COOPERATIVE EXTENSION
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In This Issue

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Chlorpyrifos Redux

(It Ain't Over 'Til the EPA Sings)

Dr. Allan S. Felsot, Environmental Toxicologist, WSU

If you've been following the latest protest fad—anti-corporate globalism, pro-butterflies and turtles—then you might have the impression that our sovereignty has been taken over by Monsanto, Dow, Microsoft, or whatever your favorite corporation happens to be. But the June 8, 2000, release of the EPA's revised risk assessment of chlorpyrifos and risk mitigation plans shows that the government, not the corporations, is firmly in charge.

Contrary to some press reports, EPA did not officially ban chlorpyrifos. The *New York Times* expressed EPA's decisions best—an accord was reached with the registrants. In a nutshell, the EPA said chlorpyrifos use around homes is too risky, but not risky enough to declare it an imminent hazard and immediately suspend it, as the FQPA would allow it to do. Rather, the agency negotiated with the principal registrant, Dow AgroSciences (DAS), and the other minor manufacturers a phase-out of residential uses and some minor proscriptions for a few agricultural commodities (apples, grapes, tomatoes).

Carol Browner, EPA administrator, declared in several press reports that a consensual phase-out would lead to swifter removal of chlorpyrifos from its most hazardous uses than the recall approach that would have taken years of litigation (2, 14). Sound contradictory? I'm just as confused but over a different issue. EPA closely guarded its revised risk assessment until the day before its official release. Supposedly, not even DAS knew the final conclusions. But the handwriting must have been on the wall, because the risk mitigation, i.e., virtual total elimination for residential uses, was a done deal on the release date.

Perhaps I'm hung up on arcane conspiratorial details. On the other hand, if you really want to understand why the agency declared chlorpyrifos even more risky than it professed in the preliminary risk assessment (6, 7, 8), then you have to slog through the hundreds of pages of details (5).

It's a dirty job, but someone has to do it. Fortunately, after nearly blinding myself, I can distill the information down to the single most important reason why you won't be able to buy the most popular residential formulation of chlorpyrifos, Dursban, after the

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year 2001. Drum rolls, please. It's that pesky little extra 10X FQPA safety factor (9).

Doing It for the Children

Exposures of pesticides that exceed EPA's levels of concern are determined by applying a 100X safety factor to the doses not causing any harm of any kind to test rats. Thus, the NOEL is divided by 100 to give the reference dose (RfD) (Table 1). The RfD is an exposure presumed to pose a reasonable certainty of no harm either after a single (acute) or lifetime (chronic) exposure. However, the FQPA mandates up to an extra 10X safety factor when the EPA uncovers any evidence that indicates fetal, neonatal, or juvenile rats are more sensitive to the effects of the pesticide at lower doses than the adult rat. In such an event, the RfD is divided by another 10X to yield the population adjusted dose (PAD) (Table 1).

TABLE 1

Toxicological Endpoints and "Safe" Levels (mg/kg/day) of Chlorpyrifos Exposure

	Preliminary Risk Assessment		Revised Risk Assessment	
Toxicological Parameter	**Acute**	**Chronic**	**Acute**	**Chronic**
LOEL	1	0.1	1-1.5	0.22-0.3
NOEL	0.5	0.03	0.5	0.03
RfD	0.005	0.0003	0.005	0.0003
PAD	0.0017	0.0001	0.0005	0.00003

LOEL = lowest dose causing cholinesterase enzyme inhibition (lowest observable effect level); NOEL = dose causing no adverse effects; RfD = NOEL/100; Preliminary PAD = RfD/3; Revised PAD = RfD/10

During the preliminary round of chlorpyrifos risk assessment, EPA imposed an extra 3X FQPA safety factor. The agency admitted that data submitted by DAS failed to show any increased sensitivity to fetal and neonatal rats. But some peer-reviewed literature suggested otherwise. Upon re-analysis of a developmental neurotoxicity study submitted by DAS and creative interpretation of a body of literature on chlorpyrifos interactions with neurons and brain cells, the EPA decided to increase the FQPA safety factor to its lawfully mandated limit of 10X. The result was that the permissible exposure of chlorpyrifos was over three times lower than in the preliminary risk assessment (Table 1).

The Neurodevelopmental Nemesis

When a pesticide exerts its effects through interactions with the nervous system, EPA requires a manufacturer to submit a battery of neurotoxicity tests. The developmental neurotoxicity (DNT) test is one of the most important for determining whether fetal and neonatal rats are more sensitive to the pesticide than the adult. Pregnant females are fed different doses of the pesticide for about a week. The newborn rats are then subjected to a number of tests ranging from cholinesterase enzyme analysis to tissue examination to behavioral observations.

DAS submitted a DNT study to EPA that was discussed in the preliminary risk assessment. EPA's conclusions at that time agreed with DAS'—no differential toxicity between the neonates and their mother. However, the agency noted that at the highest dose tested (5 mg/kg/day maternal exposure) neonatal brains were smaller than in the unexposed test group. This finding was explained away by the observation of maternal toxicity that could have affected rat development independently of the effects of the insecticide. At the mid-dose (1 mg/kg/day), no maternal toxicity was noted, but ambiguous small changes in brain size were noted, albeit not until 66 days after birth. At the lowest dose tested, 0.3 mg/kg/day, no effects were noted in the offspring. At both the mid-dose and high dose, blood cholinesterase activity was lower than in the unexposed group.

While the DNT was suggestive of an effect on neonatal brain development at the high dose but not the lower doses, some published literature suggested an effect of chlorpyrifos on neuron growth that was independent of its effect on cholinesterase (1, 19, 23). Walking the thin line between the DAS data and the

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published literature, the EPA chose to adjust the chlorpyrifos RfD by a 3X FQPA safety factor.

After the preliminary risk assessment was released, the DAS DNT study was reanalyzed and reinterpreted. EPA came to believe that the effect on neonatal brain development in the mid-dose chlorpyrifos group (i.e., 1 mg/kg/day maternal exposure) was a unique effect not seen in the mother rat, even if it was absent at the lowest dose tested. In other words, the mother rat suffered from blood cholinesterase inhibition without signs of toxicity, but 66-day-old infant rats had a minor change in part of their brain. By the way, that change was a 4% difference in the size of the brain's parietal cortex compared to the unexposed group, but EPA declared it significant. (I've heard we don't use 90% of our brain as it is, so what do I know.) Nevertheless, this "unique" effect of chlorpyrifos in the infant rats compared to the mother was enough to trigger an increased FQPA safety factor.

The Nail in the Neurodevelopmental Coffin

After the preliminary risk assessment, several more neurotoxicity papers were uncovered that reiterated chlorpyrifos' seemingly unique ability to affect neuron cell development (3, 12, 20). These papers are subject to criticism on the basis that the doses (1 milligram per kilogram of body weight, or 1 mg/kg) were subcutaneously injected into the body rather than given through the diet. The authors repeated claim that potential effects on neuronal cell development occurred in the absence of significant cholinesterase inhibition is belied by their own data showing a significant 25% inhibition of brain cholinesterase at the lowest dose tested (1 mg/kg/day) (19) . However, these studies are interesting from a mechanistic perspective and do show that certain cell growth parameters (DNA, RNA, and protein synthesis) can be altered by chlorpyrifos in the absence of typical organophosphate poisoning symptoms.

Levels of chlorpyrifos not causing significant cholinesterase inhibition affected growth of rat embryos (18) and neurites (4) in cell cultures (i.e., in vitro). However, the research has been criticized for its lack of relevance to whole body (i.e., in vivo) dietary exposure (17). More importantly, the exposures were 10-1000 times higher than what occurs in fetal and neonatal blood after exposure to low doses of chlorpyrifos (10, 13).

Finally, a recently published paper reported that a single exposure of chlorpyrifos inhibited blood cholinesterase at a lower oral dose (0.45 mg/kg) in infant rats than in adults (4.5 mg/kg) (24). Paradoxically, after 14 days of repeated exposure, the infant and adult rats were more or less equally sensitive to chlorpyrifos at the same dose, but the NOEL in the young rats rose from 0.15 mg/kg to 0.75 mg/kg. Other studies have noted that repeated exposures of neonatal rats to chlorpyrifos through the diet also result in less inhibition of cholinesterase than similar doses given to the mother (11). While EPA interpreted the single exposure study as indicative of a differential sensitivity between infants and adults, the researchers themselves made the following statement. "We conclude that while immature animals can be markedly more sensitive to lethal effects of high doses of CPF [chlorpyrifos], lesser or no age-related differences are apparent, based on non-lethal endpoints, in particular with repeated exposures."

