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# Assessing the Agroforestry Systems among Farmers and their Access to Incentives in Southwest Nigeria

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**ABSTRACT**
The study aimed at evaluating the agroforestry practices and access to incentives by farmers in Southwest Nigeria. The study adopted multistage sampling techniques to sample 465 smallholder arable farmers from Oyo, Ogun, and Osun States respectively. Moreover, primary data were collected using structured questionnaires and analysed using descriptive statistics and chi-square ($\chi^2$) test. The parameters for the study were agroforestry practices and farmers' access to incentives. The results of the study showed that majority of respondents (61.9%) were mostly men. Moreover, majority of the respondents (87.7%) were mostly engaged in farming activities on smallholder farms with a mean farm size of 7.85 ha. Additionally, majority of respondents (81.9%) were mostly practicing cultivation of multipurpose trees on cropland, taungya (71.0%), border tree planting (63.7%), alley cropping (63.2%), improved tree fallow (62.8%) and agrisilviculture (58.1%) and live fence (52.9%) were mostly used agroforestry practices. Furthermore, the results of the study revealed that there existed a significant association between agroforestry practices and farmers' access to incentives ($p < 0.01$). Finally, the study found that availability of incentives could positively influence adoption and utilization of diverse agroforestry practices.

**Keywords:** Agroforestry systems; Incentive access; Smallholder farmers; Sustainable agriculture; Southwest Nigeria

## INTRODUCTION

Agroforestry as a sustainable land use system is the incorporation of crops, livestock, and trees into one system in order to increase agricultural productivity, diversify income sources, and improve ecosystem services (Ibrahim, 2019). Through incorporating trees in agriculture, agroforestry offers food, wood for construction, firewood, fodder, fiber, medicine, among others, while enhancing soil fertility, water management, conservation of biodiversity, carbon sequestration, and making the system resilient to climate-related risks (Chija., 2018; & Catacutan et al., 2017). This system is an integration of different land uses of agriculture, forestry, and livestock (Attipoe *et al.*, 2021 & Cooper *et al*., 2024).

Agroforestry refers to a variety of agricultural systems, such as agrisilviculture, silvopastoral, agrosilvopastoral, taungya, aquasilviculture, apiculture, sericulture, and agro-pisciculture, which involve efficient utilization of resources through synergistic relationships between biological elements. Such systems contribute to the increase in soil fertility, nutrient cycle, erosion reduction, microclimate regulation, and farm production, as well as job creation and diversification of income (Thebulo *et al*., 2024).

In spite of all these advantages, adoption of agroforestry is still constrained by problems like insecure land tenure, lack of tree ownership rights, weak institutions and policy incentives especially in developing countries (FAO, 2017). The maturity period of trees also takes time which discourages the adoption of tree-based agriculture systems. Thus, provision of necessary financial, institutional and technological incentives to farmers will be an essential step towards promoting adoption and sustainability of agroforestry systems. Southwest Nigeria is ecologically endowed for agroforestry systems but there is a scarcity of information about the type of agroforestry systems and their diversity as well as access of incentives of farmers. Thus, the present study was conducted to assess the agroforestry systems of arable crop farmers and association of agroforestry systems with farmers' access to incentives.

## MATERIALS AND METHODS

### Study Area

The study was carried out in southwest Nigeria, one of the six geopolitical zones in Nigeria. These states include Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo. Southwest Nigeria is located within the geographical coordinates of 2°31′E to 6°00′E longitude and 6°21′N to 8°37′N latitude. Southwest Nigeria has a land mass that occupies an area of approximately 96,224 km² (NPC, 2006), and the climate here is tropical with wet and dry seasons. It is an area made up of tropical rainforest and derived savanna ecological zones, offering ideal environmental conditions for agriculture. Agriculture is the primary occupation in Southwest Nigeria, with crop farming as the main type of agriculture.

### Sampling Procedure and Sample Size

A multistage sampling procedure was employed for the selection of respondents for the study. First, three states comprising 50% of the southwest states of Nigeria (Oyo, Ogun, and Osun), where agroforestry activities are

widespread, were purposefully selected. In the second phase, 10% of the Local Government Areas (LGAs) in each selected state were randomly selected. In the third phase, 30% of the rural communities in each selected LGA were randomly selected proportionately, leading to a total of 24 rural communities. Lastly, in the fourth phase, 50% of the farm families were randomly selected proportionately from each selected rural community, leading to a total of 465 farm families.

