An evaluation of lablab as a summer trap crop for heliothis, and nursery crop for beneficial arthropods, in dryland cotton.

B.C.G. Scholz, A.J. Cleary, R.J. Lloyd and D.A.H. Murray
Queensland Department of Primary Industries & Australian Cotton Cooperative Research Centre
PO Box 102, Toowoomba, Qld., 4350.

Introduction

The use of strip crops planted beside, or near, cotton is being promoted as part of the cotton industrys' integrated pest management (IPM) guidelines. Strip crops may be used to act as a trap crop for heliothis (*Helicoverpa* spp.), or as a nursery for beneficial insects and spiders. Chickpea has been used as a spring trap crop for heliothis, and lucerne has been used as a summer trap for green mirids and a nursery for beneficials.

To date summer trap crops for heliothis have not been widely tested on the Darling Downs. Lablab (*Lablab purpureus*) has been proposed as a trap crop for heliothis because it is hardier than lucerne and may be better suited to dryland regions. In addition to attracting heliothis, lablab may act as a nursery for beneficial insects and spiders.

While chickpea is highly attractive to heliothis, it is not attractive to a very important group of beneficial insects – wasp parasitoids. The heliothis egg parasitoid *Trichogramma* and the larval parasitoid *Microplitis* are rarely found in chickpea. This is unfortunate, because chickpea trap crops could potentially generate millions of these useful wasps that could move into subsequent summer crops. However, lablab may act as a nursery for beneficial arthropods (including parasitic wasps) that may move into cotton and attack some pests, including heliothis.

The aim of this study was to evaluate lablab as a trap crop for heliothis, and as a nursery crop for beneficial insects and spiders.

Methods

The trial was carried out at St. John and Edwina Kents' property "Coondarra" near Jimbour on the Darling Downs. Four strips of single-skip Siokra V-15i (INGARD) cotton separated by similar sized strips of wheat stubble were monitored for pest and beneficial insects and spiders. There were 45 row-pairs of cotton in each strip. The eastern (upwind) edge of each strip was planted with eight rows of lablab (var. Highworth). The strips ranged from ca. 15 to 18 ha, and were sown on 18-19 October 1999. The lablab flowered on 5 Jan. 2000, and was slashed on 31 Jan. 2000. A second lablab flowering commenced on 6 March 2000. The INGARD cotton was sprayed with spinosad (200 mL/ha) and fipronil (60 mL/ha) on 4 Feb. 2000. This was the only insecticide applied to the crop. A small section of unsprayed INGARD cotton (approx. 1 ha) was left on the upwind edge of the farm. The yield was estimated by hand harvesting 4 x 5 m paired rows of crop in the unsprayed cotton and in three of the sprayed INGARD strips (i.e. 12 x 5 m paired rows).

Insect Assessments

The lablab and INGARD cotton strips were monitored for heliothis eggs and larvae 1-3 times per week. The terminals of five consecutive plants at six randomly selected sites per strip were inspected, and all eggs and larvae counted.

A Stihl BG72 suction machine was used to collect insects and spiders from 4 x 20 m row length of crop per strip each week. All specimens were transferred into 70% alcohol in the field, and returned to the laboratory for sorting, identifying and counting.

Heliothis egg cards were used to assess egg parasitism. Adult *H. armigera* moths were placed in oviposition chambers where they laid eggs onto paper towelling. Each card was made by stapling pieces of paper towelling containing approximately 20 *H. armigera* eggs to paper strips measuring 1.5 x 7 cm. The eggs were less than 24 hours old. Each card was stapled to the upper side of a leaf at the top of a plant. Five egg cards were stapled in lablab rows 3 and 6 (10 cards total) and five cards in cotton row-pairs 2, 13, 23, 34 and 44 (25 cards total). The egg cards were 30 m apart in each row, and were placed in approximately the same location each week. They were left in the field for 48 hours. The number of eggs on each card was counted before and after they were placed in the crop. The number of parasitised eggs was also recorded and levels of egg parasitism were calculated.

Results

There were few heliothis eggs and larvae found throughout the season (Figure 1). Good primary fruit set occurred in both the unsprayed and sprayed (one spray only) INGARD cotton. The estimated yields were 8.0 bales/ha for both the unsprayed and sprayed crop, indicating that insect pests caused little damage throughout the season.

