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ECONOMIC EVALUATION OF MAIZE INTERCROPPED WITH SOME MAJOR FOOD CROPS IN SOUTHWESTERN NIGERIA

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ABSTRACT. In Nigeria, the traditional farmer finds it more satisfactory to plant a diversity of crops than planting sole. It is cheaper for farmers to grow many crops of their own requirements than to buy them. Hence, intercrop has remained the traditional farming practice in many other developing nations. Maize is a major cereal crop grown by all farming households all over Nigeria in combination with other crops. There are many studies on intercropping of maize with other food crops in Nigeria; however, many of these studies do not bother to look into the economics of intercrop. Therefore, this study examines the economic profitability of maize intercropped with major food crops in Southwestern Nigeria. Multi-stage sampling technique was employed in the study. A total of 138 questionnaire were used for analysis. Information was collected on socio-economic characteristics of the farming households, cropping systems, cost of labour input, cost of seeds, fertilizer and chemicals; yield and price of output. Data analysis involved the use of descriptive analysis, which includes frequency distribution, mean and percentages. Also, benefit-cost ratio and net farm income analyses were employed. The results showed that the average farm size was 1.5 ha, 75% of the farmers intercropped maize with other crops and six varieties of maize were planted in the study area. Among all the crop combinations, sole maize has the least cost, while maize intercropped with cassava and yam has the highest cost. Benefit-cost analysis showed that for every N 1 spent in maize intercropped with cassava and yam, N 1.26 would be realized as profit. It is therefore, recommended that for optimal use of resources and crop combinations, both public and private extension workers should advice farmers on this finding and the most profitable crop combinations.

Keywords: enterprise; sole cropping; net farm income; benefit-cost.

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INTRODUCTION

In Nigeria and in many other developing nations, intercrop has remained the traditional farming practice. It is a wide spread food crop production system in the humid and sub-humid tropics of West Africa (Akobundu, 1980; Anuebunwa, 1991, Ande *et al.,* 2008). A cropping system is an aspect of farming system or agricultural production system, which consists of one or more enterprises, or business activities in which sets of resources and inputs are uniquely managed by the farmer in the production of one or more commodities to satisfy human needs for food, fibre, various products, monetary income and other objectives (Okigbo, 1982). This however differs from one region or zone to the other to conform to the culture of the people. Intercropping, as a type of cropping systems, is the growing of two or more crops in proximity to promote interaction between them. In line with this definition, Okigbo (1978), Wahua (1982), Ikeorgu (1983) explained that intercropping is the growing of two or more crops simultaneously on the same field, such that the period of overlap is long enough to include their vegetative stage. Intercropping is a common feature of agriculture in the tropical Africa, as well as in the Asian and American tropics (Dalrymple, 1971; Papendick *et al.,* 1976; Okigbo 1978; Kurt, 1984).

Specific intercropping systems have developed over the centuries in the different regions and they are closely adapted to the prevailing ecological and socio-economic conditions. Kurt (1984) explained that intercropping system differs frequently from one area to another with changes in soil and local climate, while social and cultural conditions may superimpose on the ecological and economic zones. Thus, as regions and ethnic groups differ in their food preferences, so also do they differ in their cropping systems. In Nigeria, the traditional farmer finds it more satisfactory to plant a diversity of crops than planting sole. It is cheaper for farmers to grow many of their own requirements than to buy them (Kurt, 1984; Gomez and Gomez, 1986). Intercropping generally not only minimizes risks due to crop failure under adverse environmental conditions, but also gives a higher total return per unit area of land (Ijoyah and Jimba, 2011).

Maize is often found severally intercropped with assorted crops, thereby forming an integral component of various cropping systems. In general, there is a high indication in the importance of intercropping, since it has for some time now become government policy to increase production by improving intercropping systems (Kurt, 1984).

