Aug 92 July 93.

ST GEORGE HELIOTHIS MONITORING PROGRAM (DAQ59C)

1993

D.M. McCOLLUM

QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

A final report prepared for the Cotton Research and Development Corporation

SUMMARY

The St George Heliothis Monitoring Project operated very successfully during the 1992/93 season. The appointment of a full-time technical assistant with a vehicle ensured reliable data collection through the entire season.

Egg collection data shows that St George *Helicoverpa armigera* have the highest insecticide resistance frequency in the Australian cotton industry. This applies to the three insecticide groups tested, synthetic pyrethroids, endosulfan and pyrethroid plus piperonyl butoxide (PBO). The results of this program have enabled growers to manage their insecticide use to avoid spray failures and is contributing to investigations of the source of the resistance problem.

In order to source the cause of our high resistance, we first need to know where *H.armigera* originate from during Stage II. Analysis of the spatial distribution of *H.armigera* abundance in egg collections revealed a trend for lower abundance outside of the St George Irrigation Area. This suggests that local conditions within the Irrigation Area (for example, permanent channel systems) are providing a harbour for *H.armigera.* Extra ecology work is required in the area to test this theory.

Light trap and pheromone trap data collected through the season supplemented the egg collection data. Light traps provided reliable estimates of species abundance in the field, but this data is not analysed until after the season. Pheromone trap data has proven inconsistent with egg collection data. All moth trapping will be discontinued in this district due to the high cost and dubious local benefits.

Thrips sampling indicated low numbers in the St George district. This was probably due to high organophosphate use in the area, rather than a regional effect. It would be desirable to pursue this research, however funding restrictions will not enable this in the short term.

The communication of project results to industry has been a major success with this project. These results are effectively used by growers and consultants in making spray decisions. The Bug Bulletin newsletter is sent out by fax-modem, which is a very efficient method of communication. The Balonne Cotton Advisory Committee (BCAC) plays an active role in the implementation of outcomes from this project. BCAC is actively pursuing ways to track the source of the resistance problem in the district.

INTRODUCTION

This project was initiated in 1991, following concern expressed by local cotton growers about suspected high insecticide resistance at St George. The performance of synthetic pyrethroids had been inadequate for a number of years, and was getting worse over time.

The Balonne Resistance Committee, now the Balonne Cotton Advisory Committee (BCAC), was formed by the St George Cottongrowers Association. This committee, comprising growers and agronomists, requested assistance from the Department of Primary Industries (DPI), resulting in the establishment of the St George Heliothis Monitoring Program with CRDC funding.

The project receives enthusiastic support from the local cotton industry. Feedback from growers and agronomists confirms the value of this work to their management and to the long-term future of the industry.

The DPI will continue this project for the next two seasons, provided CRDC continues its funding support.

OBJECTIVES

The objectives of the St George Heliothis Monitoring Program are:

1. To monitor insecticide resistance in the St George cotton growing area.

2. To communicate project results to industry personnel, so that they can make better decisions in insect control.

PROJECT METHODOLOGY

Project activities included:

- Egg collections off cotton crops over a six month period. Eggs were dispatched to Narrabri Agricultural Research Station (NARS) where grubs were reared, speciated and tested for resistance to pyrethroids, endosulfan and pyrethroid plus piperonyl butoxide (PBO).

- Two light traps were monitored twice weekly. Catches were dispatched to NARS for detailed analysis following some preliminary sorting at St George.

- Six pairs of pheromone traps were monitored weekly, the results being collated at St George.

- Crops were sampled for analysis of thrips populations. These samples were dispatched to NARS for detailed analysis of species present and changes in species abundance throughout the season.

- Project results were relayed to growers and consultants through a weekly newsletter, The Bug Bulletin.

- The Balonne Cotton Advisory Committee used project results to formulate short-term and long-term actions to address local industry problems.

