

## **Original Research Article**

### **ANALYSIS OF FARM PRODUCTIVITY IN INTEGRATED TREE CROPPING SYSTEM IN SOUTHWESTERN NIGERIA.**

#### **ABSTRACT**

*Traditional agriculture in the tropical humid southwestern Nigeria is predominantly rain fed. Small holder farmers involved mainly in permanent tree production intercropped with arable crops. Cocoa and other tree crops production have declined substantially in recent times owing to several agricultural complex constraints which have affected the morals of the farmers. Productivity is the main determinant of sustainable agricultural production. Thus, this study investigates the farm productivity in integrated tree cropping system in Southwestern Nigeria. A multistage sampling procedure was used to elicit information from 250 farmers. Data were analysed with the use of descriptive statistics, total factor productivity and multiple regression model. Descriptive statistics revealed that the farmers have organized social groups with average age of 55.12( $\pm$ 15.56) in Akindele, 50.18( $\pm$ 13.50) in Lagbedu, 52.58( $\pm$ 13.75) in Osunwoyin, and Iwara 51.52( $\pm$ 11.72). Farmers' experience in were 29.54( $\pm$ 15.79) in Akindele, 26.48( $\pm$ 13.4) in Lagebu, 30.3( $\pm$ 16.15) in Osunwoyin, and Iwara 29.9 ( $\pm$ 14.41). An average household size were 10.34( $\pm$ 5.97) in Akindele, 9.26( $\pm$ 6.33) in Lagebu, 9.04( $\pm$ 4.38) in Osunwoyin, and Iwara 10.12 ( $\pm$ 5.21) and majorly cultivate cocoa in the study area. The main constraints to production were inadequate funds, land issues, non-availability of agro-inputs, pests and diseases, poor quality pesticides, termite infestation, financial problems, among others. An average level of productivity was observed to be 0.61kg/ha in the study area. Farm size ( $p<0.1$ ), use of improved varieties ( $p<0.01$ ), hired labour ( $p<0.01$ ), fertilizers ( $p<0.01$ ) and extension contact ( $p<0.05$ ) significantly influenced level of productivity among farmers. In accordance with the findings of the study, intensive teaching programmes on the use and advantage of improved seed varieties and fertilizer by virile extension services should be encouraged as well as providing input support services in the form of credit.*

**KEYWORDS:** Productivity, Cropping System, Crops, Southwestern

#### **INTRODUCTION**

The traditional agricultural cropping system of forest zone of southwestern Nigeria are based on growing crops in mixtures, a system most commonly referred to as mixed cropping or intercropping (Osiru, 1982). The system has long been recognized as a common practice among subsistence small-scale farmers in the traditional semi-intensive system of the tropics characterized by low-input, small land size (Amujoyegbe, 2012), lack sufficient capital with plentiful labour (Hildebrand, 1976; Vandermeer, 1992 and Ntare, 1989)

Crop combination are of several permanent tree crops, (cocoa (*Theobroma cacao*), oil palm (*Elaeis guineensis*), Kola nut, walnut as well as plantain/banana, arable farmland located around the vicinity of the homestead or at another farm location. In recent time, arable-permanent crops in mixture is mostly being preferred in the forest zone. The concept of mix cropping according to Willey (1979) is to bring together, crops with different maturity time, architecture, nutrient requirement etc into a mixture at the same time, under the same management for maximum utilization of nature for the benefit of man.

Despite the importance of intercropping permanent crops with other category of crops, cocoa production, a major cash crop in southwestern Nigeria have been observed to decline substantially in recent times owing to several agricultural complex constraints which have affected the morals of the farmers. The need to carry out an on-farm survey to identify the constraints and determine the farm productivity in order to suggest likely improvement strategy that could improve cocoa productivity in Nigeria especially Southwestern. Consequently, this study investigates the farm productivity in integrated tree cropping system in Southwestern Nigeria. Specifically, describes the socio-economic characteristics of farmers, identifies the types of crops grown and the constraints to production in integrated tree cropping system, and determines the levels of productivity and factors affecting productivity among farmers in integrated tree cropping system.

