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EFFECTS OF INTERCROPPING SESAME, *Sesamum indicum* AND FALSE SESAME, *Ceratotheca sesamoides* ON INFESTATION BY THE SESAME LEAFROLLER, *Antigastra catalaunalis*, THE GREEN SEMILOOPER, *Chrysodeixis acuta* AND THE PARASITIOD, *Apanteles syleptae*.

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Abstract
Field plot experiments were conducted in 2009-2010 to study the effects of intercropping sesame Sesamum indicum L. (Lamiales: Pedaliaceae) and false sesame Ceratotheca sesamoides (Lamiales: Pedaliaceae) on infestation by the sesame leafroller, Antigastra catalaunalis (Duponchel)(Lepidoptera: Crambidae), the green semilooper, Chrysodeixis acuta (Walker)(Noctuidae) and the parasitiod, Apanteles syleptae F. (Hymenoptera: Braconidae). The experiment was carried out in a randomized complete block design. There were five treatments namely sole crop S. indicum, sole crop C. sesamoides, intercrop 1 (1 row of S. indicum: 1 row of C. sesamoides), intercrop 2 (2 rows of S. indicum: 1 row of C. sesamoides) and intercrop 3 (1 row of S. indicum: 2 rows of C. sesamoides). The treatments were each replicated three times. There was no application of insecticide on the treatments. Counting of insects was done three times a week. The crops were harvested 8 weeks after planting for the yield analysis using the land equivalent ratio. The highest mean number of A. catalaunalis was recorded on sole crop S. indicum while the least population was recorded on C. sesamoides. Intercrop 1 had the highest reduction in pest numbers among the three different intercropping patterns, while the highest yield was recorded on intercrop 2 which also had the highest land equivalent ratio value of 2.16. This value implies that the intercropped area would produce twice as much as the monocrop.

Key words: *insect damage, abundance, yield and land equivalent ratio*

Introduction

Sesame, *Sesamum indicum* L. (Lamiales: Pedaliaceae) (Bedigan, 1988) is closely related to the strictly African species, false sesame, *Ceratotheca sesamoides* (Obi et al., 2006). *Sesamum indicum* is an important crop and Nigeria is the sixth largest producer of sesame in the world (Chemonics International Inc., 2002). In 2001, Nigeria was the largest supplier to the Japanese market, the world's largest import market for sesame with an annual export valued at US $20m (Chemonics International Inc., 2002). Despite its export potential and hence ability to generate foreign exchange for the country and cash for local farmers, there has been remarkably little research on sesame in Nigeria. This is so when compared to maize and cowpea. As a small holder crop, often intercropped with other crops like maize, legumes etc, the major producing areas lies between latitude 6' and 10" N.

The practice of multicropping in the form of intercropping has been a unique asset of tropical and subtropical areas and is becoming popular day by day among small farmers. It offers the possibility of yield advantage relative to sole cropping through yield stability and improved yield (Bhatti *et al*., 2006). One of the supposed advantages of this practice is that losses from insects and diseases may be reduced (Finlay, 1975), most probably because the crop mixtures create a less favourable environment for certain pest of one or both of the component crops (Gerard, 2008). One of the main benefits of intercropping is an increase in yield per area of land (Carlson, 2008). Other suggested forms of advantages are greater stability of yield over different seasons, better use of land resources, and the possibility of better control of weeds, pests and diseases (Khan and Saeed, 1997). The objective of this study was to evaluate how intercropping could reduce infestation by the main pest of sesame, the sesame leafroller, *Antigastra catalaunalis* (Duponchel) (Lepidoptera: Crambidae), the green semilooper, *Chrysodeixis acuta* (Walker)

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(Noctuidae) and the parasitoid, *Apanteles syleptae* F. (Hymenoptera: Braconidae) and hence increase the yield of sesame.

Materials and Methods

A field experiment using a randomised complete block design was conducted at the Teaching and Research Farm of the University of Ilorin. Seeds of *S. indicum* and *C. sesamoides* obtained from Pata market Ilorin (a local market) were used for the study. There were five treatments and each treatment was replicated three times. The treatments were sole crop *S. indicum*; sole crop *C. sesamoides*; inter crop 1 (*S. indicum* and *C. sesamoides* in alternate rows 1:1); intercrop 2 (*S. indicum* and *C. sesamoides* in alternate rows 2:1) and intercrop 3 (*S. indicum* and *C. sesamoides* in alternate rows 1:2). All the treatments were sown simultaneously on 18th September, 2009 on prepared flat beds. Each plot size was 2m x 1m, made up of seven rows spaced 30 cm apart. Larvae of *Antigastra catalaunalis*, *Chrysodeixis acuta* and the egg cases of *Apanteles syleptae* were sampled three times a week from 2 weeks after sowing. Sampling was done on all rows in each plot. Fresh pods of *S. indicum* and fresh leaves of *C. sesamoides* were harvested and weighed. This was used to compute the yield of the crops. The harvest was obtained from 40 cm length in any two rows randomly selected from the sole crop plots and 40 cm in any two rows randomly selected from the component crops in the different intercrop treatments.

