Proceedings

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ABSTRACT: Queensland grain producers have highlighted a need for ‘Best Practice’ strategies for reducing mouse damage in their developing grain crops. Traditionally, the reaction to mouse plagues has been to ignore all the signs of an impending outbreak, and then apply vast quantities of rodenticides after the plague has erupted (Brown et al. 2004). This approach is neither cost effective nor environmentally aware. We aim to show how cost-effective, sustainable farm management practices affect residual mice populations and the frequency of plagues on farms. Where growers take a proactive rather than reactive approach to the problem of mice, in-crop damage and associated yield losses are expected to be significantly reduced without the expenses associated with poorly timed baiting campaigns. Eight sites on the Darling Downs are being used to compare the effects of proactive and reactive farm management practices and then develop a set of ‘Best Practice’ strategies that grain growers can use to reduce the impact of mice on their cropping enterprises. Preliminary results indicate that there is a difference in mice numbers between the treated and untreated properties, but it is too early in the project to confirm these results. Very low mouse numbers due to prolonged drought conditions also make the preliminary results inconclusive.

INTRODUCTION

Mice cause annual losses of around $30 million to the Australian grain industry (McLeod 2004). In Queensland, plagues appear to be more frequent than in other parts of Australia, possibly because of a progressive move to conservation tillage practices and often continuous cropping cycles.

Queensland has seen rapid adoption of conservation farming practices over the past 20 years, particularly on the Darling Downs where the bulk of the State’s grain is produced. A large percentage of the arable land is farmed using minimum or zero till methods in strip cropping systems. Given adequate rainfall patterns, most growers operate on a 3 year cropping cycle, however, widespread drought conditions in recent seasons has led to more opportunistic cropping practices with more fallow land than usual. There is a lot of anecdotal evidence reported from growers that the rapid change from conventional to conservation farming practices has led to higher residual mice populations and more frequent plagues in grain producing regions.

These minimum- and zero-till farming practices provide ideal environmental conditions for irregular outbreaks of mice at local and regional levels, through a lack of soil disturbance, stubble retention and intensive cropping. Without the regular soil disturbances caused by ploughing, mouse burrow systems remain undisturbed from season to season and can become very extensive, sustaining populations for years on some properties. Stubble retention, which is an integral part of conservation farming, provides cover from predators, while unharvested and spilt grain left on the soil surface provide sufficient food resources to sustain mice until the next crop in an adjacent strip has become well established.
In mid-2004, a panel of grain growers and scientists from CSIRO, University of Queensland and the departments of Natural Resources & Mines and Primary Industries formulated a list of ‘Best Practice’ farm management strategies aimed at reducing in-crop damage and associated yield losses from mice in Queensland.

These strategies included introducing regular crop monitoring for mice activity, strategic full paddock and perimeter zinc phosphide baiting, habitat manipulation of fencelines and unmown verges by slashing, mowing or herbicide applications, and close monitoring of harvesting operations to minimise grain spillages in the crop. Fencelines and verges adjacent to crops provide alternative habitat for mice in between the most palatable stages of summer and winter crops. At the conclusion of the project, we aim to produce cost-effective, sustainable farm management guidelines that will enable Queensland grain producers to reduce crop and associated yield losses caused by mice.

METHODS

Field sites
The study began in July 2004, and is being conducted on eight grain producing properties on the Darling Downs in south-east Queensland. All properties are within 80km of Dalby and operated solely as grain production enterprises. Minimum or zero till conservation farming methods are practiced on each property.

Trapping and monitoring is being undertaken approximately monthly in sorghum (summer) and wheat or barley (winter) crops and their surrounding habitats.

Experimental design
Eight properties were selected and divided into four paired sites, each pair containing a treated and untreated property. Each property pair is geographically close to minimise any differences in crop development caused by rainfall distribution or vastly different soil types. Management of the untreated properties remains entirely in the hands of the owners, with minimal input from the research team. Managers of the treatment properties carry out mice reduction strategies by habitat manipulation and baiting at the request of the research team. The timing and extent of these strategies is based on the results of ongoing trapping and monitoring on each property.

