focus on NRM research

Keeping insect pests lower for longer:
benefits of native vegetation

Dr Vesna Gagic, CSIRO

What did you research?
There are a range of ecosystem service benefits that flow from maintaining on-farm natural assets. Previous research has focused on the relationship of semi-natural vegetation providing individual ecosystem services, for example, biological control or pollination. However, there is little evidence to show the measurable effects of native vegetation on insect pest suppression in cotton production at a landscape scale or the mechanisms underpinning any effect.

By comparing insect pest suppression in relation to the crop and the proportion of native vegetation at larger scales, we researched how native vegetation links to on-farm insect pest management. For example, we asked: could native vegetation help to increase biological control and keep insect pests in cotton 'lower for longer'?

What did you research involve?
The three-year research project included:

- Sampling cotton crops and adjacent areas of native vegetation for beneficial and pest insects.
- Using digital cameras in experiments to record and then quantify *Helicoverpa spp.* egg predation by ground and canopy dwelling beneficial insects (predators) both day and night in cotton and native vegetation.
- Conducting glasshouse and field exclusion experiments to measure the interactions between pollination with and without (exclusion) pest control and their combined impact on cotton yield.
- Analysing crop-scouting data for five seasons from multiple cotton fields in the Darling Downs and calculating proportions of land use up to 2km around these fields. Over 36,400 observations, by field and date, were analysed to determine the relationship between land use, management activities and insect pest populations.

What did you find?
Sampling insects using pitfall and pan traps showed that there were a large variety of beneficial insects sampled from both cotton and semi-native vegetation areas. There was a range of beneficial insects sampled from both cotton and semi-natural vegetation that are likely to contribute to biological control of a variety of cotton pests. However, identifying insects from the video images of experiments showed the dominant beneficial insects responsible for *Helicoverpa spp*. egg predation are ants.

Interestingly nocturnal ground-dwelling predators, primarily crickets and earwigs, also contribute to egg predation. Predation of eggs was higher in unsprayed cotton crops, adjacent semi-natural vegetation compared to fields without semi-natural vegetation. It was evident that the application of insecticides (resulting from sprayed crops) reduces the benefit of adjacent semi-natural habitat for beneficial insects responsible for egg predation.

Pollination is not essential for cotton yield. However, experiments to quantify interactions between ecosystem services predation and pollination showed that pollination can reduce yield loss due to insect pest damage, therefore, provide a level of "insurance". That is when biocontrol is low (i.e. pest numbers are high) pollination can contribute to yield and reduce boll loss caused by mirids and other pests.

Relationships between land use - specifically the proportion of semi-natural vegetation - insect pests and management using insecticides at different

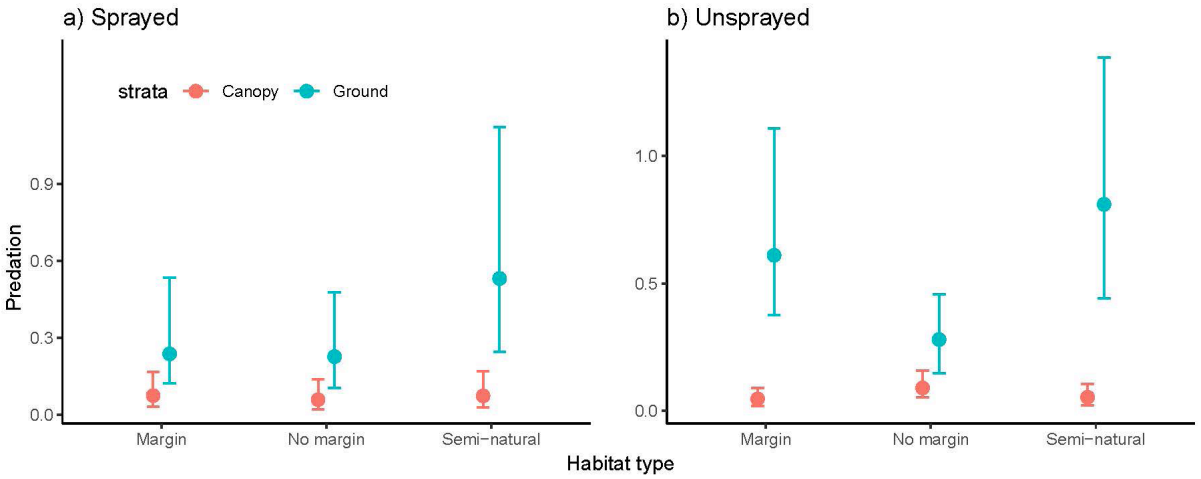

Figure 1. Effects of habitat type (semi-natural habitat, crop with margin and crop without margin) and strata (Canopy vs. Ground) on egg predation in the a) sprayed and b) unsprayed fields.

spatial scales were identified by analysing land-use information and scouting data. Results showed that the probability of mirids being present in cotton are likely to be less and remain so for longer in fields where there is 20 per cent or more semi-natural habitat at a 2km radius.

Spraying reduced the probability of mirids in a crop. However, the likelihood of mirids increasing after spraying insecticide is greater where there is less native vegetation. There is also a relationship between the size of the cotton field and proportion of native vegetation and probability of mirids. For example, the time between sprays increases with increasing native vegetation in small fields. Similarly, the likelihood of mirids being present in cotton increases as field size increases but where there is also less native vegetation.

These results begin to highlight and quantify the important interactions between ecosystem services and areas of semi-native vegetation in relation to crop production activities such as insecticide application, for managing insect pests and yield.

In summary: Native vegetation adjacent to cotton fields can:

- Increase pest predation by insect predators within cotton fields (although the application of insecticides can reduce the benefit).
- Compensate for damage to crop by insect pests such as thrips, jassids and mirids. Other studies show that this can be due to native vegetation enhancing pollination ecosystem services.
- Reduce and delay mirid colonisation and thereby reduce the risk and number of insecticide sprays in cotton fields, therefore increasing the time for beneficials to have an impact on pests.

How can I apply this research?

- Maintain native vegetation along field edges. This can increase pest control in the field, but if pest pressure is still high, pollination can reduce the yield loss.
- Reduce broad-spectrum insecticide sprays. Insecticide spraying is highly disruptive for these ecosystem services and reduces the benefits delivered by beneficial insects and facilitated by areas of semi-natural vegetation.
- Revise, develop and validate insect pest management actions such as spray thresholds to incorporate these results but also facilitate easier decision-making. For example, scouting protocols could include recording land use information such percent area of native vegetation. Combining information crop location in relation to areas of semi-natural vegetation, yield and time of season could be used to establish dynamic thresholds. These would give consultants and growers a broader range of options to maximise biocontrol and reduce insecticide applications.

Where do I go for more information?

Dr Cate Paull, CSIRO Agriculture and Food
Ph: 07 3833 5661
Em: Cate.Paull@csiro.au

Stacey Vogel, CottonInfo
Ph: 0428 266 712
Em: staceyvogel.consulting@gmail.com

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