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James J. Stapleton, Charles G. Summers, Beth L. Teviotdale, Peter B. Goodell, Timothy S. Prather, Editors

CHANGE IN EDITORIAL POLICY: CALL FOR PAPERS

As of this issue, all DANR academic personnel, regardless of location, have the opportunity to publish articles and notes in UC Plant Protection quarterly after editorial review. Authors wishing to submit material should consult recent issues for guidelines on style and length. Both printed and electronic copies [PC diskette (preferably Word Perfect or ASCII) or E-mail (jcoviello@uckac.edu) of each item submitted should be sent to: UC Plant Protection Quarterly, Kearney Agricultural Center, 9240 S. Riverbend Avenue, Parlier, CA 93648. For further information, contact the editorial staff.

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University of California and the United States Department of Agriculture cooperating

Cooperative Extension • Agricultural Experiment Station • Statewide IPM Project

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ARTICLES

DAMAGE THRESHOLD FOR THRIPS ON DRYING ONIONS

Richard L. Coviello, U. C. Cooperative Extension, Fresno County, and Milton E. McGiffen, Jr., Dept. of Botany & Plant Science, UC Riverside

Introduction

Thrips cause damage to onions by using their rasping-sucking mouth parts to abrade the plant epidermis and suck up the exuding plant sap. This causes characteristic scarring of the leaves and removes fluid and nutrients from leaf tissue. Localized tissue necrosis from feeding reduces photosynthetic ability and nutrient availability to the plant for setting and sizing the bulb, resulting in reduced yield. Reliable estimates of the population level of thrips which significantly reduces yield have not been available for drying onions grown in the San Joaquin Valley. This study was undertaken to develop data on thrips damage threshold levels on drying onions for the central San Joaquin Valley.

Methods

Onions, var. Southport White Globe, were planted on 40 inch beds at the University of California West Side Research and Extension Center on 14 December, 1993. Plots (four row X 50 feet) were established in a Latin square experimental design consisting of 5 treatments X 5 replications on 23 March, 1994. Treatments plus an untreated check consisted of insecticide sprays at various intervals applied so that differential populations of thrips would develop across plots (Table 1). Insecticide applications were made using cypermethrin (Ammo®) at 0.05 lbs a.i. per acre applied in 60 gallons of water using a tractor mounted sprayer.

Thrips populations were sampled weekly beginning 5 April and continuing until plant maturity. When the plant tops fell over, it was assumed that further thrips feeding would have no effect on yield. Sampling consisted of removing the entire aerial portion of the plant from a point just below the soil surface. In the lab, the leaves were pulled apart and washed in a mild dishwashing detergent solution which was then poured through a series of sieve screens to strain out the thrips. The thrips were placed in 70% isopropyl alcohol and counted. Adult thrips were retained after counting for later separation to species. Twenty five plants were taken from each plot during the early part of the sampling period when the thrips population was low. As the population increased, samples were reduced to 15 plants per plot and finally to 10 plants per plot for the last three samples. Since thrips populations within treatments varied widely from effects of the sprays, population pressure was measured as cumulative thrips-days (CTD). This was calculated by averaging the number of thrips per plant on two adjacent sample dates, multiplying by the number of days between samples and adding that to the previous interval's calculated thrips-days.

Twenty-seven row-feet of the two center rows of each plot (54 row-feet/plot) were harvested on 24 August with a mechanical digger. The onions which were collected in the catch frame of the digger were weighed as harvestable onions. Those that fell through the chains of the digger were collected and weighed as undersized onions. A subsample of the harvestable onions was weighed and counted to calculate average bulb weight. The subsamples were sent to the ADOGA lab in Hanford for analysis of soluble solids.

Data for plot total weights, harvestable weights, bulb weights and percent undersized were calculated by analysis of variance for Latin squares. Data for total accumulated thrips-days were transformed using a log transformation to normalize the data before calculating the ANOVA. Harvest data were regressed against the cumulative thrips-days in order to determine the relationship between yield and thrips pressure.

