

Agrichemical and Environmental News

A monthly report on pesticides and related environmental issues

Agrichemical & Environmental News

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How Much Punch Does a Peach Pack?

How Environmental Working Group & Consumers Union Have Confused Risk Management with Hazard

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

Dateline: February, 1989. CBS's *60 Minutes* uses a report by the Natural Resources Defense Council¹ (NRDC) to warn of cancer threats to tens of thousands of children from eating Alar residues in apples. Mothers were reported halting school buses to retrieve "poison" apples from their children's lunches.

Fast forward to February, 1999. Consumers Union (CU, publishers of *Consumer Reports*) and Environmental Working Group (EWG) warn parents that a child eating just one mid-sized peach or apple is eating an unsafe dose of neurotoxic insecticides known as organophosphates (OPs).

Could it be true? Does a peach pack a poison punch putting our little ones at risk for illness? Doesn't the government protect us from this type of hazard? The answers to these questions are no, no, and yes. So how can NRDC, EWG, and CU (organizations collectively referred to as EAGS, Environmental Advocacy Groups) conclude that children face undue

hazards from just eating a piece of fruit? The answer lies in understanding that levels considered safe by the EPA are NOT scientifically derived standards equal to the true level of no effect. The answer also lies in uncovering the sleight of hand engaged to estimate exposure. As the rabbit disappears into thin air under the magician's expert hands, so do the cumulative exposure assessment methods employed by the EAGs under the scrutiny of sound toxicological principles.

From Residues to Exposure

Let's look behind the magician's black box to deconstruct what is actually happening in the reports defaming the safety of food. The old report by NRDC and the recent reports by EWG (*How 'Bout Them Apples?*²) and CU (*Do You Know What You're Eating?*³) state that certain foods, especially fruits and vegetables, are laden with OP insecticide residues, and in some cases multiple kinds of residues. Based on current and historical FDA and USDA residue monitoring

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studies, these statements are absolutely true and have been since OP insecticides were registered almost 50 years ago.

All OP insecticides are characterized as nerve poisons, each working in an identical way, namely inhibition of the cholinesterase enzyme in the blood and brain. This characterization of biochemical effect is also true, having recently been given the blessing of a panel of toxicologists in the journal *Toxicological Sciences*, published by the Society of Toxicology.

In an attempt to assess potential exposure of infants and children to multiple OP residues, the EAGs try to normalize the different residues to a single toxicity scale. Once they do this, all residues of different OPs can be adjusted to the common scale and added together to estimate total OP residues in any food. The normalized residues multiplied by the amount of food eaten represents the exposure. This procedure, known as cumulative exposure assessment, was also used by the National Academy of Sciences (NAS) panel that wrote *Pesticides in the Diets of Infants and Children*. With that implied endorsement, the methodology must be correct, right? Wrong!! Such a normalization for rapidly biodegraded compounds like OPs is absolutely without any scientific foundation. Indeed, former EPA assistant administrator, Steve Johnson, publicly stated there is no scientific way to cumulate exposure of compounds with similar modes of toxicity.

Let's examine the flaws in this process of trying to cumulate exposure by normalizing toxicity to the same scale. First, I will tell you what the NAS and EAGs did to cumulate residues, and then I will review why the methodology is flawed from a biochemistry perspective. All references to specific compounds are taken from the EPA's draft REDs (Re-registration Eligibility Decision Documents, see *Agrichemical and Environmental News* Issue 155).

How EWG Cumulates Exposure

To normalize toxicity of all OP insecticides to the same scale, a toxic equivalency factor (TEF) is calcu-

lated for each OP. To calculate the TEF the following information is needed—a common toxicological endpoint for all OPs, and a decision to use one of the OPs as a reference point. The toxicological endpoint could be the NOEL (the dose causing no observable effects in test animals), which was used by the NAS, or the RfD (the EPA's Reference Dose, presumed to have a reasonable certainty of causing no effects after a lifetime of exposure). EWG chose to use the RfD for chlorpyrifos, which is 0.0003 milligram per kilogram body weight (mg/kg bw) for daily (chronic) exposures and 0.001 mg/kg for a one-time (acute) exposure. Thus, chlorpyrifos becomes the reference pesticide to which all other OPs are normalized. The TEF for any one pesticide is calculated by dividing the RfD of chlorpyrifos by the RfD of all the other OPs.

$$TEF = \frac{RfD \text{ chlorpyrifos}}{RfD \text{ OP}_x}$$

For example:

$$TEF \text{ methyl parathion} = \frac{0.0003 \text{ mg kg}^{-1}}{0.00002 \text{ mg kg}^{-1}} = 15$$

Prior to adjusting all OPs to the toxicity scale of chlorpyrifos, EWG calculates consumption by multiplying every pesticide residue by the amount of different types of foods eaten. EWG examines the complete distribution of possible exposures using a probability computer program called Monte-Carlo analysis. For different age groups, the computer program randomly matches up a pesticide residue from the FDA or USDA databases and the amount of the food eaten from the USDA National Foods Consumption Survey. The computer repeats this random matching routine to simulate hundreds of thousands of persons eating food. The results of the simulation modeling are total amounts (in mg) of different pesticide residues consumed, which is used to gauge pesticide exposure.

$$\begin{array}{l} \text{Exposure (mg consumed)} \\ \text{equals} \\ \text{mg of Food x ppm Residue} \end{array}$$

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Next, the amounts of specific pesticides consumed in different foods are multiplied by the TEFs to change the exposure into "toxic equivalents" (TEQs) of chlorpyrifos. Using methyl parathion (MP) as an example, every parathion residue would be multiplied by 15 to change it into chlorpyrifos TEQs. All TEQs for each food are then added together to estimate cumulative exposure to OPs in specific foods and for all foods eaten each day.

In summary, EWG used a computer simulation model to estimate the total daily intake of OPs, assuming that all OPs could be validly normalized to chlorpyrifos toxic equivalents.

CU Does Its Own Thing

Consumers Union came up with its own twist on the TEF by creating a new concept called the Toxicity Index (TI). Because different pesticides have different toxicities, CU could not simply add residues together. All residues were normalized to a common scale by creating an Acute Toxicity Index (ATI) for a one-day exposure and a Chronic Toxicity Index (CTI) for a lifetime exposure. To calculate the ATI, CU took the inverse of a pesticides' LD₅₀ (the median lethal dose to 50% of test rats). The more toxic a compound (as evidenced by a tiny LD₅₀), the bigger the ATI. The ATI was multiplied arbitrarily by 100 to place the resulting number on a manageable scale.

For the CTI, CU used the inverse of the RfD. As with the LD₅₀, the smaller the RfD, the bigger the CTI. As with the ATI, the CTI was multiplied by an arbitrary constant (in this case, 0.1) to place the resulting value on a manageable scale. The CTI was further modified by multiplying it by extra factors if Theo Colborn (of *Our Stolen Future*⁶ fame) said the pesticide disrupted the endocrine system, or the EPA proclaimed it caused cancer in rats.

The ATI and CTI for each pesticide in each food were multiplied by the mean residue reported in the USDA Pesticide Data Program (PDP) and the frequency of residue detections. The resulting values were then

summed (after multiplying the CTI values by 2) to yield an overall TI for each food and pesticide combination. Next, an overall toxic load was calculated for each food by simply adding the individual TIs together. Any pesticide, food, or combination of the two, with a TI higher than any other combination was considered to have a higher toxic load. For example, CU claimed to have discovered that methyl parathion (MP) residues contributed almost all of the TI for many foods. Thus foods like peaches and apples that have methyl parathion residues have higher TIs than foods like bananas, without MP residues.

TEFs and TEQs Stand on a House of Cards

While the TEF and TEQ and ATI and CTI concepts look good on paper, there is no toxicological validity for cumulating exposures nor ranking pesticides by such parameters. The concept of calculating TEQs was borrowed from methodology used to cumulate the residues of extremely persistent, highly chlorinated combustion byproducts called dioxins (see *Agrichemical and Environmental News* Issues 142 and 152). The dioxins themselves only differ from one another by the number of chlorines and their arrangement in the molecule. The TEFs used to calculate the TEQs were originally based on interaction of different forms of the dioxins with a specific cellular protein known as the Ah receptor. Interaction with this receptor preceded any toxic response. The problem with the TEF concept is that it is valid only when a chemical is already in the body at the site of the receptor or enzyme. The concept also assumes that a chemical is not going to be quickly metabolized (detoxified) by any other enzyme system in the body.

OP insecticide residues fail to meet the assumptions that would make the TEQ concept valid. When an OP insecticide on any food is eaten, the residue first passes into the intestine where it is absorbed into the blood vessels leading to the liver. In the liver, much of the pesticide is transformed by detoxification enzymes. The remaining unreacted pesticide and its

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transformation products (which, in turn, could be toxic or nontoxic) leave the liver in the blood and are distributed around the body. The transformation products will be mostly excreted within 24 hours. All cells of the body have the capability to further detoxify the remaining unreacted pesticide. Some of the pesticide may actually reach the cholinesterase (ChE) enzymes.

The rate of toxicokinetic processes—i.e., absorption by the intestine, metabolism by the liver, distribution around the body, metabolism by cells of other organs, inhibition of the cholinesterase enzyme—differs among the various OP insecticides. Thus the relationship between the ability of an OP to inhibit ChE and that OP's toxicity is not a simple, linearly proportional relationship. The OPs undergo many complex interactions and processes before any residue reaches the target enzyme.

Dose Determines the Likelihood of Reaction

The concentration of a pesticide in the immediate vicinity of an enzyme determines the likelihood that any reaction with the enzyme will occur. Different enzymes, whether detoxification enzymes or cholinesterase, have different affinities for the pesticide. For example, the residues of some compounds are so low that reactions with the cholinesterase enzyme are nil. Yet these same concentrations could be high enough for reaction with the detoxification enzymes, which have different affinities. Because the rate of every pesticide-enzyme interaction is unique, the relationships among different pesticides are not simply additive, which is presumed when the toxicity of all OP insecticides are made proportional to a reference OP. When concentrations are so low that the likelihood of reaction with the enzyme is also very low, then adding together residues of different kinds of pesticides is not going to alter the original probability of reaction with the enzyme.

The importance of pesticide dose or concentration has been overlooked in the misguided attempts to

scale all OPs to the same toxicity scale. The mathematical relationship between the effects of a pesticide and a dosage causing those effects is known as the dose-response function. As the result of the way biological populations (whole organisms, cells, or enzymes) tend to react to stimuli and stress agents, this relationship can be drawn as an S-shaped curve (Figure 1). The dose that causes a response in 50% of a test population is called the LD₅₀. The graph shows that, for methyl parathion, an oral dose of 4.5 mg/kg (arrow K) and a dermal dose of 6 mg/kg (arrow L) correspond to a 50% response (death) in the test rats. The dose of 1.5 mg/kg (arrow J) represents the lowest dose fed to pregnant rats causing some adverse behavioral effects in neonatal and juvenile rats. Rats fed a dose of 0.21 mg/kg every day for two years exhibited insignificant depression of blood cholinesterase and mild changes in nerve cells not seen in MP-free rats. This dose is shown by arrow H, representing the LOEL (Lowest Observable Effect Level) for chronic exposure. On the other hand, a dose of 0.25 mg/kg fed to pregnant rats for several days had no effects on development of the offspring. Thus, the dose shown at arrow I is the NOEL (No Observable Effect Level) for developmental effects. The NOEL for chronic exposure as evidenced by effects on cholinesterase activity and cellular pathology was 0.02 mg/kg (arrow F). No evidence of neurotoxicity was observed following a single MP exposure of 0.025 mg/kg (arrow G).