Given the reports of chlorpyrifos affecting brain cell development seemingly independent of cholinesterase inhibition, the differential impact on rat brain weight in the DNT study, and the lower NOEL for single exposure of neonates to cholinesterase, EPA invoked the "weight-of-evidence" approach and restored the full FQPA 10X safety factor.

How About Them Apples?

Once establishing the hazards of chlorpyrifos, the dose-response for effects, and the 1000X safety factor, EPA re-analyzed the dietary, drinking water, worker, and residential exposure data. In the preliminary risk assessment, EPA concluded that neither acute nor chronic dietary exposure exceeded their levels of concern. Yet, after massaging the data one

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TABLE 2

Percentages of the PAD for Acute Exposure

Population Group	Percent of Acute PAD		
	Preliminary Risk Assessment	Revised Risk Assessment	
		Pre-Mitigation	Post-Mitigation
U.S. Population	39	16	5
Infants (<1 yr)	76	130	52
Children (1-6 yr)	91	355	82
Children (7-12 yr)	62	258	64
Females (13+ yr)	38	127	40

Acute dietary exposure to chlorpyrifos in the preliminary and revised risk assessment and after removal of exposure to residues in apples, grapes, and tomatoes. Note that infants, children, and females were the groups exposed to levels exceeding EPA's concern (i.e., >100% of PAD).

more time, acute dietary exposure, but not chronic exposure, was too high, especially to infants, children, and women.

This apparent paradox between a single exposure being considered unacceptably hazardous and a lifetime daily exposure acceptable is explained by the mathematics used in the calculation. Chronic exposure is estimated using average consumption of average residues. Acute dietary exposure is based on a statistical probability analysis of residue consumption at the 99.9th percentile level. Using real residue data from different sources and a USDA database of food consumption values, EPA calculates the level of acute dietary exposure greater than 99.9% of all other people in the population. These lucky few hypothetical people (no one knows if they really exist) are the ones EPA is trying to protect from chlorpyrifos hazards. Bear in mind that the permissible exposure to chlorpyrifos is one thousand times less than the NOEL.

In the preliminary risk assessment, neither acute nor chronic dietary exposure was of concern, but just barely (Table 2 and 3). However, EPA used a new data set of residues on single apples, re-ran the probabilistic analysis for dietary exposure, and voilà, exposure exceeded levels of concern (i.e., it was greater than 100% of the revised acute PAD) (Table 2, Figure 1). However, chronic exposure, which relied on average residues and consumption data, was still below the levels of concern.

Further investigation led to the conclusion that apple residues were driving up the risk. Grapes and tomatoes didn't help either. So EPA went back to the spreadsheets, removed the apple, grape, and tomato residues, and *presto magic*, dietary exposure was acceptable again (Table 2, Figure 1). Given these results, EPA hung tough with the manufacturers and suggested that tomato use be dropped, and the tolerance for grapes (a problem with imports) and apples be lowered from 0.05 ppm to 0.01 ppm. The latter could be achieved if chlorpyrifos use was only allowed for dormant applications prior to bloom.

TABLE 3

Percentages of the PAD for Chronic Exposure

Population Group	Percent of Chronic PAD		
	Preliminary Risk Assessment	Revised Risk Assessment	
		Pre-Mitigation	Post-Mitigation
U.S. Population	23	4	3
Infants (<1 yr)	39	45	33
Children (1-6 yr)	59	81	51
Children (7-12 yr)	38	59	36
Females (13+ yr)	25	30	20

Chronic dietary exposure to chlorpyrifos in the preliminary and revised risk assessment and after removal of exposure to residues in apples, grapes, and tomatoes. No exposure scenario exceeded EPA's level of concern (i.e., exposures all less than 100%).

Residential Rejection

Residential exposure calculated in the preliminary risk assessment raised EPA's metaphorical eyebrows several notches, and things became worse with the revised PAD (Figure 2, page 6). Post-application exposures to residues from cracks and crevice treatments in houses, termite control, and lawn use were sometimes higher than the dietary exposures. In fact,

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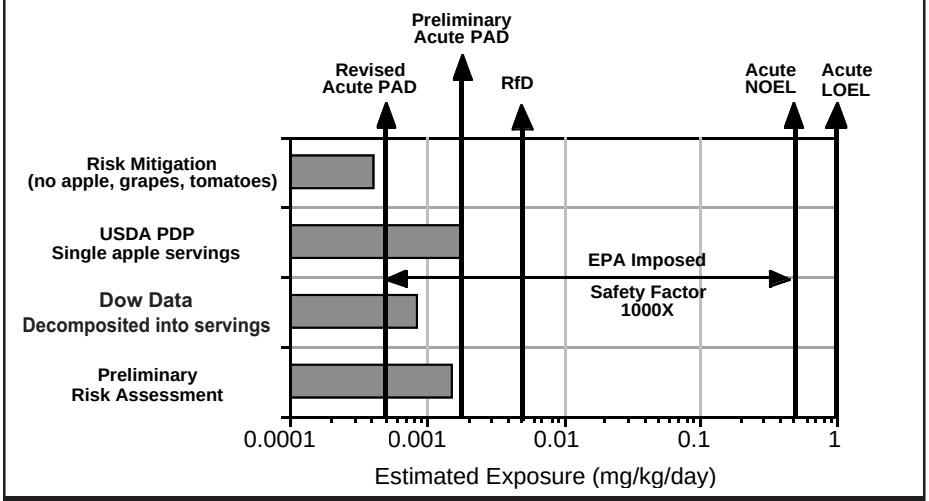
FIGURE 1

Estimated Dietary Chlorpyrifos Exposure in Children



Estimated dietary exposure to chlorpyrifos in the most exposed age group, 1- to 6-year-old children. Exposures for several scenarios are shown in comparison to the exposure estimated in the preliminary risk assessment (bottom bar). The USDA PDP analysis used residues on individual apples as opposed to composited samples of many apples. Dow submitted its own data for apple composites that were statistically deconvoluted into single-serving apples. Note that once apple, grape, and tomato residues were removed from the assessment, exposures at the 99.9th percentile were below levels of EPA concern.

the scenario for lawn treatments estimated residential exposures as about 10-fold less than the NOEL (remember that exposures must be 1000 times less than the NOEL) (Figure 2, page 6). Several termite treatment scenarios passed muster for adults, but for children the estimated exposures still edged over EPA's levels of concern.

Given EPA's perspective of chlorpyrifos hazards and the levels of permissible exposure, no amount of data manipulation was going to mitigate the risk characterization of residential exposures. Except zero use, of course. So, by December 2001, you won't be able to buy Dursban at your favorite hardware and garden store, and by 2005 termite treatments will end.

What Is "Safe?"

To say that estimated dietary and residential exposures of chlorpyrifos exceed safe levels is to misunderstand the concept and purpose of a reference dose. I know I am guilty of using the phrase "safe levels" when I really mean tolerable exposure levels that reflect our uncertainty about hazards. Closer examination of Figures 1 and 2 shows that estimated exposures to chlorpyrifos may exceed the PAD, but they are still an order of magnitude or more below the established NOELs. Bear in mind that no researcher has ever shown any effects, whether on brain development or on cholinesterase enzyme activity, at exposure corresponding to the NOEL. In short, a big uncertainty (OK, safety) factor is built in to hedge our exposure bets and account for a wide range of human response variability. Because of this built-in conservatism, to exceed the PAD, or the RfD for that matter, is not necessarily unsafe (15, 16, 21, 22). In other words, the precautionary principle is actually practiced as part of the risk assessment process, not separately from it. Of course, everyone starts getting a little sweaty when the exposures start approaching the NOEL, and some estimated residential exposures to chlorpyrifos (e.g., lawn applications) were admittedly a bit too close for comfort.

So How Do You Control Your House and Lawn Pests?

