

In This Issue

IPM Overview	1
IPM Conference Report	4
IPM in Schools	6
EPA Region 10 Welcomes Dick Stark	9
Organic Amendments for Nematode Management.....	10
EPA Booklets Available	11
One Drip at a Time (Chemigation & IPM)	12
1999 Recycling Schedule	15
Codling Moth: IPM Model	16
Dear Aggie	19
Azinphosmethyl Update	20
Federal Register Excerpts	20
Tolerance Information	21
PNN Update	22

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Integrated Pest Management (IPM) An Overview

Dr. Doug Walsh, Washington State IPM Coordinator

The National Coalition on Integrated Pest Management defines IPM, in part, as:

"A strategy that uses various combinations of pest control methods, biological, cultural, and chemical in a compatible manner to achieve satisfactory control and ensure favorable economic and environmental consequences."
 (Section 3, National Coalition on IPM, 1994).

Most agricultural producers agree with and attempt to adhere to the principles of IPM as defined above. Fundamental to the concept of IPM is that the presence of a pest does not always constitute a problem. Rather it is the knowledge that crop damage results when pest abundance surpasses a measured density. Based on scientific sampling, appropriate pest control actions can be taken to prevent the pest species from reaching an abundance that causes greater economic damage than the cost of the control measures. Such sampling, however, can prove costly, especially when a grower, waiting to sample, fails to chemically suppress a rapidly increasing pest

population, and the result is substantial crop damage and economic loss. Agricultural producers, after weighing the costs and benefits of chemically treating a pest infestation versus the risk of crop damage and economic loss if a pest population remains unsuppressed will typically choose to apply a pesticide.

The lag time between the onset of broad-scale use of pesticides and concern regarding their environmental impact was less than twenty-five years. Pesticides have created a "Catch-22" for both farmers and consumers. The use of pesticides has ensured production quantity and quality for agricultural producers. Consumers, in turn, have come to expect year-round, reasonably priced, quality, cosmetically appealing, pest free farm products. But the use of pesticides for crop protection has resulted in disturbances to the environment, pesticide resistance, and pest resurgence, and has demonstrated lethal and sublethal effects on non-target organisms. Pests are organisms that cause economic injury. IPM attempts to

...continued on next page

Dr. Doug Walsh, Washington State IPM Coordinator

manage the abundance of a pest organism in an agroecosystem through scientific knowledge of its biology and the pest's association with other organisms in its environment. The decision to use pesticides should be made after careful consideration, when a pest population may potentially cause economic damage and other control strategies are unavailable.

IPM Strategy—What's the Deal?

① **Pest Identification: "Know Your Pest!"**

- ◆ Is the pest native or introduced?
- ◆ Is its association with the crop new or old?
- ◆ For arthropods and pathogens: what plants (or crops) are alternative hosts for the pest?
- ◆ What are the early indicators of the pest's presence?
- ◆ What is the pest's reproductive strategy?
- ◆ Where does the pest go when the crop is not a suitable host (e.g., how does it overwinter)?
- ◆ What makes the crop a good host for the pest and can some change in horticultural practice make the crop a less suitable host?

② **Observation, Sampling, and Monitoring**

The crop should be observed for the presence of pests and beneficial natural enemies of pests. Pest management researchers expend substantial effort developing monitoring strategies, because, with comprehensive monitoring, a grower can make informed and accurate pest management decisions. For information on this process, the Cooperative Extension Service is a good place to start. They can provide a list of IPM manuals or forward you to an extension specialist.

③ **Control Action Thresholds**

If pests didn't cause economic harm, they wouldn't be pests and I would be out of a job. The "economic injury level" is the level at which pest abundance and the resulting damage exceeds the cost of the control. The goal of IPM is never to exceed the economic injury level. The "control action threshold" is a level of pest abundance below economic injury level—the

level that throws up the red flag and alerts the grower to take control action.

④ **Control Decision**

"An ounce of prevention is worth a pound of cure" readily applies to IPM. While monitoring pest thresholds might appear reactive, IPM on the whole can and should be proactive. Cultural techniques including crop rotation, tilling methodology, timing of planting, and routine management practices of pruning, thinning, and fertilizing can all be part of a proactive IPM strategy. Pest-resistant plantings can be introduced. Quarantines and plant certification programs can help limit the spread of pests. Efforts can be made to conserve beneficials and natural enemies through the creation or maintenance of habitat; populations of beneficials or natural enemies can be augmented. Life-cycle disruption techniques such as mating confusion can also provide proactive control of pest populations. (For more on mating disruption, see *Codling Moth* article, p. 16 of this issue.)

Overall, both proactive and reactive treatments should incorporate the broad scope of the agroecosystem. "Soft" (less-disruptive) pesticides should be used when possible. Spot treating only infected/infested areas can also prove to be a viable control technique. Of course a perfectly legal and acceptable pest control option is the application of a registered pesticide under label guidelines when the economic risk of leaving pest population unsuppressed is substantial.

Congressional Directives for IPM: Fiscal Year 1999

Following is an excerpt from the U.S. Senate Report 105-212 (page 44) that describes what Congress expects from IPM programs within each state and at the federal level.

"The Committee expects Cooperative State Research Education and Extension Service to develop guidelines for implementation of its IPM research and extension program to ensure broad-based representation that includes farmers, nonprofit organi-

IPM Overview, cont.

Dr. Doug Walsh, Washington State IPM Coordinator

zations, agribusiness, universities, and public agencies. Program guidelines should ensure extensive farmer participation in merit review and other aspects of the program, and will emphasize on-farm research and demonstration, close coordination among States and between the research and extension functions, and explicit plans for communicating usable results to intended users and interested audiences."

Show Me the Money!

To this end Congress appropriates funding to each of the states and territories of the United States via the Smith Lever 3(d) Act. Funding levels are still based on total dollars in pesticide sales with 1971 serving as the base year. Funding for general IPM programs and percent of U.S. total for selected states are listed in Table 1 (USDA 1999).

TABLE 1
IPM Funding Levels

State	\$\$\$	% of U.S.
Washington	146,100	1.92
Oregon	146,100	1.92
Idaho	112,000	1.48
California	278,100	3.66
U.S. Total	7,592,400	100

To continue to receive funding, states will now be required to establish and meet four strategic program objectives that encompass a wide range of performance goals:

- 1 to safeguard human health and the environment through improved utilization of integrated pest management (IPM) strategies and systems among identified clientele;
- 2 to increase the range of benefits and opportunities achieved by enterprises and individuals through

improved utilization of IPM strategies and systems among identified clientele;

- 3 to increase the supply and dissemination of information and knowledge about IPM strategies and systems available to IPM staff, land grant faculty, and identified clientele; and

- 4 to enhance multi-party collaborations and the exchange of information between public, private, and non-profit stakeholders in order to foster the development and adoption of IPM strategies and systems among identified clientele.

Performance will be measured on specific indicators in an annual IPM performance report. In my new role as IPM Coordinator I will be required to write the report for Washington State.

Organized crops in Washington State have mustered the resources to provide support for IPM research on specific key pests. Most notably the treefruit industry has pioneered IPM and achieved significant successes in pest management in the orchard agroecosystem.

Unfortunately with the great diversity of crops produced in the Pacific Northwest there are a number of key crop/pest combinations on which minimal research on IPM has been conducted. Identifying pests, developing sampling techniques to quantify pest abundance, and assessing crop damage will prove critical to the calculation of scientifically sound economic injury levels. Identifying pest-specific economic injury levels for crops produced in Washington and extending this information to user groups will be a major step in increasing the practice of IPM in Washington State. 🍏

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IPM Conference Tackles the Tough Issues

Dr. Catherine Daniels, Pesticide Coordinator, WSU

On March 8-10, 1999, the "International Conference on Emerging Technologies for Integrated Pest Management: Concepts, Research, and Implementation" was held in Raleigh, North Carolina, hosted by North Carolina State University (NCSU). Over thirty-five speakers, representing academia, industry, private business, government, and policy-influencing organizations participated in an information-dense program. Presentations ranged from field level (diagnostic technologies, habitat modification, weather forecasting, GIS applications), through "classroom" level (information delivery all the way from researcher to producer, status reports on biological control of pests), to the final contemplative level of public perceptions of IPM and of what it can really accomplish.

George Kennedy, past president of the Entomological Society of America, noted that the date of the conference was symbolic. The first International Conference, also hosted by NCSU, was held on that very date twenty-nine years earlier. In his words, the original meeting laid the groundwork for the IPM concepts in practice today. The first meeting was designed to address both a growing interest in ecological health and a concern about singular reliance on pesticides. He reminded attendees that decisions should be made only after looking at the agroecosystem as a whole. Dr. Kennedy felt that great progress had been made in twenty-nine years, citing how difficult it had been for plant pathology and weed science disciplines to participate with entomology at that time, when the "jargons" of each discipline were different. The concept of economic thresholds did not yet exist in those fields, and at that time, the pesticide chemistries were strictly broad-spectrum. Now, narrow-spectrum pesticide tools are available and decision systems are in place for many pathogens with thresholds of basically nil. He warned attendees to guard against a public trend of measuring the success of an IPM program by comparing the number of pesticide sprays applied to the number applied in a conven-

tional program. While reducing the number can be a desirable consequence, he said, it is not necessarily a good measure, or the only measure, of success. This point was brought home during later presentations on genetic engineering for herbicide-resistant crops. In fact, total chemical usage may increase in such cases, with single herbicides sprayed on resistant crops.

Dr. Kennedy discussed the many challenges to implementing IPM systems.

- ◆ Agricultural production systems are dynamic.
- ◆ IPM tactics are not risk-free.
- ◆ Therapeutic measures continue to be necessary.
- ◆ IPM concepts may be general but their application is site specific and often varies from year to year.
- ◆ Biological knowledge alone is not adequate to develop and implement IPM, as technologies may lag and social climates can change.

In listening to Kennedy's and others' presentations it became clear to me that, when approaching IPM implementation, we must recognize that IPM is information intensive and that it must be handled in real time. Stated another way, "there are no silver bullets."

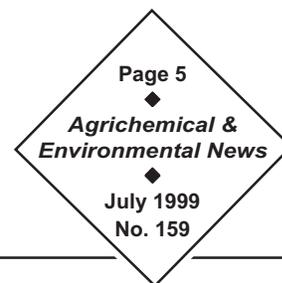
IPM is information intensive...there are no "silver bullets."

