INCIDENCE OF COTTON INSECT PESTS IN COTTON AGRO-ECOSYSTEMS IN UGANDA

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ABSTRACT

Comparative study on the population incidence of common pests of cotton in different agro-ecosystems in Uganda was carried out at each of Namulonge and Serere Agricultural and Animal Production Research Institutes; NAARI and SAARI, respectively during the cotton growing seasons 1994/95 and 1995/96. Population of the secondary pest species; thrips, aphids, whiteflies and jassids were estimated as percentages of infestation, while that of the primary pest species; lygus bugs, bollworms and stainers were counted visually at weekly intervals in both locations. Sex pheromone traps were used to monitor bollworm moths population in the two areas. Trend of pests population was different in the two sites. Rates of infestation by aphids were higher at NAARI, while that of thrips, whiteflies and jassids were higher at SAARI. Lygus, American- and pink bollworms; ABW and PBW, population were higher at SAARI, while that of stainers and spiny bollworm, SBW, were higher at NAARI. Lygus, ABW and SBW populations peaked during 3 - 5 month after germination in both areas, which suggests advancing the dates of recommended routine spray in the country to meet the peaks of the key pests as well as depending on scouting and the control action threshold levels tested in this respect to reduce the number of sprays. Stainers and PBW population increased sharply by the end of the season.

KEY WORDS: Uganda, Cotton, Pests, Population densities, IPM

INTRODUCTION

A large complex of insect and spider mite species is found in cotton ecosystems whenever the crop is grown. Of this large number, comparatively few are pests of economic significance. Many are beneficial species, either arthropod parasitoids or predators. The population of the few pests must be managed if cotton is to be grown profitably. The approach of controlling key pests by the sole use frequent and repeated applications of insecticides usually leads to the destruction of natural enemies and serious imbalance results in producing secondary pest outbreaks. Therefore, it is precisely on such key pests that IPM programs should be focused.

Cotton crop is subject to attack from the time seeds are planted until harvest. All the plant parts may be attacked, but serious

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pests are that attack the fruiting portions, reducing quality of the harvested lint and seed.

Population of different species coexisted interact with each other, thus demanding study at the community level. Inter- and intraspecific competition play an important role, and comparative studies between species and habitats are closely related and ecologically contribute greatly to data interpretation and decision making.

Available literature revealed that very few studies have been conducted on cotton pest problems in Uganda. **Coaker, 1959 and Nyiira, 1970** surveyed cotton pests and their natural enemies in the country. Recently, **Sekamatte, 1994** studied pest status and control of the cotton aphid, *Aphis gossypii* Glov. in cotton fields and **El-Heneidy et al, 1995a, 1996a, and EL-Heneidy and Seakamatte 1996a** manipulated cotton problems in the country to implement the IPM system in the cotton growing zones.

Pest management in cotton cannot be considered outside of the context of the agro-ecosystem. Sampling provides a better understanding of the complex plant - pest relationships.

The present study was carried out under the IFAD/World Bank Project " Smallholder Cotton Rehabilitation Project " (SCRP) in Uganda. This study focused on population incidence of common insect pests of cotton in the two different cotton agro-ecosystems; the dry region in eastern north and the wet region in southern west of Uganda **(Anon, 1991 and 1993 and EL-Heneidy et al., 1996a).**

METHODS AND TECHNIQUES

Studies were conducted in one experimental plot (approximately 2 hectares) located at each of Namulonge and Serere Agricultural and Animal Production Research Institutes, NAARI and SAARI, representing the two different cotton agro-ecosystems; the wet and dry regions of Uganda, respectively. Studies were carried out during the two cotton growing seasons 1994/95 and 1995/96 at NAARI and for only one season 1995/96 at SAARI. At SAARI, the plot was divided into two sub-plots to compare incidence of insect pests in early (E) and late (L) cotton plantings. Experimental plots were planted with the recommended cotton varieties of each region; BPA,89 and SATU,85, at the recommended planting periods; during July and June at NAARI and SAARI, respectively, in addition to the late planting at SAARI, which planted in August (about 2.5 months later than the early one). The plots were surrounded by conventional farming system crops; mainly sorghum, maize, beans, cassava, and cotton. Regular cultural practices were conducted throughout the seasons. To avoid any interference of pest populations, no insecticides were applied in the plots throughout the two seasons of the study.