Whether or not the potential health effects of different kinds of pesticide residues can be considered linearly proportional and thus amenable to expression as a TEQ depends on where the residue concentration falls on the dose-response curve. Most of the graph (the area to the left of arrow H) shows the doses corresponding to levels below the chronic and acute NOELs (at arrows F and G, respectively). Dosages below the specific NOELs for different compounds are not additive. In other words, owing to toxicokinetic considerations, if the dose of an OP does not elicit a reaction with the ChE enzyme, then its dose will not be additive to another OP that falls below its own NOEL. To begin to express the toxicity of one OP

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relative to another OP would require a sophisticated mathematical model of the dose-response function at doses below the NOEL.

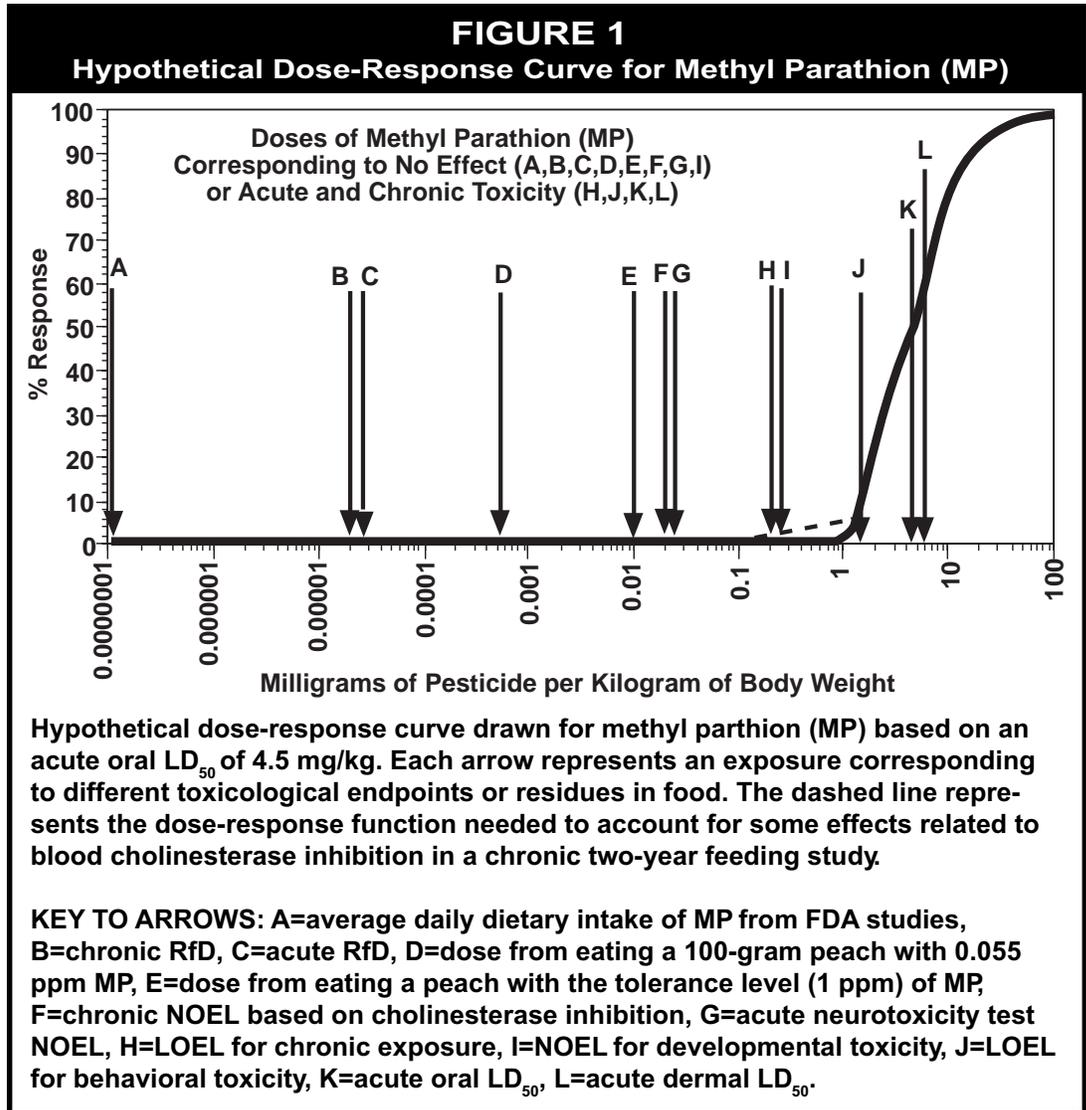
From Exposure to Risk

The EWG jumped to the conclusion that kids are eating "unsafe" residues of OPs in fruit simply because the estimated total cumulative exposures exceeded the RfD for the reference pesticide, chlorpyrifos. In other words, EWG presumed the RfD to be the true "safe" dose because EPA has decided that this artificial parameter meets the Congressional mandate of "reasonable certainty of no harm." Pertinently, NAS also calculated that cumulative exposure to OPs in some foods had some probability of exceeding the RfD, but they did not say it was an "unsafe" exposure. They just stated the output obtained from their computer model, and advised EPA that regulatory policies would have to change if the Agency believed the RfD should never be exceeded.

CU stated emphatically that they were not really estimating risk because they did not calculate actual exposures to residues. Such a seemingly honest statement is belied by other statements in the popular *Consumer Reports* magazine such as, "In general, the lower the score [i.e., the TI], the lower the overall long-

term risk." CU went on to perform a few quick calculations to show that eating 100 grams of a peach containing average levels of methyl parathion residues (0.055 ppm) gave a kid an "unsafe" dose of pesticide.

In sum, the EAGs are claiming unsafe exposures when the cumulated exposure estimates exceed the EPA-defined RfD. Thus, the decision to declare an exposure safe or not safe depends entirely on the value of the RfD. A closer examination of derivation of the RfD reveals that the EAGs are playing a semantic game.



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The RfD Is Not a Scientifically Derived Parameter

The NOEL is a measured value observed in 90-day or two-year daily feeding studies with mice, rats, and dogs. Thus, the NOEL is a scientific parameter because it is directly measured. Direct observation notwithstanding, there are actually several NOELs and the EPA decides which one to use. For example, feeding MP to rats and dogs for 90 days results in NOELs of 0.12 and 0.3 mg/kg, respectively. Feeding MP to mice, dogs, and rats for two years results in NOELs of 0.2, 0.09, and 0.02 mg/kg, respectively. For chronic toxicity, EPA chose the most conservative NOEL, 0.02 mg/kg.

Because only two to three doses are tested in chronic exposure toxicity assessments, the true NOEL actually lies somewhere on the dose-response graph between the observed NOEL and the LOEL. Note in the graph that the chronic NOEL (arrow F) is ten times less than the chronic LOEL (arrow H). Thus, the NOEL itself is somewhat conservative but with an unknown uncertainty factor built in.

In contrast to the NOEL, the RfD is calculated by the EPA by dividing the empirically observed NOEL by some uncertainty factor: 10, 100, or 1000, mistakenly called by the EAGs a "safety" factor. These factors of 10 are simply risk management decisions based on the comfort level of the collective mind of EPA staff. Ostensibly, the initial tenfold factor assumes that rats and dogs are less sensitive than humans (studies with OPs and humans indicate this is not necessarily the case). A second factor of 10 accounts for variability among people. If infants and children are deemed by EPA to be more sensitive than adults, FQPA mandates the RfD be reduced by another tenfold.

Factors of 10 have no scientific basis, i.e., no toxicological principle, to back them up. Note that among different species the differences in MP NOELs discussed above actually varied from 4 to 10 fold. Concerning differences between neonate rats and adults, EPA concluded in the MP RED that neonatal rats were not more sensitive than adult rats.

We Can All Feel Safe When Exposures Are Below the NOEL

When determining the chronic RfD for MP, EPA decided to apply a factor of 1000 to the chronic and acute NOEL based on their analysis of scientific literature concerning brain development in neonatal rats. While the Agency's interpretation of the studies is quite arguable, the regulated community is stuck for now with a chronic RfD of 0.00002 mg/kg (Figure 1, arrow B) and an acute RfD of 0.000025 mg/kg (arrow C). To be accurate, the RfD for methyl parathion (or any other OP) is not by definition the "safe" level. The safe level, if defined as one without harm, is actually the NOEL, the dose that causes no effect, even when the most sensitive but physiologically irrelevant biochemical parameter is measured. Doses represented between arrows B or C and arrow F in Figure 1 exceed the RfD, but still cause no effect of any kind. Safety is more accurately defined by a dose's location on the theoretical dose-response curve than by some arbitrary factor applied to the NOEL.

The significance of a dose's location along the dose-response curve can be further illustrated by considering the average residue of MP on peaches. According to the USDA PDP program, the average residue between 1994 and 1996 was 0.055 ppm. If a 10 kg (22 pound) toddler eats a 100 gram peach (about a quarter of a pound), her equivalent dosage will be 0.00055 mg/kg. This dosage is 45 times less than the NOEL for acute exposure and 100 times less than the NOEL for developmental problems. This latter benchmark is especially important to consider because the biggest concern about OP exposures is neurodevelopmental effects in the brain of late-term fetuses and newborn infants. If the exposure was 28 times lower, which would be at the RfD, the dose would be no safer because it already is without effect.

If the residue of MP was at its legal limit, a tolerance of 1 ppm, the equivalent dose in a 100 gram peach would be 0.01 mg/kg, two times less than the chronic NOEL for inhibition of cholinesterase and 20 times less than the NOEL for developmental effects. Both

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the average dose based on average residues in peaches and the extreme dose based on the tolerance are above the RfD. Being exposed to a dose above the RfD is neither hazardous nor unsafe.

The best way to estimate daily exposure to any pesticide residue is to examine residues in our total diet, i.e., as we would eat the food at home. Total dietary intake is more representative of what people of all ages are exposed to everyday over a lifetime. The FDA estimates this average daily dietary intake for MP at 0.0000001 mg/kg⁷ (arrow A), an exposure a full 100 times less than the RfD.

Conclusions

EWG and even CU cannot be faulted for attempting to scale all OP residues to common toxic equivalents. The NAS did it, and the FQPA indirectly mandates it. But the desire to do so does not make the procedure valid. Biochemical principals related to fundamental enzyme kinetics and the rapid biodegradation of OP residues in our bodies strongly suggest cumulative exposure assessment will be impossible without modeling the dose-response function at low doses of exposure (i.e., those far below the NOEL).

Meanwhile, I expect that EWG and CU will continue to produce their reports about poisonous peaches.

When relying on the EAGs for toxicological expertise, I'm reminded of a slogan that surely CU would appreciate: Buyer Beware! 

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WSDA Pesticide Waste Disposal

The Washington State Department of Agriculture offers a program to collect unusable pesticides for proper disposal. There is no charge, but **participants must pre-register**. (The program is paid for by an appropriation of about 1.3 percent of a state hazardous waste cleanup fund.)

LOCATION	DATE	SIGN-UP BY	LOCATION	DATE	SIGN-UP BY
Yakima	May 11	April 7	King County	Late May	April 16
Ellensburg	May 12	April 7	Mount Vernon	Late May	April 16

For details, contact WSDA Pesticide Management Division
(360) 902-2056 or mconnell@agr.wa.gov

Society of Toxicology Reacts to Consumers Union Report

The following letter from the Society of Toxicology, reprinted here in its entirety, was sent March 8, 1999, to EPA Administrator Carol M. Browner. The Society of Toxicology can be reached at (703) 438-3115 or sothq@toxicology.org; their website is www.toxicology.org/. Browner's address is U.S. Environmental Protection Agency, 1101 EPA Headquarters, 401 M Street, S.W., Washington, DC 20406

Re: "Do you know what you are eating? An analysis of U.S. Government data on pesticide residues in foods." Consumers Union, February, 1999.