**Data Collection and Analysis**

Data were collected using a well-structured questionnaire administered to farmers. The questionnaire captured socioeconomic characteristics, agroforestry systems practiced, available tree species, and access to incentives. Analysis of the obtained data was done using both descriptive and inferential statistics. Frequencies, percentages, mean and standard deviation were some of the measures that were used under descriptive analysis. The Chi-square ($X^2$) test was used to determine the association between farmers' agroforestry systems and incentives availability.

## RESULTS AND DISCUSSION

**Socioeconomic Characteristics of Farmers**

From the results in Table 1, it is evident that the farming of arable crops in Southwest Nigeria is still largely male-dominated (61.9%). This supports Adeyemo *et al*. (2020) and Obadimu *et al.* (2020), who found out that there is a large male engagement in agriculture. The respondents tended to be middle aged or above, which means they were experienced farmers and would not want to adopt any new technology, including agroforestry (Obadimu *et al*., 2020). The size of the respondent's household was average and could provide labor without having to hire extra. Farming was their main economic activity and the income obtained from this was the main source of income. The conclusion agrees with that reached by Adebayo *et al*. (2021) that the role of trees and crop products in the livelihoods of people in the countryside depends upon forest resources. The mean landholding size of 7.85 ha clearly demonstrates the fact that agriculture is practiced by small farmers. Small land holding size may be a limitation for integrating trees but at the same time stresses the need for efficient use of land through systems like agroforestry.

**Table 1: Socio-Economic Characteristics of the Respondents**

| Socioeconomic variables | Oyo State (n = 250) | Ogun State (n = 75) | Osun State (n = 140) | Total (n = 465) |
|---|---|---|---|---|
| Sex | | | | |
| Male | 162 (64.8) | 34 (45.3) | 92 (65.7) | 288 (61.9) |
| Female | 88 (35.2) | 41 (54.7) | 48 (34.3) | 177 (38.1) |
| Age (years) | | | | |
| 25-30 | 10 (4.0) | 25 (33.3) | 21 (15.0) | 56 (12.0) |
| 31-36 | 17 (6.8) | 19 (25.3) | 23 (16.4) | 59 (12.7) |
| 37-42 | 27 (10.8) | 16 (21.3) | 21 (15.0) | 64 (13.8) |
| 43-48 | 71 (28.4) | 10 (13.3) | 20 (14.3) | 101 (21.7) |
| 49-54 | 57 (22.8) | 4 (5.3) | 24 (17.1) | 85 (18.3) |
| >54 | 68 (27.2) | 1 (1.3) | 31 (22.1) | 100 (21.5) |
| Household size (persons) | | | | |
| 1-5 | 144 (57.6) | 54 (72.0) | 67 (47.9) | 265 (57.0) |
| 6-10 | 96 (38.4) | 21 (28.0) | 68 (48.6) | 185 (39.8) |
| >10 | 10 (4.0) | 0 (0.0) | 5 (3.6) | 15 (3.2) |
| Mean | 6 | 5 | 6 | 6 |
| Sources of income | | | | |
| Salary | 18 (7.2) | 48 (64.0) | 15 (10.7) | 81 (17.4) |
| Sales of tree products | 113 (45.2) | 7 (9.3) | 26 (18.6) | 146 (31.4) |
| Sales of farm products | 108 (43.2) | 14 (18.7) | 96 (68.6) | 218 (46.9) |
| Salary + Sales of tree products | 9 (3.6) | 6 (8.0) | 3 (2.1) | 18 (3.9) |
| Sales of tree products + Sales of farm products | 2 (0.8) | 0 (0.0) | 0 (0.0) | 2 (0.4) |
| Occupation* | | | | |
| Farming | 212 (84.8) | 66 (88.0) | 130 (92.9) | 408 (87.7) |
| Trading | 60 (24.0) | 19 (25.3) | 38 (27.1) | 117 (25.2) |
| Civil service | 20 (8.0) | 13 (17.3) | 15 (10.7) | 38 (8.2) |
| Artisan | 33 (13.2) | 9 (12.0) | 11 (7.9) | 53 (11.4) |
| Farm size (hectares) | | | | |
| ≤10 | 207 (82.8) | 57 (76.0) | 113 (80.7) | 377 (81.1) |
| 11-20 | 26 (10.4) | 10 (13.3) | 19 (13.6) | 55 (11.8) |
| >20 | 17 (6.8) | 8 (10.7) | 8 (5.7) | 33 (7.1) |
| Mean | 6.98 | 9.01 | 8.78 | 7.85 |
| Agroforestry experience (years) | | | | |
| ≤10 | 109 (43.6) | 61 (81.3) | 59 (42.1) | 229 (49.2) |
| 11-20 | 88 (35.2) | 13 (17.3) | 42 (30.0) | 143 (30.8) |
| 21-30 | 39 (15.6) | 1 (1.3) | 23 (16.4) | 63 (13.5) |
| >30 | 14 (5.6) | 0 (0.0) | 16 (11.4) | 30 (6.5) |
| Mean | 14.87 | 8.59 | 17.29 | 14.58 |

