

# **CROPPING ENTOMOLOGY ANNUAL REPORT**

**1976-77**

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1978

# CROPPING ENTOMOLOGY

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## CROPPING ENTOMOLOGY

(1976-77)

### I. GENERAL

The influence of legume/cereal intercropping on the development of pest populations has been examined with particular emphasis on the important pest, *Heliothis armigera* (Hubner). This year information on the pest/parasite relationship in intercrops has also been obtained.

### II. *Heliothis armigera* (Hubner)

*H. armigera* was recorded feeding on 50 cultivated plant species and 51 weed species. The most significant "carry over" hosts in the hot summer season are the weeds *Datura metel*, *Acanthospermum hispidum* and *Gynandropsis gynandra*. However, out of season crops of tomato, cowpea, and maize grown under irrigation carried a large number of larvae with up to 156,000 larvae/ha on cowpea in March. In January 103,000 larvae/ha were found on pigeonpea, while on chickpea in the same month up to 248,000 larvae/ha were present. Generally populations were low on all host plants from April to June.

Peak oviposition in *H. armigera* is generally associated with the flowering of its host plants. Detailed observations were carried out on moth behaviour in cowpea and irrigation was noted to cause a considerable increase in the number of adults present in the crop.

Nineteen parasitoids of *H. armigera* have been recorded. Parasitism levels varied depending on crop and season. Parasites were recorded in all months except June. Nematodes were important early in the season (July-September), Diptera in October and January, and Hymenoptera in most months but particularly in September-October and December-February. Overall parasitism levels were far higher on crops which had not been sprayed (28%) than on sprayed crops (10%) (Table 1.). This was also true in other areas of Andhra Pradesh where parasitism rates of 1 to 3% were recorded in DDT sprayed intercropped pigeonpea compared with 22% in one unsprayed field. Egg parasites recovered were *Trichogramma confusum* Viggiani and *Microchelonus curvimaoulatus* Cameron. No virus particles were recovered from a number of diseased larvae submitted to the Boyce Thompson Institute. Studies on chickpea grown in 25 farmers' fields revealed high parasitism levels on *H. armigera* and this had a considerable influence on the pod damage which was generally low (upto 8% pods damaged). Three farmers applied DDT at early podding stage but with no obvious benefit.

### III. INTERCROPPING STUDIES

Techniques for assessing pest and pest parasite ratios and yield losses in intercrops were devised using two cultivars of pigeonpea Hy-2 (semi-erect) and Hy-3A (erect) in both Alfisols and deep Vertisols. The treatments were sole crop pigeonpea (PP), pigeonpea intercropped in alternate rows with CSH-5 sorghum (PP/S), with HB3 pearl millet (PP/PM), with H1 *Setaria* (PP/St) and pigeonpea mixed with sorghum within rows (PP+S).

TABLE 1. LARVAL PARASITISM ON *Heliothis armigera* (Hubner) IN SPRAYED VERSUS PESTICIDE FREE AREAS, ICRISAT CENTRE (September 1976-March 1977)

Parasites	Larval percent parasitism	
	Pesticide free area (BA-25)	Sprayed area (Rest of ICRISAT Centre)
<b>1. <u>Diptera</u></b>		
<i>Caroelia illota</i> Curran.	8.3	3.1
<i>Goniophthalmus halli</i> Mes.	9.9	1.4
Others (3 species)	1.0	0.6
Total	19.2	5.1
<b>2. <u>Hymenoptera</u></b>		
<i>Diadegma</i> sp.	5.3	4.7
<i>Eriborus argenteopilosus</i> Cameron	3.1	0.3
<i>Camponotus chlorideae</i> Uchida	0.6	0.8
Others (5 species)	0.2	0.1
	9.2	5.3
Overall parasitism	28.4	10.4
Total larvae collected	3828	7877

