Productivity of yam-cassava based/land-race legumes in inter-cropping systems

Ibeawuchi II[1,*], Obiefuna JC[1], Ofoh MC[1], Matthewa-Njoku Edna[2], Ajaero JO[2]

[1]*Department of Crop Science and Technology*, *Federal University of Technology*, *P. M. B.* 1526, *Owerri*, *Nigeria*; [2]*Department of Agricultural Extension*, *Federal University of Technology*, *P. M. B.* 1526, *Owerri*, *Nigeria*

Received October 2, 2007

Abstract

Raising and sustaining the productivity of smallholder tuber based crop mixture is the major problem facing tropical agriculture. This problem is connected with the development of low input technologies, which is the sure and noble alternative of which the tuber/land race legume mixture is the answer. However, the more the component crops in the mixtures the lower, the individual crop yields. Crop mixtures involving lima bean and African yam bean were most efficient judged by the higher LER and gave the highest monetary returns which is the satisfaction of the smallholders farmer who produce majority of our foods. [Life Science Journal. 2008; 5(1): 68 – 74] (ISSN: 1097 – 8135).

Keywords: yields; yam; cassava; maize and land race legumes; monetary returns

1 Introduction

Farming is the main stay of rural economy and inter cropping which is a common feature of agriculture is very popular among farmers in southeastern Nigeria and other developing countries of the world. The practice is popular because of its advantages over sole cropping (Ibeawuchi, 2004) which include yield stability and security and higher profitability due to higher combined returns per unit area of land (Ezulike *et al*, 1993; Ibeawuchi *et al*, 2005a). The practice of inter cropping controls erosion and weeds and allows a more even distribution of farm labour than sole cropping (Raymond, 1990; Mbah *et al*, 2003; Okpara *et al*, 1995) and serves as a security against crop failure (Ibeawuchi, 2004; Ibeawuchi *et al*, 2005). As a result of these and other reasons the agronomists and other farming systems specialists are finding ways and means of improving its technologies to increase yield and enhance productivity for sustainability.

Yam, cassava and maize crops are important base crops and serve as a major source of energy and even supplied traces of proteins and mineral in the food of people. These three crops dominate most crop mixture because of their position in the daily livelihood of people especially in the tropical and sub-tropical regions of the world.

The velvet bean (*Mucuna pruriens*), the African yam bean (*Stenostylis sternocarpa*) and the Lima bean (*Phaseolus lunatus*) are all grain legumes rich in protein and has the ability to fix nitrogen in cropping systems (Ibeawuchi *et al*, 2005b). Already, lima bean and African yam bean are well known and are being utilized in most farming communities in southeastern Nigeria, however, the velvet bean was got from the wild for inclusion and study to upgrade its status, being a high yielding grain legume. It is fast gaining ground in the animal feed formulation research where it has been used at 25% level in broiler and layer birds and 40% level in pigs (Emenalom, 2002).

The objectives of this research therefore were to study the productivity of tuber/land race legumes in inter cropping systems with a view to understanding their yield pattern and monetary returns compared to their sole crop counterparts.

2 Materials and Methods

2.1 Study area

The experiment was conducted at the teaching and research farm of the School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri

*Corresponding author. Email: ii_ibeawuchi@yahoo.co.uk

(FUTO), Nigeria; located between latitudes 5º 23′ 8.7″ N and longitudes 6º 59′ 39.4″ E at a height above sea level of 55 m (Hand held Global positioning system). Owerri is in the tropical rainforest zone of southeastern Nigeria, which ecologically is characterized with more than 2,500 mm annual rainfall, 27 ºC – 29 ºC annual temperatures and 89% – 93% relative humidity. The soil of Owerri belong to the soil mapping unit number 431 that is the Amakama-Orji-Oguta soil association (Federal Department of Agriculture and Land Resources, 1985) and derived from classification the coastal plain sands (Lekwa and Whiteside, 1986). The soils formed from these acid sands are classified as Ultisols (Eshett and Anyahucha, 1992). The Ultisols (Acrisols in the FAO/UNESCO world soil map) are seriously acidic, coarse textured, highly leached upland soils occurring further south of the southeastern Nigeria and they have low mineral reserve and are, therefore, low in fertility (Eshett, 1993).

