Cooperative Extension • Monterey County

Crop Notes

July / August 2010

In This Issue:

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DOWNY MILDEW FUNGICIDES: EFFECTIVE PRODUCTS PROTECT LETTUCE

Steven Koike
Plant Pathology Farm Advisor

Downy mildew is the most important foliar disease of lettuce.

Downy mildew is the most important foliar disease of lettuce in California. Caused by the fungus-like organism *Bremia lactucae*, the disease is very familiar to growers and pest control advisors. Light green to yellow lesions form on infected leaves. With time, the characteristic white sporulation develops on the undersides of leaves. Older downy mildew lesions result in dead leaf tissue and the lesions turn brown. The pathogen is highly specialized and only infects lettuce and some weeds in the same plant family. *Bremia* is a complex organism and exists in the form of two mating types as well as a large number of pathotypes or races.

Control of lettuce downy mildew relies on the use of various integrated disease management strategies. The selection and planting of resistant cultivars is very critical to control. Because downy mildew is dependent on relatively cool and humid weather conditions, planting of lettuce in warmer and drier locations may lessen disease severity. For conventionally produced lettuce, the use of multiple applications of foliar fungicides remains a key tool for integrated control programs.

1. A number of recently available products: In recent years, the number of available, effective downy mildew fungicide products has significantly increased. In addition to older standard products such as Maneb and Aliette, growers and pest control advisors currently have a broader range of choices. Our field study was intended to compare some of these newer products in side-by-side comparisons. Four applications of each product were made to field grown lettuce at approximately 10 day intervals. Surfactants were added to the spray material. Disease control was evaluated by counting the number of downy mildew lesions per leaf. Five leaves were evaluated for each of ten plants, and a mean number of lesions per leaf was calculated.

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Five products resulted in excellent control (an average of less than 10 lesions per leaf) despite high disease pressure (untreated leaves had an average of 35.8 lesions per leaf) (Table 1). The four highest performing products in this study were Revus, Previcur Flex, Reason, and Presidio. Cabrio provided some control but is not generally considered a top downy mildew product. Tanos also provided moderate control, but has performed significantly better in other trials we have conducted.

Controlling lettuce downy mildew requires the use of integrated pest management strategies.

Qualifications: This field study consisted of side-by-side comparisons and did not include programs that use tank mix combinations and rotations of different products; such programs are highly recommended and are routinely used by pest control advisors. The broad spectrum product maneb was not included. Ridomil, which is apparently resulting in good control in some parts of California, was not included.

Table 1. Efficacy of various fungicides for control of lettuce downy mildew		
Rate per acre	Mean number of downy mildew lesions per leaf*	
Revus 8 fl oz	1.6	a
Previcur Flex 2 pt	2.5	a
Reason 8.2 fl oz	4.7	ab
Presidio 4 fl oz	6.0	ab
Forum 6 fl oz	7.2	b
Cabrio 16 oz	27.9	c
Tanos 8 oz	29.7	c
Untreated control	35.8	d
LSD (P = 0.05)	4.52	
*Treatments listed with the same letter are not significantly different from each other.		

Several recently registered products effectively control lettuce downy mildew.

2. Maneb and Mancozeb: The broad spectrum and widely used downy mildew fungicides containing the EBDC chemical maneb will soon no longer be available for lettuce. Maneb products have been a foundational rotation fungicide for lettuce downy mildew management for many years. It is hoped that mancozeb-containing products will become registered and will fill in the gap left by the loss of maneb registrations. A field study was set up to compare maneb and mancozeb in side-by-side comparisons. Four applications of each product were made to field grown lettuce at approximately 10 day intervals. Surfactants were added to the spray material. Disease control was evaluated by counting the number of downy mildew lesions per leaf. Five leaves were evaluated for each of ten plants, and a mean number of lesions per leaf was calculated.

Mancozeb-containing fungicides (Manzate products) provided comparable control to the maneb-containing material (Manex) (Table 2). All treatments successfully controlled downy mildew (an average of less than 9 lesions per leaf) under heavy disease pressure (untreated leaves had an average of 36.3 lesions per leaf). Based on our study and many other field trials,

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it is expected that mancozeb fungicides, when eventually registered, will be as effective against lettuce downy mildew as maneb fungicides.

Qualifications: This field study consisted of side-by-side comparisons and did not include programs that use tank mix combinations and rotations of different products; such programs are highly recommended and are routinely used by pest control advisors.