Beginning 1-2 weeks after germination (WAG), designated 100 plants / sampling occasion / plot / location were inspected weekly and visual counts of different insect species were taken up to harvesting. The stratified scouting technique was used (Garcia et al., 1982 and Legaspi et al., 1989).

Counts of thrips, aphids, whiteflies and jassids were estimated according to the relative categories of infestation as follows: Low =< 10, Medium = 11 - 25 and high => 26 individuals/leaf. By taking means of the three leaves per plant, one each from top, middle and lower portions of the plant, percentage infestation was calculated from 300 leaves/ 100 plants. Actual numbers were visually counted for the major cotton pests; lygus bugs, bollworms and stainers (Anon, 1991 and 1993, and EL-Heneidy et al., 1995b and 1996a).

Sex pheromone traps were placed at the beginning of squaring period in each of the experimental plots for monitoring bollworms population. Trap catches were recorded twice a week.

Obtained data was statistically analyzed using ANOVA for each of the experimental plots.

RESULTS

The following insect pest species; thrips, *Thrips* sp., aphids, *Aphis gossypii* Glov., whiteflies, *Bemesia tabaci* Genn., jassids, *Empoasca* spp., lygus bugs, *Taylorilygus vosselori* Popp., American bollworm (ABW), *Helicoverpa armigera* Hb., spiny bollworms (SBW), *Earias insulana* Boisd. and *E. piblaga* Wlk., pink bollworm (PBW), *Pectinophora gossypiella* Saunds, stainers, *Dysdercus* spp., and some other species of stink bugs were reported by Anon, 1991, 1993 and EL-Heneidy et al, 1996a as the most common and abundant species attacking cotton plants in the cotton fields in Uganda. Throughout this study almost the same species indicated above were recorded in the two different agro-ecosystems of cotton in Uganda but in relatively different trends and abundances.

Obtained data on the secondary pest species; thrips, aphids, whiteflies, and jassids of the two seasons and the two working sites are summarized in table 1. As shown in the table, infestation rates were relatively higher at SAARI by thrips, whiteflies and jassids, and at NAARI by aphids. Rates of infestation increased obviously in the second half of the season at SAARI, while that of aphids built up gradually, except NAARI,95 to reach their peaks by mid-season and then declined also gradually towards the end of the season. At NAARI,95 aphids infestation started very high and continued apparently high throughout the season.

Thrips infestation rates peaked during 2 - 4 and 3 - 6 MAG at NAARI and SAARI, respectively. Highest infestation rate (23.3 %) was recorded at SAARI (E) during the second week of the 4th MAG.

Aphids infestations peaked during 2 - 6 and 3 - 4 MAG at NAARI and SAARI, respectively. Highest infestation rate (98.3 %) was estimated at NAARI,95 during the 3rd week of the 3rd MAG.

Whitflies infestation rates peaked during 4 - 6 and 2 - 3 MAG at NAARI,94 and 95, respectively, while they peaked 2 - 6 MAG at SAARI in both E and L plantings. Highest infestation rate (83.3 %) was recorded at SAARI (E) during the 3rd week of the 4th MAG.

Jassids infestations peaked during 2 - 6 at NAARI in the two seasons of the study, while they peaked 2 - 6 and 4 - 6 MAG at SAARI E and L plantings, respectively. Highest infestation rate (71.7 %) was recorded at SAARI (L) during the 3rd week of the 6th MAG.

Data illustrated in figures 1,2 and 3 indicates trends of the population of the primary insect pests of cotton in Uganda; lygus bugs, bollworms and stainers. As shown in the figures, lygus, ABW and SBW populations started first during squaring period by relatively low numbers and then increased sharply. PBW and stainers occurred by mid-season but their population built up very rapidly at the end of the season. Generally, lygus population was relatively higher at SAARI than at NAARI, while the populations of the SBW and the stainers were obviously higher at NAARI. ABW and PBW populations were almost equivalent in the two sites, except that of ABW, which was higher during the first half of the season at SAARI and during the second half at NAARI.

Lugus populations peaked during 3 - 5 MAG in the two areas. Highest number of the pest species (84 bugs/ 100 plants) was counted at SAARI during the 1st week of the 4th MAG.