Dr. Marjorie Hoy, University of Florida, gave an overview of the current status of biological control in insects. Beginning with the statement that biocontrol is at a crossroads,

she proposed labels (similar to pesticide labels) for natural enemies. In her experience, industry self regulation was not working. Quality control of the product (natural enemy) and the information provided (how, when, and how much to release, how to monitor) to the end user were too variable across the industry. Such quality control problems would do nothing to promote the use of biocontrol agents.

Dr. Jan Meneley, AgBio President, described the difficulties of remaining economically competitive in microbial markets. He related a story of how drought killed the pest (grasshoppers) so the protozoan

IPM Conference, cont.



Dr. Catherine Daniels, Pesticide Coordinator, WSU

biocontrol agent was not needed that year. Companies rarely stay in business in this type of climate. Other presenters described a viral agent for control of grape skeletonizer on grapes. Because control was achieved for a two-to-three-year period, the product would not generate enough sales to merit marketing. Probably the biggest challenge to microbial markets, however, is chemicals. Microbials are not able to compete in the marketplace against a chemical unless pests develop resistance to that chemical.

I would like to share some thought-provoking comments that were made.

“Available technologies may be driving systems, not ecology.”

After investing many millions of dollars into genetically engineered crops, questions still remain about their non-target safety (e.g., Bt corn pollen killing Monarch butterfly caterpillars in lab studies), their contribution to selection pressure (e.g., resistance of Colorado Potato Beetle to Bt potatoes, changes in weed complexes in genetically engineered herbicide resistant monocultures), and their social acceptability (think of the European Union’s unyielding stance against genetically engineered crops). Do we engineer genes because it is the correct tool based on the specific agroecosystem involved, or do we engineer genes *because we can?*

“Media says the name IPM is hard to understand.”

Urban population numbers far outweigh those in rural (agricultural) areas and this population is very vocal about what goes on in agriculture, whether they fully understand farming practices or not. IPM is a very information-intensive discipline, yet the *USA Today* newspaper (3/9/99) quoted a survey that found the general public only reads science/technology news stories 14% of the time. How do we deliver information to a public that only consumes sound bites? When cookbooks such as *The Joy of Cooking* advocate eating organic foods, this non-scientific (but easily

assimilated) piece of information carries more public opinion weight than a dry but factual article presenting the balance between the risks of organic and conventionally grown products.

The meeting concluded with a presentation by Dr. Kathleen Merigan from the Henry A. Wallace Institute for Alternative Agriculture. She told audience members that we will fall short of the goal of 75% of our lands under IPM by the year 2000. Components of the system failed, she said, for different reasons: not enough funding for IPM, few and minor successes, too much of “the same old thing” going on in

research which did not “set well” with policy makers. Dr. Merigan’s fear was that IPM really did not “have a seat at the table” during FQPA implementation and she chided audience members for not leading the debate at EPA on the subject of Bt resistance. Her advice to the group was to avoid getting dragged into saving pesticides from FQPA scrutiny or substituting one pesticide for another. She encouraged more system-based research and approaches, and she applauded the environmental community for becoming involved in IPM, citing the Wisconsin Potato Growers and World Wildlife Fund joint program for potatoes.

In short, the conference took an unflinching look at the difficult and complex issues surrounding IPM. Space limitations allow me to highlight only a few of the many excellent presentations. The anticipated publication date of the conference proceedings, to be published by APS Press (<http://www.scisoc.org/apsspress/>), is Fall 1999. Conference attendees will receive a copy and extra copies will be available to the public for purchase. 

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How do we deliver information to a public that consumes only sound bites?

IPM in Schools

Do We Need to Legislate Common Sense?

Dr. Daniel A. Suomi, Pest Control Operator Specialist, WSDA

Across the country, administrators, parents, and legislators are trying to identify ways to make schools a safe place for children to learn. Media reports on potential safety hazards—*asbestos*, *lead*, and *pesticides*—have raised health-related questions. Parents should be reasonably certain their kids aren't exposed to these or other toxins. Does this mean we need to ban certain ones, such as pesticides, from the school environment? After all, these materials are designed to kill things. But conversely, shouldn't schools be free from harmful pests as well?

The cockroach, a pest in many schools, has contributed to an increase in asthma among young people, especially in metropolitan areas. Asthma is now one of the most prevalent diseases in our country, increasing about 4% each year. Rats and mice, occupants of numerous school buildings, consume and contaminate stored food and, as an added bonus, carry a host of potential diseases. Yellowjackets, through their painful stings, present a life-threatening situation to certain individuals. Do we want these pests in Washington State schools? Of course not. But if we don't use pesticides, won't our schools become overrun with them? How can we reduce our reliance on pesticides, control pests, and still make schools a safe place to learn?

Around the Country

Currently, about half of the states are considering school pesticide-use legislation and half of those have existing regulations (Table 1). Some states require the adoption of integrated pest management (IPM) policies. Others mandate posting of signs for pesticide applications made inside buildings and on school grounds. Some states may require that parents be notified about all pesticide applications. And several states, including Washington, have even defined IPM to

fit their own needs (see sidebar). With all this legislation, notification, and confusing terminology the basic question still remains, "are we really doing what is best for the kids?"

The goal should be simple: to provide a safe and healthy environment for students, staff, and users of school property. To achieve this, a school district will utilize safe and effective practices to control structural, nuisance, and landscape pests. All school districts should adhere to this philosophy and put it into practice. IPM can help achieve this goal and still reduce exposure to potentially harmful chemicals.

What is IPM, really? **IPM is common sense pest control.** First, you determine if a pest problem actually exists. Then, figure out why you have the problem. Next, you look for ways to get rid of the pest

IPM in Washington Defined

A variety of definitions have appeared over the years to describe integrated pest management or IPM. In 1997, the Washington State Legislature (RCW 17.15.010) defined IPM as follows:

A coordinated decision making and action process that uses the most appropriate pest control methods and strategy in an environmentally and economically sound manner to meet agency programmatic pest management objectives. The elements of integrated pest management include:

- (a) *Preventing pest problems;*
- (b) *Monitoring for the presence of pests and pest damage;*
- (c) *Establishing the density of the pest population, that may be set at zero, that can be tolerated or correlated with a damage level sufficient to warrant treatment of the problem based on health, public safety, economic, or aesthetic thresholds;*
- (d) *Treating pest problems to reduce populations below those levels established by damage thresholds using strategies that may include biological, cultural, mechanical, and chemical control methods and must consider human health, ecological impact, feasibility, and cost-effectiveness; and*
- (e) *Evaluating the effects and efficacy of pest treatments.*

IPM in Schools, cont.

Dr. Daniel A. Suomi, Pest Control Operator Specialist, WSDA

with the least possible hazard to people, property, and the environment. Finally, you document what has been done so those following you don't have to learn the entire process again.

IPM in Washington Schools—Where Are We Today?

During the 1993 legislative session, three bills were introduced that would have required implementation of IPM in public schools and libraries. Although none passed, they generated a considerable amount of public discussion about potential pesticide exposure to children. In response to this issue, the Washington State Department of Agriculture (WSDA), together with the Environmental Protection Agency (EPA), assembled a working group from state agencies, Washington State University, legislators, school officials, and citizen groups to make recommendations for improving pest management and pesticide use practices in schools.

The goal of the working group was straightforward: to ensure that pests are managed effectively without harm to children, adults, and the environment. The working group meets four times a year and has helped produce a videotape (*Integrated Pest Management - Working Together for a Healthy Future*), three IPM manuals, and an IPM seminar series for school maintenance workers. The group is currently assisting a software designer in production of a new way to train IPM practitioners using virtual reality computer technology. Assistance has come from the Washington Toxics Coalition in their Model IPM Schools program and from individual pest control

companies that visit local schools to design site-specific pest management programs. We need to build on these efforts. IPM in schools and the entire urban community must be promoted through strong state leadership.

TABLE 1
 STATES IN WHICH SCHOOL PESTICIDE USE
 LEGISLATION HAS BEEN PROPOSED

State	Current IPM Laws or Regulations in Place	Posting Applications Inside or on Grounds	Notification Prior to Applications
AZ	No	Yes	Yes
CA	No	Yes	No
CT	Yes	Yes	No
FL	Yes	Yes	No
GA	No	Yes	No
IL	Yes	Yes	No
IN	No	Yes	No
LA	Yes	No	Yes
MD	Yes	Yes	Yes
MA	No	Yes	No
MI	Yes	Yes	Yes
MN	No	Yes	No
MT	Yes	Yes	No
NH	No	Yes	No
NJ	Yes	Yes	No
NM	No	No	No
NY	Yes	Yes	No
OR	Yes	No	No
PA	No	No	Yes
TN	No	No	No
TX	Yes	Yes	Yes
VT	No	Yes	No
VA	No	No	Yes
WA	Yes	Yes	No
WV	Yes	Yes	Yes

Source: Gene Harrington, Manager of Government Affairs, National Pest Control Association

The working group now has an opportunity to assist the Seattle School Board in development of an IPM policy. If properly done, this could serve as a model for districts throughout Washington. It is inefficient and costly to revisit this process over and over, school by school; instead, a general policy could be adopted by Washington schools without further legislative mandate. A school district could then develop pest management objectives for each facility. IPM prescriptions would then be needed for the troubling pests in question. Prescriptions for many pests have already been completed; simple modifications are all that is necessary. A great deal of school IPM information can be found at www.ifas.ufl.edu/~schoolipm/. Schools districts interested in developing a program can contact me at dsuomi@agr.wa.gov.

IPM will fail if school administrators do not buy into the policy. Someone must be assigned to oversee the program, preferably at each facility. Don't think that once you have a policy, you have IPM. This is a process requiring substantial input from school officials, students, and parents, and its maintenance requires periodic fine-tuning. If you believe that IPM is too expensive, requires too much education, or is not practical for your school district, think again. But think "litigation" this time. If a pesticide is improperly

IPM in Schools, cont.

Dr. Daniel A. Suomi, Pest Control Operator Specialist, WSDA

applied and students become ill, how much could it potentially cost the school district in associated legal actions? A strong IPM policy and dedicated efforts toward its implementation can be the best prevention.