Results and Discussion

Thrips numbers were successfully manipulated so that population pressures varied significantly across the plots. Thrips reached an average of 81.8 per plant in the untreated check on 21 June at which time the plants became so desiccated they could not support the thrips population (Figure 1). Thrips population pressure as indicated by cumulative thrips-days was significantly different across all treatments from a low of 227 CTD in the treatment receiving seven sprays to 2769 CTD in the untreated check (Table 2, Figure 2). Yields were positively correlated with the number of sprays applied with all plots having significantly higher weights than the untreated check (Table 2, Figure 3). Seven sprays did not significantly increase weights over four sprays, however. While percent (by weight) undersized tended to be higher with increasing thrips pressure, as expected, only the treatments with seven sprays differed significantly from the untreated check (Table 2). Conversely, bulb weights were highest in the plots receiving the most sprays but were only significantly different in the treatments with seven sprays (Table 2).

Percent soluble solids were significantly lower in the untreated check than in all of the other treatments (Table 2). The plots receiving one spray were marginally lower in soluble solids than the plots receiving more sprays.

When plot yields were regressed against total accumulated thrips-days (Figure 3), a high degree of correlation existed, best fitted with a third-order polynomial equation (R^2= 0.81). The data suggested that a range of 500 - 600 cumulative thrips-days began to significantly reduce yield. This agreed with the ANOVA of plot yields where the first significant yield loss occurred in treatment 3 at an average CTD of 617 at the end of sampling. Only treatments 3, 4 and 5 exceeded 20 thrips per plant during the season (Figure 1), although treatment 3 did so only at the end of sampling when the tops were falling over.

Onion thrips were the predominant species present through most of the experiment as determined by the relative proportions of adults in the samples. Western flower thrips comprised the majority only in the first two sample after which the relative numbers of onion thrips increased to over 90% during the latter half of the experiment (Figure 4).

A conservative estimate of insecticide treatment threshold appears to be between 15 - 20 thrips per plant during the season, but in no case should the total thrips pressure exceed 600 thrips-days. The results of this experiment are not meant to suggest that seven or even four insecticide sprays are needed to produce a crop of onions; those numbers were required to manipulate thrips numbers within small plots. It is likely only one or two sprays would be necessary in commercial onion fields if thrips populations exceeded the threshold. Further studies need to be done to determine critical periods of damage susceptibility of plants during the growing season.

Table 1. Number of applications and dates for each treatment (cypermethrin @ 0.05 lb. a.i./acre).

Treatment Number	No. Of Sprays	Treatment dates
1	7	27 April, 13 May, 25 May, 2 June, 9 June, 15 June, 30 June
2	4	27 April, 25 May, 15 June, 30 June
3	2	13 May, 2 June
4	1	9 June
5	0	

Table 2. Harvest statistics and thrips pressure at end of sampling.

Treatment Number	Total lbs/Plot	Harvestable lbs/Plot	Percent Undersize	Bulb Wt. (gm)	% Soluble Solids	Total CTD
1	140.9 a[2]	134.1 a	4.9 a	67.2 a	25.2 ab	227.3 a
2	131.0 ab	123.3 ab	6.0 ab	52.7 b	25.6 a	473.1 b
3	119.3 b	110.7 b	7.3 ab	48.6 b	24.8 ab	616.7 c
4	92.7 c	84.3 c	9.4 ab	47.7 b	24.0 b	1137.5 d
5	61.9 d	55.3 d	10.9 b	41.8 b	22.4 c	2768.6 e

[1]Total accumulated thrips-day.

[2]Means followed by the same letter(s) are not significantly different (DMRT, p = 0.05).

(Figure unavailable)

Figure 1. Thrips damage to processing onions trial, 1994. Average number of thrips per plant for all treatments through the sampling period.

(Figure unavailable)

Figure 2. Thrips damage to processing onions trial, 1994. Average cumulative thrips-days for all treatments through the sampling period.

(Figure unavailable)

Figure 3. Thrips damage to processing onions trial, 1994. Harvestable plot weights as impacted by total accumulated thrips-days during the sampling period.

(Figure unavailable)

Figure 4. Percentage of population of adult thrips which are onion thrips or western flower thrips during sampling period.

REFLECTIVE MULCHES REPEL APHIDS AND PROTECT CUCURBITACEOUS CROPS FROM VIRUS DISEASES

James J. Stapleton, Charles G. Summers, Roger A. Duncan, and Albert S. Newton, U. C. Kearney Ag Center

Introduction

Aphid-borne virus diseases often limit successful production of cucurbitaceous crops in California. The physical presence and feeding on plants by aphids can result in considerable damage. However, the diseases caused by the viruses aphids transmit often result in far greater crop loss than is directly attributable to feeding.