Dear Administrator Browner:

We are writing on behalf of the Council of the Society of Toxicology (SOT), the leadership of the largest professional organization of toxicologists world-wide. We would like to take this opportunity to express our concern over the Consumers Union (CU) report captioned above. One of the goals of the SOT is the proper public communication of the risks from chemical exposures. We believe that, in the case of the CU evaluation, information obtained from flawed methodology misinforms the public on the risks of pesticide exposure. The report is based upon CU's term the "toxicity index (TI)," which was calculated for individual fruits and vegetables. We submit that the methodology used to determine the TI is scientifically invalid. Well-known principles of toxicology based on the need to consider dose and duration of chemical exposure are ignored or misrepresented by CU. While CU notes that the analysis is not a true risk assessment, CU implies great risk based upon its TIs!

Furthermore, CU's call for the banning of specific pesticides also lacks a scientific basis. Therefore, we believe that the CU report's conclusions concerning the dangers of pesticides in food are not credible and are unnecessarily alarmist.

We urge you to continue the ongoing efforts that keep our food supply among the safest, if not the safest, and most abundant in the world. We also urge you to reassure the American public there is not cause for alarm, and that fruits and vegetables are important components of a healthy diet.

Our Society believes strongly that consideration of sound science be an integral part of risk assessments and the regulatory actions based upon them. Many of our members are experts in pesticide toxicology and food safety. Our organization is pleased to offer to serve as a resource to you on matters concerning exposure to chemical substances. We would appreciate an opportunity to meet with you to discuss how we might provide assistance. Thank you for considering our comments.

Sincerely,

Steven D. Cohen, D.Sc.
President

Jay I. Goodman, Ph.D.
Vice President

Daniel Acosta, Jr., Ph.D.
Vice President-Elect

R. Michael McClain, Ph.D.
Past President

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; it may be wise to confirm with a telephone call before participating. Contact telephone numbers for specific events are given in the table below. 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 • Clean and dry, inside and out, with no apparent odor •
 - Majority of foil seal removed from spout (small amount remaining on rim OK) •
 - Half-pint, pint, quart, one and two-and-a-half gallon containers accepted whole •
- Hard plastic lids and slip-on lids removed • Five-gallon containers accepted whole if lids and bails removed •
 - 30 and 55-gallon containers accepted whole if above criteria is met •

DATE	TIME	LOCATION	CONTACT	PHONE	OTHER
May 17	9 am to 3 pm	Snipes Mtn, Transfer Station	Mark Nedrow	(509) 574-2472	Cardboard Accepted
May 18	8:30 am to 3 pm	Terrace Heights Landfill, Yakima	Mark Nedrow	(509) 574-2472	Cardboard Accepted
May 19	8 am to 11 am	Air Trac, Pasco	Gerald Titus	(509) 547-5301	
	12 noon to Finished	Pfister Farm Aviation, Pasco	Steven Pfister	(509) 297-4304	
May 20	8 am to 11 am	Wilbur Ellis, Eltopia	Vern Record	(509) 279-4291	
	12 noon to Finished	Eastern WA Spray, Eltopia	Willis Maxon	(509) 297-4387	
May 21	8 am to Finished	Flat Top Ranch, Burbank	Dave Hovde	(509) 749-2165	
	(call)	Broetje Orchards	Joe Shelton	(509) 749-2217	
	1 pm to Finished	Agri Northwest	Shawn Edler	(509) 547-8870	(509) 947-1144 cell
May 24	8 am to 10 am	McGregor's Walla Walla	Gary Burt	(509) 529-6787	
	11 am to 1 pm	McGregor's Waitsburg	Terry Jacoy	(509) 297-4296	
	2 pm to Finished	McGregor's Dayton	Jim Lemon	(509) 397-4355	
May 25	8 am to 12 noon	Western Farm Service, Pomeroy	Jerry Wilsey	(509) 843-3491	
	1 pm to Finished	Valley Helo Service, Clarkston	James Pope, Sr.	(509) 243-4444	
May 26	8 am to 10 am	McGregor's Pullman	Larry Schlenker	(509) 332-2551	
	11 am to 1 pm	McGregor's Palouse	Mike Dial	(509) 878-1321	
	1:30 to Finished	Cascade Flying Service, Garfield	Doran Rogers	(509) 635-1212	
May 27	8 am to 11 am	Dusty Farm Co-Op, Inc., Dusty	John Stoner	(509) 397-3111	
	1 pm to Finished	McGregor's St. John	Rick Bafus	(509) 648-3218	
May 28	8 am to 11 am	B & R Crop Care, Connell	Chris Eskildsen	(509) 234-7791	

“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.”

Insecticide Resistance as an Ecological Phenomenon

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

Biologists define evolution as the change in the genetic makeup of populations over time. These thoughts were pioneered by Charles Darwin (1868), who through observations of the natural world concluded that evolution resulted from a process he called "natural selection." Darwin's theory for natural selection relies on several postulates, including that many more individuals are born in each generation than will survive and reproduce; that there is variation among individuals in a population; that specific characteristics will result in improved survivorship and greater reproduction; that characteristics are heritable, and that enormous spans of time are available for slow gradual change.

Natural Selection vs. Punctuated Equilibrium

Public perceptions of evolution parallel Darwin's initial thoughts. Most people perceive evolution as a gradual progress that has resulted in the diversity of life forms we see today. Additionally, many see evolution as a process that reaches its zenith in the human being. Contrary to these thoughts, Eldridge and Gould (1972) put forth the concept of punctuated equilibrium. In their theory, organisms and ecosystems can remain relatively stable over time. It is short, "punctuated" ecological phenomena that drive the genetic makeup of populations in ecosystems. A pertinent example underscores the extinction of the dinosaurs at the end of the Mesozoic era. Current theory holds that a large asteroid collided with the Earth with a force equivalent to thousands of nuclear bombs. The global warming or cool down (take your pick) that resulted from this impact certainly punctuated the equilibrium for the dinosaurs.

Evolution and Pesticide Resistance

The evolution of resistance by insects to xenobiotic chemicals lies between these two extremes of evolutionary theory. The fact that plants have escaped or survived the attacks of pest insects for millions of years is the result of a process called coevolution. Feeny (1976), described the coevolution of plants with herbivorous insects as an evolutionary arms race in which plants, for survival, must deploy a portion of their metabolic budgets on defense (morphological or biochemical) against pest insects. Likewise herbivorous

insects must devote a portion of their assimilated energy on various techniques and devices to locate, attack, and overcome the defenses of host plants. To complicate matters, human intervention has affected this long-term coevolutionary relationship between host plants and herbivorous insects in several ways:

- ① Many morphological or chemical defense plant traits are not desirable horticulturally and efforts have been made to breed these traits out.
- ② Humans have introduced exotic (non-native) insects and plants to every ecosystem on every continent and island resulting in many associations of insects and plants for which there is no evolutionary precedent.
- ③ Development and wide-scale application of insecticides further complicates the human-plant-insect relationship.

Application of an insecticide into an ecosystem (agricultural or not) has the effect of punctuating the equilibrium for resident insect populations. Most of the insecticides synthesized by humans resemble in structure or mimic in activity the natural toxins produced by the plants with which the insects have coevolved. The toxicity of an insecticide is the product of the dose to which an insect is exposed in relation to the insect's ability to defend itself. Most pest insects are capable of producing many offspring per individual female per generation. Individuals with traits that enable them to survive exposure to an insecticide will eventually reproduce. The mortality of susceptible individuals in a population increases the prevalence of "resistant" or tolerant genotypes in a population. Intraspecific (within the same species) competition for resources and mates decreases, further increasing the prevalence of resistant genotypes. Additionally, interspecific (among different species) competition from competitors, predators, and parasites will likely be reduced following an insecticide application.

Through field observation of pest insect populations following insecticide application it quickly becomes apparent that some individuals are more tolerant of exposure to insecticides than others. I observed *Lygus*

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Insecticide Resistance... , cont.

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

bugs develop tolerance to pyrethroid insecticides just two years following registration of these chemicals (Walsh et al. 1998).

Pesticide resistance, then, results from the proliferation of tolerant individuals in a population and failure of susceptible individuals to reproduce following insecticide exposure. When the potency or environmental prevalence (also known as "selection pressure") of an insecticide is great and the insecticide is used extensively over a large geographic area, the likelihood of developing tolerance or resistance in pest populations is substantial. The mechanism(s) of resistance that are exhibited by insects can be morphological, behavioral, or metabolic.

Strategies to Inhibit Resistance Development

What can be done to prevent or slow the development of resistant pest insect populations? Since the strength and persistence of the resistance mechanism exhibited by an insect population depends on the strength (toxicity and persistence) of the selection pressure, relaxation of the selection pressure might prove viable. Integrated pest management techniques utilize sampling plans designed to establish treatment thresholds. The goal is to ensure that insecticides are used judiciously and only to prevent economic damage. If care is taken to avoid broad-scale applications of insecticides, untreated areas will allow survival of susceptible genotypes and will enhance the survival of beneficial predatory or parasitic arthropods. Pest-resistant crop plants and non-chemical controls should be used if these techniques can be demonstrated to be economically effective. Alternating insecticides is sometimes recommended, but may actually result in the development of resistance to several insecticide chemistries simultaneously. The medical profession takes a different approach to curtail the development of resistance of bacteria to antibiotics. Medical strategy has been to overwhelmingly overdose an infecting bacteria popula-

tion with antibiotics so that no resistant individuals remain after treatment. This technique has not stemmed the development of resistant bacteria. The media is full of reports regarding resistant "superbug" bacteria.

Selection Response

The selection response (R) exhibited by a population is demonstrated in the formula $R = h^2S$ where h^2 is the heritability and S is the selection differential (Falconer 1981). The selection differential that an insecticide imposes on a population is a mixture of many variables. Potency and persistence of the insecticide are key among these variables.

Much depends on the metabolic "cost" for an insect to be tolerant to an insecticide. If the insecticide to which the insect is exposed is extremely persistent at maintaining its toxicity then just about any metabolic cost is acceptable that permits increased survivorship and reproduction of tolerant individuals over susceptible individuals. However, if the metabolic cost for maintaining

resistance is high, the exposure level is low, and the insecticide is non-persistent, then chances are that the population may rapidly regain its susceptibility to the insecticide. As regulatory actions reduce or eliminate certain insecticides and choices narrow, pest insects stand a good chance of developing resistance to those agents still approved for use.



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Western Corn Rootworms Adapt to Crop Rotation

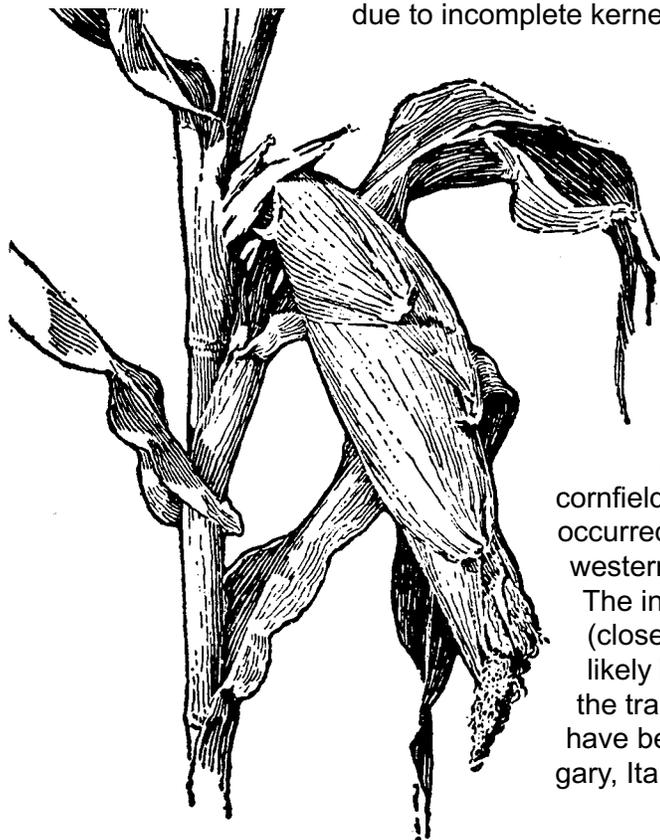
Implications for pest management programs in the eastern corn belt

Dr. Michael E. Gray and Dr. Kevin L. Steffey, Agricultural Entomologists, University of Illinois

The western corn rootworm, *Diabrotica virgifera virgifera* LeConte, is an insect pest that plagues corn producers throughout the United States Corn Belt and also in some corn-growing regions of Canada. Most of the life cycle is spent as an egg, the overwintering stage. Eggs begin hatching in late May and early June in the central U.S. Corn Belt. After egg hatch, larvae complete three instars; a full-grown rootworm grub is about 1/2-inch long. Root feeding by larvae constitutes the greatest economic threat to profitable corn production. Severe root pruning by larvae often results in lodging (plants no longer remain erect) of plants, and yields can be reduced significantly if lodging is extensive. Yield losses are due primarily to physiological factors. Fields with severe larval damage also can increase harvest expenses.

