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Welcome to the premiere edition of the Plant Protection Quarterly, published by the University of California Kearney Plant Protection Group and the Statewide IPM Project This newsletter is intended to provide UC DANR personnel with timely information on pest management research and educational activities in the South Central Region. DANR personnel desiring to be added to or deleted from the mailing list may contact the editors at Kearney Agricultural Center, 9240 S. Riverbend Ave., Parlier, CA 93648. In order to best serve you, comments and suggestions for improvement of this newsletter are invited. Farm Advisors and Specialists may reproduce any portion of this publication for their newsletters, giving proper credit to individual authors.

James J. Stapleton, Charles G. Summers, Beth L. Teviotdale Editors

IN THIS ISSUE

ARTICLES

CURRENT STATUS OF MATING OF DISRUPTION OF DECIDUOUS FRUIT PESTS WITH PHEROMONES

R.E. Rice, UC Kearney Agricultural Center

Ever since chemists and entomologists first learned how to identify and synthesize insect sex pheromones, control of pest insect populations through the process of mating disruption has been a goal of economic entomologists throughout the world. Most early attempts at mating disruption were unsuccessful, however, due to a lack of knowledge on the quantities of synthetic pheromone required in an orchard environment, optimal design and release technology for pheromone dispensers, and understanding basic insect mating behavior. By the early 1980's, however, CSIRO entomologists in Australia successfully developed a mating disruption system using a three-component blend of pheromone isomers of the oriental fruit moth (OFM), *Grapholita molesta*. After several years of field development in Australia, this technology was introduced in California in the spring of 1985. Following two years of successful efficacy trials in peaches and nectarines throughout the Central Valley, the mating disruption technique for control of OFM populations was registered for use in February 1987.

The first commercial mating disruption pheromone dispensers for OFM were provided by an Australian company, BioControl Ltd., officed in Davis, California, using polyethylene dispensers and

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pheromones manufactured by a Japanese company, Shin-Etsu Ltd. These dispensers, commonly referred to as ropes, are approximately 20 cm long, 2 mm in diameter, with an aluminum wire embedded in the plastic to facilitate tying the dispenser to small limbs or twigs in the trees. Each dispenser contains 75 mg of pheromone blend, and normally lasts for ca. 3 months. They are applied at a rate of 400 dispensers per acre (irregardless of tree density or planting distances), releasing a total of ca. 8 to 10 mg of pheromone/acre/hour. Initial recommendations for OFM mating disruption called for two applications of dispensers per season; at the beginning of the first moth (biofix) flight in February, and again 90 days later, usually sometime in late May. Dispensers are placed within the top one-half of the tree canopy and preferably within the top one-third of the canopy.

Research on OFM mating disruption has continued, emphasizing reduced applications of pheromone in orchards with low populations of OFM. OFM populations in orchards that have been treated for 2-3 yrs with pheromones have been held at sub-economic levels with only the single, early application of pheromone. Results of our 1990 OFM control efficacy trials with a new type of dispenser (BASF, Germany) continue to show excellent control of OFM in orchards with low resident populations of moths (Table 1).

Table 1. Mating disruption of Oriental fruit moth in stonefruit, using BASF OFM/PTB twin ampoule dispensers. 1990.

	Harvest	Percent Infected	
Location/Cultivar	**Date**	**Pheromone**	**Check**
KAC Field 13			
Red Diamond (n) [1]	July 26	0.0	0.0
Elegant Lady (p)	July 9	0.15	0.3
Fairtime (p)	Sept 4	1.8	3.8
Field 72/74			
Flavortop (n)	July 2	0.1	1.5
Flamecrest (p)	July 2	0.0	1.9
Fantasia (n)	July 9	0.1	0.3
Parlier			
Babcock (p)	July 5	0.2	0.3[2]
Kingsburg			
O'Henry (p)	Aug 4	3.3	4.8
Cal Red (p)	Aug 13	1.5	4.0

[1] (n) = nectarine; (p) = peach.
[2] Shin-Etsu/BioControl rope dispensers in check block as grower treatments.

In addition to the BioControl/Shin-Etsu dispenser, a second commercial OFM dispenser for mating disruption has been registered for the 1991 season by Consep Membranes, of Bend, Oregon. The Consep dispensers operate on a somewhat different release technology than the BioControl dispensers, releasing pheromone through semipermeable membranes of variable thicknesses placed over a reservoir in a larger polymer package. Several orchards were treated with these dispensers in Fresno and Tulare Counties in March 1991.