RESULTS

Insecticide Selection Pressure

Insecticide selection pressure for 1992/93 is presented in Table 1. Heliothis pressure was down on previous seasons, resulting in less use of endosulfan than usual. However, early season sucking pests were very prevalent and caused an increase in the use of dimethoate. The number of pyrethroids used was similar to the previous season, but the period of use was longer. Long periods of residual control combined with low heliothis pressure during Stage II gave us the best use of pyrethroids in the district for many years. The increased use of chlorfluazuron has relieved some of the pressure on profenofos use, and it is hoped that improved application technology with thiodicarb will allow its use in the district in coming seasons.

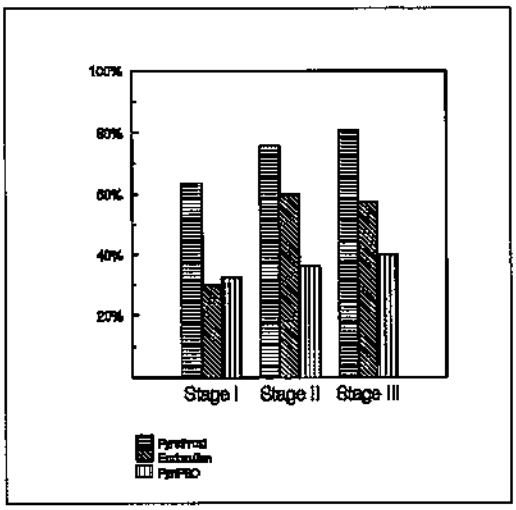


Figure 1 Insecticide resistance frequency of *Helicoverpa armigera*, St George 1992/93

Table 1 Insecticide Selection Pressure - St. George 1992/93

Insecticide	Stage I	Stage II	Stage III	Full Season
Endosulfan	4.7	0.2	-	4.9
Dimethoate	2.3	-	-	2.3
Thiodicarb	-	-	0.2	0.2
Parathion	0.6	0.4	0.5	1.5
Omethoate	0.7	0.1	-	0.8
Methomyl	0.2	0.4	-	0.6
Bacillus thuringiensis	-	0.1	-	0.1
Profenofos	-	1.3	1.1	2.4
Chlorpyrifos	-	0.1	-	0.1
Pyrethroid	-	1.8	-	1.8
Chlorfluazuron	-	0.1	1.2	1.3

Total Cotton Area 8950ha

Insecticide Resistance

Insecticide resistance frequencies for *Helicoverpa armigera* (Hubner) in the St George Irrigation Area are presented in Figure 1. These figures were slightly down on the previous season, possibly as a result of the lower selection pressure during 1992/93.

Figure 2 indicates the comparison of pyrethroid resistance frequency for the different regions being sampled. Similarly, Figures 3 and 4 compare endosulfan and pyrethroid/piperonyl butoxide (PBO) resistance frequencies respectively.

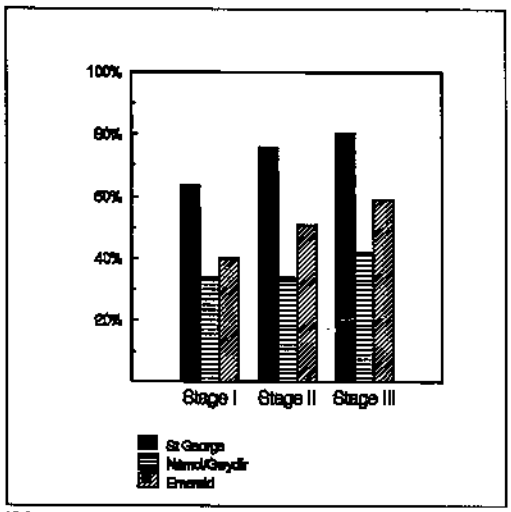


Figure 2 Resistance frequency of Helicoverpa armigera to synthetic pyrethroids, 1992/93

These figures show that St George continues to demonstrate higher resistance to all insecticide groups than the other regions.