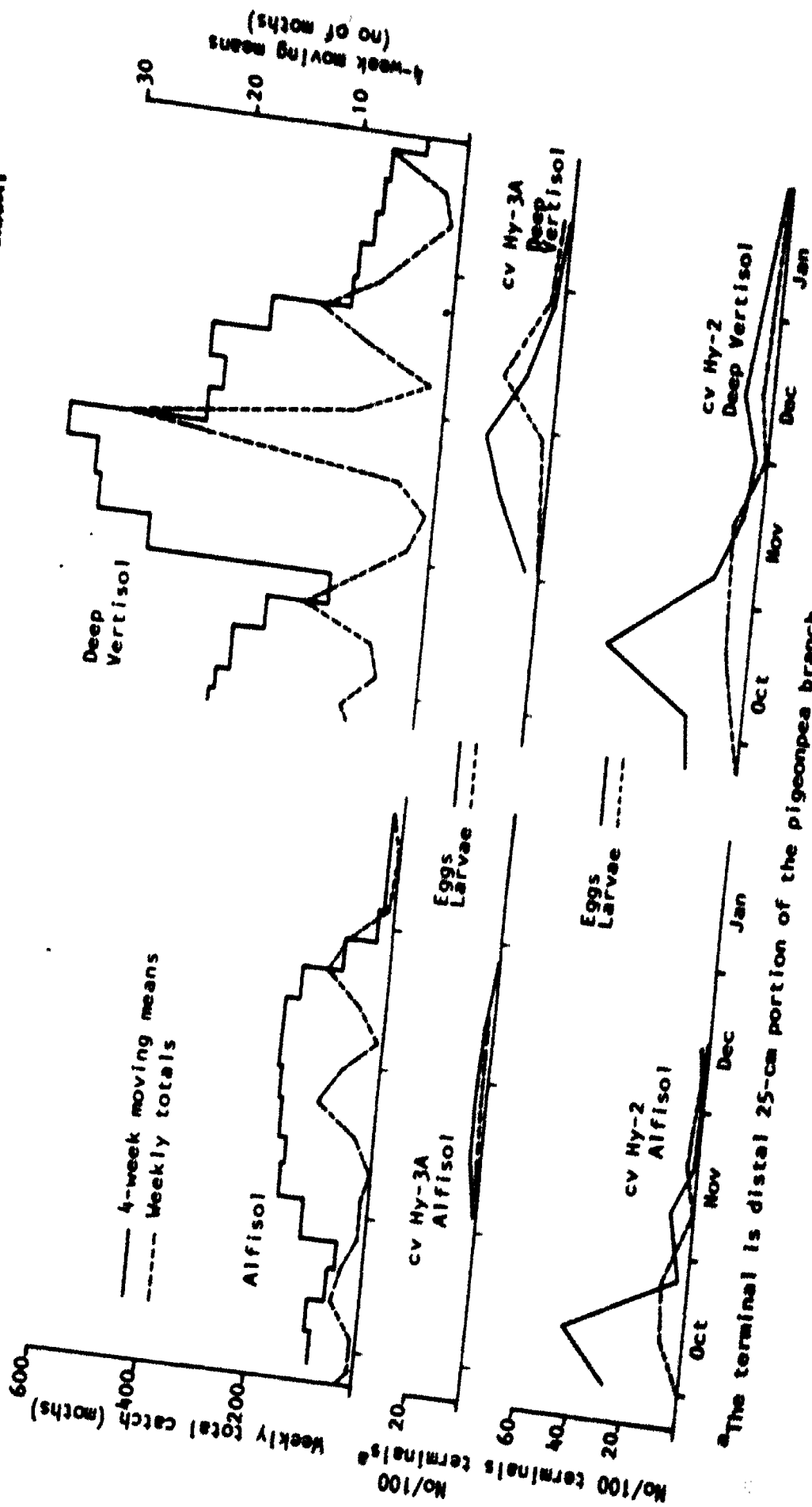
Several pod borers were recorded damaging pigeonpea, but the pod borer *H. arwigeru* was by far the most common species present and an obvious cause of yield loss. During the later stage the damage by pod fly, *Melanagromyza obtusa* (Mall.) increased, particularly on CV.Hy-3A.