The lablab was most attractive to egg laying heliothis moths when it was flowering, and this was the only time that it was preferred over cotton (Figure 1). The lablab was more attractive than cotton to green vegetable bugs and green mirids towards the end of the season (Figure 2). Both of these bugs can significantly damage cotton. Lablab may be worth considering as a "trap" crop for these pests, thereby reducing the need to use some insecticides in cotton.

The numbers of predators collected from lablab and adjacent cotton were similar at the start of the season (Nov.-Dec.), but generally increased in the lablab during January (Figure 3). Lacewings and ants were most abundant at the start of the season. Predatory bugs and spiders were the most abundant predatory groups collected in suction samples (Figure 3 and Table 1). The damsel bug, brown smudge bug and pirate bug were the most common bugs; and the lynx, night stalker and tangle web spiders were the most common spiders (Table 1). The numbers of predatory bugs and ladybird beetles found in the cotton increased markedly after the lablab was slashed (Figure 3).

Three genera of egg parasitoids were collected on egg cards, viz. *Trichogramma*, *Trichogrammatoidea* and *Telenomus*. Low levels of egg parasitism (up to 28%) were recorded on egg cards (Figure 4) even though there was less than 0.1 egg per plant for most of the season (Figure 1). Parasitism of eggs on egg cards was recorded in both cotton and lablab. However, the levels of parasitism for field laid eggs were low in lablab, peaking at 2% (Table 2). In contrast, up to 71% of field laid brown eggs were parasitised in the cotton (Table 2).

Discussion

The lablab grew well under dryland conditions. It suffered some thrips damage when it was small, but the plants outgrew the symptoms. The early flowering and pod setting of the crop (January) could lead to a reinvasion "weed" problem if seed are produced. The lablab was slashed to prevent pod setting, but this reduced its attractiveness to heliothis (Figure 1) and beneficial arthropods (Figure 3).

Vegetative lablab was not attractive to egg laying heliothis. The "trap" qualities of lablab need further study, ideally during a season of normal or high heliothis pressure. Under these circumstances vegetative lablab may be more attractive to egg laying moths. Nearby vegetative sorghum on the farm seemed more attractive to heliothis than vegetative lablab (larvae and feeding damage were obvious).

There were more predatory bugs and ladybird beetles in the lablab than the cotton during January. These predators may have been feeding on other caterpillars (loopers and plume moths), or other insects (e.g. leafhoppers). The numbers of predatory bugs and ladybirds in the cotton increased markedly after the lablab was slashed, suggesting that they may have moved from the lablab into the cotton. Slashing lablab may therefore assist the dispersal of some flying predators into adjacent cotton. Spiders were the most abundant predators collected, and observations revealed that night stalker spiders were significant predators of heliothis eggs on egg cards.

Although there was low seasonal heliothis activity, *Trichogramma* and other egg parasitoids were active from January onwards. Care must be taken when interpreting egg parasitism data using egg cards. Very few eggs that were collected from lablab plants were parasitised (Table 2), while eggs that were on egg cards were more readily parasitised (Figure 4). This indicates that *Trichogramma* are more likely to forage on paper in lablab (the egg cards) than on the surface of the plant. Perhaps the oils in lablab flowers deter *Trichogramma* in some way. A similar scenario occurs in pigeon pea, i.e. oils in the plant repel parasitoids.

Although lablab is attractive to a range of predators, the role of these predators in managing pests is poorly understood and difficult to measure. By contrast, the role of parasitoids can be measured by collecting eggs and larvae and recording the subsequent levels of parasitism. Such studies have shown that parasitoids can cause significant heliothis mortality in Queensland. A strip crop that acts as a nursery for parasitoids may

be better suited for IPM of heliothis than one that does not, and is worthy of future research.

Conclusions

- Lablab grew well under dryland conditions.
- Lablab was most attractive to heliothis when it was flowering.
- Vegetative Lablab did not act as a "trap" crop for heliothis.
- Lablab was attractive to green vegetable bugs and green mirids, and may be worth considering as a "trap" for these pests.
- Lablab acted as a nursery crop for a variety of predatory arthropods, and some moved into adjacent cotton after the lablab was slashed.
- Naturally laid heliothis eggs in lablab were rarely parasitised.
- The "trap" qualities of lablab need additional evaluation during a more "normal" heliothis season.

