A2001

January, August & Final Reports

Part 1 - Summary Project Details

REPORTS

Please use your TAB key to complete parts1,2,4 & 5

CRDC

CRDC Project Number: **DAQ122**

January Report:	☐	Due 29-Jan-01
August Report:	☐	Due 03-Aug-01
Final Report:	☒	Due within 3 months of project completion
Project Title:		Pest status and mangement of shield bugs in cotton

Part 2 – Project Contact Details

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Researcher 2 (Name of additional researcher or supervisor).

Organisation:

Postal Address:

Ph: **Fx:** **E-mail:**

Part 3 – January & August Report Format

(Maximum four pages)

1. **What were your major project objectives for the past year? (Please list).**

2. **Which of these objectives have been achieved?**

3. **How has your research addressed The Corporations three outputs: Sustainability of natural resources, profitability and competitiveness, and/or people and communities?**

4. **Which objectives were not achieved and why not? (Please detail any problems you have had during the year).**

5. **What are your specific project objectives for the coming financial year?**

6. **What aspects of your research project do you envisage having problems with in the coming year and why?**
   NOTE: This question is aimed at identifying areas in which CRDC may be able to implement assistance to help avoid potential problems.

7. **To what extent have your research results to date been disseminated to other researchers growers or the industry?**

8. **Will your research results be useful to other researchers/growers/industry in the next year and if so how do you intend to communicate these results or findings?**

9. **Were there major highlights in your work over the last six months? Please give a brief outline. (This question is optional)**

You may also submit a separate confidential report of information, which should be included in the report but which you reasonably consider is confidential information.

Additional details of budget variations:

Part 3 – Final Report Format

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

1. **Outline the background to the project.**

   With the move towards fewer and fewer disruptive insecticde sprays mediated by improvements in transgenic Bt cotton varieties, and the adoption of more selective products in conventional cotton,'shield bug' pests are emerging as a major problem. In the past, insecticdes applied against heliothis effectively controlled the 'shield bug' complex of pests.

   Unfortunately, the insecticides registered for shield bugs are mostly non-selective and are extremely disruptive to a wide range of beneficial species, and are thus antogonstic to IPM approaches aimed at conserving beneficial populations in cotton crops. Furthermore, apart from green vegetable bug (GVB), the potential of these pests to damage cotton crops has not been investigated. An action threashold of 2 per metre is currently recommended for GVB in Australia, and this conflicts with recent information from USA suggesting 1 per 2 metres coincident with 20% internal boll damage on small bolls. Severe GVB damage has been reported in many Australian cotton crops at the end of the 1999/2000 season.

   This prompted cotton industry to approve a one year contingency project to initiate research on shield bug complex in cotton with the aim to investigate the damage potential of shield bug complex in Bt transgenic cotton and develop management guidelines that are compatible with the implementation and adoption of IPM approaches.

2. **List the project objectives and the extent to which these have been achieved.**

   1. literature review to determine current global knowledge of relationships between shield bugs and cotton
   2. prepare and publish a 'shield bug' information article
   3. investigate damage potential of nymphs and adults of the shield bug complex
   4. evaluate sampling methods to monitor shield bug pests in cotton
   5. evaluate importance of Trichopoda in cotton in the South Burnett where it is established
   6. conduct preliminary investigations into insecticide management

3. **How has your research addressed the Corporations three outputs: Sustainability of natural resources, profitability and competitiveness, and/or people and communities?**

   The research into shield bug pests addresses an emerging issue resulting from a reduction in the use of disruptive insecticide sprays on cotton, especially Ingard cotton. Shield bugs have caused serious losses on some properties and impacted on profitability. Management approaches are necessary that complement the adoption of IPM, are based on accurate, locally-developed thresholds and are less reliant on insecticides. These developments will contribute to the sustainability of cotton production enterprises, maintain profitability, and benefit rural communities by reducing insecticide use.

4. **Detail the methodology and justify the methodology used.**
Brief methodologies are provided in the results section below.

5. **Detail results including the statistical analysis of results.**
Damage potential of shield bugs
To date 6 different shield bugs were found to damage cotton in Australia. They are green vegetable bug (GVB), Nezara viridula (Linnaeus), green stink bug (GSB), Plautia affinis (Dallas), red banded shield bug (RBSB), Piezodorus hybneri (Gmelin), brown stink bug (BSB), Dictyotus caenosus (Westwood), harlequin bug (HRLQB), Tectocoris diophthalmus (Thunberg) and cotton stainer bug (CSB), Dysdercus sidae (Montrouzier).

The damage potential of these shield bugs was studied by confining single adult insects of each category on 10-day-old bolls for 3 days using polystyrene foam cup cages and nylon stocking. Assessment was also made for GVB on squaring plants using field cages.

All shield bugs caused similar damage, both externally and internally. External damage was characterised by dull to shiny black spots at feeding sites, which contained white stylet sheaths. These sheaths were visible using a magnifying glass. External damage symptoms were not always related to internal damage. Only those feeding spots that resulted from severe and prolonged feeding translated into internal damage. Internal damage was easily visible and a much better guide to damage than external feeding marks. Internal damage was characterised by warty growths inside the carpels and by discoloured lint. Depending on the extent of feeding, warty growths could be small and light green or large and brown coloured. In the later case, lint turned brown and it was hard to peel the carpel off the damaged lint. In undamaged bolls, the carpel was readily separated from the lint. At boll opening, damaged lint with brown discolouration was easily seen.