*Indicate Multiple Responses. Source: Field Survey 2024

**Agroforestry Systems Practiced By Arable Crop Farmers**

Table 2 shows the agroforestry systems that respondents engaged in. Multipurpose trees on cropland (81.9%) were the most widespread agroforestry practice followed by taungya system (71.0%), border tree planting (63.7%), alley cropping (63.2%), and improved tree fallow (62.8%). The next level of adoption was moderate for agrisilviculture (58.1%), home gardening (57.6%), live fencing (52.9%), and silvipastoral (48.2%), while agrosilvopastoral (34.4%) and silvipastoral (30.3%) had low adoption. This result indicates that majority of respondents practice agroforestry farming as a mean of livelihood in Southwest Nigeria. This corroborates with

submission of Ayodele *et al*. (2025) that agroforestry remains the primary means of livelihood for most respondents, showcasing that they are highly dependent on agroforestry-based production for survival. At the state level, Osun State had the highest adoption of multipurpose trees on cropland (90.7%) and improved tree fallow (70.7%), while Oyo State had the highest adoption of the taungya system (85.2%), alley cropping (75.6%), home gardening (72.8%), and agrisilviculture (72.8%). On the other hand, adoption rates for some practices were relatively low in Ogun State. This dominance in the practice of multipurpose trees on cropland is attributed to the ability of the practice to increase soil fertility and produce fruits, timber, fuelwood, and fodder, thereby increasing productivity on the farm and income of the households (Ajayi *et al*., 2020; Ogundele *et al*., 2019). Likewise, the adoption of the taungya system is evidence of the importance of this technique for agricultural production and forest regeneration due to increased fertility of soil and improved land utilization (Babalola et al., 2021; Amusa *et al*., 2019). Border tree planting, alley cropping, and tree fallow play a great role in soil conservation, nutrient recycling, and sustainability of agricultural production (Olawale & Adebayo, 2019; Ayodele *et al*., 2018; Adeola *et al*., 2022; Adedokun *et al*., 2021). At the same time, home gardening and live fences increase food security of households, protection of farms, biodiversity conservation, and diversified income of farmers (Odebode *et al*., 2020; Akinyemi & Adebayo, 2021; Olaoye *et al*., 2018; Balogun *et al.*, 2020). Such difference between states can be explained by ecological peculiarities, experience of farmers, institutional and incentive support.

**Table 2: Farmers' Agroforestry Systems Practiced By Respondents**

| Agroforestry practices | Oyo State (n = 250) | Ogun State (n = 75) | Osun State (n = 140) | Total (n = 465) |
|---|---|---|---|---|
| Taungya system | 213 (85.2) | 42 (56.0) | 75 (53.6) | 330 (71.0) |
| Home gardening | 182 (72.8) | 40 (53.3) | 46 (32.9) | 268 (57.6) |
| Alley cropping | 189 (75.6) | 39 (52.0) | 66 (47.1) | 294 (63.2) |
| Border tree planting | 178 (71.2) | 48 (64.0) | 70 (50.0) | 296 (63.7) |
| Multipurpose trees on cropland | 204 (81.6) | 50 (66.7) | 127 (90.7) | 381 (81.9) |
| Silviolericulture | 130 (52.0) | 35 (46.7) | 59 (42.1) | 224 (48.2) |
| Silvipasture | 87 (34.8) | 28 (37.3) | 26 (18.6) | 141 (30.3) |
| Improved tree fallow | 148 (59.2) | 45 (60.0) | 99 (70.7) | 292 (62.8) |
| Live fencing | 162 (64.8) | 40 (53.3) | 44 (31.4) | 246 (52.9) |
| Agrisilviculture | 182 (72.8) | 43 (57.3) | 45 (32.1) | 270 (58.1) |
| Agrosilvopastoral | 96 (38.4) | 35 (46.7) | 29 (20.7) | 160 (34.4) |