With the expanding success of mating disruption for control of OFM, interest was generated for development of this technique for control of other deciduous fruit pests, particularly peach twig borer (PTB) and codling moth (CM). The flat trials for mating disruption of PT`B were conducted in conjunction with OFM disruption trials at the Kearney Agricultural Center in 1986. PTB pheromones were blended in the same Shin-Etsu/BioControl dispenser that contained OFM pheromones. Results of these preliminary trials for PTB disruption were encouraging, although the early application of the dispensers for OFM meant that approximately six weeks of PTB pheromone release was expended before any PTB moths emerged in late March or April. Even though these early PTB disruption trials were relatively successful, disruption of PTB was not pursued in 1987 because of the decision that dormant sprays were still much more cost effective than pheromones for disruption, and it appeared that a separate set of PTB dispensers would be required for later displacement in orchards, separate from OFM dispensers. Subsequent events, however, primarily Proposition 65 and regulatory restrictions on the use of dormant sprays, generated renewed interest in PTB mating disruption. In 1989, pheromone dispensers manufactured by the AgriSense Company (Fresno, CA) were tested in several field plots in Fresno and Tulare Counties. Although these dispensers were programmed (based on laboratory studies) for a six-month field life, they actually lasted only about two and one-half to three months in the field, due to several basic design shortcomings. In spite of these problems, however, control of PTB with the AgriSense dispensers was judged relatively successful during the 1989 season. Although AgriSense was encouraged to continue development of their pheromone release system, they declined to pursue the PTB program in 1990. Consequently, PTB pheromone dispensers were obtained in 1990 from BASF, using dispensers with twin pheromone reservoirs, one each for OFM and PTB in each dispenser unit.

The results of mating disruption trials for PTB in four orchards in 1990 are shown in Table 2. Four cultivars were examined from KAC Field 13 at commercial harvest dates and in all four cases, quantities of infested fruit in the pheromone treatments were considerably less than infested fruit in the untreated 72/74, where three varieties of early July maturing fruit were evaluated. It should be noted that both of these fields at KAC were also treated with PTB mating disruption pheromone dispensers in 1989. Neither orchard, however, received any OP insecticide in the dormant spray applied in 1989 or in 1990.

Table 2. Mating disruption of peach twig borer in stonefruits, using BASF OFM/PTB twin ampoule dispensers, 1990.

	Harvest	Percent Infested	
Location/Cultivar	**Date**	**Pheromone**	**Check**
KAC Field 13			
Blenheim (a) [1]	June 15	0.0	2.0
Red Diamond (n)	June 26	0.1	0.2
Elegant Lady (p)	July 9	1.0	2.5
Fairtime (p)	Sept 4	5.0	11.0
Field 72/74			
Flavortop (n)	July 2	0.2	17.5
Flamecrest (p)	July 2	0.4	27.0
Fantasia (n)	July 9	0.2	6.4
Parlier 1			
Babcock (p)	July 5	6.6	28.3
Kingsburg			
O'Henry (p)	Aug 4	9.1	7.2
Cal Red (p)	Aug 13	2.6	6.7

[1](a) = apricot; (n) = nectarine; (p) = peach

The pheromone-treated orchards in Parlier and Kingsburg were both under organic production management and neither had received any insecticide treatments for several years. However, even though populations of PTB were considered extremely high in the Parlier (Babcock peach) orchard, a significant reduction in twig borer damage was observed in the pheromone treatments. In the Kingsburg orchard, the O'Henry peach cultivar showed no significant reduction but, in fact, showed a slight increase in PTB at harvest. In the Cal Red cultivar, conversely, a considerable reduction was again observed in the pheromone treatment compared to the check.

The results of these trials for mating disruption and control of peach twig borer in 1990 were quite encouraging. Because of the improved efficacy of twig borer mating disruption trials in 1990, this work will be continued in 1991 in larger commercial trials with the objective of developing data sufficient to obtain registration for commercial PTB mating disruption in 1992.

Experiences and results of field trials for mating disruption of codling moth have been quite variable in comparison to efficacy trials for OFM and PTB. While some trials for CM mating disruption have been deemed fairly successful, particularly in fresh market pears, overall there have been more failures than successes. These failures are in large part believed due to improper release characteristics from the BioControl and Consep CM dispensers, probable shift in the ratio of the released three-component CM pheromone blend, sticky surface residues after extended exposure of the dispensers in the field, and probably inadequate quantities of the pheromone in the orchard canopy. The successes of CM mating disruption in pears is apparently related to crop harvest prior to the third larval generation. Mating disruption trials in pear orchards subjected to only two larval generations prior to harvest have not experienced excessive damage so far. BioControl Ltd. received a federal registration in early 1991 for codling moth mating disruption in pears only, but as of this date do not yet have a CDFA registration for this product. An extensive research program is being coordinated among Riverside, Berkeley, and Davis entomologists in 1991 with the hope that many of the problems previously experienced with CM mating disruption can be resolved during this season's work.