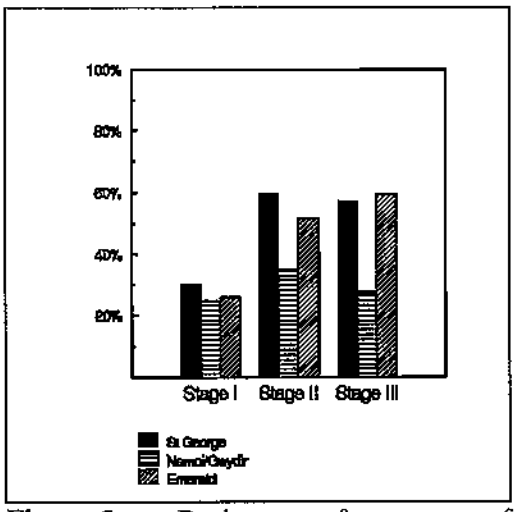


Figure 3 Resistance frequency of *Helicoverpa armigera* to endosulfan, 1992/93

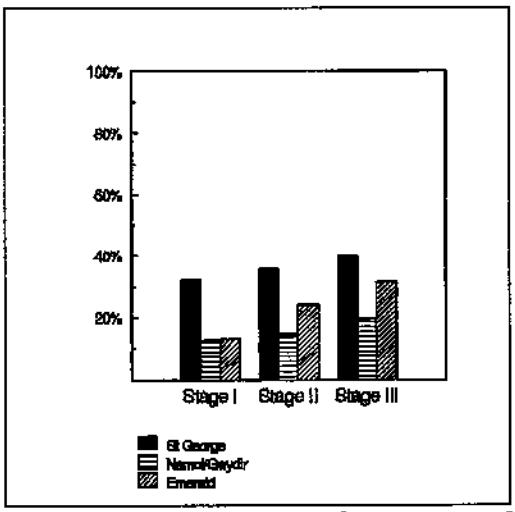


Figure 4 Resistance frequency of *Helicoverpa armigera* to pyrethroid plus PBO, 1992/93

Species Abundance Patterns

Figure 5 shows the seasonal abundance of *H.armigera* in egg collections. This pattern is very similar to the 1991/92 season, except for the fall in abundance in Stage II (Week 4). If this pattern remains consistent over a number of years, it will provide a very useful management tool.

The use of the LepTon kit in future years will allow us to fine-tune this information on an individual paddock basis. Seasonal abundance data, combined with our knowledge of insecticide resistance, has given growers the ability to modify spray decisions when *H.armigera* numbers rise.

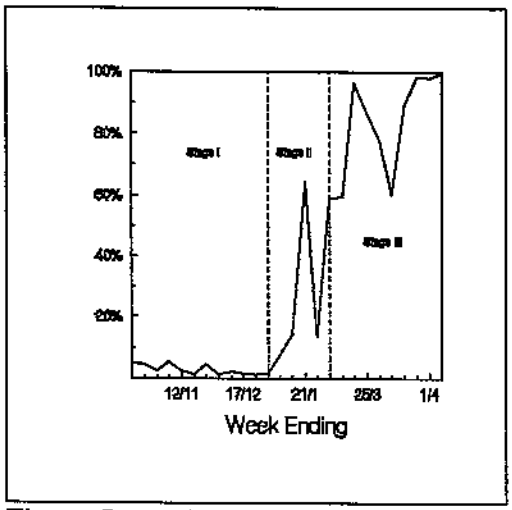


Figure 5 Seasonal abundance of *Helicoverpa armigera* in egg collections, St George 1992/93

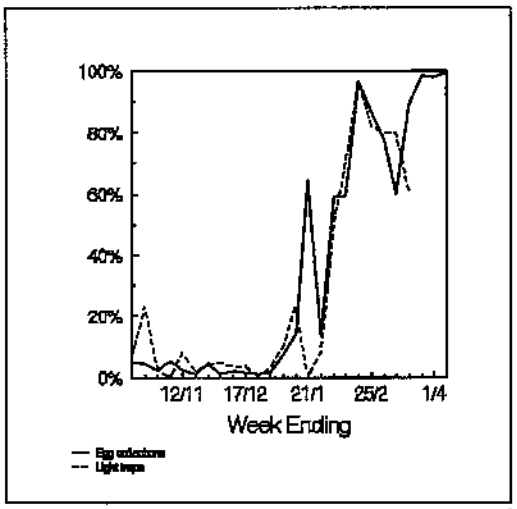


Figure 6 Seasonal abundance of *Helicoverpa armigera* in egg collections and light traps, St George 1992/93