It's so nice when the EPA and industry agree to do something together, such as removing a pesticide product from general sale. But that doesn't solve the consumers' problem with annoying pests. So what's left? If you need to control cockroaches, ants, spiders, and fleas, there are plenty of active ingredients registered in Washington State (Table 4). However, if you have a lawn pest, such as the armyworm outbreak a couple of years ago in eastern Washington and the ubiquitous cranefly in western Washington, your options are much more limited. But you can always surf the Internet for "green" sites that will tell

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you about the immorality and pitfalls of desiring a perfect lawn. And those rock gardens look great.

Et Tu, Diazinon?

I noted that diazinon is still registered for just about everything, and it will probably be substituted for chlorpyrifos. Its preliminary risk assessment came out recently, but nary a word was uttered by the chlorpyrifos-phobic world. Will it be next on the chopping block? Fewer data are available about diazinon's developmental neurotoxic effects, but it also has less agricultural use than chlorpyrifos. Whatever the impending fate of diazinon, in the end, the EPA is firmly in charge. How else can one explain a big, bad company like DAS throwing in the towel and giving up literally half of its profit returns on a thirty-five-year-old, successful product? So, for all of you who are paranoid about the global corporate takeover of America, remember that when the EPA sings, the mighty still join in with a round of the blues.

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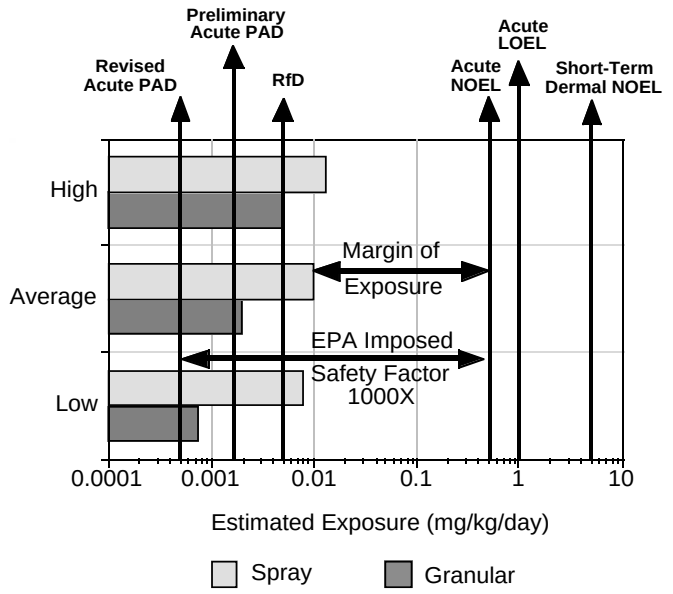
FIGURE 2

Residential Post-Application Exposure from Treated Lawns



Residential post-application exposure to a lawn treated with either a liquid or granular Dursban product. Acute toxicity endpoints (NOEL and LOEL) are used because the exposure is assumed to be short term. Any estimated exposure above the acute PAD (population adjusted dose) exceed EPA's levels of concern. The EPA also uses a margin of exposure (MOE) assessment that compares NOEL for specific routes of exposure (e.g., dermal) to the estimated exposure, and then all exposures from all routes are summed. Any chlorpyrifos exposure below an MOE of 1000 exceeds EPA's levels of concern. Note that even the low estimate of residential exposure exceeded the PAD.

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TABLE 4

Active Ingredients Registered in Washington State That Could Serve as Alternatives to Chlorpyrifos for Indoor and Outdoor Residential Use

Active Ingredient	Cockroach	Ant	Spider	Flea	Termite	Armyworm	Cranefly
acephate	X	X	X			X	X
allethrin	X	X	X	X			
arsenic acid (restricted)					X		
arsenic pentoxide (restricted)					X		
avermectin	X	X					
azadirachtin						X	
bendiocarb	X	X	X	X	X		
bifenthrin	X	X	X	X	X	X	X
bioallethrin	X	X	X	X			
boric acid or borax	X	X	X	X	X		
carbaryl	X	X	X	X			X
chloropicrin (restricted)	X	X			X		
chromic acid (restricted)						X	
copper (metallic)/cuprous and cupric oxide					X		
copper 8 quinolinolate					X		
copper as elemental					X		
copper carbonate					X		
copper naphthenate					X		
copper oxide (cuprous oxide)					X		
cupric oxide					X		
cyfluthrin	X	X	X	X	X	X	
cypermethrin	X	X	X	X	X		
d-trans allethrin	X	X	X	X			
DDVP (dichlorvos)	X	X	X	X			
deltamethrin	X	X	X	X	X	X	
diatomaceous earth	X	X	X	X	X		
diazinon	X	X	X	X		X	X
diflubenzuron					X		
diiodomethyl p-tolyl sulfone					X		
diisobutylphenoxyeth-oxyethyl dimethyl benzyl ammonium chloride	X	X		X			
disodium octaborate tetrahydrate	X	X			X		
esfenvalerate	X	X	X	X			
eugenol	X	X	X	X			
fenoxycarb				X			
fenvalerate	X	X	X	X	X		
fipronil	X	X			X		
fluvalinate		X					
garlic oil/powder		X					
halofenozide (proposed common name)						X	
hexaflumuron					X		
hydramethylnon	X	X			X		
hydroprene	X						
imidacloprid	X				X		
imiprothrin	X	X	X				
isofenphos							X
lambda-cyhalothrin	X	X	X	X			
limonene	X	X		X	X		

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SOURCE: Pesticide Information Center On-Line (PICOL) database at http://picol.cahe.wsu.edu. Note that some products can be applied only by licensed commercial operators.

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TABLE 4

Active Ingredients Registered in Washington State That Could Serve as Alternatives to Chlorpyrifos for Indoor and Outdoor Residential Use
CONTINUED FROM PAGE 7

Active Ingredient	Cockroach	Ant	Spider	Flea	Termite	Armyworm	Cranefly
linalool	X	X	X	X			
malathion	X	X	X	X		X	
Metarhizium anisopliae					X		
methyl bromide (restricted)	X	X	X		X		
methylene dithiocyanate					X		
MGK 264 (N-octyl bicycloheptene dicarboximide)	X	X	X	X	X		
mint oil	X	X	X				
sulfluramid (N-ethylperfluoroctanesulfonamide)	X	X			X		
naled	X					X	X
o-phenylphenol	X	X	X	X			
oil of cedar	X	X	X				
oil/aromatic petroleum	X	X	X				
oil/aromatic petroleum distillate	X	X	X	X	X		
oil/pet. distillate (incl. paraffinic & aliphatic)	X	X	X	X	X		
oil/xylene range hydrocarbon solvent	X	X	X				
pentachlorophenol					X		
permethrin	X	X	X	X	X	X	
phenol			X				
phenothrin	X	X	X	X			
phenylethyl propionate	X	X	X	X			
pinene	X	X	X	X			
piperonyl butoxide	X	X	X	X	X		
prallethrin	X	X	X	X	X		
propetamphos	X	X	X	X	X		
propoxur	X	X	X	X	X		
pyrethrins	X	X	X	X	X		
pyriproxyfen	X	X	X	X			
resmethrin	X	X	X	X	X		
s-methoprene	X	X	X	X			
silica gel	X	X	X	X	X		
sodium arsenate					X		
sodium dichromate					X		
sodium fluoride					X		
sodium lauryl sulfate	X	X	X				
sulfuryl fluoride (restricted)	X				X		
tetramethrin	X	X	X	X			
thymol		X					
tralomethrin	X	X	X	X			
trichlorfon	X	X					
zinc naphthenate					X		

SOURCE: Pesticide Information Center On-Line (PICOL) database at http://picol.cahe.wsu.edu. Note that some products can be applied only by licensed commercial operators.

QBL II
(No, It's Not a Boat!)

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

In *AENews* No. 169 (May 2000), I vented my frustrations about the lack of consistency in pesticide labels. Realizing that nothing short of omnipotent control would remedy the current state of affairs, I nominated myself Queen Bee of Labels. Although no call has been forthcoming from EPA confirming my title, I (that's QBL2U) have decreed that it would be a fine idea to periodically illuminate some of the more interesting things the QBL and her minions find when reviewing pesticide labels. The Royal Intention had been to refer to these items as Label Anomalies. However, after some quiet moments spent with *Webster's*, it seems clear that this isn't an appropriate moniker. Since we all know that there are no rules for pesticide labels (if you doubt me, refer to the May article), then no label, no matter what it says or how badly it is written, can be a "departure from the regular arrangement, general rule, or regular practice," and thus cannot constitute an anomaly. With this in mind the QBL is introducing the Pesticide Label Non-Anomaly Awards or, in the vernacular: the Non-Anoms. Presented forthwith is an item that recently caught the Royal Eye and that may be in contention for a 2000 Non-Anom Award in the Glaring Error category.