For lettuce, the maneb product will soon no longer be registered.

Table 2. Efficacy of maneb/mancozeb fungicides for control of lettuce downy mildew		
Rate per acre	Mean number of downy mildew lesions per leaf*	
Manex 1.6 qt	2.2	a
Manzate ProStick 1.5 lb	3.4	a
Manzate Flowable 1.6 qt	8.4	a
Untreated control	36.3	b
LSD (P = 0.05)	6.90	
*Treatments listed with the same letter are not significantly different from each other.		

Before using any fungicides, check with your local Agricultural Commissioner's Office and consult product labels for current status of product registration, restrictions, and use information. Information in this article does not constitute recommendations.

MACROPHOMINA DISEASE OF STRAWBERRY NOW IN CENTRAL COAST

Steven Koike and Mark Bolda
University of California Cooperative Extension
Monterey and Santa Cruz Counties

Two soilborne diseases have recently damaged strawberry crops.

Due to changes in the availability of soil fumigants used to manage soilborne pathogens, researchers and industry experts expected to see the emergence of new disease issues on crops that depended on methyl bromide + chloropicrin pre-plant treatments. Such concerns have indeed developed for strawberry, and growers in the southern region of California have suffered losses from two new problems: charcoal rot caused by *Macrophomina phaseolina*, Fusarium wilt caused by *Fusarium oxysporum*.

Of these two problems, charcoal rot is more broadly distributed, and over the past three or so seasons has been identified in Orange, Ventura, and Santa Barbara counties. More recently, small acreage growers in the Bay Area and Sacramento regions have found *Macrophomina* in their fields. Finally, in 2010 the first documentation of *Macrophomina* in the central coast has been made. This disease is therefore now found in our Watsonville-Salinas production district

Symptoms of charcoal rot in strawberry consist of wilting of foliage, plant stunting, and dry-

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ing and death of older leaves, with the central youngest leaves often remaining green and alive. Plants can eventually collapse and die completely. When plant crowns are cut open, internal vascular and cortex tissues are dark brown to orange brown. Disease is often most severe if the infected plant is subject to stresses such as weather extremes, water stress, poor soil conditions, or heavy fruit loads. Confirmation of charcoal rot requires isolation procedures in a pathology lab. Note that foliar dieback and internal crown discoloration symptoms are identical for both charcoal rot and Fusarium wilt; only laboratory analysis can separate these two diseases.

Charcoal rot has now been detected in various regions of California.

Macrophomina produces numerous tiny, black, irregularly shaped sclerotia. These sclerotia are survival structures that allow the fungus to persist for extended periods in the soil. Based on the known biology of *Macrophomina* and preliminary field studies conducted by the University of California, it is expected that bed fumigation with alternative fumigants will be partially effective but will not eradicate the pathogen from the soil. There is currently no recommendation for post-plant treatment of this disease and resistant cultivars have not yet been identified.

Growers with *Macrophomina* infested fields need to be concerned with limiting the spread of the fungus from infested to clean fields. Since the fungus is spread within and between fields mostly by the transport of contaminated soil during soil tillage and preparation operations, care should be taken to not move soil from field to field by machinery. Spread of *Macrophomina* in strawberry fields deals with the same issue of field sanitation that concerns growers of many other commodities; Verticillium wilt (lettuce, strawberry, pepper), clubroot (broccoli, cauliflower), Fusarium wilt (lettuce), Fusarium yellows (celery), and lettuce dieback disease (lettuce) are all problems caused by soilborne pathogens that are spread in infested soil.

The pathogen *Macrophomin*a causes strawberry plants to collapse.

Transport of infested soil can result in spread of the pathogen to clean fields.

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Internal tissues of strawberry crowns turn brown and die when infected with *Macrophomina*.

The *Macrophomina* pathogen persists in the soil by producing small, black survival structures.

