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# A Preliminary Investigation into the Effect of Intercropping on Insect Pests' Infestation and Fruit Quality of Okra, *Abelmoschus esculentus*

**✉Timothy.T. Epidi[1], and H. Okolie[2],**

*[1]Department of Crop Production Technology, Niger Delta University, PMB 071, Yenagoa, Nigeria. [2]Department of Crop Science, Rivers State University of Science and Technology, PMB 5080, Nkpolu, Port Harcourt, Nigeria.*
*✉Corresponding Author: email:tepidi@yahoo.com*

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## Abstract

*Four different intercropping patterns involving okra with pepper and maize were assessed for their effects on major insect pests of okra during the wet and dry seasons of 2006. During both seasons, the flea beetles, Podagrica uniformis and Nisotra sjostedti were the most abundant. The sole okra crop had the highest infestation of all the okra insect pests in both seasons except Sylepta derogata during the wet season; and had the most perforated leaves as well as blemished pods. It however had the highest pod weight. The strip row pattern was next to the sole pattern in both flea beetle infestation and okro yield but produced better quality pods. It also had the highest land equivalent ratio (L.E.R) of 2.2 and 1.62 during the wet and dry seasons respectively, indicating that it had intercropping advantage over the other planting patterns. The double alternate rows and scattered patterns were least effective in terms of okra yield but the pod quality was as good as in the strip pattern.*

***Key words:** sole, double alternate rows, strip rows and scattered patterns, flea beetles, Podagrica uniformis, Nisotra sjostedti , Sylepta derogata.*

## Introduction

Okra, *Abelmoschus esculentus* (L) is an erect annual herb up to 2 meters tall bearing large roundish or palmate leaves and large sulphur yellow flowers. The fruit is a beak pyramidal capsule with high mucilage content and is used as vegetable when immature.

In African traditional cropping system, okra is a good intercrop with maize (*Zea mays* L.) because they share considerably few insect pests and diseases. They grow to different heights and have different rooting patterns and feeding zones (Okigbo, 1978). Sweet pepper, *Capsicum annum* (L), also forms a good inter-crop with okra. It is hardly attacked by common above ground insect pests owing to its capsaicin content. Sweet pepper is a short lived herb normally grown as an annual. It is a good camouflage for susceptible crops like okra owing to similarities in their shoot architecture, height and leaf colour (Rice *et al*.,1987).

Okra is a favoured host for a variety of chewing and sucking insects including *Podagrica uniformis* (Jacoby), *Nisotra sjostedti* (Jacoby), *Earias insulana* (Boisduval), *Sylepta derogata* (Fallen), *Dysdercus superstitiosus* (F.), and *Nezara viridula* (L.) (Taylor, 1974; Ewete, 1978;

Odebiyi *et al*.,1981; and Epidi *et al*.,1994). These pests attack the leaves in particular, causing reduction in crop yield; and the fruit, resulting in reduction in quality. These pests have been controlled using synthetic insecticides which can cause side effects such as the pollution of soil and water, contamination of food, and destruction of beneficial as well as other non-target organisms. Entomologists have therefore been focusing on non-chemical and more environmentally friendly pest control strategies such as the use of inter-cropping.

Intercropping is popular in traditional African agriculture but the appropriate crop combination that would give a reduced pest problem must be determined. Blind adherence to the principle that a more diversified system will reduce pest infestation is clearly inadequate and often totally wrong (Risch *et al.,* 1983). This study therefore aimed at determining the effect of different planting patterns on the population of major insect pests of okra, okra yield, and damage to okra fruits.

## Materials and Methods

The study was conducted at the Teaching and Research Farm of the Rivers State University of Science and Technology, Port-Harcourt during the 2006 early and late planting seasons. Port-Harcourt lies at 18m above sea level in the humid tropical zone between latitude $4.5^0$N and longitude $7.01^0$E and has a bimodal rainfall pattern.

The cropping patterns employed in the study were sole row pattern (control), double alternate rows pattern, strip rows pattern and scattered pattern. During the wet and dry seasons, okra and maize seeds and pepper seedlings (raised in the nursery a month earlier) were planted the same day at inter and intra-row spacing of 50cm x 50cm on a plot size of 3 x 9m and replicated three times. The double alternate rows pattern was made up of two rows of maize, followed by two rows of okra, followed by two rows of pepper and this arrangement was repeated three times to give a total of 36 stands each of maize, okra and pepper in a plot.