Please refer to a copy of Albaugh's Brox-M Herbicide label, EPA registration number 42750-52. Late in 1999 this label was reviewed and, one can only assume, approved by EPA. The cover page of the label states that the product is for "control of certain broadleaf weeds in small grains (wheat, barley, oats, and rye), conservation reserve program (CRP) areas, grasses grown for seed production and flax." In the body of the label, where the application rates and use directions are given, there are use directions for only wheat, barley, oats, rye, and flax. Her Royal Highness' questions are:

- What exactly constitutes a review by EPA? Hmmmm?
- Is this product considered to be labeled for use on CRP areas and grass seed crops?
- If so, could one just apply the product any old way (read "at any old rate") and would one still be in compliance with the edict to follow the label directions (since there aren't any)?

(The Albaugh label/registration personnel did appreciate having this "non-anomaly" pointed out; the company plans to issue a revised label.)

The QBL, naturally, has the option to decree as many Non-Anom Award categories as are found to be Royally Necessary. Likely categories, in addition to Glaring Error, include: Most All-Encompassing Usage Site, Most Confusing Language, and Least Descriptive Description.

A quick review has uncovered several labels in close contention for Most All-Encompassing Usage Site. Gustafson's Kodiac HB Biological Fungicide label states, in the final use directions under seed treatment, that this product may be used on "all other seeds (agricultural, vegetable,

...continued on next page

QBL II, cont.

Jane M. Thomas, Pesticide Notification Network Coordinator, WSU

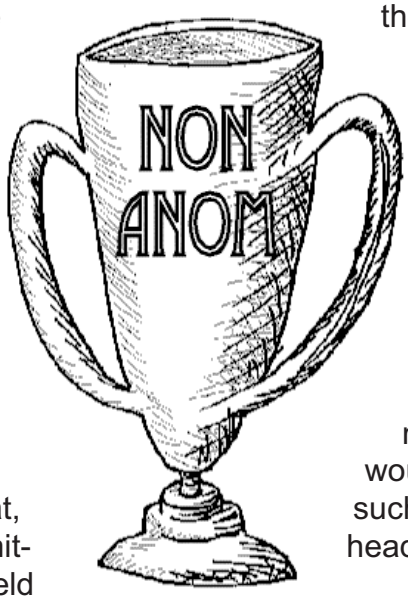
flower, ornamental)." While this would seem to cover pretty much anything, this label may not be a strong candidate as far as the Non-Anoms are concerned because this use is limited to seed treatment. A less limited contender is Appropriate Technology's Sincocin label. This product may be used on "food crops and row crops." This again is a bit limited because it must be used on things we eat or grow in rows. It begs the question: if forage grasses were planted in neat and tidy rows, could one use this product on them?

The Royal Quest for a perfect entrant next revealed the T-22 G label from Bioworks Inc. The label for this biological fungicide states that it may be used on "agronomic row or other field crops." While no clear definition of row or field crops was available despite thorough research, a call to Bioworks did turn up some interesting information. The Bioworks registration specialist stated that, on the version of the label originally submitted to EPA, the agronomic row or other field crops language was followed with "such as buckwheat, corn (popcorn, oil, grain, silage, seed, and sweet), canola, safflower, and sunflower." This gives "agronomic row or other field crops" a distinct grain/oil flavor. One wonders:

- Was EPA's intention when reviewing this label to allow use on similar grain and/oil crops or to allow use on virtually all crops?

- If the registrant had wanted to direct the use to these types of crops then why not include this somewhat helpful language on the final printed label? You know…the labels that are actually distributed to the pesticide users.

Elsewhere in this newsletter, a short article describes recent EPA efforts with respect to improving the quality of pesticide labels. It would seem that EPA's new program corrects problems one at a time, and corrects them after the fact--a more "rear-end" than "front-end" approach. If a few RULES were in place, perhaps the problems could be systematically resolved (or should I say "systemically?"). If EPA would do the right thing and finalize HRH QBL's Royal Appointment, these non-anomalies would be handled. All labels would be written according to very specific RULES and would undergo rigorous review. These RULES would require, among other things, that each label list specific crops or, at a minimum, crop groupings. The QBL would not have approved labels such as those listed above. Indeed, heads could roll for less.



If any *AENews* readers wish to nominate candidate labels for Non-Anoms in the categories of Glaring Error, Most All-Encompassing Usage Site, Most Confusing Language, or Least Descriptive Description, or if you care to suggest other categories, please contact HRH Jane M. Thomas, Queen Bee of Labels, at **jmthomas@tricity.wsu.edu** or (509) 372-7493. Be aware that all awards are given by royal decree and nothing in this process should be construed as democratic.

When it amuses her, HRH Jane M. Thomas presides over the Pesticide Notification Network at WSU.

But Seriously, Folks...
EPA Weighs in with Label Accountability Project

Having used these pages to lampoon certain errors, omissions, and general mysteries found on pesticide labels (see "If I Were the Queen of Labels," May 2000 *AENews* No. 169, and "QBL II," pages 9–10 of this issue), *AENews* editors thought it appropriate to inform readers that the U.S. Environmental Protection Agency (EPA) is, indeed, aware that not all pesticide labels are crystal clear. In fact, they have undertaken a number of efforts to improve label clarity, including the Consumer Labeling Initiative. With respect to commercial labels and the types of errors highlighted in *AENews,* they initiated a "Label Accountability Project" about a year ago.

The Label Accountability Project, according to EPA Registration Support Branch Chief Richard ("Rick") Keigwin, was established as a communication channel between state departments of agriculture and the EPA when states find confusing information (or lack of information) on a product label. The process of label review at the state level is another opportunity to uncover issues that might prove confusing to the end user.

"We routinely hear about labels EPA has approved that someone finds problematic," admits Keigwin. Wording may be unclear or inconsistent; items may be misleading or missing. EPA can't catch every error; they review over 3000 labels each year, some of which are hundreds of pages long. And, believe it or not, even EPA reviewers make mistakes. "We are human," Keigwin reminded *AENews*. Once a problem is brought to EPA's attention, the agency has the ability to require a registrant to correct the label language and immediately issue a new label.

Through the Label Accountability Project, state personnel are encouraged to contact designated EPA Project Managers assigned to particular product categories: insecticides, herbicides, fungicides, and so forth.

Is the Label Accountability Project just for use by state officials? Well, yes and no. It was started for that purpose, and state-federal communication is still its primary function. "Of course," says Keigwin, "that doesn't preclude private citizens from bringing issues to EPA's attention. As always, we encourage input from growers and other users." It is probably a good idea to go through your state department of agriculture, however, to keep all affected parties in the loop, providing that your state's department of agriculture is responsive to such concerns.

Project Management and Branch Chief contacts are listed below. The Registration Division Director is James Jones, and the Associate Director is Peter Caulkins; they can be reached at (703) 305-5447. Rick Keigwin is at (703) 305-7618. Additional contacts can be found on the Internet at **http://www.epa.gov/opprd001/contacts_rd.htm**. The Label Accountability Project is designed to clarify confusing or misleading label language, not to address individual problems with product application issues.

Category	Specific Role or Products	Name	Phone
Insecticides	Chief	Arnold Layne	(703) 305-7448
	Pyrethrins, insect repellents, first generation synthetic pyrethroids, boric acid, insect growth regulators	Marion Johnson	(703) 305-6788
	Chlorinated organic insecticides, drug/pesticide combinations, dichlorvos, endosulfan, diazinon, endosulfan, fenthion, second generation pyrethroids	George LaRocca	(703) 305-6100
Insecticide-Rodenticides	Chief	Tina Levine	(703) 305-5404
	Most organophosphates and carbamates, diflubenzuron, vertebrate repellents	Rita Kumar	(703) 308-8291
Fungicides	Chief	Luis Suguiyama	(703) 305-6027
	Fungicides and nematicides	Mary Waller	(703) 308-9354
	Fungicides and plant growth regulators	Cynthia Giles-Parker	(703) 305-7740
Herbicides	Chief	Don Stubbs	(703) 305-6287
	Phenoxys and aquatics	Joanne Miller	(703) 305-6224
	Desiccants and defoliants	Jim Tompkins	(703) 305-5697

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Food Safety Conference Teems with Information

Sally O'Neal Coates, Editor of Research Publications, WSU

The eighth Food Safety: Farm to Table Conference was held May 16 and 17, 2000, in Moscow, Idaho. Sponsored by the cooperative extension services of Washington State University (WSU) and University of Idaho (UI), the conference brings together representatives of academia, industry, and government for an annual look at current issues in food safety.

