Western IPM Center
Fostering responsible pest management for a sustainable future.

The Western Front

NEWSLETTER OF THE WESTERN INTEGRATED PEST MANAGEMENT CENTER October 2012

An IPM Educational Program for Vineyards and Orchards to Prevent and Manage Glyphosate-resistant Weeds

In 2011, the Western IPM Center funded a 1-year regional outreach project to improve the knowledge of farm advisors, county agents, and pesticide applicators about preventing and managing glyphosate-resistant weeds in vineyards and orchards. The project, which developed education and training materials and provided training to personnel in California, Oregon, and Washington, was coordinated by Kassim Al-Khatib, WIPMC Director, Director of the UC Statewide IPM Program, and Professor of Weed Science at UC Davis. Project cooperators were Brad Hanson, Assistant Cooperative Extension Weed Specialist, UC Davis; Ed Peachey, Assistant Professor, Department of Horticulture, Oregon State University; Rick Boydston, Agronomist, USDA-Agricultural Research Service, Prosser, Washington; and Tim Miller, Associate Weed Specialist, Washington State University, Mount Vernon Research Center.

The Issue

Glyphosate is considered the world's most important herbicide, because it provides broad-spectrum weed control, has favorable environmental characteristics, and has low toxicity to mammals. Throughout the western states, weeds are a major factor limiting vineyard and orchard production, and it can be tempting to overuse glyphosate because of its benefits. This project sought to extend, among other things, information about integrated weed management, which involves the use of all available strategies (cultural, mechanical, and chemical) to manage weed populations in a manner that is economically and environmentally sound. Although cultivation, mowing, and mulching are important weed-management practices currently used in grape and fruit tree production, herbicides are the major component of most weed management programs in these perennial crops. And specifically, over the past 35 years, glyphosate has been the cornerstone of weed IPM programs in vineyard and orchard cropping systems. Furthermore, because of the decline in glyphosate costs, many growers have stopped using other weed management practices and instead are using only glyphosate for weed control.

As a result of this increased selection pressure, several cases of glyphosate-resistant weeds have been reported in the western United States. Worldwide, there are currently 24 known weed species with evolved resistance to glyphosate. In the western United States, as a result of glyphosate selection pressure, cases of glyphosate-resistant rigid ryegrass (*Lolium rigidum*), hairy fleabane (*Conyza bonariensis*), and horseweed (*Conyza canadensis*) have been reported in California. In Oregon, only glyphosate-resistant Italian ryegrass (*Lolium multiflorum*) has been confirmed. No glyphosate-resistant weeds have been reported in Washington. These developments are very harmful to IPM programs, as no alternatives are currently available to replace glyphosate.

Project Objectives

Because resistance management for glyphosate is not well developed and communicated to glyphosate users, project cooperators went to work. The most effective means of preventing and managing glyphosate-resistant weeds is by using an IPM program that includes prevention, monitoring and early detection, and integration of weed management practices. This project's overall objective was to enhance IPM practices in California and the Pacific Northwest for weed management in vineyards and orchards and to provide educational workshops and materials to help prevent and manage glyphosate-resistant weeds. Specific objectives included 1) developing extension publications on glyphosate stewardship to optimize glyphosate performance for IPM uses in vineyards and orchards; 2) conducting workshops for farm advisors, county agents, and pesticide applicators on weed IPM and on monitoring, prevention, and management of glyphosate-resistant weeds in vineyards and orchards; and 3) developing a set of presentations—to be used by farm advisors and county agents in their local educational programs—on weed IPM in vineyards and orchards and on prevention and management of glyphosate-resistant weeds.

Glyphosate-resistant rigid ryegrass (Lolium ridigum) was reported in California in 1998.

Project Outputs

Training. Project participants conducted workshops for farm advisors, county agents, and pesticide applicators in two California counties in December, 2011, and in an additional county in February, 2012, for a total of three workshops. In Oregon, two workshops were offered in January, 2012. And in February, 2012, two workshops were carried out in Washington. An additional workshop will be conducted in Oregon by the end of November, 2012. Each workshop included components addressing

- IPM in vineyards and orchards
- Glyphosate stewardship (general view, efficacy, optimization, herbicide-environment interactions, drift, and safe applications)

> continued on page 3

What's Inside

Diane Clarke

Director's Comments

First, I want to thank Rick Melnicoe, Past Director, Linda Herbst, Past Associate Director, and Tom Holtzer, Past Co-Director, for their services, commitment, and hard work to develop the Western IPM Center as an institution that strongly supports the IPM community in the West. They built strong WIPMC teams and programs by listening to western IPM voices, implementing their excellent ideas, and facilitating projects and collaborations that have yielded tremendous results. As Center leaders, they created a flexible framework that works so well for the West, with its wide diversity of crops, densely- and sparsely-populated areas, immense public lands, and important natural resources. They created an environment that energized collaborations among IPM partners and focused on responding to stakeholder needs and delivering results.

