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CONTRIBUTION OF TRAP CROPS IN THE INTEGRATED CONTROL OF INSECT PESTS OF COTTON IN UGANDA.

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ABSTRACT

A study on the insect pests-predators interaction on cotton asso- ciated with common farming crops in Uganda was conducted at each of Namulonge and Serere Agricultural and Animal Production Research Institutes in the two successive cotton seasons 1994/95 and 1995/ 96, respectively. Cotton pest and predator population densities on cotton as well as the surrounding trap crops; sorghum, maize, and beans were estimated weekly throughout the cotton growing seasons. The growing seasons of all the trap crops used in this study are relatively short compared to cotton, nevertheless they showed considerable attractiveness to the major cotton pests mainly; the lygus bugs, *Taylorilygus vosselori* Popp. and the stainers, *Dysdercus* spp. to sorghum as well as the stainers to maize, and whiteflies and jassids to beans. On the contrary, trap crops also showed no preferential attractiveness to bollworms; American boll-worm, *Helicoverpa armigera* Hb. and spiny bollworms, *Earias insulana* Boisd. and *E. Piblaga* Wlk. At the same time, the population of predatory arthropod species was constantly higher on cotton with trap crops (cotton/traps) than on cotton (control) throughout the seasons. Seed cotton yields were also relatively higher (20 - 25 %) in the cotton/traps. These results seem to suggest that there is considerable contribution of the trap crops to integrated pest management of cotton pests in smallholder farming system in Uganda.

Key words: Uganda, Cotton, Trap Crops, Pests, Predators, IPM.

INTRODUCTION

Cultural manipulation provides the essential structure for biologically based alternatives for the management of pests. Cotton production worldwide has several excellent examples of using cul-tural practices as the primary base for IPM programs.

In the tropical countries, the use of monocultures is practiced only on larger farms or estates, while the more traditional approa-ches to farming utilize

polycultures. These polycultures include mixed-, row-, strip- and relay intercropping (Andrews and Kassam, 1976).

A mixed or intercropping regime provides a greater total land productivity as well as insurance against the failure or unstable market value of any single crop. In addition, crops in intercrop-ping systems may improve soil fertility and availability of alter-native source of nutritious products (Risch *et al.*, 1983) as well as reducing the incidence of insect pest attack (Tingey and Lamont, 1988) and thereby maintaining lower pest control costs. Intercrop-ping has been studied sufficiently for there is now a considerable body of evidence to show that it can be used to reduce the inci-dence of pest insects (e.g. Theunissen and Ouden, 1980, Tukahirwa and Coaker, 1982, Uvah and Coaker, 1984, and Tingey and Lamont, 1988). Population densities of herbivorous insects are frequently lower in vegetatively diverse habitats (Risch *et al.*, 1983). Herbivorous arthropods might be less abundant in the vegetatively diverse habitat because their food resources are less concentrated and therefore more difficult to find and easier to lose; because their natural enemies are more abundant and cause great mortality; or both (Nyambo, 1988).

Traditionally, smallholder farmers in East Africa, particularly in Uganda have adopted mixed, intercrops or relay cropping systems to ensure that they will be able to harvest enough food.

The use of trap crops in cotton based systems has gained considerable momentum with the increasing emphasis on integrated pest management as a strategy for production sustainability. Carefully selected trap crops used in conjunction with other management practices may provide other benefits to the production system (Guthrie, 1980).

In view of the efforts to mechanize cotton production in Uganda through animal traction; the method described in this paper (strip cropping) seems more appropriate as it allows mechanization of major operations like weeding. This paper presents results of two years study of the pests - predators interactions on cotton in association with some of the major crops in the cotton based farm-ing system of Uganda. The study provides some insight into the possible role of trap crops in improving pest management in small-holder cotton fields.

METHODS AND TECHNIQUES

One experimental plot (approximately 2.0 ha) was used at each of the two Agricultural and Animal Production Research Institutes; Namulonge (NAARI) during 1994/95 and Serere (SAARI) during 1995/96 cotton seasons. The field was divided into four sub-plots. Three sub-plots were surrounded with 8 - 10 rows of the following crops; sorghum, maize, and beans. The fourth sub-plot was planted solely by cotton and served as control (cotton/control). Maize

and sorghum were in both seasons planted 3 - 4 weeks prior to the cotton sowing dates. Beans on the other hand were planted 4 weeks after cotton emergence. Replanting was done shortly after harvesting the first maize crop on same rows to ensure the presence of this crop through the entire cotton season. Similarly, a sorghum ratoon was allowed to grow and was used as late sorghum (Diagram 1).

Cotton (varieties BPA,89 and SATU,85), for NAARI and SAARI, respectively were planted in the middle area of each sub-plot and regular cultural practices were carried out. No insecticides were applied throughout the two seasons.

