# Analysis of Costs and Returns to Maize-Cowpea Intercrop Production in Oyo state, Nigeria

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**Abstract**

Net gains on agricultural investments promote sustainable farm production. The costs and returns analysis to maize-cowpea intercrop was analysed in selected communities of Oyo state, Nigeria, to determine the profitability of the enterprise. A multi-stage stratified sampling technique was used to select a sample size of one hundred and sixty maize-cowpea intercrop farmers in eighteen farming communities in the study area. Data were obtained from the farmers on their socio-economic characteristics, resource ownership, input and output used as well as costs incurred and revenue obtained for the 2006 production season using a structured questionnaire. Data were collected on a gender-disaggregated basis and analysed with the budgetary technique using the gross margin approach. Results showed that the difference between gross revenues and total variable costs for male and female maize-cowpea intercrop farmers was statistically significant at 5% level. Maize-cowpea intercropping was found to be profitable as indicated by mean gross margins of ₦31, 200 and ₦19, 900 per hectare for male and female farmers respectively. However, the difference in the mean gross margin was not significant at the 5% level.

*Key words: Costs, Maize-cowpea intercrop, Returns*

## Introduction

Maize is Africa's most important cereal, forming a basic part of the cereal - legume intercropping system common to most developing countries' agriculture (Ofori and Stern, 1987). As a very important staple food for millions of Nigerians and residents of West Africa, maize is one of the two major crops covering about 40% of the area under agricultural production, and its production accounts for 43% of maize grown in West Africa (Smith *et al.*, 1997; Phillip, 2001; Iken and Amusa, 2004; McCann, 2005). Maize production therefore is of strategic importance for food security and the socio-economic stability of countries and sub-regions in sub Saharan Africa, including Nigeria.

Maize-legume intercropping is currently receiving global attention because of its prime importance in World Agriculture. According to Sullivan (2003), intercropping offers farmers the opportunity to engage nature's principle of diversity on their farms. It is a system of cultivating a cereal as the primary food crop, but on a legume base. Usually, cereals such as maize (*Zea mays*), millet (*Pennisetum glaucum*) and sorghum (*Sorghum bicolor*) are often intercropped with leguminous crops like beans (*Phaseolus vulgaris*), cowpea (*Vigna unguiculata*), groundnut (*Arachis hypogea*), pigeon pea (*Cajanus cajan*) and soyabean (*Glycirine max*). In fact, this is the dominant food production system in East Africa. Langat *et al.* (2000) commenting on the activities of SACRED AFRICA, and Chabi-Olaye *et al.* (2002) in their separate studies, reported that intercropping maize with legumes is one of the common cropping systems in Africa. In West Africa, cereals such as maize, pearl millet and sorghum are traditionally intercropped with cowpea (Subbarao *et al.*, 2000). Sole cropping is seldom practiced and cereal/legume rotations are rare. In Nigeria, intercropping maize with legumes, particularly cowpea, has gone a long way to improve the already limited fertility profile of many farming plots (Agboola and Fayeni, 1972).

However, studies (Enete & Okon, 2010; Fasoranti, 2008) have shown that farmers' socio-economic factors such as level of education, farm size and number of years of experience, technological and Institutional factors and gender affect the net returns to farmers' production activities, depending on their location. For instance, Safa (2005) showed that education, family size and farm size significantly influenced the profitability of farm products in Yemen, while Ahmad *et al.* (2005) indicated that farmers' access to certified seed, better land preparation, recommended doses of fertilizer and access to credit are the major influencing factors. The important questions to ask are: Are there differences in the socio-economic characteristics of male and female maize-cowpea intercrop farmers? What are the gender differentials in the costs and returns to maize-cowpea production? The paper therefore examined the gender differentials in the socio-economic characteristics of maize-cowpea farmers in the study area, analyzed the costs and returns to maize-cowpea production by gender and analyzed the effect of farmers' socio-economic characteristics on the net returns to maize-cowpea production.