2.2 Planting materials

Three land race legumes endemic in the humid rainforest zone of southeastern Nigeria were used namely African yam bean: *Sphenostylis sternocarpa*, Lima bean: *Phaseolus lunatus* and the velvet bean: *Mucuna pruriens* Var. utilis. Mucuna grows in the wild but the dark brown to black colored seeds were collected from the SAAT gene bank while lima bean and African yam bean were bought from the rural markets in Owerri agricultural zone. Other planting materials included cassava (TMS 30555), seed yams (white) obiaeturugo (local cultivar) and maize (TZSR yellow). For the repeat of the experiment in 2002, seeds of the land race legumes, seed yams and cassava cuttings and maize seeds got from 2001 harvest were used to plant in 2002.

2.3 Land preparation

For the two years (2001/2002 and 2002/2003) of the research work, land preparation was done manually with machetes, spades and rakes since minimum tillage was used. In each case, the site after clearing was left to dry. The stick and woody parts of the dry matter were later picked and removed from the site. The field was thereafter marked out for planting.

2.4 Experiment

Intercropping of the three-landrace legumes with yam, cassava and maize was carried out in 2001 cropping season. The experiment was laid out in a randomized complete block design with 18 treatments replicated 3 times. This gave a total of 54 plots. Each plot measured 3 × 4 m with a space of 1 m between each plot and 2 m between each block. There was a 1 m-guard area round the experimental area; this gave a total of 1,209 m^2 or 0.121 ha. The treatments included sole crops of the individual crops and their combinations as follows:

Yam-based: 1. yam/maize/mucuna (y/m/mp), 2. yam/maize/lima (y/m/l), 3. yam/maize/African yam bean (y/m/Ayb), 4. yam/maize (y/m).

Cassava-based: 5. cassava/maize/mucuna (c/m/mp), 6. cassava/maize/lima (c/m/l), 7. cassava/maize/African yam bean (c/m/Ayb), 8. cassava/maize (c/m).

Yam/cassava-based: 9. yam/maize/cassava/mucuna (y/m/c/mp), 10. yam/maize/cassava/lima (y/m/c/l), 11. yam/maize/cassava/African yam bean (y/m/c/Ayb), 12. yam/maize/cassava (y/m/c).

Sole cropping: 13. yam (y), 14. cassava (c), 15. maize (m), 16. mucuna (mp), 17. lima bean (l), 18. African yam beans (Ayb).

2.4.1 Planting and spacing. Planting was done in the first week of April 2001 and was also repeated in 2002. Seeds of the land race legumes were planted in holes at a depth of 2 – 5 cm at 50 × 50 cm spacing each. These were later thinned down to 1 per hole after germination giving a plant population of 20,000 plants per hectare for sole and intercropped plots of each of the three legumes.

Maize was the TZSR-yellow, purchased from Imo ADP, Owerri. Two maize seeds were planted per hole at a depth of 2 – 5 cm at 1 × 1 m spacing. This was thinned down after germination to 1 plant per stand giving a plant population of 10,000 plants per hectare.

Yam, *Dioscorea rotundata* (white) obiaeturugo local variety was purchased from Relief Market Owerri. Seed yams weighing 200 – 300 g were planted in holes measuring 30 × 30 × 30 cm at a spacing of 1 × 1 m on the flat. This gave a plant population of 10,000 plants per hectare.

Cassava (TMS 30555) cuttings were purchased from Imo ADP, Owerri. Cassava cuttings measuring 20 cm long were planted on the flat at 1 × 1 m spacing giving a plant population of 10,000 plants/ha.

2.4.2 Agronomic practices. The land was cleared and the treatments were randomly laid out in each plot. No fertilizer or agrochemical was applied .

2.4.3 Staking. The yams were staked as soon as the vines were long enough to climb the stakes. The land race legumes shared the same stake with yam. In cassava-based system, the legumes utilized the cassava stems as stake support.

2.4.4 Weeding. Weeding was done 3 times with hoe at 4, 8 and 12 weeks after planting (WAP) for all the plots in the experiment.

2.4.5 Training. Training of the yam and legume vines started immediately after staking and continued up to 12 WAP.

Harvesting was done at the maturity of each test crop.

Maize: Dried maize cobs in the field were harvested at 15 WAP when 99% of all the maize stands had dried. The cobs were sun dried and dehusked, shelled and the grain weight was obtained.

