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# EFFECTS OF STRIP INTERCROPPING AND INSECTICIDE SPRAY ON THE PERFORMANCE OF COWPEA *(VIGNA UNGUICULATA)* (L.) WALP) IN A COWPEA / MAIZE INTERCROP

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## ABSTRACT

Newly developed cowpea varieties need be subjected to traditional farmers production practices of no insecticide spray and intercropping system in order to facilitate adoption by resource poor farmers. Five improved cowpea varieties and a local check were evaluated in a Randomized Complete Block Design (RCBD) in a factorial arrangement in four replications during 1996 and 1997 early cropping seasons. Eight environments were created by spray-year-cropping systems and the data subjected to analysis of variance and means separated by the least significant difference method.

Variety x Environment mean squares was only significant for days to 90% maturity. The means of the six varieties with respect to the seven characters averaged across environments showed that IT 90K 277-2, Ife Brown (Local Check), IT 90K-76 and IT 93K 233-2-1 yielded above average (1567 kg/ha) although they were not significantly different from each other in respect of grain yield. However, for fodder yield, IT 90K 277-2 topped the varieties closely followed by IT 86D – 719 and IT 93K 233-2-1. Sole spray was significantly greater on seed yield for the two years while the yield associated with strip spray and strip no spray fluctuated between the years indicating an element of Variety x Environment interaction.

IT 90K-277-2 gave the highest yield of 1,602kg/ha in strip intercrop followed by the local check (1,596kg/ha). The Land Equivalent Ratio (LER) of the cowpea/maize strip plots ranged from 1.47 for IT 90K-277-2 to 1.69 for variety IT 93K 273-2-1. While spraying had some effects in this study, strip intercropping did not exert any adverse effect on the varieties.

## INTRODUCTION

Cowpeas *(Vigna unguiculata (L) Walp)* is among the cheapest sources of plant protein widely consumed in Nigeria. The production of this crop, particularly in the South western part of the country has not matched the demand. This shortfall is traceable to problems of poor yield resulting from multifarious pests and diseases affecting the crop at different stages of its development as well as the continuous use of low yielding varieties. Traditional agriculture usually involves growing food crops in mixtures (Adetiloye, 1980). More than 80 per cent of farmers in Nigeria practice intercropping (Okeleye et al, 1995) Legumes, usually intercropped with cassava or maize across all ecological zones in Nigeria, are cowpeas or groundnut (Singh, 1993 and Okeleye et al., 1998). Planting the cereals and cowpeas at the same time and manipulating row spacing and densities of both crops could result in good yields (500 kg/ha) of cowpeas (Haizel, 1974 and Adetiloye, 1980). However, cowpea yield is 110kg/ha in farmers fields in Minjibir and Gezara Local Government areas of Kano State, Nigeria which is the heart of cowpea growing region in West and Central Africa (Montimore, et al., 1997). The highlighted major constraints to cowpea production were insects (especially Maruca testulalis), low plant density, and competition with cereals. Wahua (1983) earlier reported that cowpea was severely affected by maize competing for nitrogen when grown together. The challenge is to find ways of improving this low productivity of cowpeas without using much inputs that are presently not available. Varietal improvement and modified cropping systems could provide solutions to the problems. There is therefore a need for a planting pattern involving maize and cowpeas planted in mixtures where competition is reduced. Traditional farmers apply little or no insecticide spray on cowpeas and consequently obtain low yield. Variations among environments for cowpea grain yield was greater when no insecticide was applied that when it is used (Blade et al.,1992). Singh (1993) proposed that new lines should be screened using cropping systems and inputs of the subsistence farmer. Blade (1992) observed significant differences in the response of cowpeas in four management systems of sole crop + insecticide, sole crop + no insecticide, intercrop + insecticide and intercrop + no insecticides in West African Savanna. Evaluating improved lines in improved management systems provide useful information as to how new varieties respond to improved management systems as well as how traditional management would limit the genotypic potential of the tested lines. There is a dearth of information on the performance of cowpeas grown in a cowpea/maize strip intercropping system with or without insecticide spray in the humid rainforest.

