Final Project Report

Title of the Project:

Strategic baiting protocols for rodents in sugarcane

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Sugar Research and Development Corporation

Executive Summary

This research was undertaken to investigate the perceived problem of secondary poisoning risk to avian predators associated with the use of rodenticides in the Australian sugar industry. Although a minor component of the rodent integrated pest management strategy and used at relatively low levels, there is widespread public concern that their use can significantly impact raptor populations. At present, only anecdotal evidence of secondary poisoning events occurring in raptor populations are available and these relate to the use of Klerat® (active constituent: brodifacoum), a now de-registered rodenticide.

Currently, two rodenticides are available for use in sugarcane crop, the acute toxicant Rattoff® (active constituent: 2.5 % zinc phosphide) and the first generation anticoagulant rodenticide Racumin® (active constituent: 0.037 % coumatetralyl). While laboratory trials indicate that raptors have a high toxic threshold to these rodenticides, trials conducted under laboratory conditions cannot reflect the complex processes which lead to secondary poisoning events that occur in the field.

Given this, the objective of this project is to provide an ecologically-based field assessment of the risks that the use of rodenticides pose to avian predators in Australian sugarcane producing areas.

The specific objectives of the study were to:

- 1. Determine how avian predators and rodent prey use the changing habitat provided by sugarcane crops.
- 2. Determine the availability of poisoned rodents to avian predators and quantify the amount of toxicant available for ingestion.
- 3. Develop a stochastic model to enable the industry to assess future secondary poisoning risks under differing application quantities/spatial patterns of rodenticide application.

Results demonstrate that

 Rodents are closely associated with crops which provide high canopy levels and therefore high levels of protection from avian predators. In contrast, raptors over-utilise open canopy crops which have low rodent densities but offer high levels of prey accessibility. These results suggest that predatory interactions between avian predators and their prey take place exclusively in open canopy crops and associated open habitats and therefore these areas should be the primary focus of secondary poisoning risk assessment studies.

- 2. Although poisoned rodents were trapped in high accessibility, open canopy adjacent habitats, their numbers were low, as was the quantity of toxicant recovered from them. Based on the low probability of encounter and the low quantity of toxicant they contain, results suggest that the risk of secondary poisoning to raptors is minimal when rodenticides are applied following industry protocols.
- 3. Computer simulations confirm that in all but extreme and therefore unlikely cases of bait application or when low bodyweight predators (such as juveniles) consume high quantities of poisoned rodents, secondary poisoning is an unlikely event when rodenticides are applied in-crop following industry protocols.

Collectively, these studies demonstrate that secondary poisoning of avian predators associated with the use of the currently available rodenticides in Australian sugar producing districts is minimal. Further, the ecologically-based method of assessing secondary poisoning risk developed in this study has broader applications in other agricultural systems where rodenticide use may pose risk to avian predators.

Background

Rodent damage to sugarcane has been of concern to the Australian sugar industry since the 1930's. In more recent times, namely the 1980's, annual surveys have indicated that damage occurred in more than 50% of sugar producing areas resulting in annual losses of between two and four million dollars. Control was based on direct mortality via baiting and a further \$0.6m was expended on annual baiting programs. In the late 1980's, a research project funded by the industry demonstrated that control via baiting was not cost-effective and an alternative management strategy was developed based on managing habitats that give rise to high productivity in rodents. This project also provided a methodology to determine the damage potential to specific crops based on site-specific attributes that contribute to the damage process. The management strategy consisted of three components:

1. Manipulating refuge habitats (harbourage) at critical stages in the life cycle of the rodents to prevent crop colonisation.

- 2. Removal of weeds from the crop prior to the breeding season to delay and reduce the extent of breeding, and
- 3. Baiting areas of specific damage potential based on the expected level of overall damage in any given year.

The strategy was implemented in 1992 with the prognosis that (*inter alia*):

- Changes in agricultural practice, more attention to crop cleanliness and the modification of non-crop areas to make them less suitable as refuges will have a major beneficial effect on crop damage. There will however, always be a need for an effective bait to cope with emergency situations or to be used in situations where the cultural modifications suggested in the management strategy are not practical.
- If the full suite of cultural modifications are implemented, in most years, baiting will not be necessary. Only in exceptionally rare circumstances would widespread, strategic baiting be necessary.

Due to widespread and intensive extension activities, the strategy has had a high adoption rate. Since 1992, the prognosis has proved correct, with damage being below the economic injury level and no baiting required except for isolated "hot spots" in paddocks that have been treated by individual growers.

The success of the management strategy, coupled with concerns for the potential secondary poisoning hazard associated with baiting resulted in there being little research on the development of strategic baiting protocols to be used in emergency situations. Unfortunately, such an emergency situation occurred during the current season where, due to widespread unfavourable weather patterns, the cultural aspects of the strategy could not be implemented and the quality of standover cane was extremely high. This situation resulted in extremely high losses due to rodent damage with no strategic baiting protocol or suitable bait material available to reduce these losses. Consequently, there is currently great concern within the industry that baiting protocols are unavailable and must be developed for future emergency situations.