EVALUATION OF PRACTICES TO MINIMIZE CHLORPYRIFOS IN TAIL WATER FROM SPRINKLER IRRIGATED VEGETABLE FIELDS

Michael Cahn and Barry Farrara
UC Cooperative Extension, Monterey County

Introduction

Chlorpyrifos is commonly used for control of soil insect pests in cole crops grown on the central coast of California. Either a granular or a liquid formulation of the pesticide is applied at planting, before the crop is irrigated with overhead sprinklers. Monitoring data from tributaries near commercial cole crop fields have confirmed that concentrations of chlorpyrifos in surface water are often sufficiently high to cause toxicity to aquatic test organisms. The central coast regional water quality control board has proposed 25 parts per trillion (25 nano-grams per liter) as the total maximum daily load target concentration for chlorpyrifos in the Salinas River. Although, chlorpyrifos is readily soluble in water, it also binds to soil and organic matter. Because a high concentration of suspended sediments (>500 mg of sediment per liter) usually is present in sprinkler induced run-off during germination and stand establishment of cole crops, a significant portion of chlorpyrifos may be associated with the suspended sediments. In addition, granular applications of chlorpyrifos may result in some product dispersed on the surface of the soil where it could be more prone to loss during irrigation events than liquid formulations sprayed on the seedline.

Objective We conducted a large scale field trial in a commercial broccoli field to evaluate if the addition of polyacrylamide (PAM) polymer to the irrigation water can reduce suspended sediments and chlorpyrifos concentration in run-off. We also evaluated if liquid and granular formulations affected the residual concentration and cumulative load of chlorpyrifos in the irrigation run-off.

We conducted a large scale field trial in a commercial broccoli field to evaluate if the addition of polyacrylamide (PAM) polymer to the irrigation water can reduce suspended sediments and chlorpyrifos concentration in run-off.

Procedures The field trial was conducted on an 18-acre, commercial vegetable field located in Monterey County, near Chualar. The soil at the site was 75% Arroyo Seco gravelly loam and 25% Danville sandy clay loam. The field had a 2 % slope. The trial was seeded with broccoli on 40-inch wide beds on 8/12/10 and irrigated with solid set overhead sprinklers. Plots received the following treatments: 1. untreated irrigation water + liquid formulation of Lorsban (Lorsban 4E) , 2. untreated irrigation water + granular formulation of Lorsban (Lorsban 15G) irrigation, 3. Irrigation water treated with 5 ppm of emulsified liquid polyacrylamide (PAM, Ciba Soilfix 50% ai) + liquid formulation of Lorsban, 4. Irrigation water treated with 5 ppm PAM + granular formulation of Lorsban. Lorsban applications were 1 lb ai/acre for both the liquid and granular formulations. The standard granular application of chlorpyrifos was made in the seed lines at planting and the liquid application of chlorpryrifos was sprayed in bands on the seedlines immediately after planting. Treatments were replicated 3 times. Applied water was measured using flow meters installed on the main line of the sprinkler system. Volume of run-off was measured at the lower end of the plots using flumes. Composite samples of bulk run-off were collected from the plots during 5 successive irrigation events. The bulk water samples were analyzed for chlorpyrifos concentration and suspended sediments. Sediment was extracted from a subset of

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run-off samples to determine the portion of chlorpyrifos in the water and sediment fractions.

Results

A total of 7.5 inches of water was applied during 5 irrigation events. Less than 0.5% of the applied water was lost as run-off during the trial. The cooperating grower applied more water than normally required for germination to create sufficient run-off for comparing treatments. Irrigations lasted longer than normal and only 3 irrigations were needed to germinate the crop.

Run-off did not occur until the 2nd irrigation event (Figure 1), and only in plots receiving untreated water (no addition of PAM). Run-off occurred in plots receiving both water treatments by the 3rd irrigation event, though the average volume of run-off was highest in plots receiving untreated water (Figure 1). Several of the PAM treated plots had no run-off until the 4th and 5th irrigations when the soil had become saturated. By the end of the 4th irrigation, the average cumulative volume of run-off in plots receiving untreated water was approximately 3 times greater than the volume of run-off from PAM treated plots (Figure 1).

The concentration of total suspended sediments (solids) in the sprinkler run-off ranged from greater than 400 ppm to 23 ppm. The concentration of suspended solids in run-off from both water treatments decreased with successive irrigations, presumably because most of the fine particles washed away during the earlier irrigations (Figure 2). The PAM treatment had significantly lower suspended solids concentration in the tail water compared to plots receiving untreated water (Figure 2), reducing sediment concentration in run-off during the 3rd, 4th, and 5th irrigations by 74%, 82%, and 84% , respectively.

The least amount of chlorpyrifos was lost from plots treated with the granular Lorsban and PAM.

Although the application of PAM significantly reduced sediment concentration in the run-off, the polymer did not reduce the concentration of chlorpyrifos. In fact, the highest concentration of chlorpyrifos was measured in plots treated with liquid Lorsban and irrigated with water treated with PAM (Figure 3). Since the least run-off was measured in the PAM treated plots, the concentration of chlorpyrifos might be expected to be highest in these plots.

