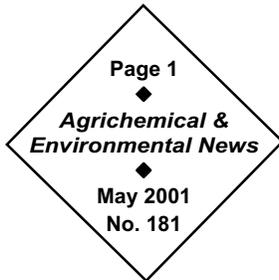


Agrichemical and Environmental News

A monthly report on pesticides and related environmental issues



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Pesticide/ESA Task Force Unveils Evaluation Process Comments Accepted through May 29

Bridget Moran, Endangered Species Coordinator, WSDA

On March 28, 2001, in Olympia, the Washington State Pesticide/Endangered Species Act (ESA) Task Force released a proposed strategy for assessing the potential biological effects of pesticide exposure to threatened and endangered salmonids in Washington State. Jim Jesernig, the Director of the Washington State Department of Agriculture (WSDA), along with other members of the Task Force, explained the proposal to representatives from the tribal, environmental, and agricultural communities. In each session, the policy perspective was given as well as the technical overview of the Task Force proposal.

The aim of the public roll-out was to introduce the Task Force's draft strategy as outlined in a document entitled, *A Process for Evaluating Pesticides in Washington State Surface Waters for Potential Impacts to Salmonids*. The draft document is available on the Internet and is open for public comment for sixty days, ending May 29, 2001. Access all documents related to the launch via the WSDA home page at <http://www.wa.gov/agr/>, or the draft

strategy document directly at <http://www.wa.gov/agr/pmd/docs/publications/final.pdf>.

Background

In response to the federal listing of salmonid species under the Endangered Species Act, the National Marine Fisheries Service (NMFS) published ESA Section 4(d) rules to protect and recover salmon and steelhead species (1). These rules identified pesticides, among other factors, as potentially limiting the recovery of at-risk wild salmonid populations.

As highlighted by the 4(d) rules, there is considerable scientific uncertainty regarding (1) the extent to which salmonids are exposed to pesticides, and (2) the effects of environmentally relevant concentrations of pesticides on the aquatic food chain and the biology of exposed fish. As a result, NMFS has stated that rather than using its enforcement authority against individual applicators for the "otherwise-lawful" (i.e., following the EPA-registered label and other applicable use restrictions) use of pesticides, it intends to address pesticide issues through the ESA

Pesticide/ESA Task Force, cont.

Bridget Moran, Endangered Species Coordinator, WSDA

Section 7 consultation process or discussions with responsible state authorities (1). The Washington State Pesticide/ESA Task Force grew out of this commitment to work with the appropriate state and federal agencies to design a science-based process to address pesticide use relative to threatened and endangered (T/E) salmonids.

The Task Force

The Washington State Pesticide/ESA Task Force is an interagency technical and policy team composed of scientists and managers from resource and regulatory agencies. These include: NMFS Northwest Region, U.S. Fish & Wildlife Service (USFWS) Western Washington Office, U.S. Environmental Protection Agency Region 10, the Washington State Departments of Agriculture, Natural Resources, Ecology, and Fish & Wildlife. Scientists from the U.S. Geological Survey and Washington State University contribute to the Task Force in an advisory capacity.

The Task Force was formed in March 2000. Under the direction of the Task Force policy members the technical team defined its goal: to determine which pesticide uses may cause harm to, or potentially limit the recovery of listed salmonids in the wild in Washington State; and to recommend the need for management actions through the regulatory process to reduce and/or eliminate exposure to and therefore risk from those pesticides.

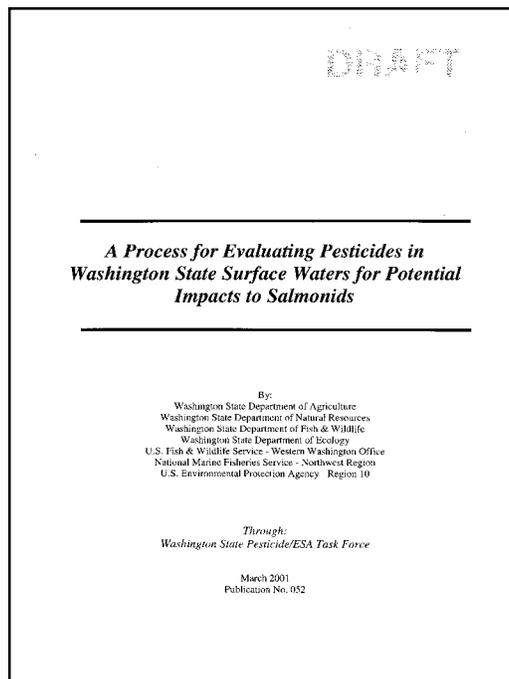
To identify pesticides that potentially limit the recovery of listed salmonids in the wild, the Task Force developed an evaluation process, or decision matrix. The pesticide decision matrix incorporates the available scientific data on 1) the occurrence of pesticides in

salmonid habitat, and 2) the toxicity of these chemicals to fish or the aquatic food chain. The matrix will also serve to identify important areas of scientific uncertainty or data gaps. The decision matrix developed by the Task Force will be used to screen pesticides to determine their potential risk to the biological requirements of salmonids.

Conclusion

The Department of Agriculture's involvement in this process is twofold: (1) to provide certainty to growers and other pesticide users that if a pesticide is identified as a potential problem for salmonids, WSDA will work with the regulated community to affect changes that will eliminate, minimize or mitigate salmonid exposure; and (2) to work with NMFS and USFWS to obtain ESA assurances for the use of pesticides that are not limiting the recovery of listed salmonids. WSDA believes that involvement in this process provides a direct avenue for input on endangered species and water quality issues that may impact Washington agriculture.

Bridget Moran is Endangered Species Coordinator with the Washington State Department of Agriculture (WSDA). She can be reached at BMoran@agr.wa.gov.

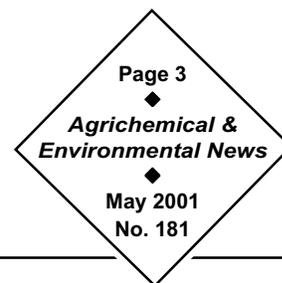


View on-line at <http://www.wa.gov/agr/pmd/docs/publications/final.pdf>; all other related documents are at <http://www.wa.gov/agr/>.

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Halstead Receives EPA Award



Agrichemical and Environmental News Staff

Sandra Halstead was recently recognized by the U.S. Environmental Protection Agency (EPA) as the recipient of their "Nonsupervisory Award for Advancing Environmental Protection" for Region 10. The award recognized her excellence in

"...pioneering a new way for EPA to work with agriculture, by collaborating with growers, land grant faculty, USDA-ARS Researchers, commodity groups, and others at the local level to work toward environmentally sensible agriculture."

Among many other achievements, Halstead assisted the Washington Pest Consultants Association (WaPCA) and Northwest Ag Plastics with obtaining EPA grant funds to purchase on-site storage containers for holding plastic containers until they can be recycled. (WaPCA and NW Ag Plastics provide an agricultural plastics recycling service, see p. 13.) She has secured funding for important IPM and reduced-risk pest management strategies and serves a leadership role in many collaborative ventures including WSU's Center for Sustaining Agriculture and Natural Resources and the Para Niños Saludables!/For Healthy Kids! project with the University of Washington and Fred Hutchinson Cancer Research Center. This award recognizes Halstead as an effective bridge between the regulatory and agricultural communities.

Sandra Halstead's office is located in the Irrigated Agriculture Research and Extension Center in Prosser. She can be reached at (509) 786-9225 or halstead.sandra@epa.gov and her website is on the Internet at <http://epa.prosser.wsu.edu>.

Halsead and other National Honor Award winners were recognized in a ceremony on April 10, 2001, in Washington, D.C. Congratulations, Sandy, on a job well done!

WSDA Waste Pesticide Collection

The Washington State Department of Agriculture periodically collects waste agricultural and commercial grade pesticides from residents, farmers, business owners, and public agencies free of charge. The goal of this program is to properly dispose of unused or unusable pesticides, eliminating these as potential sources of contamination to the environment. Since disposal is complex, participants must register prior to an event to allow WSDA and the waste contractor to determine the types and amounts of pesticides that will be collected. To register, or for

more information, contact WSDA at **(877) 301-4555**. Summer collection events are shown here. For a complete schedule, including fall and eastern Washington dates and locations, point your Internet browser to <http://www.wa.gov/agr/pmd/pesticides/WasteSchedule2001.htm>.

Collection Site (Nearest City)	Collection Event Date	Registration Deadline	Inventory-to- WSDA Deadline
Bremerton	July 17	May 30	June 12
Seattle	July 18	May 30	June 12
Bellevue	July 19	May 30	June 12
Long Beach	August 20	July 12	July 24
Grays Harbor	August 21	July 12	July 24
Forks	August 22	July 12	July 25
Port Townsend	August 23	July 12	July 25
Shelton	August 24	July 12	July 25

For information on pesticide *container* collection, see the schedule and information on page 13.

