



Australian Government

Cotton Research and
Development Corporation

FINAL REPORT 2008

*If you are participating in the presentations this year, please provide
a written report and a copy of your final report presentation
by 31 October.*

If not, please provide a written report by 30 September.

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: DAQ133

Project Title: Calibration and application of a pupae detection dog

Project Commencement Date: 1 Nov 2004 **Project Completion Date:** 30 June 2008

CRDC Program: Crop Protection

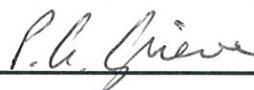
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Part 3 – Final Report Guide (due 31 October 2008)

(The points below are to be used as a guideline when completing your final report.)

Background

When the project commenced in 2004, resistance management in *Helicoverpa armigera* was a high priority issue for both conventional insecticides and transgenic Bt technology (Bollgard II). Over-wintering pupae represent one of the most vulnerable stages in the life cycle of *H. armigera*, and management efforts have been directed at reducing survival of this stage through the use of 'pupae busting', or full surface disturbance by cultivation to a depth of 10 cm. Pupae busting was mandatory for Bollgard II crops, and recommended for conventional (non-Bt transgenic) crops.

Industry compliance with pupae busting compliance is generally considered high. Pupae busting is associated with some disadvantages, including loss of soil moisture through cultivation, the potential lost opportunity to double crop, alterations to soil structure under wet conditions and its adverse impacts on machinery under dry conditions.

Under some circumstances there may be few, or even no over-wintering pupae under cotton crops and growers seriously question the need to pupae bust under these circumstances. One of the problems facing growers is the difficulty of accurately sampling for pupae. At present this can only be done by labour intensive soil sampling operations. There are also several research projects that rely on pupae sampling to quantify effects of different treatments e.g. refuge types, and that in many cases pupae densities are very low. It is difficult to maintain enthusiasm of staff when pupae sampling is relatively unproductive. There is an identified need for improved pupae detection/sampling methods.

Following the highly successful use of detection dogs for locating organochlorine residues, the idea was promoted that dogs could be trained to locate pupae in fields. The Cotton Research and Development Corporation (CDRC) funded a study (DAQ125C) to determine whether a detection dog could be trained to locate pupae. The study successfully demonstrated the potential for a detector dog to locate pupae in the field. This project represented the next step in the study – to imprint, train and calibrate a pupae detection dog against known field densities of pupae, and develop its capacity for field application.

The original project was extended from its completion date of 30 June 2007 to allow further validation attempts due to adverse seasonal conditions 2006/07. The new completion date of 30 June 2008 was agreed through negotiation with the Cotton Research and Development Corporation (CDRC)

Objectives

The project objectives were to:

- Calibrate a pupae detection dog against natural field densities of *Heliothis* pupae; and
- Maintain and manage the pupae detection dog for field applications of pupal detection.

| Objectives | Milestones | Performance Indicators | 4/5 | 5/6 | 6/7 | 7/8 |
|--|--|---|-----|-----|-----|-----|
| 1. To transfer responsibility of pupae detection dog from trainer to handler | Detection dog safely relocated with dog handler in Toowoomba | Detection dog maintained in good condition ready to conduct field-based activities | ✓ | | | |
| 2. To maintain pupae imprint on detection dog | Detection dog maintained with ability to detect pupae | Successful maintenance of detection dog's ability to locate pupae in field situations | ✓ | ✓ | ✓ | ✓ |
| 3. To calibrate pupae detection dog against field densities of pupae | Conducted pupae detection experiments in various crops at a range of pupal densities | Quantification of detection dog capability against traditional pupae sampling method | | | * | * |
| 4. Capacity build to support project continuity through training and validation of second detector dog simultaneously | Successful transfer of learning's from pilot dog to second dog. | Successful validation of second detector dog | | ✓ | ✓ | ✓ |
| 5. To assist researchers in pupae detection activities related to their work | Collaborated with researchers in pupae detection activities | Detection dog supported research teams in pupae detection | | | * | * |

✓ Milestone achieved

* Limited achievement of milestone

Methods

The pilot detection dog (Shakeel) was maintained on *Heliothis* odour from the initial feasibility project. A second candidate dog (Floyd) was imprinted on *Heliothis* odour and trained to locate *Heliothis* pupae in fields with an appropriate search pattern. A 'passive' response indicator behaviour was applied to indicate detection of pupae (drop to ground). The methodology used for the training was positive reward based training, using skills and knowledge of the researcher through previous extensive experience with detector dog training.

The methodology for calibration and validation of the detector dog was to compare the detection ability against traditional hand trowel sampling methods across a range of pupal densities and crop types (cotton, maize, sorghum, etc.).

Results

1. To transfer responsibility of pupae detection dog from trainer to handler

☺ Successfully completed – the pilot detection dog (Shakeel) was transferred from the trainer involved in the initial feasibility trial to the Principal researcher / trainer, Greg Horrocks. Greg has extensive experience in the training and handling of specialist detector dogs, and the transition was smooth and uneventful.

2. To maintain pupae imprint on detection dog/s

☺ Successfully completed – this milestone required the Entomology group within Plant Science, DPI&F Toowoomba to provide at least 100 *H. armigera* pupae each week through the life of the project to support imprinting and maintenance of the detection dogs. This was a significant feature of the success of the project.