Figure 6 shows that light trap data indicate a similar species abundance pattern to that shown by egg collections. However, light trap data is not processed until the end of the season and is therefore of questionable value to this project. Pheromone trap data are rapidly processed, but their accuracy in predicting species abundance in cotton fields is poor. Figure 7 shows the poor correlation between pheromone trap data and egg collection data.

Spatial trends of *H.armigera* abundance were mapped for different sampling sites throughout the season. The results of this analysis showed consistent differences between samples taken within the Irrigation Area (that is, the Water Resources controlled channel system) and other areas (mostly on the western side of the river). Figure 8 shows a map of the project area, indicating the abundance of *H.armigera* at the sites sampled during Stage II (Week 3). The trend for lower *H.armigera* abundance outside of the Irrigation Area was consistent throughout the season, and may represent a major clue in the source of our resistance problem. It may be that this pattern is due to prevailing winds, but this theory conflicts with the common belief that *H.armigera* is not highly migratory. It is

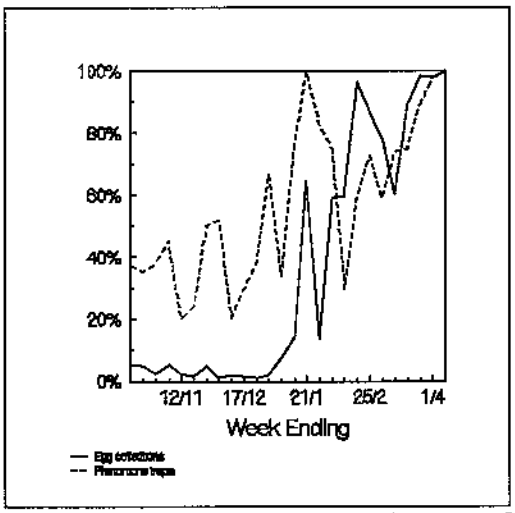


Figure 7 Seasonal abundance of *Helicoverpa armigera* in egg collections and pheromone traps, St George 1992/93