Numerous studies have shown that reflective mulches can repel aphids and delay or reduce the incidence of nonpersistent virus diseases in susceptible vegetable crops. However, the lack of suitable mulching materials has impeded adoption in California. A number of silver polyethylene mulches are now commercially available. Also, the possibility of using water-soluble, biodegradable synthetic latex spray mulches has recently been explored. The spray mulch can be applied more economically than plastic films, and can simply be incorporated into the soil after harvest rather than necessitating removal and disposal. However, sprayable mulches are not commercially available at this time. This report details field experiments to compare the effects of reflectorized spray mulch and plastic film products in repelling aphids, delaying the onset of virus diseases, and increasing yield of zucchini squash and cantaloupes.

Materials and Methods

Replicated field experiments were conducted near Fresno, California in the San Joaquin Valley in August-October 1993 and 1994 to compare silver-painted spray mulch (Styrofan^{R}, BASF Corp.) with several silver and white pigmented plastic film mulches. Experimental sites were pre-irrigated, fertilized, and treated with pre-plant herbicides according to standard practices for the area. Treatments consisted of 5-6 replications, 3.1 x 7.6 m. Plots were separated by fallow areas 3.1 m wide. Each plot was three beds wide. The center bed was used as the data row, with a guard row on either side. Treatments in the 1993 zucchini experiment included two silver polyethylene films (AEP Industries, Moonachie, NJ, USA; Polyon Barkai Ltd., Kibbutz Barkai, Israel), white polyethylene film (AEP Industries), silver nylon film and silver nylon net mulch (Specialty Ag, Reedley, CA), silver-painted spray mulch and white spray mulch (BASF Corp., Charlotte, NC), nonmulched control, and nonmulched control with two applications of the insecticide diazinon to plant foliage. Planting holes were made in the mulches and zucchini squash (*Cucurbita pepo* var. *melopepo* cv. Sunre 7918) was seeded on 3 August. After emergence, the crop was raised according to standard cultural practices. Plants were rated for appearance of first foliar symptoms of virus disease infection at the first squash harvest, and one and two weeks following the first harvest. Plants were picked 12 times, about every other day. Squash were rated for marketability (size and presence or absence of virus symptoms) and yield (fresh weight). Procedures for the 1994 cantaloupe experiment were similar, except that treatments included complete bed (66" width) coverage with silver polyethylene mulch; complete, 75%, 50%, and 25% bed coverage with silver spray mulch; and the nontreated control. Melons were harvested three times.

Results and Discussion

1993 squash. Cotton/melon aphid (*Aphis gossypii*) were found on squash plants shortly after emergence. On the date of first squash harvest, foliar virus symptoms were visible on more than 95% of the plants grown on bare soil, with or without insecticide sprays. White-colored spray or plastic mulches gave moderate (36-42%) relief from virus infection ($P<0.05$), while only 7-17% of plants grown on silver-colored spray or plastic mulches exhibited symptoms (Fig. 1). Suppression of foliar virus symptoms was not documented after the fourth picking

(Fig. 1). Multiple infection by zucchini yellows mosaic (ZuYMV), watermelon mosaic-2 (WaMV), and cucumber mosaic (CMV) viruses occurred in the field. Infection by papaya ringspot (watermelon mosaic-1) or squash mosaic viruses was not detected, and cucurbit aphid-borne yellows virus (CABYV) was not tested.

All mulch treatments allowed significant (P<0.05), 3 to 5-fold increases in cumulative, marketable yield of squash, as compared to the nonmulched controls. The silver spray mulch was as effective as silver polyethylene (Fig. 2) . Early infection of control plants drastically reduced their ability to produce fruit, and the plants were essentially nonproductive.

1994 cantaloupe melon. As in the squash experiment, aphid populations and virus pressure were high from the time the plants emerged. Nonmulched plants were nearly 100% infected with CMV, WaMV, and ZuYMV prior to the first harvest. Mulched plots did not approach 100% infection until 6 weeks later (Fig. 4). All mulch treatments gave large increases in yield (total number of cartons per acre), ranging from 4.4-fold (25% bed coverage) to 25.2-fold (polyethylene 100% bed mulch) (Fig. 5). The mulch treatments gave early protection to the emerging and developing squash plants, allowing production of a marketable crop which otherwise would not have been possible.

<u>Conclusions</u>

The results of this work, conducted under conditions of severe aphid and virus pressure, indicated that sprayable mulches can be as effective as plastic film mulches in reducing disease losses. Additional studies to refine biological and economic considerations of using spray mulch for virus suppression in vegetable crops are currently underway.