Dr. Alan McCurdy, WSU Chair of Food Science and Human Nutrition, opened the conference and introduced Dr. Larry Branen, UI Dean of Agriculture. Dr. Branen put this year's conference in context by highlighting some trends in food safety concerns over the past few decades. Additives such as BHA and BHT were foremost among consumer worries in the 1970s, he reminded us, while genetically modified (GM) crops are making headlines today. In between, we've seen various foodborne pathogens and pesticide residues take the limelight. Recalling every trendy bogeyman from Alar to *E. coli*, I couldn't help thinking of the late comedienne Gilda Radner's oft-repeated refrain, "It's always *something*."

But food safety is serious business, from the science behind it through the regulations governing it. It's a complex business as well, as the coming two days were to remind us.

FoodNet: Active Tracking of Foodborne Illness

Dr. Kammy R. Johnson, with the Centers for Disease Control and Prevention (CDC), gave the first presentation, explaining CDC's Foodborne Diseases Active Surveillance Network (FoodNet). FoodNet is a surveillance system designed to pick up many of the "lost" or "hidden" cases of foodborne illness missed by traditional reporting.

Traditional reporting, Dr. Johnson explained, can be represented by a pyramid. At the wide base, a relatively vast number of exposures to foodborne pathogens occur in the population. Moving up the pyramid, some exposures result in symptoms identified as illness, while still fewer lead to the subject seeking treatment. The numbers taper further to a very small percentage of cases in which a specific pathogen is identified and reported. The difference between incidents and reported incidents is great; CDC estimates thirty-eight cases of pathogen-related gastrointestinal malaise for every reported case.

FoodNet is an active surveillance system whereby data is collected from physicians and a segment of the general population on dietary habits, food handling procedures, diarrheal history, and history of seeking medical care for possible foodborne pathogen exposure. FoodNet surveys some twenty-eight million people, or eleven percent of the U.S. population, in nine states. Information can be found on-line at **http://www.cdc.gov/ncidod/dbmd/foodnet/**.

Dr. Johnson also briefly explained PulseNet, a network of seventeen labs with standardized methods for subtyping foodborne pathogens. This network facilitates rapid transmission and comparison of the DNA fingerprints of various agents, enabling quicker diagnosis and remediation of problem situations.

Shigella Case History

Janice Boase of Seattle and King County Public Health took the theoretical to the practical and detailed a recent case history of a *Shigella sonnei* outbreak.

Shigella is a bacterial infection resulting in symptoms of diarrhea, fever, nausea, and sometimes vomiting and toxemia. It has four known serogroups, of which *S. sonnei* is one. Incubation takes from twelve to ninety-six hours, and it is transmitted via fecal-oral pathways, including in fresh food and water. Shigella transmission in commercially prepared food is very rare.

Boase took us through The Case of the Baby Shower Bean Dip, a January 2000 incident in which a commercially prepared, layered dip was the culprit in a multi-state outbreak of Shigella that included a rash of Puget Sound cases. Her enlightening, non-technical presentation detailed the process from the first telephone reports through the late nights of data collec-

...continued on next page

Food Safety Conference, cont.

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tion through the informal and formal product recall. A discussion ensued regarding regulatory responsibilities and the difficulty in enforcing the essentially voluntary process of recall. Dr. Johnson annotated the presentation with the national CDC perspective on the same case.

Listeria*: HACCP Is Not Enough*

Next on the agenda, Senior Scientist Michael Jantschke of the National Food Processors Association focused on Listeria control from an industry perspective. *Listeria monocytogenes* (*Listeria*) is a gram-positive, rod-shaped bacterium with high tolerance to salt, refrigeration, and drying. Outbreaks in luncheon meat products made this pathogen headline news at the time of the 1999 conference. Media and regulatory attention has continued over the past year. In a May 6, 2000, address, President Clinton charged federal regulatory agencies with reducing *Listeria* infection by half over the next five years.

Current USDA and FDA policy is zero tolerance for Listeria in ready-to-eat foods, which is very difficult to maintain from a processor's perspective. Hazard Analysis and Critical Control Point (HACCP) may not provide sufficient control because of high recontamination potential (*Listeria* is highly ubiquitous in the environment). Critical components of good control include monitoring input from suppliers, separation of raw from semi-processed and processed items, control of handler and equipment movement, and minimizing physical niches in the processing environment where bacteria can grow and multiply.

While overall incidence of listeriosis is lower than that of many other illnesses associated with foodborne pathogens, serious side effects and mortality occur in a relatively large percentage of cases. Foods that have been implicated in listeriosis include cole slaw, cheese, paté, milk (especially raw), and hot dogs.

Antimicrobial Resistance: Think Global

Dr. Dale Hancock, a member of the conference committee and WSU's veterinary faculty, gave an abbreviated overview of the concerns about antimicrobial use in food producing animals. Perceived risks fall under three categories: residues, flora effects that increase exposure risks, and resistance development. Dr. Hancock's presentation focused on resistance.

A rancorous discussion has been brewing over the degree to which antimicrobial use in livestock causes and/or enhances the dissemination of multi-resistant clones. While most experts would agree that overuse of antimicrobials in livestock is not helpful, several lines of evidence suggest that global dissemination of multi-resistant clones would occur anyway.

Results from a WSU study recently published in *Emerging Infectious Diseases* (Nov.-Dec., 1999, Vol. 5, No. 6) on human/bovine *Salmonella typhimurium* indicate that a highly resistant clone appeared simultaneously in several places worldwide where no intercontinental livestock transfer had taken place. (See article at **http://www.cdc.gov/ncidod/eid/vol5no6/contents.htm**.) The group responsible for this research, including Dr. Hancock, feels that efforts to limit use of antimicrobials in livestock are probably worthwhile and should be continued, but that wide dissemination of resistant clones can be prevented only through direct infection control efforts such as quarantine periods, testing programs, requirements that purchases come from clean herds, and efforts to reduce the level of contamination of feeds.

The Trouble with Produce

Lest the vegetarians in the crowd begin feeling safe and sanctimonious, the afternoon session turned toward produce. Dr. Larry Beauchat, professor with the University of Georgia's Center for Food Safety and Quality Enhancement, gave an overview of pathogens associated with fresh fruits, vegetables, and sprouts.

Produce is open to contamination at a number of stages from field to table, from a wide range of sources. Generally, the greater deterioration or compromise to the fruit or vegetable, the higher the potential for pathogen growth. In the case of sprouts,

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Food Safety Conference, cont.

Sally O'Neal Coates, Editor of Research Publications, WSU

decontamination of seed is key to preventing the growth and spread of pathogens.

Bacterial, parasitic, and viral pathogens including *Salmonella, Vibrio, Bacillus cereus, E. coli, Cryptosporidium, Cyclospora cayatenensis*, Hepatitis A, and Norwalk/Norwalk-like virus have all been implicated in or isolated on produce, sprouts, or juice.

The study of pathogenic processes in produce is still in its infancy. No standard exists for measuring or reporting pathogens on produce. Should measurements be expressed with respect to surface area? To weight? The diversity of physical and chemical structures among produce makes generalizations difficult.

Some would argue that pathogens on produce are not, statistically speaking, a significant health issue at this time. But trends could increase incidence of exposure: diets are changing to include more fresh fruits and vegetables, food and human transport has increased, and at-risk groups including the elderly and immune-compromised are expanding.

'Taint Necessarily E. coli

Pinch-hitting ably for co-author Dr. Scott Minnich, conference co-chair Dr. Carolyn Bohach (Department of Microbiology, Molecular Biology, and Biochemistry at UI) presented a research update on Salmonella and *E. coli* on fresh sprouts. Her historic overview of these pathogens confirmed the previous presenter's assertion that the problem typically starts with contaminated seed.

