

Intercropping sunflower with local varieties of cassava in a moist savanna site of Nigeria

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Abstract

A two-year field study examined intra- and inter-row mixtures of 2 local cassava varieties with sunflower at Ogbomosho, Nigeria. There were 8 intercropping and 3 sole crop treatments replicated 4 times in a randomized complete block design. Generally, intercropping depressed the performance of sunflower more than cassava. Cassava and sunflower intercropped at alternate hills and single alternating rows had the poorest growth and yields compared with other planting patterns. There were no significant differences in the growth and yields of cassava and sunflower intercropped in 3 and 5 alternating strips. Light transmission, leaf area index and yields of both crop species followed similar trends under the various planting patterns. Intercropping at 5 alternating strips that allowed the highest leaf area also allowed the lowest light transmission and produced the highest yields. Compared to the slow growing Odongbo, the fast growing Okoyawo cassava significantly suppressed the growth and yield of intercropped sunflower especially when intercropped in alternate hills and single alternating rows. Irrespective of the planting pattern, cassava contributed more to Land Equivalent Ratios (LERs) than sunflower. Whilst Odongbo contributed 21, 34, 18, and 0.05% more than sunflower to LERs, Okoyawo cassava contributed 41, 48, 28, and 30% more than sunflower when interplanted at alternate hills single alternating rows, 3 and 5 alternating strips, respectively. Interplanting Odongbo and sunflower at 3 and 5 alternating strips improved LERs by 72 and 89%, respectively, while an improvement of 46 and 62% were obtained in mixtures of Okoyawo and sunflower for the same planting pattern.

Key words: cassava, sunflower, intercrop, growth, yield

Introduction

Mixed cropping continues to be popular among agronomists and subsistence farmers because it ensures better utilization of crop growth resources (Willey 1979, Krantz et al. 1976, Francis 1981). In the event of an unforeseen environmental hazard affecting the yield of one crop it offers an alternative, so providing a more stable food source overall from the same field (Baker 1980). Although the pattern of mixed cropping varies considerably from one area to another, and even differ among farmers within a single location, the common feature is that each system tends to reflect the farmer's needs, management ability and resources, economic considerations and convenience (Ntare 1990, Andrews 1972, Osiru & Willey 1972, Willey & Osiru 1972).

Cassava (*Manihot esculenta* Crantz) is a major food crop in Nigeria. In the southern Nigeria where it is predominant, it is seldom planted as sole crop due to its long duration to maturity. Intercrops associated with cassava in this region are highly variable and location specific. It is often intercropped with shorter duration crops such as maize, yam, cowpea, melon and vegetables (Njoku & Odurukwe 1986). Sunflower (*Helianthus annuus* L.), a short duration vegetable oil crop was recently introduced into Nigerian agriculture (Ado & Tanimu 1988) to supplement other sources of cooking oil. Despite the great potential of this crop, its adoption rate has remained very low among practising farmers in tropical Africa. This may be attributed to the paucity of information on its state of the art and performance in the cropping system of this part of the world.

Sunflower has not been extensively used as a component of crop mixture in many parts of the world but it has characteristics desirable for intercropping. The erect growth, production under wide row spacing, large and easily harvested

head, and its potential use as a staple food suggest that it would be an ideal intercrop for subsistence agriculture in Nigeria. There are conflicting reports about its suitability as an intercrop. Whilst Rice (1974) and Robinson (1984) reported strong allelopathic effects of sunflower on other crop species in USA, Mbiza (1988) and Adetunji (1993) successfully intercropped sunflower with sorghum in the drier regions of Tanzania and Nigeria, respectively. However, the performance of the crop in mixture with major root crops such as cassava and yam has not been properly documented in tropical Africa. Information on the response of this crop in mixture with cassava will enhance its acceptability as a vegetable oil crop in areas where crops are predominant.

This work reports on the growth and yields of intercropped sunflower and cassava using different spatial arrangements.

Materials and Methods

The experiments reported here were conducted at the Teaching and Research Farm of the Ladoké Akintola University of Technology, Ogbomosho during the early planting seasons of 1996 and 1997. Ogbomosho lies on latitude 8°N and longitude 4°E. This location is in the derived savanna bio-climatic zone, an extensive moist savanna belt immediately above the rainforest zone. The cropping season is relatively long, from April to October followed by a short spell of dry harmattan season. The total rainfall during the experimental period was 765 mm in 1996 and 1211 mm in 1997. A soil sample taken from a depth of 15 cm at the field site before planting was characterised as sandy loam with a pH of 6.8. The organic matter content was 0.55%, total nitrogen 0.17%, available phosphorus 9.8 ppm and potassium 0.16 meq 100g⁻¹ soil. The soil is classified as ultisol (USDA 1975).

The sunflower cultivar used for the study was Isaanka (an open pollinated cultivar of medium height which matures between 90–100 days after planting) obtained from Institute of Agricultural Research (IAR), Samaru, Zaria. Two high yielding local varieties of cassava namely Odongbo and Okoyawo commonly used as intercrop by local farmers were used for the study. Odongbo matures in 12–15 months depending on soil condition, while Okoyawo is generally harvested at 10–12 months after planting by majority of peasant farmers.

