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# Effect of Different Sorghum Plant Arrangement and Population Density on Sesame-Sorghum Intercrop

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**ABSTRACT**

**In particular, cereal and legumes intercropping is recognized as a common cropping system throughout tropical developing countries. This work is carried out in order to determine the actual within row spacing and the plant arrangement on which sorghum can be intercropped with sesame for higher yields. Varieties of sesame (*Sesamum indicum*) (CV, E8) and sorghum (*Sorghum bicolor*) (TG 5760KS ) were used for the experiment which was made up of 5 treatments which were replicated 3 times. The treatments were Sole Sesame, Sole sorghum, Sesame intercrop with sorghum at 50cm×2 stands, 50cm×1 stand and 100cm×1 stand. Data were obtained for plant height at 3, 6 and 9 weeks after planting (WAP), leaf number at 3, 6, and 9 WAP, number of branches at 4, and 8 WAP, number of capsule per plant at harvest, weight of seed, plant height at 3, 6, 9 and 12 WAP, number of leaves at 3, 6, 9 and 12 WAP, number of tillers at 4 and 8 WAP. Generally, intercropping sesame with sorghum reduces the yield of sorghum drastically. The total land equivalent ratio (LER) indicated yield advantages in intercropping sesame with sorghum, especially when sesame was intercropped with sorghum at 1 stand/50cm. It is interesting to note that, sorghum had little effect on sesame LER which produce yield advantage.**

## INTRODUCTION

Over-population, natural disasters and low food production are causes of food insecurity in Africa as well as other developing countries. Most African farmers are small-scale farmers. About 800 million people in developing countries do not have sufficient food. Improvement of crop productivity is the common aim of farmers and agriculturists. The key to sustainable agriculture probably lies in increased output per unit area together with arable land expansion. In terms of cropping systems, the solutions may not only involve the mechanized rotational mono-culture cropping system used in developed countries such as North America and Western Europe, but by also the poly-culture cropping system traditionally used in developing countries such as Africa and Latin American (Francis and Adipala, 1994).

The main reason for using a multiple cropping system is the fact that it involves integrating crops using space and labour more efficiently (Baldy and Stigter, 1997). Biophysical reasons include better utilization of environmental factors, greater yield stability, invariable environment and soil conservation practices. Socio-economic reasons include magnitude of inputs and outputs and their contribution to stabilization of house hold food supply (Beets, 1982). Intercropping which is one type of multiple cropping systems has been practiced traditionally by small-scale farmers in the tropics.

In particular, cereal and legumes intercropping is recognized as a common cropping system throughout tropical developing countries (Ofori and Stern, 1987). Cropping system may help improve productivity of low external input farming which depends largely on natural resources such as rainfall and soil fertility (Tsubo *et al*, 2003).

The importance of intercropping in providing adequate food cannot be over-emphasized, despite being the traditional method of farming, traditional farmers do not know the arrangement on which sesame can be intercropped with sorghum, and hence they resort to broadcasting. This work is carried out in order to determine the actual within row spacing and the plant arrangement on which sorghum can be intercropped with sesame for higher yields.

## MATERIALS AND METHODS

### Site description

The experiment was conducted on the research farm of the department of crop production technology, Akperan orshi College of Agriculture, Yandev, Gboko, Nigeria. Yandev is located on 7.4$^{o}$N, 8.7$^{o}$E,

### Experimental Design and Layout

A randomized complete block design (RCBD) was used during the experiment. The experiment was made up of 5 treatments which were replicated 3 times. The treatments: Sole Sesame, Sole sorghum, Sesame intercropped with sorghum at 50cm×2 stands, Sesame intercropped with sorghum at 50cm×1 stand and Sesame intercropped with sorghum at 100cm×1 stand.

### Planting and maintenance

The sesame and sorghum seeds were obtained from Benue State Agriculture and Rural Development Authority Makurdi. (BNARDA). Varieties were sesame (*Sesamum indicum*) (CV, E8) and sorghum (*sorghum bicolor*) (TG 5760KS $V_2$). The sesame seeds were planted (Broadcasted) uniformly and gently raked to superficially cover the seeds with soil at the top of the ridges and sorghum was planted by the sides of the ridges and with different spacing, Planting was done in the cropping season of 2012.