ABW numbers peaked during 2 - 5 MAG in the two locations. Highest number of the pest species (39 larvae/ 100 plants) was recorded at NAARI,94 during the 2nd week of the 6th MAG.

SBW populations peaked during 3 - 5 MAG in the two sites. Highest population of the SBW (12 larvae/ 100 plants) was found at NAARI,94 during the 2nd week of the 4th MAG.

PBW numbers peaked during the last month of the season (6th MAG) in the two areas. Highest number of the PBW (11 larvae/ 100 plants) was counted during the last week of the 6th MAG. It was observed that the pest population increased in the dry bolls after picking.

Stainers populations peaked during 5 - 6 MAG in the two locations. Highest population of the stainers (255 individuals/ 100 plants) was recorded at NAARI,94 during the 2nd week of the 5th MAG.

Sex-Pheromone Traps:

Sex-pheromone traps were tested in the cotton fields in Uganda during the two cotton growing seasons, 1994/95 and 1995/96 to provide detection of early bollworms infestation, monitoring of established populations and assisting in the timing of pesticide application. Obtained data indicated that PBW trap catches was comparatively much higher than the other two bollworm species; ABW and SBW in both locations and seasons (Table 2). ABW moth catches were slightly higher at NAARI, while that of SBW were recorded rarely and in unrepresentative numbers despite the pest larvae were counted regularly in the experimental plots. PBW catches increased drastically during the last two months of the season prior to harvesting, when they reached their peaks of; 69, 244 and 630 moth/trap/month at NAARI,94, NAARI,95 and SAARI,95, respectively mostly in January. As shown also in table (2), the catches continued their increases in the following month after harvesting.

DISCUSSION

Obtained data establishes that:

- rates of infestation and population dynamics of the insect pests of cotton recorded in this study were substantially different not only from one region to another but also from one season to another in the same location (at NAARI). **Coaker, 1959** reported that the ABW was not a serious pest in cotton and other crops in southern Uganda, and theorized that the year-round availability of food plants allowed a balance between the pest and its natural enemies. Our results as well as that of **Nyambo, 1988** disagree with the findings of Coaker, since the pest population has obviously increased due to the intensive use of insecticides in the cotton fields in Uganda and Tanzania in the last two decades.

- synchronous plantings are clearly important in areas where climatic factors allow continual development of pest infestation. Late crops are always more severely infested than those sown early **(EL-Heneidy et al., 1996b)**.

- the methodology used in this study was simple, based on visual recording in the field and facilitated interpretation of the findings. This scouting technique has been adapted to assist in IPM training of extension personnel and smallholder cotton farmers in Uganda.

- relatively high infestation rates were recorded by aphids at NAARI, and by whiteflies and jassids at SAARI throughout the seasons. Chemical control is not recommended during early stage of the season because under normal circumstances, these pests are considered of minor economic importance as they feed only on foliage, and on the other hand, they provide abundant sources of food for predators that enter the cotton fields. During mid- and

late season, these pests are included in the chemical control applied during these periods against the primary pests **(Sekamatte, 1994 and EL-Heneidy et al., 1995b)**.

- chemical control should depend on scouting and assessment of pests population **(EL-Heneidy et al., 1996a, and Sekamatte and EL-Heneidy, 1996a)**. This information assist so far in adoption of the timing of effective sprays as well as conservation of the natural enemies.

- depending on the control Action Threshold Levels (ATLs) reported by **EL-Heneidy and Sekamatte, 1996a** and as shown in the figures 1 and 2, the general mean of lygus bugs population exceeded the ATLs during the period 3 - 5 and 3 - 6 MAG at NAARI and SAARI, respectively. ABW population exceeded the ATLs during 3 - 6 and 2 - 3 MAG at NAARI and SAARI, respectively. SBW population exceeded the ATLs during 3 - 4 MAG only at NAARI and not at SAARI. Therefore, most of the key pest populations peaked during 3 - 5 MAG in the cotton fields in the two regions which suggests that the routine scheduled spray regime, which starts 35 days after germination, can be advanced at least one month to be more effective. **EL-Heneidy and Sekamatte, 1996a** stated that treatment-when-necessary schedules based on appropriate techniques of monitoring major pest populations and crop development reduced the four routine sprays to two effective ones and increased the yield about 2 - 3 folds.