Two weeks after seedling germination (WAG) 100 randomly selected plants for each crop per sampling occasion were inspected and visual counts of pests and their associated predators were recorded. Sampling followed the stratified scouting technique (Garcia *et al.*, 1982) and continued at weekly intervals until cotton harvesting. Crop infestation by aphids, whiteflies, jassids, and thrips was determined as percentages by inspecting three leaves per plant, one from each of the top, middle and lower sections of the plant. Visual counting was also used for the major pests; lygus, boll-worms; American Boll Worm (ABW), Spiny Boll Worm (SBW), and Pink Boll Worm (PBW), and stainers as well as their associated pre-daceous immature and adult stages of common predators (EL-Heneidy *et al.*, 1996). Actual numbers were recorded.

At harvesting, cotton seeds from the experimental sub-plots were picked separately and yields were determined.

RESULTS AND DISCUSSION

1- PESTS:

1.1. Sorghum:

Obtained data showed that lygus population was higher on early sorghum than on any of the other crops. Peak inci- dence occurred at 123, 177 and 480, 482 bugs / 100 plants at NAARI and SAARI during the 3rd and 4th months after germ-nation (MAG) in 1994/95 and 1995/96 seasons, respectively (Table 1). This period coincided with the flowering stage of sorghum and squaring period of cotton. As shown in Table 2 the corresponding means on the cotton with trap crops (cotton/traps) were 8.0, 23.3 and 12, 51.3 bugs / 100 plants at NAARI and SAARI, respectively.

Sorghum ratoon (late sorghum) at SAARI also showed relative attractiveness of lygus bugs from the 2nd MAG when 62 bugs / 100 plants were recorded compared to 40 bugs on the cotton / traps. Lygus population continued to build up in the 3rd MAG to reach 126 bugs / 100 plants compared with 40 bugs on the cotton/traps, then declined during the 4th and the 7th MAG on sorghum ratoon and cotton/traps, respectively. All the other pests of cotton;

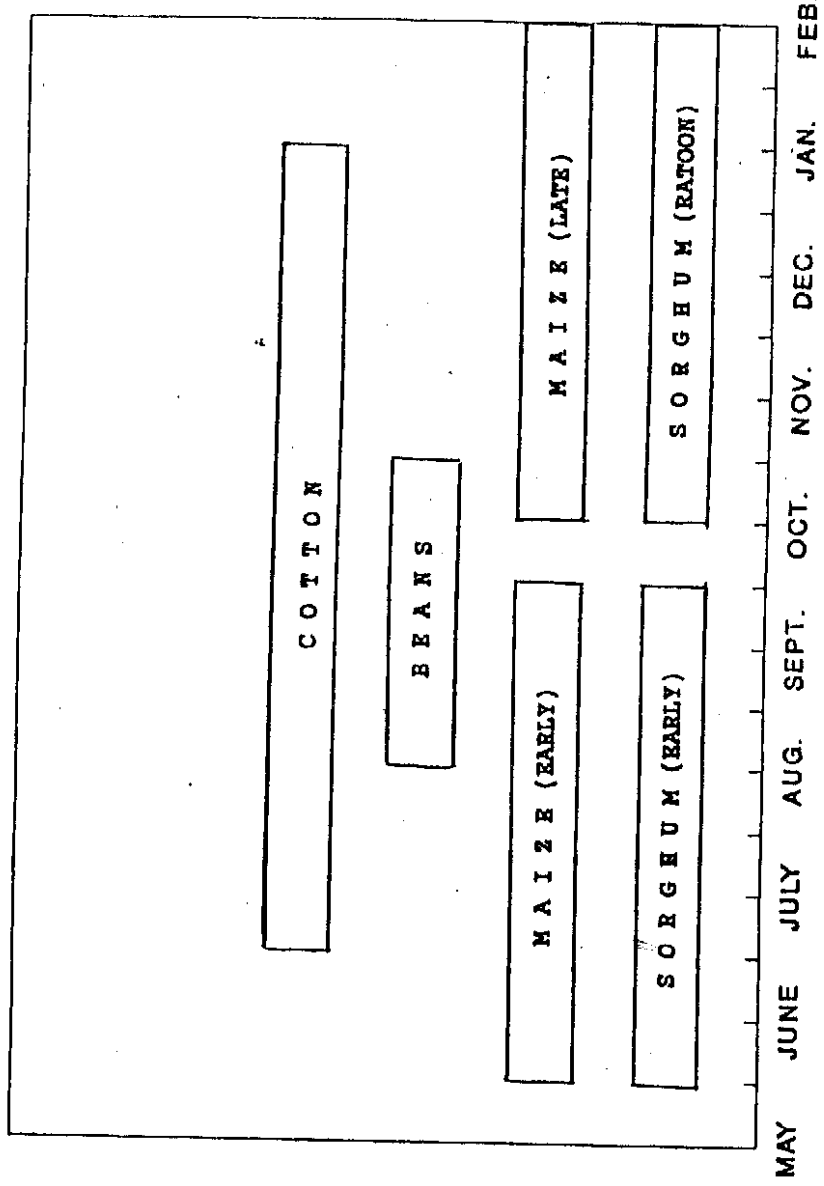


Diagram (1): Seasonal growth periods of various trap crops used for the management of insect cotton pests at SAARI in 1995/96 cotton season.

