UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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OFFICE OF
PREVENTION, PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Qualitative impact assessment of extensions to restricted entry intervals for phosmet in apples (DP # 296575)

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Product Review Panel: April 7, 2006

Summary

EPA is considering mitigation strategies to address concerns for workers exposed to phosmet following applications to apple orchards. This is a preliminary, qualitative assessment of the impact of extending the restricted entry interval (REI).

The current REI for apples is 3 days for those protected by the Worker Protection Standards (WPS) and 14 days for those individuals not protected by the WPS. A REI greater than 7 days would interfere with irrigation, mowing, limb propping and hand harvesting activities and a REI greater than 14 days would interfere with fire blight removal activities. If a REI longer than 3 days is imposed, growers would have to replace phosmet with one or more of several available alternatives. BEAD tentatively concludes that no yield or quality losses are likely if growers switch to alternative insecticides. Production costs would likely increase by 2.5% because alternatives are more costly and would have to be applied more often.

Background

Based on post-application worker risk assessments, EPA is considering mitigation strategies, including extending the restricted entry interval (REI) for phosmet use on apples. The current REI for apples is 3 days for those protected by the Worker Protection Standards (WPS) and 14 days for those individuals not protected by the WPS (e.g., pick your own operations). The risk assessment for apples indicates that an REI of 13 days would be necessary to reduce risks to workers below the Agency's level of concern at the use rate of 1.5lb AI/A. At the use rate of 4 lb AI/A, west of the Rockies, the REI necessary to reduce worker risks to that below the Agency's level of concern would be 28 days. The current preharvest interval for apples is 7 days as a stand alone spray and 8 days when tank mixed with methomyl. For operations not covered by WPS, such as pick your own, the PHI is effectively 14 days due to the extended REI. The purpose of this assessment is to provide a preliminary, qualitative assessment of the impact of increasing the REI to 13 and 28 days on apple producers and the apple industry.

Apple Production

The most recent available statistics indicate that about 394,800 acres of apples are grown in the U.S. (USDA NASS, 2005). Washington State is the largest producer and accounts for 40% of the acreage in production followed by New York (12%), Michigan (11%), California (7%) and Pennsylvania (5%). Apples are grown in other states (West Virginia, Ohio, Maryland, etc. but bearing acreage in these states combined does not exceed 5% of the total U.S. acreage. Acreage is evenly divided between the eastern and western regions of the U.S. Washington State supplies between 65-75% of the U.S. fresh apple market. Acreage has been declining since the late 1990's, but average yields have increased from about 11 tons per acre on average to almost 13 tons per acre on average for the U.S. Production has been fairly stable, at about 10.4 billion pounds annually with a total value of about $1.629 billion. Producer prices are around $354 per ton on average for both fresh and processed apples nationally.

Recent Use of Phosmet

Phosmet is applied to about 28% of the U.S. apple acreage (USDA/NASS, 2004). BEAD proprietary data indicate that phosmet use on apples increased between 1997 and 2004 from over 18% to about 28% of the crop treated. Use has remained at about 28% for the past several years. There is typically a single application per year, but there may be as many as three depending upon the application rate and pest pressure. Approximately 48% of the eastern apple crop is treated with phosmet while approximately 15% of the western apple crop is treated with phosmet.

Table 1. Apple Production, Value, and Phosmet Usage*

States (greater than 7000 acres)	Acres in Production	Total Production (million pounds)	Production as a Percentage of Total US Production	Total Value of Production (1,000 dollars)	Phosmet Usage 2003** (Percent of Crop Treated)
California	28,000	390	3.7%	57,185	28%
Michigan	43,500	760	7.3%	90,480	69%
New York	45,000	1,280	12.3%	193,560	42%
North Carolina	7,000	155	1.5%	17,420	54%
Ohio	7,500	90	< 1%	24,831	
Oregon	7,000	163	1.6%	26,057	26%
Pennsylvania	22,000	405	3.9%	40,353	37%
Washington	155,000	6,050	58.1%	962,458	12%
US Total	**394,800**	**10,419.9**		**1,629,071**	**28%**

*Sources: USDA/ NASS 2005, Noncitrus Fruits and Nuts 2004 Summary.
**USDA/NASS 2004, Agricultural Chemical Use 2003 Fruit Summary

Maximum Feasible REIs

The 2001 BEAD assessment concluded that extension of REI's to levels that keep workers from entering fields for extended periods of time could impact a grower's ability to maintain labor crews throughout the growing season (Anderson and Keily, 2001). It also could severely limit the amount of time a labor crew has to complete necessary orchard activities such as hand thinning, tree training, limb propping, summer pruning for fire blight, and hand harvesting. This could impact growers by forcing them to not achieve the desired results from those activities. If field activities are delayed for too long a period of time because of extended REI's, the impact on the fruit could be quite extensive and the grower may also lose work crews to other growers whom can provide more consistent work. Any extension of the apple REI beyond 7 days could force growers to abandon the use of phosmet on apples and force them to switch to one of the other registered alternative insecticides.