African yam bean: The long pods of the beans ripened and dried at different intervals. Harvesting of the dried pods were spread over a period of two weeks from 20 – 22 WAP. The pods were further sun-dried and split open and the seeds collected. The seeds were weighed with a Salter scale.

Lima bean: The dry pods of the bean ripened at different times. Harvesting was spread over three weeks from 19 – 22 WAP. The pods were split, the seeds collected and their weight obtained.

Velvet bean (*Mucuna pruriens*): The pods matured 17 WAP and drying started two weeks later. Harvesting of the pods, which matured and dried at different intervals began from the 18 WAP and lasted till 23 WAP. The pods were split open by applying some pressure with a small stick. The black seeds were gathered and weight obtained.

Yam: The yams were harvest at 35 WAP with spade. The tubers were gathered and weighed and the weight recorded.

Cassava: The cassava stands were harvested 60 WAP. The cassava cuttings were gathered plot by plot at 20/ bundle. Cassava tubers per plot were weighed and recorded.

2.5 Data analysis

The data collected were collated and statistically analyzed using the Megastat, developed by Orris (2000), Microsoft Excel (2000) and SPSS (2004) packages. Wahua (1999) was also used to help in data analysis and interpretation.

3 Results and Discussion

3.1 Mean yield and land equivalent ratio (LER) in the cropping systems with landrace legumes

Results (Table 1) showed the mean yield and LER of yam-based, cassava-based and yam/cassava-based cropping systems with landrace legumes in 2001. The result showed high LER in inter cropping than in sole cropping systems. From the result, yam-based, cassava-based or yam/cassava-based cropping system with either lima bean or African yam bean gave higher LER than any of the tuber based-cropping systems with *Mucuna pruriens*. All the crop combinations with mucuna had lower LER within the crop combination. The highest LER of 2.93 was realized in 2001 in yam/maize/cassava/African yam bean, followed by yam/maize/cassava/lima bean with 2.81 in the same year.

Table 2 showed the mean yield and LER of the tuber/legume mixture in intercropping systems in 2002. The result shows lower LER when compared with the 2001 cropping. The result followed the pattern of LER in 2001 for the 2002 in that higher LER were observed in yam-based, cassava-based or yam/cassava-based crop mixture with either lima bean or African yam bean than with mucuna in any of the cropping systems used in the experiment. All the crop combinations with mucuna had low LER although they were higher than the sole crops. The y/m/Ayb and c/m/l bean crop mixtures gave the highest LER of 2.45 and 2.33 respectively, in 2002.

Table 3 showed the overall yield of the various crops in the cropping system.

Yam: The results showed that sole planted yam (10.65 t/ha) had no significant tuber yield difference with y/m/Ayb (10.39 t/ha). The yam yield in y/m/Ayb was significantly different from yields of yam in all the yam/cassava-based cropping systems. This could be attributed to competition for growth resources due to many crop species in the mixture. The lowest yield of yam was obtained in all the crop combinations involving mucuna which yielded 3.34 t/ha under yam-based and 3.33 t/ha under yam/cassava-based cropping systems where it appeared as a crop component.

Maize: The results showed a significant yield difference between sole maize and intercropped maize. However, the yields of maize in combination with lima or African yam bean in all the cropping systems were better than those in combination with mucuna and were significantly different ($P \geq 0.05$). This showed the shading effects of *Mucuna pruriens* in the cropping systems where it appeared as a crop component.

Cassava: The results showed that sole cassava had the highest yield of 17.43 t/ha but this was not different from the cassava yield from c/m/Ayb 14.46 t/ha. However, this yield (14.46 t/ha) from c/m/Ayb was not statistically different from c/m/l (12.75 t/ha) and c/m/mp but was significantly different from the yam/cassava-based cropping systems. The lowest yield of 6.25 and 6.36 t/ha were obtained in y/m/c and y/m/c/mp. The landraces performed well under sole cropping more than in combination with y/m/c. However, the yields of the landraces in yam/maize or cassava/maize crop mixture were reasonably higher than those in combination with y/m/c. Mucuna inclusion

Table 1. Mean yield and LER of yam-based and cassava-based cropping system with landrace legumes in 2001