Buta-force and dragon were used as pre-emergence herbicide for weed control at the rate of 3l/ha, after which two hand weeding was carried out. Fertilizer used in this experiment was single super phosphate (SSP 18% $P_2$ $O_5$). It was applied at the rate of 20kg/ha and it was broadcasted at 4 weeks after planting. Thinning was carried out at 35 days after planting. The sesame crops were harvested and dried for 5 days and then threshed. Harvesting was done with knife by cutting the stock then tied in bundles and sundried. Sorghum was harvested 40 days after sesame was harvested; it was harvested with knife by cutting the panicles, and then threshed after it was sundried for 5 days after which they were winnowed.

### Data Collection

### Sesame Data

i. Plant height at 3,6 and 9 weeks after planting (cm)
ii. Leaf number at 3, 6 and 9 weeks after planting
iii. Number of branches at 4 and 8 weeks after planting.
iv. Average number of flower per plant at 50% level of flowering.
v. Number of capsule per plant at harvest.
vi. Weight of seed (kg)

### Sorghum Data

i. Plant height at 3, 6, 9 and 12 weeks after planting.
ii. Number of leaves at 3, 6, 9 and 12weeks after planting.
iii. Number of tillers at 4 and 8 weeks after planting.
iv. Weight of seed (kg)

### Statistical Analysis

The data collected was analyzed using analysis of variance (AVONA) and Fisher's Least Significant Difference (F-LSD).

### Determination of Land Equipment Ratio (LER)

Here, the total land area required under monoculture cropping to give the yield obtained in polyculture cropping system (Mead and Willey, 1980) was calculated.

## RESULTS

The means of agronomic traits and grain yield of sesame investigated in the study are presented in Table 1. The result shows that, there were significant differences on leaf number at 3 and 6 weeks after planting. Other traits (leaf number at 9 weeks, plant heights, number of capsule at maturity and seed weight) show no significant difference among the plant arrangement when subjected to analysis of variance at 5% level of probability.

Table 2 shows the means of agronomic traits and yield of sorghum. It shows that, there were significant difference among the plant arrangement at (plant height at 3 and 12 weeks, number of tillers at 9 weeks, leaf number at 12 weeks and the seed or grain weight). There were no significant differences on plant height at 6 and 9 weeks, leaf number at 6 and 9 weeks also on tillers at 6 weeks.

Table 3 show the effect of different sorghum plant arrangements on sesame-sorghum intercrop and their LER. All the intercropped combinations in this study gave LER greater than unity.

Intercropping came from sowing early-maturing and slow-maturing crops together, since most crops could not efficiently utilize the whole season. This is the reason why poor performance of sorghum in intercropped combinations has been attributed to late planting.

**Table 1: Means of some agronomic traits and yield of sesame grown in various cropping patterns**

| Plant arrangement | Traits | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Plant height | | | Number of leaves | | | Number of branches | | Ncm | Swt (Kg) |
| | 3WAP | 6WAP | 9WAP | 3WAP | 6WAP | 9WAP | 6WAP | 9WAP | | |
| T1 | 20.20 | 64.50 | 197.80 | 9.10 | 34.10 | 101.10 | 5.10 | 5.70 | 96.93 | 0.56 |
| T2 | na | na | na | na | Na | na | Na | na | na | na |
| T3 | 19.70 | 61.10 | 175.40 | 9.10 | 21.10 | 69.40 | 3.10 | 3.00 | 63.60 | 0.66 |
| T4 | 18.90 | 63.20 | 196.20 | 8.30 | 24.10 | 74.50 | 4.00 | 4.20 | 71.06 | 0.70 |
| T5 | 19.90 | 63.40 | 195.50 | 8.30 | 31.30 | 83.30 | 4.80 | 4.40 | 87.86 | 0.66 |
| FLSD (0.05) | - | - | - | 0.56 | 7.31 | - | - | - | - | - |

