# Influence of Intercropping on the Incidence, Abundance and Severity of Pest Damage on Okro *Abelmoschus esculentus* (Linn.) Moench (Malvaceae) and Chilli Pepper *Capsicum frutescens* Linn. (Solanaceae)

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### Abstract

Okro and Peppper were intercropped in a randomised complete block design with three replicates to assess the effect of this on the population of several insect pest of Okro. Five pests of Okro were recorded: *Podagrica uniforma*; *Podagrica sjostedti*; *Oxycarenus hyalipennis*; *Cosmophila flava* and *Dysdercus superstitiosus*. However, there were no significant difference in the population of these insects between Okro sole crop and Okro/Pepper intercrop. The insects occur in almost 1:1 ratio in both cropping system, but fruit damage in Okro/Pepper intercrop was significantly reduced by 50% in comparison to fruit damage in the sole crop Okro.

The fruit yield in Okro sole crop (27.903kg) was not significantly different from the total yield of fruits in the companion crops (18.605kg) in the Okro/Pepper intercrop. Productivity of the crops assessed in the terms of Land Equivalent Ratio (LER) gave a yield of 0.97.

Keywords: Intercropping, Okro, Pepper, Land Equivalent Ratio

### 1. Introduction

Okra (*Abelmoschus esculentus* (Linn.) Moench) also known as Okro, lady fingers etc probably originated from tropical Africa or probably tropical Asia and is now widely distributed in many tropical areas. Okra belongs to the family Malvaceae. Local farmers frequently intercrop Okro along with peppers, tomatoes, yams, cassava and other crops (Norman, 1992). The crop is the immature fruit that is variable in colour, white, dark green or red. The fruit (pod) produces about 30-80 seeds/pod (Tindall, 1983). Okra is canned, the leaves boiled and used in soups. The seeds can be used as a source of oil (Oyolu, 1983). Chilli pepper (*Capsicum frutescens* (Linn.)) also called hot pepper, bird chilli; tabasco, tatashe etc are the world's second most important Solanaceous vegetable after tomatoes. Nigeria is the largest producer of pepper in Africa, accounting for about 50% of the African production. Yields of between 1100 - 1250kg/ha of fresh pods (350 - 500kg/ha of dried fruits) may be obtained. The fruit are used as vegetables and as spices for food. Some of the extremely fiery *Capsicums* of Africa are still found to be useful for rheumatism, neuritis, inflammations and diarrhoea (Kochhar, 1981). Chillies are used in curries or dried to make cayenne pepper (Hill and Waller, 1988).

Okro foliage is prone to attack by beetles in the family Chrysomelidae and other insects which cause serious damage thus reducing yield while insects and drought are regarded as very important limitations to the production of pepper (AVRDC, 1989). Traditionally, pepper and other vegetables are grown in mixtures in holdings rarely exceeding 0.1 hectares. Under local conditions, this is a rational strategy as there is greater stability of yield over different seasons, better use of land resources, possibility of better control of weeds, pests and diseases (Khan and Saeed, 1997). Mixed cropping which is widely practised in the humid tropics has been shown to be more efficient than sole cropping (Adelana, 1984). In Nigeria crop combinations vary from one ecological zone to another. Intercropping is a new version of an old idea (Godhani et al. 2009), as increased diversity of the physical structure of plants in an intercropping system produces many benefits (Carlson, 2008). One of this is the possibility of reducing the incidence of pest and diseases and the significance of their damage (Southwood and Way, 1970).

The intercropping studies and concepts have been abandoned in the developed countries were planting and harvesting are done mechanically. Intercropping studies under optimum technology indicated substantial increase of more than 50% from different combinations of alternate row cropping over the two separate pure cultures. The practices of mixed cropping helps to check weeds which would compete with crop plants for mineral elements in the soil. Way (1972) noted that through trial and error, some subsistence farmers have

undoubtedly developed intercropping systems which reduce the pest population and have allowed them to have an economic yield. This study aims at investigating the extent to which mixed cropping can reduce insect numbers and the damage to crops done by pests in an okro/pepper mixed cropping system.

