 AB	1.36	4.05 A	1.64
7. Silver Mulch	5.91 A	1.11	4.64 A	0.84
8. Surround Mulch	5.24 A	2.70	1.68 B	1.61
9. Surround Whitewash	5.92 A	2.35	3.13 AB	1.54
10. White Mulch	2.19 BC	1.56	4.56 A	1.99
P=0.05	0.0159	0.0909	0.0127	0.5053
% CV	43.30	45.70	44.62	58.80
LSD, P=0.05	2.635	NS	2.136	NS

Figure 2b. Weight in pounds of pepper fruit harvested in 20 feet of row.

	BB's Marketable Wt	Cull Wt	Total Marketable Wt	Total Processing Wt
1. Control	1.14	0.12	16.61 BC	5.53 BC
2. Row Cover	1.16	0.00	4.91 D	2.66 C
3. Silver Reflective Mulch	1.11	0.00	16.49 BC	4.56 C
4. Green Mulch	0.76	0.41	18.26 ABC	9.63 AB
5. Red Mulch	0.69	0.76	22.68 A	6.49 ABC
6. Black Mulch	1.15	0.59	20.33 AB	5.09 BC
7. Silver Mulch	0.64	0.10	18.60 ABC	5.51 BC
8. Surround Mulch	0.55	0.33	15.20 BC	10.81 A
9. Surround Whitewash	0.87	0.26	17.80 ABC	6.75 ABC
10. White Mulch	0.95	0.26	14.73 C	7.08 ABC
P=0.05	0.5772	0.2142	0.0001	0.0454
% CV	56.11	146.59	21.93	48.81
LSD, P=0.05	NS	NS	5.299	4.547

	Total Wt
1. Control	22.14 BC
2. Row Cover	7.58 D
3. Silver reflective Mulch	21.04 C
4. Green Mulch	27.89 A
5. Red Mulch	29.16 A
6. Black Mulch	25.41 ABC
7. Silver Mulch	24.11 ABC
8. Surround Mulch	26.66 AB
9. Surround Whitewash	24.55 ABC
10.White Mulch	21.80 BC
P=0.05	0.0000
% CV	16.47
LSD, P=0.05	5.516

Figure 1. Weekly aphid counts on yellow sticky traps.