Table (1): Monthly means of cotton pest population per 100 plants in the trap crops; sorghum, maize, and beans planted at NAARI and SAARI during 1994/95 and 1995/96 seasons, respectively.

CROP / MAG		MAJOR COTTON PESTS							
		LYGUS		ABW		SBW		STAINERS	
		NAARI	SAARI	NAARI	SAARI	NAARI	SAARI	NAARI	SAARI
SORGHUM									
Early	1st	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2nd	98.0	1.5	0.6	0.3	0.0	0.0	0.0	0.0
	3rd	123.0	480.0	0.0	0.0	0.0	0.0	0.0	0.0
	4th	177.0	482.0	0.1	0.0	0.0	0.0	0.0	0.0
Late	1st	-	0.0	-	0.0	-	0.0	-	0.0
	2nd	-	62.0	-	0.0	-	0.0	-	32.5
	3rd	-	126.0	-	0.0	-	0.0	-	36.7
	4th	-	10.0	-	0.0	-	0.0	-	52.0
MAIZE									
Early	1st	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2nd	1.8	0.5	0.8	0.0	0.0	0.0	0.0	0.0
	3rd	2.4	2.5	0.8	2.0	0.0	0.0	0.0	0.0
	4th	0.0	4.0	3.0	0.0	0.0	0.0	0.0	0.0
Late	1st	-	0.0	-	0.0	-	0.0	-	2.0
	2nd	-	1.3	-	0.0	-	0.0	-	47.3
	3rd	-	1.6	-	0.4	-	0.0	-	223.2
	4th	-	0.0	-	3.0	-	0.0	-	62.0
BEANS									
Early	1st	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2nd	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	3rd	1.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0
	4th	0.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0

MAG = Month After Germination
ABW = American Boll Worm SBW = Spiny Boll Worm
Early = First planting (prior to cotton)
Late = Second planting (replant for maize and ratoon for sorghum)

Table (2): Monthly means of pests populations on cotton/trap crops and cotton/control at NAARI and SAARI during the 1994/95 and 1995/96 cotton seasons, respectively.

MAG	MAJOR COTTON PESTS							
	LYGUS		ABW		SBW		STAINERS	
	NAARI	SAARI	NAARI	SAARI	NAARI	SAARI	NAARI	SAARI
COTTON / TRAP CROPS								
1st	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2nd	5.5	0.0	2.5	0.0	2.5	0.0	0.0	0.0
3rd	8.0	12.0	4.8	0.3	2.5	0.1	2.0	0.0
4th	23.3	51.3	7.3	2.3	5.8	1.3	13.8	2.3
5th	19.3	40.8	10.8	1.2	6.5	2.7	33.0	4.7
6th	13.0	39.9	7.5	1.7	3.3	1.6	182.8	16.5
7th	16.0	29.9	23.3	1.7	3.3	1.3	177.3	170.4
COTTON / CONTROL								
1st	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2nd	3.5	4.3	1.5	2.5	1.0	0.3	0.0	0.0
3rd	9.0	37.3	5.0	14.8	3.0	1.8	0.0	4.3
4th	16.0	69.8	11.0	5.8	5.0	2.3	4.0	11.8
5th	128.0	36.5	39.0	1.3	25.0	2.3	72.0	12.0
6th	100.0	23.3	49.0	1.5	26.0	1.5	156.0	52.8
7th	64.0	15.7	31.0	1.7	11.0	0.7	876.0	111.0

secondary and primary, with slight exception of stainers on the sorghum ratoon, were higher on the cotton/traps than on the sorghum. This suggests that sorghum can reduce lygus infestation to cotton plants in two periods; squaring and bolls opening.

1.2. Maize:

In both locations, maize did not show direct prefer- ential attractiveness to bollworms (Table 1). ABW and SBW counts on maize were significantly lower than those on cotton (Table 2). It is however noticeable from Table 2 that in both locations, cotton/control suffered greater bollworm infesta- tions compared to cotton with maize. Bollworm infestations were apparently more severe at NAARI than at SAARI in both seasons.

Late planted maize at SAARI showed significant attractive- ness to stainers (Table 1). Stainer numbers on this maize were especially higher during the 3rd MAG when 223.2 individuals / 100 plants were recorded. This was significantly higher than 16.5 recorded on cotton/traps (Table 2). Late maize showed higher population of ABW during 4th MAG and less stainers than the cotton/traps. It is apparent therefore, that maize and sorghum as trap crops can play a role in the reduction of stainers population at the terminal end of the season which is the critical period of the cotton crop in terms of stainer damage.

1.3. Beans:

Bean plants showed no attractiveness to major cotton pests during their growing season, thus the population of all the primary pests were higher on cotton/traps(Tables 1 and 2). However, data not presented here showed that whiteflies and jassids populations were relatively higher on beans compared to the cotton/traps in the two sites.