Adults begin to emerge from cornfields as early as mid-July. Soon after emergence, adults begin to feed on corn leaves, then on silks and pollen during flowering. If densities are great enough, extensive feeding

on silks may reduce yields due to incomplete kernel



set. Egg laying continues through the first two weeks of September. Most eggs are laid 4 to 8 inches deep in the soil.

History and Geographic Distribution

The western corn rootworm has its origin in Central America and for centuries has had a close affiliation with corn. Speculation suggests that western corn rootworms became pests only after the Spanish introduced the European system of corn production, which included tillage and large monocultures, into Central America. These "modern" agricultural practices stood in sharp contrast to those of Mesoamerica at the time in which smaller plots, more crop diversification, and changing the locations of crops were common. In North America, western corn rootworms have been associated with corn for probably less than 1,000 years. In 1868, LeConte described species of this beetle in Colorado; several years later, Gillette discussed injury caused by this insect in Colorado from 1909 to 1911. Throughout the early 1900s, the species we now refer to as the western corn rootworm was referred to as the "Colorado" corn rootworm. In 1929, the "Colorado" corn rootworm was reported in Nebraska and severe injury was described in five southwestern counties of the state. By the mid-1940s, the "Colorado" corn rootworm had dispersed through central Nebraska. As center-pivot irrigation systems became more common throughout Nebraska, the range of this insect pest increased rapidly. During the 1960s and 1970s, the western corn rootworm continued its eastward migration. In 1964, western corn rootworms were reported for the first time in Illinois cornfields. By 1971, western corn rootworms had been observed in southwestern Michigan. During the mid-1980s, western corn rootworms could be found easily in cornfields of southwestern Virginia. This eastward expansion occurred very rapidly, about 50 miles per year. In July of 1992, western corn rootworms were found for the first time in Europe.

The infestation was discovered in a small cornfield near Belgrade (close to the airport). We suspect that western corn rootworms likely boarded a jet at O'Hare International Airport and completed the transatlantic journey. Since then, western corn rootworms have been found in Bosnia, Bulgaria, Croatia, Herzegovina, Hungary, Italy, Romania, and Serbia. The economic importance of

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...Corn Rootworm Adapts, cont.

Dr. Michael E. Gray and Dr. Kevin L. Steffey, Agricultural Entomologists, University of Illinois

western corn rootworms to corn production is a reality on two continents.

Rotation and Resistance

The most widely used pest management strategy for western corn rootworms has been rotating corn with another crop. Where corn is grown continuously (not rotated), entomologists recommend that producers scout their cornfields and apply a soil insecticide to corn the following season if rootworm densities exceed an economic threshold. In some areas of the Corn Belt, producers do not rotate corn with another crop, and application of soil insecticides each spring during planting is commonplace. Producers regard the use of soil insecticides as routine "insurance" against corn rootworms and neglect to follow scouting recommendations and use economic thresholds. Research in the 1970s, and more recently in the early 1990s, indicated that only approximately half of continuous cornfields had economic infestations of corn rootworms. However, the use of soil insecticides in continuous (non-rotated) cornfields exceeds 90% in many states. In the 1950s and 1960s, application of chlorinated hydrocarbon insecticides became routine for control of both larval and adult stages of corn rootworms. Not surprisingly, rootworms became resistant to these very persistent compounds. In the early 1970s, organophosphates and carbamates replaced the much more persistent chlorinated hydrocarbons. Until recently, western corn rootworms showed no evidence of resistance to insecticides. In 1998, resistance to methyl-parathion (PennCap-M) was confirmed in some areas of Nebraska where broadcast applications of this product to continuous corn have occurred for decades.

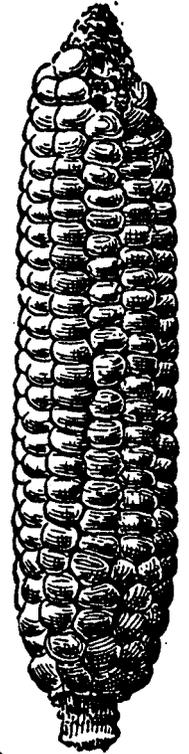
Recently, perhaps the most spectacular example of resistance by western corn rootworms began to take place in the eastern Corn Belt. For decades the recommended management strategy of crop rotation worked exceptionally well against corn rootworms. Unfortunately, in major areas of the eastern Corn Belt, the utility of this practice is collapsing. In the mid-1980s, producers in Illinois, Iowa, Minnesota, and South Dakota began reporting occasional rootworm

larval injury in rotated cornfields. After several years of research, entomologists confirmed that some northern corn rootworms, *Diabrotica barberi* Smith & Lawrence, a close relative of the western corn rootworm, could prolong their egg diapause (period of suspended development) through more than one winter. In fact, a small percentage of eggs (less than 1%) can prolong or extend their egg diapause for more than two winters. This adaptation of the northern corn rootworm likely was in response to the selection pressure exerted by the rigors of annual crop rotation.

The Worm Has Turned

Since 1994, western corn rootworm larvae have caused extensive damage in rotated cornfields of east-central Illinois and northern Indiana. The explanation for this phenomenon is a fascinating change in the egg-laying behavior of western corn rootworm: instead of laying eggs exclusively in corn, western corn rootworm females are now laying eggs in soybean fields. Because of this shift in ovipositional behavior, crop rotation no longer is a satisfactory rootworm management tactic for most producers in this area. In response, growers have dramatically escalated their use of soil insecticide on rotated cornfields. Before discovery of this new strain of western corn rootworm, soil insecticides were applied to an estimated 13% of rotated corn. Now soil insecticides are applied to an estimated 90% of the acres of rotated corn in some areas of eastern Illinois, comparable to the percentage of continuous cornfields treated.

Although the entomological literature is rich in examples of insects and other arthropods becoming resistant to one or multiple insecticides, we believe the adaptation of western corn rootworms to the corn



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...Corn Rootworm Adapts, cont.

Dr. Michael E. Gray and Dr. Kevin L. Steffey, Agricultural Entomologists, University of Illinois

and soybean rotation is on a much more unique level. Our current best guess about why western corn rootworms began laying eggs in soybean rather than just corn, is nothing more complex than old-fashioned selection pressure. The principles of natural selection described by Charles Darwin more than 100 years ago explain the dynamics of this behavioral shift: if females lay their eggs in corn where corn and soybeans are rotated annually, their offspring die. Western corn rootworm larvae cannot survive on soybean roots. Nature is not wasteful for long.

Looking Ahead

For now, soil insecticide use will continue to increase in the eastern Corn Belt. Entomologists remain watchful for the expansion of resistance to organophosphate insecticides in the western Corn Belt. Producers continue to raise questions regarding the future availability of transgenic insecticidal cultivars

for control of corn rootworms. If transgenic hybrids are commercialized soon after the turn of this century, entomologists will need to develop sound resistance management plans and enlist the strong cooperation of producers in the deployment of these resistance strategies. If such resistance management plans are not implemented, we can count on the development of resistance by the western corn rootworm in short order. Stay tuned. 

Dr. Michael E. Gray is an Associate Professor of Agricultural Entomology & Extension and the Integrated Pest Management (IPM) Coordinator in the Department of Crop Sciences, University of Illinois, Champaign-Urbana. Dr. Kevin L. Steffey is an Entomologist and Professor of Agricultural Entomology & Extension with the same department and university. They can be reached at m-gray4@uiuc.edu, ksteffey@uiuc.edu, or (217) 333-6652.

Food Safety Farm to Table Conference

This year's Farm to Table conference, co-sponsored by the Cooperative Extension systems of the University of Idaho and Washington State University, is scheduled for May 26–27. Programs include:

Pathogens du Jour

(*Listeria monocytogenes*, *Salmonella typhimurium* DT104, Toxoplasma, and others)

Safety of Retail Products

(allergens, pesticides on produce, refrigerated prepared foods)

Effects of Crop and Land Treatments on Food Safety

(heavy metals, manure and other fertilizers, organic foods, algal toxins and Vibrio)

Impact of Food Safety Policies

(liability, costs, incentives)

Registration fee is \$140. Conference planners include Richard Dougherty, Carolyn Bohach, Dale Hancock, Larry Hiller, Val Hillers, Jill McCluskey, and Barbara Rasco. For more information, contact Chris Eder, Cooperative Extension Conference Planning Service, cecps@cahe.wsu.edu or (509) 335-2954.

May 26–27, 1999
Moscow, ID/Pullman, WA

Study Evaluating Mortality Patterns in State Orchardists

Norm Herdrich, Pacific Northwest Agricultural Safety and Health Center

A study spanning three decades is examining how pesticide exposure may have affected orchardists and orchard workers in the Wenatchee area. Originally started by the U.S. Public Health Service in the late 1960s, then suspended for lack of funding, the study is now being followed up by the Pacific Northwest Agricultural Safety and Health Center (PNASH).

Study Origins

The study was started in the Wenatchee area by the U.S. Public Health Service to examine the effects of long-term occupational exposure to pesticides. It was one of the Community Studies on Pesticides funded by the Environmental Protection Agency (EPA) Division of Pesticide Community Studies as part of a national initiative on pesticide research. A research center established in Wenatchee was one of 14 across the country.

The study initially involved 1,300 white males. Of this cohort, about 700 were orchardists or orchard workers and about 600 were employed males who reported no current exposure to orchard insecticides in their workplace.

Participants in the original study gave a brief occupational history upon enrollment, including which pesticides they had used and when and how they had used them. Enrollment of individuals into the study stopped in the early 1970s. During the years of active data collection, days of pesticide use were tracked. Each year a new round of questionnaires was sent out asking about the past year's work and any new health problems.

Tracking of this study group was suspended in 1976 when funding stopped. The questionnaires and identities of the study participants were archived by the Department of Health. Unfortunately, due to the lack of funding, direct contact with participants appears to have ended with the mailing of the last questionnaire. Most participants probably never knew the study had ended; the annual questionnaire just stopped arriving.

Current Efforts

Now, PNASH researchers in collaboration with the Department of Health have obtained the original data and are studying mortality patterns among the participants. Four hundred forty-two individuals in the original cohort are deceased, according to Dr. Matt Keifer, the co-director of PNASH and director of this study. Their death certificates have been obtained and evaluated for cause of death. The objective of this work is to determine whether there appears to be excessive mortality from cancer or other specific health problems among occupationally exposed orchardists and orchard workers.

PNASH researchers have been unable to locate about 140 of the 1,300 individuals originally in the study. Of the 719 living participants, the average age is 74. Many of the survivors were recruited to participate in an Oregon Health Sciences University study of neurobehavioral and neurological function. Approximately 350 people agreed to participate and were tested. More than half of these were originally recruited as exposed and the remainder were entered unexposed controls. The vital status of the majority of the cohort has already been determined, and a good percentage of the surviving members have been tested for neurologic and neurobehavioral performance.

What Will the Researchers Be Looking For?

Lifespan

It would not be surprising to find that those participating in the study will have longer lifespans than the average for the state. This is due in part to what epidemiologists call "The Healthy Worker Effect:" workers tend to be healthier than non-workers both by necessity and because of requirements of work itself, and tend to live longer. Also, the general population mortality figures include people who are too sick to work and those whose illnesses contribute to an earlier average death age.