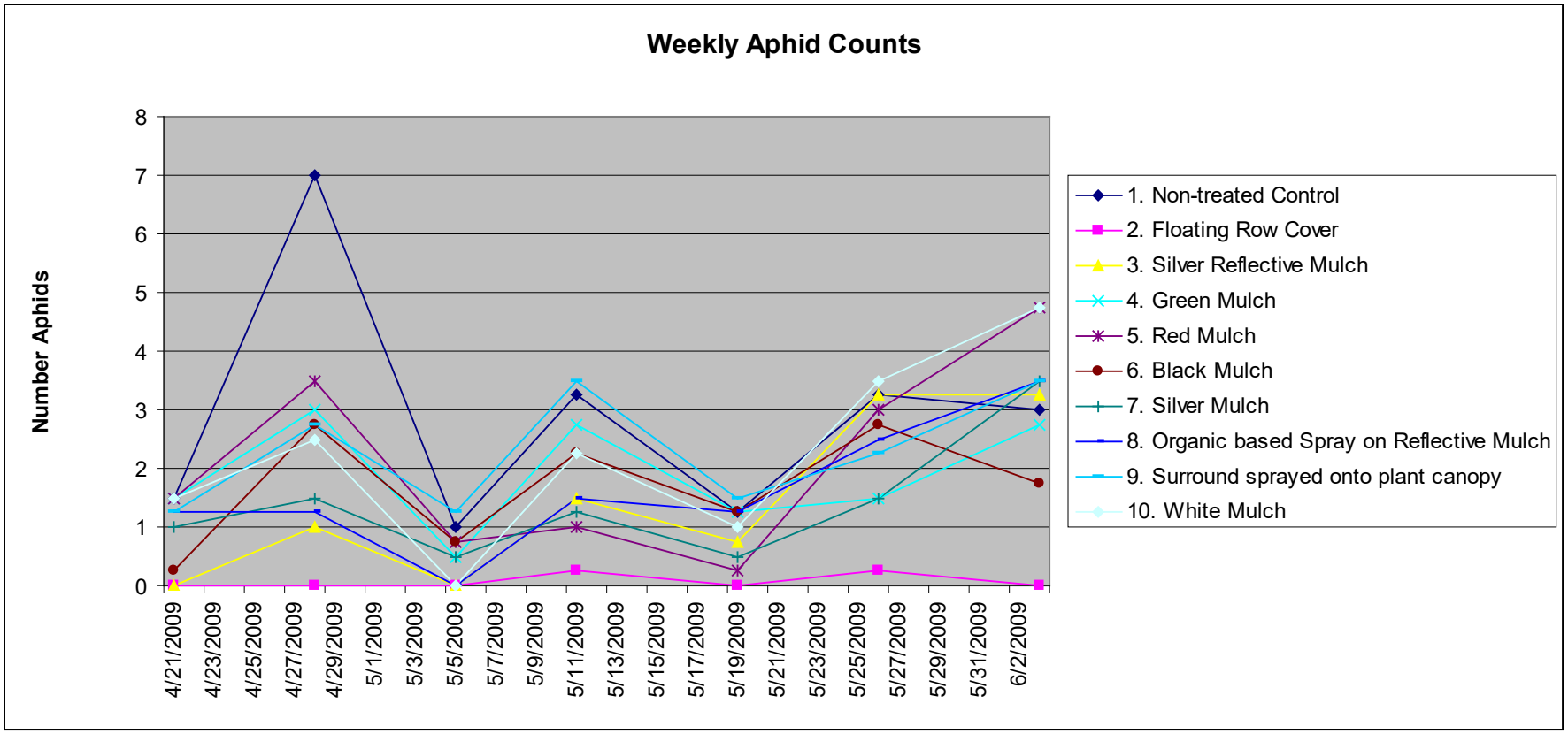


Figure 2. Weekly thrips counts on yellow sticky traps.