1.4. Cotton:

Comparative population densities of insect pests of cotton on both trap crops and control are summarized in Table (2). Concerning secondary pests of cotton; thrips population was relatively lower on cotton/traps than on the cotton / control during the existence of the trap crops, particularly the beans, but it increased and became higher on the cotton / traps after harvesting the beans as well as the other crops. Apart of different aphid species on several crops used in the study, aphids, whiteflies and jassids populations were higher on cotton/traps than on the cotton/control throughout the growing seasons in the two areas.

Concerning the primary pests; lygus population was mostly higher on the cotton/control, particularly at NAARI. At SAARI, with an exception of the 4th MAG, it continued relatively higher on the cotton/traps and after harvesting the trap crops (early plantings), particularly the sorghum (Table 2). As shown also in the table, ABW, SBW and stainers populations were mostly higher on cotton/control than on the cotton/traps in the two sites. Stainers population attractiveness affected positively with the late plantings of maize and sorghum.

2- PREDATORS

2.1. Cotton:

In most cases, the population of predators was higher on the cotton/traps than on the cotton/control (Figs. 1 and 2). As shown in the figures, the two locations during the 1995/96 season, predator counts on cotton/traps were about 25 and 20 % over those recorded on cotton/control. Around mid cotton season when the trap crops were harvested, the popula- tion of predators increased drastically on the cotton/trap plots. Highest populations of predators, 162.8 and 153 at NAARI and 102.3 and 80.5 individuals/100 plants at SAARI, on the cotton/traps and cotton/control, respectively were recor- ded during the 4th MAG (Figs. 1 and 2). True spiders and ants were the most abundant groups of predators on both cotton / traps and cotton/control of the two areas, followed by rove beetles and *Orius* spp. at NAARI (Fig. 3) and by *Cheilomenes* and *Orius* spp. at SAARI (Fig. 4).

2.2. Sorghum:

A relatively high population of predators was recor- ded on sorghum (Fig. 2). A gradual increase in the population of predators was detected towards harvesting. A peak of 273 individuals / 100 plants during the 4th MAG was recorded at SAARI and this trend maintained in the ratoon crop during the 1st and 2nd MAG (the 5th and 6th MAG on cotton) (Fig. 2). Among the predatory species; the earwigs, *Diaperasticus erythocephalus O.* population dominated all the other species (57.7 %) followed by ants (21.9 %) (Fig. 5).

2.3. Maize:

Among the trap crops, highest population of predators was recorded on maize. A peak of 527 individuals/100 plants was found during the 3rd MAG (Fig. 2). This high population of predators usually coincides with a high population of aphids found on maize plants during the tasselling period. Late plan- ted maize showed equally high abundance of predators which peaked at 209.2 individuals/100 plants during the 3rd MAG (the 7th MAG on cotton). Ants and earwigs were the most domi- nant predatory species (80 %) (Fig. 5).

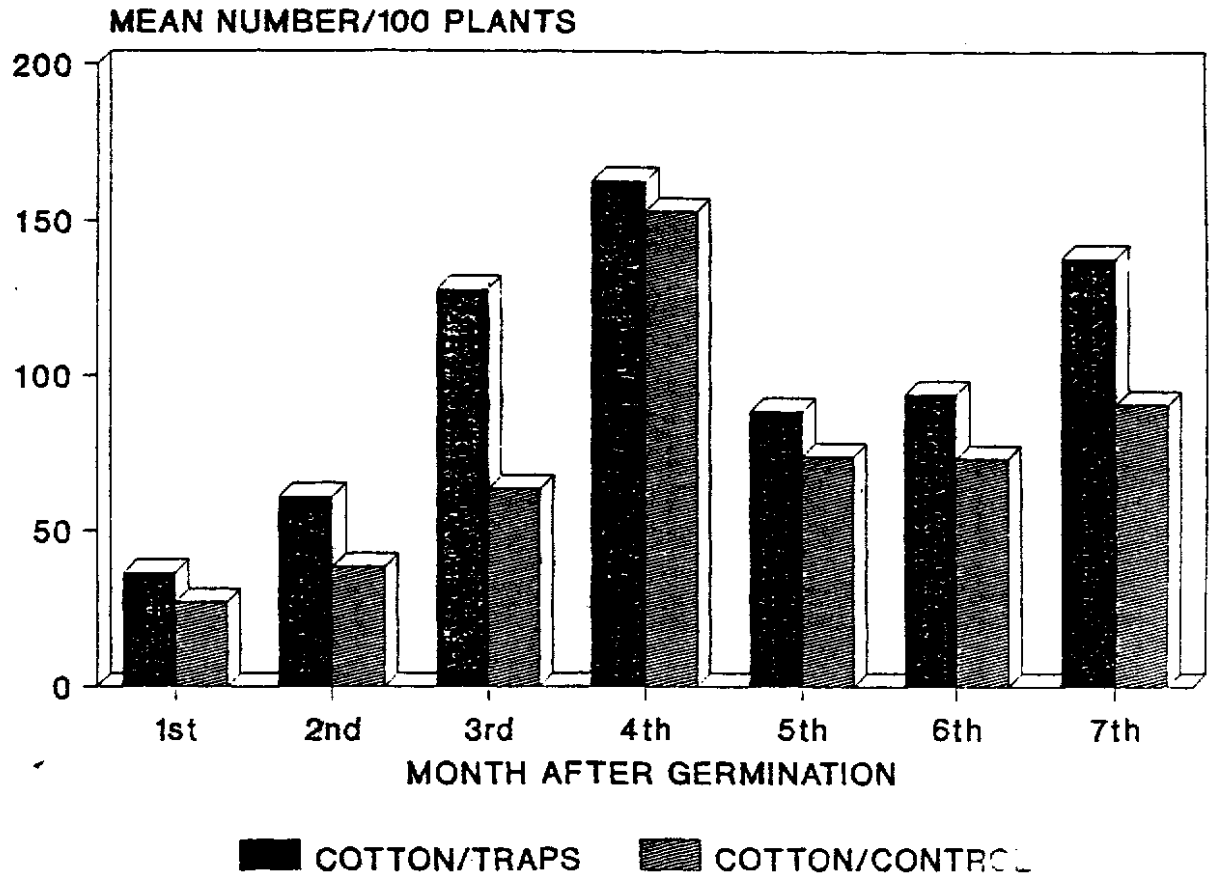
2.4. Beans:

Predators population on beans was the lowest among the trap crops (Fig. 2). Their numbers increased towards the end of the beans growing season to reach a peak of 56 individuals / 100 plants during the 3rd MAG. Ants and true spiders were the highest groups of predators counted on beans (66.7 %) (Fig. 5).

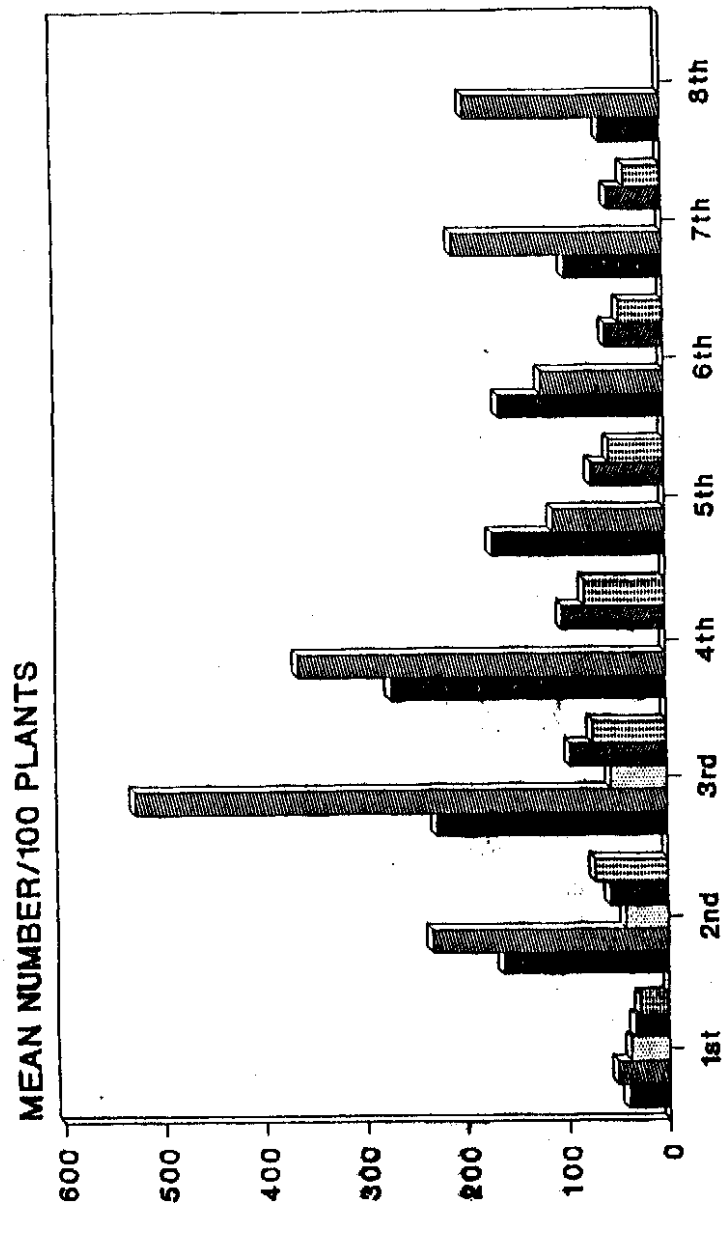
3- Seed Cotton Yield:

Significant differences in the yields of cotton seeds were obtained between cotton/traps and cotton/control in the two locations. Overall, cotton/trap plots out yielded cotton/control plots by 20-25 %. The yield differences were relatively higher at SAARI than at NAARI.