## 58    **METHODOLOGY**

59    A multi-stage sampling approach was used to select farmers in the process of surveying the on-  
60    farm productivity and constraints that have been inimical to improving tree crops production  
61    among small holder farmers. Two states were purposively selected from the southwestern  
62    Nigeria where integrated tree cropping system is practiced in the area. A total of five local  
63    governments and subsequently five growing communities were also purposively selected from  
64    each of the states based on integrated tree cropping system is practiced in the area. Five farmers  
65    were randomly selected from each of the communities to have a total of two hundred and fifty  
66    smallholder farmers were randomly selected from two states in the region.

### 67    **Analytical Technique**

#### 68 69    **Descriptive Statistics**

70    Descriptive statistics was used to describe the socioeconomic characteristics of farmers, identify  
71    the types of crops grown and constraints to production in integrated tree cropping system.

#### 72    **Total Factor Productivity**

73    Production requires combination of inputs. This consequently reflects in productivity.  
74    Productivity measures the rate of technical change in production (Chambers, 1988). Productivity  
75    is the ratio of the value of total farm output to the value of the total inputs used in farm  
76    production. Following Key and McBride (2003) approach, the productivity of a farmer was  
77    determined using the following formula:

$$78 \quad TFP_i = Y_i / \sum P_i X_i \quad \dots\dots\dots 1$$

79    Where,  $TFP_i$  = Total factor productivity (Kg/₦);  $Y_i$  = Quantity produced (Kg);  $P_i$  = Unit price of  
80    variables input (₦);  $X_i$  = Quantity of variables input used.

## Multiple Regression Model

Multiple regression model was used to determine the factors influencing the farm productivity in integrated tree cropping system. The double log model is specified as follows:

$$\ln TFP_i = a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 + a_5 \ln X_5 + a_6 \ln X_6 + a_7 \ln X_7 + a_8 \ln X_8 + a_9 \ln X_9 + a_{10} \ln X_{10} + a_{11} \ln X_{11} + a_{12} \ln X_{12} + e_i \quad \dots\dots\dots 2$$

Where,

TFPi is Total factor productivity (Kg/ha);  $X_1$  is sex of respondent (male=1, female=0);  $X_2$  is Age of the farmers (years);  $X_3$  is Years of education;  $X_4$  is Fertilizer used (Kg);  $X_5$  is Improved varieties used (Yes = 1, No =0);  $X_6$  is Farm size (ha);  $X_7$  is years of farming experience;  $X_8$  is land tenure (own land=1, otherwise= 0);  $X_9$  is household size (#);  $X_{10}$  is hired labour (manday);  $X_{11}$  is family labour (person day);  $X_{12}$  is number of contact with extension agent (#);  $X_{13}$  is primary occupation (1= farming, 0= otherwise);  $X_{14}$  is Access to credit (access=1, otherwise= 0);  $e_i$  = Error term

## RESULTS AND DISCUSSION

### Socioeconomic characteristics of the respondents

The socio-economic characteristics of farmers were presented in Table 1. The average age were 55.12(±15.56) in Akindele, 50.18(±13.50) in Lagbedu, 52.58(±13.75) in Osunwoyin, and Iwara 51.52(±11.72). This could indicate that an average farmer is relatively old in the study area. This conforms to the study of Adedeji *et al.* (2013). The average household size were 10.34(±5.97) in Akindele, 9.26(±6.33) in Lagebu, 9.04(±4.38) in Osunwoyin, and Iwara 10.12 (±5.21). This reiterates the fact that household is the central of labour to agriculture. This agrees with the findings of Ekong (2010). The average years of education were in 6.0 (±5.07) in Akindele, 6.98(±4.28) in Lagebu, 6.18(±6.04) in Osunwoyin, and Iwara 6.70 (±4.99). This implies that the literacy level of sampled farmers was relatively high. Education could help to achieve high level

of productivity. This aligns with the study of Yusuf (2014). The average years of farming experience were 29.54(±15.79) in Akindele, 26.48(±13.4) in Lagebu, 30.3(±16.15) in Osunwoyin, and Iwara 29.9 (±14.41). This implies that majority of the respondents are highly experienced in farming activities. This could boost agricultural productivity. This finding agrees with Ajewole, 2010. Average farm size were 7.64(±6.17) in Akindele, 9.51(±6.04) in Lagebu, 9.02(±6.88) in Osunwoyin, and Iwara 8.37 (±7.72). Majority of the sampled farmers have organized social group. Across the villages, farmers in lagbedu recorded the highest (82%), farmers in Iwara (78%), Akindele (66%) and the smallest Osunwoyin (46%). Membership of a social group allows interactions among members in terms of the information dissemination (Akinola, 2008).

