ON-FARM DETERMINATION OF THE PRODUCTIVITY RESPONSE OF YAM/MAIZE/CASSAVA/TELFAIRIA INTERCROP TO MOUND SIZE

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ABSTRACT

Productivity of yam (*Dioscorea rotundata* cv. '*Obiaoturugo*'), maize (*Zea mays* var. TZ-E-SR), cassava (*Manihot esculenta* Crantz. var. TMS 30572 and fluted pumpkin (*Telfairia occidentalis*) intercrop using different mound sizes was evaluated in a researcher-managed on-farm trial in the upland area of Amasiri in Afikpo Zone of Ebonyi State, Nigeria during the 2002 and 2003 wet seasons. The treatments were mound sizes of 1.5m x 0.5m (farmers' practice or control), 1.0m x 0.5m. 1.5m x 0.75m and 2.0m x 1.0m. In both years of the trial the farmers' mound size produced a significantly higher yield of fluted pumpkin leaves (0.344 t/ha and 1.04 t/ha, respectively) than the other mound sizes. The maize grain and yam tuber yields were not significantly affected by mound sizes ($p>0.05$). The effect of mound size on cassava root yield was not consistent in both years. In 2002 mound size did not affect cassava root yield but in 2003, using 2.0m x 1.0m mound size produced significantly the lowest yield (3.06 t/ha) than 1.5m x 0.5m (6.67 t/ha), 1.0m x 0.5m (6.30 t/ha) compared to 1.5m x 0.75 (5.99 t/ha). Net profits from sale of these commodities were also not significantly affected by mound size. Farmers are therefore advised to continue with their practice of 1.5m x 0.5m mound size.

Key words: Mound size, yam maize cassava. Telfairia, crop mixtures, productivity

INTRODUCTION

In their survey of the farming systems of the south eastern agro-ecological zone of Nigeria, Unamma *et al.* (1985) observed that 88% of the farmers in the zone intercrop as many as five crops, with yam (*Dioscorea spp*), maize (*Zea mavs* L.) and cassava (*Manihot esculenta* Crantz) being the most dominant. Vegetables, particularly fluted pumpkin (*Telfairia occidentalis*), okra (*Abelmoschus exculetus* (L) Moench) and melon (*Citrullus lanatus*) are usually minor components of the system.

In Afikpo agricultural zone of Abia State, Nigeria, two sizes of mound, depending on topography, common (Odurukwe *et al.*, 1988). In the lowland or swampy areas, where rice is grown, mound sizes are usually large and widely spaced apart (5-6m) with basal diameters as wide as 2 meters and height of up to 1.5m. As many as 10 stands of yam, 18 of cassava, 14 of maize and 6 of cocoyam are planted per mound Okigbo 1980). The yam and maize are usually planted lower down and the cocoyam at the base of the mound. The large mound size appears to guard against water-logging. In the upland ecology, mounds are considerably smaller and carry only 1-2 stands of yam, 4 of cassava, 2 of cocoyam and 4 of maize stands, with the basal diameter and height of the mound being usually about 2m and 70cm, respectively, and inter-mound spacing of 1.4 -2.3m.

A major constraint to agricultural production in the area was identified to be the unusually large mound sizes employed by the farmers. Not only did the wide inter-mound spaces encourage excessive weed infestation, but also the mounds are not made in rows, making farm operations difficult. The objective of this study was to establish the best economic mound size for maximum productivity of yam/maize/cassava/telfairia intercrop. This study was a collaborative study between National Root Crops Research Institute (NRCRI), Umudike and Ebonyi State Agricultural Development Projects, Abakaliki.

MATERIALS AND METHODS

The study was conducted for two years (2002 and 2003) at two different sites on acid clayey loam soil in Amasiri in Afikpo of Ebonyi State. Amasiri is approximately 5° 54'N and 70 53" E. Mean annual rainfall in the

area is 1995mm bi-modally distributed with peaks in July and September. The generally poorly drained soils in the area are derived from shales and are best described as Typic Tropaquep (FAO/UNESCO. 1973). Site and farmer selection were based on criteria defined by Unamma *et al.* (1990). The farm used in 2002 trial had been under a four-year fallow of mixed grasses and forest, while the two farms used in 2003 had been under fallow for 6-7 years. In 2002 the trial was sited in one farm, while in 2003 the four replications were spread out in two contiguous farms.

Land preparation consisted of clearing, burning and packing of thrashes, which preceded the making of mounds in rows. In 2002, mounds were made on 12th and 13th May, while in 2003 mounds were made on 16th and 17th May. Four mound sizes were compared in a randomized complete block design with 4 replications. The traditional farmers' mound size (1.5m x 0.5m) as control was compared with three mound sizes (1.0m x 0.5m, 1.5m x 0.75m and 2.0m x 1.0m). The first dimension in each case refers to the basal diameter of the mound, while the second refers to the height of the mound. The inter-mound spaces for 1.5m x 0.5m, 1.0m x 0.5m x 0.75m and 2.0m x 1.0m mound sizes were 55cm, 20cm, 40cm and 60cm, respectively.

In 2002, yam (*D. rotundata* cv. *Obiaoturugo*), maize (*Zea mays* var. *TZSR-W*) and local fluted pumpkin (*Telfairia occidentalis*) were planted from 14th to 16th May and cassava (TMS 30572) was introduced on 11th August, 2002. In 2003, yam, maize and fluted pumpkin were planted from 17th to 19th May, and cassava was introduced on 21st July. Planting materials were uniform and were provided by the researchers, while the farmer provided land and labour for cultural operations. Seed yams and cassava stems were procured from NRCRI, Umudike; maize was purchased from the National Seed Service at Umudike, while fluted pumpkin seeds were purchased from the National Horticultural Research Institute, Mbato Sub-Station. Yam was planted on the crest of the mound, maize at the base and fluted pumpkin and cassava midway on the mound. Gross plot size was 10m x 10m, while net plot size was 8m x 8m.