The major annual crops, which are of great importance to most categories of farmers, include the grain cereals – maize, sorghum, millet and rice; tubers – cassava, yam, sweet potatoes and Irish potatoes; others include beans, cow pea, soya bean and

many varieties and species of vegetables. The world food revolves around these crops and the farmers make use of factors of production - land labour, capital to ensure the feeding of the human race.

There are many studies on intercropping of maize with other food crops. A lot of these studies either focused on productivity and yield response of the intercropping systems (Iken and Amusa, 2004), compatibility and suitability of the crops for intercropping with little or no emphasis on the economic analysis of the intercropping systems. Therefore, this study examines the economic profitability of maize intercropped with major food crops in Southwestern Nigeria.

MATERIAL AND METHODS

Study area

Southwestern Nigeria represents a geo-political zone spreading between Lat. 5° and 9° N and has a land area of 114,271 km^2, representing 12% of the country's land mass. The Southwestern Nigeria comprises of six States, namely Ekiti, Lagos, Ogun, Ondo, Osun and Oyo States (REFILS Workshop Report, 2012). It has the total population of about 27,581,992 (NPC, 2006). The zone is characterized by a typical equatorial climate, with distinct dry and wet seasons. The main growing season lasts up to 9 months, with two peaks in July and September. Rainfall ranges between 1200 mm in the Northern areas of Ondo, Oyo and Osun States to nearly 2600 mm in the coastal areas of Lagos and Ogun States. Average zonal rainfall is 1480 mm, with a mean monthly temperature range of 18°C-24°C during the raining season and 30 °C-35°C during the dry season. The zone also has four distinct sub-ecologies swamp mangrove forest, moist and dry lowland forest, woodland forest and savanna mosaic. The soil has low to medium productivity potential (FMA and NR, 1997).

Sampling technique

In view of the objectives of the study, the household level data were collected from a survey in Southwestern geo-political zone of Nigeria. Multi-stage sampling technique was employed in the study. The first stage was the random sampling of three states in Southwestern Nigeria. Here, Ondo, Ogun and Oyo states were selected. The second stage was random sampling of two agricultural zones, each in the states as classified by Agricultural Development Programmes (ADPs). The third stage was the random selection of three villages in each state ADP zones. The last stage was the random selection of ten farming households in each of the villages selected.

A total of 180 questionnaires were administered, but 138 were found to have complete information useful for analysis. Information was collected on socio-economic characteristics of the farming households, cropping systems, cost of labour input, cost of seeds, fertilizer and chemicals; yield and price of output. Data analysis involved the use of descriptive analysis, which includes frequency distribution, mean and percentages. Also, benefit-cost ratio and net farm income analyses were employed.

Analytical techniques

Benefit-cost analysis is used to evaluate, measure or compare the potential benefits of farm enterprises with the costs incurred or anticipated costs.

$$BC = \frac{TR - TC}{TC} = \frac{P.Q - (VC + FC)}{VC + FC}$$

where, BC = Benefit - cost; TR = P.Q = Total revenue (naira); P = Price of farm produce (naira); Q = Quantity of farm produce offer for sale (naira); TC = VC + FC = Total cost (naira); VC = Variable cost (naira); FC = Fixed cost (naira).

Net farm income analysis

Net farm income is the difference between the revenue realized from the sales of farm produce and the cost incurred in the production of such produce within a production season. Net farm income is as given below:

NFI = TR – TC; NFI = PQ – (VC+FC),

where, NFI = Net farm income (naira); TR = PQ = Total revenue (naira); P = Price of farm produce (naira); Q = Quantity of farm produce offer for sale (naira); TC = VC + FC = Total cost (naira;) VC = Variable cost (naira;) FC = Fixed cost (naira).

RESULTS AND DISCUSSION

The mean age of the farmers was 47 years, which implies that the farmers are energetic and in their productive years. It also implies that many farm enterprises could be combined by the farmers to minimize risk of loss of farm produce, which could arise from engaging in a single enterprise. The farmers have average household size of six persons. This implies that more family labour would be used on farm. Half of the farmers (50%) had post primary education. This high level of education implies that dissemination of new technology and innovation in agriculture would be easily adopted by the farmers. This is because there is a high positive correlation between level of education and technology adoption by farmers in Nigeria, as found out in a study conducted by Gani and Adeoti, 2011.