The data collected were subjected to square root transformation before analysis using the analysis of variance. The means were compared using the T-test. The Standard Error of the Difference (SED) and the Least Significant Difference (LSD) were used to separate the means. The Land Equivalent Ratio (LER) was used to evaluate the productivity of the crop mixtures in relation to their monocultures.

Results and Discussion

In the controls with sole *S. indicum* or sole *C. sesamoides*, the sesame leafroller, *Antigastra catalaunalis* (Duponchel) (Lepidoptera: Crambidae) first appeared 3 weeks after planting (Table 1), while the parasitoid, *Apanteles syleptae* F. (Hymenoptera: Braconidae) and the green semilooper, *Chrysodeixis acuta* (Walker)(Noctuidae) appeared at 4 weeks after planting (Table 2 and 3). *Sesamum indicum* as sole crop had the highest number of *A. catalaunalis* (Table 1), supporting the fact that *A. catalaunalis* is the major pest of *S. indicum* on the field. Intercrop 1 (1:1) had the least mean number of *A. catalaunalis* that is significantly different ($P<0.05$) from sole crop *C. sesamoides*. Sole crop *S. indicum* had the highest mean number of *A. catalaunalis* for the duration of the study.

The preliminary study showed that the three intercrop arrangement were able to reduce the incidence of *A. catalaunalis* when compared to the sole crop *S. indicum*, although they were not significant at week 7 and from weeks 10-12, by which time the crops were no longer on the field.

The parasitoid *Apanteles syleptae* first occurred at 4 weeks after planting with *S. indicum* having the highest infestation density of *A. syleptae* (Table 2). There was no significant difference ($P<0.05$) in the mean number of *A. syleptae* found in sole crop *C. sesamoides* and the three different intercropping patterns. In this study intercropping *S. indicum* with *C. sesamoides* had no effect on the population of *C. acuta*, since there was no significant difference in the population of the pest between the five treatments (Table 3). Perrin (1977) in discussing the effects of intercropping on insect population was of the opinion that visual as well as olfactory effects and diversity of hosts play an important role. Similarly Aiyer (1949) reported that biological complexities prevailing in crop mixtures which might affect olfactory mechanisms are disturbed in crop mixtures with aromatic plants. The result of the population count of *C. acuta* on sole crop and intercrop did not support any of these contentions.

A. catalaunalis insect density was similar on intercrop 1 and 3 although this was not statistically significant ($P>0.05$). The land equivalent ratio values showed that intercrop 3 had a higher value than intercrop 1 (Table 4). Intercrop 2 was the least favoured intercropping pattern; since it had the highest number of *A. catalaunalis* among the three intercrop pattern although it had the highest land equivalent ratio value of 2.16, indicating that it had the highest productivity among the intercrop patterns. In terms of yield, intercrop 2 and 3 gave yields twice as high as the yield obtained in the monocrops, indicating that both *S. indicum* and *S. sesamoides* did well as intercrops.

Intercrop 1 at 3 weeks caused a significant reduction in the population of *A. catalaunalis* compared to the population of the insect on sole crop *S. indicum*. This is in agreement with the work of Ahuja *et al*. (1999), where it was reported that the capsule damage due to the gall fly and the leaf webber as well as the capsule borer at harvest were significantly less in intercropped sesame compared with the sole cropped sesame. Similarly, intercrop 1 and 3 reduced insect numbers when compared with the sole *S. indicum* and as such could be used as alternate crops in areas of sesame production. This suggestion agrees with the work of Way (1976) who reported that the other crop in a mixed cropping system may limit pest incidence in one or more ways, such as acting as a barrier or serving as an alternate host, diverting the pest from the crop at risk. Though the three intercrop systems brought about a reduction in pest populations when compared with *S. indicum*, intercrop 1 resulted in the best reduction among the three intercrop patterns. However, this was not significantly different from the other two intercrops and as such; should be used in areas of large scale sesame production to help reduce damage from the sesame web worm, *A. catalaunalis*.

References

Ahuja, D.B.; Prakash, A. and Rao, O. (1999). Insect pest of sesame and their management. In Prakash A, Rao, editors. Applied Entomology, Insect pest of pulses and oil seeds and their management, *Journal of Applied Zoologist Research Association* 2: 223-240.

Aiyer, A.K. (1949). Mixed cropping in India. Indian Journal of Agricultural Science. 19: 439 – 543.

Bedigan, D. (1988). Sesamum indicum L. (Pedaliaceae), Ethnobotany in Sudan, crop diversity, lignans, origin and related taxa. In: Goldblatt P and Lowry, P.P., editors. *Modern Systematic Studies in African Botany. AETFAT monographs in systemic botany*, 25:315-321.

Bhatti, I.A., Ahmad, R., Jabbar, A., Nazir, M.S., and Mahmood, T. (2006). Competitive behaviour of component crops in different Sesame-Legume intercropping systems. *International Journal of Agriculture and Biology.* 8(2): 165-167

Chemonics International Incorporated, (2002). Overview of the Nigerian Sesame industry. Prepared for The United States Agency for International Development (USAID)/Nigeria. RAISE IQC Contract No. PCE-1-00-99-00003-00. Task Order No. 812. 34pp.