CITRUS LEAF SPOT IN MEXICO – A NEW *ALTERNARIA* DISEASE SOUTH OF THE BORDER

James J. Stapleton, UC Kearney Agricultural Center

In 1981, a new foliar disease of Mexican (key) lime trees (*Citrus aurantifolia)* was found in a commercial citrus producing area in Colima, Mexico. The symptoms of the disease - small, raised, watersoaked pustules surrounded by chlorotic halos on succulent leaves and twigs, which sometimes became deformed or defoliated, and then became necrotic and cracked as host tissue matured - were very similar to those classically produced by the citrus canker organism, *Xanthomonas campestris* pv. *citri*. Bacteria were recovered from diseased material and identified as being *Xanthomonas spp.*, and the disease was named "bacteriosis." Pathogenicity tests resulted in symptoms that were similar, though not identical, to those found in the field. Also, some serological assays for citrus canker tested positive on diseased plant material. Host range tests showed that, although the disease was most often found on Mexican lime, many other citrus varieties and rootstocks were susceptible, especially when growing near infected Mexican lime groves (6,9). As all forms of citrus canker were considered to be diseases of serious economic consequence, quarantines were initiated by USDA, in order to protect our citrus industry. The presence of a citrus canker-like disease in Mexico was widely reported in scientific and industry publications, and a "Mexican" strain of the citrus canker bacterium was described in scientific journals (3, 4, 10).

Questions as to the nature of the disease began to arise, however, when consistent recovery of *Xanthomonas* bacteria from diseased tissue was not obtained. Also, the disease was most severe during the dry, winter months in Mexico, rather than during the warm and rainy summer months. This is contrary to the typical epidemiology of citrus canker (9). In 1986, an Alternaria fungus was isolated from lesions of "bacteriosis," and artificial inoculations of Mexican lime plants with the fungus gave symptoms virtually identical to those observed in the field (2). Subsequent surveys of infected Mexican lime and other citrus trees showed consistent association with *Alternaria* (2, 5). A recent taxomonic study indicated that the fungus is a previously-undescribed species, and proposed the name *A. limicola* to describe it (7). It is unlike *A. citri*, which can cause fruit blemishes and rot (10).

A. limicola is now considered to be the casual agent of the "bacteriosis" disease in Mexico, which has been renamed "citrus leaf spot" (2, 5, 8). The presence of a citrus canker-like disease in Mexico has been discounted. Bacteria of, or similar to the genus *Xanthomonas have* infrequently been isolated from diseased or healthy citrus tissue since the problem was first observed. However, the so-called "Mexican." or "D" strain of *X. campestris* pv. *citri* has characteristics very similar to the "B" strain found in a number of citrus-growing areas in South America. Moreover, the "D" strain designation is based upon isolation of a single strain from plant material sent to the USA for diagnosis several years ago and never since confirmed.

Field studies showed that, under native conditions, citrus leaf spot was primarily a cosmetic disease occurring on shoots and foliage, and did not cause significant damage to fruit or tree vigor (1). USDA, APHIS recently proposed lifting its longstanding quarantine on Mexican citrus fruit, based upon the determination that citrus canker is not present in that country. Regardless of regulatory action taken, the scientific literature should be revised so as to nullify the existence of a so-called "D" or "Mexican" strain of *X. campestris* pv. *citri*, unless conclusive evidence to the contrary is presented.

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ABSTRACTS

Seasonal Occurrence and Organo-Phosphate Resistance of The Cotton Aphid, *Aphis Gossypii*, in Tulare County

E. E. Grafton-Cardwell, UC Kearney Agricultural Center

The cotton aphid, *Aphis gossypii* Glover, emerges in the east side of the San Joaquin Valley in early spring and infests cotton as soon as it emerges. During most years, parasitic wasps and predatory insects control these springtime populations. Cotton aphid reappears at the end of the cotton growing season and builds to very high numbers as the bolls open. The sticky honeydew that the aphid produces can cause the cotton thread to break during the ginning and spinning processes. Growers generally use organophosphate insecticides to kill aphids and prevent sticky cotton. Ever since the 1986 field season, cotton aphid populations have been higher than normal in the spring (possibly due to the drought) and have become more and more difficult to control with pesticides. My research goal was to determine if pesticide resistance is a factor in the erratic chemical control of cotton aphid.