Acknowledgements

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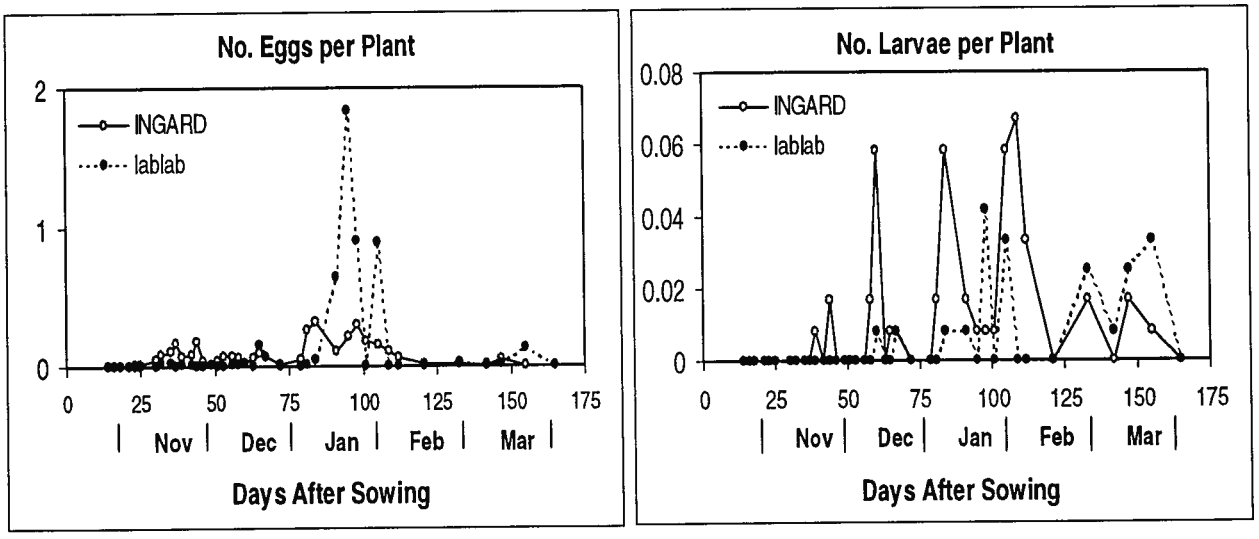

Figure 1: The numbers of heliothis eggs (white and brown) and larvae in INGARD cotton and adjacent lablab strips at Jimbour during 1999/2000. Data are the mean numbers per plant (n = 120). The lablab started flowering on 5 Jan 2000 (79 DAS), and was slashed on 31 Jan. 2000 (105 DAS).