## 2. Materials and Methods

The experiment was carried out using a randomised complete block design with three treatments i.e. okro sole crop, pepper sole crop and pepper/okro intercrop. The treatments were each replicated three times and were randomly arranged in the experimental plots. The pepper and okro seeds used were (pepper-Sombo and okro-LD 88) were obtained from the institute of Horticultural Research (NIHORT). All the experiments were carried out at the Teaching and Research Farm of the Faculty of Agriculture and Forestry, University of Ibadan.

The okro seeds were sown on the prepared flat surface at a depth of 3 cm while the pepper seedlings were transplanted to the prepared sites. This was done for both the sole crop and intercrop plots. The total land area was 16 m x 11.8 m with each plot measuring 5 m x 3.6 m and separated from each other by a space measuring 0.5 m. The crops were planted in flat beds. The okro was thinned to two plants per stand two weeks after emergence. NPK fertilizer was added to the plots by side dressing after the pepper had been established to augment the fertility of the soil. There was no chemical control of pests in the experimental plot during the period of the experiment. In okro and pepper sole plots, sampling for insects was done on the 4<sup>th</sup> and 5<sup>th</sup> rows using none destructive visual counting, while in the intercrop plots, sampling for insects of okro were done on the 4<sup>th</sup> and 5<sup>th</sup> rows while for pepper in the intercrop plot. Insect sampling was done on the 2<sup>nd</sup> and 7<sup>th</sup> rows. Sampling for all the insects was done twice a week and it was done in the morning. Correlation and regression analysis of the insect pest of okro against the various weather variables were carried out. The productivity of the crop mixtures in relation to their monocultures were evaluated by the Land Equivalent Ratio (LER).

### 3. Results

Of all the insects recorded the population of *Podagrica sjostedti* Jac. (Coleoptera: Chrysomelidae) was lowest while that of *Podagrica uniforma* Jac. (Coleoptera: Chrysomelidae) was the highest with about 15 folds different in the population of the two species of *Podagrica* (table 1). Between okro sole crop and okro/pepper intercrop, there was no significant difference in the population of any of the species recorded. All species occur in almost a 1:1 ratio in the two cropping systems. However, all species were significantly lower (P < 0.05) in number in pepper sole crop than in either okro sole or okro/pepper intercrop. The results showed that irrespective of the cropping systems, *Podagrica uniforma, Dysdercus superstitiosus* (Fabricius) (Hemiptera: Pyrrhocoridae) and *Oxycarenus hyalipennis* (Costa) (Hemiptera: Lygaeidae) are major pests of okro in that order of importance at least for the season of the experiment.

The population of *Oxycarenus hyalipennis* has a significant negative correlation with relative humidity. Similarly there was a negative but none significant correlation between the population of *Podagrica uniforma* and *Dysdercus superstitiosus* (table 2). However there was a low level of correlation between the insect population and temperature. Okro sole crop had the highest yield of 27.9 kg (table 3) which was twice the yield of okro in the intercrop (11.8 kg). This yield (27.9 kg) was not significantly different from the total yield of the two crops in the intercrop (18.6 kg); it was however significantly different from the yield in pepper sole crop (12.3 kg). The lowest yield of 6.7 kg was recorded from pepper in the intercrop. Damage to the okro in the okro/pepper intercrop was significantly lower by 50% than in the okro sole crop. However there was no damage to pepper in both cropping systems.

The land equivalent ratio for the okro/pepper intercrop was 0.97. Fig. 1 shows the damaged and undamaged fruit yield in the different cropping systems. Damage in the okro sole crop (10.6 kg) was significantly higher than damage of okro in the intercrop (5.0 kg). There was no damage on pepper either as sole crop or in the intercrop.