- further studies are still needed for the control of the stainers, the late season pest species, which increase rapidly in the period when chemical control is not recommended to avoid contaminating the cotton lint and seeds. **EL-Heneidy and Sekamatte, 1996b** reported that the late season plantings of maize and sorghum showed significant attractiveness to the stainers at the end of the cotton season.

- destruction of the dry bolls remaining on the cotton stalks after harvesting is the most important cultural practice used to reduce the PBW population entering the diapause and emerge in the following cotton season to reattack the cotton bolls **(EL-Heneidy et al., 1995b)**.

- Statistical analyses indicated that least significance was found between the two planting dates at SAARI,95, and the two seasons at NAARI, while significant differences were recorded between the two cotton regions particularly, in thrips, aphids, jassids, and stainers populations.

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Table (1): Monthly percentages of infestation by the secondary insect pests of cotton at NAARI and SAARI during 1994/95 and 1995/96 cotton growing seasons.

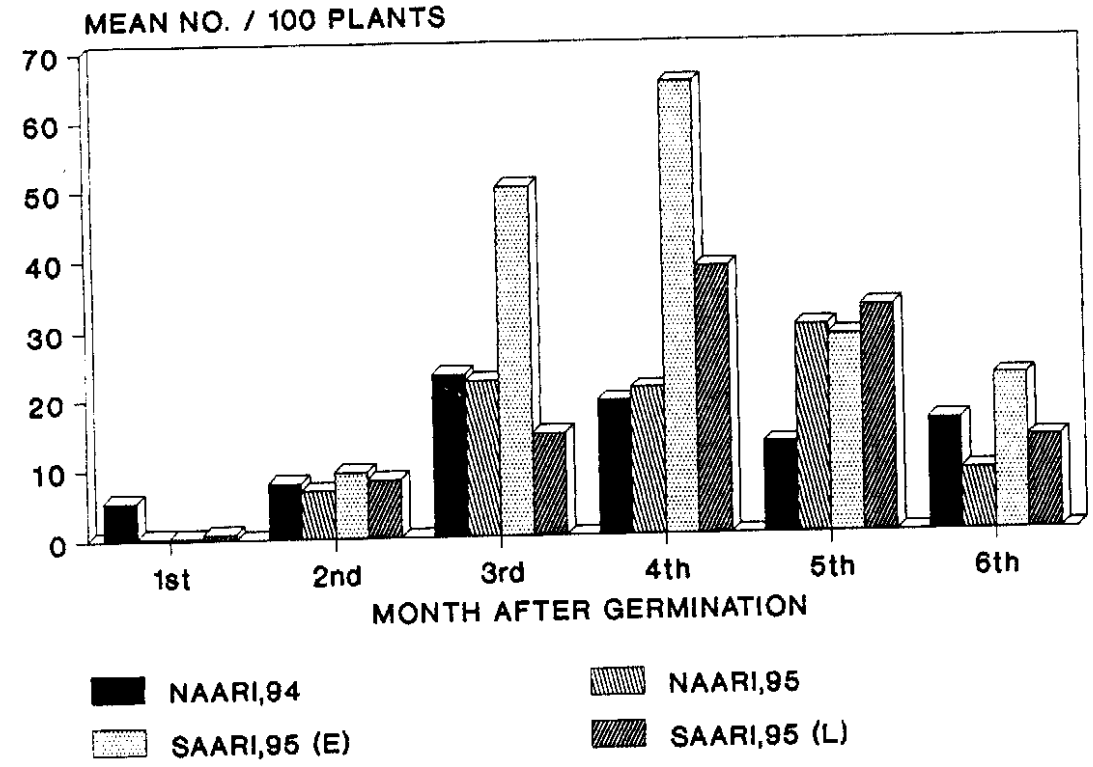
MAG / LOCATION	% INFESTATION			
	THRIPS	APHIDS	WHITEFLIES	JASSIDS
1st				
NA,94	0.4	38.3	12.9	1.3
NA,95	0.0	94.2	19.2	0.4
SA,95 (E)	0.6	24.3	11.9	9.0
SA,95 (L)	1.7	7.1	7.5	5.4
2nd				
NA,94	0.4	54.6	17.1	3.8
NA,95	0.8	84.2	42.9	7.5
SA,95 (E)	3.0	32.2	39.9	30.4
SA,95 (L)	0.8	43.0	32.5	7.5
3rd				
NA,94	0.0	68.3	29.6	2.5
NA,95	5.0	90.4	32.1	5.7
SA,95 (E)	8.7	44.7	39.7	17.0
SA,95 (L)	6.3	15.0	51.7	10.0
4th				
NA,94	0.0	80.8	37.5	0.9
NA,95	4.5	65.0	12.1	5.9
SA,95 (E)	15.0	59.3	53.9	14.0
SA,95 (L)	7.5	32.9	48.8	44.2
5th				
NA,94	0.0	50.8	39.6	2.0
NA,95	0.8	74.6	7.1	3.8
SA,95 (E)	6.0	16.6	35.2	18.2
SA,95 (L)	5.0	44.6	45.8	42.9
6th				
NA,94	0.0	48.4	32.9	4.6
NA,95	0.0	88.9	15.0	5.1
SA,95 (E)	11.5	10.5	26.5	26.1
SA,95 (L)	10.0	30.0	71.4	47.9