(Figure unavailable)

Figure 1. Development of foliar virus disease symptoms in 'Sunre 7918' zucchini squash as influenced by reflective mulch or insecticide treatments. Bars tended by the same letter are not different (P<0.05). Treatments: Pols = Polyon silver polyethylene; AEPs = AEP silver polyethylene; SpAs = Specialty Ag silver mylar; SSp = BASF spray mulch (painted silver); AEPw - AEP white polyethylene; WSp = BASF white spray mulch; Net = Specialty Ag silver mylar net; Diaz = diazinon insecticide control; Con = bare ground control.

(Figure unavailable)

Figure 2. Cumulative, marketable fruit yield of 'Sunre 7918' zucchini squash as influenced by reflective mulch or insecticide treatments. Bars tended by the same letter are not different (P<0.05). Treatments: Pols = Polyon silver polyethylene; AEPs = AEP silver polyethylene; SpAs = Specialty Ag silver mylar; SSp = BASF spray mulch (painted silver); AEPw = AEP white polyethylene; WSp = BASF white spray mulch; Net = Specialty Ag silver mylar net; Diaz = diazinon insecticide control; Con = bare ground control.

(Figure unavailable)

Figure 3. The effect of reflective mulches on alighting by alate aphids on fall planted zucchini squash plants. Means sharing a common litter(s) are not significantly different at P = 0.05 (DMRT). Comparisons are valid only within sample dates.

(Figure unavailable)

Figure 4. Seasonal dynamics of foliar virus symptoms on cantaloupe melon.

(Figure unavailable)

Figure 5. Cumulative total yield of cantaloupe melon. SS = silver spray. Means followed by the same letter(s) are not significantly different at P<0.05 (DMRT).

ABSTRACTS

REPORT TO THE WALNUT MARKETING BOARD FINAL REPORT FOR PROJECT 92 WMB 9, December, 1994

<u>Development of a Polymerase Chain Reaction (Pcr) Protocol to Detect the Deep Bark Canker Pathogen, Erwinia Rubrifaciens, in Walnut Tissue</u>, *Beth L. Teviotdale and Nick Panopoulos, UC Kearney Ag Center*

Contaminated graftwood is a suspected means by which deep bark canker disease is spread. To investigate this possibility, and ultimately to develop a source of bacteria-free budwood from which to produce healthy trees, a highly sensitive method to detect the pathogen in walnut tissue is needed. A procedure known as polymerase chain reaction (PCR) would meet this requirement. The subject of this project is to develop a PCR protocol to detect the deep bark canker bacteria in walnut tissue. The research has progressed, and an important step, the ability to get reproducible results using two primers, has been achieved but an applicable system has not yet been attained. Deep bark canker was found recently on Chandler trees in two orchards in

Kings County and three orchards in Tulare County. To estimate the relative susceptibility of Chandler to deep bark canker, 6-yr-old Hartley and 7-yr-old Chandler trees in separate orchards in Kings County were inoculated with three isolates of the deep bark canker pathogen. Average canker length was 34.1 inches on Chandler and 13.1 inches on Hartley. Similar inoculations of 11-yr-old Hartley, Chandler, Sinensis and Vina trees in a planting in Davis indicate that the disease is severe on Hartley, Chandler and Sinensis cultivars. The number of trees with deep bark canker increased from 4 to 14 and from 6 to 11 in each of two Chandler orchards in Tulare County mapped in 1993 and 1994.

1995 BELTWIDE COTTON PRODUCTION CONFERENCES, San Antonio, TX, January, 1995

Distribution of Silverleaf Whitefly In the San Joaquin Valley
P.B. Goodell, L.D. Godfrey, J. Wood, J.W. Eckert, R. Swalm, D. Keaveny, W. Tyson, and D.M. Dauod, UC Kearney Ag Center

Silverleaf whitefly has increased its range in the San Joaquin Valley during the period 1992 to 1994 based on reports, survey data, and trap lines. From a limited infestation southeast of Bakersfield, Kern county in 1992, the infestation has spread to all six cotton producing counties in the San Joaquin Valley. Populations are higher in the east side of the valley than the west and higher in the south counties than the north counties. Except in very limited situations, cotton producers have not suffered the same level of infestation through the growing season as those in the desert Southwest. The reasons for this moderated population buildup may be climatic and temperature related.