Cotton aphids were collected from throughout the San Joaquin Valley during the 1988-89 field seasons. Winged forms were generally more tolerant of pesticides than nonwinged forms of the aphid. Spring populations were more tolerant of pesticides than the fall populations. Organophosphate resistance (Metasystox-R, Lorsban, Bidrin) was found in many populations of cotton aphid. In contrast, resistance to the pyrethroid (Capture) and the chlorinated hydrocarbon (Thiodan) was rare. Organophosphate resistance declined as the season progressed. The majority of the organophosphate resistant populations were found on the east side of the valley, where aphids first appear. Spring 1990 surveys of Tulare County showed that cotton aphid appeared on weeds before cotton emerged, and that most populations had resistance to organophosphates before they reached cotton.

In terms of resistance management, organophosphates should be used as little as possible for cotton aphid control. There are not very many alternative pesticide classes available. If organophosphates must be used they should be reserved for the end of the season when they are more effective and when the open cotton bolls need protection.

Vegetation Management in Kiwifruit Vineyards Without Synthetic Herbicides

Bill Fischer, UCCE Fresno County

There is interest in the production of kiwifruit "organically," without the use of synthetic pesticides. A study was initiated to evaluate different methods of weed control that would meet certification standards for "organically grown" kiwifruit.

A five-times replicated trial was conducted in an 8 year old kiwifruit vineyard trained on a pergola system. The vineyard was irrigated two or three times a week with low volume drip emitters. However, several times during the season, additional water was applied by flooding the area between raised berms. The weeds in the middles, between the vine rows, were mowed periodically.

The following treatments were limited to a 4 ft. strip of soil centered on the vine row:

a. Mowed with a nylon cord mower, "Weed Eater"
b. Sprayed with saturated fatty acid (Sharpshooter 80%);
c. Opaque landscape fabric mulch (Typar) secured with "U" shaped wires pushed into the soil.

- The most effective control was obtained where the landscape fabric Typar mulch was used. The irrigation water applied with low volume drip emitter readily penetrated the mulch.
- Mowing twice with the "Weed Eater" was adequate to maintain effective weed control through November.
- Spraying twice with saturated fatty acids resulted in good weed control throughout the growing season.
- No significant differences were obtained among treatments using 5%, 7.5% and 10% solutions of Sharpshooter 80% in 74 gallons per treated acre.
- The effectiveness of mowing and treating with Sharpshooter only twice during the season may be attributed to shading of the soil under the pergola system of vine training.

The photosynthetically active radiation (PAR) waveband was measured with a Sunfleck Ceptometer.

The average mean under the vines, 2.5 feet above the soil surface, was 23 (ranging between 6 and 47).

In the middles, under somewhat sparse foliage, light intensity was higher. The reading ranged from 79 to 120 PAR and, where Bermudagrass was growing in the middles, the PAR readings varied from 113 to 187. The average readings adjacent to the vineyard in full sunlight the PAR was 1268. In a nearby younger kiwifruit vineyard, also under a pergola system, without a full canopy, the PAR varied from 355 to 960.

Typar landscape fabric mulch provided excellent weed control. The irrigation water, applied with drip emitters, readily penetrated the fabric. The mulch persisted in excellent condition throughout the season. Continued evaluation of mulches such as Typar landscape fabric is warranted. Under a canopy that provides good shading, the control of vegetation in the vine row can be maintained with a nylon cord mower such as the "Weed Eater" or with the use of saturated fatty acids such as Sharpshooter.

Conclusions:

Effective management of the vegetation can be maintained in kiwifruit vineyards with or without the use of synthetic herbicides. Several combinations of herbicides provided good control of a broad spectrum of different species of weeds. However, to maintain season-long control, retreatments may be required, especially in vineyards frequently irrigated with low volume emitters. Evaluation of MON-13202, a newly introduced herbicide, should also be pursued.

"Relay-Planting" from Alfalfa to Cotton, Blackeyes or Silage Corn

Harold M. Kempen, Douglas Munier, and Martha P. Gonzales, UCCE Kern County

Recent studies evaluated techniques for planting summer crops directly into old alfalfa sod after the season's first or second cuttings. Weeds and alfalfa were considered severe problems with this method.