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...Mortality Patterns in Orchardists (cont. from p. 15)

Norm Herdrich, Pacific Northwest Agricultural Safety and Health Center

Causes of Death

"Farmers are thought to experience lower all-cause mortality," notes Fred Adams, a graduate student working on the PNASH project. "The farming lifestyle, characterized by high physical activity and low rates of alcohol and tobacco consumption is thought to result in a lower risk of chronic disease."

Cancer Incidence

As for cancer-related causes of death, based on the results of other long-term studies of farmers, the PNASH researchers will look specifically for excesses of leukemia; Hodgkin's and non-Hodgkin's lymphoma; soft tissue sarcomas; and prostate, brain, stomach, and multiple myeloma. Positive associations between these cancers and exposure to pesticides have been found in other studies.

Availability of Results

In the coming year, a data set on exposure classification and mortality status will be completed and data analysis will begin. According to Dr. Keifer, upon completion of the data analysis, a manuscript summarizing the results will be produced and submitted as a

scientific paper. Results will also be available to Washington State's farming community. Keifer notes that many of the children of the original members of the cohort are now about the same age as their fathers were when the study was started and that these individuals have expressed particular interest in the study findings. 

The Pacific Northwest Agricultural Safety and Health Center, funded by NIOSH, is one of eight such centers in the United States. The Center's mandate is to study occupational health and safety issues in farming, forestry and fishing in the four Region X states of Idaho, Washington, Oregon and Alaska. Dr. Richard Fenske is the Center Director, Dr. Matthew Keifer is Co-Director, and Sharon Morris is Associate Director. Adrienne Hidy is the Center's Administrator, and Marcy White is the Program Coordinator.

This article was prepared by Norm Herdrich, PNASH Outreach Coordinator. To obtain additional information, he can be contacted at (509) 926-1704, or e-mail him at normh@u.washington.edu.

Federal Register Excerpts

In reviewing the February 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 February 4 Federal Register, EPA announced it had determined that Monsanto's glyphosate-tolerant canola line, designated as RT73, is no longer considered to be a regulated article under regulations governing the introduction of genetically engineered organisms. (Page 5628)

In the February 5 Federal Register, EPA announced a revised version of the pesticide science policy document originally entitled "Guidance for Identifying Pesticide Chemicals That Have a Common Mechanism of Toxicity, for Use in Assessing the Cumulative Toxic Effects of Pesticides" is now available. The title has been changed to "Guidance for Identifying Pesticide Chemicals and

Other Substances That Have a Common Mechanism of Toxicity." The revised document describes the approach that EPA will use for identifying and categorizing pesticide chemicals and other substances that cause a common toxic effect by a common mechanism, for purposes of assessing cumulative toxic effects. (Page 5796)

In the February 24 Federal Register, EPA announced that the Reregistration Eligibility Decision (RED) for 1, 3 dichloropropene was available and that the agency would accept comments through April 26, 1999. (Page 9145). 

Tolerance Information

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

Tolerance Information						
Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
3,7-dichloro-8-quinoline carboxylic acid (herbicide)	2/10/99 page 6542	40.00 1.00 800.00 4.00 5.00 4.00 5.00 1.00 1.50 0.20 0.60	wheat, milled fractions wheat, straw wheat, aspirated grain fractions wheat, grain wheat, forage sorghum grain sorghum grain, forage sorghum grain, fodder mbp; cattle, goat, hog, horse, and sheep poultry, fat fat; cattle, goat, hog, horse, and sheep	Yes	New	5/30/00
Comment: These time-limited tolerances are being established in response to a Section 18 crisis exemption being granted for the use of 3,7-dichloro-8-quinoline carboxylic acid to control volunteer flax in North Dakota wheat and to control annual weeds in Nebraska sorghum.						
propyzamide/pronamide (herbicide)	2/10/99 page 6529	0.05 1.00 0.50	cranberries grass, forage grass, hay	Yes	Extension	12/31/01
Comment: These time-limited tolerances are being extended in response to EPA issuing Section 18 exemptions for the use of propyzamide for dodder control in Massachusetts' cranberries and for weed control in Oregon grass seed crops.						
tebufenozide (insecticide)	2/10/99 page 6539	5.00	turnip, tops	Yes	Extension	12/31/00
Comment: This time-limited tolerance is being extended in response to EPA again granting Section 18 exemptions for the use of tebufenozide to control beet armyworms in Texas and Tennessee turnip greens.						
fenbuconazole (fungicide)	2/17/99 page 7794	2.00	stone fruit group (except plums and prunes)	Yes	Extension	12/31/01
Comment: Time-limited tolerances are being reestablished due to a chemistry data gap for storage stability in other raw agricultural commodities. However, based on apparent storage stability, EPA believes that the existing data support reestablishment of time-limited tolerances to December 31, 2001.						
cinnamaldehyde	2/17/99 page 7801	exempt	all food commodities	N/A	N/A	N/A
Comment: This exemption applies when this chemical is used as a broad spectrum fungicide/insecticide/algaeicide in accordance with good agricultural practices.						
diphenylamine (plant growth regulator)	2/19/99 page 8273	10.00	pears	Yes	New	12/1/01
Comment: This time-limited tolerance is being established by EPA to cover the inadvertent transfer of diphenylamine residues from apples to pears during packing.						
formic acid (insecticide)	2/22/99 page 8526	exempt	honey and beeswax	N/A	N/A	N/A
Comment: This exemption applies when formic acid is used to control tracheal mites and suppress varroa mites in bee colonies and is applied in accordance with label directions.						

PNN Update

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

The Pesticide Notification Network (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 the past month.

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

Label Changes

Dow has revised the label for its herbicide Treflan TR-10. The label changes include:

- ♦ removing wild oat from the list of controlled weeds,
- ♦ deleting use directions for forage legumes (alfalfa use directions remain in effect),
- ♦ adding dry bulb onion use directions, and
- ♦ deleting potato use directions.

Du Pont has revised the labels for its fungicides Benlate and Benlate SP. On both labels, gummy stem blight was deleted from the list of pests controlled on cucurbits.

FMC has revised the label for its insecticide/miticide Brigade WSB. The label now includes directions for use on strawberries.

Ecogen has added watercress to the label for its product Crymax Bioinsecticide.

• Uniroyal has issued a revision to its Topside O/S label. The revision deletes greenhouses and shadehouses from the label.

Uniroyal has issued revised labels for its line of Terraclor products.

♦ Terraclor Flowable Fungicide, Terraclor 2LB Emulsifiable, Terraclor 10% Granular, and Terraclor 75% Wettable Powder have had a statement added that excludes cowpeas from the bean use directions.

♦ The Terraclor Flowable and 75% Wettable Powder labels have had use directions added for the control of root stem rot and damping off on beans, broccoli, Brussels sprouts, cabbage, cauliflower, pepper and tomato.

♦ Directions for use on direct seeded hot peppers have been added to the Terraclor Flowable Fungicide label.

♦ The Terraclor 75% Wettable Powder label has been revised via the addition of carnation, chrysanthemum, and rose cut flower use directions and directions for the control of melting out/leaf spot on turf.

Ecogen has revised the label for its product AQ 10 Biofungicide. The changes include adding both chemigation and aerial application instructions as well as adding the following PNN-related crops: artichoke, arugula, bean, eggplant, endive, lettuce, pea, pepper, spinach, sweet potato, hops, blackberry, blueberry, boysenberry, cranberry, currant, loganberry, raspberry, kiwi, dill, mint, basil, cilantro, oregano, parsley, thyme, greenhouse nursery, greenhouse flower, bulb, nursery, flower, rose, greenhouse rose, ornamental tree, and shrub.

Manufacturers' Use Deletions

In the January 27, 1999, Federal Register, EPA announced that it had received a request from Kincaid to delete livestock dipping uses from the label of its insecticide Marlata 50. Unless this request is withdrawn, this use deletion will become effective June 1, 1999.

In the February 24, 1999, Federal Register EPA announced that it had received a request from Agrevo to delete nonbearing fruit and nut tree uses from the following product labels: Ficam 2 1/2 G, Turcam, and Turcam 2 1/2G. Unless this request is withdrawn, these use deletions will become effective May 26, 1999.

Manufacturers' Product Cancellations

...PNN Update, cont.

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

In the February 3, 1999, Federal Register, EPA announced that it had received a request from Blue Ridge Pharmaceuticals to voluntarily cancel its registration for Cyfly 1% Premix. Unless this request is withdrawn by August 2, 1999, EPA will issue cancellation orders for this product.

In the January 27, 1999, Federal Register, EPA announced that it had received a request from DuPont to voluntarily cancel SLN WA-930007. This SLN had previously been issued for the use of DuPont's Sinbar Herbicide for weed control in alfalfa seedlings. Unless this request is withdrawn by July 26, 1999, EPA will issue orders canceling this registration.

In the January 27, 1999, Federal Register, EPA announced that it had received a request from Bayer to voluntarily cancel registrations for three Guthion insecticides. These are Guthion 2S, Guthion 50% Wettable Powder, and Guthion 3 Flowable. Collectively, these products are registered for use on: alfalfa, apple, artichoke, blackberry, boysenberry, broccoli, Brussels sprout, cabbage, cauliflower, celery, cherry, Chinese cabbage, Christmas tree plantation, conifer, crabapple, cranberry, cucumber, dry bulb onion, eggplant, filbert, grape, loganberry, melon, nectarine, nursery, onion, ornamental, peach, pear, pepper, plum, potato, prune, quince, raspberry, rye, strawberry, tomato, and walnut. Unless this request is withdrawn by July 26, 1999, EPA will issue orders canceling these registrations.

In the January 27, 1999, Federal Register, EPA announced that it had received a request from Gowan to voluntarily cancel the registration for its insecticide Azinphos-M 50W. This product is labeled for use on: apple, apricot, artichoke, barley, bean, blackberry, boysenberry, broccoli, Brussels sprout, cabbage, cauliflower, celery, cherry, Christmas tree plantation, conifer nursery, cowpea, crabapple, cranberry, cucumber, eggplant, filbert, grape, loganberry, melon, nectarine, nursery, oat, onion, ornamental, peach, pear, pepper, plum, potato, prune, quince, raspberry, rye, soybean, spinach, strawberry, tomato, walnut, watermelon, and wheat. Unless this request is withdrawn by July 26, 1999, EPA will issue orders canceling this registration.

In the January 27, 1999, Federal Register, EPA announced that it had received a request from Valent to voluntarily cancel the registration for its insecticide Othene Turf, Tree, & Ornamental Spray WSP. This product is labeled for use on the following PNN-related sites: Christmas tree plantations, deciduous/shade trees, flower, greenhouse ornamental, greenhouse rose, nursery, ornamental, ornamental ground cover, ornamental tree, pasture, rangeland, rose, shrub, and turf. Unless this request is withdrawn by July 26, 1999, EPA will issue orders canceling this registration.

In the January 15, 1999, Federal Register, EPA announced that Bayer, the sole registrant of isofenphos, is proposing to terminate all registrations for products containing this insecticide. In Washington, registrations currently exist for Oftanol 5% Granular and Oftanol 2 Insecticide. These products are registered for commercial use on the following PNN-related sites: turf, ornamental, and nursery. While EPA intends to grant Bayer's request, they are soliciting comments on this proposed action. Bayer has proposed a three-step, 12-month cancellation process that includes immediate cancellation of Oftanol 5% Granular. EPA plans to allow continued sale, distribution, and use of stocks already in the hands of dealer and users. Bayer has also proposed a schedule that would allow it to market Oftanol 2 Insecticide until September 30, 2000 and for product in the channels of distribution to be sold by dealers after this date. EPA plans to allow use of isofenphos products until stock in the channels of distribution is exhausted, rather than to set a time limit on the use of existing stocks.