Croping system	Yield (t/ha) of the sole cropping and in combination						LER of the crops						Total
	y	m	c	mp	l	Ayb	y	m	c	mp	l	Ayb	
y	10.75						1						1
m		0.85						1					1
c			18.3						1				1
mp				5.25						1			1
l					0.63						1		1
Ayb						0.61						1	1
y/m	10.01	0.76					0.93	0.86					1.79
y/m/mp	10.03	0.16		3.12			0.28	0.18		0.59			1.05
y/m/l	10.02	0.86			0.53		0.93	0.98			0.84		1.91
y/m/Ayb	10.57	0.86				0.54	0.98	0.98				0.89	1.96
c/m		0.78	9.28					0.89	0.51				1.4
c/m/mp		0.33	9.11	2.97				0.36	0.5	0.57			1.45
c/m/l		0.84	12.8		0.44			0.95	0.7		0.7		2.35
c/m/Ayb		0.84	13			0.48		0.95	0.71			0.79	2.45
y/m/c	7.64	0.73	8.08				0.73	0.83	0.44				2
y/m/c/mp	1.92	0.27	8.83	1.1			0.18	0.31	0.48	0.21			1.18
y/m/c/l	7.64	0.75	11.6		0.37		0.73	0.85	0.64		0.59		2.81
y/m/c/Ayb	7.61	0.81	12			0.38	0.73	0.92	0.66			0.62	2.93

Table 2. Mean yield and LER of yam-based and cassava-based cropping system with landrace legumes in 2002

Croping system	Yield (t/ha) of the sole cropping and in combination						LER of the crops						Total
	y	m	c	mp	l	Ayb	y	m	c	mp	l	Ayb	
y	10.05						1						1
m		0.76						1					1
c			16.61						1				1
mp				4.3						1			1
l					0.64						1		1
Ayb						0.54						1	1
y/m	8.97	0.51					0.85	0.67					1.52
y/m/mp	3.67	0.21		1.92			0.85	0.28		0.45			1.08
y/m/l	8.49	0.54			0.46		0.81	0.71			0.72		2.24
y/m/Ayb	10.21	0.6				0.37	0.97	0.79				0.69	2.45
c/m		0.55	10.31					0.72	0.38				1.1
c/m/mp		0.18	10.33	1.07				0.24	0.62	0.25			1.11
c/m/l		0.54	12.69		0.55			0.71	0.76		0.86		2.33
c/m/Ayb		0.53	15.89			0.40		0.7	0.96			0.74	2.4
y/m/c	6.93	0.43	4.42				0.66	0.57	0.26				1.49
y/m/c/mp	4.73	0.22	3.89	1.28			0.49	0.28	0.23	0.3			1.31
y/m/c/l	7.94	0.53	5.85		0.26		0.75	0.71	0.35		0.41		2.22
y/m/c/Ayb	8.46	0.51	6.49			0.11	0.8	0.67	0.39			0.2	2.06

in all crop mixtures with yam and maize depressed the yields of yam and maize in their association.

Table 3. Mean over all yield (t/ha) of the various crops in the cropping system

Croping system	Various crops (t/ha)					
	y	m	c	mp	l	Ayb
y	10.65^{a}					
m		0.82^{a}				
c			17.43^{a}			
mp				4.78^{a}		
l					0.64^{a}	
Ayb						0.58^{a}
Yam-based						
y/m	9.49^{ab}	0.64				
y/m/mp	3.34^{d}	0.19^{d}		2.52^{b}		
y/m/l	9.26^{b}	0.70^{b}			0.50^{b}	
y/m/Ayb	10.39^{a}	0.73^{b}				0.46^{b}
Cassava-based						
c/m		0.67^{b}	9.80^{c}			
c/m/mp		0.21	9.97^{b}	2.02^{b}		
c/m/l		0.69^{b}	12.75^{b}		0.49^{b}	
c/m/Ayb		0.68^{b}	14.46^{ab}			0.43^{b}
Yam/cassva-based						
y/m/c	7.29^{c}	0.63^{c}	6.25^{d}			
y/m/c/mp	3.33^{d}	0.14^{d}	6.36^{d}	1.18^{c}		
y/m/c/l	7.79^{c}	0.64^{c}	8.75^{cd}		0.32^{c}	
y/m/c/Ayb	8.04^{b}	0.66^{bc}	9.25^{c}			0.25^{c}

Means followed by the same alphabet (a, b, c, d) are not significantly different at 5% probability, Duncan's Multiple Range Test.