The cumulative loss of chloropyrifos from each plot was estimated by multiplying the volume of run-off by the concentration of chlorpyrifos in the run-off. The least amount of chlorpyrifos was lost from plots treated with the granular Lorsban and PAM (Figure 4). The application of PAM limited the volume of run-off, and the granular formulation of Lorsban minimized the concentration of chlorpyrifos in the tail water. The greatest lost of chlorpyrifos was from plots irrigated with untreated water and treated with the liquid formulation of Lorsban.

Suspended sediments were extracted from run-off samples collected from plots receiving untreated water. The average concentration of chlorpyrifos on the sediments ranged from 86 to 821 nanograms per gram of dry soil. Samples from the Lorsban 4E plots had higher concentrations of chlorpyrifos in the bulk, supernatant, and sediment fractions than samples analyzed from Lorsban 15G plots. Adjusting for the suspended solids concentration of the run-off, we estimated that on average only 4% of the chlorpyrifos was associated with the sediment fraction of the run-off. The remainder (96%) of the chlorpyrifos would therefore be in the water fraction of the run-off.

Discussion and conclusions

The results of this trial showed that polyacrylamide did not reduce the concentration of chlo-

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rpyrifos in sprinkler run-off, but the polymer did reduce the load of chlorpyrifos lost in run-off by improving infiltration during the first 3 irrigation events. Following normal practices, the grower would have irrigated less than occurred in this trial such that the PAM treatment may have had minimal loss of tail water. A number of studies conducted in the northwestern region of the United States have documented improved infiltration with the application of PAM under furrow irrigation. However, few studies have shown the same infiltration benefit from the application of PAM in California.

The concentration of suspended sediments in the run-off of the trial field was lower than measured in other soils on the east-side of the Salinas Valley. Typically fields in the same area have 1000 to 2000 ppm of suspended sediments in irrigation tail water. The untreated plots had less than 400 ppm in our trial, which means that flocculating sediments from tail water may have had minimal effects on the overall concentration of chlorpyrifos in the run-off. Although PAM was effective in reducing sediment concentration in the run-off, the polymer was less effective than at other sites where it has been tested in the Salinas Valley. Other trials have shown that the addition of PAM reduced suspended sediment concentration by more than 90%. The average reduction in suspended sediment concentration was 80% in this trial. Our estimates are that less than 4% of the chlorpyrifos was associated with the suspended sediments in the run-off. Because chlorpyrifos may be attracted to organic matter more than soil colloids, the low organic matter content of this soil may have also lessened the amount of chemical associated with the suspended sediments.

The combination of limiting run-off during germination and using a granular formulation of Lorsban may minimize the load of chlorpryifos impacting surface water in Salinas valley.

The results of the trial also showed that a concentration of about 2000 ppt chlorpyrifos was measured in run-off from plots treated with granular Lorsban but initially greater than 6000 ppt in plots treated with the liquid formulation (Lorsban 4E). The high concentration of chlorpyrifos in the tail water suggests that the liquid formulation mobilizes more rapidly than the granular product during an irrigation event. The liquid product was sprayed on the soil surface while the granular product was buried about ¼ inch below the soil surface in the seed line. In this trial, granular product on the soil surface had a negligible effect on the final concentration of chlorpyrifos in the run-off.

Recommendations for minimizing chlorpryifos in run-off

The lowest concentration of chlorpyrifos measured in the run-off during this field trial was significantly higher than the water quality target of 25 ppt for surface water in the lower Salinas valley. Although it may not be possible to reach this water quality target in tail water, the combination of limiting run-off during germination and using a granular formulation of Lorsban may minimize the load of chlorpryifos impacting surface water in Salinas valley. Our main recommendations are to:

1. Minimize overall irrigation run-off by optimizing the duration of the irrigation sets.
2. Use PAM to improve infiltration and to reduce the load of suspended sediments in the run-off.
3. Use the granular rather than the liquid formulation of chlorpyrifos. The results of this trial showed that the liquid formulation was more likely to be carried in the run-off than the granular formulation.
4. Avoid applying granular or liquid product directly on the soil surface where it may be easily carried in run-off during irrigation events.

Acknowledgements: The authors thank Dow AgroSciences for financial support for this project and Nick Poletika and Jim Muller for advice and help with the field trial.