## Materials and methods

*Study area*

The study was conducted in Oyo state in the South-western part of Nigeria. The state is located between latitudes $7^{0}3'$ and $9^{0}12'$ north of the equator and longitudes $2^{0}47'$ and $4^{0}23'$ east of the Meridian, and covers a total land area of about 27, 249 square kilometres, with a ratio of almost 1:1 distribution of male to female population. Based on the prevailing climatic conditions and vegetation types, the state has three agroecological zones, viz: rainforest, savannah and derived savannah (Agboola, 1979). The rainforest is characterized by high relative humidity and supports the cultivation of tree crops like citrus, oil palm and cocoa as well as arable crops like cassava, maize and yam. The vegetation of the savannah zone mainly supports the cultivation of crops such as sorghum, maize, cowpea and yam, while the derived savannah combines the peculiar characteristics of the first two. Both male and female

farmers engage in agricultural production, including the cultivation of maize-cowpea intercrop.

*Sampling procedure and Data collection methods*

Based on the number and proportion of male and female farmers in each community by the Oyo State Agricultural Development Programme listing, the maize-cowpea farmers were stratified along gender lines into male and female components. At least eight (8) respondents were randomly selected to make a total of one hundred and sixty (160) respondents for the study. The communities involved in the study were: Igboho, Iwata, Mokolade, Eleke, Ajiroba, Aba Taiye, Otiri, Ajepero, Idiyan, Wasangari, Saki, Ipapo, Lagboye, Karimu, Iganna, Oje-owode, Egbede and Agboye. Primary and secondary data were employed for this study. Primary data were collected from the maize-cowpea intercrop farmers with the aid of a pre-tested structured survey questionnaire. Information sought included farmers' socio-economic characteristics such as gender, age, level of education, farm size, household size, land resource productivity and input-output relationships as well as costs incurred and revenue obtained in the production season. All data were collected on a gender-disaggregated basis.

*Analytical techniques*

Data were analysed using the gross margin budgetary technique specified as:

GM = TR – TVC; TR = Quantity of output ($Q_i$) x Price ($P_i$) and

TVC = Quantity of Input ($X_j$) x Price ($P_j$)

$$GM = \sum_{i=1}^{n} P_i Q_i - \sum_{j=1}^{n} P_j X_j$$

where GM = gross margin (₦/ha)

$P_i$ = average price of output *i* (₦/kg)

$Q_i$ = average quantity of output *i* (kg/ha)

$P_j$ = average price of input *j* (₦/kg)

$X_j$ = quantity of input *j* used (kg/ha)

For this study, the gross margin is expressed as:

$$GM = \sum_{i=1}^{n} P_i Q_i - \sum_{j=1}^{n} P_j X_j$$

Where i is the number of observations ( i= 1, 2, 3, 4, …160)

$P_iQ_i = P_{mi}Q_{mi} + P_{ci}Q_{ci}$

$P_{mi}$ = average price of maize sold (₦/kg)

$Q_{mi}$ = average quantity of maize sold (kg/ha)

$P_{ci}$ = average price of cowpea sold (₦/kg)

$Q_{ci}$ = average quantity of cowpea sold (kg/ha)

$P_jX_j = C_{mj}Q_{mj} + C_{cj}Q_{cj} + L_j + C_{fj} + Q_{fj} + C_{aj} + Q_{aj}$

$C_{mj}$ = average cost of maize seed used for planting (₦/kg)

$Q_{mj}$ = average quantity of maize seed used for planting (kg/ha)

$C_{cj}$ = average cost of cowpea seed used for planting (₦/kg)

$Q_{cj}$ = average quantity of cowpea seed used for planting (kg/ha)

$L_j$ = average cost of labour used for all farm operations (₦)

$C_{fj}$ = average cost of fertilizer used in planting (₦/kg)

$Q_{fj}$ = average quantity of fertilizer used in planting (kg/ha)

