

ENVIROFEAST® IPM IN COTTON: PART 1. INTEGRATION WITH LUCERNE STRIPS TO MANAGE GREEN MIRIDS IN COTTON

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Introduction

The green mirid, *Creontiades dilutus* (Stål), is one of the key early season pests on cotton in Australia. Adults and nymphs feed preferentially on the meristematic tissue (both apical and axillary buds) of the cotton plant (Bishop, 1980). Severe infestations cause cotton plants to lose squares and also cause damage to growing tips, resulting in significant delays in growth and maturity of the plant (Adams and Pyke, 1982; Chinajariyawong *et al.*, 1988; Khan 1995 unpublished data). This delay can lead to loss in yield and/or quality.

Currently, populations of green mirids in commercial cotton are suppressed by insecticide sprays (mainly synthetic pyrethroids, organophosphates, cyclodienes and carbamates) applied for *Helicoverpa* spp. In high infestations, dimethoate is the only effective insecticide available for green mirid control. The use of these insecticides early in the season disrupts beneficial insects activity and deters any chance of a true integrated pest management (IPM) program being developed for cotton. However, with the proposed introduction of Ingard (transgenic) cotton by Monsanto in Australia by 1997/98, it is expected that synthetic insecticide use on cotton will be reduced and green mirids may assume greater importance in the Australian cotton industry as they are unaffected by the Bt toxin in these plants. Green mirid infestations of Ingard cotton may therefore require the use of synthetic chemicals for control. Chemicals will disrupt the natural enemies of cotton pests and flare mites, aphids and other pests. If these things do happen, then Ingard cotton will require the same insecticide strategy as normal cotton to manage secondary pests. However, to realise the full benefits of the Ingard technology, growers should use new management techniques for green mirids which do not rely on insecticides.

In California, interplanting alfalfa in cotton has been reported by Stern *et al.*, (1969) and Sevacherian and Stern, (1974) to be very effective in managing lygus bugs in cotton. Since 1992-96, we have conducted a series of research trials to determine whether green mirids prefer lucerne to cotton and the potential of lucerne interplanted with commercial cotton as trap crops for the management of green mirids.

How were the trials conducted?

Field studies of green mirids on cotton and lucerne

In a study during 1992-93, lucerne was planted as strips 8 metres (or rows) wide and 100 metres long in an irrigated cotton farm at the Australian Cotton Research Institute (ACRI) in Narrabri. The lucerne strips were 46 metres apart. The lucerne/cotton interplant replicated three times across the field. The lucerne was planted on 15 September 1992 and cotton 5 October 1992. The lucerne strips were irrigated at the same time as cotton. One half of each lucerne strip were slashed every 4 weeks. The 4-week slashing sequence stimulate new growth and prevented the lucerne from haying off before the end of the study (i.e. end of the cotton season).

Green mirid adults were sampled once every week from 2 November 1992 to 23 March 1993 using a small portable Dvac suction sampler (Homelite Textron Inc., NC, USA). A gauze bag (25 cm deep) was inserted into the suction tube to collect insects sucked from plants. In a single pass, the tube of the vacuum sampler was drawn along the tops of each host plants and a 20 metre of row of vacuum sampling on either plant constituted a sample. After each sampling, the contents of the D-vac were transferred to a plastic bag, chilled and taken to the laboratory and frozen for later counting and identification.

Comparison of cotton crops with and without interplanted lucerne

In 1993-94 a study was conducted in irrigated cotton fields at Norwood near Moree in New South Wales. The fields were 20 hectares each and were adjacent to each other, separated by a 20 metre access road. Two lucerne strips each measuring 12 metres (or rows) wide and 592 metres long were planted as borders to cotton 100 metres (rows) wide and 592 metres long. This was replicated three times across one of the field; the second field was without lucerne strips. One half of each lucerne strip was slashed or mowed every 4 weeks to stimulate growth and prevent the lucerne from haying off. The cotton with lucerne strips was left unsprayed until 6 January and then sprayed with Envirofeast[®] product and *Bacillus thuringiensis* (Bt) sprays. These products are known to have no insecticidal or repellent effect on green mirids on cotton (Mensah unpubl). The field without lucerne strips was left unsprayed until 15 December and thereafter sprayed with conventional insecticides which had most effect on *Helicoverpa* spp.