3. To calibrate pupae detection dog against field densities of pupae

☹ Limited achievement of milestone – this milestone was not fully completed. It had been recognised early in the project that successful field validation would be significantly impacted by the availability and access to suitable 'pupal loads' as required. Validation was scheduled for 2007-08 after poor seasonal conditions during 2006-07 limited validation attempts.

Unfortunately, suitable populations of pupae did not present themselves again during the season to allow validation to be completed. Despite extensive assessment of candidate populations of pupae, the late season pest activity was relatively low, and suitable sites on which to conduct validation experiments were few and far between.

The dog was fully maintained imprinted to the *Heliothis* odour with the expectation that when the opportunity presented itself with a suitable field population of pupae, the team would mobilise and undertake the required assessments. The dog did work in numerous field situations, however, not at a regular and consistent enough level to allow statistical validation. Where field work was able to be undertaken, the detector dog was able to demonstrate a detection success rate of 80-100%.

The opportunity to undertake the validation was further complicated by the division of labour across a number of projects and priority work areas that affected the availability of key personnel.

4. Capacity build to support project continuity through training and validation of second detector dog simultaneously

☺ Successfully completed – In January 2006, the pilot detector dog's (Shakeel) ability to detect odour was noticed to be reduced. The dog was an aged dog, so this was not unexpected. The contingency plan to fast-track the second detector dog (Floyd) training and field responses was implemented. In March 2006, Shakeel's performance declined sharply, and arrangements were made to have her health and future performance in the team assessed. Shakeel was euthanased (April 27th) for a chronic health condition. Permission to destroy her was obtained from Cotton Research Development Corporation – her legal owners.

5. To assist researchers in pupae detection activities related to their work

☹ Limited achievement of milestone – as for the calibration objective, this milestone was not fully completed largely due to the lack of suitable populations of pupae. As much field work as possible was undertaken in association with the funding party, however, seasonal conditions severely limited opportunity for this to occur. The results of the field work that was possible were very positive, with Floyd detecting pupae at a success rate of 80-100%.

Conclusion

The project team members are disappointed that the pupae detection dog project did not achieve to the planned level of milestone achievement. The most critical non-achieved milestone was the field validation of the detector dog. This highlights the limiting impact seasonal conditions had on the project. The opportunity to access and respond to suitable sites quickly was also impacted by the division of labour demands for the key researchers to the project. This meant it was not always possible for the team members to avail themselves of suitable validation opportunities when they were presented.

Extension Opportunities

One of the consistently demonstrated highlights of the Pupae Detection Dog Team was the excellent public relations profile generated wherever the team appeared, either at formal conference proceedings or farm walks. Although this was not a planned or recognised milestone for the project, the stakeholder interest generated in the dogs was a significant measure of the interest in the project and detector dog technology application in general.

The key published products for the project included two posters (copies attached)

- (a) A 'virtual poster' (PowerPoint show) at the 13th Australian Cotton Conference 2006 - 'Sniffer dog stalks silent enemy'.
- (b) A poster at the World Cotton Research Conference 2008 - 'A detector dog for Helicoverpa pupae'

Part 4 – Final Report Executive Summary

The feasibility of detecting *Heliothis* pupae using a sniffer dog has been successfully demonstrated previously (DAQ125C). This project has taken the feasibility status closer to commercial realisation with consistent and ongoing demonstration of the ability of an appropriately imprinted, maintained and trained detector dog to work under field conditions and detect *Heliothis* pupae.

It is disappointing that the field validation milestone was not fully completed, despite best efforts to secure appropriate sites and pupal loads for consistent and robust assessment of the detection ability of the dog.

Alternate validation options include managed assessment with ‘seeded’ sites used to assess the dog. The confounders of soil disturbance, human odour and other small, but highly significant olfactory triggers would need to be assessed and managed to allow fair and valid assessment to be undertaken.

The use of detector dogs has consistently been demonstrated to be a highly effective screening tool (high sensitivity). It would be unfortunate if the limited achievement of milestones in the project is interpreted as a failure of the detector dog ability and application to support identification of *Heliothis* pupae in field situations to assist resistant management decisions.

One success of the project consistently demonstrated was the excellent public relations profile generated by the dogs. The novelty and innovativeness of the dogs is a valuable PR tool that can be applied to engage producers and stakeholders on any relevant issue, using the dog’s ability and attractiveness as the entry point to engagement. This factor should not be underestimated as a general successful engagement strategy.

13th Australian Cotton Conference

Sniffer Dog Stalks Silent Enemy



Greg Horrocks, Floyd, Allison Crook,
Dave Murray & Richard Lloyd
DPI&F Queensland
Toowoomba



Queensland Government
Department of Primary Industries and Fisheries

What is the Silent Enemy?

- Over-wintering *Helicoverpa armigera* pupae
- Survive winter in soil
- Carry over resistance genes
- Emerge as moths in spring



Pupae Busting has problems!



- Cost of cultivating fields
- Wear and tear on implements
- Soil structural degradation
- Loss of soil moisture and opportunity cropping



Sampling Pupae

- Trowel method
- Time consuming
- Inefficient
- Affected by soil conditions
 - too wet, too dry?
- Low densities hard to sample