The objective of this study therefore was to investigate the effects of insecticide application on the performance of some cowpea cultivars in a cowpea/maize strip intercropping system.

## MATERIALS AND METHODS

Six cowpea cultivars from the International Institute of Tropical Agriculture (IITA) were evaluated at University of Agriculture, Abeokuta, in Nigeria ($7^0$N20', $3^0$23'E) during the 1996 and 1997 early cropping seasons under sole and strip cropping. In each year, planting was done in the first week of June. The experiment was subjected to spray and no spray condition thereby creating eight year-spray – cropping system environments. The varieties used were IT 90K 277-2, IT 90K-76, IT 93K-233-2-1, IT 86D-721 and IT 86D-719 and Ife Brown (check). Design was a Randomized Complete Block (RCB) in a factorial arrangement in four replications. The soil was sandy (77.5%) with low clay 8% and silt (10%). The other soil properties of the site were Total N (0.08%), P (8ppm), Organic Matter (2.09%), PH 5.9, CEC (mol (P +) kg –1 (7.1).

The field was disc ploughed and harrowed. Plot size was 25m2 (5x5m). Sole cowpea plot consisted of six rows while the cowpea/maize strip plot consisted of four rows of cowpea and two of maize. The first and last rows of the strip plot consisted of maize. Spacing, irrespectively of crop or cropping system was 1 x 0.25m at 2 seeds / stand. Weed control was done manually three times at 2, 6 and 10 weeks after planting (WAP) respectively. Spraying with insecticide commenced at five WAP for the spray plots. Sherpa plus EC 200

Rate of 30mls/10litres of water was applied at each spraying. Spraying was done every ten days until maturity.

Data were taken on number of days to 50% flowering, number of days to 90% maturity, number of pods/plant, fodder yield and grain yield. Data collected were subjected to analysis of variance (ANOVA), using the environment and cowpea varieties as factors. Means of treatments were separated by the Least Significant Difference (LSD) Method, according to the procedure of Gomez and Gomez (1976).

## RESULTS AND DISCUSSION

The mean squares from analysis of variance for the seven characters evaluated are presented in Table 1.

**Table 1: Means Square of the Five Characters Evaluated in Cowpea Cultivars**

| Source | DF | Seed yield Kg/ha | Fodder Kg/ha | Pod Yield kg/ha | Days to 50% Flowering | Days to 90% Maturity |
|---|---|---|---|---|---|---|
| Environment | 7 | 20,820,907** | 190,580** | 3,655,721** | 30.15** | 5,186.61** |
| Rep. Within Env. | 24 | 786,644** | 21,147 | 3,220,376* | 9.27** | 4.30 |
| Variety | 5 | 710,492** | 92,966** | 1,129,330 | 53.62** | 38.40** |
| Variety x Env. | 35 | 364,613 | 29,154 | 1,426.478 | 4.99 | 9.68** |
| Error | 120 | 264.214 | 17,2 [illegible] | [illegible],156 | 2.33 | 4.18 |

The eight environments created by spray –year cropping system showed significantly different effects for all the characters evaluated. The varieties were only different in respect of seed yield, fodder yield as well as days to 90% maturity. Variety x environment interaction means square was only significant for days to 90% maturity indicating that the varieties matured differently under the environments.

The means of the six varieties in respect of the seven characters averaged across environments are presented in Table 2.

Table 2: **Means of the Characters of Cowpea Varieties across treatment**

| Variety | Seed Yield Kg/ha | Fodder Kg/ha | Pod Yield Kg/ha | Days to 5o% Flowering | Days to 90%Maturity |
|---|---|---|---|---|---|
| IT 90k 277-2 | 1780.6 | 3516 | 2514,9 | 47.63 | 91.80 |
| Ife Brown(Local Check) | 1655.7 | 2336 | 2242.3 | 47.49 | 90.78 |
| IT 90k 76 | 1589.5 | 2162 | 2196.1 | 44.47 | 89.78 |
| IT 93k 233-21 | 1571.6 | 2468 | 2190.7 | 45.75 | 90.69 |
| IT 86D—721 | 1406.5 | 1973 | 2456.3 | 47.09 | 88.88 |
| IT 86D—719 | 1391.6 | 2482 | 2006.8 | 46.34 | 89.88 |
| MEAN | 1565.9 | 2489.5 | 2261.9 | 46.45 | 90.30 |
| LSD | 254.4 | 65.1 | 596.1 | 0.76 | 1.01 |