New Funding

The Western IPM Center has been very active since June 30, when Rick and Linda retired. In late August, we were notified that the Center was awarded a new 4-year cooperative agreement. We will continue to build on the successes of the Center and collaborate with our stakeholders and the other Regional IPM Centers.

New Leadership

The Center now has three Co-Directors: myself; Peter Ellsworth, University of Arizona; and Paul Jepson, Oregon State University. I'm also serving as the PI. We are in the process of hiring a new Director. The role of the Co-Directors is to provide input to the Director, who will manage the Center. The Co-Directors each oversee a signature program as well (see article on page 6). Carla Thomas is serving as Associate Director, after working closely with Linda to receive training in her new role.

Rick Melnicoe

Recent Meetings

In September, the WIPMC held a staff meeting with its management and Comment Coordinators (Al Fournier, University of Arizona; Cathy Tarutani, University of Hawaii; and Jane Thomas, Washington State University Tri-Cities). We also held Advisory and Steering Committee meetings. The meetings were lively, with a number of action items that came from each. You will see more information about the continuation of successful WIPMC projects and the introduction of new ones. There will be an increase in communication about the full portfolio of services and funding opportunities offered by the WIPMC and more support tools to

Carla Thomas

engage our stakeholders in these opportunities. There will be more activity in documenting the importance and impact of IPM in the West as we work to broaden and diversify our funding base to support IPM throughout the western region.

Requests for Grant Proposals

The RFPs for the Western IPM Center-funded grants and the RIPM program for the western region will be posted soon. If there are topics that you feel should be of high priority in the RFPs, please contact Carla Thomas, ***cthomas@ucdavis.edu***, with your input by October 30.

The WIPMC and the other Regional IPM Centers have received tremendous support from our stakeholders concerning the importance of the centers and the work they and their grant recipients do. We appreciate this support and look forward to continuing our dialog in an inclusive, calm, rational manner.

—Kassim Al-Khatib

PMSP Update

Completed:

- **Desert Turf (Arizona, Nevada, and Southeastern California)**

Ongoing:

- **Orchid (Hawaii):** Currently being reviewed
- **Turf (Hawaii):** Currently being reviewed

Rick Melnicoe

- Herbicide resistance (general view, mechanisms of resistance, co-evolution, prevention, and management)
- Herbicide-resistant crops (impact on weed resistance and landscape)
- Glyphosate-resistant weeds (monitoring, mechanisms of resistance, prevention, and management).

To further the outreach, workshop PowerPoint presentations were provided to farm advisors and county agents (to be used in their local education programs) and posted on the UC Statewide IPM Program Web site.

Corn treated with glyphosate (left); untreated check plot (right).

Publications. As part of this educational outreach, project cooperators produced four Extension publications that are now available on the UC Statewide IPM Program Web site and cross-linked to the Oregon State University and Washington State University Web sites. These publications include:

Glyphosate Stewardship: Keeping an Effective Herbicide Effective

Lead Author: Tim Miller

This publication discusses ways to use glyphosate effectively, listing the following factors that should be considered, as they play a role in how well glyphosate controls weeds:

1) Formulation choices should be made based on the acid equivalent (the amount of glyphosate needed to control particular weed species) listed on the label.
2) Label instructions should be followed on use of adjuvants (products mixed with the formulated herbicide to improve its performance), such as surfactants, water-conditioning agents, or buffering agents.
3) Glyphosate should be applied to weeds that are as dust-free as possible. Since glyphosate binds tightly to soil, application to dusty weeds results in inactivation of much of the herbicide before uptake can occur. Glyphosate activity is poor in wheel tracks because of dust or mud on the weed foliage.
4) For various reasons explained in the publication, weed control with glyphosate is more effective with low-volume applications.
5) When tank mixing glyphosate with other pesticides or additives, chemical interactions can occur. To prevent unwanted interactions and possible reduction in the effectiveness of glyphosate, applicators should mix with other products only as listed on the glyphosate label.
6) Miscellaneous environmental conditions before, during, and after glyphosate application affect glyphosate absorption. Just a few examples include cold or heat, soil moisture, and leaf moisture from dew or rain.
7) To achieve maximum control with glyphosate, application timing is important. The stage of growth and life cycle of targeted weeds and the stage of growth and age of the crop need to be considered prior to using glyphosate.