Green mirid adults and nymphs were sampled weekly by taking a 20 metre row vacuum sample as previously described, separately from the lucerne strips and also cotton with and without lucerne strips.

Integration of lucerne with commercial cotton under an IPM regime

The experiment was conducted on commercial irrigated cotton fields at Auscott in Narrabri, NSW in 1993-94 season. The reason for this study was to determine whether the

incorporation of lucerne into cotton crops under an IPM regime could control mirids to levels similar to those in fields managed with conventional insecticides. The lucerne strips in the IPM field were 8 metres (rows) wide and 620 metres long. Two strips of lucerne were planted as borders to 250 metres (rows) of cotton and this was replicated three times across the cotton field. The lucerne strips were managed by alternate slashing of 4 rows every 4 weeks. Other fields without lucerne strips, but with mirids managed with conventional insecticides sprayed against *Helicoverpa* spp., were used as a standard control. The control plots had three replicates and were located 100 metres from the IPM plot. The cotton in the IPM field received nine Envirofeast® sprays and four *Bacillus thuringiensis* (Bt) sprays. The conventional insecticide-managed plot received 9 synthetic insecticide sprays against *Helicoverpa* spp.

A 20 metre row vacuum sample of green mirids adults and nymphs was taken weekly from each of the three lucerne strips and cotton in the IPM plot and also from each of the three conventional insecticide managed plots. Sampling started on 28 October 1993 and finished on 21 March 1994. Data were expressed as numbers of green mirids per metre in lucerne and cotton under conventional insecticide and IPM regimes.

Results and Discussion

The results of this study indicated that green mirids distinctly prefers lucerne to cotton and that lucerne could be used as a trap crop to manage mirids in commercial cotton (Figure 1). In commercial cotton interplanted with lucerne as strips green mirids were controlled on cotton compared with commercial cotton without lucerne strips (Figure 2). The high numbers of green mirid adults on the lucerne strips came about as a result of non-preference of the mirids to cotton. When lucerne was planted within cotton under an IPM regime, without insecticide sprays for the control of *Helicoverpa* spp., mirid numbers in the cotton crop were reduced to levels similar to that achieved in commercial cotton with 9 synthetic insecticide sprays (Figure 3). The high numbers of green mirids on the lucerne at the expense of cotton under the IPM regime (Figure 3) indicates that lucerne is a useful trap crop, and acts as a sink for the pest.

For lucerne to remain attractive to green mirids throughout the cotton season, there is the need to stimulate regrowth and retain its freshness. This means the crop should not be allowed to hay off. We stimulated and maintained new growth of lucerne throughout the cotton season by slashing half of each lucerne strip every 4 weeks at each study site. The decline in green mirid numbers on lucerne in this study did not result in increased green mirids numbers on cotton during that period. This means that there was no movement of green mirids from lucerne onto cotton. In contrast, there were some movements of green mirids adults onto weeds such as grasses, wild turnip, Noogora burr, variegated thistle etc adjacent to the study site. The movement of some green mirid adults onto weeds around the study site instead of onto the cotton crop could indicate that cotton is not a preferred host. Mr Moazzem Khan, a postgraduate student working on the ecology of mirids has said that the hardness and hairiness of the cotton plant can affect green mirid's establishment and oviposition on the plant. Hence the lucerne in this study was acting as a sink not a source of green mirids to cotton. The

collapse of green mirids populations in January at all study sites could be due to aerial application of synthetic pyrethroids in the vicinity of the study area.

In this study, we have artificially diversified the cotton system and introduced a host choice situation by interplanting lucerne with cotton. This resulted in attraction of the pest onto the preferred host plant (i.e. lucerne) leaving the cotton crop relatively free from damage. There have been speculations by some researchers that lucerne strips could be a source of green mirids, mites and whiteflies. But for the past 4 years we have worked with lucerne strips within commercial cotton, there have been no evidence to prove these speculations. We conclude that lucerne could be used as strips within commercial cotton in Australia to manage green mirids which could otherwise be controlled only by synthetic insecticides.