Dr. Bohach explained the stages of commercial sprout production (soaking, rinsing/incubating, sprouting, and packaging) and outlined the methodology (originally developed for detection of coliforms in water, meat, or feces) she and Dr. Minnich used in their research on Washington and Idaho sprouts over the last year. When a high coliform count was detected in both dry and sprouted seed, the subject manufacturer was found to be soaking seed in 0.01% bleach solution instead of the recommended 10% solution. In addition, the researchers analyzed lots of peas that were supposedly contaminated with *E. coli* 0157:H7. When the presumptive *E. coli* 0157:H7 were fully identified, the researchers found a gram-positive bacteria that was not *E. coli* 0157:H7 and, in fact, no fecal coliforms were found in the samples tested. This result highlighted the conclusion that standard coliform tests are likely not appropriate for vegetables.

Echoing Dr. Beuchat's sentiments, Dr. Bohach said that testing for pathogens such as *Salmonella* and *E. coli* on produce is still a young science. The methods used for testing meat may not be appropriate for produce. Her efforts over the past year have added to the knowledge base; for one thing, they showed that coliform counts from sprouts and peas do not necessarily indicate the presence of fecal *E. coli.*

GMPs for Your Veggies

Dr. Nancy Nagle, President of California consulting firm Nagle Resources, wrapped up the first afternoon with a discussion of produce safety and good agricul-

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How Clean is Too Clean?

A recurring point of discussion with respect to produce was "how clean is too clean?" If measures are implemented so that produce doesn't spoil at its natural rate, scary things can happen. Scientists understand that invisible and potentially harmful bacteria can multiply with time, but consumers may rely on appearance. It might be better for that head of broccoli to turn brown or that bag of cabbage to get slimy so that consumers have a visual clue not to eat it.

Food Safety Conference, cont.

Sally O'Neal Coates, Editor of Research Publications, WSU

tural practices, emphasizing safety in the field. She presented a historic overview of foodborne pathogens in the United States, and stressed the importance of preventing contamination rather than remediating it. Critical factors identified by Dr. Nagle included: reducing animal contamination (by ensuring separation of feedlots/pastures from crop areas); keeping good cropping and pesticide application records; safeguarding (irrigation and processing) water quality; using manure and compost properly; teaching worker sanitation and providing appropriate toilet and handwashing facilities; maintaining vehicles and field equipment in a manner that reduces cross-contamination potential.

End of Day One, End of Part One

This year's conference was so full of information, the editors of AENews decided to break this round-up into two parts. Watch for the highlights of Day Two—including managing manure and compost, regulations and organics updates, and genetically modified crop issues—in next month's *AENews*.

For further information on the 2000 Food Safety: Farm to Table Conference, contact Conference Co-Chair Carolyn Bohach at **cbohach@uidaho.edu** or (208) 885-5906; committee member Val Hillers at **hillersv@wsu.edu** or (509) 335-2970; or *AENews* Editor Sally O'Neal Coates.

A Further Note on Mites and Abamectin Resistence

Dr. David G. James, Entomologist, with Tanya S. Price, Research Technician, WSU

In last month's article on abamectin resistance ("Abamectin Resistance in Spider Mites on Hops," *AENews* No. 170), we documented resistance levels of up to 100-fold in some Yakima Valley hop yard strains. We concluded that growers using the recommended application rate of 16 fluid ounces per acre would get effective mite control, but we advised against using abamectin more than once a season.

All this is still true. However, due to some difficulties by a certain Australian entomologist in this team in converting imperial to metric (remember, even NASA has problems with this…) we previously overestimated the concentration of abamectin applied in a typical yard by a factor of 10. Applying 16 ounces of abamectin in 200 gallons per acre results in a concentration of around 10, not 100 parts per million (ppm). Abamectin-resistant mites studied currently require 5 to 10 ppm for 100% kill. Clearly, we are sailing extremely close to the wind regarding the margin necessary for complete control. Any inefficiencies in spray application or coverage will very likely result in poor mite control. It is now easier to understand how instances of control failure with abamectin occurred in the bad mite season of 1997.

So, our message remains the same but the necessity to heed it becomes critical. Abamectin should only be used **once** a season. It should only be used when mite populations warrant it. It should be used at the correct, full rate (16 ounces per acre), and thorough spray coverage is essential. We reiterate our invitation to hop growers who experience mite control problems with abamectin to contact us at WSU-Prosser, so we can examine the resistance status of their mites.

*Dr. David James is an Entomologist of Australian extraction. He can be reached at the Washington State University Irrigated Agriculture Research and Extension Center (IAREC) in Prosser at **djames@tricity.wsu.edu** or (509) 786-9280. Also at IAREC, Agricultural Research Technician Tanya Price's e-mail is **tprice@tricity.wsu.edu**.*

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Pheromones Researched for Red Currant Pest Control

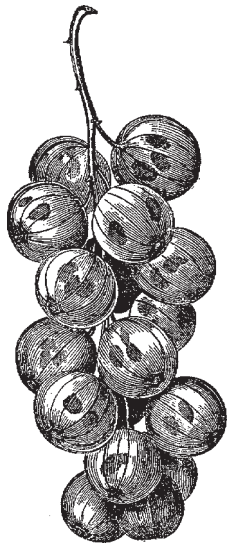
Softer Strategy May Replace Insecticides

Dr. David G. James, Entomologist, WSU

Small Crop, Big Problem

Red currants are a minor crop in Washington. Production centers on two growers in the Prosser area. These growers have a significant pest control problem with the currant borer (CB) and currant stem girdler (CSG). Failure to control these insects results in progressive dieback to cane bushes and reduced yields caused by their cane-tunneling larvae. Ethyl parathion was used effectively against CB and CSG for many years but its use was cancelled on currants in 1991. Fenpropathrin (Danitol), a synthetic pyrethroid, has been used under a Section 18 permit since 1997.

CBs are clearwing moths and CSGs are sawflies. Control sprays are applied to these pests when adults are seen flying in currant fields during May and June. However, because of a protracted emergence period and difficulties in obtaining good control, two or three applications are usually required over a four-to-six-week period. Multiple applications of these broad-spectrum insecticides kill beneficial predators, often resulting in secondary outbreaks of spider mites. The mites, in turn, sometimes have to be controlled with a miticide after harvest of the currants in July.



CURRANTS

An Idea from Downunder

Currant borers are also pests of currants in Europe, Australia, and New Zealand. Some growers "downunder" have been using pheromone-based mating disruption as an effective alternative to insecticide sprays for CB.

Many apple growers in the Pacific Northwest are familiar with the technique of mating disruption. Around twenty-five percent of Washington apple growers now use this technique for codling moth control. They saturate the atmosphere of their orchards with the moth's pheromones, which confuses and disorients the male moths so that they cannot find mates, leaving the females to die without producing offspring. The same system works for CB in New Zealand and Australian currant fields.

The female sex pheromone of CB was identified in 1985 (2). Within a few years, mating disruption was shown to be an effective way of controlling the borer in New Zealand blackcurrants (3).

As an Australian entomologist with experience in developing pheromones as management tools for horticultural pests, I was motivated to take up the baton to investigate suitability of this technology to the Washington market, and to ensure its successful implementation.

Which Scent for Washington Borers?

Two pheromone strains are recognized for CB. One strain, a blend of two components, occurs in New Zealand, Europe, and Canada; the other, consisting of a single component, has only been reported in Australia (1). Clearly, it was important to know what strain would be effective on Washington CB before attempting to develop a mating disruption control program.

Earlier this year, we collected dormant canes from Washington currant fields and dissected out overwintering CB larvae. These larvae were placed in warm temperatures and fed on an artificial diet to produce adult moths long before adults appeared in the field. Pupae were sent to Dr. Allard Cossé of the U. S. Department of Agri-

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Pheromones, Red Currants, cont.

Dr. David G. James, Entomologist, WSU

culture (USDA) in Peoria, Illinois. Dr. Cossé, a specialist on moth pheromones, examined newly emerged adults to determine the chemical structure of the female sex pheromone. Using a number of sophisticated analytical techniques, Dr. Cossé was able to confirm that Washington CB produced the two-component pheromone blend characteristic of New Zealand, Canadian, and European moths.