Section 18 Specific Exemptions

On February 3, 1999, EPA granted a specific exemption for the use of Bayer Bee Strips to control varroa mites in beehives. The exemption is limited to the use of 324,000 strips, one strip per five combs, and it expires February 2, 2000.

EPA has issued a Section 18 specific exemption for the use of Stinger to control lotus, purple aster, and clover in cranberries. This exemption allows for:

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...PNN Update, cont.

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

- ♦ use on 175 acres.
- ♦ a maximum 0.25# a.i. per acre per growing season.
- ♦ a 60 day preharvest interval.
- ♦ expiration on 12/31/99.

Supplemental Labels and Use Recommendations

Dow has issued another supplemental label for its herbicide Treflan TR-10. This labeling provides directions for preplant incorporation of Treflan TR-10 for preemergent control of weeds in direct seeded alfalfa.

Dow has issued revisions to two supplemental labels previously issued for Treflan HFP. The supplemental labels allow for weed control in eggplant and for preplant incorporation in direct seeded Chinese cabbage and kohlrabi. The revised supplemental labels now include precautions stating that eggplant, Chinese cabbage, and kohlrabi tolerance to Treflan HFP is marginal and the labels list cultural practice and application directions to follow for best results.

Du Pont has issued a supplemental label for its insecticide Asana XL. The supplemental label provides directions for use on sugarbeets.

Du Pont has issued a supplemental label for its fungicide Benlate SP. The supplemental label provides use direction for the control of Swiss needle case disease in Douglas fir plantations.

Du Pont has revised all of its previously issued supplemental labels for post emergence grass control in lentils, canola and crambe, beans, sugarbeets, and peas. All have been revised to allow for higher application rates for annual and perennial grass control and to add a precaution about applying Assure II to crops under stress. In addition, the supplemental label previously issued only for use on dry peas has been revised and now includes use directions for succulent peas.

Gowan has issued 2ee use recommendations for three of its insecticides. These recommendations provide directions for the use of Endosulfan 3EC, Endosulfan 50

WSB, and Lorsban 50W to control *Lacanobia* fruitworm in apples.

Nufarm has issued a product bulletin for its Cuproxat Flowable Copper Fungicide. This bulletin provides directions for the control of bacterial blight on beans, downy mildew on hops and onions, early and late blight on potatoes, and septoria leaf blotch and helminthosporium spot blotch on wheat and barley.

Miscellaneous Regulatory Information

• In the December 16, 1998, Federal Register, EPA announced that the RED for dicofol was available for review and comment. Comments will be accepted until February 16, 1999. Major provision of the risk mitigation measures proposed by EPA are as follows:

- ♦ All residential uses have been eliminated from labels and will be voluntarily canceled.
- ♦ Mixers/loaders/applicators must wear additional personal protective equipment (PPE), and use enclosed cabs and cockpits.
- ♦ All wettable powder formulations produced after December 31, 1998 must be placed in water soluble packaging.
- ♦ Application with handheld equipment is eliminated for liquid formulations.
- ♦ Liquid formulations produced after December 31, 1998 must bear labeling requiring closed mixing systems for dry beans.
- ♦ A revised Restricted Entry Interval (REI) will be set, based on Dislodgeable Foliar Residue (DFR) data submitted in October, 1998, and on the dermal toxicity study being submitted in December, 1998.
- ♦ Dicofol applications are limited to no more than one per year. Previously, for some uses, the number of applications was either unrestricted or limited to 2 or 3 applications per year.
- ♦ Dicofol applications on strawberries will not exceed 2 pounds a.i./acre per year. This has been reduced from 2.4 pounds a.i./acre per year.
- ♦ A spray drift and Runoff Caution Statement is being added to the label. Also, a statement prohibiting application directly to water is being added to the label.

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Additionally, as a result of previous agreements with the registrants, applications will not exceed:

- ♦ 3 lb ai/acre for apples and pears (reduced from 4 lb ai/acre);
- ♦ 2 lb ai/acre for pecans and walnuts (reduced from 4 lb ai/acre);
- ♦ 1.3 lb ai/acre for grapes (reduced from 1.5 lb ai/acre);
- ♦ 0.63 lb ai/acre for cucurbits (reduced from 1.5 lb ai/acre);
- ♦ 0.75 lb ai/acre for tomatoes and peppers (reduced from .8 lb ai/acre);
- ♦ 1.5 lb ai/acre for stonefruits;
- ♦ 1.5 lb ai/acre for beans; and
- ♦ 0.55 lb ai/acre for nonresidential lawns and ornamentals.

Dicofol is the active ingredient in 10 products currently registered in Washington. The commercial products are Dicofol 4EC and various Kelthane formulations. The homeowner products are Greenlight Red Spider Spray and High Yield Kelthane Spray. Dicofol is registered for use on the following PNN-related sites: Apple, bean, blackberry, cantaloupe, Christmas tree plantation, crabapple, cucumber, cucurbit, filbert, flower, grape, greenhouse nursery, greenhouse ornamental, hop, lima bean, melon, mint, nursery, ornamental, ornamental tree, pear, pepper, pumpkin, quince, raspberry, squash, strawberry, tomato, turf, walnut, and watermelon.

• In the December 16, 1998, Federal Register, EPA announced that the RED for triclopyr was available for review and comment. Major provisions of the risk mitigation measures proposed by EPA are as follows:

- ♦ The maximum application rate permitted on pasture and rangeland and all other sites where cattle can be grazed will be 1 lb/ae/A per year; for forestry applications the maximum will be 6 lbs/ae/A; for all other sites the maximum allowed rate will be 8 lb ae/A for the BEE and 9 lb/ae/A for the TEA.
- ♦ Labels must include best management practices for spray drift.

- ♦ A label statement warning users of the potential of triclopyr to leach to ground water in certain situations is required.
- ♦ A restriction against grazing lactating dairy animals until the following season is required. All conflicting grazing instructions must be removed. Labels must specify a 14 day PHI for grass hay, and retain the existing pre-slaughter interval of 3 days.
- ♦ An REI of 48 hours for triclopyr TEA, and 12 hours for triclopyr BEE is established for uses within the scope of the Worker Protection Standard; early entry PPE consisting of coveralls, chemical resistant gloves, protective eyewear—for TEA formulations, and shoes+sox) is required.
- ♦ Homeowner reentry is restricted until sprays have dried and dusts have settled.

Triclopyr is the active ingredient in Access, Confront, Cool Power, Crossbow, Garlon 4, Horsepower, Pathfinder II, Redeem and the Turflon products. It is registered for commercial use on the following PNN-related sites: Christmas tree plantation, CRP lands, ditch bank, fence row, farm building area around, forest, forest conifer release/site preparation, golf course, grass, grass hay, industrial site, lawn, noncrop agricultural area, noncrop non-agricultural area, pasture, rangeland, rights-of-way, recreation area, and turf.

• In the December 16 Federal Register, EPA announced that the RED for propachlor was available for review and comment. In Washington, propachlor is registered for use as Monsanto's Ramrod Flowable Herbicide and is registered for use on corn seed crops, field corn, sorghum, and onion seed (via SLNs).

Because EPA had concerns for the occupational risk posed to mixers and loaders of the dry flowables, the registrant has agreed to voluntarily cancel their formulation of the dry flowable product. Note that the product registered for use in Washington is a liquid formulation.

In addition, EPA is requiring that propachlor labeling now include the following:

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- ◆ Ground water, surface water, spray drift, and skin sensitization advisory language must be placed on all propachlor labels.
 - ◆ Advisory statement for the Environmental Hazards of toxicity to terrestrial and aquatic plants, fish and aquatic invertebrates for both manufacturing use and end use products.
 - ◆ Advisory statement for toxicity to non-target organisms for granular products.
 - ◆ The PPE for mixers/loaders for all liquid products must include chemical resistant gloves.
 - ◆ The PPE for mixers/loaders of granular products must include: long-sleeved shirt, long pants, chemical-resistant apron, chemical resistant footwear, chemical resistant gloves.
 - ◆ PPE for applicators for all propachlor granular products must include: long-sleeved shirt, long pants, chemical resistant apron, chemical resistant footwear, chemical resistant gloves.
 - ◆ Labels referring to the engineering controls for application of all liquid formulations must specify a closed system.
 - ◆ Labels for all products must contain User Safety Requirements for the cleaning and maintenance of Personal Protective Equipment.
 - ◆ An Environmental Hazard Statement for granular formulations must be included requiring that spilled granules must be covered or incorporated.
 - ◆ Rotational crop label amendment stating that only crops for which there are registered propachlor uses may be rotated to treated fields.
 - ◆ A 48 hour restricted entry interval (REI) is required based on the acute toxicity of the active ingredient. The PPE required for early entry is protective eyewear.
- In the December 16, 1998, Federal Register, EPA announced that the RED for dichlobenil was available for review and comment. In Washington, commercial dichlobenil products are registered for use on the following crops/usage sites: apple, asphalt/cement, blackberry, blueberry, building adjacent area, cherry, cranberry, deciduous/shade tree, evergreen tree, farm building area around, fencerow, filbert, forest, forest nursery/seed orchard, grape, impounded water, industrial site, nectarine, non-bearing apple, non-bearing berry, non-bearing cherry, non-bearing filbert, non-bearing grape, non-bearing nectarine, non-bearing peach, non-bearing pear, non-bearing plum, non-bearing prune, nursery, ornamental, ornamental tree, peach, pear, plum, prune, raspberry, recreation area, right-of-way, rose, sewer, and shrub.
- In the RED, EPA announced it is requiring the following risk mitigation measures for continued dichlobenil registration:
- ◆ Ground water advisory.
 - ◆ Application rate reduction to # 10 lbs. a.i./A.
 - ◆ Soil incorporation of 10% Granular formulation.
 - ◆ Soil incorporation of granular formulations applied to ground in liners in which ornamental stock placed.
 - ◆ Ventilation requirements for application of sewer products in inhabited buildings.
 - ◆ Reentry Interval of 24 hours for horticultural/nursery use sites, unless the product is soil incorporated or soil injected.
 - ◆ Restricted entry until granules are thoroughly watered in and treated soil has dried for uses on ornamentals, residential and commercial landscaping, and all products intended primarily for home use.
 - ◆ Changes to various PPE requirements.
- In the January 13, 1999, Federal Register, EPA announced that the RED for bromoxynil is available for review and comment. In Washington, bromoxynil is registered for use as Broclean, Bromac, Bromox, Bronate, Butracil, and Moxy 2E and is labeled for use on the following sites: alfalfa, alfalfa seed, barley, brassica seed crops, CRP lands, corn, flax, garlic, grass, grass hay, grass seed, mint, oat, onion, rye, sorghum, triticale, turf, and wheat.
- In the RED, EPA is requiring two changes that effect use of this pesticide in Washington. First, handlers of bromoxynil products must wear chemical resistant gloves and aprons. Second, EPA is establishing a 26 day REI for turf grown on sod farms.

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• PNN Notification 1998-52 reported that EPA was deleting popcorn and carrot uses from technical grade chlorpyrifos labels because EPA had realized that tolerances had never been established for these uses. In the February 3 Federal Register, EPA announced that popcorn was being deleted from the labels for Lorsban 4E and Nufos 4E. The following existing stock provision was included in this notice: "The Agency has authorized the registrants to sell or distribute product under the previously approved labeling for a period of 18 months after the effective date of use deletions." Be aware that while this allows for the purchase of Lorsban 4E and Nufos 4E labeled for use on popcorn, no tolerance exists for this use.