### 4. Discussion

In this study there were no significant differences in the population of any of the five species of insects between sole okro and okro/pepper intercrop system. 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 and disturbed in crop mixtures with aromatic plants. The result of the population count on sole crop and intercrop plots did not support any of these contentions. Pepper did not appear to affect either visual stimuli or olfactory mechanism involved in the orientation of the pests on okro in the intercrop system judging from the level of infestation in both. The relatively low level of infestation of pepper and the fact that no damage was recorded on pepper in both cropping systems showed that pepper is a none-host. In general, table3 shows that there were no significant changes in the microclimatic situation in both okro sole and okro/pepper

intercrop. Although Potts (1990) mentioned microclimate as one of the beneficial effect of intercropping, it should however be noted

Karel et al (1982) reported that increased shading and humidity and reduced temperature brought about by some crop mixtures favour high population of some foliage beetles. In this study, environmental parameters (temperature and humidity) are related to the insect numbers in different ways; none seem to be important enough to account for any significant fluctuation in the number of various insects in the two cropping systems.

The fruit damage in the okro sole crop was significantly higher than in okro/pepper intercrop by 50% even though the numbers of all the insect species in both cropping systems were virtually the same. The reduction in fruit damage may enhance viability of okro seeds. This result can be explained from the work of Tahvaniian and Root (1972), who reported that the confusing olfactory and visual stimuli received from the host and none-host may disrupt normal feeding habits or mating behaviour associated with intercropping. The fact that there was no damage on pepper in the intercrop system showed that pepper is a none-host for the insects recorded in this study. Mumford and Baliddawa (1982) reported that there is often a significant decrease in the rate of pest population development due to the unfavourable environment of intercrops and also a net reduction in damage and infestation. The result obtained showed an unidentified factor in the okro/pepper intercrop did cause a significant reduction in damage even though this cannot be said of infestation.

The land equivalent ratio (LER) value recorded was 0.97 which showed a low productivity of the okro and pepper in the intercrop. Since the LER value was less than unity, this indicated that the crops are not good as mixtures in the intercrop. Okro had a LER value of 0.43 while pepper had a LER value of 0.54 showing that okro was suppressed in the mixture.

### 5. Conclusion

The result indicates that the okro/pepper mixture did not appear to have reduced the various insect pest populations of okro. However the damage in the intercrop was significantly lower from that of okro in the sole crop. There was apparently no yield advantage in intercropping pepper with okro.

#### References

Adelana, B.O. (1984). Evaluation of maize – tomato mixed cropping in south – western Nigeria. Indian. J. Agric. Sci., 54: 564 – 569.

Aiyer, A.K. (1949). Mixed cropping in India. Indian J. Agric. Sci., 19: 439 - 543.

AVRDC. (1989). Progress report 1987. Asian Vegetable Research and Development Centre, Shanhua, Tainan. pp 87-97.

Carlson, J.D. (2008). Intercropping with Maize in Sub – arid Regions. In: *Community Planning and Analysis*, Technical Brief. April 16<sup>th</sup>. 6pp

Godhani, P.H., Patel, R.M., Jani, J.J., Yadav, D.N., Korat, D.M. and Patel, B.H. (2009). Impact of habitat manipulation on insect pests and their natural enemies in hybrid cotton. *Karnataka J. Agric Sci.*, 22(1):104 – 107.

Hill, D.S. and Waller, J.M. (1988). Pests and diseases of tropical crops. Pub. Longman grp. U.K. Intermediate tropical agric. Series, vol. 2, 432p.

Karel, A.K., Lakhani, D.A. and Ndunguru, B.J. (1982). *Intercropping of maize and cowpea*: Effect of plant population on insect pests and seed yield. In C.L. Kaswani and B.J. Ndunguru (eds.) *Intercropping Proc. Symp. on Intercropping* in semi – arid areas, held at Morogoro, Tanzania. 4 – 7 August 1980. Pp 102 – 109.

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

Kochhar, S.L. (1981). Tropical crops: a textbook of economic botany pub Macmillan Publishers Ltd. 467p.

Mumford, J.D. and Baliddawa, C.W. (1982). Factors affecting insect pest occurrence in various cropping system. *Insect Sci. Appl.*, 4 (1/2): 59 -64.

Norman, J.C. (1992). Tropical vegetable crops. Pub Arthur H. Stockwell Ltd. 252p.