The average farm size is 1.5 ha and more than half (62%) of the respondents cultivated less than 1 ha of farmland. This shows that agricultural practice in Southwestern Nigeria is still largely controlled by small scale farms. The small farm size could be as a result of land tenure system and to a large extent the level of urbanization in the area. Most farmers (75%) engaged in inter-cropping of maize with other crops (*Tables 1 and 2*). Maize intercropped with cassava is the most practiced enterprise combination and 36% of the farmers intercropped maize with cassava in the study area (*Fig. 1*). Six varieties of maize were planted in the study area. However, Suwan-1-SR-Y (30%), DMR-LSR-Y (25%) and combination of Suwan-1-SR-Y and DMR-LSR-Y (15.9%) were mostly planted (*Table 3*).

This shows that 70.9% of the farmers planted either Suwan-1-SR-Y or DMR-LSR-Y varieties. This suggests that the farmers are used to planting improved maize varieties. The adoption and planting of these improved varieties of maize could be due to high level of education in the area.

Table 1 - Demographic characteristics of the respondents

Characteristics	Frequency	Percentage	Mean
Age (years)			
≤ 30	6	4.2	
31 – 40	26	18.7	47
41 – 50	52	37.9	
51 – 60	41	29.9	
61 above	13	9.3	
Total	**138**	**100**	
Level of Education			
No formal education	19	13.8	
Primary school	50	36.2	
Secondary school	54	39.1	
Post-secondary school	15	10.9	
Total	**138**	**100**	
Farm size (ha)			
< 1	86	62.1	
1 – 3	39	28.1	1.5
> 3	13	19.8	
Total	**138**	**100**	
Household size			
≤ 3	13	9.3	
4 – 7	90	65.2	6
8 – 11	35	25.5	
Total	**138**	**100**	
Cropping pattern			
Mono-cropping	34	24.6	
Intercropping	104	75.4	
Total	**138**	**100**	

Table 2 - Distribution of enterprise combinations

S/N	Crop combinations	Frequency	Percentage	Ranking/ Remark
1	Maize (mono-cropping)	33	23.9	2
2	Maize + cassava	50	36.2	1
3	Maize + yam	10	7.2	5
4	Maize + cassava + yam	12	8.7	4
5	Maize + cassava + melon	8	5.8	6
6	Maize + cassava + vegetable	18	13.0	3
7	Maize + yam + vegetable	7	5.1	7
	Total	**138**	**100**	

Note: 1 denotes most practiced crop combination.

Table 3 - Maize varieties cultivated by the respondents

Maize varieties	Frequency	Percentage
DMR-LSR-W	4	2.9
DMR-LSR-Y	35	25.4
DMR-LSR-Y, DMR-LSR-W	10	7.2
SUWAN-1-SR-Y	42	30.4
SUWAN-1-SR-Y, LOCAL	9	6.5
SUWAN-1-SR-Y, DMR-LSR-W	1	0.7
SUWAN-1-SR-Y, DMR-LSR-Y	22	15.9
SUWAN-1-SR-Y, DMR-LSR-Y, DMR-LSR-W	2	1.4
TZSR-Y-1	6	4.3
TZSR-W-1	2	1.4
TZSR-Y-1, TZSR-W-1	2	1.4
Total	**138**	**100**