Integrated Management of *Meloidogyne Incognita* on San Joaquin Valley Cotton, *P.B. Goodell, J.W. Eckert, D. J. Munier, and S. Wright, UC Kearney Ag Center*

To evaluate the efficacy of several management tactics for root-knot nematode, three trials over five sites were conducted in 1994. These involved three rates of aldicarb (0,3.5,5.0,7.0 formulated lbs/ac), deep tillage within the planting bed, and host plant resistance. The use of aldicarb did show a positive yield response although not significantly in most cases. Increasing the rates of aldicarb did not ensure increased yield response. Currently it is not possible to predict a positive yield outcome based on pre-plant nematode population estimates. Deep tillage had a significant yield response in both trials. The resistant Acala cotton variety, C225, produced significantly more lint and resulted in significantly less population increase than other varieties.

6th INTERNATIONAL VERTICILLIUM CONFERENCE, Dead Sea, Israel, June, 1994

Verticillium wilt of cauliflower: A new disease in California, *S. T. Koike, U.C. Cooperative Extension, Monterey County, and K. V. Subbarao, Dept. of Plant Pathology, U.C. Davis @ U.S. Agricultural Research Station, Salinas.*

In 1990, commercial cauliflower plantings in the Salinas Valley showed symptoms of a vascular wilt disease. Symptoms consisted of chlorosis, defoliation, stunting, wilting, and vascular discoloration of the root and stem. Surveys indicated that incidence of symptomatic plants in affected fields could be as high as 95%. This problem was initially detected in a few fields in two counties. Presently, the disease is widely distributed in five coastal counties, *Verticillium dahliae* (Kleb.), was consistently isolated from cauliflower stem tissue, and pathogenicity tests using root dip techniques confirmed that this fungus was the causal agent. Other crucifers grown in the Salinas Valley, such as bok choy, cabbage, and Chinese cabbage, are also susceptible to this pathogen. However, commercial broccoli fields remained unaffected, even though such crops were planted in highly infested soils. Soils from the Salinas Valley were assayed for microsclerotia by plating dried soil onto NP-10 selective media using a modified Anderson sampler. Propagule counts show that *V. Dahliae* is widely distributed in the region, having populations as high as 93 microsclerotia/g soil. All commercially available cauliflower cultivars were susceptible to the pathogen, though they varied in the degree of symptom severity. Soil fumigants (chloropicrin, chloropicrin + methyl bromide, Vapam, Mocap) injected into pre-formed beds but left untarped failed to significantly reduce soil inoculum or increase yields. The ability of *V. dahliae* to survive in soil for long periods of time, lack of resistant cultivars, and prohibitive costs of standard tarped soil fumigation applications make this disease a serious threat to the cauliflower industry in California.

METHYL BROMIDE ALTERNATIVES CONFERENCE, Orlando, FL, November, 1994

A Discussion of Five Portable Soil Drenching Devices, Three Biocide Injection Methods and Ten Biocide Agents Under Field Conditions, *M . V. McKenry, U.C. Kearney Ag. Center*

A portable soil drenching device has been developed for delivery of any number of short-residual, water soluble, biocidal materials for pre-plant soil treatment in order to eliminate pests and disease agents. The device includes a series of hoses, each having drip irrigation emitters in place thereon at 30-cm intervals. The hoses may be attached to the underside of a tarp. Each hose is sealed at one end and attached at the other end to a manifold delivery system. The hoses are deployed onto the field which is to be treated, and the manifold is connected to a water supply and material mixing source. The selected materials are mixed with the water and introduced into the hose and manifold system by one of three alternative methods (uniform delivery, wave delivery or stacking) resulting in drenching of the field for elimination of pests and/or disease agents. Alternative embodiments allow for connection to existing linear, wheel line, and center-pivot irrigation systems and for the use of low atomizing sprinklers instead of hoses.

The standard biocides that have now received greatest evaluation have been the MIT-liberators, including Vapam®, Soil Prep® or Metham Sodium®. Nine other biocides evaluated at least once in a field situation include: emulsified 1,3-dichloropropene, carbon bisulfide, Clorox®, chlorine dioxide, calcium hypochlorite plus urea, Acrolein, urea plus sucrose, Furfural and cold water extracts from the stubble of safflower, *Carthamus tinctorius*, marigold, *Tagetes tenuifolia* and Cahaba White Vetch, *Vicia sativa* x *Vicia cordata*.