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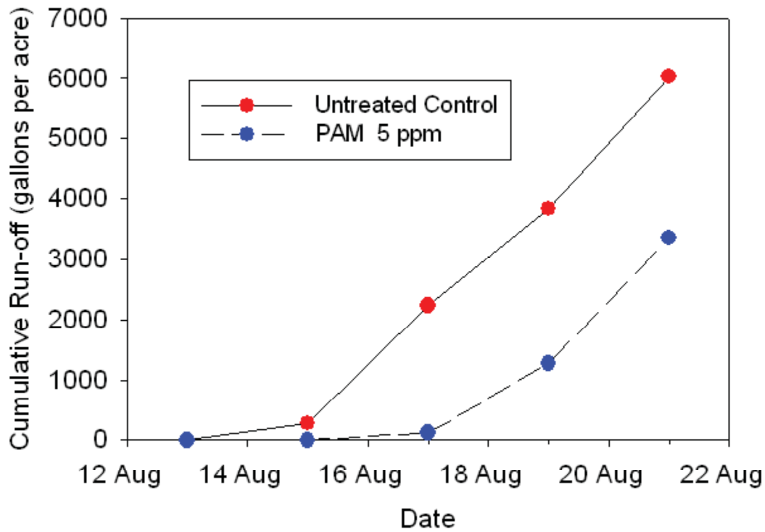

Figure 1. Effect of PAM on cumulative volume of run-off during 5 irrigations with overhead sprinklers.

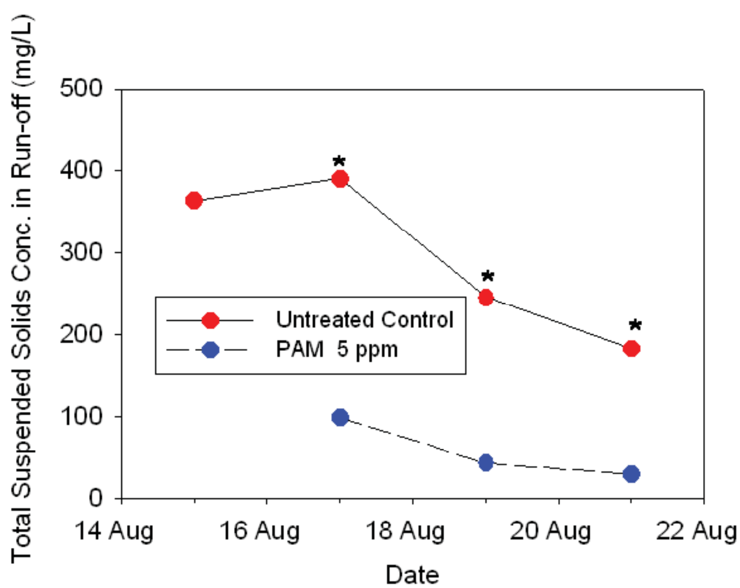

Figure 2. PAM treatment effects on average suspended solids concentration in sprinkler run-off from a commercial broccoli field. Treatment means on dates denoted with "*" are statistically different at the $p < 0.05$ confidence level.

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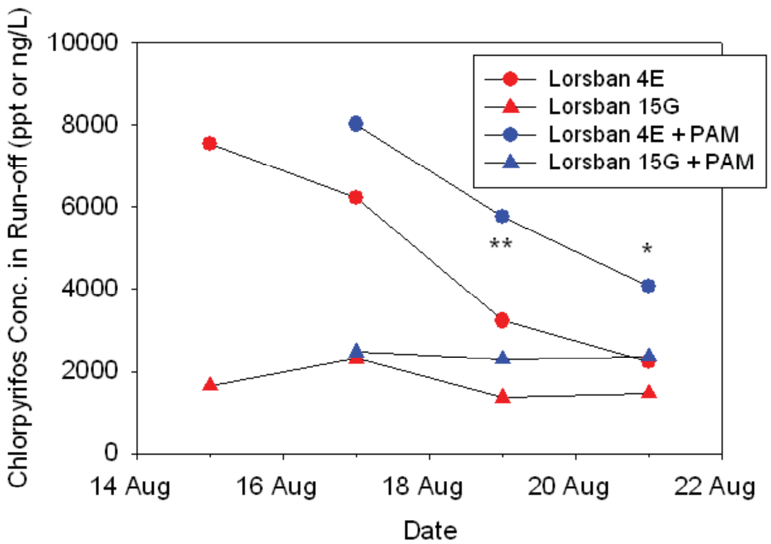

Figure 3. PAM and formulation treatment effects on chlorpyrifos concentration in composite samples of sprinkler run-off from a commercial broccoli field. Treatment means on dates denoted with "*" or "**" are statistically different at the p < 0.05 and 0.01 confidence levels, respectively.