IT 90k 277-2, Ife Brown, IT 90k-76, and IT 93k-233-2-1 yielded above average (1567. 25kg/ha) but they were not significantly different from each other in respect of seed yield. However, in fodder yield, IT 90k 277-2 topped the varieties followed closely by IT 86D -719 and IT 93k 233-2-1; IT 90k 277-2 also topped in the number of pods produced followed closely by IT 86D-721.

All the varieties were however not statistically different from each other in respect of this character.

The disease and insect scores were very close indicating a comparative level of built-in resistance. The duration of flowering for the varieties was similar. The latest variety, Ife Brown flowered in 47.94 days while IT 90k –76, flowered in 44.47 days, a period of about 3 days. The maturity followed the same trend ranging from 88.88 days for IT 86D-721 to 91.80 days for IT 90k 277-2.

Table 3 shows the means of the eight environments across the varieties.

**Table 3: Means of eight treatment combinations across varieties**

| Environment | Seed Yield Kg/ha | Fodder Kg/ha | Pod weight | Days to maturity | Days to Flowering |
|---|---|---|---|---|---|
| Sole Spray (96) | 914.0 | 1364 | 1428.8 | 45.1 | 103.3 |
| Sole Spray (97) | 2760.0 | 3222 | 3698.4 | 46.3 | 764 |
| Sole No Spray (96) | 756.6 | 1851 | 1230.7 | 46.8 | 104.5 |
| Sole No Spray (97) | 2362.0 | 3396 | 3177.2 | 45.8 | 76.6 |
| Strip Spray (96) | 748.5 | 1916 | 1201.0 | 45.9 | 103.1 |
| Strip Spray (97) | 2367.0 | 2957 | 3743.6 | 46.9 | 76.5 |
| Strip No Spray (96) | 450.2 | 1614 | 756.0 | 48.9 | 104.9 |
| Strip No Spray (97) | 2181.4 | 3991 | 2907.2 | 46.5 | 76.4 |
| LSD (0.05) | 528.4s | 86.6 | 1069.2 | 1.81 | 1.23 |

Sole Spray was significantly greater on seed yield for the two years while the yield associated with strip spray and strip no spray fluctuated between the years Suggesting an elementof genotype x environment interaction. Except in 1997 when strip spray and strip no spray had comparative effect on seed yield, spraying in sole or strip had limited effect on high yield.

Spray produced fodder yield of 1364 and 3222kg/ha in 1997 and 1997 respectively. Sole no-spray, however, in 1996 and 1997 produced 1851 and 3396kg/ha respectively of fodder. Similarly strip spray produced nearly lower fodder yield than strip no spray. It will appear that spraying depresses fodder yield.

It increases seed yield at the expense of fodder. When plants are sprayed, insect pests are controlled which allowed more flowers and hence more seed to be produced. Photosynthate is consequently directed more towards seed production than fodder yield. The number of pods did not differ significantly from each other under the various environments. Disease and insect scores were not significantly influenced by spray or strip planting. This result is contradictory to earlier reports by Andrew (1974) and Ugen and Wien (1996). These workers reported a reduction in damage caused by pests and diseased under intercropping.

Days to flowering and maturity

were not affected by spraying in strip planting or sole. There characters are likely to be under high genetic control. The means of the spraying regimes across years are presented in Table 4.

**Table 4. MEANS OF THE SPRAYING REGIMES ACROSS YEARS**

| Environment | Seed Yield Kg/ha | Fodder Kg/ha | Pod weight | Days to maturity | Flowering |
|---|---|---|---|---|---|
| Sole Spray | 1937. | 229.3 | 2563.6 | 45.1 | 89.81 |
| Sole No Spray | 1559.3 | 220.95 | 2203.98 | 46.3 | 90.55 |
| Strip Spray | 1557.8 | 243.65 | 2472.3 | 46.4 | 89.8 |
| Strip No Spray | 1315.8 | 260.25 | 1831.6 | 47.7 | 90.68 |

There were no significant differences between sole spray and sole no spray, both yielded 1837 and 1559kg/ha respectively. Strip spray yielded 1557.8kg/ha while strip no spray produced 1315.8kg/ha Fodder yield followed the spray pattern.