The eggs laid and number of larvae of *H. arwigeru* were far lower on pigeonpea grown on the Alfisols than on the deep Vertisols and similar trend appeared in moth numbers trapped (Fig.1). The larval parasitism by Diptera was much higher than by Hymenoptera on pigeonpea and levels declined as both the cultivars approached maturity in both soil types.

No difference in *M. obtusa* damage levels were observed between trials grown on the soil types, but time played an important role. Cultivar Hy-3A was more susceptible and heavily attacked. An increasing trend of pod shedding in CV. Hy-2 on Vertisols and CV.Hy-3A on Alfisols was observed. Upto 62% of shed pods were damaged, 56% by lepidopteran borers, 2% by pod fly and 4% by a hymenopteran pests, *Taraxostigmodes* sp.

The final yield loss data were obtained using the actual weights of damaged and undamaged pods and seeds and calculating the potential yields if all pods had been undamaged. Loss in seed yield caused by insect pests was lowest in sole crop blocks in CV.Hy-2 in Vertisol and CV.Hy-3A in Alfisol (Table 2). Increased damage to pigeonpea in Vertisols resulted in lowering of shelling percentages in both the cultivars.

**FIGURE 1:**  
**EGG AND LARVAL NUMBERS OF *HELIOTHIS ARMIGERA* (NUMBER/100 TERMINALS ON INTERCROPPED PIGEONPEA (cv Hy-2 and Hy-3A) AND TRAP RECORDS OF MOTHS AT TWO LOCATIONS, ICBSAT CENTER, 1976-77**



<sup>a</sup>The terminal is distal 25-cm portion of the pigeonpea branch.



**TABLE 2. POD NUMBERS PRODUCED PER 25 PLANTS, YIELD (KG/HA) AND PERCENTAGE INSECT-CAUSED YIELD LOSS\* ON INTERCROPPED PIGEONPEA (CV. Hy-2 AND Hy-3A) ON ALFISOLS AND VERTISOLS, ICRISAT CENTER, 1976-77**

Treatment	Hy-2		Hy-3A		
	Alfisol <sup>b</sup>	Vertisol <sup>b</sup>	Alfisol <sup>b</sup>	Vertisol <sup>b</sup>	
PP/S	Pod No.	930.2	710.2	582.7	525.8
	Yield/ha	320.2	169.6	175.7	84.4
	% yield loss	19.7	35.1	43.9	43.0
PP + S	Pod No.	790.7	426.6	707.2	455.0
	Yield/ha	336.5	129.3	279.2	69.9
	% yield loss	23.2	39.6	41.3	51.1
PP/PM	Pod No.	1045.0	765.6	837.5	424.4
	Yield/ha	302.2	219.3	375.0	94.6
	% yield loss	18.0	23.9	38.9	54.6
PP/St	Pod No.	1175.5	841.2	888.0	651.6
	Yield/ha	405.7	229.5	426.7	200.0
	% yield loss	24.1	27.3	35.6	49.0
PP	Pod No.	1101.7	1257.8	1277.0	677.2
	Yield/ha	317.2	489.5	634.5	193.8
	% yield loss	20.7	22.6	31.0	55.0
CD (P<0.05)	Pod No.	NS	NS	227.1	86.1
	Yield/ha	NS	NS	169.2	NS
	% yield loss	3.8	9.0	NS	NS

PP - Pigeonpea; S - Sorghum; PM - Pearl Millet; St - Setaria

\* Inclusive of two pickings in CV. Hy-2

The yield of both cultivars was higher on Alfisols in inter-cropped blocks but CV. Hy-2 in sole crop blocks yielded more on Vertisols (see Table 2).

