10-18-1987

RODENTICIDE USE IN AGRICULTURAL CROPS

Terrell P. Salmon
Animal Damage, University of California, Davis, California

RODENTICIDE USE IN AGRICULTURAL CROPS

Terrell P. Salmon[1]

ABSTRACT

The in-crop use of pesticides is allowed only after establishment of a crop tolerance with supporting residue data for the crop. Residue data from different regions and pesticide application methods (hand treatment, aerial broadcast, etc.) are required. Most rodenticide uses have been considered as non-crop since they are generally applied in and around rodent burrows and runways. Because of this, rodenticides do not generally have tolerances or residue information for crop use.

Recent inquiries by the Environmental Protection Agency (EPA), a review of current rodenticide labels, and new pesticide laws, suggest the need for re-evaluating the question of in-crop use of rodenticides. This paper reviews the current situation regarding tolerances, crop residue research and some possible approaches to solve this important problem. This information has national significance since EPA is the responsible agency for setting food crop tolerances in the United States.

BACKGROUND

The Federal, Food, Drug and Cosmetic Act (FFDCA) requires that pesticide use in raw agricultural products is allowed only after a clearance for that crop is established. A clearance can take several forms including a crop tolerance with supporting residue data, an exemption, or a GRAS (Generally Recognized As Safe) determination. Rodenticide uses have generally been considered as non-crop since they are usually applied in and around rodent burrows and runways and not directly on the crop. Because of this, most rodenticides do not have crop residue information, nor have tolerances been established by EPA.

Recent inquiries by EPA, a review of current rodenticide labels used in California, and new Federal and State pesticide laws and regulations, suggest we need to re-evaluate the question of in-crop use of rodenticides. Individuals as well as regulatory agencies are questioning the interpretation that rodenticide use is not considered crop use, even when used within the crop boundaries. For example, EPA has recently stated that compound 1080 grain bait on rangeland for ground squirrel control is a crop use, the crop being range vegetation.

The issue of rodenticide use in crops is national in scope. However, I am using examples from California to illustrate the problems associated with in-crop use of these materials.

CURRENT RODENTICIDE USE IN CALIFORNIA

Most rodenticides used for field rodent/rabbit control in California are produced and distributed by the County Agricultural Commissioner's office. According to the California Department of Food and Agriculture (CDFA), 1,552,806 lbs of rodenticide bait were used or distributed by the Agricultural Commissioners in 1985 (CDFA Report 3A, 1986). Significant amounts of rodenticides were used for each major rodent/rabbit pest in California (Table 1). While CDFA Report 3-A does not contain crop use data, this is sometimes collected through other reporting systems.

1/Extension Wildlife Specialist, Animal Damage, University of California, Davis, California 95616

Table 1. Rodent bait used, sold, or given away by California Agricultural Commission in 1985. GRAIN BAIT MATERIAL (in pounds)

	1080	ZnP	Strychnine	Anticoagulant
Squirrels	378968.3	43572.0	12056.5	838192.0
Gophers	3197.0	22.0	142839.1	6333.0
Voles	8515.0	34175.0	---	2287.0
Rabbits	---	---	1457.5	7722.0
Rats	---	15951.5	---	67695.0
TOTAL	390680.3	93720.5	156353.1	912052.0

Table 2. Crop vs. non-crop treatment with rodenticides in Tulare County, County, 1981.

	Crop Acres Treated	Non-crop* Acres Treated	Total Acres Treated	% Use Non-crop
1080	65,735	537	66,272	0.8
Anticoagulants	50,241	5,849	56,090	10.4
Zinc Phosphide	42,508	33,336	75,844	44.0
Strychnine	5,558	8,879	14,437	61.5
	164,042	48,601	212,643	22.9

*miscellaneous treatments interpreted as non-crop

Such data from Tulare County, CA, indicated in-crop rodenticide use was significant in 1981 (Table 2) with 77.1% of the rodenticide applied to crop areas (Salmon in press). Some of this use may actually be non-crop since materials reported as used in crops may have been applied to the perimeter of those crops. Nevertheless, these data indicate significant rodenticide use in close association with crops. While statewide data on rodenticide use in crops in California are not available, the Tulare County situation suggests the majority of field rodenticides used are applied in crops.