Currently there is strong public perception that any form of strategic baiting will result in an unacceptable level of (predominantly avian) secondary poisoning and, in the absence of independent data, the industry will find it difficult to implement strategic baiting in future emergency situations. For strategic baiting to be used by the industry, it must be demonstrated that it is cost-effective and that protocols are developed that minimise any secondary poisoning hazard. These requirements are not only needed for registration purposes but also to demonstrate good governance by the industry. The aim of the current project was to provide an ecologically-based assessment of avian predator secondary poisoning risk and to investigate if buffer zones (bait exclusion zones) reduced this risk.

Objectives

The key objective of this project was to provide data aimed at satisfying industry and public concerns regarding the use of strategic baiting in emergency situations and to develop baiting strategies that minimise secondary hazards to avian predators.

This objective was met by determining that after in-crop rodenticide application, only a small proportion of rodents caught in open canopy areas had consumed poison and the level of toxicant in these rodents was low regardless of whether three metre, six metre or no bait buffer zones were incorporated into the industry baiting protocol. Thus the study demonstrates clearly that secondary poisoning risk to avian predators is low if baits are applied using current industry protocols.

Methodology

Refer to the thesis which accompanies this report.

Outputs

The novel techniques developed in this project contribute significantly to our understanding of factors that give rise to secondary poisoning in Australian sugarcane producing districts. The report concludes that when used correctly, both baits currently available for in-crop use should pose little risk to avian predators. Further, this finding can be readily adaptable to other broad-scale agricultural systems (for example, in the grain growing industry) which share similar cropping patterns and potentially similar predator/prey interactions. Therefore, this project has contributed significantly to not only the Australian sugar industry but will have applications to similar cropping systems worldwide. The development of a stochastic computer model which enables bait application scenarios and the associated risk this poses to avian predators to be modelled also contributes significantly to the Australian sugarcane industry. The model uses inputs readily available in all sugar producing districts (for example area under sugarcane, amount of bait sold in the district) and enables users to assess and manage risk over both the short and long terms.

Intellectual property

There are no commercial considerations or discoveries made which need protection. The information provided in this report forms the basis of a thesis (attached) that will be published in the scientific literature as research papers.

Environmental and Social Impacts

The environmental impacts from this project are positive. Results demonstrate that when used in accordance with industry rodent integrated pest management strategies and industry baiting protocols, potential for secondary poisoning risk is limited for avian predators.

No social impacts are envisaged.

Expected outcomes

This project provides the first quantitative study of avian secondary poisoning risk posed by the use of rodenticides in the Australian sugarcane industry. Results demonstrate that there is limited risk of secondary poisoning occurring when industry baiting protocols are adhered to. The results should dispel industry and public concern that secondary poisoning associated with the use of Rattoff® and Racumin® is a major potential problem in Australian sugar producing regions.

Additional outcomes from this project include an increase in our ecological knowledge about how predators and their prey interact in heterogenous environments, a better understanding of the influence that canopy cover has in determining crop use by rodents and a clearer view of how the quantity of bait application and the spatial distribution of bait within the district affects secondary poisoning risk.

Future Research Needs

When this project was initiated, industry baiting protocols confined rodenticide application to only closed canopy crops. The results presented in this report therefore identify the risk of secondary poisoning to avian predators associated with baiting these mature crops.

Currently, there is there is some evidence that the industry is relaxing baiting protocols, enabling rodenticides to be applied in open canopy crops when visual signs of rodent activity suggest damage to early crop growth stages. Due to demonstrated association in this thesis between high avian predator foraging levels in open canopy areas, this decision may dramatically increase the potential interaction between avian predators and poisoned rodents.

While an assessment of the risk associated with this decision is required, the logic of bait application as a means of cost-effective crop protection at this early stage also needs to be assessed, particularly given the extremely high use of trash-blanketing in the industry and the comparatively low level of rodent damage associated with this cropping technique.

Whisson (1996) demonstrated that although rodents established low level populations in trash-blanketed crops after harvest, population levels remained low through the early growth period (December to March) and further, that stomach contents of rodents trapped in trash-blanketed crops where predominately comprised of non-cane vegetation. This suggests that in this early growth phase, sugarcane crops provide poor habitat and hence a poor food source for rodents. Further, breeding intensity was low in trash-blanketed areas, evident in the low percentage of female pregnancies compared to conventional, non trash-blanketed crops, during this early growth stage. As the growing season progressed, population levels and so resulting damage increased only when dispersing juveniles entered these crops from adjacent weedy areas late in the growing season (May).

Given low population densities, a predominance of non-cane vegetation in stomachs of trapped animals and low fecundity in trash-blanketed areas and in the absence of any information relating perceived damage levels in early growth stages to economic losses at harvest, it appears control at this early stage is unwarranted. Therefore, future research should focus on the following three questions:

- 1. Do visual signs of rodent damage in recently emerged trash-blanketed ration crops translate into economic loss at harvest?
- 2. If economic losses are significant at harvest, can rodenticides be cost-effective in minimising damage and therefore economic loss? and
- 3. Given the strong association between avian predator hunting and open canopy crops, are the secondary poisoning risks associated with baiting these crops acceptable?

Recommendations

The issue of secondary poisoning has been a contentious subject for the Australian sugar industry. The research conducted in this study demonstrates clearly that when used within the rodent IPM and applied to crops according to industry standards, risk to avian predators is minimal. This finding should interest both growers and conservationists and thus should be widely disseminated in sugarcane producing districts.

List of publications

The studies that form the basis of this report will be published in the scientific literature and will contribute to a PhD Thesis. A list of publications will be forwarded once they have been accepted into journals.