An Example

I recently attended an IPM in Schools Workshop in Detroit, Michigan, that was part of the Pesticide Regulatory Education Program sponsored by EPA. We visited Cass Technical High

School, an inner-city school with over 3000 students (that's in one building, folks). For years, this facility has fought a losing battle with cockroaches. Traditional pest control methods (surface applications of insecticides) were ineffective. Students at Cass were afflicted with asthma at rates significantly higher than in other schools.

A team was formed, consisting of students, staff, and faculty, to investigate the problem. Some thirty students learned everything they could about cockroaches and put their newly acquired knowledge into practice. They educated other students about how each of them contributed to and could help solve the problem, worked with maintenance staff to exclude pests from the school, instituted improved sanitation measures, placed insect monitoring stations, released biological control organisms, and developed a recordkeeping system. Insect growth regulators, placed in bait stations, were used as a least toxic chemical method to control the pests. The result: cockroach populations are way down, the kids feel great about what they have done, and the program has received national recognition for being the first student-led IPM program in the country.

We came away from that school amazed. Here you

have a group of students who identified a problem—their problem—and found a process to solve it. Why can't more schools do this? There is a tremendous opportunity to make IPM part of any school's curriculum. Students can learn about many of the biological sciences, entomology, horticulture, plant pathology,

biological control, population dynamics, and medicine, as well as other disciplines including chemistry, genetics, and building design.

Initially, school administrators were unsupportive of the students' efforts. After the newspapers, television stations, and magazines started sending

reporters to the school, guess who now stands 100% behind IPM? But the issue is bigger than recognition for a job well done—the Cass experience is serving as a springboard for student participation in school and community projects involving pest management. As this process unfolds, these young people will start

sharing ideas with their parents. This is an excellent way to get "IPM" into the vocabulary of the general public.

Where Should We Be Going?

School districts must be proactive in their pest management; they cannot continue to do business as in the past. If your pest control technician is still applying space sprays for

general pest control, consider hiring someone else. The old "spray and pray" philosophy has been replaced with a system that identifies and monitors pest populations, uses alternative techniques, keeps records, educates building occupants about pests and pest management, and applies highly selective, reduced toxicity pesticides. Simply switching from one pesticide to another does not represent a comprehensive IPM program.

The old "spray and pray" philosophy has been replaced...

...switching from one pesticide to another does not represent a comprehensive IPM program.

IPM in Schools, cont.

Dr. Daniel A. Suomi, Pest Control Operator Specialist, WSDA

Even without an official IPM policy, all school districts should, at a minimum:

- ◆ analyze their current pest control program
 - ◆ is it working?
 - ◆ what does it cost?
- ◆ identify problem pests
- ◆ determine which pesticides are being used
- ◆ check pesticide applicator licenses
- ◆ require continuing education for applicators
- ◆ maintain current pesticide application records
- ◆ provide secure pesticide storage facilities

Implementation of an IPM program does not have to be difficult; many sources are available to assist you. Numerous alternatives to pesticides have been developed and are every bit as effective. Learn about these alternatives and blend them into your existing pest management program. Be proactive and prevent pest problems before they occur instead of reacting to a pest crisis by using pesticides exclusively. Successful IPM programs draw on a variety of effective techniques. And for good measure, add in a dose of plain old common sense. 

Dr. Dan Suomi is the Pest Control Operator Specialist with the Washington State Department of Agriculture and is also Chair of the IPM in Schools Working Group. He can be reached at dsuomi@agr.wa.gov or (360) 902-2044.

Region 10 Welcomes Dick Stark

Sandra Halstead, EPA FQPA Specialist, Region 10

In late May, Dr. Richard Stark joined the EPA Region 10 staff in Prosser, Washington, as a Senior Environmental Employee working on Food Quality Protection Act and Columbia Plateau agricultural initiatives. Dick's doctoral degree is in entomology and his experience includes research on insect pests of hops and potatoes and regulatory entomology with Washington State Department of Agriculture (WSDA) in honeybee certification and apple maggot-infestation tracking.

Initially, Dick will be gathering information on pesticide use data for inclusion in the crop profiles for asparagus, blue grass seed, peaches, and apricots. In addition, he will assist with grower surveys on Integrated Pest Management (IPM) strategies in tree fruits in cooperation with the Pear IPM Project in Yakima under the leadership of Brooke Peterson.

Dick also teaches science-related courses at Yakima Valley Community College and Heritage College. Until additional office space is obtained, Dick and I will share an office. Dick's e-mail is stark.richard@epa.gov.

Organic Amendments for Nematode Management on Potatoes

Dr. Gerry Santo, Nematologist, WSU Prosser

The Columbia root-knot nematode, *Meloidogyne chitwoodi*, is a serious problem to potato production, blemishing tubers and rendering them unmarketable. Seventy to eighty percent of the potato acreage grown in Washington receives nematicide treatments to control *M. chitwoodi* and the northern root-knot nematode, *M. hapla*. Annual control costs are estimated at \$20 million. Yield losses without chemical treatments may be as high as \$40 million. Management strategies for *M. chitwoodi* include the use of nematicides, green manure crops, crop rotation, and early harvest (1, 2, 3, 4). Control is heavily dependent on soil fumigation. The continued availability of these nematicides is a major concern to potato growers. Recently, we have been investigating the use of organic amendments crambe (*Crambe abyssinica*), meadowfoam (*Limnanthes alba*), and milkweed (*Asclepias syriaca*) seedmeals for managing *M. chitwoodi* on Russet Burbank potato.

Crambe and meadowfoam are industrial crops grown for oil in North Dakota and the Willamette Valley of Oregon, respectively. Crambe and meadowfoam seedmeals, processing by-products of the oil extraction of the seeds, contain high levels of glucosinolates. When the seedmeal is incorporated into the soil, the glucosinolates undergo an enzymatic breakdown to release isothiocyanate, which is toxic to certain insects, fungi, nematodes, and weeds. Isothiocyanate is similar to the active ingredient of the soil fumigant metam sodium

(Vapam™). Milkweed is a new crop being produced for its fiber in pillows and comforters and for industrial quality oil extracted from the seed. Any toxic compounds in milkweed are not yet known.

At the Irrigated Agriculture Research and Extension Center (IAREC) in Prosser, Washington, we evaluated all three seedmeals as soil amendment for control of *M. chitwoodi* in the greenhouse and in the field. Greenhouse experiments showed that each of the three was toxic to *M. chitwoodi*. Field studies were conducted in 1997 and 1998 in a loamy sand field infested with *M. chitwoodi*. Crambe and meadowfoam were evaluated in 1997, and crambe and milkweed in 1998.

Application Specifics for Field Evaluations

For the field studies, we constructed plots three rows wide and 25 feet long, with 34-inch row spacing, arranged in a randomized complete block design with five replications.

Seedmeals were evaluated at 5 and 10 tons per acre (T/A). In 1997 and 1998,

Telone II™ at 20 gallons per acre (gal/A) and Mocap™ 6EC at 12 pounds of active ingredient per acre (lb ai/A) served as standard nematicide checks, and untreated plots served as controls (Table 1). Telone II™ was applied 18 inches deep at 18-inch spacing three to four weeks before planting and packed immediately with a cultipacker. Mocap™ was applied just before planting as broadcast spray with a CO₂ pressurized backpack sprayer and incorporated 6 inches deep

TABLE 1
 Percent cull of Russet Burbank potato tubers infected with *Meloidogyne chitwoodi* from Crambe, Meadowfoam, and Milkweed seedmeal plots, WSU-IAREC, Prosser, WA

Treatment (rate/A)	Percent Culls	
	1997	1998
Untreated	89a	61a
Telone II 20 gal	7d	0c
Mocap 6EC 12 lb ai	34bc	32ab
Meadowfoam 5T	96a	--
Meadowfoam 10T	46b	--
Crambe 5T	53b	11bc
Crambe 10T	16cd	10bc
Crambe 5T + Mocap 6EC 12 lb ai	--	0.2c
Crambe 10T + Mocap 6EC 12 lb ai	--	3c
Crambe 10T + Mocap 6EC 6 lb ai	--	11bc
Milkweed 5T	--	38ab
Milkweed 10T	--	3c

Values are means of five replicates. Values in each column followed by the same letter do not differ at $P < 0.05$, according to Least Significant Difference test. Percent data were transformed to $\text{Arcsin}[\sqrt{x}]$, analyzed, and transformed back to real numbers.

Nematode on Potatoes, cont.

Dr. Gerry Santo, Nematologist, WSU Prosser

with a rototiller. The seedmeals were applied three to four weeks before planting as a broadcast, incorporated 6 inches deep with a rototiller, and packed immediately with a cultipacker. Certified Russet Burbank potato seed pieces were planted and the tubers were harvested approximately five months later. Nematode counts, yield, and tuber infection data were obtained from the middle row of each plot. Twenty tubers were selected at random, peeled by hand, and examined for nematode infection.

Results to Date (Table 1)

Results in 1997 showed that crambe was more effective than meadowfoam seedmeal in reducing tuber damage caused by *M. chitwoodi*. However, only Telone II™ had less than 10% culls. Tubers with six or more infection sites were graded as culls. Processors may reject or severely downgrade potato fields with more than 10% cullage. Crambe was further tested in 1998 along with milkweed seedmeal. Crambe at 5 and 10 tons (T) provided good control, and milkweed at 10 T gave excellent control. Crambe seedmeal treatments in combination with Mocap (at 12 lb ai/A) gave excellent control. Research with crambe and milkweed alone and in combination with nematicide treatments will continue in 1999. The previous years' results show that crambe and milkweed seedmeals

may be another effective management strategy for controlling *M. chitwoodi* on potato. The best means to suppress nematode populations would be to integrate all or a combination of the management practices available. 

Dr. Gerry Santo is a Nematologist with Washington State University in Prosser. He can be reached at gsanto@tricity.wsu.edu or (509) 786-9256.

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Two EPA Booklets Available

The fifth edition of the U.S. Environmental Protection Agency's *Recognition and Management of Pesticide Poisonings* is now available. This manual has been produced by EPA since 1973 to provide health professionals with current information on the hazards and treatments of pesticide poisonings and injuries.

The manual deals almost entirely with short-term (acute) harmful effects of pesticides, drawing upon source material from published texts, pesticide product literature, and direct communication with toxicologists. It is indexed by signs and symptoms, as well as by products. New features for the fifth edition

include tabular listings of commercial products in each chapter, and new chapters on disinfectants and taking patients' environmental and occupational histories.