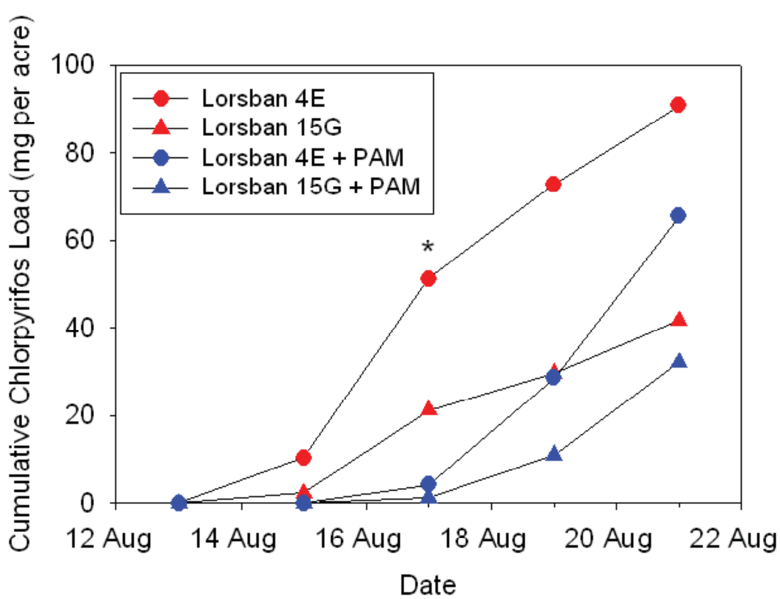

Figure 4. PAM and formulation treatment effects on cumulative load of chlorpyrifos transported in sprinkler run-off from a commercial broccoli field. Treatment means on dates denoted with "*" are statistically different at the p < 0.01 confidence level.

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SUSCEPTIBILITY OF WESTERN FLOWER THRIPS TO SPINETORAM (RADIANT) ON STRAWBERRIES IN EARLY PRODUCTION SEASON

Jianlong Bi, Yi Yu, Frank Zalom and Mark Bolda
University of California

Western flower thrips, *Frankliniella occidentalis*, are widespread pests throughout strawberry production regions in California. Their feeding asparatus consists of one mandible and one stylet or tube. Adult and nymphal thrips use their mandibles to punch holes in plant cells then insert their stylets to suck up contents from these cells. Their feeding on strawberries can cause decreased yield and quality such as bronzing of the fruit surface. Control of this pest has been heavily dependent upon chemical insecticides.

Western flower thrips are widespread pests throughout strawberry production regions in California.

Spinosad is a new insecticide class derived from a natural soil bacterium *Saccharopolyspora spinosa*. Spinosad kills many pest insect species including western flower thrips by causing excitation of the insect's central nervous system, leading to involuntary muscle contractions, ultimately paralyzing the insect due to neuromusticular fatigue. In order to be effective, spinosad must be ingested by the insect. The first generation of spinosad registered on strawberries in California is a mixture of spinosin A and D (Success and Entrust) while the second generation is spinetoram (Radiant). Since their registration on strawberries in California, Success, Entrust and Radiant have been heavily used to control western flower thrips.

Extensive reliance on chemical insecticides for thrips control has resulted in thrips resistance to almost all major classes of insecticides. Resistance monitoring can be an effective component of a resistance management program and detection of changes in resistance/susceptibility can facilitate use of alternate control measures. We initiated a study to determine status of the thrips susceptibility to spinosad and the impact of management strategy on the susceptibility. Here we report their susceptibility to Radiant in early season of the strawberry production.

Susceptibility of western flower thrip populations to Radiant from four strawberry fields in the Salinas area (Dayton Ranch, McFadden Ranch, Foster Road Ranch and Harris Road Ranch) and two strawberry fields in the Watsonville area (Holly Ranch and Beach Road Ranch) were surveyed from late May to mid-June, 2009. Strawberries in these fields were in their first-year production. Western flower thrips with strawberry flowers were collected on May 29 from the Holly Ranch, Foster Road Ranch and Harris Road Ranch, on June 2 from the Dayton Ranch and McFadden Ranch and on June 17 from the Beach Road Ranch. Collected samples were immediately shipped to the Zalom lab in UC Davis to start bioassay experiments.