State Issues

New Registrations

- WSDA has registered Dow's insecticide Success for use. This product is registered for use on the following PNN-related sites: apple, broccoli, Brussels sprout, cabbage, cauliflower, celery, Chinese broccoli, Chinese cabbage, collard, dandelion, eggplant, endive, fennel, kale, kohlrabi, lettuce, mustard, parsley, pepper, rhubarb, spinach, Swiss chard, tomatillo, tomato, and watermelon.
- WSDA has registered Du Pont's fungicide Curzate 60DF for use. The fungicide is labeled for late blight control in potatoes.
- WSDA has registered Novartis' Predict Herbicide for use. This product is labeled for use on ornamentals and field grown nursery stock.
- WSDA has registered Novartis' fungicide Agri-mycin Agricultural Streptomycin for use. This product is labeled for use on apple, ornamentals, pear, pepper, potato, and tomato.
- WSDA has registered Whitmire Micro-Gen's Prescription Treatment Pyrigro Microencapsulated Growth Regulator. This product is labeled for use on the following PNN-related crops: greenhouse flower, greenhouse ornamental, greenhouse rose, and greenhouse shrub.
- WSDA has registered two Whitmire Micro-Gen insecticides for use. The products, Prescription Treatment Talstar-GH and Prescription Treatment Talstar-N, are both labeled for use on the following PNN-related sites: greenhouse flower, non-bearing apple, non-bearing apricot, non-bearing cherry, non-bearing crabapple, non-bearing filbert, non-bearing nectarine, non-bearing peach, non-bearing pear, non-bearing plum, non-bearing prune, non-bearing walnut, nursery, ornamental tree, and shrub.
- WSDA has registered Whitmire Micro-Gen's Prescription Treatment Travail CS Insecticide for use. This product is labeled for use on the following PNN-related sites: agriculture container, food handling area, and turf.
- WSDA has registered Whitmire Micro-Gen's Prescription Ultra-Fine Oil for use. This product is labeled for use on the following PNN-related sites: apple, apricot, asparagus, bean, beet, blackberry, blueberry, boysenberry, cabbage, caneberries, celery, cherry, Christmas tree plantation, conifer, corn, cucurbit, deciduous/shade tree, eggplant, evergreen tree, field corn, flower, grape, greenhouse bean, greenhouse bulb, greenhouse celery, greenhouse cole crop, greenhouse flower, greenhouse lettuce, greenhouse ornamental, greenhouse pepper, greenhouse radish, greenhouse shrub, greenhouse tomato, herb, indoor landscape plant, lettuce, loganberry, melon, mint, nectarine, ornamental tree, peach, pear, pepper, plum, potato, prune, radish, raspberry, rose, shrub, squash, strawberry, sugarbeet, sweet corn, sweet potato, tomato, and youngberry.
- WSDA has registered two Ecogen BT kurstaki product's for use. The insecticides and the associated crops are:

Lepinox WDG Bioinsecticide: alfalfa, alfalfa seed, barley, corn, grass hay, pasture, oat, rye, sorghum, soybean, turf, wheat, and corn seed.

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Condor Wettable Powder Bioinsecticide: alfalfa, alfalfa seed crop, apple, apricot, artichoke, asparagus, barley, bean, beet, blackberry, blueberry, broccoli, Brussels sprout, cabbage, canola, carrot, cauliflower, celery, cherry, chickpea, Chinese cabbage, collard, cranberry, cucumber, cucurbit, currant, dandelion, dill, eggplant, endive, field corn, filbert, forest nursery/seed orchard, garlic, grape, grass hay, grass seed crop, greenhouse ornamental, herb, hop, horseradish, kale, kohlrabi, leek, lentil, lettuce, melon, mustard, nectarine, nursery, oat, okra, onion, ornamental, parsley, parsnip, pasture, pea, peach, pear, pepper, plum, popcorn, potato, prune, pumpkin, quince, radish, rape, raspberry, rutabaga, rye, safflower, salsify, shallot, sorghum, soybean, spinach, squash, strawberry, sugarbeet, sunflower, sweet corn, sweet potato, Swiss chard, tomato, turf, turnip, walnut, watermelon, and wheat.

- WSDA has registered Sulfur Mills' Cosavet DF for use. This product is labeled for use on the following crops: alfalfa, apple, asparagus, barley, bean, beet, blackberry, blueberry, boysenberry, broccoli, Brussels sprout, cabbage, carrot, cauliflower, cherry, collard, corn, cucurbit, currant, dewberry, garlic, gooseberry, grape, kale, lettuce, loganberry, mint, nectarine, oat, onion, ornamental, pea, peach, pear, pepper, plum, potato, prune, raspberry, rose, rutabaga, rye, sorghum, soybean, strawberry, sugarbeet, tomato, turnip, walnut, and wheat.

- WSDA has registered Platte's insecticide Clean Crop Carbaryl Bait for use. This product is labeled for use on the following crops: alfalfa, apple, asparagus, bean, beet, broccoli, Brussels sprout, cabbage, carrot, cauliflower, cherry, collard, corn, cucumber, eggplant, endive, horseradish, kale, lettuce, melon, nectarine, okra, parsley, parsnip, pea, peach, pear, pepper, plum, potato, prune, radish, rutabaga, safflower, sorghum, spinach, squash, strawberry, sugarbeet, sunflower, sweet corn, Swiss chard, tomato, turnip, and walnut.

- WSDA has issued a registration to Olympic Horticultural Products for their product Strike 25 Greenhouse &

Nursery Systemic Fungicide. This product is labeled for use on the following sites: bulb, deciduous/shade tree, evergreen tree, flower, greenhouse, greenhouse ornamental, nursery, ornamental, and rose.

- UCB Chemicals has not reregistered its product Thiram 75W. The uses previously found on this label have been split and are now included on three new labels. The new labels and the associated usage sites are as follows:

UCB Thiram Granuflo Agricultural Fungicide: apple, peach, strawberry.

UCB Thiram Granuflo Seed Protectant Fungicide: barley, bean, beet, broccoli, Brussels sprout, cabbage, canola, cantaloupe, carrot, cauliflower, collard, conifer, cowpea, cucumber, eggplant, endive, field corn, flax, flower, grass, kale, kohlrabi, lentil, lettuce, lima bean, millet, mustard, oat, okra, onion, pea, pepper, pumpkin, radish, rye, safflower, sorghum, soybean, spinach, squash, sugarbeet, sunflower, sweet corn, Swiss chard, tomato, triticale, turnip, watermelon, and wheat.

UCB Thiram Granuflo Turf Fungicide: turf.

- WSDA has registered Y-Tex SwineGuard Pour-On RTU for use to control biting flies, lice, and mites on swine.

- WSDA has registered Waterbury's insecticide Country Vet Farm and Dairy CV-40D. This product is labeled for use on the following PNN-related sites: agricultural production building, cattle, horse, and swine.

- WSDA has registered Loveland's Seed Mate Isotox Seed Treater F. This product is registered for use as a seed treatment on bean, corn, pea, soybean, and sunflower seed.

- WSDA has registered Wellmark's Altosid Premix. This product is labeled for use to control horn flies in cattle manure.

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• WSDA has registered four JJ Mauget products. The names, type, ingredient, and the sites they are labeled for use on are listed below.

Mauget Carbojet - fungicide - oxycarboxin: conifer, deciduous/shade tree, evergreen tree, ornamental tree.

Mauget Abacide - insecticide - avermectin: indoor landscape plant, ornamental tree, shrub.

Mauget Abasol - fungicide, insecticide - DEBC, avermectin, carbendazim: conifer, deciduous/shade tree, evergreen tree, ornamental tree.

Mauget Imisol - fungicide, insecticide - imidacloprid, DEBC, carbendazim: conifer, deciduous/shade tree, evergreen tree, ornamental tree.

• WSDS has registered Wellmark's product Enstar II Inset Growth Regulator. This product is labeled for use on the following sites: greenhouse, greenhouse bulb, greenhouse flower, greenhouse shrub, greenhouse ornamental, and greenhouse rose.

• WSDA has registered Abbot Labs' Ditera WDG Biological Nematicide Granule. This product is labeled for use on flower, nursery, ornamental, and turf sites.

• WSDA has registered AGSCO's seed treatment product, Lindane ST40 for use. This product is labeled for use on the following PNN-related crops: pea, cucumber, watermelon, melon, squash, cabbage, cauliflower, broccoli, Brussels sprouts, barley, sunflower, lentil, wheat, rye, oat, radish, Sudan grass, safflower, carrot, onion, and bean.

• WSDA has registered American Chemet Corporation's Chem Copp 50 Fungicide for use. This product is labeled for use on the following PNN-related sites: alfalfa, apple, apricot, bean, beet, blueberry, broccoli, Brussels sprout, cabbage, caneberries, cantaloupe, carrot, cauliflower, celery, cherry, cranberry, cucumber, currant, eggplant, filbert, gooseberry, grape, honeydew, hop, lettuce, nectarine, onion, peach, pear, pepper,

plum, potato, prune, pumpkin, quince, spinach, squash, strawberry, sugarbeet, tomato, walnut, and watermelon.

• WSDA has registered two additional Agrtrol products. The products, their active ingredients, and labeled usage sites are listed below.

Flouronil Fungicide - chlorothalonil & R-metalaxyl - melon, cucumber, potato, pumpkin, squash, tomato, and watermelon.

Agri Tin - triphenyltin hydroxide - potato, sugarbeet.

• WSDA has registered three Lesco products for use. All are labeled for use on the following sites: golf course, lawn, noncrop non-agricultural area, recreation area, roadside right-of-way, and turf. The products and their active ingredients are as follows:

Lesco Eliminate Liquid Selective Herbicide: 2,4-D triisopropanolamine, triclopyr triethylamine, and clopyralid.

Lesco Momentum Premium Herbicide: dicamba dimethylamine, MCPA dimethylamine, and triclopyr triethylamine.

Lesco Three-Way Ester II Selective Herbicide: dicamba, MCPA isooctyl ester, and triclopyr triethylamine.

Section 24c Registrations

• On December 17, 1998, WSDA issued revisions to two SLN's that provide for the use of Vineland Formaldehyde Solution on daffodil and iris bulbs. The two SLN's are: WA-980006 issued to Holland America Bulb Farms, and WA-980007 issued to the LeFeber Bulb Company. The expiration dates have been removed from both SLN's and each now carries a statement saying that the SLN must be in the possession of the user at the time of the application.

• WSDA has issued a new SLN and revised to two others all providing for the use of Imidan products on blueberries to control blueberry maggots and leafrollers.

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Both existing SLN's, WA-950015a for the use of Imidan 70WP and WA-950016 for Imidan 70WSP, were revised via the addition of a pollinator protection statement and the deletion of the expiration date. A new SLN, WA-950015b, was also issued for the same type of use of Imidan 70W.

- On January 27, 1999, WSDA issued an SLN, WA-990001, to Rhone-Poulenc for the use of its Ethrel Brand Ethephon Plant Regulator to remove unwanted seed cones on Douglas-fir seed orchards.
- On February 3, 1999, WSDA issued an SLN, WA-990002, to Bayer for the use of its insecticide Admire 2 Flowable to treat potato seed pieces for the control of aphids and Colorado potato beetles. This SLN has been issued with a 12/31/03 expiration date.
- On February 4, 1999, WSDA issued an SLN, WA-990003, to American Cyanamid for the use of its herbicide Prowl 3.3 EC to control annual bluegrass, volunteer grasses, and other weeds in established grass seed crops. This SLN has been issued with a 12/31/03 expiration date.
- On February 9, 1999, WSDA issued an SLN, WA-990004, to Gustafson for the use of a mixture of Tops-MZ and Gaucho 75ST as a potato seed-piece treatment. The combined product, Tops-MZ-Gaucho Potato Seed-Piece Treatment, is for the control of *Fusarium*, *Rhizoctonia*, *Helminthosporium* (silver scurf), aphids, and Colorado potato beetle, and to reduce the spread of *Phytophthora* on potatoes. This SLN expires 12/31/03.
- On February 12, 1999, WSDA issued an SLN, WA-990005, to Novartis for the use of its product Dual Magnum Herbicide to control weeds in radish seed crops. Note that this SLN specifically excludes use on daikon seed crops. This registration expires 12/31/04.
- On February 17, 1999, WSDA issued an SLN, WA-990007b, to Zeneca for the use of Bravo Weather Stik to control various diseases on grass seed crops. This SLN expires 12/31/03.
- On February 17, 1999, WSDA issued an SLN, WA-990008b, to Zeneca for the use of Bravo Ultrex to control various diseases on grass seed crops. This SLN expires 12/31/03.

