*NIGER AGRIC. J. 35 (2004) 13 - 21*

# EVALUATION OF THE PLANTING SCHEDULE OF SOYBEAN/SORGHUM INTERCROP SYSTEMS FOR OPTIMUM YIELDS IN THE GUINEA SAVANNA ZONE OF NIGERIA.

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## ABSTRACT.

A soybeans/sorghum intercrop planting schedule field trial was conducted at Badeggi (Guinea Savanna) in Nigeria, during the 2000 and 2001 cropping seasons. Sorghum seedlings were intercropped with soybean on the following days after planting soybean (DAPS: - (1) 0DAPS (2) 14 DAPS (3) 28 DAPS. Sole soybean and sole sorghum were also planted as treatments 4 and 5 respectively. The objective of the trial is to determine the planting schedule that will result in optimum yields of the component crops. Experimental design was randomized complete block (RCB) with three replicates. Results obtained indicated that although all intercrop treatments were advantageous, optimum yields of the component crops were obtained when sorghum

## INTRODUCTION.

Intercropping, defined as the growing of two or more crops simultaneously or partly simultaneously on the same piece of land, has been traditionally favoured by peasant farmers as it reduces the likelihood of total crop

failure (Balasubramanian and Sekayange, 1991). In almost all peasant cropping systems, intercropping predominates. The most important reasons for the persistence of this farming practice are that gross return per unit area of land is usually higher under intercropping than in sole cropping. It also helps in the control of erosion and weeds and brings about even distribution of labour than in sole cropping (Okigbo and Greenland, 1976) Agboola (1979) claimed that maize/cassava intercropping systems are widely practiced in West Africa. He attributed this popularity to high compatibility and complimentarity of the crops with the fast growing maize exploiting the environment earlier than the slow growing cassava. In intercropping that involves photosensitive sorghum, (*Sorghum bicolor* (L) Moench) temporal complimentarity between crops is often exploited by growing them with an earlier maturing crop. A well documented example of this is the millet/sorghum combination in Nigeria, where it is estimated to occupy 18% of the mixed crop area (Norman, 1975). Many other crops like cowpea (*Vigna unguiculata* ), Beniseed (*Sesamum indicum* L.), Groundnut (*Arachis hypogea*) and Soybean (*Glycine max* (L) Merril) have been reported as intercrops in Nigeria (Yayok, 1981). Grain legumes play an important role in the cropping system in African agriculture by virtue of their short duration, drought tolerance, ability to fix nitrogen biologically, grow in depleted soil and in association with root and cereal crops. Different species of grain legumes are grown in various forms of cropping systems. There are two types of mechanisms postulated for the beneficial effects of legumes in multiple cropping system (Reddy *et al.*, 1983). These are (i) through immediate transfer, in which nitrogen travels directly from the legumes in to associated crop and (ii) through residual effect, in which nitrogen fixed by the legumes is available to an associated sequentially cropped non-legume after senescence of the legume and decomposition of it's organic residue. Although several

researchers (Remison, 1978; Eaglesham *et al.*, 1981) reported some direct transfer of nitrogen in a maize + cowpea intercrop, most studies indicates a residual effect from the leguminous crop (Kang, 1983: Reddy *et al.*, 1983). In Malawi, where many small holder farmers intercrop maize (*Zea mays* L) and pigeon pea (*Cajanus cajan*), it was demonstrated that intercropping long duration pigeon pea varieties without reducing the normal maize plant population, resulted in minimal yield reduction of the associated maize and the benefit of pigeon pea grain yields and fuel-wood (Sakala, 1994). The efficiency of intercropping system are most often assessed in terms of their land equivalent ratio (LER) which is defined as the relative land area that would be required as sole crop to produce the yield achieved in intercropping. Thus a LER of 1.2 indicates that intercropping out yield sole cropping by 20%. Soybean and sorghum intercrop is fast becoming popular among the peasant farmers in the Guinea Savanna. There is thus, the need to determine the best time to introduce soybean or sorghum into the intercrop system, for optimum yields of the component crops. This information is presently lacking and if provided, will encourage farmers who normally grow soybean or sorghum as sole to commence growing them as intercrop. This will increase the land area put to the cultivation of both crops and thereby, enhance the agricultural and industrial development of the nation.