Treatments with MIT-liberators have repeatedly given consistent performance when applied via the Portable Soil Drenching Device (PSDD). Soil must be properly prepared or have the capability of infiltrating 10 to 15 cm water in 6 to 8 hr, respectively. Control of plant-parasitic nematodes at 98 to 99.9% one year after treatment is possible within the surface 150 cm of soil at 1º to 30º C. At 360 kg ai/ha drenched to the 150-cm depth the MIT-liberators give 100% control of viable tree and vine roots down to 60-cm depth. At double that treatment rate 100% root kill is achievable to 120-cm depth. Soils containing viable roots smaller than pencil-sized do not pose a problem; however at the existing labeled rate of 360 kg ai/ha the MIT-liberators are only mediocre in performance in replant of orchards and vineyards. The increased growth response (IGR) following use of MIT-liberators has not always been as dramatic as it is after use of methyl bromide. Grapes, *Vitis vinifera*, can grow better after MIT than methyl bromide, however, walnuts, *Juglans niger*, and peach, *Prunus persica*, may not. Efforts are underway to drench IGR-promoting substances into the surface 30 cm of soil during treatments with MIT.

Nematode infested fields to be planted to annual-type crops or one-year nursery crops may be successfully treated by using 220 to 360 kg ai/ha in 10 cm water delivered to the surface 90 cm of soil profile. Products delivered to soil via PSDD become locked into the soil profile, thereby greatly reducing their volatilization when properly applied.

In terms of nematode kill in 150 cm of soil, the emulsified 1,3-D treatments can perform slightly better than treatments with MIT-liberators. Relative to the IGR response, there are indications that some materials are better promoters for certain crops but not others.

Integrated Management of Perennial Crops in California Using Mulch and Drip Irrigation: a Systems Approach
James J. Stapleton, U. C. Kearney Ag. Center

Management of many high value annual crops using plastic mulch is commonly practiced in several regions of the U.S.A., as well as other areas of the world. Plastic mulch has been tested experimentally on numerous tree crops, usually with favorable results. When unfavorable results occurred, they were usually attributed to "souring" the soil and subsequent root damage. In this paper, a holistic management system is described using black plastic mulch and drip irrigation which integrates soil disinfestation, irrigation conservation, elimination of herbicide use in tree rows, and sometimes increased flowering and yield responses. The system is compatible with pre-plant soil fumigation and post-plant chemigation. It has been tested successfully in the San Joaquin Valley of California on perennial crops including apple, almond, apricot, peach, pecan and orange. Experimentation began as an offshoot of solarization, a method of disinfecting soil using solar energy. The system was found to be effective in controlling Verticillium wilt, certain nematodes, and virtually all weed species.

Reductions in seasonal irrigation water requirements of up to 90% have been documented in first-, second-, and third-leaf trees. Water management is critical with this system, as excessive irrigation can trigger root injury and "soil souring" referred to earlier.

Weed growth along tree rows is prevented with this system, eliminating the necessity of repeated herbicide applications. In soil highly infested with nutsedge (*Cyperus* spp.), shoots occasionally poke through the mulch, but are readily controlled manually or with topical glyphosate applications.

It has been apparent that the mulch/drip system applies varying amounts of stress, as measured by tree performance and leaf moisture potential, to treated trees. Clear film, commonly used with solarization, can allow excessive buildup of heat in San Joaquin Valley soils, injuring or killing young trees. Therefore, black film, which heats soil to a lesser degree, has been used in more recent field trials. Nevertheless, slight heat stress is postulated to trigger the increased flowering and yield responses commonly observed in the young trees under the mulch regime. These phenomena usually disappear in experimental trees when the mulch is removed.

Although results of these field trials have been favorable, continued testing of additional parameters, such as effects of, and compatibility with the range of pesticides and fertilizers employed by producers using this technique, and varietal responses of treated plants, must be done.

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Solarization as a Framework for Alternative Soil Disinfestation Strategies in the Interior Valleys of California

James J. Stapleton, U. C. Kearney Ag. Center

For the last 40-50 years, agriculturists have relied almost exclusively on chemical fumigants and disinfestants for controlling soilborne pests in horticultural crops. Recently, however, environmental and health concerns have precipitated a search for effective nonchemical and integrated management strategies to replace heavy chemical use.