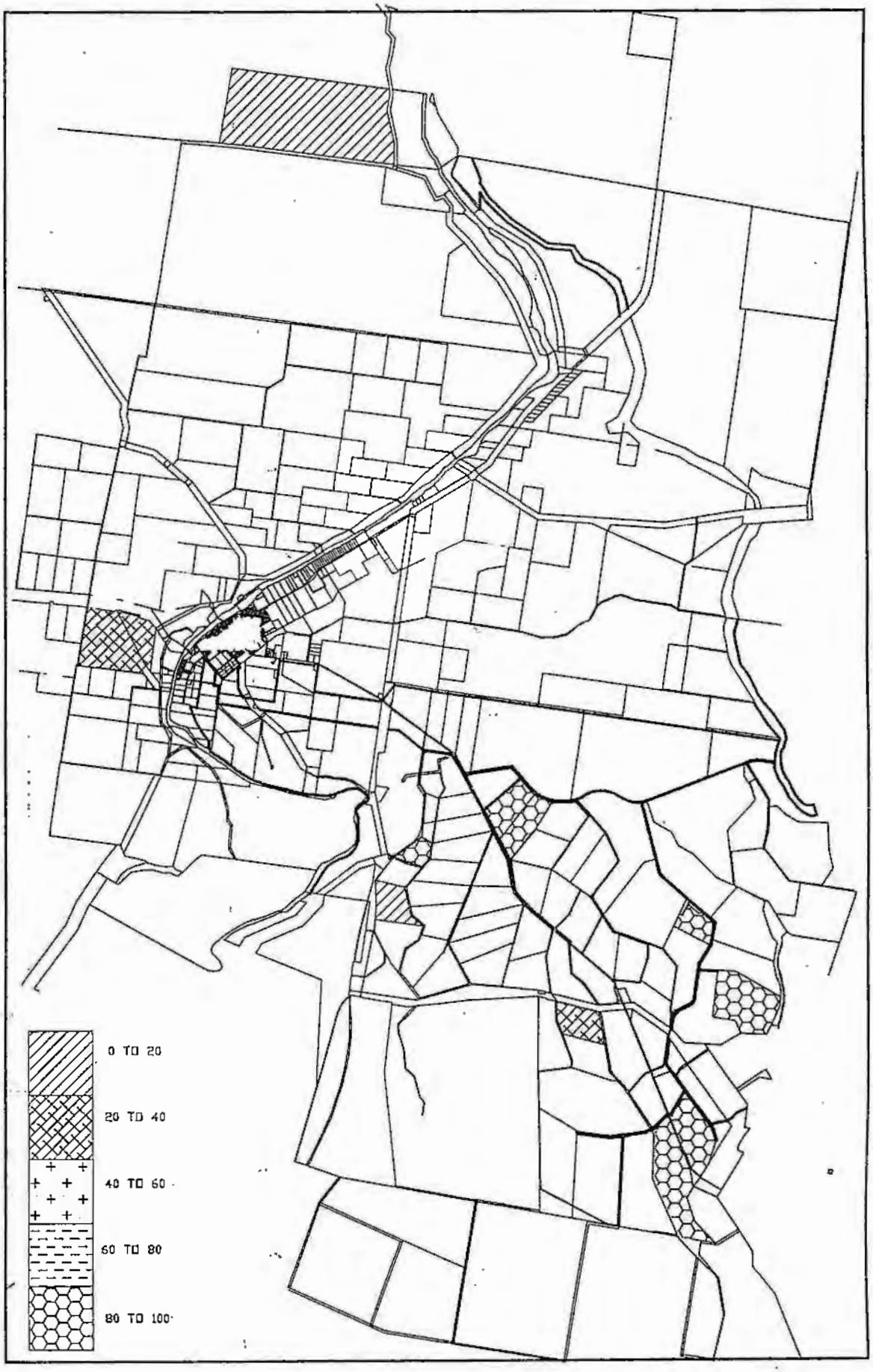


Figure 8 Spatial distribution of *H.armigera* abundance, St George, Stage II/Wk 3, 1993

Table 2 Thrips abundance and species composition, St George 1992/93

	Early season	Mid season	Late season
F.schultzeii	XX		XX
T.tabaci	XX		
T.imaginis		X	X
Haplothrips		X	X
S.sexmaculatus			X

more likely that the channel system itself is affecting the local emergence patterns. The channels provide a year-round source of moisture and grasses and lucerne proliferate throughout the system. These may be an important refuge for heliothis pupae, negating some of the effects of fallow cultivation.

Thrips sampling

A study of thrips abundance and species composition was initiated to compare populations at Narrabri Agricultural Research Station to the St George district. The results of thrips sampling are presented in Table 2. Generally thrips numbers were very low at St George. This is probably due to the fact that samples were taken from commercial cotton fields, which were subjected to heavy early season use of insecticides. To get a more accurate picture of thrips numbers and species composition, samples from unsprayed cotton would be required. Unfortunately, this work will not be continued, due to funding restraints.

The species with most economic significance in cotton are *Frankliniella schultzei* (Trybom) and *Thrips tabaci* (Lindeman). Their numbers followed the same pattern as at Narrabri in previous seasons. *F.schultzeii* was found in both early and late season collections. *T.tabaci* was only present early in the season. *Haplothrips spp*, large predacious thrips, were more numerous than at Narrabri. *Scolothrips sexmaculatus* (Pergande) was present at one site only.

APPLICATION OF RESULTS

The greatest value of this project has been in the application of results by growers and consultants. The quick turn-around time for reporting results has been a major priority, and has proven to be a critical part of cotton management in the district. Communication structures and the close industry cooperation established over the past two seasons will provide benefits beyond the scope of resistance monitoring in the future. For example, LepTon kit results will be collated and relayed to industry during the next season using the processes developed in the Resistance Monitoring project.