Biocontrol of Insect Pests in Potato

Drs. L. Lacey, D. Horton, and T. Unruh, USDA-ARS; Dr. K. Pike, WSU; M. Márquez, USDA-ARS

Of the many insect and mite pests found on potato, those with the greatest opportunities for biological control in the context of integrated pest management are the Colorado potato beetle, *Leptinotarsa decemlineata*, and the green peach aphid, *Myzus persicae*. This essay focuses on these two species, with examples of other insect pests when appropriate.

Principles of Biological Control

Some background on the general principles of biological control is useful in understanding its benefits and costs in potato production. Biological control is the science of purposefully enhancing the activities of beneficial species to reduce the damaging activities of pest species. It is the foundation for sound integrated pest management (IPM) (26).

Biological control takes three forms in practice: classical, conservation, and augmentative.

Classical biological control involves importing a natural enemy of a pest insect to an area where it does not naturally occur. If the introduced enemy establishes (as it does in about 30% of cases) and if it has a high level of parasitism or predation in its native range (18), this can result in long-term reduction of the target pest population. Typically, classical control has been most successful in perennial agroecosystems such as tree crops, vineyards, ornamental plantings, and forests.

Conservation biological control fosters natural enemy abundance by reducing harmful influences and enhancing positive ones. This may entail replacing a broad-spectrum insecticide with a species-specific tactic or a narrow-spectrum insecticide or changing the timing of insecticide use to avoid periods when natural enemies are most exposed. It can include providing alternate habitats for the natural enemy to feed, reproduce, or overwinter.

Augmentative biological control can be either inoculative or inundative. When seasonal agricultural practices interfere directly with natural enemies or with the availability of host or prey populations,

natural enemy populations may be reduced to such a degree that they may be unable to catch up to rapidly increasing pest populations and prevent pest damage of the commodity before harvest. Inoculative control can be used to address these seasonally repeating problems, which are typical of annual cropping systems such as potatoes. Natural enemies can be introduced earlier in the season than they would normally occur, giving them time to reproduce and suppress pests earlier in the cropping cycle. Inoculative biological control is the foundation for pest control in many glass house production systems (31) and has been attempted for potatoes. Inundative approaches involve augmentation of the natural enemy population for an immediate, directed effect. Releases are typically large-scale and are often repeated many times during the cropping cycle.

So where does biological control using insects and pathogens fit into potato management? A review of the more notable beneficial insect species and pathogens that attack Colorado potato beetle and green peach aphid will provide some insight on this subject.

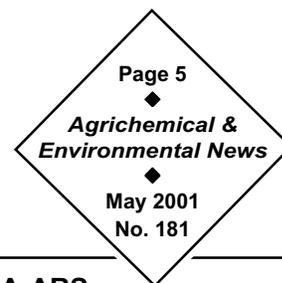
Colorado Potato Beetle Enemies

The twospotted stinkbug, *Perillus bioculatus*, is known to be an effective enemy of Colorado potato beetle (12). Feeding on all stages of the beetle, a single twospotted stinkbug may consume over 300 eggs during its development (27). Second instar stinkbug nymphs consume approximately five newly hatched beetles per day, or almost thirty larvae per nymph over the duration of that instar.

Attempts to establish *Perillus* as a classical biological control agent in Europe have proven unsuccessful (21). Naturally occurring densities of *P. bioculatus* appear to be too low to control the beetle below economically damaging levels, thus inundative releases of insectary-reared bugs have been studied in the field. Releases at the rate of one predator per plant caused reductions in beetle densities of about 30%, while releases of three per plant reduced beetle numbers by 60% (1). It is, however, unlikely that these predators can be reared economically enough

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Potato Biocontrol, cont.



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for inundative releases to be commercially viable (12). Despite considerable research, the timing and rate of release that will prove most effective in controlling the beetle remains unclear. More basic research on the biology of this species outside of potato fields could offer opportunities to modify adjacent habitats to enhance the abundance of *Perillus*. Combining releases of *P. bioculatus* with use of a microbial pathogen may provide better control of the beetle than either organism by itself (5, 25). More research is needed regarding compatibility of these predators with other control products, both biological and chemical.

Ladybird beetles can be common in potato fields particularly if aphids are present. Some species (most notably, *Coleomegilla maculata*) may feed extensively on Colorado potato beetle eggs. Laboratory trials indicate that a single adult *C. maculata* consumes more than ten Colorado potato beetle eggs per day, though that rate drops when aphids are present. No significant tests of inundative releases of *C. maculata* for suppression of Colorado potato beetle have been published.

Ground beetles (carabids) are common in unsprayed potato fields, but their impact on Colorado potato beetle is not known, partly because there are many species present and their feeding activity is either cryptic or nocturnal. Laboratory studies have shown that a number of different species of ground beetles feed on Colorado potato beetle, in both choice and no-choice tests (12). One species, *Lebia grandis*, has been shown to actively feed on eggs of Colorado potato beetle, consuming over forty-five eggs per day per predator. Recent conservation experiments using straw mulch in potato plots showed a significant reduction in the number of middle instars of first generation Colorado potato beetle attributed to carabids mid-May to mid-June (3). Ground beetles are much too slow growing and difficult to rear to be considered for augmentative forms of biological control.

Myiopharus doryphorae is a tachinid fly whose larvae are parasites of Colorado potato beetle larvae. The adult *M. doryphorae* injects maggots into the body of

the larval beetles. Since parasitism typically does not build until later in the season (29), this fly's effectiveness in controlling the beetle may not be commercially viable.

When a wasp (*Edovum puttleri*) was found in Colombia attacking a close relative of Colorado potato beetle, then subsequently found attacking Colorado potato beetle in Mexico, researchers attempted to establish it as a classical control agent. Control failed, however, because the wasp could not survive the winters in our northern production areas. Another stumbling block is that the wasp is known to depend on aphid excretions (honeydew) as an energy source, but aphids are typically not very abundant in potato until July. Augmentative releases hold more promise for successful control. One study showed 50% egg parasitism resulting from early-season releases of *E. puttleri*.

Species of Neuroptera (lacewings), Hymenoptera (vespid wasps), Nabidae (damselfly nymphs), Araneae (spiders), Lygaeidae (big-eyed bugs), and Reduviidae (assassin bugs) have been reported to feed on eggs, larvae, or adults of Colorado potato beetle. In general, their impact on the beetle under commercial conditions is unknown, but recent studies using predator exclusion cages show that egg survival is increased threefold if predators are excluded (19). These studies demonstrated that predation activity was independent of beetle density. Thus, the use of other nondisruptive tactics that lower beetle populations are fully compatible with predator activity.

Green Peach Aphid Enemies

Ladybird beetles, hoverflies, and lacewings are the dominant predators of green peach aphid. Studies have compared feeding rates of different predator species to help determine which might be most effective in the field. Ladybirds appear to be of particular importance in suppressing green peach aphid in potatoes (28), but the whole predator complex (comprising big-eyed bugs, damselfly nymphs, hoverflies, lacewings, and minute pirate bugs) must be considered in any biological control program for potato.

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Potato Biocontrol, cont.

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Timing of aphid infestation, timing of predator infestation, and densities of immigrating pest and predators are critical in determining whether natural enemies successfully suppress green peach aphid populations in potatoes.

Many Hymenoptera (the order containing bees and ants) are aphid parasites. Two Old World parasitic wasps, *Aphidius colemani* and *A. matricariae*, that attack green peach aphid are now established in Washington's potato production areas. Most of the main insecticides used on potatoes in the past have adversely impacted beneficial insects, including parasitic Hymenoptera. Use of more selective products will increase parasite and predator survival and presence in potatoes.

Another Old World parasite, *Praon gallicum*, discovered attacking green peach aphid in 2000 in western Washington, is now in culture at WSU Prosser, and will be mass-reared in early 2001 and subsequently released against green peach aphid in eastern Washington. These newly released species are enhancing the existing pool of beneficials, and will impact green peach aphid populations not only on potatoes, but also on weeds. These parasites will not eliminate the aphid, but they are expected to play a more important role in the future as softer chemicals come into wider use.

Aphid parasitoids are readily mass produced, but their potential for augmentative releases early in the season before aphids become numerous has not been adequately studied. The cultivation of wild plants that harbor early season aphids that would serve as alternative hosts or "bridge species" to enhance early season parasitoid abundance has also not been studied systematically.

It is important to realize that aphids are not a pest of potatoes because they cause *direct* damage. There is, in fact, little evidence that aphids become abundant enough to cause yield reduction or direct damage in cultivated potato. The major damage caused by the aphid is through its ability to vector viruses.