$T_1$ = Sole sesame, $T_2$ = Sole sorghum, $T_3$ = Sesame intercropped at 2 stands/50cm within row spacing, $T_4$ = Sesame intercropped at 1 stand/50cm within row spacing, $T_5$ = Sesame intercropped at 2 stands/100cm within row spacing, na = not applicable,
Ncm = number of capsule at maturity, FLSD = Fisher Least significant Difference
Swt = seed weight

**Table 2: Means of some agronomic traits and yield of sorghum grown at various cropping patterns**

| | Traits | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plant height | | | | Number of leaves | | | | Number of tillers | | |
| Plant arrangement | 3WAP | 6WAP | 9WAP | 12WAP | 3WAP | 6WAP | 9WAP | 12WAP | 6WAP | 9WAP | Seed weight (Kg) |
| T1 | na | na | na | na | na | na | na | na | Na | na | na |
| T2 | 17.33 | 21.66 | 64.80 | 286.00 | 6.00 | 8.93 | 10.80 | 8.53 | 1.86 | 2.80 | 0.633 |
| T3 | 15.66 | 19.86 | 49.30 | 120.03 | 5.53 | 7.06 | 7.70 | 14.40 | 0.40 | 1.00 | 0.166 |
| T4 | 13,33 | 19.53 | 54.06 | 153.38 | 3.60 | 7.73 | 7.80 | 14.66 | 0.26 | 1.10 | 0.233 |
| T5 | 12.26 | 19.53 | 40.80 | 125.20 | 5.56 | 6.86 | 8.20 | 13.10 | 0.13 | 1.00 | 0.200 |
| FLSD (0.05) | 1.59 | - | - | 70.21 | - | - | - | 3.68 | - | 1.50 | 0.178 |

$T_1$ = Sole sesame, $T_2$ = Sole sorghum, $T_3$ = Sesame intercropped at 2 stands/50cm within row spacing, $T_4$ = Sesame intercropped at 1 stand/50cm within row spacing, $T_5$ = Sesame intercropped at 2 stands/100cm within row spacing, na = not applicable

FLSD = Fisher Least significant Difference

**Table 3: Effect of different sorghum plant arrangement on sesame-sorghum inter crop and their respective Land Equivalent Ratio (LER)**

| Plant arrangement | Grain yield (t/ha) | | Partial LER | | Total LER |
|---|---|---|---|---|---|
| | Sesame | sorghum | Sesame | Sorghum | |
| T1 | 0.560 | Na | na | na | |
| T2 | na | 0.633 | na | na | |
| T3 | 0.660 | 0.160 | 1.176 | 0.260 | 1.438 |
| T4 | 0.700 | 0.233 | 1.250 | 0.368 | 1.618 |
| T5 | 0.660 | 0.200 | 0.178 | 0.315 | 1.493 |

$T_1$ = Sole sesame $T_2$ = Sole sorghum,
$T_3$ = Sesame intercropped at 2 stands/50cm within row spacing
$T_4$ = Sesame intercropped at 1 stand/50cm within row spacing
$T_5$ = Sesame intercropped at 2 stands/100cm within row spacing

## DISCUSSION

Generally, intercropping sesame with sorghum reduces the yield of sorghum drastically as similarly reported by Sigh *et al*. (1973), Olufajo (1991), Mohta and De (1980). The total land equivalent ratio (LER) indicated yield advantages in intercropping sesame with sorghum, especially when sesame was intercropped with sorghum at 1 stand/50cm. It is interesting to note that, sorghum had little effect on sesame LER which produced yield advantage.

## CONCLUSION & RECOMMENDATION

Intercropping sesame and sorghum gave large total LER which indicates yield advantage in intercrop. The researchers therefore recommend intercropping of sesame with sorghum at 1 stand/50cm for higher yield.

## COMPETING INTEREST

The authors have no conflict of interest of any type among them. The project had been co-sponsored by authors.

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