This latest update was fostered by a larger initiative, Pesticides and National Strategies for Health Care Providers, which was clarified in a workshop held April 23-24, 1998. The proceedings of this workshop (EPA 735-R-98-001) and the *Recognition and Management* manual (EPA 735-R-98-003) are available through EPA at (703) 305-7666; the manual is available on the Internet at <http://www.epa.gov/pesticides/safety/healthcare>.

One Drip at a Time

Alternative Chemical Application Techniques for Environmental Stewardship

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

The Grower's Dilemma

Imagine this. Because of your ingenuity and tireless productivity, you produce a vital but very cheap product of high quality. Yet no one seems to appreciate what you have accomplished as evidenced by layers of government regulation and weekly headlines proclaiming you are ruining the earth. Such is the plight of our farmers. The pressure is on them to guard soil and water quality, protect field workers, reduce pesticide residues in food, and eliminate waste. Despite their desire to use less pesticide under reliable integrated pest management (IPM) programs, they find pesticides are still a key tool in existing IPM systems, due in part to a lack of a detailed knowledge about specific limiting factors in the minor crop agroecosystems of the Pacific Northwest. Given the societal constraints on growers, how can they continue to use the pesticides they urgently need and maintain their efficacy?

Since passage of the Food Quality Protection Act (FQPA), "reduced-risk pesticides" (in the lexicon du jour) have been touted as the way for growers to have their cake and eat it too. But such simplistic use of jargon overlooks the long lead time necessary to develop an array of alternative chemicals that would be useful in agriculture dominated by minor crops. Furthermore, any new, alternative chemistries must stand the test of the marketplace.

While new chemicals that EPA considers to present a reduced risk are always welcome, we may be overlooking ideas for taking immediate action. Considering that the application process itself creates the highest residues, and thus the greatest hazard for runoff and worker exposure, perhaps it is time to examine closely whether we can improve pesticide delivery.

New Ideas for Old Technology

Application technology is simply a system of "dose

transfer." For the vast majority of pest control operations the technology has not changed; it still consists of a tank, pump, and set of nozzles. The biggest problem with this old technology is that the spray aerosols end up off the target—i.e., if protection of foliage is desired, some of the of the spray lands on the soil where it can be carried by runoff. Certain combinations of nozzle sizes and sprayer pressures produce aerosols that can be carried in the air for hundreds and sometimes thousands of feet away from the field.

Spray-nozzle technology has advanced to the point where off-target drift can be minimized, but not completely eliminated. Electrostatic sprayers give the spray aerosols an electric charge as they exit the nozzle, causing the droplets to be attracted to leaf surfaces. Although such sprayers have been demonstrated to be very effective in nearly eliminating off-target movement while maximizing foliar coverage, the technology is not widely used due to cost and limited initial effectiveness under field conditions.

Many herbicides and some insecticides are targeted for the soil. Developing weeds would absorb the herbicide directly from the soil. Insecticides that can be easily absorbed by plant roots will move into new growing tissue, making it toxic to feeding insects. Chemigation or application through irrigation systems can be

ideal delivery techniques for these types of pest management strategies.

Sprinkling It On

A form of chemigation called fertigation, or delivery of fertilizers in irrigation water, has been practiced for some time using overhead center pivot irrigation rigs. Irrigation water is pumped from a central location into a wheel-mounted pipe (boom) the radial length of a circular field. The water is delivered through a series of sprinklers along the boom as the rig slowly circles the entire field. With center pivot fertigation, nutrients

**While new chemicals
are always welcome,
perhaps we can also
improve delivery...**

One Drip at a Time, cont.

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

can be metered out as the crop needs them, and they can be incorporated into the soil with the infiltrating water despite the growing plant canopy.

Preemergence herbicides can be delivered through center pivot chemigation systems. An advantage of this application technique for herbicides is efficient soil incorporation of the pesticide and drastic reduction in drift. A potential disadvantage is runoff from the edges of fields that are over-watered.

Center pivots have seen only limited use for insecticide application. One of the more established uses has been the application of insecticides in corn. One concern about center pivot chemigation of insecticides and/or fungicides is whether coverage of foliage is as good as with sprayers. On the other hand, one study has estimated the costs of center pivot chemigation as nearly ten times less than the costs of conventional aerial or ground spraying.

Dripping It On

Furrow irrigation is rapidly being replaced by drip irrigation. In drip irrigation, water is delivered to the crop through enclosed plastic pipes with regularly spaced holes or emitters. The pipes run parallel to the crop rows, either within the row or alongside it. The pipes may be placed beneath the soil surface, on the surface, or hanging above the surface. Fertilizers are commonly injected into drip tubes periodically through the growing season. Roots tend to grow toward the zones where the water is emitted, so this method places nutrients efficiently, where they are most needed.

Pesticide application via drip irrigation has been limited, with fumigants and nematicides being the most common.

The Drip Advantage

Because the spatial distribution of water is controlled, drip irrigation has been recognized as a water conser-

vation technique that can also virtually eliminate runoff and soil erosion. The former is especially true when irrigation is set to optimize crop needs rather than administered on a routine, daily schedule.

In addition to eliminating pesticide runoff, drip chemigation can reduce worker hazards and waste disposal concerns because it is essentially a closed system of application. The pesticide is injected directly into a system of irrigation piping; thus, exposure of applicators and field workers is tremendously minimized by the absence of drift and foliar residues.

Container rinsewater is the only waste, and it can be recycled by injection into the irrigation system. Thus, waste containment costs are reduced along with the potential for off-site transport of contaminated water.

Use of drip irrigation systems for systemic insecticide and/or fungicide application is highly compatible with IPM principles. If subsurface chemigated pesticides could be proven to translocate very rapidly into apical leaves of a growing plant, then applications could be made when a pest population reached an economic threshold rather than prophylactically, resulting in reduced cost and chemical use. Furthermore, pesticide usage could be reduced if a recently registered product was used; such pesticides generally require only a fraction of the application rate of older products.

Drip chemigation offers the possibility of boosting control efficacy because the pesticides would be targeted only to attacking pests, leaving predator and parasitoid populations unharmed—not always the case with broadcast sprays.

Those crops attacked by aphids, nematodes, and diseases may be the most probable candidates to adopt chemigation of systemic pesticides. New products like the systemic insecticide imidacloprid have much lower active ingredient rates than conven-

...drip irrigation (for pesticide application) is highly compatible with IPM.

Drip Chemigation, cont.

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

tional sprayed products, potentially reducing the health hazard even further.

Caveats Necessitate Research

Despite the apparent advantages of drip chemigation, several concerns need to be addressed. First, to avoid prophylactic applications, we must determine how fast a pesticidal dose is reached. Plant uptake of the pesticide will vary among soils and specific irrigation systems. Ideally, a crop advisor would inform a grower when a pest population reaches an economic threshold, and then the grower could inject the pesticide into the drip system in a timely fashion.

A second concern is leaching. Many drip systems turn on the water according to a routine schedule. More precise systems use moisture sensors that control watering times according to a predetermined optimal soil moisture level. If drip systems are turned on excessively, soils can become saturated, promoting chemical leaching. Leaching not only creates a potential for contamination of shallow water tables, but dilutes the chemical intended for absorption by the plants.

Interdisciplinary Problem Solving

At Washington State University, Dr. Robert Evans (Biological Systems Engineering), Dr. Wyatt Cone (Entomology), and I (Crop and Soil Sciences) have been conducting studies to address the concerns listed above. With funding from the Washington Hop Commission, the Hop Research Council, and the USDA National Research Initiative Competitive Grants Program, we are studying imidacloprid movement and uptake by hops at the WSU Prosser experimental drip yard. At this experimental yard, irrigation pipes are buried at a depth of about 18 inches, and water is emitted from tiny holes spaced every three feet along the pipe length.

In our first-year studies, we noted that the systemic aphicide imidacloprid, which is comparatively water soluble, tended to leach to levels of 3.5 feet when water was turned on daily without regard to plant needs. We hypothesized that soils became saturated, moving the chemical too far below the emission zone.

In the second and third years of our studies, irrigation water was automatically turned on only when soil moisture dropped below an optimal level determined for hop growth. When the soil moisture content rose to this level, the water was automatically turned off. Consequently, imidacloprid residues remained near the emitter; no significant leaching occurred.

Imidacloprid residues in soil declined very quickly to low parts per billion levels within several weeks after injection. At the same time we noted that residues rose rapidly in plant leaves within one week after injection. We are hypothesizing that hop plants may be absorbing significant proportions of the applied imidacloprid because of the tendency of roots to grow toward the emitters.

Where We Go from Here

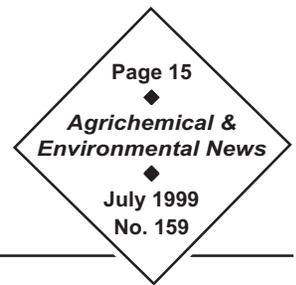
In the 1999 growing season we are focusing on increasing the accuracy of soil moisture monitoring by placing more sensors in the yards. We are conducting a side-by-side comparison of imidacloprid movement when irrigation timing is controlled by ambient soil moisture conditions and when it is turned on daily for a fixed time interval. We are also investigating how long-term interaction of imidacloprid residues with the soil affects the chemical's availability for plant uptake and its potential for leaching.

We remain committed to studying drip chemigation as an alternative method of environmental stewardship. Combining the chemistry, biology, and engineering disciplines has enabled us to answer some questions about a promising crop protection system. Such studies are especially needed with the new crop of reduced risk pesticides trickling onto the market. 

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Editor's Note: For more information and discussion about drip irrigation technology, visit <http://www.microirrigationforum.com/>.

1999 Pesticide Container Recycling Schedule



Washington Pest Consultants Association

Washington Pest Consultants Association organizes an annual series of collection dates and sites for empty pesticide containers. Dates and locations are subject to change; confirm with a telephone call to the number listed in the table before participating. For general questions, or if you are interested in hosting an event at your farm, business, or in a central location in your area, contact Clarke Brown at (509) 965-6809 or Roger Ours at (509) 930-6950.