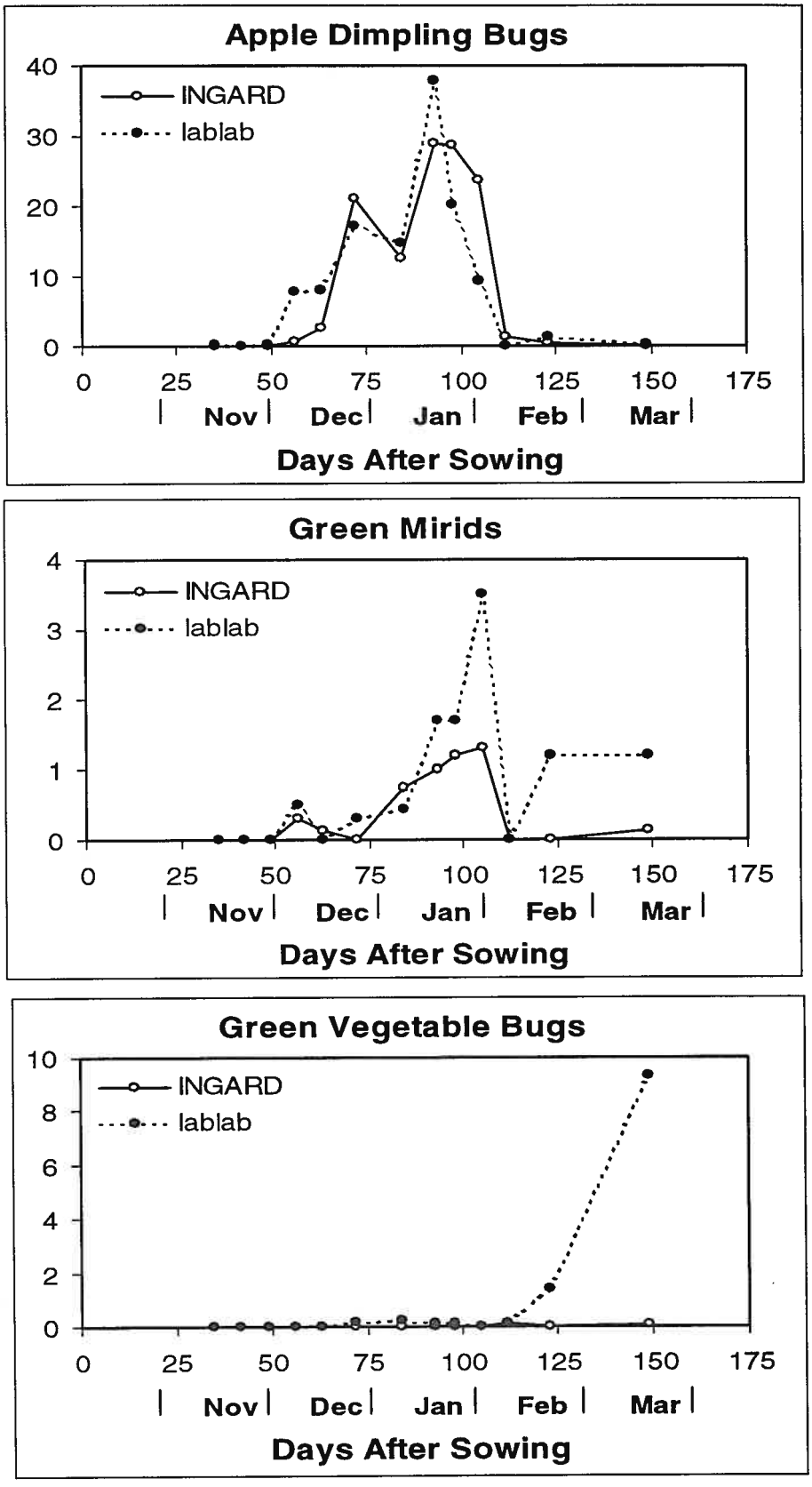

Figure 2: The numbers of other cotton pests in INGARD cotton and adjacent lablab strips at Jimbour during 1999/2000. Data are the mean numbers collected from 20 m row of crop with a suction machine (n = 16). The lablab was slashed on 31 Jan. 2000 (105 DAS).