#### IV. CROP PROPORTION (PIGEONPEA/ ) STUDIES

On sorghum (CSH-5) and pigeonpea (ICRISAT-1) sown in late June on Vertisols in various crop proportions the percentage larval parasitism on *H. armigera* declined with the increase in plant population but the levels were only significantly different ( $P < 0.05$ ) during the peak parasite activity on pigeonpea (Table 3). Data from similar trials during 1975-76 on both soil types have revealed that fewer egg and larval numbers are present per ha from blocks with fewer plants per ha. The pest numbers, pest-parasite ratios and plant density relationship will affect the efficiency of selection procedures for resistance to *H. armigera* in the pulse screening program.

#### V. PEST MONITORING ON SORGHUM IN INTERCROP/CROP PROPORTION TRIALS

It was confirmed that shoot fly, *Atherigona soocata* Rond. attack was more severe on late sowings. The damage levels were higher on sorghum grown on Alfisols with upto 43% compared with a maximum of 20% in Vertisols. This was associated with slow initial growth of seedlings in Alfisols, which was also a factor encouraging heavier attack on sorghum in some Vertisols areas sown after unweeded fallow. *Orius* sp., a predatory bug and earhead bugs, *Calocoris angustatus* Leth., were present in higher numbers in Alfisols than on Vertisols (53 compared with 25 per 40 earheads and 16.5 compared with 3 per 40 earheads, respectively). Predatory spiders were found in greater

TABLE 3. PARASITISM LEVELS (%) ON *Heliothis armigera* (Hubner) ON SORGHUM (CSH-5) AND PIGEONPEA (ICRISAT-1) GROWN IN VARIOUS CROP PROPORTIONS IN DEEP VERTISOLS, ICRISAT CENTER, 1976-77

Plant pop. (thousand/ha) (Pigeonpea:sorghum)	% Parasitism				
	Sorghum		Pigeonpea		
	Mid Sep.	Late Nov.	Mid Dec.	Early Jan.*	Early Feb.
32.0 : 85.5	40.5	9.5	32.0	34.5	39.4
15.0 : 128.5	37.9	9.5	37.0	50.5	34.4
11.5 : 145.0	31.5	8.0	39.0	51.0	17.9
8.0 : 150.0	26.9	15.0	53.0	59.0	30.2
CD (P<0.05)	NS	NS	NS	7.3	NS

\* Peak activity of parasites observed

numbers on sorghum earheads on Alfisols, unlike thrips which were more on Vertisols (21 compared with 15 per 40 heads).

#### VI. LIGHT TRAP STUDIES AND INSECT FAUNA AT ICRISAT CENTER

A third light trap at a Vertisols watershed was commissioned in April. Regular monitoring by light traps of over 50 important pests of the SAT on legumes and cereals for the past three years is revealing basic information on seasonal variations in pest species.