CONTAINERS MUST MEET THE FOLLOWING CRITERIA:

- Rinsed—no residue remaining • Majority of foil seal removed from spout (small amount remaining on rim OK) •
- Clean and dry, inside and out, with no apparent odor • Hard plastic lids and slip-on lids removed •
- Half-pint, pint, quart, one and two-and-a-half gallon containers accepted whole •
- Five-, 30-, and 55-gallon containers accepted whole if lids and bails removed •

DATE	TIME	LOCATION	CONTACT	PHONE	OTHER
July 12	9 am to 3 pm	Snipes Mtn, Transfer Station	Mark Nedrow	(509) 574-2472	Cardboard Accepted
July 13	8:30 am to 3 pm	Terrace Heights Landfill, Yakima			
July 26	8 am to 12 noon	Wilbur-Ellis, Chelan	Brian Hendricks	(509) 682-5315	
July 27	8 am to 12 noon	Wilbur-Ellis, Brewster			
	1 pm to 5 pm	Wilbur-Ellis, Tonasket			
July 28	8 am to 10 am	NW Wholesale, Oroville	Herb Teas	(509) 662-2141	
	12 noon to 3 pm	NW Wholesale, Okanogan			
Aug 2	8 am to 10 am	Cenex, Almira	Scott Winona	(509) 632-5645	(509) 641-0611 cell
	11 am to 1 pm	Wilbur Airport	Greg Leyva	(509) 647-2441	or Dennis Buddrius (509) 647-5394
	2 pm to Finished	Davenport Airport	Lee Swain	(509) 725-0011	
Aug 3	8 am to 10 am	Western Farm Service, Harrington	Jim Hurst	(509) 253-4311	
	1 pm to 3 pm	McGregor's, St. John	Rick Bafus	(509) 648-3218	
Aug 4	8 am to 10 am	McGregor's Colfax	Joel Fields	(509) 397-4691	
	12 noon to 2 pm	Cascade Flying Service, Garfield	Doran Rogers	(509) 635-1212	
	3 pm to Finished	Dale's Flying Service, Palouse	Dale Schoepflin	(509) 878-1531	
Aug 5	8 am to 10 am	McGregor's Pullman	Larry Schlenker	(509) 332-2551	
	12 noon to 3 pm	Valley Helo Service, Clarkston	James D. Pope	(509) 758-1900	
Aug 6	8 am to 10 am	Western Farm Service, Pomeroy	Jerry Wilsey	(509) 843-3491	
	12 noon to 2 pm	McGregor's, Waitsburg	Terry Jacoy	(509) 297-4296	
Aug 9	8 am to 11 am	Wilbur-Ellis, Eltopia	Vern Record	(509) 297-4291	
	12 noon to 2 pm	Pfister Crop Care, Pasco	Steve Pfister	(509) 297-4304	
	3 pm to Finished	Air Trac, Pasco	Gerald Titus	(509) 547-5301	
Aug 10	8 am to 10 am	Eastern WA Spraying Svc, Eltopia	Willis Maxson	(509) 297-4387	
	11 am to 2 pm	B & R Aerial Crop Care, Connell	Chris Eskildsen	(509) 234-7791	
	3 pm to Finished	B & R Ag. Chemical, Othello	Larry Hawley	(509) 488-6576	

“Our industry does not want pesticide containers to become a waste issue. If we take the time to clean and recycle these products, we can save money, show that the industry is responsible in its use of pesticides, and reduce inputs to the waste stream.”

Codling Moth: Serious Pest Provides IPM Model

Dr. Doug Walsh, Agrichemical & Environmental Education Specialist, WSU

The codling moth, *Cydia pomonella*, is the key arthropod pest of apples and pears in the Pacific Northwest, driving the insect and mite pest control programs for the entire region's pome fruit industry. Millions of dollars have been spent developing controls and control strategies for this pest. Integrated pest management (IPM) of the codling moth is essential for the economic survival of tree fruit producers in the western United States.

The Magnitude of the Problem

With the exception of specific areas of Eastern Asia, codling moth is a pest worldwide, wherever temperate deciduous fruits are produced. As a testimony to its impact, a brief survey of the electronic literature database AGRICOLA 1999 yielded 3,444 references to codling moth. Of these, 1,137 references contained codling moth in the title, ninety-two of which were textbooks. Many land grant universities maintain detailed web pages on the biology and recommended controls for codling moth (see sidebar).

Background in Brief

Asia Minor is believed to be the native home for codling moth. Codling moth was introduced to North America at least 200 years ago and it successfully followed the Oregon Trail westward with its fellow pioneers. Apples, pears, walnuts, and occasionally other fruits are attacked. Codling moth larvae are direct pests in that they directly damage the marketed agricultural product. Culls are either destroyed or used in the process or juice market at a substantially reduced economic return. When infesting populations remain unsuppressed, most of the fruit in an orchard will be damaged. The availability of effective broad-spectrum insecticides over the past fifty years has enabled fruit growers to maintain economic control of codling moth.

Life Stages

Codling moth eggs average about 1/12-inch long, are oval, flat, and, when first laid, translucent. Eggs are laid individually on leaves or fruit. The larvae (worms) bore deep into the fruit, rendering it unacceptable for sale in the fresh market. Reproductive adults (moths)

and juveniles (caterpillars) inhabit very different habitats.

The codling moth overwinters as a mature larva in a cocoon. Larvae are found under loose bark scales on the tree, in litter at the base of the tree, in woodpiles, on picking bins in the orchard, or on farm buildings near packing sheds where culled apples might have been dumped. Overwintering larvae begin changing into pupae about the time the first apple blossoms show pink color.

The first adult moths begin to emerge about the time the Red Delicious are in full bloom. Peak emergence is usually seventeen to twenty-one days later, depending on temperature. Adults continue to emerge for six or seven weeks and are most active on warm evenings when temperatures exceed 60°F. Moths mate and mated females can begin laying eggs within a day of emerging from their pupae. In laboratory studies it has been observed that under optimal conditions mated females have an extremely high reproductive potential and can produce well over 100 eggs during their fecund period (Howell 1970).

Codling moth is a multivoltine pest (multiple generations per year). Each year, some first-generation larvae enter diapause, a state of delayed development and inactivity. The rest stay in the cocoon for two to three weeks, then emerge as adults. Second-generation adults begin emerging in early July. Adult activity peaks in mid-July to early August and continues into early September. Second-generation larvae are in the fruit from mid-July until late September. Mature larvae of the second generation leave apples as early as mid-August in search of overwintering sites.

In exceptionally warm years, a partial third generation may be produced. Moths representing a third flight emerge in late August or early September and deposit eggs. While larvae will enter fruit, causing severe damage in some cases, they usually do not complete development before winter conditions arrive or the fruit is harvested.

...continued on next page

Codling Moth, cont.

Dr. Doug Walsh, Agrichemical & Environmental Education Specialist, WSU

Chemical Control

Over the past twenty years pest control activities have relied on suppressing infestations of codling moth via air-blast application of the organophosphate insecticides azinphos methyl and methyl parathion. The systemic insecticides are transported through plant tissues to the codling moth larvae and the larvae are controlled when they feed on or are contacted by the insecticide. This strategy has had some drawbacks. Insecticide residues (though far below legal allowable tolerance) can be detected (see "Free? Unlikely." *AENews*, Dec. 1998) on many fruits on market shelves. This has resulted in substantial negative press and has led to confusion and negative perceptions for consumers. Another problem is tolerance to azinphos methyl, which has been documented following multiple applications (Varela et al. 1993, Knight 1994). (For a brief description the development of pesticide resistance see "Insecticide Resistance as an Ecological Phenomenon, *AENews*, April 1999.) Broad-scale application of potent organophosphate insecticides is also highly disruptive to beneficial arthropods and pollinators including honey bees. Disruption of beneficial arthropod populations can contribute to the outbreak of secondary pests including spider mites (Solomon and Glen 1979). On the other hand, reduction or discontinuance of broad-scale insecticide use can result in an increase in other pest populations. In the case of the treefruits under discussion, reducing codling moth via more targeted means has resulted in an increase of several leafroller species (Knight et al. 1999).

IPM-based Alternatives: Monitoring and Mating Disruption

Substantial efforts have been made to develop alternatives to organophosphate control strategies for codling moth. One strategy involves predicting the timing of egg hatching. Since newly hatched larvae are typically more susceptible to insecticides than larger larvae or adults, fewer applications of tradi-

tional, broad-spectrum insecticides are needed if timed properly. Additionally, softer chemistries (e.g. *Bacillus thuringiensis*, horticultural oils, insect growth regulators) can be considered. Timing is particularly critical with these agents, as oils are only active as a contact killer and biopesticides like *B. thuringiensis* have very short periods of residual activity.

We can now scientifically monitor moths' emergence from their cocoons and adult male moths' mating flight

activities. In areas where codling moth has narrow generation patterns, models linking climate to codling moth life cycle can be generated. These models, called "phenology models," are based on temperature records and can be used to predict mating and egg hatching. Since the males captured are on mating flights it can be assumed that other males were successful and mated with fertile females. These females can begin laying eggs within about a day of mating. Using the phenology model to predict larval hatch allows for better timing of pesticide application. Monitoring, modeling, and timing of application is an effective strategy in geographic areas where generations are clearly bracketed. Unfortunately, it is less

Codling Moth on the Web

Washington State University

<http://www.tfrec.wsu.edu/IPMnews/index.html>
or link to "Orchard Arthropods" under "Entomology Resources" at <http://entomology.tfrec.wsu.edu/entohome.html>

Oregon State University

<http://www.ippc.orst.edu/codlingmoth/>,
or <http://www.consep.com/pages/techbulliten/Technical%20Bulletin%20CM.html>

Michigan State University

<http://www.msue.msu.edu/vanburen/fcodmoth.htm>

Cornell University

<http://www.nysaes.cornell.edu:80/ipmnet/ny/fruits/FruitFS/codmoth.html> or a *Scaffolds* newsletter article at http://www.nysaes.cornell.edu/ent/scaffolds/1999/5.24_insects.html

University of California at Davis

<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn013.html>

Dr. Doug Walsh, Agrichemical & Environmental Education Specialist, WSU

effective in the Pacific Northwest, since the adults emerge at various times and generations overlap.