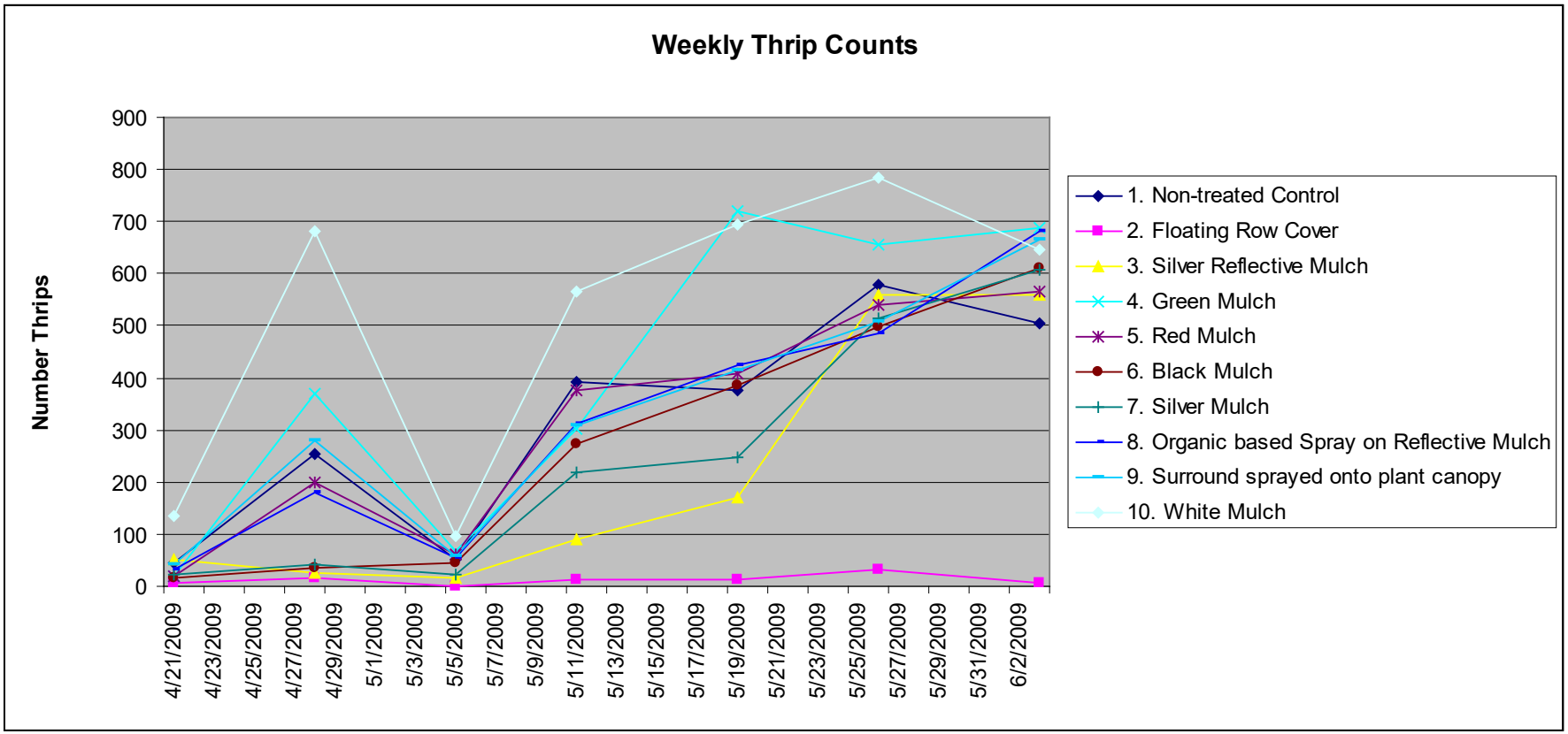


Figure 3. Average weekly aphid counts.

