

# FINAL REPORT

DAQ00086

## Integrated Pest Management for Pulses in Northern Australia - Sustainable Production in a Changing Cropping Environment

### PROJECT DETAILS

PROJECT CODE: DAQ00086

PROJECT TITLE: INTEGRATED PEST MANAGEMENT FOR PULSES IN NORTHERN AUSTRALIA -SUSTAINABLE PRODUCTION IN A CHANGING CROPPING ENVIRONMENT

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### Summary

DAQ00086 targeted major Integrated Pest Management (IPM) gaps in summer pulses & provided IPM support in new & traditional production areas.

Project success was ensured by locating key trials on a research station with total control over pests, irrigation etc., complemented with on-farm trials where necessary.

Key achievements include new threshold models for mirids in mungbeans & soybeans & Helicoverpa in mungbeans. New pesticide options were found for soybean moth, soybean aphid & redbanded shield bug.

A new soybean/break-crop IPM course/manual was developed & the Accredited Mungbean Agronomist course's IPM module upgraded. Over 300 growers/consultants attended 16 IPM courses from Narrabri to the Burdekin.

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## Conclusions

### Pest Management Mungbeans:

- A mirid threshold model (60 kg/ha per mirid/m<sup>2</sup>) has been finalised for mungbeans and validated across a wide range of crop yields (0.4-1.6t/ha).
- The newly-developed *Helicoverpa* threshold model (35kg/ha per larva/m<sup>2</sup>) should be valid for podding mungbeans under typical growing conditions (not overly wet, but not in extreme drought). However, additional threshold data is required for *Helicoverpa* across a broader range of growing conditions. Nonetheless, the data from DAQ00086's heli ET trials provide a very good understanding of *Helicoverpa* /mungbean interactions, and the likely risk factors under varying growing conditions.
- The Heli ET data clearly shows that mungbeans have an extraordinary ability to compensate for early reproductive damage, and supports mirid ET data, showing that mirid spraying can be slightly delayed (by 1 week from early budding) without effecting yield, thereby reducing the risk of a repeat spray being necessary.
- For *Helicoverpa*, the data suggests that under good growing conditions, mungbeans can easily compensate for moderate levels (3-4 larvae/m<sup>2</sup>) of early damage at flowering/podset.

### Pest Management Soybeans:

- Soybeans are far less susceptible to mirid attack than mungbeans, with no yield loss measured in crops with up to 5 mirids/m<sup>2</sup>, i.e. 10 times the mungbean mirid threshold.
- Mirid damage in soybeans is confined to flowering/early podding, with no damage observed in harvestable seeds
- The same podsucking bug threshold can be used across all current culinary cultivars from the large seeded Bunya to small seeded Nato type Oakey. While bugs damage more seeds of small seeded than large seeded cultivars, the former set more seeds. As bug thresholds are based on the maximum allowable % damage, these two factors cancel each other out.
- Contrary to published opinion, beat sheet sampling efficiencies of adult and small nymph podsucking bugs are <50% and <10% respectively. However sampling efficiency for large nymphs is 100%. Sampling inefficiencies for small nymphs are most likely cancelled out by high small-nymph mortality.
- New pesticides have been identified to address key pest problems. Abamectin, already registered in soybeans, gives excellent control of soybean moth. Pirimicarb gives excellent control of soybean aphids & Shield (clothianidin) is more effective against redbanded shield bug than deltamethrin plus salt.

- Other products have been found wanting. The antifeedant Spirotetramat does not reduce the rate of podsucking bug feeding, while efficacy gains achieved by adding PBO to deltamethrin are negated by a doubling of the rate of damage of surviving/re-infesting bugs. This totally unexpected finding warrants investigation with other products.

#### **Novel options/Moth attractants:**

- While Magnet attracts etiella in peanuts & beanpodborer in mungbeans, very large scale trials are required to evaluate Magnet's in-field efficacy as incoming moths from surrounding untreated areas confound results in smaller trials (even 2 ha trials).

#### **Extension:**

- The soybean IPM courses have proved extremely popular (300 attended 16 courses) with ongoing requests for further workshops.
- The networks established at these workshops will be invaluable for new Northern IPM project DAQ00153.
- The Turning Point/Keypad electronic evaluation system, used in recent IPM workshops & conferences, is invaluable in capturing pest incidence, information gaps, pesticide use data etc.