Because of this, only extremely low densities of the aphid are tolerated in commercial potato fields, particularly in July when aphids fly into potato from other hosts. Thus, even if natural enemies were highly effective at suppressing the aphid at low densities, aphid numbers may still be high enough to cause economic damage through the virus pathogens they vector. This is the problem inherent in relying on biological control of aphid.

Serious study of predators and parasitoids for biological control of green peach aphid in commercial fields will not occur until virus problems are solved. Current work to breed or engineer virus resistant potato varieties is very promising.

Pathogens of Potato Pest Insects

Pathogenic organisms have a number of advantages over conventional chemical pesticides (22, 30). These include:

- ◆ specificity to the target organism or to a limited number of host species,
- ◆ little or no direct impact upon parasitoids and invertebrate predators,
- ◆ harmless to vertebrates and plants,
- ◆ no toxic residues,
- ◆ little or no environmental pollution,
- ◆ little or no development of resistance by the target organism (some exceptions),
- ◆ no secondary pest outbreak,
- ◆ compatibility with other biological control agents,
- ◆ possibility of long-term control,
- ◆ ease of application, and
- ◆ adaptability to genetic modification through biotechnology.

Disadvantages include:

- ◆ specificity only to target organism,

Potato Biocontrol, cont.

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- ◆ strict timing of application for maximal effect,
- ◆ long period of lethal infection (i.e., little or no “knock-down” effect),
- ◆ inactivation by environmental factors (e.g., ultraviolet light, desiccation, temperature extremes, etc.) and therefore, short field persistence,
- ◆ expensive to produce (especially for pest-specific pathogens),
- ◆ difficult to formulate,
- ◆ short shelf life,
- ◆ possibility for development of resistance by target organisms (especially to bacterial toxins),
- ◆ uneconomical except for niche markets, and
- ◆ risks associated with genetically-modified organisms.

Bacterial Pathogens

Bacillus thuringiensis has been a well-known agent for control of Colorado potato beetle over the past decade. The bacterium must be ingested in order to be active. It ultimately causes rupturing of cells in the larval beetle's midgut, which leads to death. A number of factors influence the larvicidal activity of *Bt*, such as the age of targeted larvae, temperature, spray rate and coverage of the plants, timing and number of applications, and inactivation by sunlight. Younger larvae are the most susceptible (32). Although adults are not susceptible, they may be repelled by *Bt*-treated plants (13). Numerous formulations are available and have proven effective when applications are carefully timed.

Distinct advantages of *Bt* formulations over conventional chemical pesticides include their safety for applicators and field workers and their lack of activity on nontarget organisms, including natural enemies. In the irrigated desert of Washington State, the insect biodiversity in *Bt*-treated plots was unaffected. However, certain hemipterous predators were nearly eliminated in plots treated with aldicarb (Temik) (23).

Fungal Pathogens

Fungal pathogens are important natural enemies of a wide variety of insect and mite pests in virtually every agroecosystem (15); both the green peach aphid and Colorado potato beetle have been studied with respect to fungal enemies.

Beauveria bassiana is the fungus shown thus far to be the most effective in controlling Colorado potato beetle. It can be grown on artificial media, is easily harvested (11,14), can be stored for fairly long periods, and can be applied using conventional spray equipment. *B. bassiana* is commercially available, offering results ranging from unacceptable (8, 9, 16) to effective control (14, 16, 23). Factors that affect its larvicidal activity include: temperature, humidity, age and stage of the insects, timing and number of applications, dosage, agricultural practices, and deactivation by sunlight (9, 10).

Fungal pathogens may prove effective on green peach aphid in potato (bacterial and viral pathogens are not). Several fungi in the order Entomophthorales can cause dramatic crashes in aphid populations. *Verticillium lecanii* has shown good to excellent activity against the green peach aphid in humid environments (4, 17), but use of *V. lecanii* and other Hyphomycetes for control of aphids in potato has not yet been investigated in detail. In the irrigated desert of the Pacific Northwest humidity may not be sufficiently high to enable rapid germination and infection.

Note that some agricultural practices may interfere with fungi and other natural enemies of potato pest insects. Some fungicides used to control plant disease in potatoes have been reported to interfere with fungal pathogens of the green peach aphid (24).

Viral Pathogens

The majority of viral pathogens used in microbial control are baculoviruses applied against Lepidoptera. Certain species of Lepidoptera have been reported as defoliators of potato, but their importance is variable and eclipsed by the Colorado potato beetle. The most serious lepidopteran pest of potato

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in the Americas is the potato tuber moth, *Phthorimaea operculella* (Gelechiidae). Larvae can mine foliage and attack tubers in the soil or storage where they tunnel through the flesh of the potato. In addition to causing direct damage they facilitate entry and damage by secondary pests and diseases. Only one virus is currently used against potato pest insects in the Americas. Pilot programs employing the granulovirus of the potato tuber moth have had remarkable success in South America and are markedly safer and more sustainable than chemical alternatives. Most tuber moth virus production is done on a cottage scale.

Integration of Biological Control into Integrated Pest Management

Sustainable agriculture in the twenty-first century will rely increasingly on alternatives to chemical pesticides for pest management that are environmentally friendly and reduce the amount of human contact with pesticides. The IPM strategy, in which natural enemies (parasites, predators, and pathogens) of pest arthropods and other alternative measures play significant roles in crop protection (20), can contribute to a more sustainable approach to managing pests in potato production (2, 6). However, a truly integrated approach in ALL agricultural practices will be required to obtain the maximum effect from a given intervention or practice without interfering with the effectiveness of other practices (7).

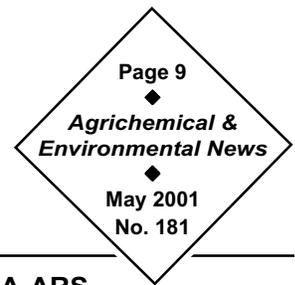
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Excerpted from the paper "Biological Control of Insect Pests of Potato in North America" presented at the 2001 Washington State Potato Conference and Trade Show, "Taller en Español sobre la producción de papas." Full text of the original presentation is available in both English and Spanish on AENews' electronic edition at <http://www.tricity.wsu.edu/aenews>. Drs. Lerry Lacey, Dave Horton, and Tom Unruh, and Ms. Martha Márquez are with the U. S. Department of Agriculture's Agricultural Research Service at the Yakima Agricultural Research Laboratory in Wapato, and Dr. Keith Pike is with Washington State University's Irrigated Agricultural Research and Extension Center in Prosser. The Wapato laboratory can be reached at (509) 454-6550 and Dr. Lacey can also be reached at llacey@yarl.ars.usda.gov.

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Update on WSU's Center for Precision Ag

Dr. Francis J. Pierce, Center for Precision Agricultural Systems, WSU

"Advancing the science and practice of precision agriculture in Washington State and beyond" is the guiding principle of the newly formed Center for Precision Agricultural Systems (CPAS) at Washington State University (WSU). That's precisely how I see it as the center's Director, a position I've held since last September. So, exactly what is precision agriculture, where is the center located, and what is its purpose? Who is Fran Pierce? What does all this mean to you and to Washington agriculture? These good questions deserve good answers.

Center Director

First, let me introduce myself. I am a soil scientist by training, with M.S. and Ph.D. degrees in Soil Science from the University of Minnesota and a B.S. degree in Geology from the State University of New York at Brockport. You can see that I am very grounded in the earth sciences. I came to Washington from Michigan State University (MSU) where I was a professor of Soil Science in the Department of Crop and Soil Sciences, having been on that faculty for sixteen years. My research interests in Michigan centered on soil management. I worked on issues related to conservation tillage, soil and water quality, and precision agriculture as it related to the production of the major grain crops, as well as potato, sugar beet, dry bean, and tomato. In my early years at MSU, I also worked in extension and later taught undergraduates in the area of soil management and environmental impacts. Since 1991, I have been actively involved in the development and evaluation of precision agriculture. On September 1, 2000, I became the Director of the Center for Precision Agricultural Systems at WSU.

What is Precision Agriculture?

Precision agriculture is much more than you might believe! Over the years, it has been defined in many ways. The most common perception of precision agriculture is that it involves the application of

technology to assess how soils, plants, and pests vary spatially within fields so that commonly used production inputs can be applied at variable rates. This conjures up images of four-wheelers sampling soils, plants, and pests under the guidance of global positioning systems; images of yield monitors, variable rate applicators, lots of data, and lots of colored maps.