NA,94 = NAARI, 1994/95
NA,95 = NAARI, 1995/96
SA,95 (E) = SAARI, 1995/96 (Early planting)
SA,95 (L) = SAARI, 1995/96 (Late planting)

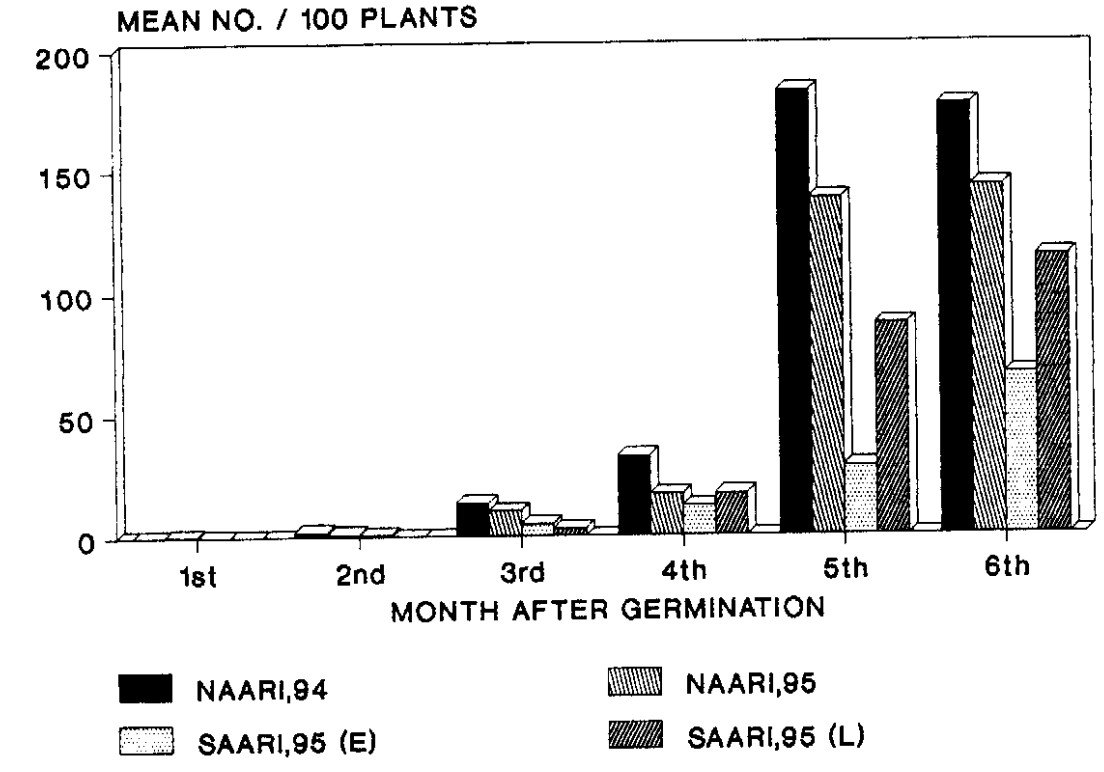
Table (2): Monthly total sex pheromone trap catches of bollworm moths at NAARI and SAARI during 1994/95 and 1995/96 cotton seasons