3.2 Monetary returns analysis of the cropping systems

Tables 4 and 5 showed the monetary returns of the cropping systems in 2001 and 2002, respectively. The 2001 market surveys were carried out in 2001 for all the crops except that of cassava which was carried out in 2003. Also, the market surveys for cassava of the 2002 cropping were carried out in 2003 while the others were done in 2002. The price per kg for all the crops were determined from the market surveys conducted in 2001, 2002 and 2003 but that of mucuna could not be determined in any of the rural and urban markets visited for the surveys. There were higher crop prices in 2002 than in 2001, in all, cassava cost was very low per unit price unlike yam that had high unit price in all the survey years. Intercropping y/m/Ayb and y/m/l gave the highest monetary returns of N 635.3×10^{3} and N 604.6×10^{3}, respectively. The lowest monetary yields were got from crop combinations with *Mucuna pruriens* in y/m/mp which gave N 152×10^{3} y/m/c/mp with N 157.29×10^{3}, and c/m/mp with N 93.33×10^{3} per hectare respectively. The higher the number of crops in a mixture the lesser the returns per crop but when gathered together becomes high in terms of quantity and money returns. However, the returns follow the trends of the LER (Tables 1 and 2 respectively).

3.3 Productivity of tuber / landrace legumes

The results of the two years experiment showed that the efficiency of inter cropping relative to sole cropping expressed as LER was greater than 1.0; indicating a higher productivity per unit land area. This yield advantage was achieved by intercropping either yam/maize/ any of the landrace legumes or cassava/maize/any of the landrace legumes. The results agreed with the reports of Willey (1979), Kurt (1984) and Okpara *et al* (1995) who stated that intercropping was more advantageous than sole cropping, especially when legumes which improve soil fertility were involved resulting in higher component yields and invariably in higher productivity and monetary returns.

3.4 Monetary returns of the tuber/legume cropping systems (N : K /ha)

Yield advantage of intercropping over sole cropping and the crop yields as related to LER can only be properly measured when it is converted or related to the real money values. This agreed with the view by Willey (1979) who explained that the practical significance of LER could only be fully assessed when related to the actual economic returns. In the two trial years (2001 and 2002) the economic performance of the cropping systems showed that there were high monetary yield in inter-crops than in sole crops. This agreed with the report by Mbah *et al* (2003). On the LER basis, the highest yield advantage was realized in y/m/c/Ayb and y/m/c/l with 2.93 and 2.81 respectively in 2001, whereas it was y/m/Ayb and c/m/Ayb with 2.45 and 2.40 respectively in 2002. The high LER as obtained from the crop mixtures in 2001 did not reflect in high monetary returns except for that of 2002. In 2001, LER of y/m/c/Ayb (2.93) and y/m/c/l (2.81) were higher than that of y/m/Ayb (1.96). The y/m/Ayb gave higher monetary returns than the other two crop combinations. However, in 2002, y/m/Ayb with highest LER of 2.45 had the highest monetary returns. These observations agreed with Ifenkwe and Odurukwe

Table 4. Cost-return analysis of the cropping systems from market surveys of 2001 and 2002

Croping system	Yield (t/ha) of the sole cropping and in combination						Returns (N/ha) (× 10^3)						Total
	y	m	c	mp	l	Ayb	y	m	c	mp	l	Ayb	
y	10.75^{a}						430a						430^{c}
m		0.88^{a}						176^{a}					176^{e}
c			18.25^{a}						54.75^{a}				54.75^{f}
mp				5.25^{a}						N/A			N/A
l					0.63^{a}						37.8^{a}		37.8^{f}
Ayb						0.61^{a}						45.75^{a}	45.75^{f}
y/m	10.01^{a}	0.76^{a}					400.4^{a}	152^{b}					552.4^{b}
y/m/mp	3.00^{c}	0.16^{d}		3.12^{b}			120^{d}	32^{d}		0			152^{e}
y/m/l	10.02^{a}	0.86^{a}			0.53^{ab}		400.8^{a}	172^{a}			31.8^{b}		604.6^{e}
y/m/Ayb	10.57^{a}	0.86^{a}				0.54^{ab}	422.8^{a}	172^{a}				40.5^{b}	635.3^{e}
c/m		0.78^{a}	9.28^{e}					156^{b}	27.84^{c}				183.84^{e}
c/m/mp		0.33^{c}	9.11^{c}	2.97^{b}				66^{c}	27.33^{c}	0			93.33^{e}
c/m/l		0.84^{a}	12.8^{b}		0.44^{b}			168^{a}	38.4^{b}		26.4^{c}		232.8^{d}
c/m/Ayb		0.84^{a}	13.03^{b}			0.48^{b}		168^{a}	39.09^{b}			36^{e}	243.09^{d}
y/m/c	7.64^{b}	0.73^{a}	8.08^{d}				305.6^{b}	146^{b}	24.24^{e}				475.84^{c}
y/m/c/mp	1.92^{c}	0.27^{c}	8.83^{d}	1.10^{c}			76.8^{c}	54^{c}	26.49^{e}	0			157.29^{e}
y/m/c/l	7.64^{b}	0.75^{b}	11.64^{bc}		0.37^{c}		305.6^{b}	150^{b}	34.92^{b}		22.2^{d}		512.72^{b}
y/m/c/Ayb	7.61^{b}	0.81^{a}	12.00^{b}			0.38^{c}	304.4^{b}	162^{a}	36^{b}			28.5^{d}	530.9^{b}