The concept is simply not that complicated. Certainly, the past decade has seen great advances in variable-rate application. With the latest technologies, we are now capable of managing inputs at levels of detail never before possible. But it is important that the concept of precision agriculture not be limited to such a narrow and highly specialized view. There has been a lot of "that's not for me" from farmers and their service/input providers who, for a variety of reasons ranging from technology aversion to negative past

experiences, were reluctant to explore or utilize precision agriculture. I think precision agriculture is far from reaching its potential in benefiting growers in Washington State and elsewhere, in part because of this narrow view of what it is and how it can be applied to everyday farming practices.

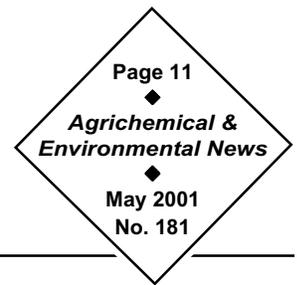
My view of precision agriculture is very broad and inclusive. I believe that the technological innovations, the information strategies, and the fundamental principles of precision agriculture can significantly impact agriculture from genetics to the table, from small to large production operations. I believe you will see this view of precision agriculture expressed in the efforts of CPAS faculty and collaborators over the next few years.

The Center

CPAS was funded by the Washington State Legislature as part of the Advanced Technology Initiative (ATI) in 1999. The legislation provides permanent

The term "precision agriculture" encompasses a wide range of ideas and practices...

Precision Ag Center, cont.



Dr. Francis J. Pierce, Center for Precision Agricultural Systems, WSU

base funding for the center as part of WSU's annual budget appropriation. The funding primarily covers the center's annual operations and provides some flexible dollars for research, education, and extension programs in precision agriculture. The vision articulated for CPAS is that it shall become the internationally recognized leader in the development of precision agricultural systems for products and environments characteristic of Washington agriculture. The goal of CPAS is to foster collaborative research, education, and outreach programs that create practical technologies and management systems for precision agriculture that support competitive production of Washington's agricultural commodities, stimulate the state's economic development, and protect the region's environment and natural resources. A major function of the center is to provide leadership in precision agriculture for Washington and to secure the necessary re-

sources to support center-sponsored activities in precision agriculture. More about CPAS can be found on its website, at <http://www.cpas.prosser.wsu.edu>.

CPAS is located at the Irrigated Agriculture Research and Extension Center (IAREC) in Prosser. My decision to locate CPAS there was based largely on the fact that IAREC is centrally located in the irrigated agricultural area of the state, a region that produces a diverse array of crops and accounts for approximately seventy percent of the production value of Washington agriculture. Thus, a range of opportunities for implementing precision agriculture exist nearby as well as in the extensive small grain production areas of eastern Washington.

CPAS, in its full configuration, will consist of a director, an associate director, faculty, collaborators, and an advisory board. The center director has a 100% research appointment in the College of Agriculture and Home Economics and reports to its dean. The

associate director will assist the director in operations and fundraising, and will be responsible for coordinating the Public Access Weather System (PAWS) and the geospatial laboratory for research and education currently under development at CPAS. Center faculty is comprised of researchers and educators who are actively involved in research relevant to the center, who teach courses related to precision agricultural systems, or who make other significant contributions to the center; they may be

WSU faculty or others involved with WSU and CPAS efforts. Center collaborators are businesses, entities, or individuals who contribute to CPAS' success by making in-kind or cash contributions of at least \$5,000 annually in support of the center's research, education, or public service activities. Benefits and responsibilities of center collaborators will be defined by contractual agreements so that expectations are understood

clearly. The advisory board—to be formed in the near future—will be comprised of persons who have knowledge, interest, and commitment to precision agriculture and therefore the efforts of the center. The purpose of the CPAS advisory board is to provide outside perspectives and advice to the director.

Current CPAS Thrusts

If we take the broad view of precision agriculture, from genetics to the table, many opportunities exist for precision agriculture in Washington. The following is a brief overview of a few areas CPAS is currently pursuing. These types of projects and concerns are representative of the general goals and objectives of the center. As these projects develop, details will be available on the CPAS website.

Precision Quality Management in Small Grains

This project's purpose is to increase profitability of wheat and barley production in Washington by

...continued on next page

Precision Ag Center, cont.

Dr. Francis J. Pierce, Center for Precision Agricultural Systems, WSU

optimizing grain quality through precision input management and/or grain quality differentiation at harvest. The latter uses grain quality and yield sensors embedded in the grain flow of combines to differentiate grain quality such as protein content.

Precision Viticulture

This effort has a broad objective to optimize grape quality for juice and wine production using site-specific nutrient, water, and pest management; identity preservation/tracking; and sensors for grape quantity and quality tracking.

Precision Tree Fruit Management

Our major focus is to provide precise technologies and management practices toward two objectives: 1) lowering the cost of tree fruit production thereby increasing Washington growers' competitive ability in a global market economy and 2) minimizing adverse impacts of tree fruit farming operations on the environment through precise management of nutrients, pests, water, and crop management products.

Multi-Environment Field Laboratory

With the assistance of industry partners, CPAS is developing a field laboratory at WSU Prosser devoted to the development and application of precision agricultural technologies that will serve as a showcase for precision agriculture in Washington. The system will consist of a Pierce linear move system equipped with a Nelson irrigation sprinkler package that is automated for precision control of water, nutrients, and pesticides and for autonomous sensor applications in small scale, highly controlled experiments.

Geospatial Laboratory for Research and Education

Geographic Information Systems (GIS), Global Position Systems (GPS), and remote sensing are three important technologies that enable precision

agriculture. With industry partners, we are developing extensive capabilities needed for research utilizing these technologies along with capabilities for teaching applications of these technologies for use on the farm and within specific crop commodity industries. Formal coursework in these and related technologies is already approved on the WSU Pullman campus in the Crop and Soil Sciences and Biosystems Engineering Departments. A continuing education computing facility is envisioned for the center at Prosser.

Moving Forward

The CPAS is moving forward and working within and between various commodities in Washington to bring existing precision agriculture technologies and practices to Washington agriculture and to innovate where new ones are needed to make Washington agriculture more competitive in a global market and sustainable in its environmental stewardship. We have a long way to go and will need cooperation with representatives from many dimensions of Washington agriculture.

Washington State is a great place to explore, expand, and innovate in precision agriculture. In fact, some of precision agriculture's roots are right here in Washington State. Some of the earliest efforts in site-specific nutrient management occurred here in Washington, such as the work Dr. Max Hammond and others on the use of grid soil sampling and variable-rate fertilizer application in potato.

I look forward to learning more about Washington, its people, and its agriculture. Let me know how CPAS can help you.

Dr. Fran Pierce is the Director of the Center for Precision Agriculture (CPAS) at Washington State University. CPAS is located in Prosser at the Irrigated Agriculture Research and Extension Center (IAREC), (509) 786-2226. Dr. Pierce can be reached at fjpierce@wsu.edu, and CPAS is on the Internet at <http://www.cpas.prosser.wsu.edu>.