Testing on Washington Currants

At the time of writing, we are preparing to conduct the first Washington CB mating disruption trial, using a four-acre currant field. "Twist-tie" pheromone dispensers will be placed in the field at a density of around 100 per acre. The trial will be evaluated by assessing the mating status of trapped moths and monitoring resultant larval populations and cane damage.

Normally, research on using pheromones to manage insect pests has a lengthy timeline from initiation to grower adoption. Pheromone identification and synthesis and the elucidation of bioactivity can take many years of research. Field evaluation can also take a number of seasons to complete. Once a synthetic pheromone has been demonstrated to be an effective pest management tool, there often remains the hurdle of finding an entity sufficiently motivated to take on commercial production.

With CB, we are very fortunate in not only having a research and adoption template available, but we also have a commercial supplier of the pheromone already in existence. The Japanese company Shin-Etsu manufactures CB pheromone for New Zealand growers and likely would be happy to add a few extra growers to their client base for this product. Thus, if our field trials are successful, Washington currant growers should have a pheromone-based management system available to them within a few years.

What About CSG?

A pheromone-based solution for currant stem girdler (CSG) is also being researched. Dr. Robert Bartelt, also with the USDA's Peoria office, is an expert on sawfly pheromones. He has examined adult currant stem girdlers and believes this species utilizes a pheromone or pheromones to bring the sexes together. Initial field studies also indicate that male CSG can be attracted to sticky traps baited with virgin female CSG. More research is planned.

Insecticide-Free Production?

The prospects are good for currant production in Washington without CB insecticides. I anticipate our local growers will be able to use mating disruption to control CB within a few years. A pheromone solution to the CSG problem may take longer but a long-term goal of currant production without insecticides appears achievable.

Dr. David James is an Assistant Entomologist with Washington State University's Irrigated Agriculture Research and Extension Center (IAREC) in Prosser. He can be reached at ***djames@tricity.wsu.edu*** *or (509) 786-9280.*

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2000 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. The table below shows dates for June and the first week of July only; a full schedule through October is available in the electronic version of *AENews* at **http://www.tricity.wsu.edu/aenews**. Dates and locations are subject to change; use the contact names and telephone numbers provided to confirm. For general questions, or to host an event at your farm, business, or in a central location in your area, contact Northwest Ag Plastics representative Clarke Brown at (509) 965-6809 or David Brown at (509) 469-2550 or **dbrownwash@msn.com**. More information on pesticide waste and container recycling is available on the Internet at **http://pep.wsu.edu/waste/wd.html**.

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	SPONSOR	CONTACT	PHONE
July 3	8p-11p	Harrah	Ag Air	Lenard Beierle	(509) 865-1970
July 10	8a-Noon	Walla Walla	McGregor's	Gary Burt	(509) 529-6787
	1p-3p	Waitsburg	McGregor's	Terry Jacoy	(509) 337-6621
July 12	8a-10a	Prescott	Agri Northwest	Shawn Elder	(509) 547-8870
		Prescott	Broetje's Orchard	Joe Shelton	(509) 749-2217
	11a-2p	Prescott	Flat Top Ranch	Dave Hovde	(509) 547-9682
	3p-5p	Pasco	Air Trac	Gerald Titus	(509) 547-5301
July 13	8a-11a	Eltopia	Wilbur Ellis	Vern Record	(509) 297-4291
	1p-3p	Eltopia	Eastern Wa Spray Serv.	Willis Maxon	(509) 297-4387
July 14	8a-Noon	Connell	B&R Crop Care	Chris Eskildsen	(509) 234-7791
	1p-3p	Pasco	Pfister Crop Care	Steve Pfister	(509) 297-4304
July 17	8a-10a	Oroville	Northwest Wholesale	Herb Teas	(509) 662-2141
	11a-3p	Tonasket	Wilbur Ellis	Brian Hendricks	(509) 682-5315
July 18	8a-10a	Okanogan	Okanogan Air Service	Bill Lockwood	(509) 422-2617
	1p-4p	Brewster	Wilbur Ellis	Brian Hendricks	(509) 682-5315
July 19	8a-Noon	Chelan	Wilbur Ellis	Brian Hendricks	(509) 682-5315
July 20	8a-Noon	Yakima	Wilbur Ellis	Doug Whitner	(509) 248-6171
July 31	8a-11a	Wilbur Airport	Greg's Crop Care	Greg Leyva	(509) 647-2441
	2p-4p	Davenport Airport	Northwest Aviation Inc	Lee Swain	(509) 725-0011
Aug. 1	8a-11a	St John	McGregor's	Rick Bafus	(509) 648-3218
	2p-4p	Mockonema	McGregor's	Dale Deerkop	(509) 635-1591
Aug. 2	8a-11a	Garfield	Cascade Flying Service	Doran Rogers	(509) 635-1212
	1p-4p	Palouse	Dale's Flying Service	Dale Schoeflin	(509) 878-1531
Aug. 3	8a-10a	Pullman	McGregor's	Larry Schlenker	(509) 332-2551
	1p-3p	Dusty	Dusty Farm Co-Op Inc.	John Stoner	(509) 397-3111
Aug. 4	8a-11a	Clarkston	Valley Helo Service	James D. Pope	(509) 758-1900
	1p-3p	Pomeroy	McGregor's	Mark Welter	(509) 843-1468
Aug. 8	8a-11a	Dayton	McGregor's	Doug Wendt	(509) 382-4704
	1p-4p	Waitsburg	McGregor's	Terry Jacoy	(509) 337-6621
Aug. 9	8a-11a	Eltopia	Wilbur Ellis	Vern Record	(509) 297-4304
	1p-3p	Pasco	Pfister Crop Care	Steve Pfister	(509) 297-4304
	4p-5p	Pasco, Kahlotus Rd.	Air Trac	Gerald Titus	(509) 547-5301

"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."

Commercial Applications of Moth Pheromone

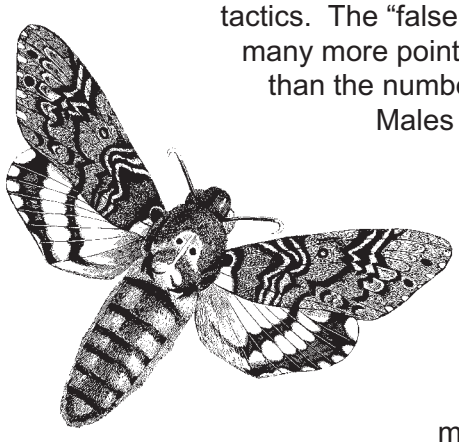
Page 19
Agrichemical & Environmental News
July 2000
No. 171

Dr. Douglas B. Walsh, Entomologist, WSU

Consumer concern about pesticide residues has increased regulatory pressure and promoted the use of softer chemicals. Sex pheromone attractants have become a very useful tool in the management of moth pests. In recent issues of *AENews*, I have addressed the chemical and biological aspects of moth pheromones (3, 4); this article briefly explains the commercial applications of these pheromones.

Mimicking Nature

Using knowledge of insect biology, researchers have designed lures and traps that faithfully copy the ratio of chemical components and emission rate of receptive females. Several companies have developed efficient and inexpensive pheromone traps that uniformly dissipate pheromones over time and optimize capture efficiency for various target species.



Tracking and Trapping

The initial and still most important commercial application of moth sex pheromones is the monitoring of mating flights of male moths. Insecticide mode of action is dependent upon the life stage of the target pest. Knowing when male moths have reached the mating flight stage provides a biofix—or biological reference point—for the other stages in that particular moth species' life.

Insects are ecothermic (e.g., cold blooded); their bodies must absorb heat from the environment to physiologically mature and reproduce. Measuring the amount of heat accumulated over time allows pest management specialists to predict, using *phenology* (relationship of biology to climate) models, when subsequent life stages may occur in insect species.

Physiological time—the amount of heat needed by an organism to develop—is often expressed in "degree days." For instance, if a moth species has a developmental threshold of 54° F, and the temperature remains at 55°F (or 1° above the lower developmental threshold) for twenty-four hours, one degree day is accumulated. Degree-day monitoring can help predict when a pest may reach a life stage susceptible to control methods.