One of the most successful new codling moth controls has been achieved by treating orchards with synthetic codling moth sex attractant or pheromones (Howell et al. 1992). It is estimated that roughly 25% (50,000 to 60,000 acres) of apples in Washington State are treated in this manner, a technique known as "mating confusion" or "mating disruption." In mating disruption programs, orchards are saturated with female attractant pheromones. Males become hyperactive, confused, and subsequently unable to find "real" females to copulate with; no fertile eggs are laid. Pheromones can be used in conjunction with traps; in these cases, the trapped males are captured and killed.

Use of pheromones is most effective when codling moth population pressure is low. (Low population densities make it less likely that males can accidentally find females.) When necessary, growers may, and should, still apply insecticides to knock down infestations.

Use of mating disruption techniques can be more expensive than conventional insecticides (Williamson et al. 1996). Most growers using mating disruption use Isomate C+® at roughly 200 dispensers per acre at a price of about \$50.00 to \$60.00 per acre with labor for application. There is some evidence that costs can decrease with time. Research directed by WSU Wenatchee Tree Fruit Research and Extension Center's (TFREC) Jay Brunner in the Howard Flat area indicates that area-wide application of mating confusion can potentially reduce azinphos methyl use by 50 to 80%.

Mating confusion is best approached as an area-wide pest management strategy—all for one and one for all. Adjacent orchards need to practice the same techniques at the same time for maximum effectiveness. Adult female codling moths are strong flyers, and matings will occur in nearby orchards if growers fail to cooperate.

Conclusions

There is a need for effective alternatives to azinphos methyl chemistry for codling moth control. IPM approaches are being investigated, and progress has been made in the areas of life-cycle modeling, use of softer chemistries, use of fewer applications, and use of mating disruption techniques. As traditional insecticide applications for codling moth decrease, other pests previously controlled by the broad-spectrum insecticides will emerge as secondary pests, in the manner of the leafrollers, which have already become an increasing concern for growers.



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ACKNOWLEDGMENT

I thank the entomology treefruit researchers including Drs. Jay Brunner, Elizabeth Beers, and John Dunley at the WSU Tree Fruit Research and Extension Center in Wenatchee for the detailed description on the biology and lifecycle of the codling moth they maintain on their homepage. This information proved invaluable for me in writing this essay.

Dear Aggie

Providing answers to the questions you didn't know you wanted to ask

In contrast to the usually more sober contributors to the Agrichemical and Environmental News, Dear Aggie deals light-heartedly with the peculiarities that cross our paths and helps decipher the enigmatic and clarify the obscure. Questions may be e-mailed to Dear Aggie at dearaggy@tricity.wsu.edu. Opinions are Aggie's and do not reflect those of WSU.

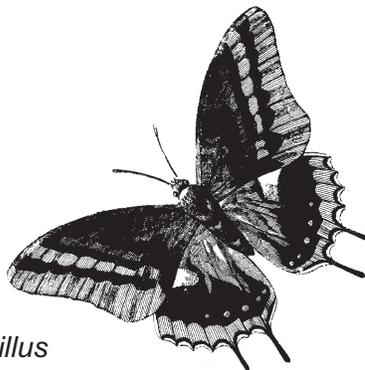
Dear Aggie:

I've never liked the idea of "messing with Mother Nature," and the latest science news seems to bear that out. I hear that genetically altered crops are killing butterflies! How can we stop this?

**Sign me—
Pro-Butterflies,
Anti-Genetics**

Dear P-BAG:

Indeed, a controversy has been raging in Europe over genetically modified (GM) crops, including Roundup Ready® corn and beans, and corn containing Bt (*Bacillus thuringiensis*). Adding fuel to the fire, the science magazine *Nature* (vol. 399, p. 214) recently reported that corn pollen from GM plants containing the Bt gene (which codes for a protein toxic to pest moth larvae) could land on hosts suitable for desirable butterfly caterpillars. Scientists at Cornell University brushed some Bt corn pollen on milkweed plants, which are the only host for Monarch butterflies. Not quite half of the caterpillars died. Thus was born the idea that GM crops may have direct unintended environmental consequences, particularly toward butterflies. Of course, lost on the mainstream media is that currently used pesticides drifting on milkweed could kill 100% of the larvae, not to mention that increased use of the spray version of Bt, which is certified for use in organic agriculture, could drift on milkweeds and cause the same problem as GM corn pollen. Aggie is pretty sure that nobody in the loop is "anti-butterfly"—we're all just trying to come up with solutions for problems more complex than one article in a popular journal might imply.



Dear Aggie:

I was delighted when, a few years ago, a co-worker suggested I take echinacea supplements to protect me from a cold that was spreading around our office. It seemed to work! Soon, I began taking ginkgo, since I heard it's good for memory. Now a neighbor, who used to suffer from depression, is singing the praises of St. John's wort—she says it's "changed her life," and, best of all, it's sold over the counter in health food stores! I must admit, I'm starting to get suspicious about these "natural cure-alls." Should I be?

Slightly Suspicious about Supplements

Dear Supplementally Suspect:

Aggie knows the feeling. When you go into a health food store, I bet you expect to get safe, natural products. We all know that many of the remedies touted in these "natural" markets are derived from plant products. And, surely, if it comes from plants, it must be OK (marijuana addiction notwithstanding), right? The fact is, the herbal remedies sold over the counter as dietary supplements undergo little testing, if any. Furthermore, some evidence has come to light that some of these supplements may have endocrine disruption properties. Several months ago, researchers publishing in *Fertility and Sterility* (March 1999), a journal of the American Society for Reproductive Medicine, reported that lower than recommended concentrations of the three herbs you mentioned, St. John's wort, *Echinacea purpurea*, and *Ginkgo biloba*, had toxic effects on hamster eggs and human sperm. Is this cause for concern? Thus far, Aggie hasn't seen any protests from the organizations that want to ban synthetic chemicals showing similar effects. But I think I'll try jogging the next time I feel depressed. 

Azinphosmethyl 50W Cancellation

Jane M. Thomas, Pesticide Notification Network Coordinator

On June 4, responding to a request made by Micro Flo, WSDA issued correspondence immediately canceling the registration for Micro Flo's insecticide Azinphosmethyl 50W (EPA registration number 51036-164). The cancellation requires that dealer/distributors immediately stop selling Micro Flo's Azinphosmethyl formulated as loose product in open-top bags. (Ed. Note: Azinphosmethyl, the trade name, is one word; active ingredient azinphos methyl is two.)

The cancellation is in response to recent discussions among EPA, industry, and public interest groups regarding azinphos methyl. As a result, an agreement has been reached to convert all azinphos methyl products to water-soluble bags and to relabel existing water-soluble bag formulations with additional worker risk mitigation language. Micro Flo is immediately implementing these measures by recalling all existing Micro Flo azinphos methyl products currently in the channels of trade. To this end Micro Flo is asking all distributors to return all Azinphosmethyl 50W product in open-top bags to Micro Flo; relabel all Azinphosmethyl 50W Soluble product already packaged in water-soluble bags; and contact dealer customers and request that they stop selling or distributing any Azinphosmethyl 50W product (open-top bags) and return any unsold product.

Until very recently Micro Flo maintained registrations for two Azinphosmethyl 50W formulations in Washington: a loose product sold in open-top bags, Azinphosmethyl 50W, EPA # 51036-164; and a product packaged in water soluble bags, Azinphosmethyl 50W Soluble, EPA # 51036-205. Micro Flo has just finished registering a new water-soluble formulation, Azinphosmethyl 50W Soluble, under EPA registration number 51036-164. This product is intended to replace not only the Azinphosmethyl 50W but also their original water-soluble formulation that carries outdated labeling and is in discontinuance. The new Azinphosmethyl 50W Soluble is labeled for use on essentially the same crops as the Azinphosmethyl 50W. 

Federal Register Excerpts

In reviewing the May postings in the Federal Register, we found the following items that may be of interest to the readers of *Agrichemical and Environmental News*.

In the May 4 Federal Register, USDA announced it was considering establishing programs and regulations for farm-raised fin fish and was soliciting comments on this idea. The agency believes a national program could help protect the health of farm-raised fin fish, help producers of farm-raised fin fish meet international trade requirements, and help encourage international trade in U.S. aquaculture products. (Page 23795)

In the May 12 Federal Register, EPA announced the availability of the draft documents entitled: Extrapolation of the Benzene Inhalation Unit Risk Estimate to the Oral Route of Exposure (NCEA-W-0517) and the IRIS [Integrated Risk Information System] Summary for Benzene. The documents are available on the Internet at <http://www.epa.gov/ncea>. (Page 25502)

In the May 19 Federal Register, EPA announced the availability of the revised risk assessment and related documents for azinphos-methyl. These documents are available on EPA's Office of Pesticide Program's web page at URL: <http://www.epa.gov/pesticides/>. EPA will be accepting comments on these documents until July 19, 1999. (Page 27258)

In the May 24 Federal register, EPA proposed revoking exemptions from the requirement for a tolerance for formaldehyde on a list of grain and forage crops from post-

harvest application/use as a fungicide to treat animal feeds. This action is being taken because EPA believes there are no registered uses of formaldehyde on these commodities. (Page 27943)

In the May 24 Federal Register, EPA proposed revoking certain tolerances for diazinon, parathion, disulfoton, ethoprop, and carbaryl. These revocations are being proposed because EPA believes that either there are no longer any registered uses, that the specific commodity is no longer used as an animal feed and the forage tolerances are not necessary, or that the previous tolerance is now covered by a tolerance provided under a different crop listing. (Page 27947)

In the May 26 Federal Register, EPA announced it was soliciting comments on a draft policy paper entitled Use of the Pesticide Data Program in Acute Dietary Assessment. Comments will be accepted until July 26, 1999. (Page 28485)

In the May 26 Federal Register, EPA issued a notice of its plans to proceed with the cancellation of all products containing isofenphos in response to requests for voluntary cancellation made by Bayer Corporation, the sole U.S. registrant of the insecticide. (Page 28471)

In the May 26 Federal Register, EPA announced the availability of the preliminary human health risk assessment and related documents for phostebupirim. Comments will be accepted until July 26, 1999. (Page 28469) 