Studies were done for two years each on cotton, blackeyes, and silage corn. Alfalfa was sprayed after a border irrigation following the first or second alfalfa cutting with glyphosate at 3 lb ai/a. We found that planting cotton with a disc planter into alfalfa sod was risky, since alfalfa recovery was too rapid to allow normal tillage for removal of remaining plants. We tested a 20-inch sweep centered on the planted row to cut off crowns. After crop emergence, further sweep cultivation of the middles was done, throwing dirt to the crop. This performed well in each crop.

In each crop, annual weeds such as pigweed, barnyardgrass, and green foxtail were not serious problems, with or without the residual herbicides we tested, except when sprinkled up. This was due to the dry soil mulch that developed after planting under no rainfall conditions at this time of year. The use of glyphosate was very effective in suppressing perennial weeds such as purple nutsedge and bermudagrass and killing spring-emerging annual weeds. Tests with eight other foliar herbicides for control of alfalfa suggested that none presently perform better than glyphosate. However, dicamba did well and was registered for preplant use on corn.

Relay planting could shorten the time interval between crops, eliminate many tillage operations, save about $50 in land preparation costs, and gain $150-250 from one or two extra alfalfa cuttings. It could reduce particulate air pollution, a major problem in the San Joaquin Valley. Further study should include blading off all alfalfa crowns at planting. Newer foliar herbicides might allow no-till culture of corn or blackeyes, but probably not of cotton.

Effects of Nitrogen Fertilization on Brown Rot Susceptibility in Stone Fruits

Themis J. Michailides and R. Scott Johnson, UC Kearney Agricultural Center

Nitrogen fertilization has long been recognized as being associated with changes in levels of disease and yields of plants. More obvious in root and seedling diseases, reports on the effects of N fertilization on fruit diseases are limited. In the summer of 1988, we observed a natural resistance to infections by *Monilinia fructicola* of nectarine fruits collected from low N trees. In contrast, nectarines collected from trees that received higher levels of N fertilization were severely infected by brown rot. Preliminary experiments in the summer of 1990 indicated that 12.5% of fruit from trees fertilized with 325 lbs of N/acre had natural brown rot infections, compared to only 4.2% of those from trees fertilized with 250 lbs, and 0% of fruit from trees fertilized with 100-175 lbs. In a similar manner, 76-90% of Fantasia nectarines collected from trees that had been fertilized with high (250-325 lbs N/acre) rates of N and spray-inoculated (without wounding) with a conidial suspension of M fructicola were infected and developed 10 lesions of brown rot/fruit, whereas

62-67% of fruits from trees fertilized with low rates (150-175 lbs; N/acre) were infected with only 2-3 lesions/fruit. Similar results were obtained with Flavortop nectarines, although incidence and severity of disease were lower for this cultivar. After wound inoculation, however, fruits from trees fertilized with different levels of N were equally susceptible to the fungus.

NEWS ITEMS

UC IPM NOTES

Peter B. Goodell, UC Kearney Agricultural Center

This column is dedicated to providing communication about the activities of the UC Statewide IPM Project (UC IPM). As coordinator of the extension unit of the Project, it is my goal to increase interaction among experiment station and extension personnel, and UC IPM. The Plant Protection Quarterly is part of that effort. It is an honor for UC IPM to financially support this publication.

As part of a restructuring of the UC IPM project, two IPM Advisors have been relocated to KAC. There are now three Advisors forming a core IPM extension group including myself, Bill Barnett, and Jim Stapleton. We are assigned to the South Central Region, reporting to the Regional Director. Each of us has a specific discipline orientation and each brings specific skills and experience which will provide strength to the core group. The purpose of developing this group was several fold. First, consolidation of resources enables us to get the most from each dollar. Next, by being at the same site, communication among us is enhanced, the opportunity for more integrated team projects is increased, and communication with research and extension personnel at KAC is facilitated. Finally, consolidation provides the opportunity for coordination of regional projects among experiment station and county-based researchers.

The other four IPM Advisors will remain county based. Carolyn Pickel has been transferred to the Sutter-Yuba Counties office. Phil Phillips is located at the Ventura office and Bud Beasley is located at UCR. Sue Blodgett is located in the Sonoma County office, with UC IPM providing travel, S/E and clerical support. The central coast area IPM Advisor position, formerly headquartered in Santa Cruz County was lost in the last round of budget cuts. This position has been identified as the highest priority for the Statewide IPM Project, and if restored, it will be assigned to KAC as an IPM Advisor with a discipline specialty in vegetation/weed management.