**Table 1: Socioeconomic characteristics of the farmers**

| Variables                   | Field site   |              |              |              |
|-----------------------------|--------------|--------------|--------------|--------------|
|                             | Osun state   |              | Oyo state    |              |
|                             | Iwara        | Osunwoyin    | Akindele     | Lagbedu      |
| Age                         | 51.52(11.72) | 52.58(13.75) | 55.12(15.56) | 50.18(13.50) |
| Household size              | 10.12(5.21)  | 9.04(4.38)   | 10.34(5.97)  | 9.26(6.33)   |
| Years of formal education   | 6.70(4.99)   | 6.18(6.04)   | 6.0(5.07)    | 6.98(4.28)   |
| Years of farming experience | 29.9(14.41)  | 30.3(16.15)  | 29.54(15.79) | 26.48(14.5)  |
| Total farm size             | 8.37(7.72)   | 9.02(6.88)   | 7.64(6.17)   | 9.51(6.04)   |
| Membership of cooperative   | 78           | 46           | 66           | 82           |

Figure in parenthesis () represents standard deviation

**Source:** Data analysis, 2015

### Crops Grown in Integrated Tree Cropping System

Generally, there were different crop enterprises grown in the study area as shown in Table 2. In Akindele village, the major crop grown is cocoa. Other crops grown in order of importance are cassava, yam, plantain/banana, oil palm and maize. Cassava is usually intercropped with maize, vegetable, tomatoes, pepper and other crops. Other crops grown include orange, kolanut, walnut,

125 watermelon/cucumber, pepper and pineapple. In Lagbedu village in Ogo-Oluwa LGA of Oyo  
 126 state, crops grown in descending order of importance are cocoa, cassava, yam, cashew, oil palm  
 127 and maize. Other crops grown include orange, guinea corn, tomatoes, vegetables, pepper,  
 128 groundnut, cowpea, pineapple, cucumber, kolanut and banana/plantain. Crops grown in Iwara in  
 129 order of importance are cocoa, cassava, yam, maize, oil palm, plantain/banana, kolanut, orange  
 130 and cocoyam. Others include walnut, pineapple, mango, rice, pear, bitter-kola, pepper, coffee,  
 131 okro and cashew. Crops grown in Osunwoyin village in order of importance are: cocoa, oil palm,  
 132 cassava, maize, yam, cocoyam, tomato, vegetables, plantain, soybean and kolanut/bitter-kola.  
 133 Others are orange, cowpea, cashew, pineapple and pepper.

134 **Table 2: Crops Grown in Integrated Tree Cropping System by Order of Importance**

| Ranking<br>of Crops | Field Sites         |                         |                         |                 |
|---------------------|---------------------|-------------------------|-------------------------|-----------------|
|                     | Osun state          |                         | Oyo state               |                 |
|                     | Iwara               | Osunwoyin               | Akindele                | Lagbedu         |
| 1 <sup>st</sup>     | Cocoa               | Cocoa                   | Cocoa                   | Cocoa           |
| 2 <sup>nd</sup>     | Cassava             | Oil palm                | Cassava                 | Cassava         |
| 3 <sup>rd</sup>     | Yam                 | Cassava                 | Yam                     | Yam             |
| 4 <sup>th</sup>     | Maize               | Maize                   | Plantain/banana         | Cashew          |
| 5 <sup>th</sup>     | Oil palm            | Yam                     | Oil palm                | Oil palm        |
| 6 <sup>th</sup>     | Plantain/banan<br>a | Cocoyam                 | Maize                   | Maize           |
| 7 <sup>th</sup>     | Kolanut             | Tomato                  | Orange                  | Orange          |
| 8 <sup>th</sup>     | Orange              | Vegetables              | Kolanut                 | Guinea corn     |
| 9 <sup>th</sup>     | Cocoyam             | Plantain                | Walnut                  | Tomatoes        |
| 10 <sup>th</sup>    | Walnut              | Soybean                 | Watermelon/Cucumb<br>er | Vegetables      |
| 11 <sup>th</sup>    | Pineapple           | Kolanut/Bitter-<br>kola | Pepper                  | Pepper          |
| 12 <sup>th</sup>    | Mango               | Oil palm                | Pineapple               | Groundnut       |
| 13 <sup>th</sup>    | Rice                | Orange                  | -                       | Cowpea          |
| 14 <sup>th</sup>    | Pear                | Cowpea                  | -                       | Pineapple       |
| 15 <sup>th</sup>    | Bitter-kola         | Cashew                  | -                       | Cucumber        |
| 16 <sup>th</sup>    | Pepper              | Pineapple               | -                       | Kolanut         |
| 17 <sup>th</sup>    | Coffee              | Pepper                  | -                       | Banana/plantain |
| 18 <sup>th</sup>    | Okro                | -                       | -                       | -               |
| 19 <sup>th</sup>    | Cashew              | -                       | -                       | -               |