## **Recommendations**

#### **Pest Management Mungbeans:**

- In well growing mungbeans, mirid sprays can be delayed by up to a week, if light (= 2 x threshold) pest pressure at early flowering, thereby reducing the risk of the need for a repeat spray.
- In well growing mungbeans, *Helicoverpa* sprays can be delayed if only moderate pest pressure (= 2 x threshold) at flowering, thereby reducing the risk of the need for a repeat spray.
- However for *Helicoverpa*, small crop size is a yield loss risk factor at the early reproductive stages, and sprays should not be delayed if significantly above threshold in small crops (the threshold is approximately 2 larvae/m<sup>2</sup>).

#### **Pest Management Soybeans:**

- Mirid sprays in soybeans are not required for mirid populations of at least 5/m<sup>2</sup>, and possibly higher in large well-watered crops.
- Mirid sprays in soybeans are not required after soybeans enter the podfill stage (R5).
- The current podsucking bug threshold can be used across all current cultivars from the large seeded Bunya to small seeded Nato type Oakey.
- As podsucking bug thresholds are based on % bug damage, crop size (number of seeds per square metre) needs to be determined for each crop.
- Multiply beat sheet counts of adult podsucking bugs x 2 to allow for a 50% sampling inefficiency, but leave counts of small nymphs (instars I & II) as is, as sampling inefficiencies will most likely be cancelled out by high levels of mortality for these early bug stages.
- Delay podsucking bug sprays until podfill starts, as data from threshold trials confirms published literature reports that immature pods don't favour nymphal development. Delaying podsucking sprays (of necessity currently with non selective pesticides) reduces the risk of SLW attack.
- Add a 0.5% salt adjuvant to pesticides if targeting the difficult to control redbanded shield bug (*Piezodorus oceanicus*).
- Check the APVMA PUBCRIS web site for the latest permits/registration status for pirimicarb and abamectin (Wizard 18) for the control of soybean aphid and soybean moth respectively.

## **Outcomes**

Economic benefits include (a) increased yields because of more thorough pest scouting, & more-timely pest control, e.g. for mirids & *Helicoverpa* in mungbeans; (b) savings because of a reduction in unnecessary spraying, the 'no spray' decision being based on DAQ00086 data, e.g. for mirid ppns. <5/m<sup>2</sup> in soybeans; & (c) increased product quality, with a resultant increase on crop value, & increased value chain capture & the realisation of the full economic potential particularly of the soybean

breeding programmes new culinary soybeans. This increase in value (up to \$500/ha) has been particularly evident in soybeans many areas of coastal Queensland. For example soybeans in the Bundaberg/Isis region of SE Qld have progressed from mostly poor quality crushing grade to 70-75% of the crop making the higher value (by \$100/t) culinary grade. This equates to about an increase in soybean value of \$500K pa for this region alone, or \$2M over the equivalent 4 year life of the project.

Potential environmental benefits include (a) reduced spraying because of the identification of "no need to spray' scenarios, e.g. for mirid ppns. <5/m<sup>2</sup> in soybeans, & low (<4 m<sup>2</sup>) helicoverpa populations in well-grown (not drought stressed) flowering mungbeans, (b) the extended window for biopesticides such as helicoverpa NPV into flowering mungbeans, because of the crops ability greater tolerance of pest damage at this stage, & (c) reduced spraying because of a significant increase in pest thresholds, e.g. the Helicoverpa threshold in podding mungbeans, which has been doubled as a result of research by DAQ00086. On the downside of the ledger, spraying for some pests has probably increased. The prime example is increased spraying for podsucking bugs because of heightened grower awareness (resulting from DAQ00086's extension activities) of the need to control podsucking bugs to achieve to top seed quality.

Major social benefits arising from DAQ00086's D&E initiatives include the development of the Soybean/Break Crop IPM training courses for new growers in coastal farming systems, & the ongoing support/improvement of a similar Agronomist training course in mungbeans. Over the life of the project, over 300 growers/consultants received intensive IPM training at 17 workshops. This has greatly increased industry's IPM capacity in new grain growing regions from Bundaberg to the Burdekin. In more established regions, these courses have been critical in updating established consultants IPM skills, & in introducing new consultants to IPM concepts. The networks established have been invaluable in keeping researchers in contact with the latest pest issues as they arise. As a result, the project was able to respond to and address major pest problems quickly, e.g. the soybean moth outbreak of 2009 (see <http://thebeatsheet-ipmnews.blogspot.com/2009/02/soybean-moth>), and to run localized field walks for affected growers.