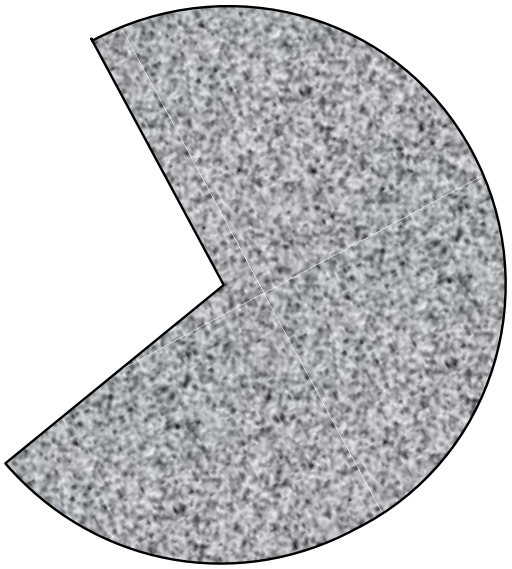
$C_{aj}$ = average cost of agrochemicals used in planting (₦/litre)

$Q_{aj}$ = average quantity of agrochemicals used in planting (litre/ha)

## Results and discussion

### Socio-economic characteristics of maize-cowpea intercrop farmers by gender:

Male and female farmers represented 72% and 28% respectively of the 160 respondents (Figure 1). About 55% and 53% of the male and female farmers were within the active age bracket of 31-50 years, which was in agreement with some studies (Adesehinwa & Bolorunduro, 2007; Oyegbami *et al*, 2010). This implies that about half the population of the two groups of farmers was involved in active farm production. 91% of the male respondents were married while the largest group of female farmers, representing about 44%, was widowed. Household sizes ranged from 2 to 18 with average values of 10 and 6 for male and female farmers respectively. Also, the mean years of farming experience were about 29 and 17 for the male and female respondents respectively, of which the difference was statistically significant at the 5% level.



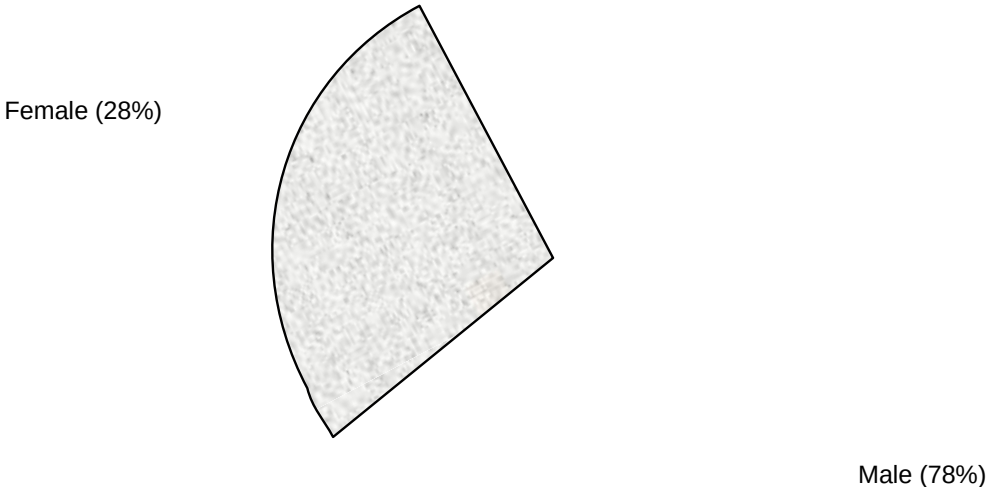
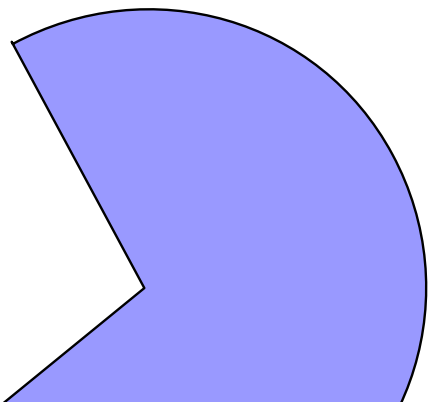