Carlson, J.D. (2008). Intercropping with maize in Sub-arid Regions. In: Community Planning and Analysis, Technical Brief. April 16th. 6pp.

Finlay, R.C. (1975). Intercropping Soybeans with Cereals. In: Whigham, D.K. editor. Soybean production and utilisation. University of Illinois, Urbans, U.S.A. p 77-85.

Gerard, B.M. (1976). The effect of plant density on maize and cowpea pests. Papper presented to the symposium on intercropping in semi-arid areas, Morogoro, Tanzania, 10-12th May.

Khan, S.A. and Saeed, M. (1997). Competitive relationships of component crops in different wheat-based intercropping systems. JAPS. 7 (1-2): 37-39.

Obi, R.K., Iroagba,I.I. and Ojiako, O.A. (2006). Virucidal potential of some edible Nigerian vegetables. *African Journal of Biotechnology*. 5(19):1785-1788.

Perrin, R.M. (1978). Pest management in multiple cropping systems. Agro-Ecosystems. 3: 93 – 118.

Way, M.J. (1976). Diversity and stability concepts in relation to Tropical Insect Pest Management. Proc. 9th Annual Conference and 10th Anniversary celebration. *Entomological Society of Nigeria*, 68-93.

Table 1: Effect of intercropping *C. sesamoides* and *S. indicum* on the population of *A. catalaunalis* between 1 – 12 weeks after planting (WAP)

	Mean number of *A. catalaunalis* counted /week										
Treatments	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP	9WAP	10WAP	11WAP
Sole C. sesamoides	0.7a	0.7a	3.0a	4.1a	2.1a	1.4a	1.1a	0.9c	0.8ab	0.7a	0.7a
Sole S. indicum	0.7a	0.7a	6.0d	7.9c	4.5c	3.2c	1.5a	0.1a	0.9bc	0.9a	0.7a
Intercrop 1	0.7a	0.7a	3.2a	5.2b	3.9b	2.2b	1.1a	0.8b	0.7a	0.8a	0.7a
Intercrop 2	0.7a	0.7a	4.8c	6.0b	3.7b	2.4b	1.4a	0.9c	1.0c	0.8a	0.7a
Intercrop 3	0.7a	0.7a	4.1b	5.2ab	3.9b	2.0b	1.1a	0.9c	0.7a	0.7a	0.7a
LSD	NS	NS	0.8	1.3	0.6	0.5	NS	0.2	0.2	NS	NS

Transformed data using square root transformation presented. Means not followed by the same letter in a column are significantly different at P<0.05.

Table 2: Effect of intercropping *C. sesamoides* and *S. indicum* on the population of *A. syleptae* between 1 – 12 weeks after planting (WAP)

	Mean number of *A. syleptae* counted /week							
Treatments	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP
Sole C. sesamoides	0.7a	0.7a	0.7a	0.9a	1.1a	0.9a	0.7a	0.7a
Sole S. indicum	0.7a	0.7a	0.7a	1.2c	3.6dc	1.1a	0.8a	0.7a
Intercrop 1	0.7a	0.7a	0.7a	0.9a	2.5b	1.0a	0.7a	0.7a
Intercrop 2	0.7a	0.7a	0.7a	0.9a	2.6b	1.1a	0.9a	0.7a
Intercrop 3	0.7a	0.7a	0.7a	1.0ab	2.8bc	1.2a	0.7a	0.7a
LSD	NS	NS	NS	0.2	0.4	NS	NS	NS

Transformed data using square root transformation presented. Means not followed by the same letter in a column are significantly different at P<0.05.

Table 3: Effect of intercropping *C. sesamoides* and *S. indicum* on the population of *C. acuta* between 1 – 12 weeks after planting (WAP)

	Mean number of *C. acuta* counted /week							
Treatments	1WAP	2WAP	3WAP	4WAP	5WAP	6WAP	7WAP	8WAP
Sole C. sesamoides	0.7a	0.7a	0.7a	0.7a	0.8a	0.7a	0.7a	0.7a
Sole S. indicum	0.7a	0.7a	0.7a	1.1a	0.9a	0.8a	0.7a	0.7a
Intercrop 1	0.7a	0.7a	0.7a	0.8a	0.8a	0.7a	0.7a	0.7a
Intercrop 2	0.7a	0.7a	0.7a	0.9a	1.0a	0.8a	0.7a	0.7a
Intercrop 3	0.7a	0.7a	0.7a	0.8a	0.8a	0.7a	0.7a	0.7a
LSD	NS	NS	NS	NS	NS	NS	NS	NS

Transformed data using square root transformation presented. Means not followed by the same letter in a column are significantly different at P<0.05.

Table 4: Effect of insect population on *S. indicum* and *C. sesamoides* yield (g)

Treatments	*S. indicum*	*C. sesamoides*	LER
	Yield (g)		
Sole C. sesamoides		354	
Sole S. indicum	211.1		
Intercrop 1	213.5	330.4	1.93
Intercrop 2	243.7	357.6	2.16
Intercrop 3	226.7	361.0	2.09

LER= Land Equivalent Ratio