Source: Field Survey 2024

**Association between Agroforestry Systems Practiced by Farmers and Access to Incentives**

Relationships between the agroforestry practices of the farmers and access to incentives were investigated by means of the Chi-square ($\chi^2$) test. The findings are presented in Table 3 below. It can be seen that there are statistically significant associations ($p < 0.01$) between farmers' access to incentives and all of the agroforestry systems under investigation. Statistically significant associations were found for the taungya system ($\chi^2 = 60.465$, df = 3); home gardening ($\chi^2 = 36.584$, df = 3); alley cropping ($\chi^2 = 19.519$, df = 3); border tree planting ($\chi^2 = 14.388$, df = 3); multipurpose trees on cropland ($\chi^2 = 14.169$, df = 3); silviolericulture ($\chi^2 = 39.757$, df = 3); silvopastoral systems ($\chi^2 = 64.004$, df = 3); improved tree fallow ($\chi^2 = 41.552$, df = 3); live fencing ($\chi^2 = 26.437$, df = 3); agrisilviculture ($\chi^2 = 27.754$, df = 3), and agrosilvopastoral systems ($\chi^2 = 82.902$, df = 3). The above results indicate that farmers' involvement in agroforestry systems is highly correlated with their access to incentives. This means that there is no significant correlation between the agroforestry systems used and access to incentives and the statement that there is a significant correlation between the agroforestry systems used and access to incentives was not accepted. In other words, the results imply that farmers' access to incentives influences farmers' use of different agroforestry systems. It is evident from the works of Shibu & Kumar (2021) and Verchot & Zomer (2020), which proved that diversified agroforestry systems help improve farmers' access to various types of incentives. Likewise, Roshetko & Lasco (2021) stressed that certain agroforestry systems help achieve access to incentives.

**Table 3: Test of the Association between Agroforestry Systems Practiced By Farmers and Level of Access to Incentives**

| Agroforestry practices | Chi-square values ($\chi^2$) | Degree of freedom (df) | p-values |
|---|---|---|---|
| Taungya system | 60.465 | 3 | 0.001** |
| Home gardening | 36.584 | 3 | 0.001** |
| Alley cropping | 19.519 | 3 | 0.001** |
| Border tree planting | 14.388 | 3 | 0.002** |
| Multipurpose trees on crop land | 14.169 | 3 | 0.003** |
| Silviolericulture | 39.757 | 3 | 0.001** |
| Silvopastoral | 64.004 | 3 | 0.001** |
| Improved tree fallow | 41.552 | 3 | 0.001** |
| Live fencing | 26.437 | 3 | 0.001** |
| Agrisilviculture | 27.754 | 3 | 0.001** |
| Agrosilvopastoral | 82.902 | 3 | 0.001** |

**Association is significant at 0.01 level of significance

Source: Field Survey 2024

## CONCLUSION

This research has found that agroforestry practices are common among smallholder farmers in Southwest Nigeria. The study has revealed that the adoption of agroforestry practices in the region includes multipurpose trees which help increase farm productivity, diversify livelihoods and sustainably manage the land. The dominance of economically important fruits and trees points to the importance of agroforestry in enhancing food security and income of households in the region whereas the lack of indigenous high value timber species points to the need for more conservation efforts. The finding showing a significant relationship between agroforestry practices and availability of incentives shows that the financial and institutional support for adoption and implementation of diversified agroforestry system is crucial. It is recommended that the government and other concerned parties should provide financial and extension assistance in terms of subsidies of planting materials and credits. The other recommendation is the conservation and enrichment planting of indigenous high value timber species.

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