Tolerance Information

Tolerance Information						
Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
myclobutanil (fungicide) Comment: This time-limited tolerance is being extended in response to a request made because of continued incidence of powdery mildew in Florida and California strawberries.	5/6/99 page 24292	0.50	strawberries	Yes	Extension	3/31/00
azoxystrobin (fungicide) Comment: This extension is being granted in response to EPA again granting Section 18's for the use of azoxystrobin to control Cercospora leaf spot on watercress grown in West Virginia, Tennessee, Alabama, and Florida.	5/12/99 page 25488	1.00	watercress	Yes	Extension	10/30/00
dimethomorph (fungicide) Comment: The wet peel potato tolerance is a permanent tolerance. The tolerances for the cereal grain group are time-limited tolerances established to cover indirect or inadvertent residues of dimethomorph.	5/12/99 page 25451	0.15	potatoes, wet peel	No	N/A	N/A
		0.10	Cereal Grain Group, hay	Yes	New	5/12/04
		0.15	Cereal Grain Group, straw			
		0.05	Cereal Grain Group, grain			
		0.05	Cereal Grain Group, forage			
		0.15	Cereal Grain Group, fodder			
halosulfuron (herbicide) Comment: In this action EPA is establishing new permanent tolerances, is reducing the tolerances for those items marked with an asterisk, and is deleting tolerances for soybean, seed soybean, forage; soybean, hay; wheat, grain; wheat, forage; and wheat, straw.	5/12/99 page 25439	0.05	corn, pop, grain			
		0.80	corn, pop, fodder			
		0.80	corn, sweet, fodder/stover			
		0.20	corn, sweet, forage			
		0.05	corn, sweet, kernel + cob with husks removed;			
		0.05	tree-nuts (crop group 14), nutmeat			
		0.05	corn, field, grain*			
		0.20	corn, field, forage*			
		0.80	corn, field, fodder*			
		0.05	sorghum, grain, grain*			
		0.05	sorghum, grain, forage*			
		0.10	sorghum, grain, fodder/stover*			
diphenylamine (PGR) Comment: This time-limited tolerance is being established to cover the possibility of indirect or inadvertent residues of the plant growth regulator diphenylamine being transferred from apples to pears during packing.	5/13/99 page 25842	10.00	pear	Yes	New	12/1/01
sulfosulfuron (herbicide) Comment: This exemption applies when methacrylic copolymer is applied to growing crops, to raw agricultural commodities after harvest, or to animals when applied/used as an inert ingredient in pesticide formulations	5/19/99 page 27186	0.02	wheat grain	No	N/A	N/A
		0.10	wheat straw			
		0.30	wheat hay			
		4.00	wheat forage			
		0.006	milk			
		0.005	fat and meat of cattle, goat, swine, horse, and sheep			
		0.05	mbp of cattle, goat, swine, horse, and sheep			
methacrylic copolymer (inert) Comment: This exemption applies when methacrylic copolymer is applied to growing crops, to raw agricultural commodities after harvest, or to animals when applied/used as an inert ingredient in pesticide formulations	5/19/99 page 27182	exempt	see comment	No	N/A	N/A
emamectin benzoate (insecticide)	5/19/99 page 27192	0.025	celery	No	N/A	N/A
		0.025	head lettuce			
		0.025	Brassica, head & stem subgroup (5-A)			
tebuconazole (fungicide) Comment: This time-limited tolerance is being issued in response to EPA granting Section 18 emergency exemptions for the use of tebuconazole to control garlic rust in garlic grown in California, Arizona, and Nevada.	5/26/99 page 28377	0.10	garlic	Yes	New	6/30/00
spinosad (insecticide) Comment: The tolerance for tuberous and corm vegetables is a permanent tolerance; all others are time-limited.	5/26/99 page 28363	0.02	tuberous & corm vegetables (crop subgroup 1C)	No	N/A	N/A
		1.00	corn, sweet, stover	Yes	New	6/20/01
		0.02	corn, sweet, kernel, plus cob with husk removed			
		0.60	corn, sweet, forage			
clomazone (herbicide) Comment: This time-limited tolerance is being extended in response to EPA again granting Section 18 emergency exemptions for the use of clomazone to control weeds in watermelons grown in Maryland, Virginia, and Delaware.	5/26/99 page 28374	0.10	watermelon	Yes	Extension	5/30/01
terbacil (herbicide) Comment: This time-limited tolerance is being extended in response to EPA again granting Section 18 emergency exemptions for the use of terbacil to control weeds in watermelons grown in Maryland, Virginia, and Delaware.	5/28/99 page 28924	0.4	watermelon	Yes	Extension	5/30/01
fenhexamid (fungicide)	5/28/99 page 28917	4.00	grapes	No	N/A	N/A
		3.00	strawberries			
		6.00	raisins			

Jane M. Thomas, Pesticide Notification Network Coordinator

The PNN is operated by WSU's Pesticide Information Center for the Washington State Commission on Pesticide Registration. The PNN system is designed to distribute pesticide registration and label change information to groups representing Washington's pesticide users. The material below is a summary of the information distributed on the PNN in April.

Our office operates a web page called PICOL (Pesticide Information Center On-Line). This provides a label database, status on registrations and other related information. PICOL can be accessed on URL <http://picol.cahe.wsu.edu> or call our office, (509) 372-7492, for more information.

Federal Issues

Section 18 Specific Exemptions

On May 6 EPA issued a Section 18 specific exemption (file symbol 99-WA-16) for the use of Bayer's Folicur 3.6F to control stripe rust on barley. This exemption allows for:

- ◆ one application per year,
- ◆ treatment of a maximum of 175,000 acres in Washington, and
- ◆ use through 8/15/99.

On May 11 EPA issued a Section 18 specific exemption for the use of Axiom DF on wheat to control annual ryegrass. The exemption allows for:

- ◆ a single application per season,
- ◆ use on 50,000 acres in Asotin, Columbia, Garfield, Spokane, Walla Walla, and Whitman counties,
- ◆ a 12-hour REI, and
- ◆ an expiration date of May 31, 1999.

On May 19 EPA granted a Section 18 emergency exemption for the use of Novartis' Orbit Fungicide to control yellow rust in raspberries. This exemption provides for the following:

- ◆ 5 applications per growing season,
- ◆ a 30-day PHI,
- ◆ use on 9,500 acres in Clallum, Clark, Cowlitz, Island, King, Kitsap, Leis, Pierce, Skagit, Snohomish, Thurston, and Whatcom counties, and
- ◆ an expiration date of 7/1/99.

On May 19 EPA granted a Section 18 emergency exemption for the use of Novartis' Orbit Fungicide to

control cottonball disease in cranberries. (A copy of this exemption is available on the web. See URL: <http://www.tricity.wsu.edu/~mantone/sect18/1999wsec.html>). This exemption provides for the following:

- ◆ a maximum of 4 applications,
- ◆ a 45-day PHI,
- ◆ use on 150 acres, and
- ◆ an expiration date of 7/31/99.

On May 24 EPA granted a Section 18 emergency exemption for the use of Novartis' Tough 5EC Herbicide to control redroot pigweed and kochia in mint.

This exemption provides for the following:

- ◆ a maximum of 2 applications,
- ◆ a 49-day PHI,
- ◆ use on 17,960 acres in Adams, Benton, Clark, Franklin, Grant, Kittitas, Lincoln, and Yakima counties, and
- ◆ an expiration date of 12/31/99.

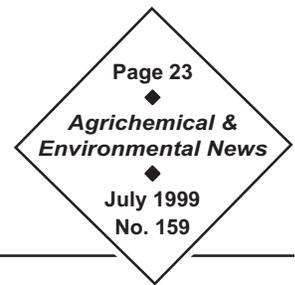
On May 27 EPA granted a Section 18 emergency exemption for the use of AgrEvo's Tattoo C to control late blight on potatoes. (A copy of this exemption is available on the web. See URL: <http://www.tricity.wsu.edu/~mantone/sect18/1999wsec.html>)

This exemption provides for the following:

- ◆ a maximum of 11.5 pints of Tattoo C may be applied per acre per season,
- ◆ a 14-day PHI,
- ◆ use on 150,000 acres, and
- ◆ an expiration date of 5/25/00.

On May 25 EPA granted two Section 18 emergency exemptions for the use of Zeneca's Gramoxone Extra for the desiccation of weeds in dry peas and in green

PNN Update, cont.



Jane M. Thomas, Pesticide Notification Network Coordinator

peas grown for seed. The exemptions provide for the following:

- ◆ a single application of 1 to 1.5 pints Gramoxone Extra per acre,
- ◆ a 7-day PHI,
- ◆ use on 16,58 acres, and
- ◆ an expiration date of 11/30/99.

On May 27 EPA granted a Section 18 emergency exemption for the use of Rohm & Haas' Aphistar 50WP for the control of root aphids on true fir Christmas trees. The exemption provides for the following:

- ◆ two applications made at least 30 days apart,
- ◆ use on 5,250 acres, and
- ◆ an expiration date of 10/31/99.

Supplemental Labels and Use Recommendations

Monsanto has issued supplemental labels for two of its products. These labels are:

- ◆ Roundup Ultra: Directions for use in dormant alfalfa.
- ◆ Rodeo Emerged Aquatic Weed and Brush Herbicide: Directions for the control of European Beachgrass in Oregon and Washington.

Miscellaneous Regulatory Information

In the May 19 Federal Register, EPA announced the availability of the revised risk assessment and related documents for azinphos-methyl. These documents are available on EPA's Office of Pesticide Program's web page at URL: <http://www.epa.gov/pesticides>. In Washington, azinphos-methyl is registered for use under several different Azinphosmethyl labels and is also marketed as Guthion and Sniper. Azinphos methyl is labeled for use on nearly fifty crops and usage sites.

In the May 19 Federal Register, EPA announced that it has issued a Notice of Intent to Suspend to Sureco for its Red Arrow Insect Spray. This notice was issued because Sureco failed to provide the data that EPA required as part of its reregistration review.

In the May 26 Federal Register, EPA announced that it is proceeding with the cancellation of all products containing isofenphos. This action is in response to Bayer's voluntary cancellation request that was initially announced in the January 15 Federal Register (see PNN notification 1999-39). In this notice, EPA announced that effective May 26 the registration for Bayer's Oftanol 5% Granular (EPA # 3125-330) was cancelled. EPA will continue to permit inventory already in the hands of dealers and users to be distributed, sold, and used. Oftanol 2 (EPA # 3125-342) will be cancelled 9/30/99 and EPA is authorizing a 1-year existing stocks provision that allows Bayer to sell and distribute all remaining inventory until 9/30/00. Also likely to be affected are three other isofenphos products registered for use in Washington by the Scotts Company. These products are: Insecticide IV (EPA # 538-162), Scotts Oftanol Grub Control (EPA # 538-225), and Scotts 27-3-10 Fertilizer Plus Insect Control (EPA # 32802-23-538).

