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Original Article

# Farm level adoption of agroforestry production technology among smallholder farmers in Kaduna state, Nigeria

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## ABSTRACT

This study evaluated farm level adoption of agroforestry production technology among smallholder farmers in Kaduna State, Nigeria. Multi-stage sampling technique was adopted. A total sample size of 120 smallholder agroforestry farmers was used. Primary data were collected with the aid of structured and well-designed questionnaire. Analytical tools used were: Descriptive statistics, adoption index, probit dichotomous regression model, and principal component model. The results show that about 75% of the sampled agroforestry farmers were male; the average age of the smallholder farmers was 46 years. Majority (77.3%) of the sampled agroforestry farmers had formal education; the average farm size under cultivation by the agroforestry farmers was 2.6ha. The farmers practiced the following agroforestry production system: Alley farming (8.33%), taungya system (27.5%), aquaforestry (4.17%), home garden (8.33%), boarder planting (4.17%), retaining trees on farm land (30.83%), shelterbelt, and wind break (16.67%). The estimates of adoption index revealed that 33.33% of agroforestry farmers had scores <0.40, also, 54.17% had adoption index between 0.40 and 0.80, while 12.5% had adoption index between 0.81 and 1.00. The factors significantly influencing the adoption of agroforestry production technology were: Age ($P < 0.01$), farm size ($P < 0.01$), household size ($P < 0.05$), gender ($P < 0.01$), education level ($P < 0.05$), and access to extension services ($P < 0.10$). The smallholder agroforestry farmers were faced with problem of land tenure system, agroforestry is capital intensive, lack of extension services to farmers, inadequate capital, and inadequate technical know-how of the practice. Therefore, the study recommends that inputs such as improved seed varieties, fertilizers, and chemical input should be provided to farmers by government or NGOs at a subsidized rate and at right time, extension services should also be provided to smallholder farmers on the improved agroforestry production technologies, training on farm demonstration, workshops, seminars including media broadcasting, and symposium should be properly organized for adequate training of smallholder agroforestry farmers to understand the technicalities of agroforestry production practices and smallholder agroforestry farmers should be encouraged to join cooperative organizations for them to have access to credit facilities.

**Keywords:** Agroforestry production technology, farm level adoption, Kaduna state, Nigeria

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## INTRODUCTION

Agricultural sector plays an important and key role in Nigeria's economy, the sector employs more than half of the country's workforce and it is contributing significantly to the gross domestic product of the country.[1] Smallholder farmers with small farm size farm lands scattered all over the geopolitical zones are the backbone of Nigerian agricultural production, and their productivity and level of income are essential for achieving food security and poverty reduction. However, smallholder farmers in Nigeria face numerous challenges, including soil degradation, climate change, and low productivity. Agroforestry, which can be defined as an integrated land-use system that combines

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trees with crops and/or livestock, offers a sustainable solution to these challenges.[2,3] Agroforestry can also be defined as a sustainable land use system that involves the intentional integration of trees and crops and or livestock on the same land.[2] Agroforestry systems can be classified into four categories: Agrosilvopastoral, silvopastoral, agrosilvicultural, and silvicultural systems.[4] Agroforestry integrates trees with crops and/or animals with the main objectives of reducing risk and increasing total productivity. The trees also have a significant contribution in fixing nitrogen that can increase agricultural productivity. Many of the rural poor are able to generate income through the production of trees which has created the enabling environment for ease of access to health services and nutritional sources. Agroforestry has been shown to provide multiple benefits, including soil conservation, improve soil fertility, reduce erosion, and provide additional income from tree products, biodiversity conservation, increased crop and livestock productivity, and improved livelihoods.[4,5] Agroforestry produces food and fiber on the same land with trees and crops that reduce food insecurity, support livelihood, reduce poverty, and provide grassland environment. In addition, agroforestry production technologies play an excellent role in providing livelihood of rural farmers on sustainable basis by enhancing their income. Agroforestry production technologies have contributed a lot in the protection of watershed services and maximize the production systems. The role of agroforestry is important on current Sustainable Development Goals of the United Nations through climate change adaptation and mitigation. However, despite the potential benefits of agroforestry, the adoption rate among smallholder farmers in Nigeria remains low. Factors such as lack of awareness, lack of access to inputs, and limited technical knowledge have been identified as major barriers to adoption of agroforestry production technology.[3,1,5-8]