Section 24c Cancellations

- WSDA has issued a letter canceling SLN WA-940003. This SLN was previously issued for the use of Lorsban 4E to control cutworms in non-bearing grapes. While no reason was given for the cancellation, note that SLN WA-970008 also provides for the use of Lorsban 4E to control both cutworms and mealybugs in grapes.
- WSDA has issued a letter canceling SLN WA-800030. This SLN was previously issued for the use of Dow's Treflan EC for weed control at layby in onions. While no reason was given for the cancellation, note that the Section 3 main label now includes directions for use of this product on dry bulb onions.
- WSDA has issued a letter canceling the following SLN's: WA-950011 and WA-950012 for the use of Imidan 70WP and Imidan 70WSB for the control of European pine shoot moth in pine trees, and WA-950013 and WA-950014 for the use of Imidan 70WP and Imidan 70WSB to control insects in shade and ornamental trees. The SLN's are being cancelled by Gowan because these uses have been added to the Section 3 main label either via the issuance of a supplemental label or via a label revision.
- WSDA has issued a letter canceling SLN WA-950018. This SLN was previously issued for the use of Cryolite Bait (EPA# 10163-41) to control black vine weevils in cranberries. The SLN is being cancelled because Gowan has added these use directions to the label for Gowan Cryolite Bait (EPA# 10163-225).
- On February 4, 1999, WSDA issued correspondence confirming that SLN's Wa-980002(a) and 980002(b) were not being renewed in 1999. These SLN's had previously been issued to Zeneca and Microflow for the use of Captan 50 WP to control Anthracnose, Botrytis, and Spur Blight on caneberries. The SLN's were initially issued with a December 31, 1998 expiration date and, at

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that time, WSDA had stated that these registrations would not be renewed (see PNN Notification 1998-42).

- On February 5, 1999, WSDA issued a letter canceling SLN WA-930007. This SLN had previously been issued to DuPont for the use of its product Sinbar Herbicide to control weeds in seedling alfalfa. This SLN was cancelled by DuPont because the use has been added to the main Sinbar Herbicide label.

Section 24c Revisions

- WSDA has issued revisions to two SLN's that provide for the use of Vineland Formaldehyde Solution on daffodil and iris bulbs. The two SLN's are: WA-980006 issued to Holland America Bulb Farms, and WA-980007 issued to the LeFeber Bulb Company. The expiration dates have been removed from both SLN's and each now carries a statement saying that the SLN must be in the possession of the user at the time of the application.

- WSDA has issued a revision to SLN WA-980001. This SLN was previously issued to Gowan for the use of its Cryolite Bait to control weevils on blueberries, raspberries, and strawberries. The revision is limited to the removal of the expiration date.

- WSDA has issued revisions to two SLN's previously issued to Gowan for the use of its insecticide Metasystox-R. SLN WA-950005 provides for use to control aphids and leafminers on Christmas trees and field grown nursery stock. WA-950004 allows for use to control aphids on strawberries. The revisions included removing the expiration dates from both SLN's.

- WSDA has issued revisions to two SLN's previously issued for the use of Sencor DF. The SLN's are WA-930003 for use on tall fescue and bluegrass seed crops and WA-940041 for use on timothy hay. Both SLN's now carry a statement requiring that applicators follow all applicable directions and precautions on the Sencor DF main label.

- On January 26, 1999, WSDA issued a revision to SLN WA-980018. This SLN had previously been issued to Novartis for the use of its fungicide Tilt on to control leaf and glume blotch diseases in wheat. The revision adds "rusts (*Puccinia* spp)" to the list of pests to be controlled.

- On January 27, 1999, WSDA again issued a revision to SLN WA-770040. This SLN had previously been issued to DuPont for the use of its product Benlate Fungicide for preplant treatment of asparagus crowns. This revision corrects the EPA registration number and adds a 12/31/03 expiration date.

- On February 5, 1999, WSDA revised two SLNs previously issued to Bayer for the use of Sencor DF (WA-970003) and Sencor Solupak (WA-970004) on green peas. The revisions remove the expiration dates from both SLN's.

- On February 5, 1999, WSDA issued revisions to two SLN's. The SLN are: WA-970036 issued to Gustafson for the use of 42-S Thiram Fungicide on parsley seed produced for export to Mexico; and WA-980030, issued to Brandt Consolidated for the use of Saf-T-Side on hops. In both cases the expiration dates were revised to 12/31/03.

- On February 5, 1999, WSDA issued a revision to SLN WA-980008. This SLN had previously been issued to the Association of Basin Nurseries for the use of Harvade-5F for the defoliation of non-bearing apple nursery stock. The revision removes the expiration date.

- On February 5, 1999, WSDA issued a revision to SLN WA-980015. This SLN had previously been issued to Gowan for the use of its insecticide Endosulfan 3EC to control clover head aphids in clover seed crops. The revision adds an aquatic toxicity statement and changes the expiration date to 12/31/03.

- On February 5, 1999, WSDA issued a revision to SLN WA-980017. This SLN had previously been issued to Drexel for the use of its insecticide Endosulfan 3EC to control armyworms, Colorado potato beetles, and aphids

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on potatoes. The revision adds the following statement to the SLN:

“Do not make more than 3 applications per year. Do not apply more than 3.0 pounds active ingredient (i.e. 4 quarts of product per acre per year.”

• On February 5, 1999, WSDA issued a revision to SLN WA-980031. This SLN had previously been issued to Zeneca for the use of its herbicide Fusilade DX to control weeds in fescue grass grown for seed. The revision clarifies that this SLN is for use on fine fescue grasses only (not tall fescue), changes the expiration date to 12/31/04, and removes feeding restrictions.

• On February 8, 1999, WSDA issued a revision to SLN WA-980014. This SLN had previously been issued to Mt. Adams Orchard Corporation for the use of Mycoshield Agricultural Terramycin to control fire blight in pears. The revision removes the expiration date.

• WSDA has revised three SLN's, all for the use of Lorsban 4E. The SLN's and the significant revisions are discussed below.

SLN WA-940004. For the control of garden symphylans on strawberries. Addition of a chemigation restriction.

SLN WA-970008. For the control of grape mealybugs and cutworms on grapes. Addition of a bee caution statement.

SLN WA-970012. For the control of various borers, beetles, aphids, and other insects on cottonwood/ poplar trees grown for pulp. Revision of the bee caution statement and removal of the expiration date.

• On February 9, 1999, WSDA issued a revision to SLN WA-980021. This SLN was previously issued to Nichimen America for the use of its Kaligreen Potassium Bicarbonate Soluble Powder to control powdery mildew on hops. The restricted entry language has been revised to read “Restricted-entry interval is 4 hours,

unless early-entry PPE is worn.” Also, the expiration date has been amended to December 31, 2003.

Miscellaneous Regulatory Information

• Detectable residues of the slug/snail bait metaldehyde were observed in recent tests. Prior to these tests it was assumed that metaldehyde would not leave detectable residues. However, the rates used for these tests were far in excess of typical field applications. Metaldehyde's registrant, Lonza, has made a request to EPA that the tests be redesigned and rerun at more realistic rates. Should EPA decline this request, Lonza has stated it will only support metaldehyde use on leafy Brassica vegetables, tomato, citrus, artichoke, and strawberry.

If EPA denies Lonza's request further residue testing will be required to retain metaldehyde for use on the crops not supported by Lonza. IR-4 is requesting that individuals or groups wanting to retain metaldehyde for use on nonsupported crops submit Pesticide Clearance Request Forms (PCR) to develop supportive residue data. The contact person for the PCR forms is the Washington IR-4 representative, Doug Walsh. He may be reached at: Doug Walsh, State Liaison IR-4 Project; Agrichemical and Environmental Education Specialist; Food and Environmental Quality Laboratory; Washington State University, Prosser; 24106 N. Bunn Rd.; Prosser, WA, 99350; Phone: 509-786-9287; Fax: 509-786-9370; E-mail: dwalsh@tricity.wsu.edu.

Metaldehyde is currently registered for commercial use on the following crops: alfalfa, alfalfa seed, apple, apricot, asparagus, barley, barley seed, bean, bean seed, beet, beet seed, blackberry, blueberry, boysenberry, broccoli, Brussels sprout, buckwheat, bulb, cabbage, cabbage seed, carrot, carrot seed, cauliflower, celery, cherry, clover, clover seed, collard, collard seed, corn, corn seed, cucumber, currant, dill, dewberry, eggplant, flower, flower seed, garlic, ginseng, gooseberry, grape, grass, grass hay, grass seed, greenhouse, various greenhouse vegetable crops, herb, horseradish, kale, kale seed, kohlrabi, kohlrabi seed, leek, lentil, lentil seed, loganberry, melon, millet, mint, mustard, mustard seed, nectarine, nursery, oat, oat seed, okra, onion, orchard floor, ornamental, parsley, parsnip, pea, pea

...PNN Update, cont.

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

seed, peach, pear, pepper, plum, pimento, potato, potato seed, prune, pumpkin, radish, radish seed, raspberry, rhubarb, rose, rutabaga, rye, shallot, sorghum, soybean, spinach, spinach seed, squash, sweet potato, Swiss chard, Swiss chard seed, triticale, turnip, turnip seed, walnut, watermelon, wheat, and wheat seed.

- WSDA has issued a preproposal notification for chapter 17.21 RCW: Washington Pesticide Application Act. WSDA is soliciting input on a proposal that would require orchard managers to remove all bloom on the orchard floors and from surrounding areas prior to applying pesticides with residual activity. According to Eric Johansen, WSDA's intent would be to require bloom removal when insecticides with a long residual activity (1 day or greater) are to be applied. The purpose of issuing this preproposal notice is to get feedback from interested parties on this idea for enhanced pollinator protection. Note that because this is a preproposal notification (as opposed to a notice of proposed rulemaking), some details (the definition of surrounding area and specifics as to what pesticides this applies to) are missing. Questions may be addressed to Cliff Weed (360) 902-2036 or Erik Johansen (360) 902-2078.

- On January 19, 1999, Abbott Labs reported to WSDA a total of 16 incidents of fruit spotting following the use of their product Retain Plant Growth Regulator. Abbott believes that all of the incidents occurred when high rates of organosilicone surfactant were used in conjunction with extreme heat.

- PNN notification 1999-38, confirming WSDA's plans not to renew SLN's WA-980002a or WA-980002b, may have caused some concern. Captan is still registered for use on caneberries via SLN WA-950034. This SLN

is issued to Drexel for the use of its Captan 50W to control various diseases on caneberries. Another SLN, WA-940026, is also still in place for Micro Flo's Captan 50WP (EPA # 51036-166); however, this SLN is being retained only long enough to allow the product to clear the channels of trade.

- WSU's Pesticide Information Center has recently undertaken a review of the RED's put forth by EPA since 1997. The information below is a summary of risk mitigation decisions contained in the RED that appear to be of interest to Washington's agricultural community.

PENDAMETHALIN: EPA has determined that the REI for pendamethalin products shall be increased from 12 to 24 hours and that the application rate for sod farms shall be reduced from 3 pounds a.i. per acre to 2.

WSU's Pesticide Information Center has recently undertaken a review of the RED's put forth by EPA since 1997. The information below is a summary of risk mitigation decisions contained in the RED that appear to be of interest to Washington's agricultural community.

ALACHLOR: EPA has decided that to lessen the human health, ecological, water, and food quality risk from alachlor, the maximum single application rate has been reduced from 6 pounds a.i. per acre to 4. EPA has also decided to classify alachlor as an RUP and, in addition, is requiring a 12-hour REI for uses within the scope of the WPS. Alachlor is registered for use in Washington as: Bronco, Bullet, Freedom, Lariat, Lasso, and Partner.