State Issues

New Registrations

On 4/16/99, WSDA registered a new use recommendation for Rhone Poulenc's Sevin Brand 4F Carbaryl Insecticide. The bulletin provides directions for the use of this product for petal fall fruit thinning in apples and for use on pears.

WSDA has registered four Novartis products for use. The product name, active ingredient, and labeled usage sites are listed below.

- ◆ Factor Herbicide (prodiamine): bulb, Christmas tree plantation, conifer, conifer nursery, forest nursery/seed orchard, nursery, ornamental, rose, deciduous/shade tree, shrub, flower, and ornamental tree.
 - ◆ Arbotect 20-S Fungicide (thiabendazole): deciduous/shade tree.
- Vanquish Herbicide (diglycoamine salt of dicamba): ditch bank, forest conifer release/site preparation, golf course, and turf.

Jane M. Thomas, Pesticide Notification Network Coordinator

- ◆ Endurance Herbicide (prodiamine): bulb, conifer, evergreen tree, ornamental, deciduous/shade tree, shrub, flower, and conifer nursery.

WSDA has registered Novartis' Thiolux Dry Flowable Micronized Sulfur. This fungicide/insecticide is labeled for use on the following PNN-related sites: alfalfa, apple, asparagus, barley, bean, beet, blackberry, blueberry, boysenberry, broccoli, Brussels sprout, cabbage, carrot, cauliflower, cherry, collard, corn, cucumber, currant, dewberry, flower, garlic, gooseberry, grape, grass seed crop, kale, loganberry, melon, mint, nectarine, oat, onion, pea, peach, pear, pepper, plum, potato, prune, raspberry, rose, rutabaga, rye, sorghum, soybean, squash, strawberry, sugarbeet, tomato, turnip, walnut, and wheat.

WSDA has registered three Monsanto herbicides that are specifically labeled for use on corn crops. Field Master (acetochlor, glyphosate, and atrazine), Mon 8411 (acetochlor), and Mon 58430 (acetochlor) are each labeled for use on corn silage, field corn, popcorn, and corn seed crops.

WSDA has registered Monsanto's Mon 78300 Herbicide. This product is labeled for use for forest site preparation, and for site preparation for forest nurseries and Christmas tree plantings.

WSDA has registered Monsanto's Roundup Original RT Herbicide. This product is labeled for use on the following PNN-related sites: asparagus, CPR lands, rangeland, ditch bank, grape, orchard floor, apple, apricot, nectarine, plum, prune, pear, cherry, peach, alfalfa, barley, bean, beet, carrot, corn, grass, lentil, millet, oat, onion, pea, potato, radish, sorghum, soybean, sugarbeet, sweet potato, and wheat.

WSDA has registered five Monsanto glyphosate products. The products are: Roundup Solugran Dry Herbicide, Roundup Custom Herbicide, Roundup Original Herbicide, Rascal Herbicide, and Honcho Herbicide. (The labeled usage sites for all products are very similar. Please check individual labels for usage sites of interest.) In addition, Monsanto has

issued three supplemental labels for its Roundup Original Herbicide. These provide for:

- ◆ Broadcast applications for use in Christmas Tree plantations in Oregon and Washington,
- ◆ Forestry and utility rights-of-way use, and
- ◆ Post emergence applications to soybeans with the Roundup Ready gene.

Section 18 Crisis Exemptions

On May 7 WSDA issued a crisis exemption for the use of Novartis' Switch 62.5WG to control gray mold on strawberries. The exemption allows for:

- ◆ 4 applications per year,
- ◆ a 0-day PHI,
- ◆ a 12-hour REI,
- ◆ use on 1,500 acres,
- ◆ use until 6/30/99.

Section 24c Registrations

On April 22 WSDA issued an SLN, WA-990019, to Novartis for the use of its fungicide Ridomil Gold EC to control pink rot and pythium leak on potatoes. This SLN expires 12/31/04.

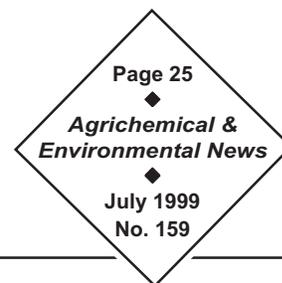
On April 23 WSDA issued an SLN, WA-990019, to Novartis for the use of its herbicide Tough 5EC to control weeds in chickpeas. This SLN expires 12/31/04.

On April 29 WSDA issue three new SLNs for the use of Zeneca's Bravo Weather Stik. The SLNs and their uses are:

- ◆ WA-950036b: For control of Cladosporium leaf spot on spinach and Swiss chard seed.
- ◆ WA-960029b: For the control of late blight, early blight, and Botrytis vine rot on potatoes.
- ◆ WA-880013b: For the control of Ramularia leaf spot on non-bearing strawberry plants in nurseries.

On May 6 WSDA issued an SLN, WA-990022, for the use of Gowan's Dimethoate 4 to control aphids on both dry and succulent peas. This SLN expires 12/31/04.

PNN Update, cont.



Jane M. Thomas, Pesticide Notification Network Coordinator

On May 4 WSDA issued an SLN, WA-990021, for the use of DuPont's product Curzate 60DF Fungicide to control downy mildew on spinach and cabbage seed crops. This SLN expires 12/31/04.

Section 24c Cancellations

On May 13 WSDA issued a letter canceling SLN WA-980022. This SLN was previously issued to JMS Flower Farms for the use of its Stylet Oil to control powdery mildew on hops. The SLN is being cancelled because JMS Flower Farms has revised its Stylet Oil label and the main label now includes directions for use on hops.

Section 24c Revisions

On April 29 WSDA revised three SLNs previously issued for the use of ISK's Bravo Weather Stik. For each SLN the registrant name has been changed from ISK to GB Biosciences and each has had an expiration date of 12/31/03 added. The SLN numbers, and associated crops and pests are:

- ◆ WA-880013; non-bearing strawberries in nurseries; Ramularia leafspot
- ◆ WA-950036; spinach and Swiss chard seed crops; Cladosporium leafspot
- ◆ WA-960029; potato; late blight, early blight, and Botrytis vine rot.

On May 4 WSDA issued a revision to SLN WA-980020. This SLN had previously been issued to Griffin for the use of its Declare Insecticide on peas. The revision changes the expiration date to 12/31/03.

On April 30 WSDA issued revisions to two SLNs, WA-970037 and WA-980003. Both had previously been issued to Platte for the use of its Trifluralin HF on evening primrose seed (for export to the UK) and clover seed crops, respectively. An aquatic toxicity statement has been added to each SLN and the expiration dates have both been revised to 12/31/03.

On May 4 WSDA revised SLN WA-980013. This SLN had previously been issued to Platte for the use of its Amine 4 2,4-D Weed Killer for weed control in trees grown for pulp production. The revision includes

changing the expiration date to 12/31/03.

On May 7 WSDA issued revisions to five SLN's for the use of Uniroyal's Comite. A 12/31/03 expiration date was added to each of the SLN's listed below:

- ◆ WA-770012: For the control of two-spotted spider mite on sweet corn seed, clover seed, and carrot seed crops.
- ◆ WA-870029: For use on mint to control two-spotted spider mite.
- ◆ WA-890020: For use on alfalfa seed crops to control two-spotted spider mite.
- ◆ WA-910033: For use on sweet corn.
- ◆ WA-970010: For chemigation use on potatoes.

On May 12 WSDA issued a revision to SLN WA-930013. This SLN was previously issued to Zeneca for the use of Diquat Herbicide as a harvest aid for use on carrot, radish, and turnip seed crops. The revisions include the addition of coriander, spinach, and table beet seed crops to the label, changes to the application directions, and the addition of a feeding restriction. This SLN expires 12/31/03.

On May 12 WSDA issued a revision to SLN WA-840036. This SLN was previously issued to Bayer for the use of its insecticide Di-Syston 8 to control asparagus aphids and thrips on asparagus. The revision includes changes to the pollinator protection statement and the addition of a 12/31/03 expiration date.

On May 17 WSDA issued a revision to SLN WA-980023. This SLN was previously issued to Wilbur-Ellis for the use of Superior Spray Oil NW to control powdery mildew on hops. The revision changes the expiration date to 12/31/03.

On May 21 WSDA issued a revision to SLN WA-990016. This SLN had previously been issued to Zeneca for the use of its Quadris Flowable Fungicide to control rusts and powdery mildew in grasses grown for seed. The revision:

Jane M. Thomas, Pesticide Notification Network Coordinator

- 1) Reduces the lower-end usage rate from the previous 9 oz/acre to 6 oz/acre, and
- 2) At the registrants request the prohibition against using an adjuvant has been removed and adjuvant use is now listed as optional.

On May 19 WSDA issued a revision to SLN WA-980026. This SLN had previously been issued to Helena Chemical for the use of its Omni Supreme Spray to control powdery mildew in hops. The revision changes the expiration date from 12/31/98 to 12/31/04.

On May 13 WSDA revised two SLNs previously issued to ISK Biosciences for the use of Bravo Ultrex (WA-960012a) and Bravo Weather Stik (WA-960013a) on blueberries. The revisions include changing the registrant name from ISK to GB Biosciences and adding a 12/31/03 expiration date to both SLNs.

On April 12 WSDA issued a revision to SLN WA-950010. This SLN was previously issued to Platte Chemical for the use of its Conifer 90 Herbicide to control weeds in new alder plantings on forest sites. The revisions include:

- 1) Addition of a state restricted use statement, and
- 2) Changing the expiration date to 12/31/04.

Miscellaneous Regulatory Information

In an April 23 letter to EPA, WSDA has proposed that the tolerance for phosphamidon on apples be retained until December 21, 2002. WSDA has indicated that this date was previously discussed with EPA and has been agreed upon by both agencies. Any questions on this topic should be addressed to WSDA. Interested parties should contact either Erik Johansen (360) 902-2078, or Joel Kangiser (360) 902 2049. 