$^{a, b, c, d, e, f}$ mean significantly different ($P \geq 0.05$), Duncan's Multiple Range Test. Survey data were collected from Ekeukwu-Owerri, Nkwo-Orodo, Nkwo-ukwu-Ihiagwa and Eke-Obiangwu. Yam = N 40/kg, Maize = N 200/kg, Cassava = N 3/kg, Mucuna = NA, Lima bean = N 60/kg, African yam bean = N 75/kg.

Table 5. Cost-return analysis of the cropping systems from market surveys of 2002 and 2003

Croping system	Yield (t/ha) of the sole cropping and in combination						Returns (N/ha) (× 10^3)						Total
	y	m	c	mp	l	Ayb	y	m	c	mp	l	Ayb	
y	10.54^{a}						527^{a}						527^{b}
m		0.76^{a}						212.8^{a}					212.8^{c}
c			16.61^{a}						59.796^{a}				59.796^{e}
mp				4.3^{a}						N/A			N/A
l					0.64^{a}						57.6		57.6^{e}
Ayb						0.54^{a}						64.8	64.8^{e}
y/m	8.67^{b}	0.51^{b}					448.5^{b}	142.8^{b}					591.3^{ab}
y/m/mp	3.67^{d}	0.21^{d}		1.92^{b}			183.5^{e}	58.8^{c}		0			242.3^{c}
y/m/l	8.49^{b}	0.54^{b}			0.46^{b}		424.5^{b}	151.2^{b}			41.4		617.1^{a}
y/m/Ayb	10.21^{a}	0.6^{b}				0.37^{b}	510.5^{a}	168^{b}				44.4	722.9^{a}
c/m		0.55^{b}	10.31^{b}					154^{b}	37.116^{c}				191.116^{d}
c/m/mp		0.18^{e}	10.33^{b}	1.07^{d}				50.4c	37.188^{c}	0			87.588^{e}
c/m/l		0.54^{b}	12.69^{ab}		0.55^{b}			151.2^{b}	45.684^{b}		49.5		246.384^{c}
c/m/Ayb		0.53^{b}	15.89^{a}			0.40^{b}		148.4^{b}	57.204^{a}			48	253.604^{c}
y/m/c	6.93^{c}	0.43^{c}	4.42^{d}				246.5^{c}	120.4^{b}	15.912^{e}				482.812^{b}
y/m/c/mp	4.73^{d}	0.22^{d}	3.89^{d}	1.28^{c}			236.5^{d}	61.6^{c}	14.004^{e}	0			312.104^{c}
y/m/c/l	7.94^{bc}	0.53^{b}	5.85^{c}		0.26^{c}		397^{c}	148.4^{b}	21.06^{d}		23.4		589.86^{b}
y/m/c/Ayb	8.46^{b}	0.51^{b}	6.49^{c}			0.11^{c}	423^{b}	142.8^{b}	23.364^{d}			13.2	602.364^{a}

$^{a, b, c, d, e}$ mean significantly different ($P \geq 0.05$), Duncan's Multiple Range Test. Survey data were collected from community-based local markets in Owerri. Yam = N 50/kg, Maize = N 280/kg, Cassava = N 3.60/kg, Mucuna = NA, Lima bean = N 90/kg, African yam bean = N 120/kg.