**Figure 1: Distribution of respondents by gender**



## Table 1: Socio-economic characteristics of Maize-cowpea Intercrop farmers in Oyo state, Nigeria.

| Variable | Male respondents (n = 115) | | Female respondents ( n = 45) | | Total sample ( n = 160) | |
|---|---|---|---|---|---|---|
| | Frequency | Percentage (%) | Frequency | Percentage (%) | Frequency | Percentage (%) |
| **Age (years)** | | | | | | |
| 21 – 40 | 35 | 30.5 | 31 | 68.9 | 66 | 41.3 |
| 41-60 | 67 | 58.2 | 13 | 28.9 | 80 | 50.0 |
| > 60 | 13 | 11.3 | 1 | 2.2 | 14 | 8.7 |
| Mean | 48.6 | | 37.1 | | | |
| t-value | 23.66* | | | | | |
| **Marital status** | | | | | | |
| Single (unmarried) | 4 | 3.5 | 2 | 4.4 | 6 | 3.8 |
| Married | 105 | 91.3 | 19 | 42.3 | 124 | 77.4 |
| Widowed | 4 | 3.5 | 20 | 44.4 | 24 | 15.0 |
| Separated / divorced | 2 | 1.7 | 4 | 8.9 | 6 | 3.8 |
| **Household size** | | | | | | |
| 1-5 | 22 | 19.1 | 25 | 55.6 | 47 | |
| 6-10 | 48 | 41.7 | 18 | 40.0 | 66 | |
| ≥ 16 | 14 | 12.3 | 0 | 0.0 | 14 | |
| Mean | 9.7 | | 5.8 | | | |
| t-value | 6.76* | | | | | |
| **Farm size (ha)** | | | | | | |
| ≤ 2.00 | 55 | 47.8 | 45 | 100 | 100 | 62.5 |
| 2.01 – 4.00 | 49 | 42.6 | 0 | 0.0 | 49 | 30.6 |
| ≥ 4.01 | 11 | 9.6 | 0 | 0.0 | 11 | 6.9 |
| Mean | 2.58 | | 1.23 | | | |
| t-value | 7.75* | | | | | |
| **Farming experience (years)** | | | | | | |
| ≤ 20 | 35 | 30.4 | 33 | 73.4 | 68 | 42.5 |
| 21 – 40 | 61 | 53.0 | 11 | 24.4 | 72 | 45.0 |
| 41 – 60 | 19 | 16.5 | 1 | 2.2 | 20 | 12.5 |
| Mean | 29.3 | | 16.5 | | | |
| t-value | 13.95* | | | | | |
| **Level of education** | | | | | | |
| None | 34 | 29.6 | 19 | 42.2 | 53 | 33.1 |
| Primary | 50 | 43.5 | 23 | 51.1 | 73 | 45.6 |
| Secondary | 21 | 18.2 | 3 | 6.7 | 24 | 15.0 |
| Tertiary | 10 | 8.7 | 0 | 0.0 | 10 | 6.3 |
| **Frequency of extension visits per annum** | | | | | | |
| None | 5 | 4.3 | 38 | 84.4 | 43 | 26.9 |
| Once | 68 | 59.2 | 7 | 15.6 | 75 | 46.9 |
| Twice | 40 | 34.8 | 0 | 0.0 | 40 | 25.0 |
| Thrice or more | 2 | 1.7 | 0 | 0.0 | 2 | 1.2 |

**Table 2: Type of occupation of respondents**

| Type of occupation | Male farmers | Percentage (%) | Female farmers | Percentage (%) | Total respondents | Percentage (%) |
|---|---|---|---|---|---|---|
| Primary (Full time farming) | 75 | 65.2 | 28 | 62.2 | 103 | 64.4 |
| Secondary (Part time farming) | | | | | | |
| - Trading | 8 | 6.9 | 12 | 26.7 | 20 | 12.5 |
| - Hunting | 14 | 12.2 | - | - | 14 | 8.8 |
| - Weaving | - | | 4 | 8.9 | 4 | 2.5 |
| - Carpentry | 16 | 14.0 | - | 0 | 16 | 10.0 |
| - Tailoring | 2 | 1.7 | 1 | 2.2 | 3 | 1.8 |
| Total (n) | 115 | 100.0 | 45 | 100.0 | 160 | 100.0 |

Source: Field survey, 2007

Furthermore, about 45% male and 48% female farmers engaged in secondary occupations such as carpentry, hunting, trading and tailoring in the order of predominance among male farmers, and trading, weaving and tailoring among the females (Table 2). These secondary occupations served as non-farm income-generating activities in which the respondents were engaged either perpetually or during the lean periods on their farms. Trading recorded the highest for women (27%) and carpentry for men (14%). Focus Group Discussion participants indicated that income from these sources complements farm income and are usually used to augment input needs on the farm.