Hoe weeding was carried out at 3, 8 and 12 weeks after planting yam and maize. Yams were staked at 4 stands per stake. N:P:K 15-15-15 compound fertilizer was ring-applied at 800kg/ha (equivalent to 120kg N. 52kg P and 100kg K/ha) at 4 weeks after planting. Insect pests of Telfairia were controlled by foliar application of vetox 85 at the rate of 1.3kg a.i/ha. applied at 30 days after planting, when the destructive beetles (or leafhoppers) attacked the leaves of the Telfairia.

Fresh Telfairia leaves were harvested at fortnightly intervals starting from second week of July to the first week of October each year. The leaves were sold in kg. bundles. Maize was harvested at field-dry stage at 5 months after planting and converted to yield per hectare at 14% moisture content. Yam tubers were harvested at senescence in mid-December, while cassava was harvested in September of the following year at 12 months old. All harvests were weighed and monetary yields estimated from prevailing local market prices (yam at N10, 000/t, maize at N4, 500/t, cassava at N2, 400/t and Telfairia at N4, 000/kg. Net profits from the sale of produce from each treatment were calculated after subtracting the cost of inputs (planting materials, labour, and fertilizer) but not cost of the land. Data for each year were analysed separately; the data for both years were later pooled after an F-test showed that the variances for the data of the two years were heterogenous only for Telfairia leaf and cassava root yields.

RESULTS AND DISCUSSION

The yields of yam and maize were not significantly affected by mound size in 2002 and 2003 (Tables 1 and 2). The yield of fluted pumpkin (*T. occidentalis*) leaves was significantly highest with mound size of 1.5m x 0.5m (farmer' practice) in both years (Tables 1 and 2). For cassava, the root yields were not significantly different among the mound sizes in 2002 (Table 1) but in 2003, the farmers practice (1.5m x 0.5m), 1.0m x 0.5m and 1.5m x 0.75m gave similar root yields, which were significantly greater than that of 2.0m x 1.0m mound size (Table 2).

Mound size and productivity of intercrops

Table 1. The effect of mound sizes on productivity of yam/maize/fluted pumpkin/cassava intercrop in Amasiri, in Afikpo area of Ebonyi state Nigeria in 2002

Treatments (mound size)*	Pumpkin leaves	Maize grain (14% MC)	Yam tuber	Cassava root	Net profit (N/ha x10^3
1.5m x 0.5cm (control)	0.344	0.53	14.47	7.40	23.20
1.0m x 0.50m	0.084	0.34	13.45	6.43	20.78
1.5m x 0.75m	0.036	0.62	16.57	7.40	27.59
2.0m x 1.0m	0.070	0.32	14.81	7.48	23.00
LSD (0.05)	0.092	NS	NS	NS	NS
C.V.(%)	43.18	71.45	48.85	43.07	17.13

* Mound size =Basal diameter x height N.S = not significant ($p \geq 0.01$).

Table 2: The effect of mound size on productivity of yam/maize/fluted pumpkin/cassava intercrops in Afikpo state Nigeria Ebonyi in 2003

Commodity yields (t/ha)

Treatments(mound size)	Pumpkin leaves	Maize grain (14% M.C)	Yam tuber	Cassava root	Net profit (N/ha. x 10^3
1.5m x 0.5cm (control)	1.014	0.71	9.68	6.67	17.74
1.0m x 0.5m	0.333	0.80	9.70	6.30	14.51
1.5m x 0.75m	0.464	0.62	11.23	5.99	16.45
2.0m x 1.0m	0.411	0.89	11.73	3.06	14.77
LSD(∞ = 0.05)	0.310	NS	NS	2.71	NS
C.v.(%)	56.12	52.68	44.04	24.19	41.78

* Mound size = Basal diameter x height; N.S = not significant ($p \geq 0.01$).

The net profits from sale of these commodities were not significantly affected by mound sizes for the two years (Table 1 and 2).

The pooled yield data of the component crops for the two years are shown in Table 3. A two-year average shows that there were no significant differences in the maize grain and yam tuber yields due to mound sizes. There were, however, significant differences in the yields of cassava roots and fluted pumpkin leaves. For cassava, using mound size of 2.0m x1.0m reduced root yield significantly over the other sizes. For fluted pumpkin, the use of 1.5m x 0.5m mound size gave the highest leaf yield. The net profit, as also shown in Table 3, indicates that the net profits did not differ among the mound sizes.

The overall objective of intercropping is to increase the yields of component crops, as well as to generate profit to solve other needs of the farmer.

Table 3: The effect of mound size on productivity of yam/maize/Telferia/cassava intercrop at in Afikpo (pooled for both years)

Commodity yield (t/ha)

Treatments (mound Size*)	Pumpkin leaves	maize grain (14% M.C)	Yam tuber	Cassava	Net profit
1.5m x 0.5m (control	0.698	0.62	12.08	7.09	20.86
1.0m x 0.5m	0.208	0.57	11.58	6.37	18.09
1.5m x 0.75m	0.250	0.63	13.90	6.75	22.81
2.0m x 1.0m	0.240	0.61	13.30	5.54	19.48
LSD(0.05)	0.010	NS	1.35	NS	NS

* Mound size = Basal diameter x height.

CONCLUSION:

In this trial, an attempt was made to change the mound size of the farmer from 1.5m x 0.5m to 1.0m x 0.5m, 1.5m x 0.75m or 2.0m x 1.0m. The farmer's practice of 1.5m x 0.5m mound size gave better yield of cassava and fluted pumpkin leaves. Therefore, we recommend that farmers should continue with their current mound size.

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