Selection Pressure, Shifting Populations, and Herbicide Resistance and Tolerance

Lead Author: Brad Hanson

This 5-page publication includes sections on herbicide tolerance and weed shifts, herbicide resistance, mechanisms of herbicide resistance including target-site and nontarget-site resistance, glyphosate resistance, current status of herbicide resistance in weeds, and management of herbicide-resistant weeds. As the publication explains, tolerance can occur through temporal, spatial, or physiological mechanisms. Weed shift is the term used when a weed population becomes dominated by a species that is not affected by the weed control measures that have been used. Control measures that cause weed shift are often chemical, but they can also be nonchemical (e.g., flaming, weeding, or mowing). Herbicide resistance in weeds is an evolutionary process and is due in large part to selection caused by repeated use of the same herbicide, or repeated use of products with the same mode of action. Herbicide resistance mechanisms that relate to the specific site of action are called target-site mechanisms, while those that do not involve the active site of the herbicide in the plant are called nontarget-site mechanisms. An example of a nontarget-site mechanism would be a weed's enhanced metabolic ability to degrade an herbicide. Resistance to glyphosate in weeds is through both target-site and nontarget-site mechanisms.

The publication lists a number of cropping system, weed, and herbicide characteristics that can contribute to herbicide resistance. In terms of cropping systems, weeds in crops with little or no crop rotation or pre-plant or in-season tillage, with low crop competition, and with little or no rotation of herbicides with the same mode of action are more susceptible to herbicide resistance. A few examples of weed characteristics that affect selection pressure for herbicide resistance include high susceptibility to the herbicide, high seed production, and multiple generations per year. Herbicide characteristics that contribute to increased selection pressure for herbicide resistance include having a single site of action, having high efficacy, being used at high use rates compared to the amount needed, having a long soil residual activity, and having a high frequency of use.

The publication lists preventive measures that can be taken to delay or avoid herbicide resistance (i.e., rotating crops and herbicides and using tank mixes) and concludes that herbicide-resistance management requires the integrated diversification of chemical and nonchemical weed control methods.

Preventing and Managing Glyphosate-resistant Weeds in Orchards and Vineyards

Lead Author: Ed Peachey

This publication encourages the integrated use of mechanical, cultural, chemical, and biological prevention and management tactics. It notes characteristics of weed species and factors in the use of cultural practices that can influence the development of resistance. A table lists herbicides that have soil residual activity and are labeled for use in trees and vines, and the authors advise that combining an herbicide that has soil residual activity with glyphosate (or with another postemergence herbicide) can greatly extend the period of weed control and eliminate or greatly reduce the need for multiple applications of glyphosate.

Managing Glyphosate-resistant Weeds in Glyphosate-resistant Crops

Lead Author: Kassim Al-Khatib

This 5-page publication includes sections on IPM in glyphosate-resistant crops, field scouting, herbicide considerations in glyphosate-resistant crops, and herbicide options for managing glyphosate-resistant weeds. The most important principle of glyphosate-resistance management is to prevent the survival and spread of glyphosate-resistant populations. This publication lists the generally-recommended practices that growers or weed control managers should consider incorporating into their farming practices for managing glyphosate resistance:

- Growers or weed managers should utilize multiple herbicide modes of action, including those with residual effects, before applying glyphosate and/or tank mixing another herbicide with glyphosate.
- Growers or weed managers should apply herbicides at the recommended stage of weed growth as stated on the label.
- Conventional herbicides can and should still be part of the overall weed management system in glyphosate-resistant cropping systems.
- Since glyphosate resistance may be controlled by more than one gene, it is important for growers or weed managers to use full label glyphosate rates.

Impacts and Potential Impacts

The educational materials, workshops, and training sessions have improved the knowledge of farm advisors, PCAs, consultants, and other attendees about preventing and managing glyphosate-resistant

> continued on page 8

European Grapevine Moth, *Lobesia botrana* (Lepidoptera: Tortricidae) Eradication Program in California

By Lucia G. Varela and Monica L. Cooper, University of California Cooperative Extension

On September 15, 2009, the European grapevine moth (EGVM) was reported for the first time in North America, in Napa County, California. It had been previously reported for the first time in South America in 2008, in Chile, and it was subsequently reported in Argentina in 2010. In Napa County in 2009, larval damage and associated fungal rot resulted in total crop loss in a 10-acre vineyard. This triggered regulatory actions by the U.S. and California Departments of Agriculture (USDA and CDFA). Growers in Napa County reported crop damage in the now-known infested area in 2008 and throughout 2009. The introduction of this invasive species is of great concern because of increased production costs and the potential loss of markets due to trade restrictions. Though the largest infestation was in a wine grape production region, EGVM adults were detected in very low numbers in a table grape vineyard. If pest populations were to become established in table grape production regions, significant economic impact to the California table grape industry could result due to export restrictions imposed by importing countries.

