PROJECT REPORT

Project Title: Determining the source of Primary and Secondary Rodenticide Exposures – Agricultural Field Baits vs. Commensal Application

Research Agency: USDA National Wildlife Research Center (NWRC)

Principal Investigator: John Johnston

Budget: $435,673.00

Background:

Rodents pose significant public health risks, and are major ecological and agricultural pests. Rodents vector diseases such as hanta virus, plague, tularemia and rat bite fever (CDC, 2006; Merck 2006). Rodents, especially rats, contribute to the extinction of native flora and flora in numerous locals (Atkinson, 1977). Burrowing rodents cause structural damage to earthen dams and irrigation ditches (Hegdal and Harbour,1991). Finally, rodents cause significant damage to a variety of crops and rangeland grasses for livestock grazing (Primus et al., 2000).
The control of rodent pests (rats, mice, ground squirrels) in both urban and rural environments relies primarily on the use of rodenticides (Johnston et al, 2005). For example, in California, application of 0.01% and 0.005% diphacinone steam rolled oat baits are essential for control of ground squirrel induced damage to crops and rangeland grasses. Unfortunately, non-target scavenging wildlife such as raptors, mountain lions and coyotes can be exposed to the rodenticides by feeding on the carcasses of poisoned pest rodent species (Fig 1.) (Littrel, 1988; EPA, 2007). Regardless of the benefits of rodenticide use, non-target secondary hazards represent the greatest hurdle to the expanded use and even the continued availability of anticoagulant rodenticides in the United States. Purported incidents of anticoagulant poisoned raptors are reported in newspapers, the scientific literature and EPA adverse incidents database (6(a)(2)). These incidents effect EPA regulations regarding the continued availability of anticoagulant rodenticides.

Description and Extent of the Problem:
Anticoagulant rodenticide poisoning in wildlife is typically confirmed via analytical chemistry analyses of liver tissues and determination of prolonged blood clotting times (Howald et al., 1999; Fudge, 2000; Stone et al., 2003). However, these analyses do not permit identification of the source of the rodenticide or the magnitude of rodenticide exposure . Though non-target wildlife are sometimes poisoned by anti-coagulant rodenticides, there is no ability to differentiate

between agricultural and residential uses as the source of exposure. Unfortunately, this lack of ability to differentiate between the source of non-target poisoning may result in restrictions on all anticoagulant rodenticide uses when only a subset of the applications are resulting in the majority of non-target exposures.
Additionally, the inability to estimate the magnitude of exposure often results in the assumption that rodenticide exposure caused mortality in all cases where detectable rodenticide residues are present. This practice invariable overestimates non-target anticoagulant rodenticide induced mortality.

Previous Control Techniques or Outreach Efforts Related to this Proposal:

Previous research addressing potential secondary hazards of rodenticide baits has focused on reducing the potential for secondary hazards (baiting strategies, bait adjuvants) or determining the magnitude of secondary hazards and risks. There has been no research aimed at developing techniques to differentiate between secondary hazards associated with commensal versus commercial bait application.

Current Control Techniques or Outreach Efforts Related to this Proposal:

Anticoagulant baits produced in California contain dyes which permit applicators to readily differentiate between baits intended for commensal verses commercial (agricultural, industrial) uses. Commensal baits contain water soluble dyes which are readily excreted after ingestion. Anticoagulant baits prepared by California counties are intended for commercial uses and contain the oil based dye Oil Blue O.. These dyes are readily stored in the fat following ingestion. Animals which consume the California County manufactured baits typically contain visible dye markings in their fat (Fig. 2).

Need for Research or Outreach:
There is a need to develop approaches to permit identification of the source of rodenticide baits which lead to non-target secondary poisonings. There is also a need to develop a method to permit the distinction between lethal and sub-lethal non-target exposure. Ideally, these approaches would not require any reformulation of current bait as such reformulations could trigger additional registration requirements.

Objectives:

1. Develop analytical methods to quantify oil dye (Oil Blue O) in animal tissues and oat baits.

2. Determine dye dose versus dye residue relationship in mammal (rat) and bird (corvid) species.

3. Determine diphacinone dose vs. residue relationship in mammal (rat) and bird (corvid) species.

4. Plot log ([dye]/[diphacinone]) vs post exposure time as a means to estimate target and/or non-target exposure to California county produced diphacinone bait.

5. Validate the exposure estimation technique developed in objective 4 in canid species for secondary exposure scenario.

Progress To Date:

This project was cancelled by the Principal Investigator.

Last Updated:

01/22/2011