Around thirty grain growers were surveyed and none were prepared to return to ploughing as a means of managing or reducing mice populations on their properties, thus, this option wasn’t included in the list of possible strategies. Burning stubble to reduce cover met with similar negative reactions, the reason being that it leaves soils susceptible to erosion during heavy rainfall, and was also excluded as a possible management option.

Trapping
Trapping is conducted approximately monthly for two or three consecutive nights throughout the year using 80 snap-back traps per property. The traps are laid at 10m intervals in four lines of 20. Two lines are placed within the crop and two lines in surrounding habitats, such as fencelines, road verges or fallow paddocks. Traps are baited each night with fresh ham.

The traps are picked up early on the morning after setting. All mice caught are weighed, measured, sexed, and general health and condition recorded. All females >70mm head/body length are autopsied for breeding condition (lactation, pregnancy, number and size of embryos, scars from previous pregnancies). All field data is recorded on site. In the six months that data has been recorded, 8767 traps have been set over 15 trap nights.
Yield and damage assessments
Yield potential and mice damage for each crop is assessed in the last couple of weeks before harvest. Information on actual crop yields is gathered from each grower after harvest.

RESULTS
Preliminary statistical analysis indicates that while the continued drought conditions have reduced mice populations to very low levels, there are still many more mice trapped on the untreated properties than on the treated ones as seen in Fig.1. While this result may be attributed in part to habitat manipulation and strategic baiting carried out on the control properties, the research team does not yet have enough data to confirm this. For at least half of the trapping events used to generate the graph in Fig. 1, trap success rates averaged 0% across most of the sites. To show how drought has affected the trap success rates on this project, trapping records from the Central Downs transect indicate trap results ranging between 7% and 38% for the three month period January through March, between 1999 and 2003.

The Central Downs transect is trapped regularly and results used to update a plague prediction model developed for the Darling Downs. Improved seasonal conditions and several more years of regular trapping will give a more accurate outline of the effectiveness of the ‘Best Practice’ strategies being employed to reduce mice damage.

![Trap Success](image)

**Fig. 1.** Trap success rates in 4 treated and 4 untreated sites.

Trapping sites have been divided into 9 broad habitat types, namely young (no head/grain development) summer crop, young winter crop, mature (head/grain development) summer crop, mature winter crop, summer crop stubble, winter crop stubble, fallow, unmown/grassy verge and mown verges. Trap success rates have been so low that there has been no distinction made yet between treated and untreated properties (Fig.2).

The spike in populations trapped in mature winter crops (2004) is explained by high mice numbers in barley on one untreated property and very high numbers on its paired treated property. The treated property was baited with zinc phosphide after trap success rates reached 19% and populations rapidly fell. Mice populations remained high for a couple of months on the untreated site.
Breeding season began later than expected in 2004. The first pregnant females were trapped in November, while in a normal season, we’d expect to be catching breeding females by September or October. As very few pregnant or lactating females have been caught, no attempt has been made to correlate breeding activity with habitat or treatments.

**DISCUSSION**

Drought conditions have prevailed over much of Queensland for the past couple of seasons. A minor plague occurred on the Darling Downs during the spring/summer of 2004. Mice populations subsequently crashed and have remained low since then, with trap success rates ranging from 0 to 27%. In most months since this project began, trap results on most properties have ranged from 0% to 5%, with occasional short-term spikes in population levels. These results make comparisons between treated and untreated properties so early into the project very difficult.

Caughley *et al.* (1998) found that more mice tend to be found in undisturbed grassy verges and along fencelines. So far this study has shown that mature winter crops are preferred over undisturbed or alternative habitats (Fig. 2), however this result may be misleading due to the short duration of the project to date. It is expected that trap success rates in other habitats will change once several years of trapping data is accumulated.

The influence of habitat, treatments and environmental conditions on breeding patterns will be closely examined as more data is gathered during the project.

The consensus among Queensland’s grain growers is that mice are a fact of life and are here to stay. This may well be the case but this project expects to show that there are a variety of cost-effective and environmentally sustainable methods for reducing their impact on crops at both local and regional levels. Improved proactive, rather than reactive management of the problem may go a long way toward reducing the frequency and severity of mice plagues in future years.

*Fig. 2.* Trap success rates by habitat class.
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REFERENCES