Impacts of Extending the REI beyond the Maximum Feasible Length

Extending the REI beyond the maximum feasible length (7 days) would result in growers turning to one of several available alternatives for control of pests targeted by phosmet. The primary pests targeted for control with phosmet include codling moth, plum curculio, apple maggot, and oriental fruit moth. Other pests that may be controlled with phosmet include leafroller species, tarnished plant bug, and European sawfly.

Alternatives

Alternatives (chemical class) for control of these pests are:

- azinphos-methyl, diazinon, and dimethoate (organophosphate);

- acetamiprid, imidacloprid, thiacloprid (neonicotinoids)
- indoxacarb (oxadiazine)
- carbaryl (carbamate);
- esfenvalerate, fenpropathrin, and lambda-cyhalothrin (synthetic pyrethroids);
- methoxyfenozide, novaluron (where registered), pyriproxyfen, and tebufenozide (insect growth regulators);
- mating disruption (pheromones)
- Kaolin (clay)

BEAD believes that acetamiprid, thiacloprid, novaluron and methoxyfenozide are among the most effective and promising alternatives to phosmet. BEAD believes that growers will substitute two applications of neonicotinoids and two applications of insect growth regulators to provide season long control of the pests which are currently controlled with phosmet. Attachments 1 and 2 provide comparative insecticide efficacy for pests currently targeted for control with phosmet for eastern and western apple production, respectively.

Azinphos-methyl is as effective as phosmet but its long REI's (7-14 days) and preharvest intervals (14-21 days) severely hamper its usefulness as an alternative. Additionally, the apple use of azinphos-methyl is currently undergoing reregistration and its use on apples may be further restricted in the near future. Some of the alternatives, such as pyrethroids, are less compatible with integrated pest management (IPM) and mating disruption programs than is phosmet. Pyrethroids often precipitate secondary pest outbreaks, such as spider mites, and cause growers to resort to the use of miticides, which may cost over $50 per acre.

In addition, extension of the REI for hand-harvesting beyond 7 days may lead to unnecessary prophylactic insecticide applications to ensure crop protection prior to harvest.

In recent years, some broad-spectrum insecticides, such as organophosphates, have been replaced by insecticides with a narrower activity spectrum. The older chemicals not only controlled the target pest(s), but also controlled most other exposed insects. In some cases, a consequence of the shift to newer chemistries is that crop damage from insects that until recently were considered minor pests appears to be increasing. However, concomitantly, the shift to narrower-spectrum chemicals may result in less mortality for beneficial species, including natural enemies, which should in turn increase natural mortality for some insect pests, ultimately leading to less pesticide use. To the extent that these pest dynamics continue to evolve and remain rather difficult to predict, this analysis examines only the potential short-term (2 to 3 years) impacts of replacing phosmet with insecticides with a narrower activity spectrum.

Impacts

Because an REI for phosmet beyond 7 days would interfere with key crop production and pest management practices, growers would likely stop using it altogether and turn to one or more of several available alternatives. Based on the availability of new alternatives, BEAD tentatively concludes that yield or quality losses are unlikely if phosmet could not be used. It is likely that production costs will increase because alternatives are more costly, would have to be applied more often, or would result in applications of additional pesticides to control secondary pests.

BEAD's alternative scenario of substituting two applications of neonicitinoids and two applications of insect growth regulators for the typical three applications of phosmet would result in a cost increase of $60 per acre ($45 for phosmet versus $105 for the alternatives) which is equivalent to a 2.5% increase in production costs (Atwood and Smearman 2005, Table 8).

Request for Additional Information in Stakeholder Comments

As this is a preliminary assessment, BEAD would welcome data that could be used to refine this assessment if necessary. Useful information would include:

- particular regional or pest problems leading to phosmet use;
- comparative product performance data, including yield and quality impacts;
- relative product costs; and
- restrictions or other constraints on the use of alternatives.
- Information on the feasibility of use, comparative efficacy, and/or cost of use of non-chemical alternatives to phosmet.

References

Atwood, DW and S Smearman. 2005. 2005 Grower Impact Assessment of Azinphos-methyl Use in Apples (DP307589). Biological and Economic Analysis Division, Office of Pesticide Programs, U.S. Environmental Protection Agency, 1200 Pennsylvania Ave., NW, Washington, DC 20460-0001

Brunner JF, Beers EH, Dunley JE, Doerr M, Granger K. 2005. Role of neonicotinyl insecticides in Washington apple integrated pest management. Part I. Control of lepidopteran pests. 10pp. Journal of Insect Science, 5:14, Available online: http://www.insectscience.org/5.14/Brunner_et_al_JIS_5_14_2005.pdf

[Contains efficacy data from 33 heavily infested apple orchards in Washington. In these efficacy tests, the grower standard (azinphos-methyl and/or phosmet) provided significantly better control of codling moth than acetamiprid in 20 out of 33 trials. Azinphos-methyl averaged 94% control in these trials compared to 82% control achieved by acetamiprid and 71% control achieved by thiacloprid.]