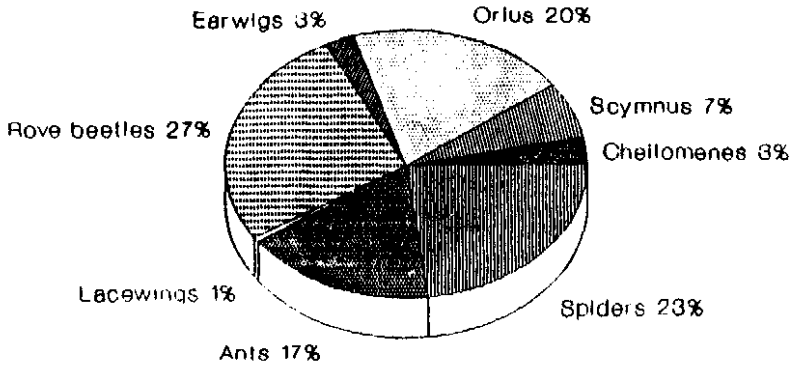
Fig. (1): Monthly m[illegible] number of predators/100 plants on co[illegible]on with trap crops and cotton without (control) at NAARI during 1994/95 season.



NAARI, 1994



Fig, (2): Monthly mean number of predators/100 plants on cotton with trap crops and cotton without (control) at SAARI during 1995/96 season.



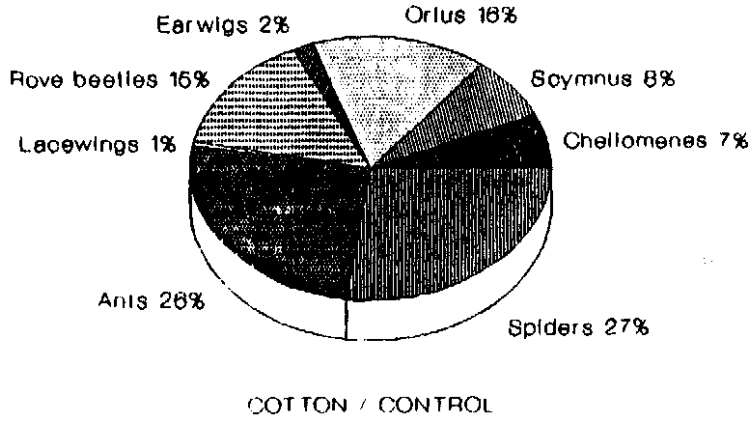
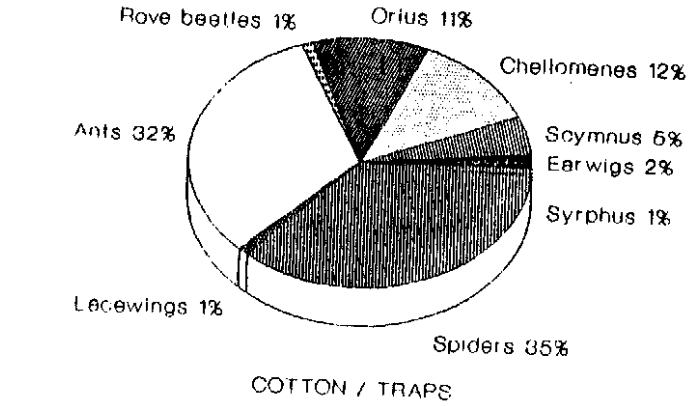


Fig. (3): Relative abundance of predatory species on cotton with trap crops and cotton without (control) at NAARI during 1994/95 season.



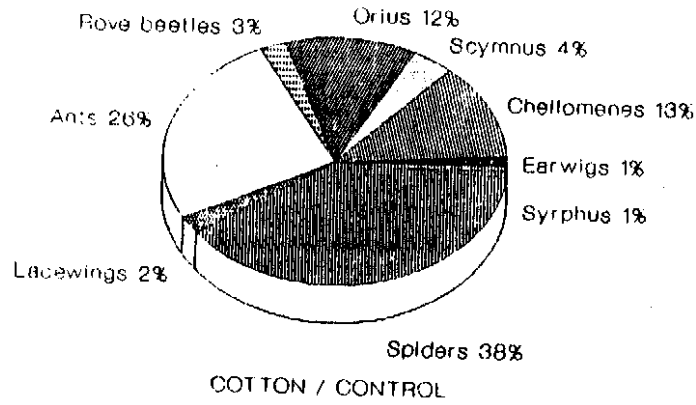
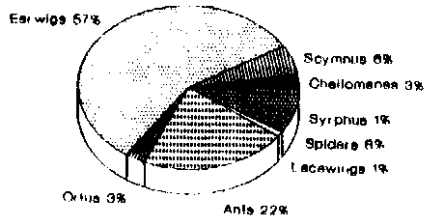
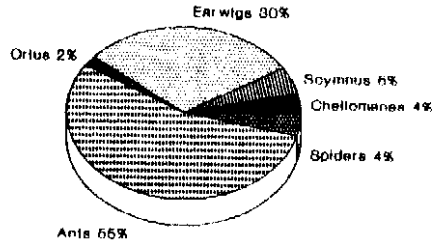


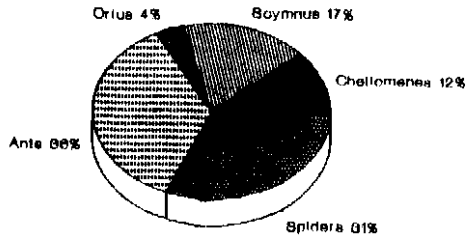
Fig. (4): Relative abundance of predatory species on cotton with trap crops and cotton without (control) at SAARI during 1995/96 season.