135 Source: Data analysis, 2015

136

137 **Constraints to Production in Integrated Tree Cropping system**

138 Constraints to production in the integrated tree cropping system were presented in Table 4. The  
 139 three main constraints ranked highest among problems listed were inadequate funds, land issues  
 140 and non-availability of agro-inputs in Iwara; pests and diseases, low productivity/yield and poor  
 141 quality pesticides in Osunwoyin; termite infestation, financial problems and die-back disease  
 142 were identified in Akindele, and marketing, funds and diseases in Lagbedu. Identified areas of  
 143 intervention in Lagbedu are: provision and multiplication of disease-free improved cocoa  
 144 seedlings. In Osunwoyin, promoting high-yielding vegetable crops and appropriate agro-inputs  
 145 were listed as potential areas of intervention. In Iwara, capacity building of farmers through  
 146 training on the efficient use of farm resources and how best to source for funds, encouraging  
 147 increased land allocation to crop enterprise activities that result from an optimal farm plan, and  
 148 providing access to improved crop varieties such as cocoa, maize and cassava are the main areas  
 149 of immediate intervention. In Akindele, raising seedlings, preventing post-harvest losses by  
 150 using recommended preservatives and embarking on value addition processing activities, and  
 151 increasing their involvement in profitable enterprises were identified areas of intervention.  
 152 Farmers' interest in livestock keeping, particularly poultry production, as well as fish production  
 153 was also noted in all the field sites.

154 **Table 3: Constraints to production in the integrated tree cropping system**

| S/No | Field Sites      |                    |                     |                   | Ranking of Constraints |
|------|------------------|--------------------|---------------------|-------------------|------------------------|
|      | Osun State       |                    | Oyo State           |                   |                        |
|      | Iwara            | Osunwoyin          | Akindele            | Lagbedu           |                        |
| 1    | Inadequate funds | Pests and diseases | Termite infestation | Marketing (price) | 1 <sup>st</sup>        |

|    |                                       |                         |                               |                         |                  |
|----|---------------------------------------|-------------------------|-------------------------------|-------------------------|------------------|
| 2  | Land issues                           | Low productivity/yield  | Financial                     | Financial               | 2 <sup>nd</sup>  |
| 3  | Non-availability of agro-inputs       | Poor quality pesticides | Die back disease              | Disease                 | 3 <sup>rd</sup>  |
| 4  | Marketing problems                    | Black pod disease       | Lack of seedlings             | Politics                | 4 <sup>th</sup>  |
| 5  | Pests and diseases                    | Low quality seedlings   | Stem borers                   | Pests/ parasites        | 5 <sup>th</sup>  |
| 6  | Lack of skill                         | Low production scale    | Defoliators                   | Seedlings               | 6 <sup>th</sup>  |
| 7  | Poor roads                            | Post-harvest processing | Black pod disease (Cherelles) | Access to land          | 7 <sup>th</sup>  |
| 8  | Post-harvest processing (flash dryer) | Marketing               | Inadequate labour             | Bush burning            | 8 <sup>th</sup>  |
| 9  | No improved varieties                 | -                       | Post-harvest processing       | Post-harvest processing | 9 <sup>th</sup>  |
| 10 | -                                     | -                       | Improper packaging of produce | -                       | 10 <sup>th</sup> |

---

155

156 Source: Data analysis, 2015

### 157 **Productivity level in the integrated tree cropping system**

158 Farmers' productivity levels in the integrated tree cropping system were presented in Figure 1.

159 An average level of productivity was observed to be 0.61kg/₦ in the study area. Majority

160 (90.5%) of the respondents had productivity levels of less than 1kg/₦. This implies that the

161 farmers were not productive at the time of the study. Hence, the little returns to their investments

162 in the integrated tree cropping system.