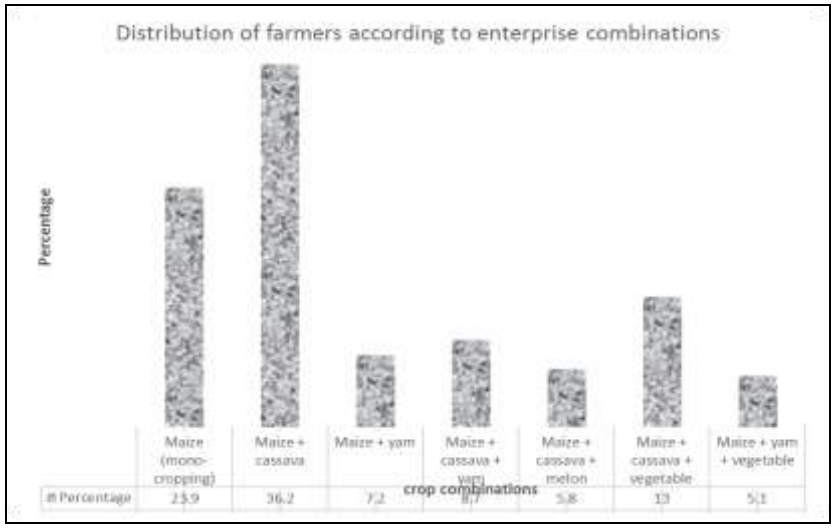

Figure 1 - Distribution of farmers according to enterprise combination

The least cost enterprise was sole maize, while the highest cost enterprise was maize intercropped with cassava and yam (*Table 4*). Benefit-cost analysis indicates that for every N1 spent in maize intercropped with cassava and yam, N1.26 would accrue as benefit. Therefore, the enterprise (crop combination) that gives the highest return to management was maize intercropped with cassava and yam, while the crop

combinations that gave the least return to management was maize intercropped yam and vegetable (*Table 4*). Analysis of net farm income shows that maize planted sole gave the highest net income (*Table 5*). This is due to the fact that cost of input was low, especially cost incurred on planting materials. However, the risk is very high because if there is crop failure perhaps due to outbreak of pest or disease, drought, flood etc there could be a total loss of income in sole cropping system. Among the intercropped, maize intercropped with cassava and yam gave the highest net farm income, while maize intercropped with yam and vegetable gave the least net farm income (*Table 5*).

Table 4 - Benefit-cost analysis of different crop combinations

S/N	Crop combinations	Total cost (N)	Revenue (N)	Benefit-cost	Ranking
1	Maize (sole)	27574.26	103129.00	2.74	1
2	Maize + cassava	28567.38	50007.50	0.75	5
3	Maize + yam	28469.10	24205.50	(0.15)	7
4	Maize + cassava +yam	32803.00	74212.50	1.26	2
5	Maize + cassava + melon	30809.73	55122.50	0.79	4
6	Maize + cassava + vegetable	28707.12	53949.50	0.88	3
7	Maize + yam + vegetable	28608.84	28147.79	(0.02)	6

Note: 1 is the most profitable and values in parenthesis are negative returns to management.

Table 5 - Net farm income of different crop combinations

S/N	Crop combinations	Total cost (N)	Revenue (N)	Net farm income	Ranking
1	Maize (sole)	27574.26	103129	75554.74	1
2	Maize + cassava	28567.38	50007.5	21440.12	5
3	Maize + yam	28469.1	24205.5	-4263.6	7
4	Maize + cassava +yam	32803	74212.5	41409.5	2
5	Maize + cassava + melon	30809.73	55122.5	24312.77	4
6	Maize + cassava + vegetable	28707.12	53949.5	25242.38	3
7	Maize + yam + vegetable	28608.84	28147.79	-461.05	6

CONCLUSION AND RECOMMENDATION

Fifty percent of farmers in the study area intercropped cassava with maize; however, it was the least profitable. The non-profitable enterprises were the combinations of maize with only yam, and maize with yam and vegetable. The most profitable enterprise was maize intercropped with cassava and yam.

Farmers, generally, guide against risk or loss; so, they may not want to plant only maize, which is most profitable. Therefore, awareness should be given to farmers by government at all levels on the most viable profitable crop combinations through the services of the extension agents.

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