(1991) and Muoneke *et al* (2002) who reported that highest LER values did not always reflect the highest monetary returns to the farmer. Further more, the yam-based systems, were more economically beneficial than the cassava-based systems, in spite of the high yields of cassava in the two trial years. This could be attributed to the unit market price of yam, which was greater than that of cassava. This agreed with the report by Mbah *et al* (2003). The monetary yield of *Mucuna pruriens* could not be determined during the market surveys, because it is a lesser-known food legume by farmers in Owerri Agricultural Zone but, the seeds are important for their protein content (Mucuna news, 2001, Third edition). However, (Mucuna news, 2001) reported that *Mucuna pruriens* is consumed around Nsukka area of Enugu State, Nigeria showing that it must attract some monetary values in this part of the Country. Furthermore, Emenalom (2002) reported that the Velvet bean (*Mucuna pruriens*) is currently being used in animal feed formulation research at 25% level of feed in broiler and layer birds and 40% level in pigs, thus indicating its economic values and potentials in the future to the farmers.

4 Conclusion

Intercropping land race legumes with tuber and cereal crops showed a net benefit involving competitive reduction in growth and yield of tuber/legume in the mixture plots. Intercropping is a better bet for the small holder farmer since it tolerates weeds, pest/disease, gives reasonable yield over sole cropping, a higher LER over sole cropping and monetary returns, more so, it feeds the farmer his family and the surplus for the nation at large. *Mucuna pruriens* should be relay planted when maize had been harvested and the cassava and yam well established so as to avoid its characteristic shading habit on other crop component.

References

1. Emenalom OO. Evaluation of seeds of *mucuna prurient* (velvet bean) as feed ingredient in poultry and feed diets. PhD thesis FUT, Owerri. 2002.
2. Ezulike TO, Udealor A, Anebunwa FO, Unamma RPA. Pert damage and productivity of different varieties of yam, cassava, and maize in intercross. Agric Science and Technology 1993; 3(1): 99 – 102.
3. Federal Department of Agricalture and Land Resources (FDALR). The reconna
4. Ifenkwe OP, Odurukwe SO. Potato/maize intercropping in Jos Plateau of Nigeria. Field Crop Research 1990; 23: 73 – 82.
5. Ibeawuchi II, Nwufor MI, Obasi PC, Onyeka UP. Sustainable Agriculture as a tool for poverty Alleviation: a review of strategies for crop production in southeastern Nigeria. JASR 2005a; 5(2): 11 – 9.
6. Ibeawuchi II. The Effect of Land race Legumes on the productivity of tuber based cropping systems of S/E Nigeria. Ph.D Thesis. 2004; 132 – 43.
7. Ibeawuchi II, Obiefuna JC, Ofoh MC, Ihejirika GO, Tom CT, Owneremadu EU, Opara CC. An Evaluation of four soybean varieties intercropped with Okra in Owerri Ultisol of Southeastern Nigeria. Pakistan Journal of Biological sciences (PJBS) 20045b 8(2): 215 – 9.
8. Kurt GS. Intercropping in tropical smallholder agriculture with special reference to West Africa. GTZ 1984; 1 – 233.
9. Mbah EU, Muoneke CO, Okpara DA. Evaluation of cassava/soybean intercropping system as influenced by cassava genotype. Nig Agric J Agric Soci 2003; 33: 11 – 8.
10. Mucuna News (2001Third issue). Developing multiple uses for a proven Green manure cover crop. Update on the progress of the project. Increasing mucuna potential as a food and feed crop. Center for cover crops information on seed exchange in Africa s (CIEPLA).
11. Muoneke CO, Akigbode IO, Magaji MD. Productivity of roselle/cowpea intercropping system in a semi-arid agroecoloyg. Global J Agric Sci 2002; 1(2): 111 – 8.
12. Okpara DA, Omaliko CPE, Ugbaja RAE. Evaluation of the productivity of African yam bean (*Sphenostylis sternocarpa*)/yam (*Dioscorea rotundata*) in intercrops under different African yam bean densities. Sci Engr Techn 1995; 2(1): 9 – 15.
13. Raymond PP. Agriculture in transition. Journal of Sustainable Agric 1990; 1(1): 9 – 39.
14. Willey RW. Intercropping–its importance and research needs. Part 1. Competition and yield advantage. Field Crops Abstract 1979; 32: 1 – 10.