One of the most effective options available for immediate adoption in conducive climates is soil solarization. Solarization is a hydrothermal process which utilizes solar radiation captured, with present technology, under plastic film mulching materials to heat soils and disinfest them of plant pests and pathogens. It is a technique which conforms to principles of integrated pest management, since it has a complex mode of pesticidal activity, can control a broad spectrum of soilborne disease, weed, nematode, and insect pests, and can be combined for greater efficacy with other methods of pest control, such as biological and chemical agents.

Since its inception and early development during the mid- 1970's, soil solarization has been tested and modified under local conditions in more than 50 countries. The idea of harnessing passive solar energy to replace the need for highly toxic soil fumigants is intriguing, and has captured the imagination and interest of agricultural scientists and producers around the world. Because of its cost (ca. $200-500 US dollars/acre), it is a method primarily compatible for use with high-value, low-acreage horticultural crops. Because of the physical limitations of heating soil by passive solar energy, it is primarily compatible with shallow-rooted crops in areas with hot, cloudless summer climates.

Besides disinfesting soil while reducing or eliminating the need for chemical fumigants, solarization offers other attractive benefits to users, including increased levels of available mineral nutrients, changes in soil microflora favoring biological pest control, water conservation and additional pest management when the solarization mulch is maintained as a row cover during the following crop, and usually, increased yield and quality of crops following treatment.

If widespread implementation of solarization is desired, user-accessible, predictive models for specific soilborne pests and pathogens must be available. Normally, plastic mulch film for solarization is left in place for 4-6 weeks incubation. However, optimal use may require a longer time, which may impede scheduling of other production practices. Improvements to the solarization process which will aid treatment predictability through increased soil heating or integration with other methods of pest control, are necessary to make the appeal of solarization more attractive to a wide spectrum of users. For example, solarization, when combined with certain nitrogenous fertilizers, gave increased control of fungal and nematode pathogens of vegetable crops, as well as increased yields. Also, excellent control of diseases of cucumber and lettuce was obtained in California by integrating solarization with cruciferous crop residues and composted poultry manure ("biofumigation") when neither method alone was effective.

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IPM NOTES

USDA ANNOUNCES NATIONAL PLAN TO INCREASE USE OF INTEGRATED PEST MANAGEMENT

WASHINGTON, Dec. 14--The U.S. Department of Agriculture announced today an aggressive Integrated Pest Management (IPM) initiative to provide farmers with the new tools they need to deal with environmental and economic challenges into the 21st century. This initiative delivers on the Clinton Administration's commitment to help agricultural producers implement IPM methods on 75% of total crop acreage by the year 2000.

"The IPM initiative is just one of the many ways USDA is improving service to its customers," said Deputy Secretary of Agriculture Richard Rominger. "By setting an ambitious goal for our IPM research and education programs, USDA will develop new biological controls and other IPM tools that will help farmers remain competitive in the global market."

Integrated pest management is a systems approach that combines a wide array of crop production practices with careful monitoring of pests and their natural enemies. IPM practices include use of resistant varieties, timing of planting, cultivation, biological controls, and judicious use of pesticides. These IPM practices are used in greenhouses and on field crops. IPM systems anticipate and prevent pests from reaching economically damaging levels.

The USDA initiative focuses research and education programs to meet producers' needs by increasing the role of people at the state and local levels in setting priorities and streamlining the process of funding IPM research and extension programs. In addition, the initiative establishes a new program for research into replacements for pesticides that may be lost through pest resistance or regulation.

"This IPM initiative is a good example of how USDA is strengthening and focusing its research and extension programs to produce results that benefit agriculture and the country as a whole," said Rominger. "With this initiative, USDA is kicking off a concerted national effort to achieve widespread use of IPM into the next century."

FACT SHEET - USDA'S INTEGRATED PEST MANAGEMENT (IPM) INITIATIVE

Integrated pest management (IPM) strategies have been applied in agriculture for over 30 years. American farmers have adopted IPM methods for pest management on nearly half of all fruit and nut, vegetable, and major field crop acreage. The challenge for USDA in 1994 and beyond is to further increase knowledge of IPM, improve delivery of technical expertise and increase implementation of IPM.

Through education and the delivery of scientific expertise, USDA will help farmers use new pest management practices which will meet agricultural production, human health and environmental goals. This Initiative delivers on the Clinton Administration's commitment to help agricultural producers implement IPM methods on 75% of total crop acreage by the year 2000.