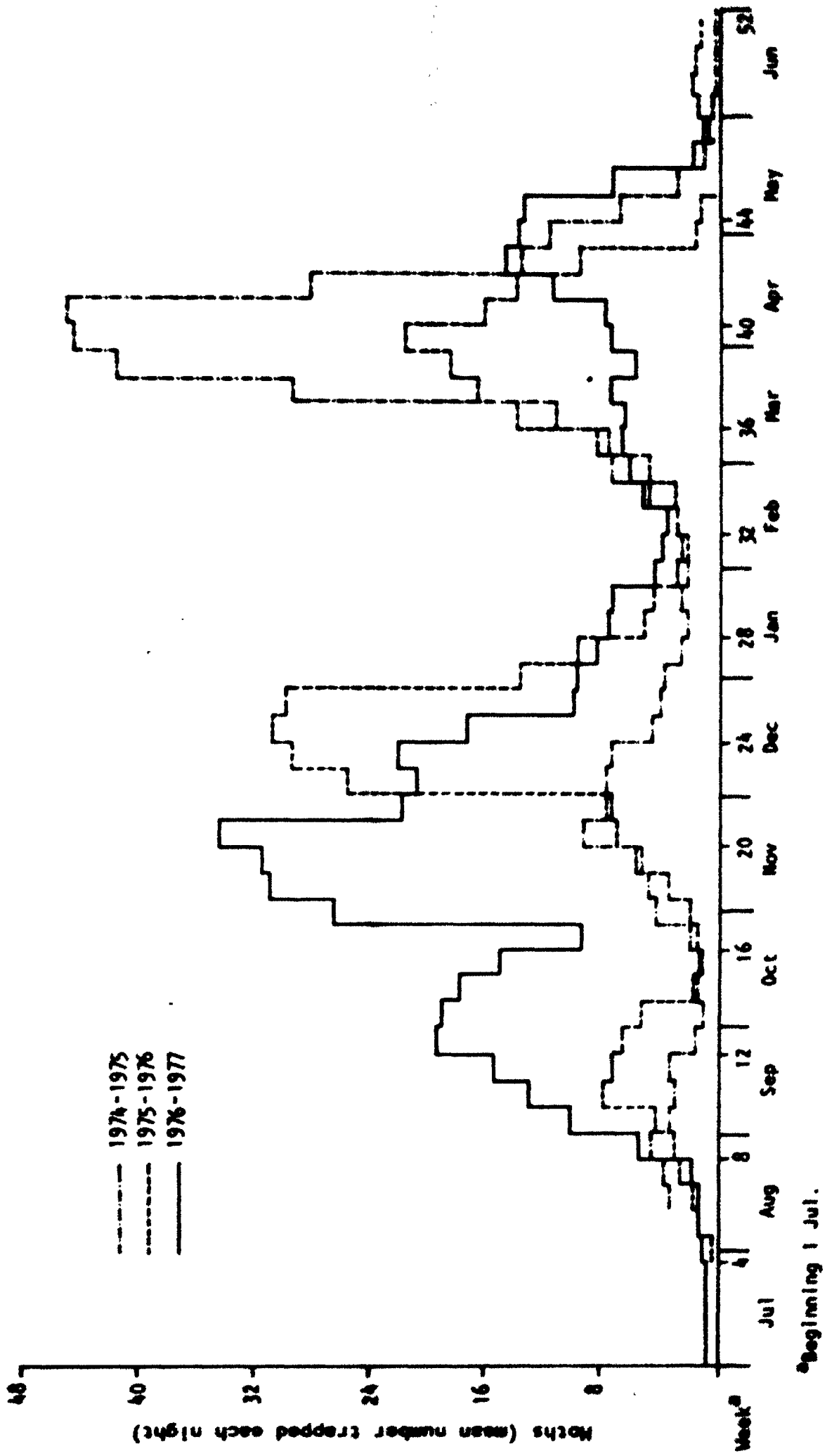
Four week moving means during 1974-77 for *H. armigera* moths recorded from Trap 1 are shown in Figure 2. The first and the third peaks were further displaced during this year but the second appeared in the same week as observed during 1974-75. A fourth peak at the end of April in this year was from a summer cowpea crop at the ICRISAT Center.

The most significant pests and beneficial fauna to date on the range of crops were authenticated. A list of parasites, predators and hyperparasites along with a detailed list of pests and insects has been compiled.

#### VII. LOOKING AHEAD

In cropping systems entomology it is hoped to use larger plots to provide a more realistic 'field' situation and to allow regular sampling without seriously affecting population levels. Work on pest-parasite surveys to establish the real farmer situation will also be intensified. Since there are indications that some insecticide sprays

**FIGURE 2:**  
**CATCH OF *HELIOTHIS ARMIGERA* (MUMMERS) AT ICISSAT CENTER**  
**(Trap No. 1, C.I. Bldg, Aug '74 - May '77. Plotted as 4-week moving average)**



<sup>a</sup>beginning 1 Jul.

may still be necessary in intercropping situations, the development of integrated pest-management systems will be a prime objective in future years. The importance of plant type, plant populations and spacing will also be studied further.

Collaboration with organisations, such as COPR, Boyce Thompson and CIBC on the possibility of biological and viral control of *Heliothis* is being discussed and a survey of biological and microbial agents on *H. armigera* in India is planned for the coming season. An initiative to establish a trap grid in India to elucidate migratory behaviour of *H. armigera* within the sub-continent will hopefully mature.