Visit the website:
<http://www.cpas.prosser.wsu.edu>

2001 Pesticide Container Recycling Schedule

Washington Pest Consultants Association

DATE	TIME	LOCATION	SPONSOR	CONTACT	PHONE
5/14	9a-11a	George	Dependable Spray	Ceourt Rylaarsdam	509-785-2061
	1p-3p	Quincy	Cobia Spray Svc	Jim Cobia	509-750-2888
5/15	8a-10a	Quincy	Wilbur Ellis	Dale Martin	509-787-4433
	1p-3p	George		Randy Wentworth	509-878-1565
5/16	8a-10a	Quincy	Quincy Farm Chem	Ron Turner	509-787-3556
	1p-3p	Quincy	Simplot	Butch Creameans	509-787-1571
5/21	8a-10	Waverly	Wilbur Ellis	Monte Bareither	509-283-2432
	1p-3p	Tekoa	McGregor Co	Charles Wedin	509-284-5391
5/22	8a-10a	Oakesdale	Wilbur Ellis	Jerry Jeske	509-285-4511
	1p-3p	Garfield	Cascade Flying Svc	Doran Rogers	509-635-1212
5/23	8a-10a	Palouse	Dale's Flying Svc	Dale Schoeflin	509-878-1531
	1p-3p	Dusty	Dusty Farm Coop	Chris Crider	509-397-3111
5/24	8a-10a	Warden	Kilmer Crop Dusting	Terry Kilmer	509-349-2491
	1p-3p	Bruce	Cenex	Lori Anderson	509-488-5261
5/25	8a-10a	Othello	S Saddle Orchard	Mike Macy	509-539-5836
	2p-4p	Black Rock	Stemilt Orchards	Jim Taylor	509-830-4888
5/29	8a-10a	Walla Walla	McGregor Co	Gary Burt	509-529-6787
	1p-3p	Waitsburg		Terry Jacoy	509-337-6621
5/30	8a-10a	Pomeroy	Western Farm Svc	Jerry Wilsey	509-843-3491
	1p-3p	Dayton	McGregor Co	Jeff Bruce	509-382-4704
5/31	8a-10a	Prescott	Agri Northwest	Shawn Elder	509-547-8870
	1p-3p	Prescott	Broetje Orchard	Joe Shelton	509-749-2107
			Flat Top Ranch	Dave Hovde	509-547-9682
6/1	8a-10a	Kennewick	Valley Roz #3	Charlie Slover	509-783-3513
6/4	9a-3p	Outlook	Snipes Mtn. Trans. Stn.	Mark Nedrow	509-574-2472
6/5	9a-3p	Terrace Hts.	T.H. Landfill	Mark Nedrow	509-574-2472
6/6	8a-10a	Whitstran	Simplot	John Cullen	509-973-2245
	1p-3p	Hanks Rd.	Olsen Bro. Farm	Keith Oliver	509-781-1106
6/7	8a-10a	Sunnyside	Bleyhl Farm Sevice Inc.	Vern Bos	509-839-4200
	1p-3p	Zillah		Dan Simmons	509-829-6922
6/18	8a-10a	Spokane	WSDA	Tim Schultz	509-533-2686
	1p-3p		WSU Coop. Ext.	Jim Lindstrom	509-533-2690
	8a-10a	Mead	Cenex	Todd Race	509-466-5192
6/19	8a-10a	Deer Park	Inland Agronomy	Jim McAdam	509-276-2611
	2p-4p	Davenport	Northwest Aviation Inc.	Lee Swain	509-725-0011
6/20	8a-10a	Wilbur Airport	Greg's Crop Care	Greg Leyva	509-647-2441
	1p-3p	Odessa	Smith Air Inc.		509-982-2231
6/21	8a-11a	Moses Lake	Tom Dent Aviation	Tom Dent	509-765-6926
	2p-4p		Moses Lake Air Service	Perry Davis	509-765-7689
6/22	8a-10a	Warden	Wilbur Ellis	Brian Preston	509-349-2333

Washington Pest Consultants Association (WaPCA) has been involved in recycling plastic pesticide containers since the early 1990s. They organize an annual series of collection dates and sites, contracting with Northwest Ag Plastics to collect and granulate the plastic containers. This table shows April and May dates only; a full schedule of dates through October is available on-line at <http://pep.wsu.edu/waste/wapca.html>. Dates, times, and locations are subject to change; use the contact information to confirm. For general questions, or to host an event at your farm, business, or in a central location in your area, contact Clarke Brown at (509) 965-6809, Dave Brown at (509) 961-8524 (dbrownwash@msn.com), or the Northwest Ag Plastics office at (509) 457-3850. THERE IS NO FEE FOR THIS SERVICE.

CONTAINER CRITERIA:

- Rinsed—no residue
- Clean and dry, no odor
- Majority of foil seal removed from spout
 - Hard plastic lids and slip-on lids removed
 - Glue-on labels may remain
- Half-pint, pint, quart, 1 gallon, 2.5 gallon, and 5 gallon containers accepted whole
 - For 30 and 55-gallon containers, call 509-457-3850.

Our industry does not want pesticide containers to become a waste issue. If we take the time to clean and recycle these products, we save money, show the industry is responsible, and reduce waste stream inputs.

For information on waste pesticide disposal, see the Washington State Department of Agriculture program schedule on page 3.

Repelled and Repulsed Two-Spotted Spider Mites React to Agrichemicals

Dr. Douglas B. Walsh, Entomologist, and Dr. Gary Grove, Plant Pathologist, WSU

Concern about sublethal effects of pesticides on non-target organisms has increased. Many research efforts to date have focused on impacts to beneficial arthropods such as predatory mites; little consideration has been directed toward the effects of pesticides on other non-target pests.

Understanding the distribution of an arthropod pest within its host plant's canopy can help us determine that species' potential for reaching damaging population densities. In this article we review a series of studies in which we screened a number of substances for their ability to irritate two-spotted spider mites (*Tetranychus urticae*).

In short, we conducted bioassays with two-spotted spider mites over a twelve-week period to evaluate the repellency and repulsiveness of thirty-three agrichemicals: eighteen fungicides currently registered or pending registration for crop use, three petroleum-derived spray oils (PDSOs), four spray adjuvants, and eight insecticides.

Materials and Methods

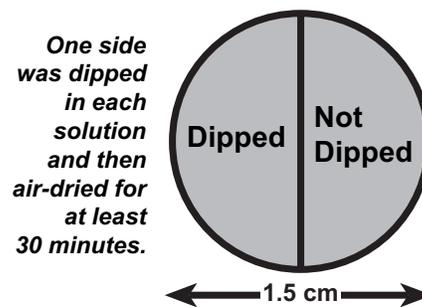
From wine grape leaves, we cut disks measuring 1.5 centimeters in diameter. We then dipped one half of each leaf disk (except those we reserved as non-treated controls) into a pesticide solution of each respective treatment for five seconds. Each dipped disk was allowed to dry for at least thirty minutes.

When dry, the leaf disks were fixed, top-surface down, on a two-inch by two-inch cotton square saturated with distilled water in a petri dish. This configuration inhibits mites from moving off the leaf disks.

To measure repellency, ten adult female *T. urticae* were transferred to the treated side of leaf disks. Repellency was then gauged by the number of mites choosing to move off the treated surface. To measure repulsiveness, ten were transferred to the untreated side of another set of leaf disks. Repulsiveness was then gauged by the number of mites choosing to stay on the untreated surface. We established controls by

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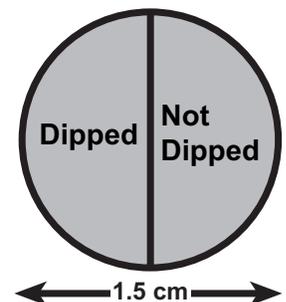
Leaf Disks Used in This Study



1.5 centimeter circles were cut from wine grape leaves

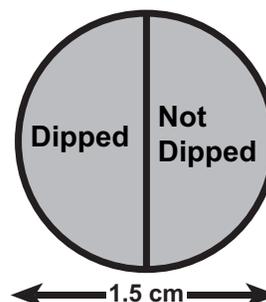
Repellency

10 mites were placed on the bottom leaf surface of the TREATED (dipped) side. The solution's repellency is gauged by the mites' tendency to move to the non-treated (not dipped) side.



Repulsiveness

10 mites were placed on the bottom leaf surface of the NON-TREATED (not dipped) side. The solution's repulsiveness is gauged by the mites' tendency to stay on that side.



Twenty-four hours after placement on the leaf disk, the number of mites on the treated or non-treated side were counted. Ten adult female mites on a 1.5-centimeter disk is a crowded situation. Their tendency to redistribute is an indication of the repellency and repulsiveness of the solution on which they find themselves or adjacent to which they find themselves.

Repelled, Repulsed, cont.

Dr. Douglas B. Walsh, Entomologist, and Dr. Gary Grove, Plant Pathologist, WSU

placing ten *T. urticae* on a single side of a non-treated leaf disk. We also used Permethrin (Pounce 3.2 EC), a synthetic pyrethroid, at a rate of 1.6 fluid ounces per 100 gallons solution (10% the field rate of 16 fluid ounces) to serve as a treated control. Pyrethroid insecticides are known for their significant repellency to mites.

After holding the disks at room temperature for twenty-four hours, we counted the mites present on the non-treated sides of the leaf disks.