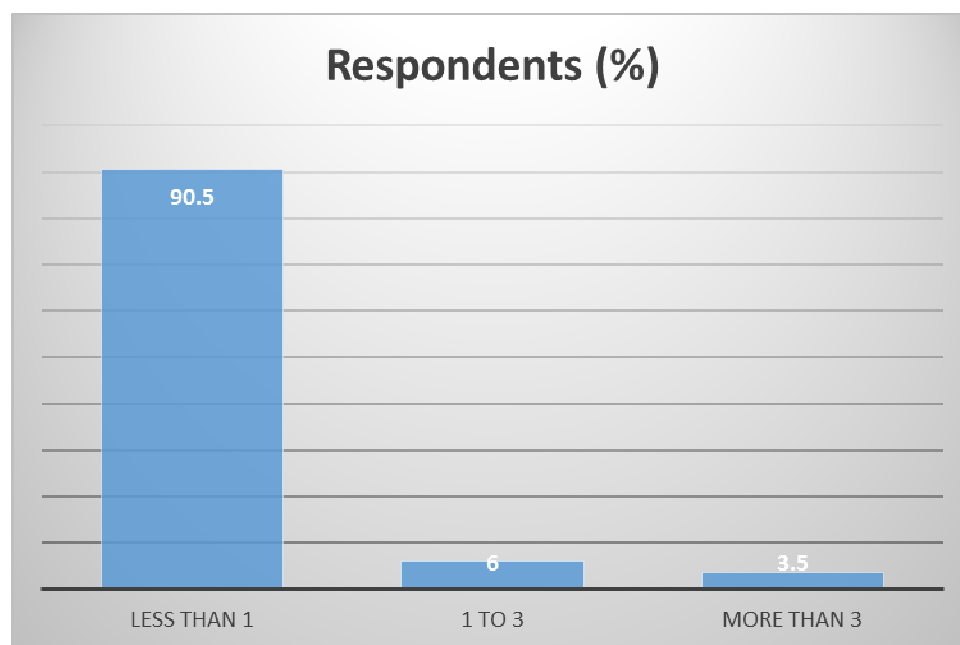


**Figure 1: Levels of productivity**

#### **Determinants of level of productivity in the integrated tree cropping system.**

Table 4 reveals the factors affecting the level of productivity among farmers in the integrated tree cropping system. Farm size ( $p < 0.1$ ), use of improved varieties ( $p < 0.01$ ), hired labour ( $p < 0.01$ ), fertilizers ( $p < 0.01$ ) and extension contact ( $p < 0.05$ ) significantly influenced level of productivity among farmers. The coefficients of farm size ( $p < 0.1$ ), extension contact ( $p < 0.05$ ) and hired labour ( $p < 0.01$ ) were positive. This implies a unit increase in farm size, extension contact and hired labour increases the level of productivity by their magnitude of coefficient; 0.57, 0.01 and 0.006 units, respectively. The coefficients of improved varieties and fertilizers were negatively signed. This suggests that a unit increase in the use of improved varieties and fertilizers decreases level of productivity by the magnitude of their coefficients; 2.25 and 0.77 units, respectively. This could be ascribed to high technicality associated with the use of these technologies.

179 **Table 4: Determinants of total farm productivity in the integrated tree cropping system**

| Variable                | All Respondents (n=200) |
|-------------------------|-------------------------|
| Age (years)             | -0.9586 (0.98)          |
| Household size (#)      | -0.5359 (1.02)          |
| Education (years)       | 0.399 (1.19)            |
| Farm experience (years) | -0.711 (1.17)           |
| Primary occupation (%)  | -0.072 (0.11)           |
| Farm size (ha)          | 0.572 (1.74)*           |
| Improved seed (kg)      | -2.254 (3.58)***        |
| Hired labour (%)        | 0.005 (3.06)***         |
| Family labour (Man-day) | -0.580 (1.52)           |
| Fertilizer (kg)         | -0.770 (5.93)***        |
| Land tenure (%)         | 0.367 (0.18)            |
| Extension contact (%)   | 0.005 (2.02)**          |
| Access to credit (%)    | -2.497 (1.35)           |
| R-square                | 0.370                   |
| Adjusted R-square       | 0.323                   |
| F-value                 | 7.77                    |