CROPS TREATED WITH RODENTICIDES

Rodenticide use is important to agriculture. About 10% of all crops in Tulare and Yolo Counties, Ca., were treated with rodenticides in 1981 (Salmon in press). Table 3 lists the percent of crop acreage in Tulare County treated with rodenticides in 1981. While the quantities of rodenticide used for some treatments were quite small, the total impact of these treatments can be extremely large. For example, the production value of kiwis is very high and treatment with rodenticides to protect them is much more valuable (economically) than treatment to protect a similar area of rangelands. Since most commercial crops grown in California are susceptible to rodent damage (Clark 1986), they all need clearances under FFDCA. Many will need tolerances for the various rodenticides and application methods, including residue data to support the use of the material in the crop.

ESTABLISHED TOLERANCES FOR RODENTICIDES

Tolerances are set by EPA and published in the Federal Register. The tolerance is the permissible quantity of pesticide allowed in the product at time of sale. There are few crop tolerances established for rodenticides. Table 4 lists the established tolerances (1-16-87) including their appropriate Federal

Table 3. Crop acreage treated with rodenticides in Tulare Co., 1981.

Crop	% of Crop Acreage Treated
Alfalfa	6.6
Wheat	2.8
Almonds	23.3
Cotton	2.0
Barley	3.3
Pasture	13.1
Olives	35.1
Avocados	63.5
Misc. Veg.	5.6
Pistachios	32.2
Misc. Fruit	69.9
Plums	13.3
Prunes	32.5
Oranges (Citrus)	15.6
Pomegranates	16.5
Peaches	3.3
Lemons	2.0
Kiwis	61.5
Grapes	2.5
Nectarines	0.3
Sugar Beets	0.9
Beans	4.6
Corn	13.8
Persimmons	10.3
Walnuts	15.9
Grain	26.0

regulatory authority. Aluminum phosphide is the only rodenticide with tolerances for all crops. Zinc phosphide has tolerances for range, grapes and sugar cane. No other rodenticide tolerances have been established.

CURRENT CALIFORNIA RODENTICIDE LABEL INFORMATION

Information on crop use from CDFA's rodenticide labels indicates that, with the exception of strychnine, the materials are restricted to non-crop use. The degree of restriction depends on the interpretation of the terms "exposure", "hazard", and "contaminate". The two common label restrictions are "Use only in rodent infested areas where exposure to agricultural crops as commodities will not occur," and "Do not use in rangeland, pasture or cropland."

ALUMINUM PHOSPHIDE

Aluminum phosphide tolerances have been established for pre-harvest rodent burrow fumigation in crops. Prior to establishment of these tolerances, post harvest treatment tolerances for most crops were already established. Crop residue data for burrow fumigation were provided to EPA on almonds, hay, peanuts and possibly other crop by the manufacturer. Since little or no phosphine residue was found in these crop samples, EPA apparently applied the post harvest tolerance to pre-harvest treatments. They also allowed use in all crops despite the lack of residue data for all crops. The data submitted apparently satisfied EPA that phosphine was not likely to enter the crop in levels exceeding the established tolerances.

ZINC PHOSPHIDE

Tolerances on range and grapes are established; however, California labels do not allow use in these crops. In-crop residue tests with 2% ZnP have been conducted by the University of California for alfalfa, sugar beets, tomatoes, artichokes (in progress), table beets, lima and snap beans, peas, and spinach. Work has also been done on alfalfa (Tickes 1985) and range vegetation (Okuno et al. 1975). None of these studies have found significant quantities of zinc phosphide in the crop. Residue data from different regions and pesticide application methods (hand treatment, aerial broadcast, etc.) are required by EPA. Because of this, EPA needs additional residue data before an alfalfa tolerance can be established on a national basis.