Monitoring also provides a sense of population size. If monitoring demonstrates that pest insect populations could potentially reach damaging densities, controls can be implemented.

Disruption and Confusion

Another commercial application of moth pheromones is mating disruption (MD). MD can involve several tactics. The "false trail" technique involves placing many more point sources of pheromone per acre than the number of calling females in the vicinity. Males follow the deceptive pheromone plumes (3) and use their carbohydrate reserves in fruitless pursuit of the artificial pheromone sources. False trail strategy has evolved to be used in conjunction with insecticides in some cases. For example, in the mid-1970s, pink bollworm males were observed in the field trying to mate with hollow-fiber pheromone lures (1). Cotton producers readily embraced the concept that a dead male is even better than a weary one. Since then, commercial pink bollworm pheromone products have been applied in a sticky substance containing small amounts of a contact insecticide.

A second tactic in pheromone control of moth populations involves male confusion. This occurs when ambient pheromone concentrations smother the plumes or calling females. When the male's central nervous system is inundated with signals from his antenna receptor sites, he becomes habituated and can no longer hone in on prospective mates (4).

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Commercial Applications of Moth Pheromones, cont.

Dr. Douglas B. Walsh, Entomologist, WSU

MD success depends upon area-wide adoption of pheromone programs (2). Many such programs have been adopted in Washington, Oregon, and California, reducing broad-spectrum insecticide inputs in some areas.

Promising Outlook

Pheromones and other behavior-modifying chemicals offer non-insecticidal alternatives that are compatible with today's social climate and emphasis on integrated pest management. Pheromone lures are now commercially available for virtually all economically important lepidopteran species. Attempts are ongoing to develop and implement programs for a variety of caterpillar pests within orchard tree fruit systems.

Dr. Douglas B. Walsh is an Agrichemical and Environmental Education Specialist with WSU's Food and Environmental Quality Laboratory. His office is at the Irrigated Agricultural Research and Extension Center (IAREC) in Prosser, and he can be reached at ***dwalsh@tricity.wsu.edu*** *or (509) 786-2226.*

REFERENCES

1. Brooks, T. W., and R. L. Kitterman. 1977. Gossyplure H. F. Pink bollworm *(Pectinophora gossypiella)* population suppression with male sex attractant pheromone released from hollow fibers: 1976 experiments (cotton pests). Proc Beltwide Cotton Prod Mech Conf. 79-82.

2. Walsh, D. B. 1999. Codling moth: Serious pest provides IPM model. Agrichemical & Environmental News (July) 159:16-18.

3. Walsh, D. B. 2000. The chemistry of moth pheromones. Agrichemical & Environmental News (April) 168:12-13.

4. Walsh, D. B. 2000. The biology of moth pheromones. Agrichemical & Environmental News (June) 170:14-15.

FURTHER READING

See also Dr. David James' article on pheromone use against currant borer and currant stem girdler in Washington currants, page 16 of this issue.

PNN Update

Jane M. Thomas, Pesticide Notification Network Coordinator

The Pesticide Notification Network (PNN) is operated by WSU's Pesticide Information Center for the Washington State Commission on Pesticide Registration. The system is designed to distribute pesticide registration and label change information to groups representing Washington's pesticide users.

PNN notifications are available on our web page. To review those sent out in May, either access the PNN page via the Pesticide Information Center On-Line (PICOL) Main Page, **http://picol.cahe.wsu.edu/,** or directly, at **http://www.tricity.wsu.edu/~mantone/pl-newpnn.html**.

We hope that this new electronic format will be useful. Please let us know what you think by submitting comments to Jane Thomas at (509) 372-7493 or **jmthomas@tricity.wsu.edu**.

Federal Register Excerpts

Compiled by Jane M. Thomas, Pesticide Notification Network Coordinator

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

In the May 10 Federal Register, EPA announced that it was seeking comments on the draft Pesticide Registration (PR) Notice regarding insect repellents labeling restrictions for use on infants and children as well as restrictions on food fragrances and food colors. Comments on this PR Notice are due to EPA by July 10. (Page 30113)

In the May 10 Federal Register, EPA announced that it was seeking public comment on a draft PR Notice titled "Draft Guidance for Pesticide Registrants on Voluntary Pesticide Resistance Management Labeling Based on Mode/Target Site of Action." Comments on this PR Notice are dure to EPA by July 10. (Page 30115)

In the May 11 Federal Register, EPA announced that the preliminary human health risk assessments and related documents for malathion were available for review and comment Electronically, these documents are available on the web at the following URL: **http://www.epa.gov/pesticides/op/malathion.htm**. Comments are due to EPA on or before July 10, 2000. (Page 30407)

In the May 17 Federal Register, EPA announced that it has issued Pesticide Registration (PR) Notice 2000-5 "Guidance for Mandatory and Advisory Labeling Statements." This PR notice provides guidance to the registrant for improving the clarity of labeling statements in order to avoid confusing directions and precautions and to prevent the misuse of pesticides. This document is available electronically at the following URL: **http://www.epa.gov/opppmsd1/PR_Notices/pr2000-5.htm**. (Page 31313)

In the May 19 Federal Register, EPA announced that the preliminary human health and ecological risk assessments and related documents for diazinon are available for review and comment. These documents are available electronically at the following URL: **http://www.epa.gov/pesticides/op/diazinon.htm**. Comments on these documents are due to EPA on or before July 18, 2000. (Page 31902)

In the May 24 Federal Register, EPA announced the issuance of PR Notice 2000-6 "Minimum Risk Pesticides Exempted under FIFRA Section 25(b); Clarification of Issues." This PR notice is intended to clarify several aspects of the exemption for minimum risk pesticides--see FIFRA section 25(b)-- including composition, labeling, food tolerances, and state regulation. An electronic copy of this PR notice can be accessed from the following URL: **http://www.epa.gov/pesticides/**. (Page 33542)

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Tolerance Information

Chemical (type)	Federal Register	Tolerance (ppm)	Commodity (raw)	Time-Limited		
				Yes/No	New/Extension	Expiration Date
pyridate (herbicide)	03-May-00 Page 25647	0.03	collards	No	N/A	N/A
		0.20	peppermint tops			
		0.20	spearmint tops			
		0.03	brassica, head and stem subgroup			
prohexadione calcium (plant growth regulator)	03-May-00 Page 25655	3.00	pome fruit group	No	N/A	N/A
		0.10	kidney of cattle, goat, hog, horse, and sheep			
		0.05	meat byproducts of cattle, goat, hog, horse, and sheep			
fludioxonil (fungicide)	03-May-00 Page 25652	5.00	apricot	Yes	Extension	31-Dec-01
		5.00	nectarine			
		5.00	peach			
		5.00	plum			
exemptions for the use of fludioxonil to control brown rot, gray mold rot, and rhizopus rot on						
cromazine (insecticide)	04-May-00 Page 25857	2.00	onion, green	No	N/A	N/A
		0.10	onion, dry bulb			
		0.80	potato			
		0.50	sweet corn			
		0.50	sweet corn, forage			
		0.50	sweet corn, stover			
		0.50	radish, root and tops			
		1.00	lima beans			
		0.05	milk			
		0.05	meat, fat, and mbp of cattle, goat, hog, horse, and sheep			
azoxystrobin (fungicide)	04-May-00 Page 25860	0.02	tree nuts	No	N/A	N/A
rule first establishing these tolerances was issued.						
myclobutanil (fungicide)	10-May-00 Page 29963	0.20	asparagus	No	N/A	N/A
		2.00	caneberry subgroup			
		3.00	currant			
		3.00	peppermint and spearmint tops			
		1.00	succulent snap bean			
		0.50	strawberry			
		0.30	tomato			
		0.50	tomato puree			
		1.00	tomato paste			
		1.30	apple wet pomace			
		0.20	cucurbit vegetable group			
		2.00	gooseberry			
		0.03	indirect or inadvertent residues on many crops - see comment			
rotational crop groups: root and tuber vegetables group; leaves of root and tuber vegetables group; leafy vegetables (except						
mancozeb (fungicide)	24-May-00 Page 33469	2.00	ginseng	No	Extension	31-Dec-01
Comment: With this action, EPA is re-establishing a time limited tolerance for mancozeb on ginseng.						
tebufenozide (insecticide)	24-May-00 Page 33472	0.10	tree nut crop group	No	N/A	N/A