In addition to the regulatory response, there were rapid research and outreach responses by USDA-Animal and Plant Health Inspection Service (APHIS) and the University of California Cooperative Extension (UCCE) Service and Statewide IPM Program. UCCE personnel developed brochures, a bilingual poster, and online presentations to help vineyard workers and professionals recognize all life stages of EGVM and take appropriate steps. Information generated from field observations, research trials, and regulatory policy was reported semi-weekly through the UCCE Napa County EGVM newsletter. This alert system provided grape growers in all affected regions of the state the information needed to apply control measures at the appropriate time. In addition, the most current information on detection, biology, and management was presented through more than 85 seminars and field days in 2010 and 2011.

Damage

First-generation larvae feed on flower clusters inside a "nest" of webbing. Second and third generation larvae feed inside berries. Injury to the berries allows for infections by various fungi, resulting in bunch rots, which are the main cause of fruit loss.

Quarantine

The regulatory program uses two criteria to define an EGVM detection: 1) a total of two or more adult EGVM are trapped within 3 miles of each other and during the timeframe of one lifecycle, or 2) DNA analysis confirms the presence of one or more immature stages. In 2010 and 2011, quarantine areas were established within a 5-mile radius of EGVM detections. In 2012 the quarantine area was decreased to a 3-mile radius from a detection.

Jack Kelly Clark

European grapevine moth adult.

Delimitation

In 2009, the pest was detected late in the season, at or near the end of the third adult flight. From October 7 to 26, 2009, delimitation (defining the limits) of the population was attempted by deploying 265 pheromone-baited traps in a radial pattern from the original find. Additional traps were placed on the border between Napa and Sonoma counties. Despite the large number of larvae found in vineyards during this period, only six moths were trapped in Napa County. This indicates that the majority of the population was in the larval or pupal stage at the time that the trapping occurred. Ground surveys revealed two pockets of infestation, one between the towns of Oakville and Rutherford and another east of the city of Napa.

In order to determine where EGVM populations were located, in 2010 traps were deployed throughout the vineyard regions of California, at densities of 25 or 16 traps per square mile, inside and outside the quarantine area, respectively. These delimitation traps caught moths in 10 California counties (see table). Napa County had the highest densities and greatest geographical distribution, although trap catches decreased from the first to the third flights of 2010. The neighboring county of Sonoma, to the west, had the second highest number of sites with detections. As a result of the delimitation trapping, eight California counties had regulated areas. Monterey and Santa Clara Counties were not regulated, because only one moth was caught in each during 2010.

Number of EGVM Male Moths Trapped by County in California, 2010–2012

	North Coast				Central Valley			Central Coast			Sierra Nevada
Flight	Napa	Sonoma	Solano	Mendocino	Fresno	Merced	San Joaquin	Santa Cruz	Santa Clara	Monterey	
2010	100,831	59	11	36	11	4	2	1	3	1	0
2011	113	9	0	0	0	0	0	1	19	0	4
2012	77	0	0	0	0	0	0	0	0	0	0

Statewide trapping efforts continued in 2011 and 2012 at densities of 25 traps per square mile of vineyard. In urban areas the density was five traps per square mile in 2010 and 25 traps per square mile in 2011–2012. Traps in urban areas were placed on EGVM host plants, when available. In 2011, moths were caught in five counties in substantially lower numbers than in 2010. Moths were trapped in Nevada and Santa Cruz Counties, resulting in a total of 10 regulated counties. The greatest number of moths was caught in Napa County. In the remaining four counties, moths were caught only during the first flight. In 2012, moths were caught only in Napa County during the first flight.

Procedures for Deregulation

In order to qualify for release from quarantine restrictions, there may not be any EGVM life stages found within the identified area for a total of five consecutive generations. In areas slated to be deregulated, commercial vineyards and residential properties within 500 meters of any EGVM detection must be surveyed at a density of 100 traps per square mile for at least two generations, with traps deployed by March and maintained through the end of the season. In these areas, no mating disruption is permitted. Four counties (Fresno, Mendocino, Merced, and San Joaquin) that did not have detections during the second and third EGVM generations of 2010 and in 2011 were deregulated in early 2012, and Solano County is in the process of being deregulated. Of the five remaining counties, four of them (Nevada, Santa Clara, Santa Cruz, and Sonoma) may qualify for deregulation at the end of 2012 if all the conditions mentioned above are met.