## MATERIALS AND METHODS

A field experiment was conducted at the experimental station of the National Cereals Research Institute in Badeggi ($9^{\circ}$ 4'N and $6^{\circ}$ 7'E) in 2000 and 2001. Badeggi is in the Guinea Savanna agro-ecological zone of Nigeria. Composite soil samples were obtained with a soil tube into a plastic bucket and properly mixed. It was air dried at room temperature and passed through a 2mm sieve before it was taken to the laboratory for analysis. Soil total N was determined by the Kjeldahl method, available P by the Bray I method, exchangeable

K by use of a flame photo meter and organic matter (OM) by the Walkey-black method. The soil pH was measured in a soil/water ratio of 1:2 with a glass electrode and pH meter. Soil physical properties were determined by the hydrometer method. The experiment was planted on ridges on a 14m x 38m land area. Sorghum seedling (Red seeded, photo-period sensitive local variety) was intercropped with soybean variety TGX1019-2EB on the following days after planting soybean (DAPS); (1) 0 DAPS i.e. 22nd and 27th of July 2000 and 2001 respectively (2) 14 DAPS i.e. 5th and 10th of August in 2000 and 2001 respectively, (3) 28 DAPS i.e. 19th and 24th of August in 2000 and 2001 respectively, (4) sole soybean planted on 22nd and 23rd of July in 2000 and 2001 respectively. (5) All sorghum seedlings were obtained from a sole sorghum nursery planted in both years on the 15th June. Trial design was RCB with 3 replicates. Soybean seeds were drilled on the crest of each ridge while sorghum seedlings were planted in the lower side of each ridge. Soybean plant spacing was 5cm x 75cm (266,666 plants/ha), while the sorghum plant spacing was 100 x 75cm (13,333 plants/ha) x 2: sorghum plants were thinned to two plants per stand. The gross plot (4 x 3m) consisted of 4 ridges while the net plot (2 x 1m) consisted of the two centre ridges of each plot. NPK (single sources) were band-applied at the rate of 30 kg/ha and at 2 weeks after planting. Weed control was achieved by two hoe weedings at 3 and 6 weeks after planting. Data collected from 15 plants obtained at random per treatment were: - plant heights, Stover weights, number of soybean pods and branches per plant. Data were analyzed using analysis of variance and significant means separated by LSD.

**RESULT AND DISCUSSION**

Analyzed soil test result of the composite soil samples presented in Table 1, indicated that the soil pH ranges between 5 to 5.7, the organic matter low, P and K contents below their critical levels and the soil texture is sandy.

**Table 1: Soil Test Value of Experimental site.**

| 2000 | | 2001 | |
|---|---|---|---|
| **Chemical Characteristics** | | **Chemical Characteristics** | |
| pH | 5.00 | pH | 5.70 |
| OC | 0.36% | OC | 0.78% |
| OM | 0.62% | OM | 1.34% |
| N | 0.03% | N | 0.04% |
| Available P | 2.35ppm | Available P | 2.90ppm. |
| K | 0.05cmol $kg^{-1}$ | K | 0.08cmol $kg^{-1}$ |
| Ca | 1.34cmol $kg^{-1}$ | Ca | 0.24cmol $kg^{-1}$ |
| Mg | 0.58cmol $kg^{-1}$ | Mg | 1.23cmol $kg^{-1}$ |
| Mn | 0.02cmol $kg^{-1}$ | Mn | 0.02cmol $kg^{-1}$ |
| Na | 0.04cmol $kg^{-1}$ | Na | 0.04cmol $kg^{-}$ |
| Total acidity | 0.02cmol $kg^{-1}$ | Total acidity | 0.02cmol $kg^{-1}$ |
| ECEC | 2.05 | ECEC | 1.63 |
| Physical characteristics | | Physical characteristics | |
| Sand | 87.58% | Sand | 87.52% |
| Silt | 11.11% | Silt | 11.28% |
| Clay | 1.31% | Clay | 1.20% |
| Texture class | Sandy | Texture class | Sandy |

Results obtained in 2000 indicated that soybean plant height, pods, branches per plant and yields, were not significantly affected by the different times of introducing sorghum seedlings into the soybean/sorghum intercrop treatments (Table 2 and 3). This was probably due to the fact that sorghum has an initial slow growth, thus, minimizing the detrimental effects that could be caused by the competition of the component crops for water, nutrients and light in the first few weeks of the intercrop. The planting of soybean on the crest of the ridge couple with the wide sorghum plant spacing (1 x 0.75m) also helped to minimize the shading effect of the dominant sorghum plants, on soybean plants.