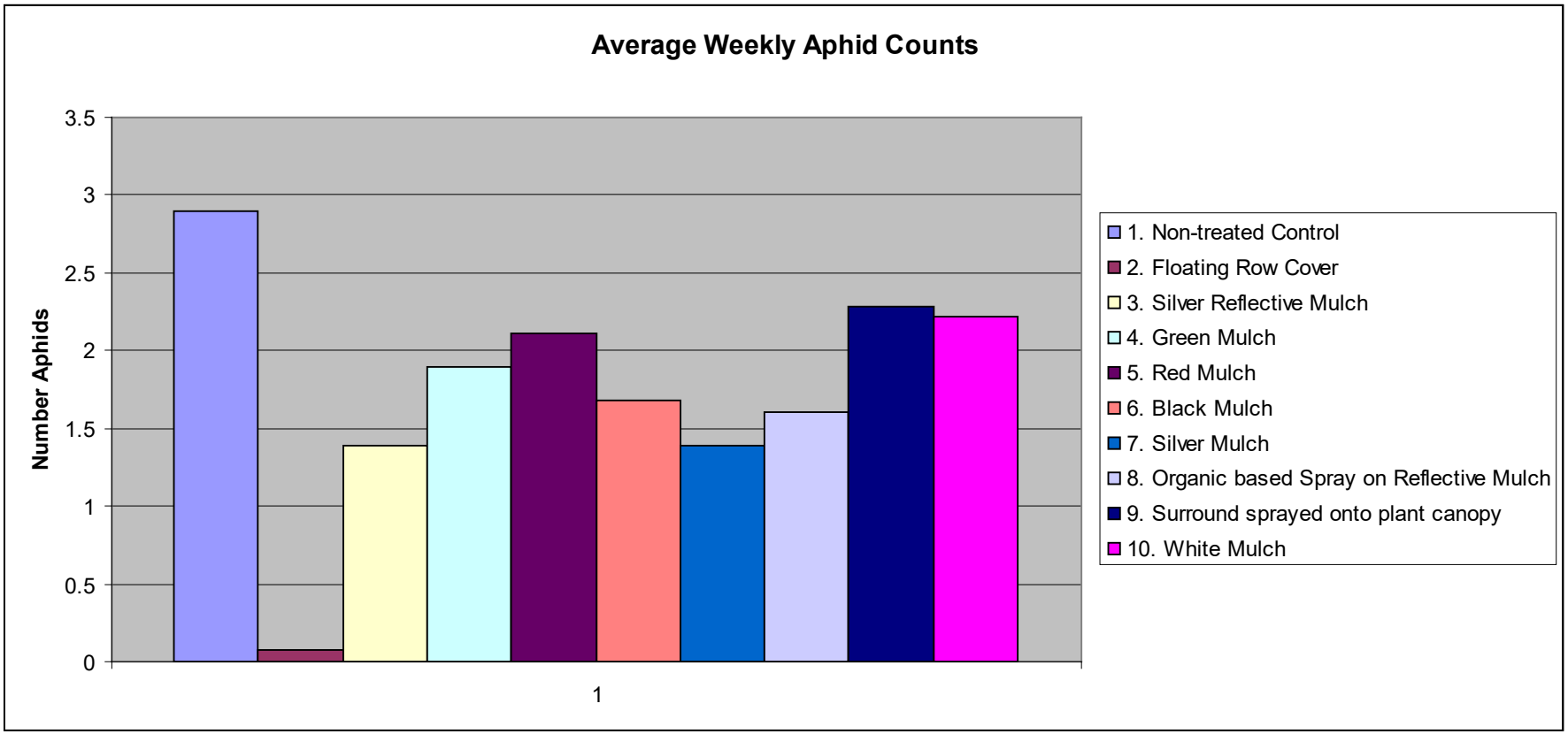
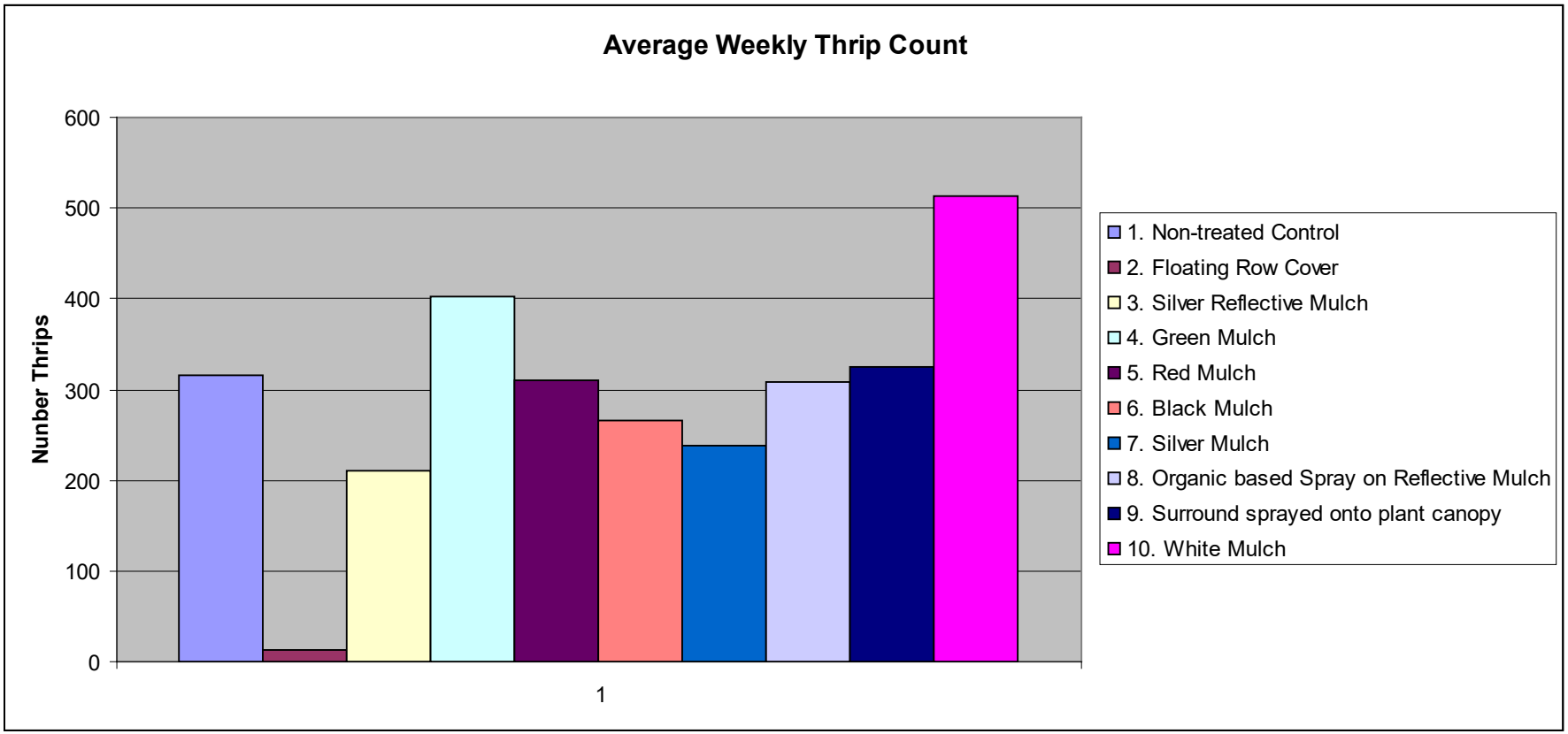


Figure 4. Average weekly thrips counts.



Key Points of 2009 Pepper Trial

1. No virus problems
    a. Aphid pressure was non-existent
    b. Silver reflective and floating row cover lowered aphid counts the most
    c. Silver much and whitewash on soil also appeared to work well.
    d. Thrip counts were moderate
    e. Floating row cover and silver reflective much reduced thrip counts
    f. White plastic mulch made thrip counts worse.

2. All the treatments except floating row cover increased the number of fruit over control
    a. Red mulch and black mulch significantly increased yields over control
    b. Green mulch and red mulch significantly increased total weight over control

3. Data would likely be different if aphid pressure and virus present