The Balonne Cotton Advisory Committee (formerly the Balonne Resistance Committee) has established a strong working relationship between growers, consultants and researchers. The committee is formulating long-term plans to address industry problems, and providing short-term advice based on results of the Resistance Monitoring Project.

INFORMATION TRANSFER

The major form of information transfer in this project was The Bug Bulletin newsletter. An example of this newsletter is shown in Appendix 1.

The Bug Bulletin was sent out with weekly results obtained from egg collections and pheromone traps, as well as other relevant industry news and recommendations. The newsletter was transmitted by fax-modem, which is an efficient and inexpensive method of technology transfer.

The Bug Bulletin is recognised by growers and consultants as a valuable source of information. The major advantages of this type of information transfer are the efficiency and speed of delivery of information.

LIST OF PERSONNEL

Project Leader:
Doug McCollum

Technical Assistant:
Jodie Pedrana

Consultants:
David Hall, Jamie Street, John Barber

Research Collaborators:
Dr Neil Forrester, Dr Gary Fitt, Dr Lewis Wilson

Balonne Cotton Advisory Committee:
Sno Harm, Nick Bligh, David Moon, Ian Thomas, David Hall, Jamie Street, John Barber, Penny Wells, Scott Sheppard, Mike Jones, Daryl Jones, Jodie Pedrana, Doug McCollum

APPENDIX 1

Financial Statement - St George Heliothis Monitoring Program (DAQ59C)

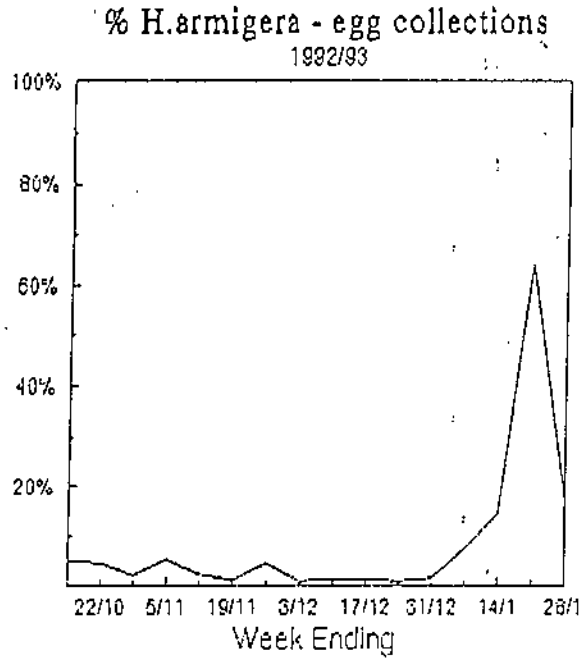
	Head of expenditure				
	Salaries	**Travel**	**Operating**	**Capital**	**Total**
Budget	18372.00	760.00	13765.00		32897.00
Expenditure	13829.35	333.56	15371.01		29533.92
Unspent funds	4542.65	426.44	-1606.01		3363.08

APPENDIX 2

Bug Bulletin

Edition 11; 1992/93

Just when we thought the doom and gloom had set in for the rest of the season, the heliothis have decided to give us a temporary reprieve. The results reported last week gave an interim result of 77% H.armigera in egg collections for the week ending 21 January. However, the pressure dropped off later in that week making the final result 64.4%. Interim results for the week ending 28 January have H.armigera back to 17%.



With Stage III starting tomorrow, spray options are now fairly limited. The Resistance Committee has expressed concern about the high use of profenofos in the area, prompting a move for regular profenofos resistance testing from now on. It is recommended that no more than 3 consecutive profenofos sprays be used, to try and preserve the use of this important chemical. Helix or Larvin should be used as rotation chemicals, rather than other organophosphates.

Doug McCollum (5/2/93)

Heliothis Monitoring Program

Queensland Department of Primary Industries