Anderson, N and T Kiely, 2001. Biological and Economic Analysis of AZM and Phosmet on Apples.   Biological and Economic Analysis Division, Office of Pesticide Programs, Environmental Protection Agency 20460. www.epa.gov/oppsrrd1/op/azinphos/bead_Pears1.pdf

Crop Data Management System. 2006. ChemSearch Database.

Doerr, M., J. Brunner, E. Beers, J. Dunley, and V. Jones. 2004. Building a multi-tactic pheromone based pest management system in western orchards. Unpublished Progress Report. Tree Fruit Research and Extension Center, Wenatchee, WA

[Contains efficacy data from 15 operational apple orchards using mating disruption in Washington. In these efficacy tests, the grower standard (azinphos-methyl and/or phosmet) provided levels codling moth control equivalent to those seen in methoxyfenozide and other selective/non-organophosphate insecticides.]

USDA/NASS, 2004. Agricultural Chemical 2003 Fruit Summary. http://usda.mannlib.cornell.edu/reports/nassr/other/pcu-bb/agcf0804.pdf

USDA/NASS. 2005. Noncitrus Fruits and Nuts 2004 Summary. NASS/USDA http://usda.mannlib.cornell.edu/reports/nassr/fruit/pnf-bb/ncit0106.pdf .

Attachment 1. Comparative Efficacy of Phosmet Alternatives for Eastern Apple Production

	Available Alternatives and Efficacy Rating[1]							
	From 2003 Pest Management Strategic Plan for Mid Atlantic Apples and New England Apples				**From Efficacy Data Submitted by Bayer**			
Insecticide	Codling Moth	Oriental Fruit Moth	Plum Curculio	Apple Maggot	Codling Moth	Oriental Fruit Moth	Plum Curculio	Apple Maggot
Azinphos methyl	E	G-E	E	G-E	G-E	G-E	E	F-G
Phosmet	E	G-E	G	G-E				
Thiacloprid	F-G	G			F-G[2]	F-G[2]	F-G[2]	F-G
Imidacloprid					F-G	F-G	F-G	P
Acetamiprid	G	G	G		G[1]	G[1]	G[1]	G
Thiamethoxam	P	P	G		F	F	G	
Indoxocarb	G	G	G	F-G	F-G[2,3]	F-G[2,3]	E	
Spinosad	F	F	F	F-G	P-F	P-F	P-F	
Tebufenozide	F	F	F		P-F	P-F	P-F	
Methoxyfenozide	G	G			G[2]	G[2]	G[2]	
Clothianidin					P-F	P-F	P-F	P
Azadirachtin	F-G	F	F					
Kaolin	P-F	F	F	F-G	F-G	F-G	G	
Esfenavalerate	G-E	G-E	G-E	G-E	P-F	P-F	P-F	
Bti	F	F	F					
Carbaryl	F-G	F-G	F-G	G				
Fenpropathrin	E	E	G	G-E				
Diazinon	G	G	G	G				
Dimethoate	G	G	G	G				
Gamma					F	F	F	
Lambda	E	E	G	G-E				
Pyriproxyfen								
Novaluron					G[2,3]	G[2,3]	G[2,3]	

[1]Efficacy ratings: E=Excellent, G=Good, F=Fair, P=Poor/None, X=no data
[2] Higher Rates perform better
[3] Timing of application critical to control

Attachment 2. Comparative Efficacy of Phosmet Alternatives for Western Apple Production

Insecticide	**Available Alternatives and Efficacy Rating**[1]		
	Codling Moth (WSU 2005 Crop Protection Guide)	Codling Moth (Bayer Submission)	Apple Maggot (OSU PNW Insect Management Handbook)
Abamectin	X		
Acetamiprid	E	P-G	
Azadirachtin	X		
Azinphos methyl	E	G-E	R
Bacillus thuringiensis	P		
Carbaryl	F		
Diazinon	F		
Dimethoate	F		
Endosulfan	P		
Gamma-cyhalothrin	X		
Mineral oil	G		
Imidacloprid	X		
Indoxacarb	F-P		
Kaolin[2]	F	F	
Lambda-cyhalothrin	E		
Methomyl	X		
Methoxyfenozide	G		
Oxamyl	X		
Pheromone	P-E		
Phosmet	G-E		R
Pyriproxyfen	G		
Spinosad	F-G	P-F	
Tebufenozide	F-G	F	
Thiacloprid	E	F-G	
Novaluron		F-G	

[1] Efficacy ratings: E=Excellent, G=Good, F=Fair, P=Poor/None, X=no data, R=Recommended, no efficacy data suppled

[2] Must be applied as often as needed to maintain coverage.