<u>Basic Principles of USDA’s IPM Initiative</u>:

- Involving farmers and practitioners in the development and assessment of IPM programs improves USDA customer service and increases the adoption of IPM practices. IPM teams comprised of producers, land grant universities, crop advisors and consultants and private industry will be convened in each state to identify the important research and education needs for their crops and to establish guidelines for evaluating USDA IPM programs. IPM teams will set priorities for IPM research and extension programs to ensure that the most important and appropriate technologies are available to meet their needs and increase adoption.

Outcome: USDA IPM research and education programs will be directed to serve the priorities for IPM adoption set at the regional and local levels.

- Streamlining and coordinating USDA IPM programs at the federal, state, and local levels ensures the efficient, accountable, and effective delivery of research and education programs. USDA IPM programs in various agencies have been coordinated to carry out a single Department-wide IPM Initiative to meet the 75% adoption goal. Coordination of USDA IPM teams joins their resources and technical expertise to help make real progress at the field level.

  Outcome: The streamlining and coordination of IPM programs will ensure that they are efficient and cost effective.

- Increasing the use and adoption of IPM enables farmers to achieve both economic and environmental objectives. IPM systems have a proven track record of ensuring economical pest control and incorporating environmental data in decision-making. USDA's Initiative builds upon that experience and contributes more education and technological resources.

  Outcome: USDA's IPM Initiative delivers the research, technical resources and education programs necessary for farmers to realize economic, environmental, and human health goals.

What is IPM?

Integrated pest management is a systems approach that combines a wide array of crop production practices with careful monitoring of pests and their natural enemies. Practices and methods vary among crops and among different regions of the country. For example, in some regions, a frequently used method is the introduction of insects which naturally prey on particular pests into infested areas (i.e., bugs eating bugs). In other areas, crop rotations, planting dates, resistant varieties and cultural practices are used in combination with other methods to manage pests before they reach damaging levels. These IPM practices are used in greenhouse, crop acreage, and urban gardening settings.

Key Elements of the USDA Initiative Strategy

The principal elements of the USDA IPM Initiative build upon the strengths of USDA working relationships with states and the private sector to deliver IPM knowledge and technologies to end users. The USDA Initiative establishes key programs now and sets priorities for research and education efforts to accomplish future IPM adoption goals.

By setting this Initiative in motion, USDA is doing more than establishing a goal for adoption of IPM will improve the economic and environmental performance of American agriculture. The Initiative also establishes a new way of focusing research and education programs to meet producers' needs. Four basic elements are key to the success of the Initiative:

- The IPM Initiative increases the role of people at the state and local levels in shaping the focus of USDA programs. This Initiative will bring together teams of producers, researchers, extension staff, crop advisors and consultants, and others. IPM teams will be convened by the Extension Service IPM coordinators in each state. Those teams will identify research and education needs, set priorities for IPM adoption for the commodities in heir states and regions, and evaluate progress in IPM adoption.

- The IPM Initiative streamlines the process of funding research and extension programs to ensure resource delivery to the most important needs. Special grants programs for IPM research and education efforts are combined into a single competitive grants program to meet the individual or multi-state needs identified by IPM teams.

- The IPM Initiative will make sure that producers have new tools to control critical pests. USDA is establishing a new program for research into replacements for pesticides that are being lost through pest resistance or regulation. The program, which fulfills a commitment made by USDA in a Memorandum of Understanding with EPA, will involve producers in the design of projects that will conduct applied research and technology transfer necessary to ensure the availability of effective pest management methods.

- Finally, the IPM Initiative is pulling together all of the activities of our agencies into a single Department-wide effort that is more efficient and more effective in getting new knowledge into the hands of producers. For example, the priority needs identified by IPM teams will be used to orient area-wide IPM programs conducted by the Agricultural Research Service, IPM research conducted through the National Research Initiative, as well as the Extension Service's IPM programs, which will be directed to meet the educational needs of producers and their advisors for IPM adoption.

A USDA IPM Coordinating Council will provide interagency policy, programmatic, and budgetary guidance. The Council includes all USDA agencies involved in IPM activities: Cooperative State Research, Education, and Extension Service (CSREES), Agricultural Research Service (ARS), Animal and Plant Health Inspection Service (APHIS), Economic Research Service (ERS), Consolidated Farm Service Agency (CFSA), Forest Service (FS), Natural Resources Conservation Service (NRCS), and the National Agricultural Statistics Service (NASS).

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