Control Measures

With the goal of eradication, eggs and larvae of the first and second generations of 2010 were targeted with insecticide applications. Insecticide treatments during the third generation were recommended if eggs or larvae were detected. The insecticides most widely used were methoxyfenozide, chlorantraniliprole, and, for organic production, *Bacillus thuringiensis* kurstaki and spinosad. Mating disruption dispensers were recommended in Napa County only. Isomate® EGVM was deployed at the beginning of the second flight once the product was registered for use by U.S. EPA and the California Department of Pesticide Regulation.

In 2011 and 2012, recommendations were to treat the first two of the three generations on all vineyard acreage within 500 meters of the location of a life stage detection and to apply mating disruption. Mating disruption was not used in areas of the state that were attempting to be released from quarantine regulations at the end of that year. For each of the two first generations, a conventional insecticide, or two applications of an organic insecticide, was recommended. Napa and Sonoma Counties had the greatest number of affected sites. Approximately 25,200 vineyard acres in Napa County and 2,390 vineyard acres in Sonoma County were inside the 500-meter treatment zones in 2011. In the remaining eight regulated counties in 2011, the combined area requiring treatments was approximately 2,500 acres.

The recommended timing of insecticide applications was determined by monitoring the male flight with pheromone traps, observing egg and larva development, and calculating degree-days (10°C for the lower threshold and 30°C for the upper threshold). To minimize costs to growers, a treatment window of 3 weeks was provided for each generation so that the applications could be combined with powdery mildew treatments.

In urban and residential areas, CDFA personnel removed flower and fruit clusters from noncommercial grapevines in the spring and early summer. In addition, mating disruption dispensers were deployed in some urban areas in some counties.

Alternate Host Surveys

In 2010 and 2011, UCCE personnel conducted a monitoring program in olive groves in Napa County, primarily using pheromone traps. In addition, in 2010, UC personnel conducted timed searches during the first and second generations when third to fifth larval stages were present. USDA-APHIS personnel conducted bi-monthly surveys in the riparian corridor and adjacent vegetation during the 2010 and 2011 field seasons. Surveys were conducted on wild grapes and EGVM-regulated plants. Plants being regulated are those listed as hosts in the European literature. The only host of consequence identified so far in California is grape, Vitis vinifera. Olive flowers were a minor host in Napa only during the first EGVM generation of 2010. Olive fruit did not host either the second or third generations. No moths were caught on traps placed in olive groves in 2011. EGVM larvae were not found on wild grapes in the riparian corridor. Daphne gnidium, considered an important alternate host in Mediterranean Europe, is not found in the United States.

Summary

As a result of the rapid response, EGVM populations decreased from more 100,000 in 2010 to very low numbers in 2012, as recorded by detection traps in the statewide program. The program relies on trap counts as an indirect measure of population density in the absence of a large, dedicated workforce to conduct visual sampling and monitoring programs. In those areas where mating disruption was deployed during 2011 and 2012, the lack of an effective tool to monitor under mating disruption prevented us from reliably measuring population levels.


Lucia Varela

Cluster damage caused by larval feeding.

By November 2011, four counties met all the conditions for deregulation, and a fifth county had met them as of August, 2012. In these counties, no moths were caught during five generations. No mating disruption was used in these areas during the last year before deregulation. For the last two generations, trap density was increased to 100 traps per square mile. Populations initially detected by the trapping program in these counties were quite low and of limited distribution. With fewer affected properties, treatment programs were easier to manage. This is in stark contrast to the nearly 25,000 acres that were affected by the 500-meter treatment zones in Napa County (considered the epicenter of the population) in 2011 and 2012.

Feasibility of Eradication

It remains to be seen whether the aggressive treatment program will successfully eradicate EGVM from California, especially in areas such as Napa County where populations were well-established and widely distributed. Arguments for the feasibility of eradicating EGVM from California are that 1) no alternate host of consequence has been found, 2) effective control tools are available, and 3) to date, there has been a high level of compliance with treatment programs. However, moths are weak flyers, and at very low populations, pheromone emitted by females to attract males may compete with the pheromone traps and further limit the program's ability to detect small populations. Populations have also been detected in residential areas, where they are harder to monitor and more complicated to manage.

Western IPM Center Develops Two New Signature Programs, Continues a Third

Based on stakeholder-established regional priorities, in September the Western IPM Center began two new signature programs related to 1) climate and weather-based decision support tools and 2) crop pest losses and impact assessment. A third signature program, begun in 2011 to develop protocols for response to invasive species, will continue in this funding period. WIPMC leadership and staff will be involved in directing the activities for the three programs, providing support to accomplish each program's objectives. All three programs will foster new collaborations between and among individuals and agencies, and they will all support collaborations with the other Regional IPM Centers.