Results

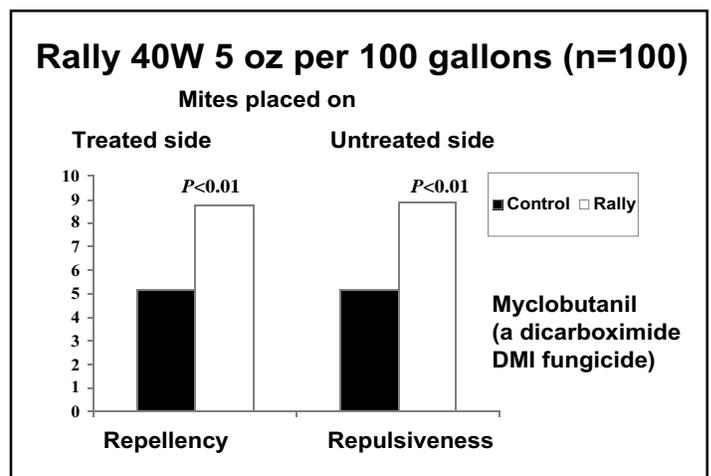
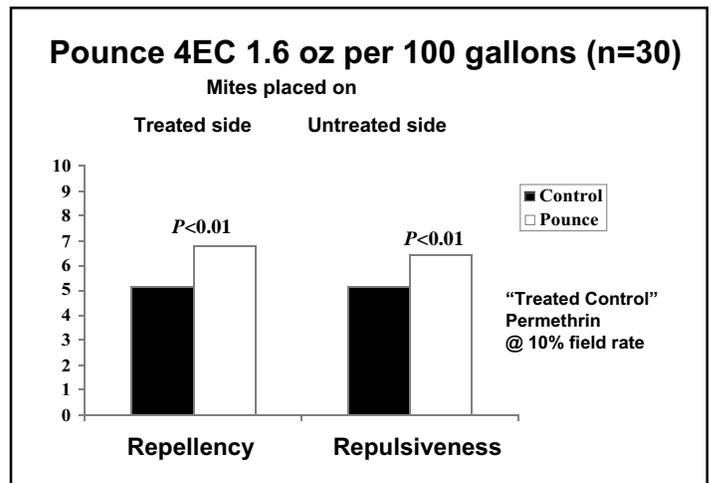
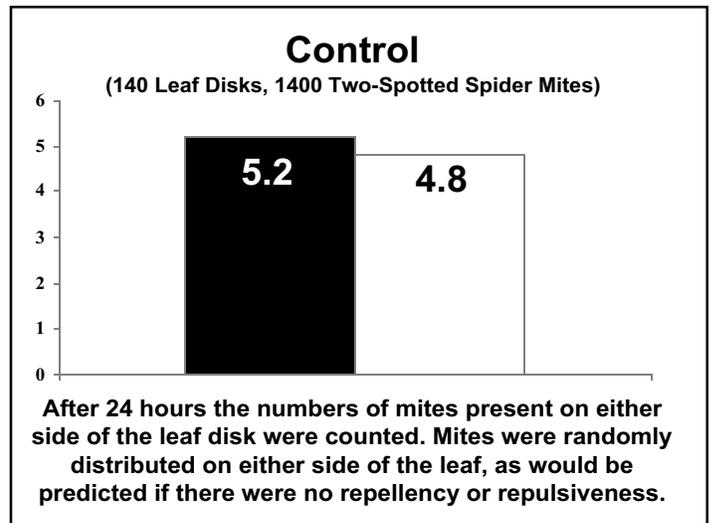
Bioassays were conducted over twelve separate dates. Analysis of variance among the non-treated controls for these twelve dates determined no significant differences in results among the respective sample dates. This finding enabled us to pool all sample dates among all respective treatments for analysis of variance among all chemical treatments tested. Significant ($p < 0.05$) and highly significant ($p < 0.01$) repellency and repulsiveness were observed within all categories of compounds tested: fungicides, insecticides, petroleum distillates, and spray adjuvants. Statistical comparisons were performed between the non-treated control and the chemical treatments to determine if individual agrichemicals were repellent or repulsive to spider mites.

The graphs to the right show repellency and repulsiveness results for Pounce and for Rally, one of the fungicides we examined. The following pages show comparative repellency and repulsiveness results for the fungicides, PDSOs, adjuvants, and insecticides we studied.

Discussion

Spider mites under natural conditions tend to gather in groups near their founding female. Once ambient conditions are compromised (e.g., resources are depleted, the area becomes overpopulated, days become too short, or temperatures get too cold), they begin to disperse. If mites are irritated by the introduction of a particular agrichemical, it will affect their

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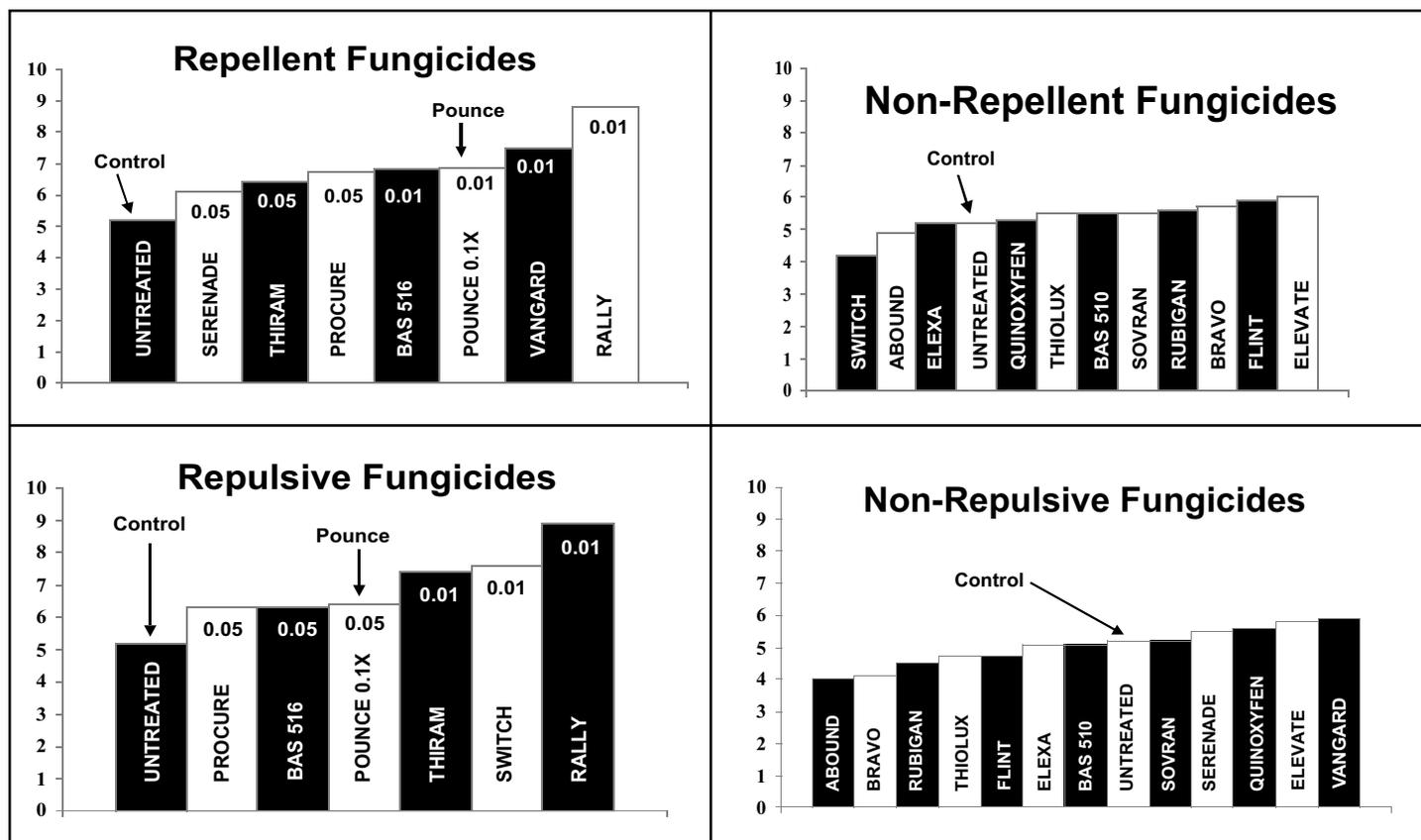
Repelled, Repulsed, cont.

Dr. Douglas B. Walsh, Entomologist, and Dr. Gary Grove, Plant Pathologist, WSU

distribution within the canopy of the tree, plant, or vine. Mites will likely migrate to areas of the canopy where exposure to the irritant is reduced. Changes in the distribution of mites will complicate mite population abundance sampling schemes. It will also complicate biological control efforts—female predatory mites will typically lay their eggs near groups of spider mites so that when her eggs hatch her offspring will have ready access to prey. Furthermore, examples of chemically irritated mites reproducing more rapidly have been documented. Specific categories of pesticides for which this has been documented include organophosphate and pyrethroid insecticides. Finally, if the agrichemicals we studied are affecting

spider mites, it is likely that predatory mites and other beneficial arthropods are irritated as well. Flying insects may choose to go elsewhere and predatory mites may choose to walk away. These studies indicate that agrichemical application may be having a substantial sublethal effect on the biology and ecology of non-target organisms within the plant canopy.

Drs. Doug Walsh and Gary Grove have offices at the Irrigated Agriculture Research and Extension Center in Prosser, (509) 786-2226. Dr. Walsh can be reached at dwalsh@tricity.wsu.edu and Dr. Grove can be reached at ggrove@tricity.wsu.edu.