Month / Pest	NAARI,94			NAARI,95			SAARI,95		
	ABW	SBW	PBW	ABW	SBW	PBW	ABW	SBW	PBW
July	-	-	-	-	-	-	1	0	13
Aug.	10	0	0	1	0	0	0	0	14
Sept.	0	1	0	1	0	3	0	0	65
Oct.	7	0	0	0	0	0	0	2	68
Nov.	2	0	0	0	0	14	3	0	49
Dec.*	10	0	1	13	0	26	1	1	109
Jan.*	5	0	50	1	0	244	0	0	630
Feb.	1	0	69	1	0	234	-	-	-

* December at NAARI and January at SAARI was the month of picking.

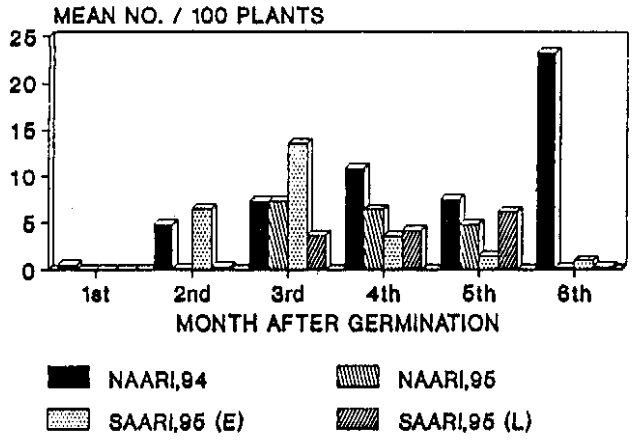


(a)



(b)

Fig. (1): Monthly mean numbers of lygus bugs (a) and stainers (b) / 100 cotton plants at NAARI during 1994/95 and 1995/96 seasons and at SAARI; early- (E) and late- (L) plantings during 1995/96 season.



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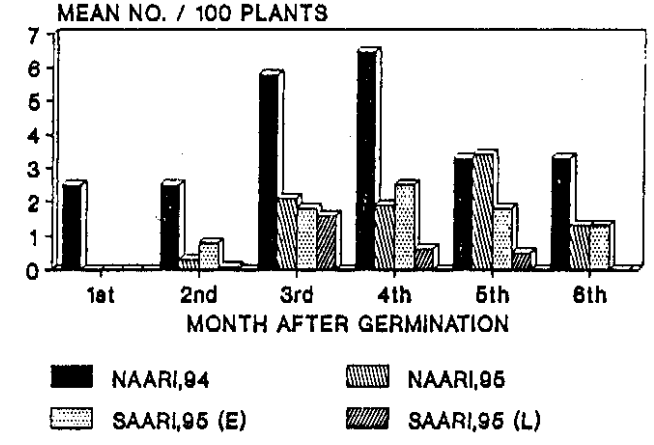

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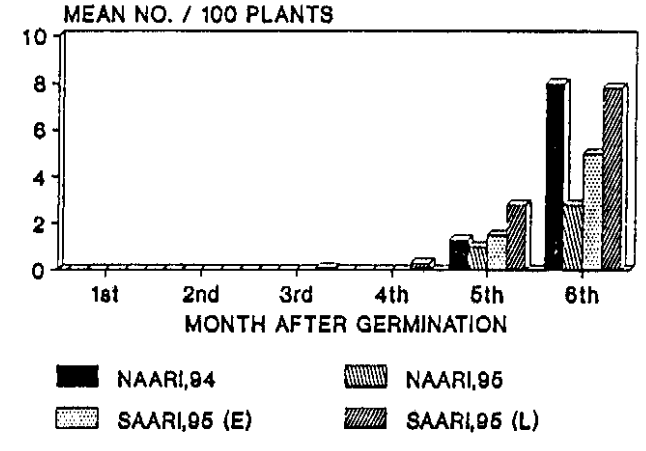

(c)

Fig. (2): Monthly mean numbers of the larvae of the cotton bollworms; ABW (a), SBW (b), and PBW (c) / 100 cotton plants at NAARI during 1994/95 and 1995/96 seasons and at SAARI; early- (E) and late- (L) plantings during 1995/96 season.