Radiant was diluted in distilled water and several concentrations were used to produce a range of mortality. Strawberry bare-root seedlings were planted in pots filled with soil mixture in a greenhouse/shadehouse as a source for leaflets on which to conduct the bioassays. Plants used in the experiments were at the three to six trifoliate stages when leaflets were removed for the bioassays, and were never treated. The most-recently fully-expanded strawberry leaflets were dipped for 10 s into a solution containing specific amount of the insecticide. Control leaflets were dipped into distilled water only. After the leaf surface was dried, 25-35 adult thrips were transferred from field collected flowers with an aspirator to the upper surface of a treated leaflet encased in a Munger cell apparatus with a layer of wet paper facing the lower surface of the leaflet. (Fig.1). Adult mortality was determined at 24, 48 and 72 h, respectively, after the initial exposure. Thrips that were unable to walk at least a distance equivalent to their body length were considered dead.

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Results showed that across all the sampling sites, there was a positive mortality response of western flower thrips to increased Radiant concentration and mortality of the thrips increased progressively from 24 h to 72 h after initial exposure (Tables 1-3). Concentration of Radiant at 187 µg of active ingredient is equal to a spray volume of 50 gallons per acre at full label rate on strawberries (10 oz/acre). At 72 h after initial exposure to this concentration, mortalities of the thrips from the Holly Ranch and the Harris Road Ranch were 100% while the mortality from the McFadden Ranch, the Beach Road Ranch, the Dayton Ranch and the Foster Road Ranch was 88%, 87%, 79% and 59%, respectively.

Extensive reliance on chemical insecticides for thrips control had resulted in thrips resistance to almost all major classes of insecticides.

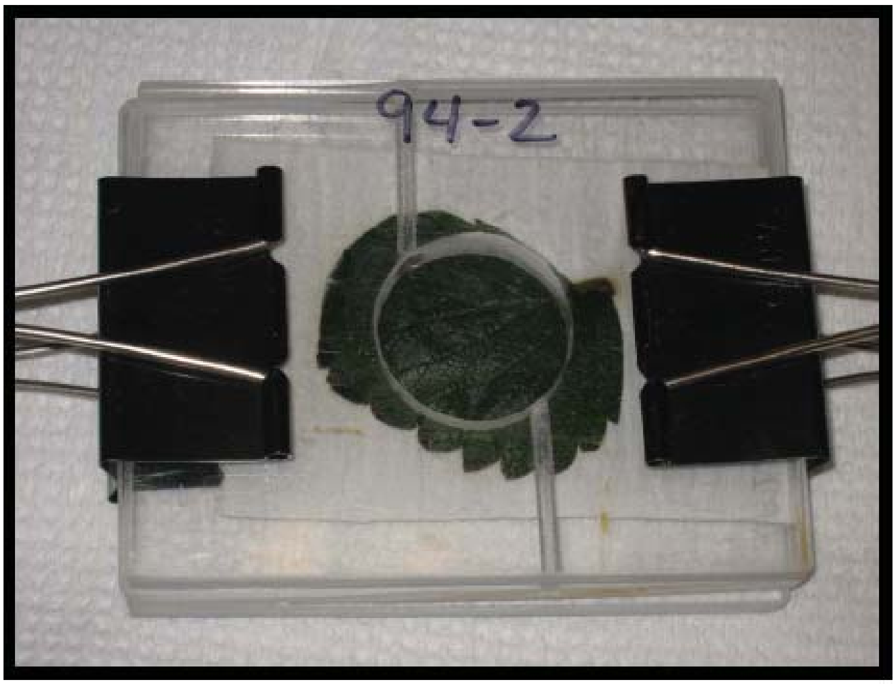

Fig. 1. A Munger cell apparatus is used to determine the susceptibility of western flower thrips to the insecticide Radiant.

Susceptibility of western flower thrip populations to Radiant insecticide from four strawberry fields in the Salinas area and two straberry fields in Watsonville area were surveyed from late May to mid-June, 2009.