COMPOUND 1080

Table 4. Currently established tolerances (1/26/87).

Chemical	Tolerance PPM	Crop/Commodity	Authority
Aluminum Phosphide	0.01	All crops--pre-harvest treatment of rodent burrows	40 CFR 180.225
Zinc Phosphide	0.1	Range	40 CFR 180.284
	0.01	Grapes	
	0.01	Sugarcane	

No tolerance has been established for Compound 1080 nor has crop residue data been obtained. The proposed California labels clearly state 1080 is for non-crop use only. This will drastically change the use pattern of this material since most is used on range sites.

STRYCHNINE

No tolerances have been established for strychnine. Residue tests have been conducted for apples and alfalfa through the USDA-IR-4 program (Smith 1982). Translocation studies suggest this chemical is not likely translocated in alfalfa or other crops (Miller et al. 1983; Smith 1982). Because strychnine is the most common pocket gopher bait, much of the use is in-crop since that is where the gophers are living.

ANTICOAGULANTS

No crop tolerances for anticoagulants have been established. Residue data for first generation anticoagulants are not available. Some residue work has been done on newer products in wheat, apples, and alfalfa (Askham 1986). In this work, no uptake of anticoagulant by plants was detected. Unfortunately, according to the USDA-IR-4 program, the lack of basic data on the older anticoagulants is severe and their continued registration is in doubt. This led the USDA-IR-4 program to not pursue petitioning for tolerances for these rodenticides, despite a request from California.

SUMMARY OF POTENTIAL ACTIONS

If the in-crop (including range) use of rodenticides is to continue, we need to form a united position and work with EPA, state pesticide regulatory authorities and rodenticide manufacturing to resolve the tolerance/residue problem. The following are actions that, if pursued, may lead to improved rodenticide use.

1. Work to define terms "exposure," "hazard," and "contaminate" as they relate to rodenticide use in-crops. Also, define "in-crop."
2. Argue that below-ground, dormant season and no crop contact uses of strychnine (and other rodenticides) do not need a tolerance. This would likely need to be based on translocation studies.
3. Pursue the establishment of tolerances for zinc phosphide for all crops based on aluminum phosphide tolerances.
4. Demonstrate that zinc phosphide residue work to date shows no problem so allow use on all crops without further residue work once tolerances in #3 are established.
5. Develop a plan of action to develop anticoagulant residue data and the information needed to continue their registration. Translocation studies are likely the key to the residue issue.
6. Develop better understanding of rodents and their control to improve control programs. This should lead to less pesticide use and

possibly greater emphasis on control adjacent to, instead of in, the crop.

We need to recognize the problems of in-crop use of rodenticides and work diligently to solve them.

LITERATURE CITED

ASKHAM, L.R. 1986. Anticoagulant translocation and plant residue studies in crops. Vert. Pest Conf. 12:133-139.

CDFA REPORT 3A. 1986. Division of Plant Industry. Calif. Dept. of Food and Agric., Sacramento, CA.

CLARK, J.P. 1986. Vertebrate Pest Control Handbook. State of Calif., Dept. of Food and Agric., Sacramento, CA. pp.273.

OKUNO, I., R.A. WILSON, and R.E. WHITE. 1975. Determination of zinc phosphide in range vegetation by gas chromatography. Bull. Environ. Contam. Toxicol., 13:392-396.

MILLER, G.C., W.W. MILLER, L. HANKS, and J. WARNER. 1983. Soil absorption and alfalfa uptake of strychnine. J. Environ. Qual. 12(4):526-529.

SALMON, T.P. In Press. Evaluating Rodenticide Use Impacts of Agricultural Production. In: Vertebrate Pest Control Methods and Materials. W. Jackson, Ed.

SMITH, H.G. 1982. Strychnine residue studies and their implications in rodent control. Vert. Pest Conf. 10:214-218.

TICKES, B.R. 1985. Zinc phosphide in subterranean burrow systems. Bull. Environ. Contam. Toxicol., 34:557-559.