The most damaging shield bug was GVB followed by GSB, RBSB, CSB, HRLQB and BSB. GVB caused almost 50% yield loss compared to the control. However, this was based on single boll assessments. Large-scale field experiments are needed to refine the yield loss assessments among the shield bugs. Both nymph and adult shield bugs caused damage to bolls. However, earlier instars caused less damage than later instars (the first instar did not feed at all). Damage varied with boll age. Small bolls were more vulnerable to GVB damage than older bolls. Damage to bolls older than 20 days was negligible, the preferred age being 10 days or less. Bolls aged less than 7 days were vulnerable to shedding due to shield bug damage.

Green vegetable bug showed potential to cause damage to squares where feeding turned anthers brown.

Sampling method to monitor shield bugs
Three sampling methods- beat cloth, suction and visual count were evaluated to monitor shield bugs in early March. GVB, HRLQB and CSB were the available

shield bugs during the assessment. Beat cloth was the most efficient sampling method irrespective of insect category, followed by visual counting.

Importance of Trichopoda in cotton

Trichopoda giacomellii, a parasitoid of large nymphs and adult GVB, has been released and established in the South Burnett. Weekly assessment was made from November 2000 to March 20001 in cotton and other available hosts of GVB including wild turnip, soybean and mungbean. Parasitism rate was highest (about 30-60%) in November and December and thereafter the rate declined, perhaps due to interference from chemicals applied to control cotton insects.

Investigation into insecticides to manage shield bugs

Two trails were conducted in collaboration with Hugh Brier, a pulse entomologist, in soybean grown beside cotton since shield bugs did not occur in cotton . The insecticides tested were azamax (neem product) (0.5 L/ha), dibrom (550 mL/ha of Naled 900 g/L), chlorpyrifos-methyl (1 L/ha of Rescue 500 g/L), 3 rates of trichlorfon (0.5 L/ha, 1.25 L/ha and 0.5 L/ha + salt) and 3 rates of endosulfan 350EC (0.7 L/ha, 2.1 L/ha and 0.7 L/ha + salt). Endosulfan was used as the standard insecticide and salt was included because in Brazil researchers found insecticide mixed with salt enhanced pod sucking bug mortality in soybean. In both trials endosulfan, even at the low rate, killed significantly more shield bugs than other products. Endosulfan killed around 90% whereas trichlorfon killed around 55%. Endosulfan was also less disruptive to beneficial insects. Rescue was most disruptive followed by dibrom. Salt mixture enhanced mortality but not significantly. Further study is necessary in this respect.

6. **Discuss the results, and include an analysis of research outcomes compared with objectives.**
   See preceding section.

7. **Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. Where possible include a statement of the costs and potential benefits to the Australian cotton industry and future research needs.**
   This one year project was funded by contingency and a NEW 3-year project (DAQ110C Pest status and management of shield bugs in cotton) has been funded commencing on 1 July 2001.

8. **Describe the project technology (eg. commercially significant developments, patents applied for or granted licenses etc).**
   No IP or patents involved.

9. **Provide a technical summary of any other information developed as part of the research project. Include discoveries in methodology, equipment design, etc.**
   None applicable.

10. **State the recommendations on the activities or other steps that may be taken to further develop, disseminate, or to exploit the project technology.**

Dr Khan has taken an active role in promoting his findings through publications and grower and consultant meetings. The NEW project will expand on the findings from the one-year project.

11. List the publications arising from the research project.

1. Khan, M. and Murray, D. (2001). Understanding the damage potential of the shield bug complex on cotton in Australia. Proceedings of the 32nd Australian Entomological Society Conference, Sydney
2. Khan, M. and Bauer, R. (2001). Comparing damage to cotton bolls caused by green mirid and green vegetable bug. The Australian Cottongrower. 22 (4): 16-18
3. Khan, M., Simpson, G., Brier, H., Knight, K. and Murray, D. (200). Update on green vegetable bugs in cotton 2000/2001. CRC publication
4. Simpson, G., Khan, M., Brier, H. and Knight, K. (2000). Beware the green veggie bug. The Australian Cottongrower. 21(6): 17-23

Part 4 – Final Report Plain English Summary

You must submit a half to one page Plain English Summary of your research proposal that is not commercial in confidence, and that can be published on the World Wide Web. An electronic copy of the Plain English Summary must also be forwarded by e-mail (angela@crdc.org.au).

This was the one-year contingency project leading into a NEW project DAQ110C. Some of the findings presented here are preliminary and further studies are necessary.

Damage potential of shield bugs

Six different shield bugs were found damaging cotton in Australia - green vegetable bug (GVB), green stink bug (GSB), red banded shield bug (RBSB), brown stink bug (BSB), harlequin bug (HRLQB), and cotton stainer bug (CSB). All shield bugs caused similar damage, both externally and internally. External damage symptoms (dull to shiny black spots at feeding sites) were not always related to internal damage. Internal damage was easily visible and was a much better guide to damage than external feeding marks. Internal damage was characterised by warty growths inside the carpels and by discoloured lint. Lint turned brown and it was hard to peel the carpel off the damaged lint. GVB was the most damaging shield bug followed by GSB, RBSB, CSB, HRLQB and BSB. GVB caused almost 50% yield loss compared to the control. Large-scale field experiments are needed to refine the yield loss assessment. Both nymph and adult shield bugs caused damage to bolls. Earlier instars caused less damage than later instars (the first instar did not feed at all). Damage varied with boll age. Small bolls were more vulnerable to GVB damage than older bolls. Damage to bolls older than 20 days was negligible, the preferred age being 10 days or less. Bolls aged less than 7 days were vulnerable to shedding due to shield bug damage. Green vegetable bug showed potential to cause damage to squares where anthers turned brown at feeding sites.

Sampling method to monitor shield bugs

Three sampling methods- beat cloth, suction and visual count were evaluated to monitor shield bugs in early March. GVB, HRLQB and CSB were the available shield bugs during the assessment. Beat cloth was found to be most efficient sampling method irrespective of insect category.

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