Regional Infrastructure for Climate- and Weather-based Decision Support Tools

From 2006 to 2011, the Western IPM Center funded a regional weather systems work group to establish a cooperative, multistate, multiagency, public- and private-sector platform for refinement and delivery of climate- and weather-based pest and crop models. The work group developed tools that integrate U.S. weather data and research-based plant pest and disease models to serve many decision support needs in agriculture in the United States and the West (see *http://uspest.org/wea/*).

The goal of this signature program is to advance IPM systems in the western United States and nationally by providing access to quality-controlled climate and weather data for any state that wishes to partner with the Western IPM Center. The program will achieve this goal by combining advanced, server-based tools and services with tailored education and outreach. State partners will identify their specific needs for data and services, and these will then be delivered from the central system through the local partner's Web site.

The services offered through this program will include 1) incorporating data from specific agricultural weather networks that will then be made available for integration within state-based systems; 2) comprehensive back-up for weather data; 3) centralized delivery of quality-controlled weather data from diverse networks in a specified region; and 4) additional access to virtual weather station utilities. The program aims to ensure that each state will have the basic datasets they need in order to develop and deliver weather-based decision support tools and to exploit the models and tools that already exist. Project cooperators will provide workshops at regional meetings to describe these services and to enable partners to advance their IPM-support capacities further.

Crop Pest Losses and Impact Assessment Program

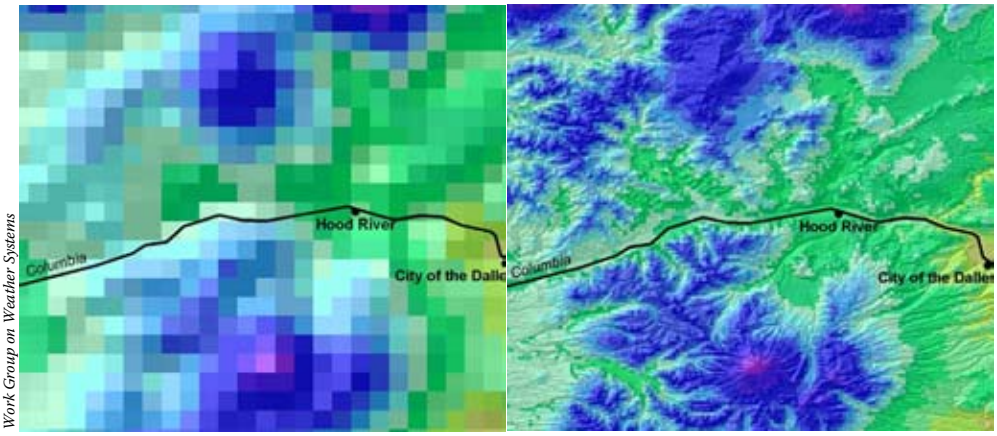
Funded as a Western IPM Center work group since 2004, the Crop Pest Losses and Impact Assessment program has developed a process for capturing real-world data on the impacts of pests and pest management practices on crops. These data are essential for IPM evaluation and needs assessment, identification of stakeholder priorities, support of pesticide registration needs, and to respond to federal, regional, and local information needs. The group has worked with stakeholders in Arizona and southern California (and occasionally West Texas) in key desert crops (cotton, cantaloupes, watermelons, and lettuce) to develop the data. Surveys, which are implemented through face-to-face workshops, provide insights into growers' decision making and the intent behind specific pest management practices. Stakeholder participation at the face-to-face workshops is increased by careful scheduling and by providing benefits for participation (e.g., CEUs, travel reimbursement).

Gary Kramer, USDA-NRCS

Cotton

The goal of this signature program is to expand the reach and implementation of the crop pest losses survey program to other states so that they may benefit from the process, the survey instruments, and the impact assessment analyses. This will provide a major step forward in learning about IPM practices in use by growers and in evaluating IPM adoption.

To meet this goal, project personnel will work with interested parties in western states to help them conduct their own pilot crop pest losses assessments, including survey preparation, workshop implementation, data collection, and analysis. They will support collection of data on pest losses (insects, weeds, and plant pathogens), pesticide use, and control costs, plus calculations of economic and environmental impacts of pest management practices. Data survey instruments will be made available online for adaptation to other crops and regions, and training and onsite support will be provided to states wishing to use this process to assess IPM implementation. While face-to-face interactions are preferable to ensure quality and completeness of data provided, cooperators will determine whether online surveys can be an economical supplement (if not substitute) for workshops.



Work Group on Weather Systems

These images show a 4km (left) and 800m (right) scaling of temperature for the Mount Hood area of Oregon, a cherry and pear production region. To advance IPM systems in the West and nationally, access to quality-controlled climate and weather data will be provided for any state wishing to partner with the Western IPM Center.