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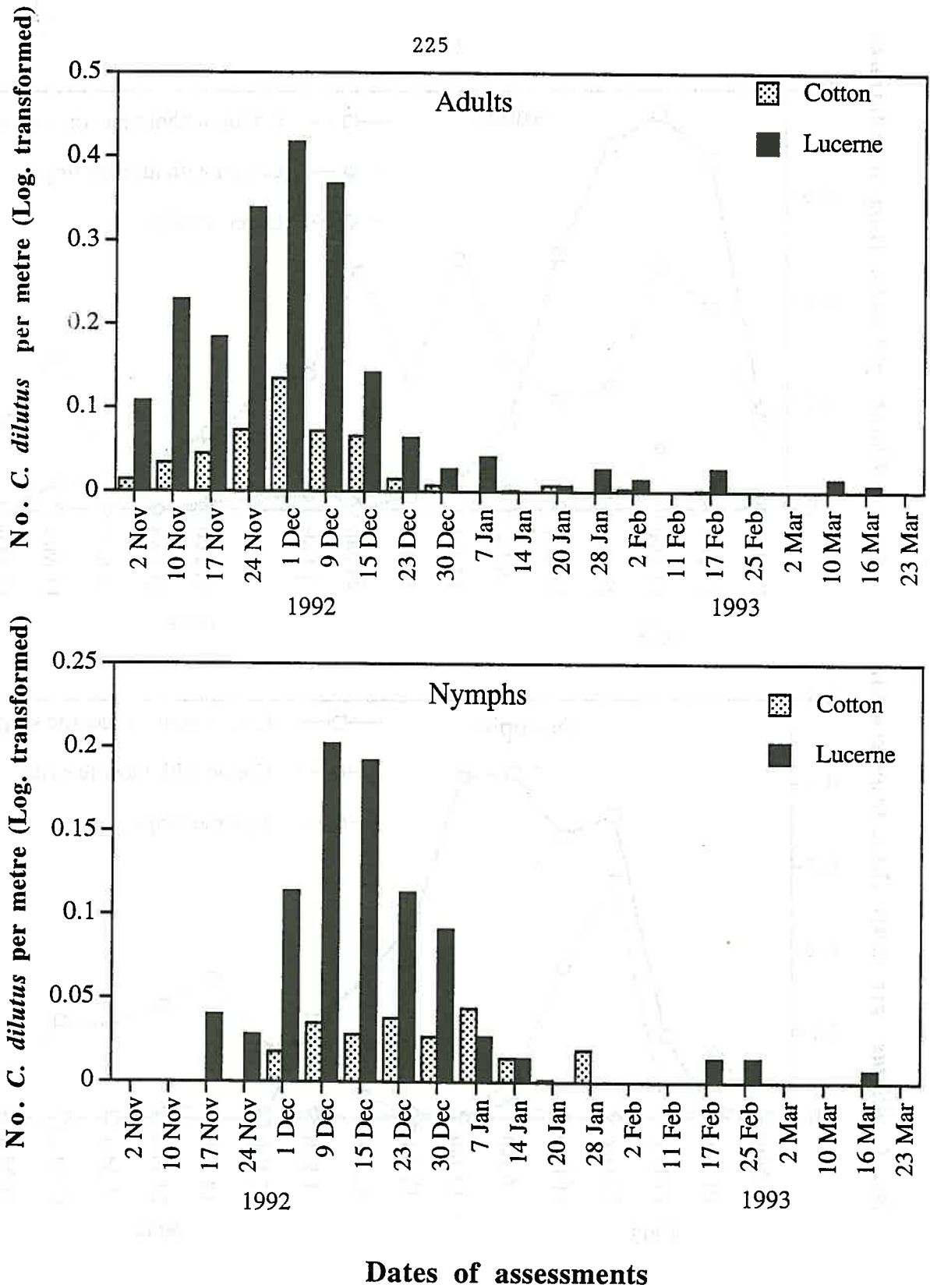
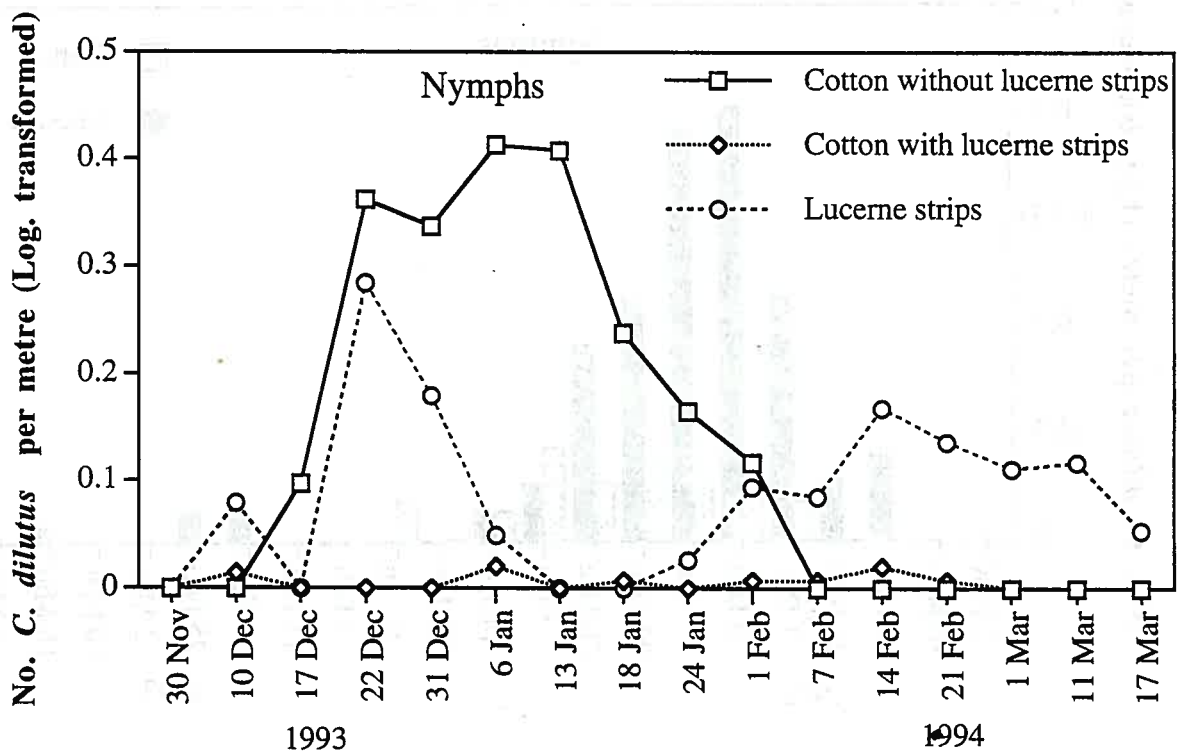
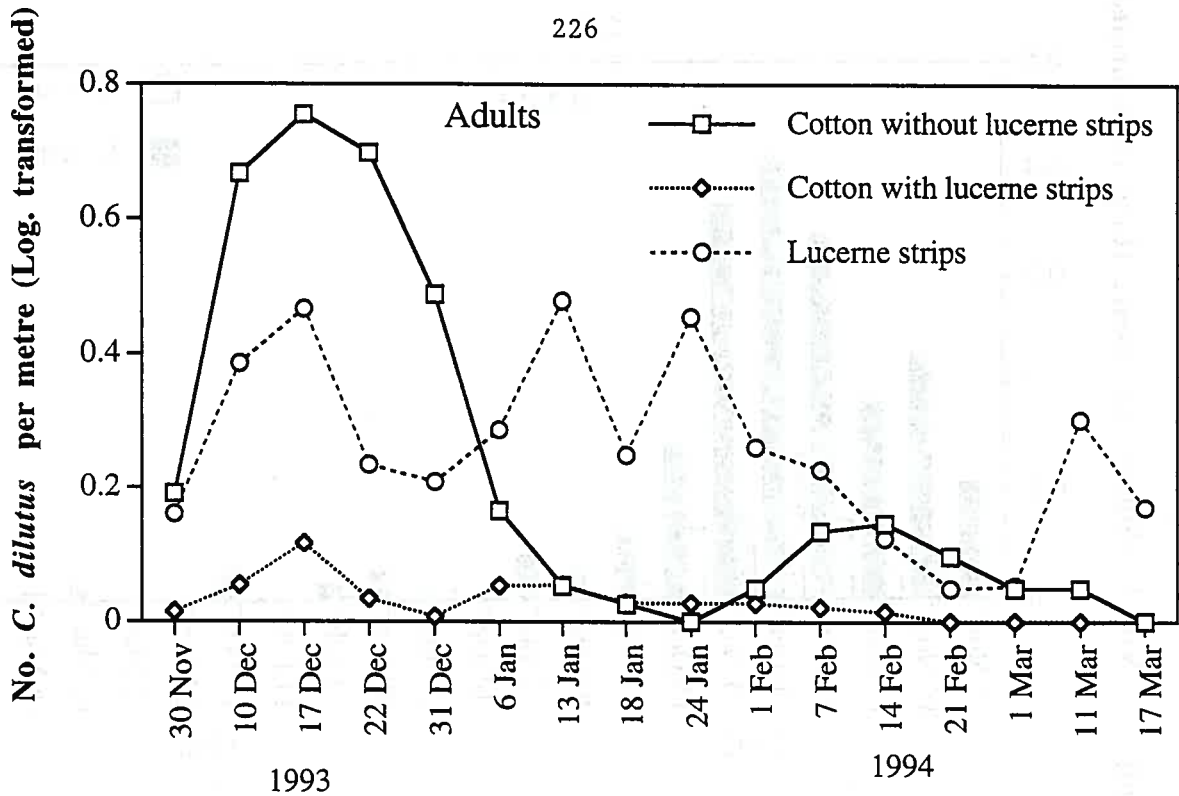
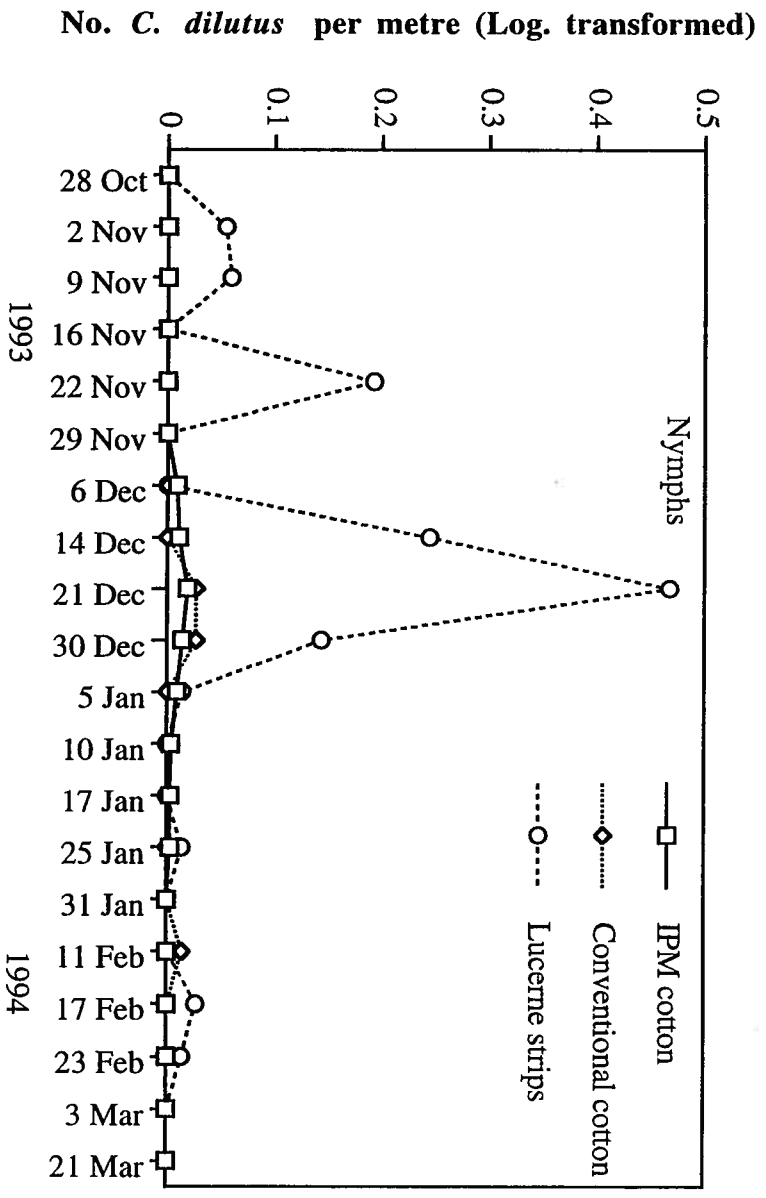