## Table 2: Soybean yields components

| | Plant Height (cm) | | Branches/plant | | Pods/ Plant | | Stover yields (kg/ha) | |
|---|---|---|---|---|---|---|---|---|
| Treatments | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 | 2000 | 2001 |
| Sorg/Soy0DAPS | 45.10 | 34.20 | 2.80 | 2.80 | 34.10 | 21.20 | - | 191.00 |
| Sorg/Soy14DAPS | 49.00 | 42.40 | 3.40 | 4.40 | 32.60 | 38.80 | - | 360.00 |
| Sorg/Soy28DAPS | 50.20 | 49.40 | 3.30 | 4.20 | 45.30 | 27.10 | - | 202.00 |
| Sole Soybean | 45.00 | 44.40 | 4.30 | 4.90 | 30.50 | 38.30 | - | 303.00 |
| LSD | NS | NS | NS | 2.00 | NS | NS | - | 16.80 |

## Table 3 Soybean yields

| | Soybean yields (kg/ha) | |
|---|---|---|
| Treatment | 2000 | 2001 |
| Sorg/Soy0DAPS | 867.50 | 1177.00 |
| Sorg/Soy14DAPS | 828.60 | 1283.50 |
| Sorg/Soy28DAPS | 1152.10 | 1245.50 |
| Sole Soybean | 895.40 | 1544.50 |
| LSD NS | 322.00 | |

1. Sorg/Soy 0DAPS; Sorghum intercropped with soybean at 0 day after planting soybean
2. Sorg/Soy 14DAPS; Sorghum intercropped with soybean at 14 days after planting soybean
3. Sorg/Soy 28DAPS; Sorghum intercropped with soybean at 28 days after planting soybean

**In 2000 and 2001 cropping seasons, there were no significant differences between the sole soybean treatment and intercrop treatment for soybean pods per plant and plant height. However, soybean branches per plant, dry Stover weight and seed yields were significantly (P = 0.05) reduced in the intercrop treatment in 2001 (Table 2 and 3). This was more so when soybeans and sorghum seedling were planted on the same day (0DAPS). Earlier unset of competition for light, nutrients and water when the component crops were planted**

on the same day (0DAPS), as compared to when sorghum seedlings were introduced at 14 and 28 DAPS must have been responsible for the soybean yield reduction and poor performance of the yield component. On the other hand in both 2000 and 2001, sorghum plant heights, Stover weights and seed yields, were significantly (P = 0.05) higher when soybeans seeds and sorghum seedlings were planted on the same day (0DAPS) as compared to when the seedlings were introduced at 14 and 28 DAPS (Table 4)

**Table 4: Sorghum yields and yields components**

| | Plant Height (cm) | | Stover yields (kg/ha) | | Sorghum yields (kg/ha) | |
|---|---|---|---|---|---|---|
| *Treatments* | **2000** | **2001** | **2000** | **2001** | **2000** | **2001** |
| Sorg/Soy0DAPS | 391.30 | 397.40 | 3,400.00 | 2600.00 | 1130.00 | 1017.50 |
| Sorg/Soy14DAPS | 250.80 | 327.20 | 2,000.00 | 1300.00 | 870.00 | 797.00 |
| Sorg/Soy28DAPS | 205.30 | 317.10 | 833.00 | 1250.00 | 217.00 | 690.50 |
| Sole Soybean | 306.40 | 414.40 | 4,500.00 | 3050.00 | 1202.50 | 1134.00 |
| LSD | 58.32 | 38.30 | 242.87 | 67.00 | 655.26 | 43.60 |

This was probably so because sorghum seedlings that was planted on the same day as soybean had a longer time to (Ogunlela, *et al.*, 1982) indicated that nitrogen is the most important nutrient required for optimum yield of sorghum in the savanna. This result suggests that planting of soybeans and sorghum seedlings on the same day (0DAPS) gives optimum utilize mineral fertilizer applied and symbiotic nitrogen (N) fixed by soybeans.
yields of the components crops. This fact was further collaborated by the Land Equivalent Ratio (LER) which in 2000 and 2001respectively, gave a LER of 1.9 and 1.7 for (0DAPS), 1.6 and 1.5 for (14 DAPS), 1.5 and 1.4 for (28 DAPS) (Table 5).

**Table 5: Land Equivalent Ratios**

| | 2000 | 2001 |
|---|---|---|
| 1. Sorg/Soy 0DAPS | 1.91 | 1.66 |
| 2. Sorg/Soy 14DAPS | 1.65 | 1.53 |
| 3. Sorg/Soy 28DAPS | 1.47 | 1.42 |
| 4. Sole Soybean | - | - |
| 5. Sole sorghum | - | - |

## CONCLUSION

Simultaneously planting of soybean seeds and sorghum seedlings is best for optimum resource utilization and yield of the component crops


## ACKNOWLEDGEMENT

We will like to thank the management of the National Cereals Research Institute (NCRI) Badeggi for the approval given for this trial to be executed. We are also grateful to members of Oilseed Research Division at NCRI for the human and material support granted during the execution of this project.

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