Oyolu, C. (1983). Okra seeds: Potential source of high quality vegetable oil. Proc. 5<sup>th</sup> Ann. Conf. Hort. Soc., Nigeria, Nsukka.

Perrin, R.M. (1977). Pest management in multiple cropping systems. Agro - Ecosystems, 3:93 - 118.

Potts, M.J. (1990). Influence of intercropping in warm climates on pest and diseases of potato with special reference to their control. *Field Crop Res.*, 25: 133 – 144.

Southwood, T.R.E. and Way, M.I. (1970). Ecological background to pest management pp 6 – 29. In *Concepts of Pests Management*. Ed. Rabb, R.L. and Guthrie, F.E. North Carolina State University, Raleigh, North Carolina.

Tahvaniian, J.O. and Root, R.B. (1972). The influence of vegetatimal diversity in the population ecology of a specialised herbivore, *Pyllotreta cruciferae* (Coleoptera: Chrysomelidea) *Oecologia* (Berlin) 10: 321 – 346.

Tindall, H.D. (1983). Vegetables in the tropics. Pub Macmillan education Ltd. 533p.

Way, M.J. (1972). Observation on cowpea (*Vigna unguiculata* (L.) Walp) insects at IITA Proceedings of 14<sup>th</sup> International Congress of Entomology. Canberra. Australia, 22 – 30, August 1972, p. 293.

Table 1. Mean number of the various insect species in okro/pepper cropping system

INSECT SPECIES							
CROPPING SYS	ТЕМ	Oxycarenus hyalipennis	Podagrica sjostedti	n Podagrica uniforma	Cosmophila flava	Dysdercus superstitiosus	
Okro/Pepper Okro Sole	31.95 <u>+</u> 7 32.73 + 5	.35a 8.4 .08a 9.4	1 <u>+</u> 0.55a 4 + 1.73a	120.82 <u>+</u> 16.86a 124.85 + 13.73a	17.68 <u>+</u> 4.18a 18.62 + 3.75a	49.87 <u>+</u> 3.33a 47.38 + 5.88a	
Pepper Sole	7.77 <u>+</u> 0.0	00b 7.7	7 <u>+</u> 0.00a	8.41 <u>+</u> 0.21b	7.77 <u>+</u> 0.00b	9.21 <u>+</u> 0.57b	

\*Means followed by the same letters are not significantly different down the column. (Duncan's Multiple Range Test at P (0.05) level of significance.

Table 2. Correlation of the different insect species with the weather variables under the sole and intercrop systems

Environmental				Insect Species						
Variables	es Podagrica uniforma		Podagrica sjostedti		Oxycarenus hyalipennis		Cosmophila flava		Dysdercus superstitiosus	
	Sole Crop	Intercrop	Sole Crop	Intercrop	Sole Crop	Intercrop	Sole crop	Intercrop	Sole Crop	Intercrop
Temperature	-0.068	-0.054	-0.134	0.173	-0.492	-0.342	0.089	0.089	0.247	0.073
Relative Hum	idity -0.477	-0.479	0.341	0.349	-0.624*	-0.438	0.438	0.459	-0.443	-0.627*
Solar Radiatio	n 0.554	0.534	-0.346	-0.243	0.453	0.397	-0.501	-0.511	0.335	0.447

\*Significant at P (0.05) level of significance.

Table 3. Okro and pepper fruit yield with the land equivalent ratio under various cropping systems

CROPPING SYSTEM		YIELD (Kg)				
	DAMAGED	UNDAMAGED	TOTAL	LER		
Okro (inOkro/Pepper)	5.071a	6.824	11.895	(18.605)		
Pepper (in Okro/Pepper)	0.00	6.710	6.710	0.97		
Okro Sole	10.678b	17.225	27.903			
Pepper Sole	0.00c	12.355	12.355			

Means followed by the same letter are not significantly different down the column, (Duncan's Multiple Range Test at P(0.05) level of significance)



Figure 1. Fruityield in Okro/Pepper Mixture and Sole Crops