## Table 3: Costs and returns to maize-cowpea intercrop in Oyo state, Nigeria

| S/No | Item | Whole Sample | Male | Female | t-value |
|---|---|---|---|---|---|
| 1 | Value of crops per hectare (₦'000/ha) = Gross Revenue | 118.9 | 76.5 | 42.4 | 2.03* |
| 2 | Variable costs items per hectare (₦'000/ha): | | | | |
| a | Labour | 32.4 | 22.7 | 9.7 | 2.17* |
| b | Planting material (seed) | 14.9 | 8.5 | 6.4 | 1.03 |
| c | Inorganic fertilizer | 13.2 | 10.1 | 3.1 | 3.41* |
| d | Other agro-inputs (e.g. herbicides, pesticides) | 7.3 | 4.0 | 3.3 | 1.96* |
| 3 | Total variable costs per hectare (₦'000/ha): (a+b+c+d) | 67.8 | 45.3 | 22.5 | 2.40* |
| 4 | Gross margin/ha (1-3) | 51.1 | 31.2 | 19.9 | 1.05 |
| 5 | % labour to variable cost (2a/3*100) | 47.8 | 50.1 | 43.1 | 1.97* |
| 10 | Total (n) | 160 | 115 | 45 | 1.32 |

Source: Data analysis, 2008

Results showed that the difference between the gross revenues of male (₦76, 500/ha) and female (₦42, 400/ha) maize-cowpea intercrop farmers in the study area was statistically significant at the 5% level. The difference between the total variable costs (male: ₦45, 300; female: ₦22, 500) was also significant at 5%. The significant components of total variable costs were labour, agrochemicals and inorganic fertilizer. Labour constituted the highest component of total variable cost, representing about 50% and 43% of the cost expended by male and female farmers respectively. There was a significant difference between the average labour cost for males (₦22, 700) and females (₦9, 700) at the 5% level. The difference in costs expended on planting material (seed) was not statistically significant.

There were variations in the ranking of other variable costs incurred by both male and female respondents. For male farmers, inorganic fertilizer, planting material (seed) and other agro-inputs such as herbicides and pesticides ranked next to labour in descending order. For female farmers, the order was planting material (seed), other agro-inputs such as herbicides and pesticides, and inorganic fertilizer. These imply that while both male and female farmers incurred high labour costs on their farming operations, agrochemicals accounted for the least item of cost for males and inorganic fertilizer for females. FGD participants ascribed this to male farmers having easy access to hired labour to carry out regular weeding on their farms and therefore spent on herbicides, while female farmers could not afford the high cost of inorganic fertilizers and rather used organic manure which was commonly obtained from livestock (mostly goat and poultry) farmers in the area.

The average gross margin (GM) was ₦31, 200 and ₦19, 900 per hectare for male and female farmers respectively. The positive values showed that maize-cowpea cultivation in Oyo state, Nigeria is indeed a profitable farm enterprise. However, the

difference between the mean values of GM for male and female farmers was not significant at the 5% level. This implies that female farmers make almost equal profit as much as their male counterparts in maize-cowpea intercrop production in the study area and suggests the need to consider the efficiency of resource use / management practices embarked upon by the male and female respondents.

## Conclusion

The study provided better understanding of the gender differentials in the access to, and use of resources for agricultural production. A major outcome of the study is that the maize-cowpea enterprise is male-dominated; but, most of the men, though highly experienced, are aging. The socio-economic factors that were found to influence productivity and profitability were age, household size, farm size and years of farming experience. The study finally recommended the need by development agencies to encourage more female farmers in maize-cowpea intercrop systems by better extension services, and providing access to low-cost inputs to enhance farm productivity.

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