The strip rows pattern contained six rows of maize followed by six rows of okra and then six rows of pepper giving 36stands of each crop per plot. The scattered pattern was made up of three units containing six stands of each crop randomly planted at six points on the plot. However, the planting distances and number of stands were the same as in other plots.
The sole rows pattern (control) was made up of okra plants grown as pure stands and comprised a total of 108 stands. From 21 days after planting, major insect pests of okra were identified and their numbers determined at 2 day intervals between 7-9am when the insects were less active. The flowers, fruits and both surfaces of the leaves were checked and the number of different insect pests recorded. Damage to the leaves was assessed by visual rating of foliage using IITA (1974) scale1-5 score at 3 weeks interval. Pepper fruits and okra pods were harvested at 4 days interval and weighed using Ohams electric balance L.S.2000. Maize was harvested once and weighed using sunrise model top plate spring balance. Okra pod quality was also determined using the IITA (1974) visual rating scale.

## Results

*Insect pest population*

*P. uniformis*: There were significant differences between the treatments during the wet season. The control (sole pattern) had the highest mean population (9.78) while the lowest was recorded in the scattered pattern (4.3). Flea beetle populations of the double alternate rows pattern and strip rows pattern were not significantly different. A similar result was obtained during the dry season. The control (7.88) had the highest population followed by the strip rows pattern. Both the double alternate rows and scattered patterns were not significantly different (Table1).

*N. sjostedti*: During the wet season, significant differences were observed between the treatments (Table 2). The control had the highest population (2.13) while others were not significantly different from one another. Similarly, there was significant treatment effect with respect to insect population during the dry season. The control had the highest (2.12), followed by the strip rows. The double alternate rows and scattered patterns were not significantly different.

*S. derogata*: Table 3 shows that during both seasons, irrespective of treatment, the population of *S. derogata* on okra was the same.

**Table 1: Mean population per plant of *P. uniformis* on okra planted as sole or intercrop in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Sole pattern | 9.78 ± 0.10 | 7.88 ± 0.03 |
| Double alternate rows | 5.18 ± 1.01 | 3.82 ± 0.53 |
| Strip rows | 6.43 ± 1.18 | 5.48 ± 1.21 |
| Scattered pattern | 4.30 ± 0.23 | 3.48 ± 0.39 |
| | LSD=1.48 | LSD=1.29 |

**Table 2: Mean population per plant of *N. sjostedti* on okra planted as sole or intercrop in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Sole pattern | 2.13 ± 0.30 | 1.33 ± 0.33 |
| Double alternate rows | 1.43 ± 0.44 | 1.00 ± 0.58 |
| Strip rows | 1.92 ± 0.20 | 1.33 ± 0.33 |
| Scattered pattern | 1.72 ± 0.48 | 1.00 ± 0.58 |
| | LSD=0.36 | LSD=0.33 |

**Table 3: Mean population per plant of *S. derogata* on okra planted as sole or intercrop in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Sole | 1.16 ± 0.49 | 1.28 ± 1.04 |
| Double alternate | 1.11 ± 0.55 | 1.11 ± 0.55 |
| Strip rows | 1.14 ± 0.57 | 1.22 ± 0.69 |
| Scattered pattern | 1.14 ± 1.13 | 1.07 ± 0.37 |

Means were transformed to $\sqrt{x + 1.0}$. No significant differences.

*Okra pod quality and yield*

During the wet season, the sole pattern (control) suffered significantly more damage than the other patterns with many holes and blemishes, and hence the poorest quality. Other treatments were not significantly different from one another. During the dry season, pod quality was the same irrespective of treatment (Table 4).

**Table 4: Mean pod quality (1-5 visual scale) of okra planted as sole or intercrop in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Sole | 3.13 ± 0.07 | 2.93 ± 0.11 |
| Double alternate | 1.53 ± 0.50 | 1.20 ± 0.20 |
| Strip rows | 2.53 ± 0.70 | 2.60 ± 0.35 |
| Scattered pattern | 1.20 ± 0.53 | 1.38 ± 0.50 |

LSD=1.64

In respect of yield, the wet season's planting showed significant differences among the various cropping patterns (Table 5). Sole cropping had the highest yield (2,857 kg/ha) followed by the strip pattern (2,453 kg/ha). The strip pattern did better than both the scattered and double alternate rows patterns. Scattered pattern was not different from the double alternate rows pattern. A similar result was obtained during the dry season.