SORGHUM



MAIZE



BEANS

Fig. (5): Relative abundance of predatory species on trap crops at SAARI during 1995/96 season.

Certainly, trap cropping alone has not been always sufficiently effective in controlling key pests, but it may be grown to attract pests away from the target crop and/or it may sufficiently change the environment to increase the role of natural enemies. Alterna-tively a pesticide, preferably with a selective action, may be applied to the trap crop to prevent populations of the pests migra-ting to the cotton.

In Tanzania and Nigeria, damage to cotton has generally increa-sed when farmers have increased sowings of maize rather than sor-ghum, natural enemies often being very effective on sorghum (Matthews and Tunstall, 1994). These findings are in agreement with the present results that maize compared to sorghum has a limited direct influence on predator activity during much of the cotton growing season. The most conspicuous effect of maize was its attraction of stainers during the late season in a phenomenon not recorded in Uganda before. In contrary to our results, EL-Zik *et al.*, (1989) reported that grain sorghum generally does not harbor cotton pests. While in this investigation it was found that it harbored lygus bugs during the season, and stai-ners in late season. We however concur with them that sorghum does harbor substantial populations of natural enemies that attack aphids, spider mites, and lepidopterous larvae. As sorghum matures, these natural enemies move into cotton and are a good source for biological control of cotton pests. Planting cotton next to grain sorghum is a good practice. The results on predator abundance are in support of the natural enemies hypothesis which attributes lower pest incidence in intercropped systems to a higher density of predators (Root, 1973). The behavior of maize in respect of pest attraction,is probably linked to the disruption theory.(Bach,1980).

Coaker, 1990, correctly noted that in the near future it is unlikely that intercrops will have a role within the framework of intensive crop production, except perhaps in smaller scale farming enterprises and horticulture, and as a result most intercrop studies will remain pertinent to situations in tropical countries.

This study has been purely descriptive in nature but has ellu-cidated the important role of mixed cropping, a practice that seems to be on the increase among smallholder farmers in Uganda. The present work will certainly require a follow up by way of detailed ecological studies to allow the development of appropriate predic-tive theories. Such theories are necessary to allow extrapolation of our results to various other situations within the diverse cotton based farming systems.

In conclusion, the use of trap crops, in conjunction with appropriate cultural practices showed considerable benefit for managing insect pests in cotton-based farming system of Uganda. It appears as one of the key components of this strategy which may serve to reduce key pest population, to avoid particularly early season application of insecticides as well as to promote the

activity of natural enemies. In addition, from the socio-economical point of view, it can also provide revenue to the farmers.

Clearly further studies are needed with this agro-ecosystem to determine what alternative tactics could be superimposed on the trap crops or what can be done to further encourage the natural enemies. In the context of mechanizing cotton production in Uganda through use animal traction equipment, smallholder growers may have to refrain from the present traditional intercropping.

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REFERENCES

Andrews, D.J. and Kassam, A.H. (1976): Importance of multiple cropping in increasing world food supplies. In: Papendick, R.I., Sanchez, P.A. and Triplet, G.B. (eds), Multiple Cropping. American Society of Agronomy Special Publication No. 27, pp. 1-10.

Bach, C.E. (1980): Effects of plant diversity and time of coloni- zation on an herbivore - plant interaction. Oecologia 44, 319 - 326.

Coaker, T.H. (1990): Intercropping for pest control. British Crop Protection Agriculture. Options for Reducing Agrochemical Usage. British Crop Protection Council, Fornham, U.K., pp. 71-6.

El-Heneidy, A.H.; Sekamatte, B.; Mwambu, N. and Nyamntale, C. (1996): Integrated Pest Management Approach in Cotton Agro- ecosystem in Uganda. 1- Basic Field Data. African Crop Science Journal. (in press).

EL-Zik, K.M.; Grimes, D.W. and Thaxton, P.M. (1989): Cultural manage- ment and pest suppression. Pages 11-36 in R.E. Frishbie, K.M. EL-Zik, and L.T. Wilson, eds. Integrated pest management systems and cotton production. Wiley.New York.

Garcia, A.; Gonzalez, D. and Leich, T.F. (1982): Three Methods for Sampling Arthropod Numbers on California Cotton, Environ. Entomol. Vol. 11, No. 3: 565 - 572.

Guthrie, W.D. (1980): Breeding for resistance to insects in corn. In Harris, M.K. (ed), Biology and Breeding for Resistance of Arthropods and Pathogens in Agricultural Crops, Proc. of an International Short Course in Host Plant Resistance, Texas A&M Univ. July 22 August, 1979. pp. 290 - 322.