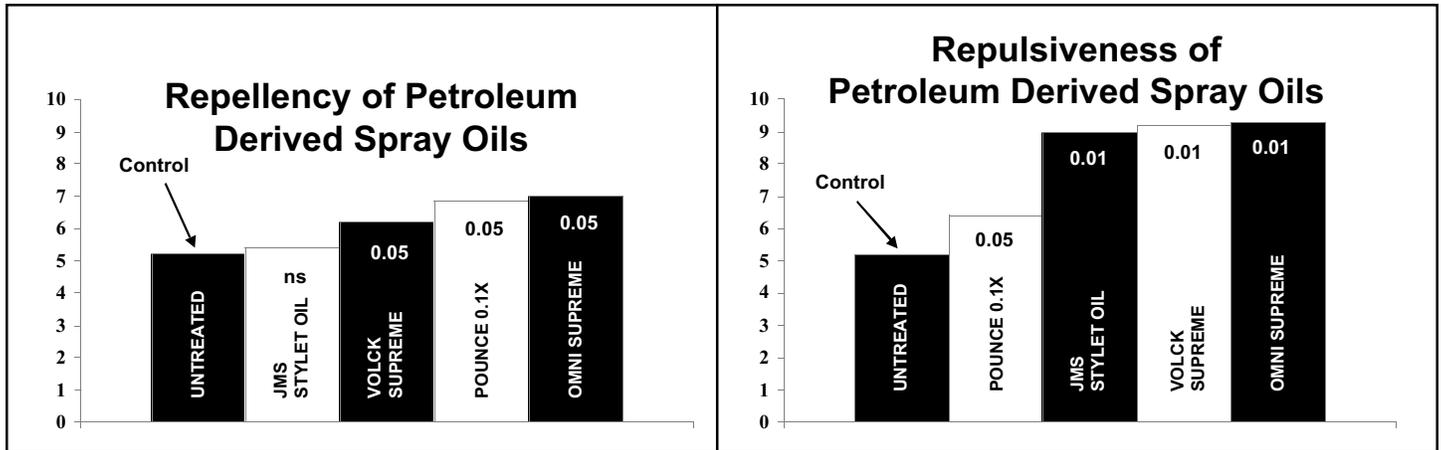


FUNGICIDES

Among the formulated fungicides tested, Serenade and Thiram were repellent ($p < 0.05$); Procure, BAS 516, Vanguard, and Rally were highly repellent ($p < 0.01$). Procure and BAS 516 were repulsive ($p < 0.05$); Thiram, Switch and Rally were highly repulsive.

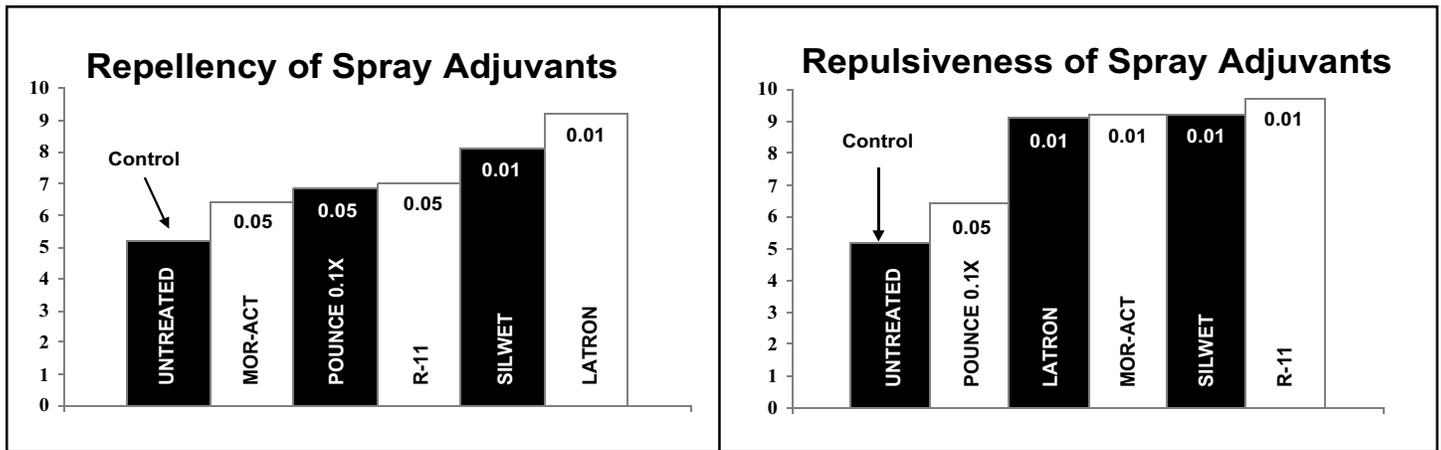
Repelled, Repulsed, cont.

Dr. Douglas B. Walsh, Entomologist, and Dr. Gary Grove, Plant Pathologist, WSU



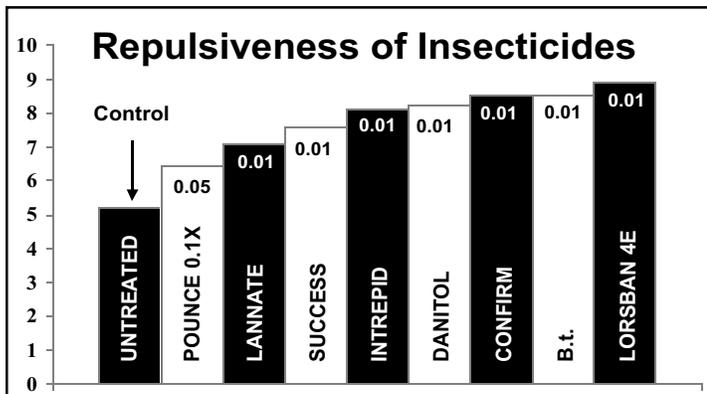
PETROLEUM-DERIVED SPRAY OILS

Volck Supreme and Omni Supreme Spray were highly repellent ($p < 0.01$) and JMS Stylet Oil, Volck Supreme, and Omni Supreme Spray were highly repulsive ($p < 0.01$). An interesting note is that JMS Stylet was not repellent but was repulsive.



SPRAY ADJUVANTS

Mor-Act was repellent ($p < 0.05$), and Latron 1956B, R-11, and Silwet were highly repellent ($p < 0.01$). All four spray adjuvants were highly repulsive ($p < 0.01$).



INSECTICIDES

All of the insecticides tested except the biological insecticide MVP II were highly repellent. However, when mites were placed directly on the synthetic pyrethroid fenpropathrin and organophosphate chlorpyrifos for the repellency test, approximately 40% of them died from pesticide exposure. Death had not been a factor in any of the other types of agrichemicals tested. This biased our results and for this reason we eliminated all of the insecticides from our overall repellency analysis of variance. MVP II did not prove repellent. The formulated insecticide products, Lannate, Success, Intrepid, Danitol, Confirm, and Lorsban all were highly repulsive ($p < 0.01$).

Making Monkeys Out of Environmentalists

Bill Duncan, Columnist for the *Capital Press*, Salem, OR

This article originally appeared as "Making Monkeys Out of Enviros" in the March 2, 2001, issue of Capital Press newspaper.

The Competitive Enterprise Institute (CEI) recently published an article in *CEI Update* on scientific research of the unusual behavior of capuchin monkeys in Venezuela that sort of makes monkeys out of environmentalists who campaign to ban all pesticides. At least the article shows that monkeys are smarter than humans when it comes to battling mosquitoes. Written by Jennifer Zambone, an environmental policy analyst for CEI, the story tells how these monkeys seek out a particular millipede and once they find it, crush the millipede and rub it over their body.

What scientists found so unusual about this behavior is that the monkeys ignored the usual hierarchy in capuchin life and all the monkeys share equally in the millipede massage regardless of their rank. The scientists analyzed the millipede secretions and discovered the wormlike arthropod is loaded with benzoquinones, a potent insect repellent, many times more toxic than the artificial chemical repellent used by the U.S. Army.

The reason the monkey wants to anoint its body with eau d'millipede, as Zambone calls it, is not so much to thwart the mosquitoes, but what the mosquitoes carry—bot fly larvae. Bot flies lay eggs on the abdomen of the mosquito. When the mosquito alights on the monkey to feed, the heat of the mammal hatches the eggs. The bot fly larvae embed themselves under the monkey's skin and live there for about six weeks, causing large, painful lesions. In great enough numbers, these can sap the monkey's immune system, lowering its ability to fight off infection.

By applying squashed millipedes to the fur, the monkey is covering itself with benzoquinones that will ward off mosquitoes and the pest they carry.

Clever, these monkeys.

The scientists discovered that some of the monkeys would put the millipede in their mouths and go into a frenzy until they had spit it out. A scientist who was analyzing the secretions put a millipede in his mouth

and immediately fell to his knees, Zambone recounts, saying that "it was painful and irritating." They found that the millipede, in self-defense, manufactures extra potent benzoquinones which caused the discomfort when it was mouthed.