There were 11 treatments: 2 of sole cassava, odongbo and okoyawo; 1 sole sunflowers; and 8 different cassava-sunflower combinations, arranged in a replacement series within and between the rows. Thus for each of the cassava varieties there were 4 cassava-sunflower combinations. These treatments were replicated 4 times in a randomized complete block design. The intra-row plant spacing was 60 cm and the inter-row spacing 90 cm. There were 20 rows per plot and 20 plants per row. There were 32 intercrop and 3 sole crop plots, each measuring 16.2 x 11.4 m. Following ploughing and harrowing, cassava cuttings and sunflower seeds were planted at the stipulated treatment levels. After the first weeding at 3 weeks after emergence, fertilizer (NPK 15–15–15) was applied broadcast at the rate of 125 kg/ha. This is the rate recommended for cassava/maize intercrop in this region by KWADP (1988). The same rate was recommended for sunflower/sorghum intercrop at Samaru, Zaria (Ado & Tanimu 1988).

For sunflower, growth parameters such as plant height, stem diameter and leaf number were measured at anthesis while head diameter, seed yield and total dry weight per plant were measured at maturity. Cassava was harvested at 12 months for tops and fresh tuber yields. Plant height, stem diameter and dry matter yield of plant were also measured at harvest. Representative samples of at least 3 tubers from each plot were selected and analysed for starch and dry matter immediately after harvest. When this could not be completed on the same day, samples from the same replicate were kept in sealed polythene bags and stored in the refrigerator and the analysis was done the next day. Starch was extracted from the pulp and determined after Obigbesan (1977) method. Energy yields were computed using the values in Oyenuga (1968). Leaf area per plant was determined on an automatic leaf area meter, model LI3000. This was later converted to leaf area index (LAI). Light transmission was measured with a Lambda portable light meter LI - COR model 185.

Sunflower seed yield and fresh tuber yield of cassava were determined each year using plants in an area of 16.2 x 3 m² at the middle of each plot. These were used to compute the Land Equivalent Ratio (LER) using the formula below:

$$LER = \frac{X_a}{M_A} + \frac{X_b}{M_B}$$

Where X_a and X_b are the component yields of crops A (cassava) and B (sunflower) grown within a mixture, and M_A and M_B are the yields of monocultures of A and B on a similar unit area. Treatment differences were tested by 2-way analysis of variance (Little & Hills 1975) from which standard errors of the differences were calculated.

Results

The 1997 season plants are more vigorous than that of 1996 due to low and poor distribution of rainfall in the latter season. Thus the growth and yields of 1997 plants were higher than that of 1996. However, the effects of intercropping treatments on the performance of the mixture were similar for both seasons, so that means of the 2-year data are described.

Effect on growth and development of cassava and sunflower. Cassava and sunflower grown as sole crops were more vigorous than those planted in mixture (Tables 1 and 2). Generally, depression in the growth of the 2 varieties of cassava and sunflower increased with increased severity of intercropping. Compared to sole crop, plant height, stem diameter, leaf number and dry weight of the 2 varieties of cassava were considerably reduced when interplanted in alternate hills and single alternating rows with sunflower. The magnitude of these reductions were highest in Odongbo variety of cassava (Table 1). The growth characteristics of interplanted cassava were similar to that of sole at 3 and 5 alternating rows the sunflower. However, number of days to 50% anthesis was not affected by interplanting methods.

In sunflower, neither growth nor development characteristics were significantly affected when interplanted with Odongbo cassava (Table 2). Growth characteristics such as plant height, stem diameter, leaf number, head diameter and total dry weight of sunflower were significantly reduced when interplanted in alternate hills and single alternating rows with Okoyawo cassava. Interplanting sunflower with

Table 1. Effect of planting methods on the growth and development of cassava planted either as sole or in mixture with sunflower

Planting methods	Plant height (cm)	Stem diameter (cm)	No. of days to 50% anthesis	Leaf no. per plant	Dry weight per plant (g)
Sole Odongbo	38.3	1.4	96.7	28.4	62.4
Alternate hill with sunflower	21.7	0.6	102.3	16.6	27.3
Between row of sunflower	27.8	0.9	95.1	19.3	30.2
Three rows of cassava alternating with 3 rows of sunflower	33.1	1.2	96.3	27.1	58.7
Five rows of cassava alternating with 5 row of sunflower	38.0	1.5	96.4	27.8	61.1
Sole Okoyawo	55.8	1.8	72.5	37.8	87.1
Alternate hill with sunflower	29.6	0.9	73.8	25.1	37.4
Between row of sunflower	34.1	1.1	72.1	29.3	49.3
Three rows of cassava alternating with 3 rows of sunflower	49.7	1.7	72.0	37.1	79.1
Five rows of cassava alternating with 5 row of sunflower	56.1	1.9	72.4	38.3	82.6
SE	0.12	0.10	1.25	0.61	2.11