Number of pods was however responsive to spraying. For example sole spray produced 1563kg/ha while sole no spray produced 2203.9kg/ha. Similarly strip spray yielded 2472.3kg/ha while strip no spray yield was 2472.3kg/ha and strip no spray yielded 1831.6kg/ha. Spraying was significant on increasing pod yield under sole and strip planting. The disease and insect scores were not affected by spraying whether under sole or strip planting. Days to flowering and maturity did not depend on spraying or strip planting. There was yield reduction in intercropped cowpea to sole cowpea for all the varieties (Table 5.)

**Table 5: Cowpea yield under sole and strip intercropping systems**

| *Variety* | *Cowpea (kg/ha)* | | *Maize (kg/ha)* | | ***Cowpea yield in intercrop relative to sole*** | ***Maize yield in intercrop relative to sole*** | ***LER*** |
|---|---|---|---|---|---|---|---|
| | *Sole* | *strip* | *Sole* | *strip* | | | |
| IT86D-719 | 1492.28 | 1291.00 | 3350.00 | 2703.84 | 0.87 | 0.81 | 1.68 |
| IT86D-721 | 1508.22 | 1304.80 | 3350.00 | 2415.24 | 0.87 | 0.72 | 1.59 |
| IT90K-277-2 | 1959.12 | 1602.12 | 3350.00 | 2187.17 | 0.82 | 0.65 | 1.47 |
| IT90K-76 | 1815.42 | 1371.56 | 3350.00 | 2933.46 | 0.76 | 0.88 | 1.64 |
| IT93K-273-2-1 | 1689.23 | 1453.89 | 3350.00 | 2775.40 | 0.86 | 0.83 | 1.69 |
| IFE BROWN | 1714.70 | 1596.63 | 3350.00 | 2525.88 | 0.93 | 0.75 | 1.68 |
| LSD | 254.4 | | 608.61 | | | | |
| CV% | 33% | | | | | | |

IT 90k 277-2 gave the highest yield of 1,602kg /ha in strip intercrop followed by the local check (Ife Brown with 1,596kg/ha) and IT 90k 273-1 (1453.9kg/ha). A reduction in intercropping maize yield was also observed. Varieties that were high yielding when sole cropped are equally high yielding under intercropping. Variety IT 86D-719 produced the lowest yield both under sole and in strip intercropping. These data suggest that intercrop yield depends on the potential yield of a variety when sole cropped and its adaptability to intercropping which is indicated by the ratio of intercropped yield to monocrop yield. The land equivalent ratio (LER) of the cowpea/maize plots ranged between 1.47 for IT 90k – 277-2 to 1.69 for IT 93k 273-2-1. The LER is the ratio of the land area needed under sole cropping to one intercropping at the same management level to give an equal amount of yield. LER is the sum of the fractions of the intercrops relative to their sole crop yields (FAO, 1991). This high LER obtained for the cowpea varieties confirm the often expressed conclusion that intercropping is beneficial to the traditional farmer (Ugen and Wien, 1996). A less than one LER suggest that the variety may not be suitable for intercropping. While spraying had some effects in this study, it appears that strip planting did not exert any influence on the varieties and therefore these varieties could be intercropped with maize. The experiments probably need to be redesigned with different spraying regimes. The new design should also include the normal intercropping and row spacing of 1m x 0.5m

## CONCLUSION

Insecticide application significantly increased grain yield particularly under monocrop system. Grain yield associated with strip intercropping either under insecticide spray or no spray fluctuated between the years, indicating an element of Genotype x Environment the cowpea. The LER the cowpea maize strip plots of ranged between 1.47 and 1.69 indicating that strip intercropping in still advantageous over cropping and that the varieties are suitable for intercropping with maize.

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