Table 1. Susceptibility of western flower thrips populations to Radiant (May 29, 2009)

Site	Concentration (µg ai spinetoram/ml)	n	24 h		48 h		72 h	
			No. of dead	Mortality (%)	No. of dead	Mortality (%)	No. of dead	Mortality (%)
Holly Ranch	23.5	53	27	50.94	31	58.49	46	86.79
	47	27	13	48.15	19	70.37	23	85.19
	94	44	22	50.00	24	54.55	35	79.55
	187	63	39	61.90	52	82.54	63	100
	Control	40	1	2.50	3	7.50	4	10.00
Foster Road Ranch	187	37	7	18.92	10	27.03	22	59.46
	374	43	19	44.19	27	62.79	41	95.35
	561	46	21	45.65	39	84.78	46	100
	ck	38	0	0	1	2.63	2	5.26
Harris Road Ranch	187	79	76	96.2	78	98.73	79	100
	374	65	64	98.46	65	100	65	100
	561	69	69	100	69	100	69	100
	Control	40	0	0	1	2.50	3	7.50

94 µg ai/ml = a spray volume of 100 gallons per acre at full label rate of Radiant (10 oz/acre)
187 µg ai/ml = a spray volume of 50 gallons per acre at full label rate of Radiant (10 oz/acre)

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Table 2. Initial survey of susceptibility of western flower thrips populations to Radiant (samples collected on June 2, 2009)

Site	Concentration (µg ai spinetoram/ml)	n	24 h No. of dead	24 h Mortality %	48 h No. of dead	48 h Mortality %	72 h No. of dead	72 h Mortality %
Dayton Ranch	94	48	15	31.25	33	68.75	35	72.92
	187	72	19	26.39	48	66.67	57	79.17
	374	80	14	17.50	54	67.50	66	82.50
	561	70	22	31.43	58	82.86	66	94.29
	Control	54	5	9.26	9	16.67	13	24.07
McFadden Ranch	94	28	9	32.14	24	85.71	24	85.71
	187	52	38	73.08	45	86.54	46	88.46
	374	38	27	71.05	36	94.74	38	100.00
	561	37	30	81.08	35	94.59	37	100.00
	Control	33	3	9.09	4	12.12	8	24.24

Resulsts showed that there was a positive mortality response to western flower thrips to increased Radian concentration and the mortality increased progressively from 24 h to 72 h after initial exposure.

Table 3. Initial survey of susceptibility of western flower thrips populations to Radiant (samples collected on June 17, 2009)

Site	Concentration (µg ai spinetoram/ml)	n	24 h No. of dead	24 h Mortality (%)	48 h No. of dead	48 h Mortality (%)	72 h No. of dead	72 h Mortality (%)
Beach Road Ranch	23.5	105	8	7.62	30	28.57	51	48.57
	47	99	8	8.08	31	31.31	51	51.52
	94	59	10	16.95	25	42.37	39	66.10
	187	82	38	46.34	58	70.73	71	86.59
	374	90	51	56.67	79	87.78	88	97.78
	561	103	63	61.17	96	93.20	102	99.03
	935	113	111	79.65	112	96.46	113	99.12
	Control	108	6	5.56	7	6.48	12	11.11

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2156 Sierra Way, Suite C • San Luis Obispo, CA 93401-4556
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Pump efficiency, chemigation, and backflow prevention workshop

Date: Sept. 8, 2010

Time: 10:00 – 12:00

Location: UC Cooperative Extension Parking lot; 2156 Sierra Way, San Luis Obispo

Cost: No charge

Presenter: Bill Green, CSU Fresno Center for Irrigation Technology

Agenda:

1. PG&E's Advanced Pump Efficiency Program (APEP)- 1 HOUR Total 10- 11 am
    a. Description and eligibility- 5 minutes
    b. 3 Big Ideas to Save Energy Moving Water- 40 minutes
        i. Better Water Use Efficiency (WUE)
        ii. Lower pressure irrigation systems
        iii. Improved pump efficiency
    c. Pump Efficiency Demonstration- 15 minutes

2. Chemigation / Groundwater Protection (CDPR)- 1 HOUR Total 11- 12 am
    a. History of groundwater regulations- 5 minutes
    b. California requirements to chemigate- 10 minutes
        i. 3 things that have to be achieved when injecting chemicals through the irrigation system
            1. Protect the water source
            2. Shut down the chemigation event when irrigation system is operating properly
            3. Prevent backflow from the water source to the chemical supply tank or container
        ii. Basic Equipment- 25 minutes
            1. Diagrams
            2. Alternative equipment
        iii. Chemigation demonstration- 15 minutes
        iv. Individual County restrictions on fertigation- 5 minutes

DPR Continuing Education credits have been requested

Support for this workshop provided by PG&E