You probably would not find this report in the mainstream media because it is rather revealing in exposing government's tendency to over-regulate, something Competitive Enterprise Institute publicly announces that it opposes.

What Zambone found so interesting in this study is that during the West Nile virus outbreak on the East Coast last summer, environmental activists were opposed to spraying pesticides that would kill the virus carrying mosquitoes, claiming the chemicals were deadlier than the disease. Their argument was that people should use commercial insect repellents to ward off the mosquitoes. Zambone notes, "it is hard to get the insect repellents when activists want them banned as well."

She said that in 1992, New York banned all products containing DEET concentrations over thirty percent. The ban was lifted, but the fight to ban any repellent with a greater concentration than thirty percent continues, even though it is known that concentrations of thirty to fifty percent are the most effective for warding off ticks which cause Lyme Disease. New York has one of the highest numbers of Lyme Disease cases in the nation.

Zambone concluded that when it comes to battling mosquitoes, the capuchin monkeys in the jungles of Venezuela are smarter than humans. "Many among us don't seem to have even the inherent intelligence of the capuchin monkey." I think I agree.

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Pest of the Month

Thrips

Dr. Douglas B. Walsh, Entomologist, WSU

Thrips are small insects in the order Thysanoptera. They are pests of ornamentals, tree fruits, and field crops. Several species including western flower thrips (*Frankliniella occidentalis*) and onion thrips (*Thrips tabaci*) can cause economic harm in Washington State. Both *F. occidentalis* and *T. tabaci* can thrive on a wide range of host plants.

Description

Thrips typically have four featherlike wings, each consisting of a thick supporting strut with fine hairs on the front and hind edges. Onion thrips are yellowish and about 1/25-inch (1 mm) long. Adult females have fully developed wings, but males are wingless. Western flower thrips are similar in size but can have several color forms. Thrip populations vary substantially in abundance depending on the time of year, host plants available, and phenological stage of the host plant.

Life Cycle and Habits

Thrips go through six life stages: egg, first instar, second instar, prepupa, pupa, and adult. The first two instars and the adults feed by piercing and removing the contents of individual plant cells. No feeding takes place during the quiescent prepupa stage, which often occurs in the soil. This is the stage during which the antennae enlarge and the wings (if any) develop. Ovipositing thrips insert eggs into plant tissue.

Development times for completion of one generation of western flower thrips vary from eleven days at 77° to 87°F, to forty-four days at 50° to 60°F. Generation times for onion thrips can vary from fifteen to thirty days during the onion-growing season.

Onion thrips, as their name implies, are predominantly a pest of onions, garlic, and other bulb-type crops. Populations are female-biased; reproduction

for this species is typically parthenogenic. They concentrate between the sheaths and stems of the onion plant, where their feeding removes cytoplasm and gives heavily infested onions a silvery appearance. In cases of severe infestation, onion stems can turn brown and die.

Western flower thrips usually feed in enclosed plant tissues such as flowers, buds, fruit, or meristems. Adult western flower thrips can also feed on pollen and spider mite eggs. Sex is required for normal reproduction. Females can lay male eggs if they remain unmated. However, mating is required for the production of female eggs. Western flower thrips are pests of ornamentals, and tree fruits, and onions. They have rasping-sucking mouthparts and feed by rasping the surface of the leaves and sucking up the liberated plant fluid. Direct feeding damage to fruits, flowers, and leaves includes streaking, spotting and tissue distortion. The stippling damage caused by thrips feeding on individual cells resembles and can be confused with the stippling which results from spider mite feeding.

Control

A number of generalist predators feed on western flower thrips, including minute pirate bugs, big-eyed bugs, and several species of predatory mites. Unfortunately, populations of these predators are disrupted by insecticide application in many agroecosystems.

Chemical control of thrips has proven challenging for ornamental and food crop producers in Washington State. Registered products include dimethoate, lambda-cyhalothrin, methyl-parathion, and formetanate hydrochloride. To complicate matters, thrips have a well-documented history of developing tolerance and then resistance to organophosphate and pyrethroid insecticides.



Federal Register Excerpts

Compiled by Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

In reviewing the March postings in the Federal Register, we found the following item that may be of interest to the readers of Agrichemical and Environmental News. This is a regular feature of the electronic HTML and PDF version of AENews.

In the March 21 Federal Register, EPA announced the availability of a Pesticide Registration (PR) Notice and a Response to Public Comments document outlining EPA's policy on insect repellents for use specifically on infants and children. The PR contains label changes and policy clarification intended to reduce risks associated with the improper use of insect repellents. The PR Notice also states EPA's current position on insect repellents formulated to contain colors and fragrances predominantly associated with food (e.g., grape, orange, or watermelon). (Page 15868)

Thrips

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Several alternative chemistries have been developed in the last decade that show some promise for suppressing thrips. Spinosad (Success), a reduced-risk insecticide, has demonstrated some thrips control activity and has recently been registered for use on stone fruits. Abamectin (Agrimek) has been used extensively in ornamental crops for suppression of thrips populations. Pyriproxifen (Knack) has a registration pending on apples and several other crops. This insect growth regulator is purported to have some activity against thrips.

Next month's AENews will feature details on a thrip field study my colleagues and I conducted in Summer 2000.

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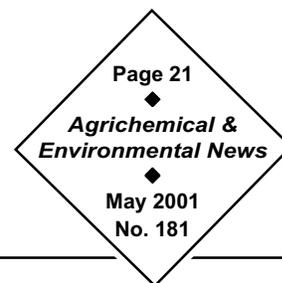
Call for Abstracts

The North American Agromedicine Consortium invites the submission of abstracts dealing with all aspects of occupational and environmental health and safety in agriculture, forestry, and fisheries. Papers may deal with such topics as food safety; exposure assessment and injury/illness surveillance (chemical, zoonotic); prevention and intervention (educational, engineering, behavioral approaches); health care access and delivery; minority, women's, and children's issues; susceptible populations; sociological and cultural issues; policy and economics; community health; and diagnosis and treatment.

Papers will be presented at the fourteenth annual meeting of the North American Agromedicine Program to be held November 4 through 6, 2001, in Charleston, South Carolina. Detailed instructions for abstract submission can be found on the consortium's website at <http://www.agromedicine.org/>. Abstracts must be postmarked by July 31, 2001.

Agromedicine is devoted to health and safety issues in modern agriculture, including farm families and environments, workers in agriculture-associated industries, and consumers of agricultural products. The underlying purpose is to reduce or eliminate chronic and acute illnesses and injuries associated with agricultural commodities and products.

Tolerance Information



Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
chlorothalonil (fungicide)	3/12/01 pg. 14330	0.10	asparagus	No	N/A	N/A
		5.00	pepper, non-bell			
		0.10	fat of cattle, goats, hogs, horses, & sheep			
		0.50	kidney of cattle, goats, hogs, horses, & sheep			
		0.05	mbp of cattle, goats, hogs, horses, & sheep			
		0.03	meat of cattle, goats, hogs, horses, & sheep			
pyriproxyfen (insecticide)	3/14/01 pg. 14852	0.10	See comment	No	N/A	N/A
Comment: This tolerance is established for all foods exposed as a result of the proposed use of Nylar in food handling establishments where food and food products are held, prepared, processed or served.						
clethodim (herbicide)	3/14/01 pg. 14829	1.00	vegetables, tuberous and corm	No	N/A	N/A
		5.00	sunflower, seed			
		10.00	sunflower, meal			
		1.00	fruiting vegetable group			
		0.50	carrots			
		0.50	radish, roots			
		0.70	radish, tops			
		0.60	leaf petioles subgroup			
		2.00	melon subgroup			
		0.50	squash/cucumber subgroup			
		0.50	cranberry			
		3.00	strawberry			
		10.00	clover, forage			
		20.00	clover, hay			
		1.00	sugarbeet, tops*			
		1.00	sugar beet, molasses*			
2.00	potato, granules/flakes*					
Comment: Items marked with an asterisks are existing tolerances that are being amended with this action.						

PNN Update

The Pesticide Notification Network (PNN) is operated by WSU's Pesticide Information Center for the Washington State Commission on Pesticide Registration. The system is designed to distribute pesticide registration and label change information to groups representing Washington's pesticide users. PNN notifications are now available on our web page. To review those sent out in the month two months prior to this issue's date, either access the PNN page via the Pesticide Information Center On-Line (PICOL) Main Page on URL <http://picol.cahe.wsu.edu/> or directly via URL <http://www.pnn.wsu.edu>. We hope that this new electronic format will be useful. Please let us know what you think by submitting comments via e-mail to Jane Thomas at jmthomas@tricity.wsu.edu.