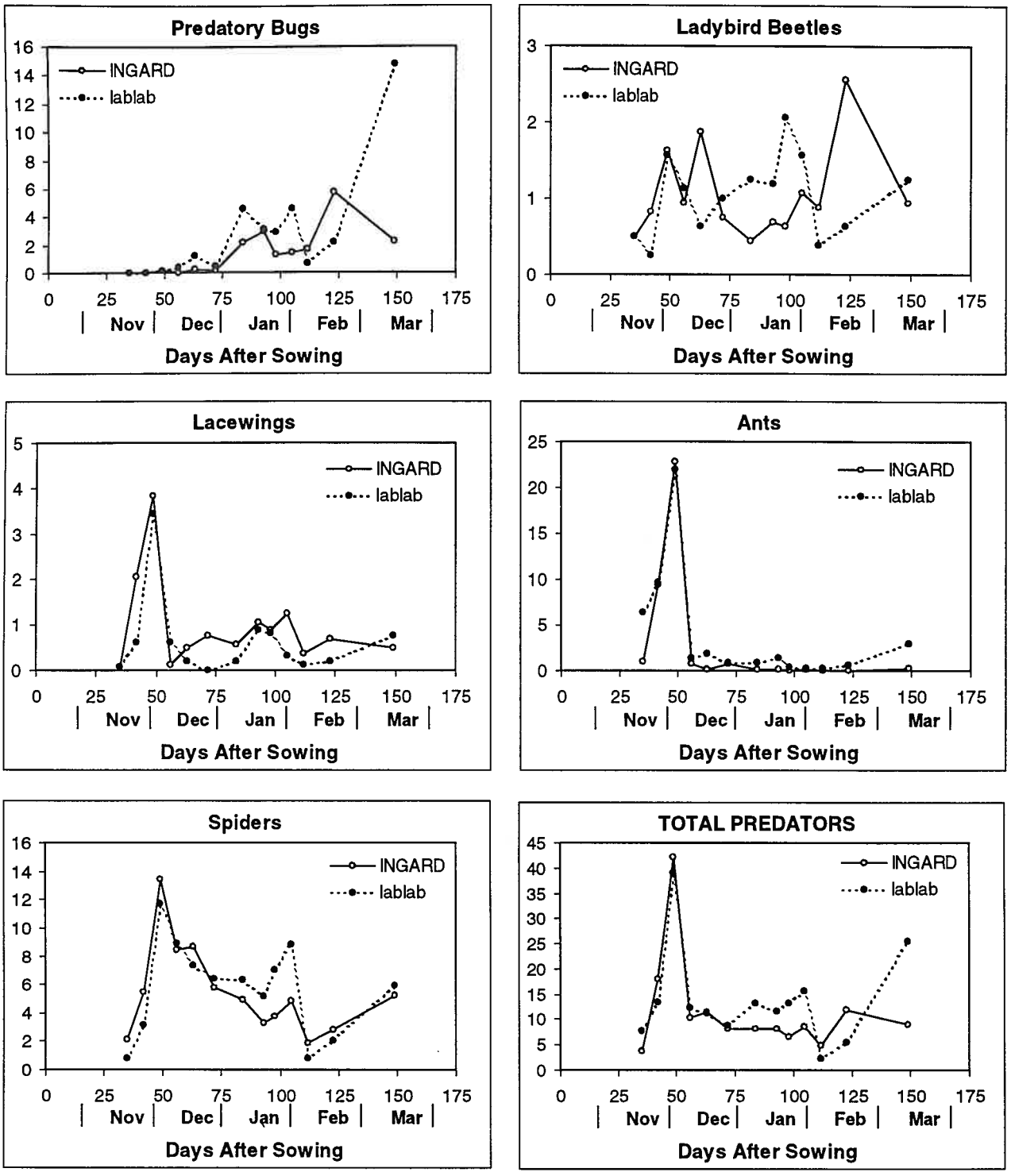

Figure 3: The numbers of beneficial insects and spiders found in INGARD cotton and adjacent lablab strips at Jimbour during 1999/2000. Data are the mean numbers collected from 20 m row of crop with a suction machine (n = 16). The lablab was slashed on 31 Jan. 2000 (105 DAS).

Table 1: The total numbers of predators collected in suction samples during the season. Data are the total numbers of each species collected from 208 samples in each crop over the season. Each sample was a 20 m row of crop.

Species of Predator	Scientific Name	Number Collected		
		INGARD	Lablab	Total
Bugs:				
Damsel Bug	*Nabis kinbergii*	120	237	357
Brown Smudge Bug	*Deraeocoris signatus*	52	154	206
Pirate Bug	*Orius* sp.	101	101	202
Shield Bug	*Oechalia schellenbergii*	3	32	35
Big-eyed Bug (BEB)	*Geocoris lubra*	9	16	25
Glossy Shield Bug	*Cermatulus nasalis*	0	10	10
Green BEB	*Germalus* sp.	0	3	3
Total Bugs		**285**	**553**	**838**
Ladybirds:				
Two-spotted	*Diomus notescens*	62	41	103
Transverse	*Coccinella transversalis*	47	36	83
Striped	*Micraspis frenata*	23	50	73
Variable	*Coelophora inaequalis*	29	34	63
Three-banded	*Harmonia octomaculata*	18	5	23
Spotted	*Harmonia conformis*	1	3	4
Larvae (all)		39	45	84
Total Ladybirds		**219**	**214**	**433**
Red and Blue Beetle	*Dicranolaius bellulus*	8	9	17
Green Lacewing	*Mallada* sp.	100	67	167
Brown Lacewing	*Micromus tasmaniae*	56	38	94
Lacewing Larvae		46	26	72
Total Lacewings		**202**	**131**	**333**
Spiders:				
Lynx	*Oxyopes* spp.	301	310	611
Night Stalker	*Cheiracanthium* spp.	136	303	439
Tangle Web	Family Theridiidae	308	111	419
Jumping	Family Salticidae	110	173	283
Flower	Family Thomisidae	94	173	267
Orb Weavers	Family Araneidae	59	19	78
Others		123	99	222
Total Spiders		**1131**	**1188**	**2319**
Ants:				
Small Black	*Iridomyrmex* sp.	509	424	933
Large Black	*Iridomyrmex* sp.	37	251	288
Green Head	*Rhytidoponera* sp.	20	94	114
Total		**566**	**769**	**1335**