Protocols for Responding to Invasive Species in the West

In 2011, the Western IPM Center undertook a signature program related to invasive species (see update, below), with the overall goals of improving prevention, detection, and reporting as well as rapid risk assessment and response to new invasive species threats. This signature program is being continued in the current grant period.

With its many international ports of entry and borders with states and nations, western states are under exceptional pressure from increasing introductions of exotic and invasive insects, weeds, and plant diseases. Invasive species pose a serious threat to agricultural production, services from natural resources, and urban communities. To deal effectively with invaders in ways that are economically and environmentally acceptable and that cause minimum disruption of IPM strategies and tactics targeting other pests it is critical to have coordinated cooperation, knowledge of these species, understanding of invasive species biology and ecology, and potential control and eradication strategies.

Project cooperators will continue developing processes that ensure regional communication and collaboration for earlier detection and rapid response to manage, control, and/or eradicate the identified high priority invasive species. The program brings together a work group of interested partners in the West—including federal, regional, state, and local entities—to address invasive insects, plants, and plant pathogens, and coordinate a rapid response to a few of the most threatening of these. In the new grant period, weed, insect, and plant pathogen subgroups of the work group established in 2011–2012 will continue their work. Each group is charged with developing a generalized plan for the pest type addressed by the group, taking into account necessary leadership and participation, critical avenues of communication, and appropriate messaging; rapid collection of available information from reliable sources; and mechanisms to implement such a plan efficiently. Focus groups will extend the participation, in particular to involve tribes and other underserved groups. Each subgroup is expected to develop an educational tool and hold a symposium related to early detection and rapid response in their pest discipline, bringing in others who would benefit by use of the protocols.

Joseph M. DiTomaso, University of California - Davis, Bugwood.org

Horseweed (Conyza canadensis).

Update: 2011–2012 Signature Programs

IPM and Water Quality

Work group members met in November, 2011, and April, 2012, to draft three 1-hour educational modules on "Best Management Practices to Reduce Pesticide Impacts on Water Quality in the West." The agriculture module targets agricultural licensed pesticide applicators. The two urban modules are tailored for landscape professionals and homeowners/master gardeners. All three modules have been peer-reviewed, and the final versions of the curricula will be made available to IPM educators late this year.

Protecting Pollinators and Beneficials

This signature program has been completed. A 2-day workshop entitled, "Protecting Beneficials in Hawai'i and the American Pacific: A Workshop on the Conservation of Pollinators and Other Beneficial Species" was held for growers and extension personnel on April 18 and 19 in Waikiki Beach, Hawai'i. A full report on this successful workshop was the lead story in the Western IPM Center's June, 2011, newsletter: ***http://www.wripmc.org/newsletter/index.html.***

Coordinating Responses to Invasive Species in the West

In July, the Western IPM Center convened a meeting of a broad range of invasive species specialists throughout the region to identify high priority invasives in the West. After a whole-group discussion of regional needs, three pest-specific subgroups (weeds, pathogens, and arthropods) met. The whole-group discussion included, among other things, a focus on how the group might help build relationships among universities, growers, regulators, commodity groups, and other stakeholders to more effectively respond to invasives. Each subgroup chose a high-priority invasive species and began planning their approach to providing leadership, communication, and coordination of responses. The weed subgroup will focus on hydrilla (*Hydrilla verticillata*); the pathogen subgroup chose the pathogen *Liberibacter solanacearum,* which causes zebra chip in potato and vein greening in tomato; and the arthropod subgroup chose European grapevine moth (*Lobesia botrana*).

IPM Adoption Dynamics and Impact Assessment

Adoption of IPM practices is a central theme of much of the work of the Western IPM Center and other Regional IPM Centers. Documenting and quantifying adoption of IPM practices and their impacts plays an important role in many Center-funded projects. However, in spite of the significance of adoption, there has been little targeted effort to develop good practice guidelines for assessing IPM adoption, or to research the dynamics of adoption generically. This signature program began in 2012 for the purpose of developing impact assessment strategies and tools for the West and beyond.

The immediate objective is to develop a good practice guide for natural scientists to use in routine adoption studies. The longer-term objective is to provide a forum for interaction among researchers, social scientists, economists, and extension specialists with an interest in adoption dynamics to facilitate development of methodology on IPM adoption and preparation of grant proposals.

Team participants met by conference call for the first time in September and will have a face-to-face meeting later this year following regular teleconferences.