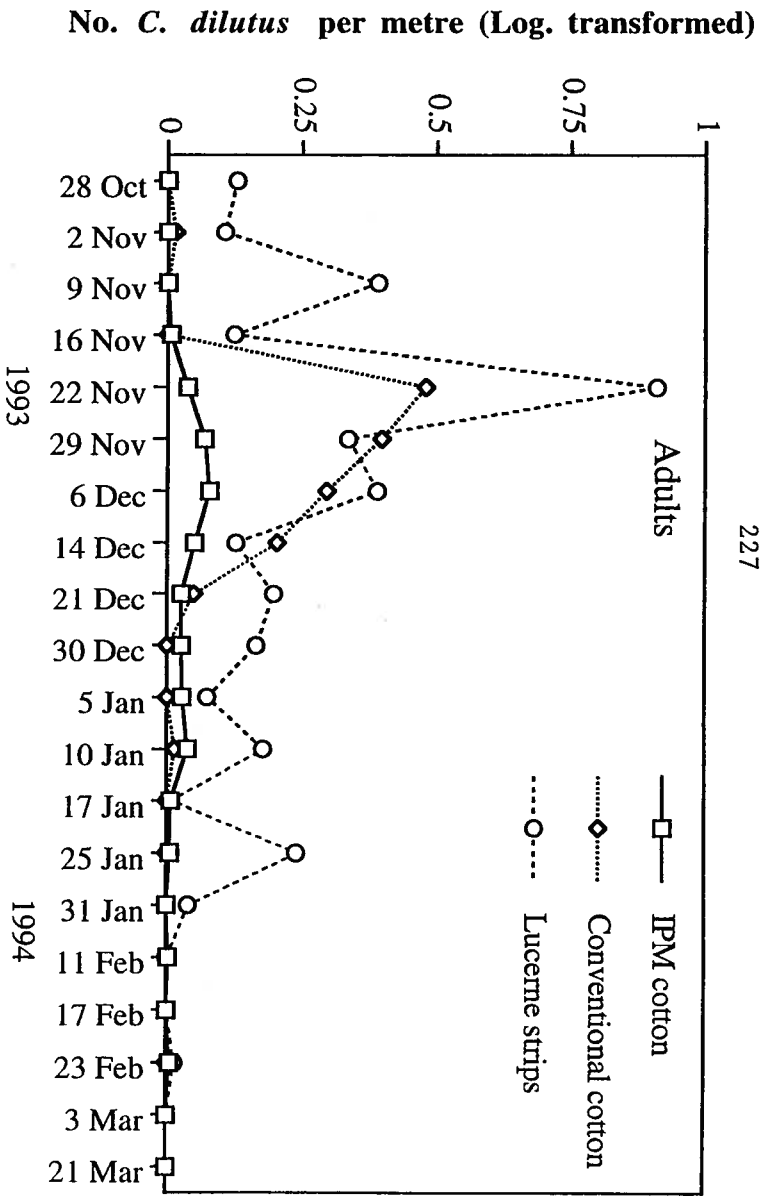


Figure 1. Number of green mirid adults and nymphs in lucerne strips and in cotton at the Australian Cotton Research Institute farm at Narrabri, 1992-93.



Dates of assessments

Figure 2. Comparison of number of green mirid adults and nymphs in cotton with and without lucerne strips at Norwood near Moree, 1993-94.



Dates of assessments

Figure 3. Number of green mirid adults and nymphs in cotton under conventional and IPM regimes at Auscott in Narrabri, 1993-94.

The amount of CO_2 evolved in the reaction of $CaCO_3$ with HCl is directly proportional to the amount of $CaCO_3$ present.

Graph of CO_2 evolved vs. Time