Matthews, G.A. and Tunstall, J.P. (1994): Insect Pests of Cotton. Nyambo, B.T. 1988. Significant of host-plant phenology in the dynamics and incidence of the cotton bollworm, *Heliothis armigera* Hb. (Lepidoptera : Noctuidae), in Western Tanzania. Crop Protection 7, 161-167.

Risch, S.J.;. Andow, D and Altieri, M.A. (1983): Agroecosystem diversity and pest control: data, tentative conclusions, and new research directions. Environmental Entomology 12, 625-9.

Root, R.B. (1973): Organization of a plant arthropod association in simple and diverse habitats: the fauna of Collards *(Brassica oleracea)*. Ecological Monograph 43, 95 - 124.

Theumissen, J. and Den Ouden, H. (1980): Effects of intercropping with Spergula arvensis on pests of Brussels sprouts. Entomologia Experimentalis et Applicata 27, 260-8.

Tingey, W.M. and Lamnont, W.J. Jr. (1988): Insect abundance in field beans altered by intercropping. Bulletin of Entomological Research 78, 527-35.

Tukahirwa, E.M. and Coaker, T.H. (1982): Effect of mixed cropping on some insect pests of brassicas; reduced *Brevicornis brassicae* infestations and influences on epigeal predators and the disturbance of oviposition behavior in *Delia brassicae*. Entomologia Expermintalis er Applicata 32, 129-40.

Uvah, I.I.I. and Coaker, T.H. (1984): Effect of mixed cropping on some insect pests of carrots and onions. Entomologia Experimentalis et Applicata 36, 159-67.

مساهمة المصائد النباتيه فى المكافحة المتكامله لآفات القطن القطن الحشريه فى أوغندا

أحمد حسين الهنيدى و بن سكاماتى
معهد البحوث الزراعيه والإنتاج الحيوانى سوروتى أوغندا

تميل أكثر الزراعات التقليديه فى الدول الإستوائية نحو الإستفادة من الزراعات المتعددة ٠وعادة ماتكون الكثافة العددية للآفات الحشرية أقل فى هذه الأوساط النباتية المتنوعة.

أجريت دراسة على تفاعل الآفات الحشرية والمفترسات على القطن المصاحب بالمحاصيل الحقلية الشائعة فى أوغندا بكل من معهدى البحوث الزراعية والإنتاج الحيوانى بنامولونجى وسيريرى فى موسمى القطن المتتاليين ١٩٩٤/٩٥ ، ١٩٩٥/٩٦ قدرت أسبوعيا الكثافة العددية للآفات والمفترسات على القطن وأيضا على المصائد النباتية المحيطة به مثل السورجام والذره الشامية والبقوليات على مدار موسمى نمو القطن. كانت مواسم نمو جميع المصائد النباتية المستخدمة فى هذه الدراسة أقصر مقارنة بالقطن ومع ذلك فقد أوضحت جذبا ملحوظا لأفات القطن المستخدمة فى هذه الدراسة أقصر مقارنى بالقطن ومع ذلك فقد أوضحت جذبا ملحوظا لأفات القطن الرئيسية، بقة اللايجس والصابغات للسورجام وأيضا الصابغات للذرة الرفيعة والذبابة البيضاء والجاسيد للبقوليات، على الجانب الأخر أوضحت أيضا المصائد النباتية عدم جذبها لديدان اللوز، دودة اللوز الشوكية. فى نفس الوقت كان تعداد الأنواع المفترسة من مفصليات الأرجل أعلا دائما على القطن المصاحب بمصائد نباتية (قطن/مصائد) عن مثيله قطن (المقارنه) على مدار المواسم. كان أيضا محصول بذرة القطن أعلا نسبيا (٢٠ ٢٥٪) فى قطن/ المصائد ٠توضح هذه النتائج المساهمى الإعتبارية للمصائد النباتية المتكاملة لآفات القطن فى نظام الملكيات الزراعية الصغيرة فىأوغندا.

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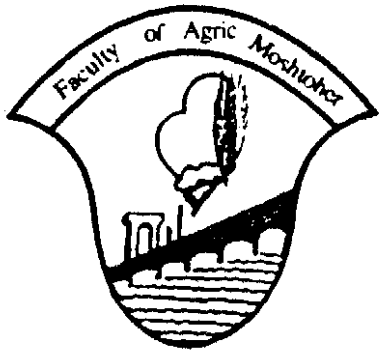

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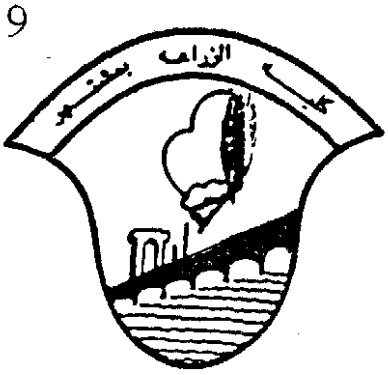

المجلد الرابع والثلاثـــون . العـــدد الثالث سبتمبر ١٩٩٦م