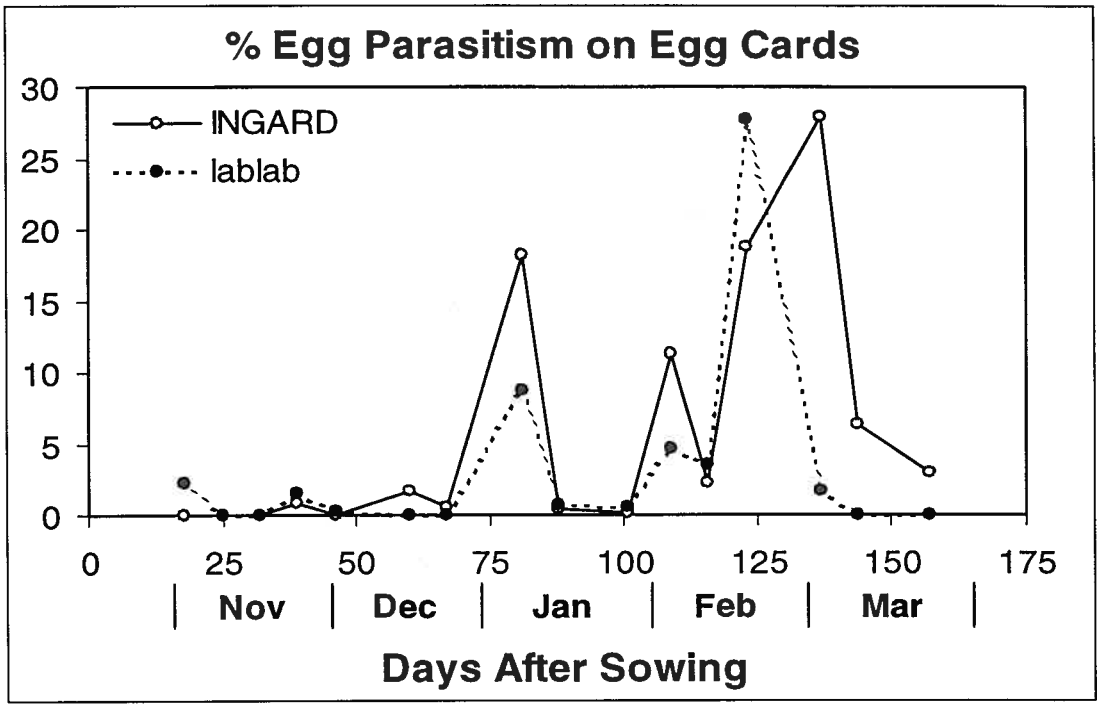

Figure 4: The levels of heliothis egg parasitism recorded on egg cards at "Coondarra", Jimbour. The lablab was slashed on 31 Jan. 2000 (105 DAS).

Table 2: The levels of heliothis egg parasitism recorded for field collected eggs.

Crop	Date	% Egg Parasitism (No. Eggs Collected)		
		White Eggs	Brown Eggs	Total Eggs
lablab	19 January 2000	0 (46)	2.4 (55)	1.4 (101)
	21 January 2000	0 (33)	0 (55)	0 (88)
	25 January 2000	0 (30)	0 (19)	0 (49)
	27 January 2000	0 (3)	0 (48)	0 (51)
	31 January 2000	0 (31)	4.9 (47)	3.1 (78)
	Total	**0 (143)**	**1.8 (224)**	**1.1 (367)**
INGARD	25 January 2000	52.0 (31)	71.4 (37)	63.3 (68)
	2 February 2000	-	66.7 (76)	66.7 (76)
	9 February 2000	-	8.0 (42)	8.0 (42)
	Total	**52.0 (31)**	**55.8 (155)**	**55.2 (186)**