**Table 5: Mean pod yield (kg/ha) of okra planted as sole or intercrop in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Sole | 2,857 ± 78 | 3,648 ± 45 |
| Double alternate | 1,864 ± 114 | 2,003 ± 102 |
| Strip rows | 2,453 ± 86 | 2,472 ± 124 |
| Scattered pattern | 2,035 ±112 | 2,391 ± 129 |

LSD=186 LSD=201

*Maize yield*

Maize yield was the same irrespective of the planting pattern and season (Table 6).

**Table 6: Mean fresh cob weight (kg/ha) of maize intercropped with okra under different cropping patterns in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Double alternate | 9, 907 ± 1,542 | 6,534 ± 1,286 |
| Strip rows | 9, 573 ± 1,409 | 6,133 ± 231 |
| Scattered pattern | 10,907 ± 689 | 7,067 ± 1,007 |

*Pepper yield*

There were significant differences between the treatments during the wet season (Table 7). The strip row pattern had the highest yield (5,856 kg/ha) while the scattered pattern had the least (560 kg/ha). The same trend was observed during the dry season.

**Table 7: Mean fresh fruit weight (kg/ha) of pepper intercropped with okra under different cropping patterns in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Double alternate | 2,008 ± 16 | 1,378 ± 72 |
| Strip rows | 5,856 ± 154 | 5,013 ± 273 |
| Scattered pattern | 560 ± 131 | 564 ± 25 |

LSD=234 LSD=327

*Land equivalent ratio*

During both seasons, strip row pattern had the highest land equivalent ratio (Table 8). All patterns had land equivalent ratio of more than 1.

**Table 8: Land equivalent ratio of the different intercrop patterns in the wet and dry seasons of 2006.**

| Treatments | Wet Season | Dry Season |
|---|---|---|
| Double alternate | 1.92 | 1.37 |
| Strip rows | 2.20 | 1.62 |
| Scattered pattern | 1.89 | 1.45 |

## Discussion

The population of *P. uniformis* was the highest irrespective of season and treatment. The control (sole pattern) had the highest population and infestation level. This is in consonance with the findings of Okigbo and Greenland (1976), and Risch (1981) that sole cropping is always prone to high insect pests' infestation. Amoako-Atta (1983) opined that some intercrops provide mechanical barriers and restrict the dispersal of insect pests.

Although it had a poor okra fruit yield, the treatment with the least population of *P. uniformis* in all the seasons was the scattered pattern. It would seem that availability of okra in pockets within the plot made it more difficult for *P. uniformis* to locate the host plant. Difficulty in locating the host plant in turn would lead to starvation, lower fecundity and hence lower productivity. After *P.uniformis*, *N. sjostedti* was the most abundant insect during both seasons. Both flea beetles were more abundant in the wet than the dry season possibly owing to availability of more luxuriant vegetation during the wet season. Also, it is a common phenomenon for most insects to commence reproduction and the diapausing ones complete their life cycle at the onset of rains (Risch *et al.*, 1983).

In both seasons, the sole pattern had the highest pod yield but the poorest pod quality. So, although the sole pattern produced the highest yield, its pod quality was undesirable as the African housewife would prefer unblemished pods. In contrast, the strip pattern produced a good yield and marketable good quality pods, as well as the highest land equivalent ratio. The implication of this is that in addition to the judicious use of land, the strip pattern is an efficacious cultural practice for the control of *P. uniformis* , *N. sjostedti* and possibly *S. derogata* if present at higher populations than observed in this study.

Further, since okra is a vegetable crop, the use of synthetic insecticides is undesirable because of human health implications. Moreover, the negative impact on the environment such as destruction of beneficial insects and pollution of land and water calls for reduced use of these pesticides where possible. Therefore, strip rows pattern of intercropping is recommended for reduced insect pest infestation and improved quality pod yield of okra in an okra/pepper/maize intercrop.

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