Glyphosate—*from page 3*

weeds. All participants of the workshops acknowledged that the publications and training will help them incorporate IPM processes in decision making to prevent and manage glyphosate-resistant weeds. Additional potential impacts of this project among growers and IPM consultants include:

- Improved knowledge about the use of IPM in vineyards and orchards
- Increased understanding of the risks to pest management overall when IPM is not fully adopted
- Increased understanding of the relationship between resource management and IPM
- Increased number and diversity of IPM practices, leading to reduced risks from pests and pest management strategies to crops, human health, and the environment
- Increased economical and environmental benefits through the reduction of high-risk activities while productivity and profitability of grape and tree fruit production are sustained

Finally, project cooperators expect that this training model can be applied to additional specialty and agronomic crops in the future to improve the use of IPM and reduce negative consequences of standard pest management practices.

State Brief

UTAH

Utah State University Cooperative Extension will be sponsoring a 1-day workshop on spotted wing drosophila and brown marmorated stink bug in mid-February, 2013 (date to be decided). Speakers will include Dr. Jana Lee, Research Entomologist, USDA-Agricultural Research Service in Corvallis, Oregon, and Dr. Tracy Leskey, USDA Research Entomologist at the USDA Appalachian Fruit Research Station, West Virginia. Dr. Lee has a multistate program studying the spotted wing drosophila's fruit preference and damage, while Dr. Leskey is heading up an extensive stink bug network and research program. The workshop will include other speakers as well as a grower perspective. When finalized, details will be posted on the Utah State University IPM Program Web site, ***http://utahpests.usu.edu/ipm***.

—Marion Murray, Utah State University Cooperative Extension, ***marion.murray@usu.edu.***

Mark Your Calendar

2012

- PestWorld 2012, October 17–20, Boston, Massachusetts. ***http://www.npmapestworld.org/pestworld2012***
- Entomological Society of America 60th Annual Meeting, November 11–14, Knoxville, Tennessee. ***http://www.entsoc.org/am/fm/index.htm***

2013

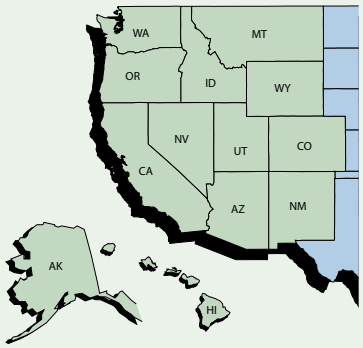
- 53rd Annual Meeting of the Weed Science Society of America & 67th Annual Meeting of the Northeastern Weed Science Society, February 4–7, Baltimore, Maryland. ***http://www.wssa.net/meetings/wssaannual/info.htm***
- Western Society of Weed Science Annual Meeting, March 11–14, Catamaran Resort Hotel, San Diego, California. ***http://www.wsweedscience.org/default.asp***
- 59th Annual Conference on Soilborne Plant Pathogens (formerly Soil Fungus Conference), March 26–28, Oregon State University, Corvallis, Oregon. ***http://soilfungus.ars.usda.gov***
- 52nd Annual Meeting of the Society of Nematologists, July 14–17, Cleveland, Ohio. ***http://www.nematologists.org***
- American Phytopathological Society (APS)-Mycological Society of America (MSA) Joint Meeting, August 10–14, Austin, Texas. ***http://www.apsnet.org/meetings/annual/pages/default.aspx***
- Entomological Society of America 61st Annual Meeting, November 17–20, Austin, Texas. ***http://www.entsoc.org/am/fm/index.htm***

2014

- 26th Vertebrate Pest Conference, March 3–6, 2014, Big Island, Hawaii. ***http://www.vpconference.org***

Rick Melnicoe

Center Scope



The Western IPM Center enhances communication between federal and state IPM programs in the western United States: Alaska, Arizona, California, Colorado, Hawaii and the Pacific territories, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. It serves as an IPM information network, designed to quickly respond to information needs of the public and private sectors.

The Western Front is published three times a year by the Western Integrated Pest Management Center (WIPMC), University of California, One Shields Ave., Davis, CA, 95616. The newsletter is available online at ***www.wripmc.org.*** The WIPMC is supported by a grant from USDA-National Institute of Food and Agriculture.

Director:
Kassim Al-Khatib, (530) 752-8350
kalkhatib@ucdavis.edu

Editing, Writing, Design:
Diane Clarke, (530) 752-7011
dmclarke@ucdavis.edu

Acknowledgements:
Banner images: wheat field, *Rick Melnicoe, WIPMC;* Seattle skyscrapers, *Denny Fleenor, Washington State University;* and creek in foothills, *Suzanne Paisley, University of California Division of Agriculture and Natural Resources, Communication Services*

USDA United States Department of Agriculture National Institute of Food and Agriculture