180 \*\*\* Significant at 1%, \*\* Significant at 5%, \* Significant at 10%

181 Figures in parentheses ( ) represent t-values.

182

183

## 184 CONCLUSION AND RECOMMENDATION

185 Cocoa is the major crop grown by the farming households in Southwestern Nigeria. The main  
186 constraints to production were inadequate funds, land issues, non-availability of agro-inputs,  
187 pests and diseases, poor quality pesticides, termite infestation, financial problems, among others.  
188 Majority of the sampled farmers are old, experienced, and have organized social group. The  
189 study concluded that the farmers were not productive at the time of the study. Farm size ( $p<0.1$ ),  
190 use of improved varieties ( $p<0.01$ ), hired labour ( $p<0.01$ ), fertilizers ( $p<0.01$ ) and extension  
191 contact ( $p<0.05$ ) significantly influenced level of productivity among farmers. These variables  
192 remains the policy variables that could boost productivity among cocoa farmers in the study.  
193 Therefore, intensive teaching programmes on the use and advantage of improved seed varieties

and fertilizer by virile extension services should be encouraged as well as providing input support services in the form of credit. This would help the farmers to manage their resource economically. Hence, this could improve their productivity.

## REFERENCES

- Adedeji, T. O., Nosiru, M. O., Akinsulu, A. A, Ewebiyi, I. O., Abiona, B. G. and Jimoh, T. S. (2013): Adoption of New Rice for Africa (NERICA) technology in Ogun State, Nigeria *Journal of Development and Agricultural Economics* 5(9):365-371.
- Ajewole. O. C., (2010): Farmer's response to adoption of commercially available organic fertilizers in Oyo state, Nigeria. *African Journal of Agricultural Research* 5(18): 2497-2503.
- Akinola, A. A. (2008): Effects of balanced plant nutrient management systems technologies on food security in selected villages of Kaduna state, Nigeria. Unpublished Ph.D thesis submitted to the Department of Agricultural Economics, School of Postgraduate Studies, Obafemi Awolowo University, Ile-Ife, Nigeria.
- Amujoyegbe, B. J. (2012): Farming System Analysis of Two Agro Ecological Zones of Southwestern Nigeria. *Agricultural Science Research Journal* 2 (1):13-19.
- Chambers, R. (1988). Farmer first. *International Agricultural Development*. Nov/Dec 1988: 10-12.
- Ekong E.E (2010): Rural Sociology: An Introduction and Analysis of Rural Nigeria (3rd ed.), Dove Educational Publishers Uyo, Nigeria
- Hildebrand, P. E. (1976): Generating technology for traditional farmers. A Multidisciplinary technology. In Papandic, R.I., Sanchez, P.A. Triplett G.B (eds) *Multiple Cropping*. Madison. *American Society of Agronomy*. 178-192.
- Ntare, B.R. (1989): Intercropping morphological different cowpea with pearl millet in a short season environment in the Sahel. *Experimental Agriculture*. 26:41-47.
- Ogunkunle, C. O. and Awotoye, O. O. (2011): Soil fertility statues under different tree cropping system in a southwestern Nigeria. *Notulae Scientia Biologicae* 3: 123 – 128.
- Osiru, D.S.O. (1982): Intercropping: a review of the possible advantages. *Proceedings of the Indian Statistical Institute International conference on Frontiers of Research in Agriculture*. Calcutta, September 27-October 1, 1982. pp 304-320.
- Vandermeer, J. H. (1992): The ecology of intercropping. Cambridge University Press, Cambridge, U.K. 156 pp.

- 236  
237 Willey, R.W. (1990): Resource use in intercropping systems. *Agricultural Water Management*,  
238 Amsterdam, v.17, p.215-231.  
239  
240 Yusuf, O. J. (2014): Assessment of Farm Waste Utilization among Rural Dwellers in Osun State,  
241 Nigeria. Unpublished Ph.D. Thesis, Obafemi Awolowo University, Ile-Ife.  
242