### Objectives of the Study

The broad objective evaluated farm level adoption of agroforestry production technology among smallholder farmers in Kaduna State, Nigeria. Specifically, the objectives are to:

i. Determine the socioeconomic profiles of smallholder agroforestry farmers
ii. Determine the types of agroforestry production technologies adopted by smallholder farmers
iii. Estimate the adoption index of agroforestry production technologies among smallholder farmers
iv. Evaluate socioeconomic factors influencing adoption of agroforestry production technology among smallholder farmers, and
v. Determine the constraints faced by smallholder farmers in adopting agroforestry production technology in the study area.

## METHODOLOGY

This research study was conducted in Kaduna State, Nigeria. Kaduna State occupies between Longitudes 06° 15| and 08° 50| East and Latitudes 09° 02| and 09° 02|North of the equator. The State has land area totaling 4.5 million hectares. The state vegetation is divided into two, the Southern guinea savanna and Northern guinea savanna. There are two seasons in Kaduna State. The seasons are: Wet and dry seasons, the dry season is between October to March, and the wet season starts from April to October, in between the wet and dry seasons is the brief harmattan period which span from November to February. The mean or average rainfall is about 1,482 mm, the temperature of Kaduna State ranges from 35°C to 36°C, which can be as low as 10°C to 23°C during the harmattan period. The population of Kaduna as at 2021 was 8.9 million people. They are involved in agricultural activities. The people are involved in agroforestry production technology. Crops grown include: Okra, pepper, maize, ginger, sorghum, rice, yam, cassava, millet, and tomatoes. Animal reared include: Cattle, goats, sheep, rabbit, and poultry.

### Research Design

A descriptive cross-sectional research design was employed in this study with the aim of describing the socioeconomic profiles or characteristics of smallholder agroforestry farmers, determine the various types of agroforestry technologies adopted among smallholder farmers, and to evaluate socioeconomic factors influencing adoption of agroforestry production technology among smallholder farmers in the study area.

### Sampling Techniques and Sample Size

A multi-stage sampling technique was adopted for this study. In the first stage, purposive sampling procedure was used to select Kaduna State based of the numerous numbers and concentration of smallholder agroforestry farmers in the area. The second stage involved random selection of four area councils using ballot box method. In the third stage, three villages were selected randomly from each area council based on the intensity of smallholder agroforestry farmers. In the fourth stage, from sampling frame of 171 smallholder agroforestry farmers, proportionate and simple random sampling technique was used in each village to select the desired sample size of 120 smallholder agroforestry farmers. This study employed the formula advanced by Yamane[9] in the determination or estimation of the sample size. The formula is stated thus:

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

Where,

$n$ = Desired sample size
$N$ = Finite size of the population
$e$ = Maximum acceptable margin of error as determined by the researcher

### Methods of Data Collection

The data for this study were collected through the use of well-designed structured questionnaire. The data collected were cross-sectional data from primary source, the data collected from smallholder agroforestry farmers were socioeconomic profiles of the farmers, types of agroforestry production technologies adopted, and constraints faced by farmers in the course of agroforestry production technology in the study area. Data were analyzed using the following descriptive and inferential tools:

### Descriptive Statistics

Data collected from field survey on smallholder agroforestry farmers were summarized through the use of mean, frequency distributions, and percentages. Descriptive statistics were used to summarize the socioeconomic profiles of smallholder agroforestry farmers as stated in specific objective one (i) and determine the types of agroforestry production technologies adopted among smallholder farmers as stated in specific objective two.

### Adoption Index

Adoption index (AI) of individual smallholder agroforestry farmers following Alabi *et al*.[10] was calculated as follows:

$$AI_i = \frac{TS_i}{TTS} \quad (2)$$

$$AAI = \frac{\sum AI_i}{N} \quad (3)$$

Where,

$AI_i$ = Adoption Index of the Smallholder Agroforestry of the $i^{th}$ Farmer

$TS_i$ = Technology-Use Score of the $i^{th}$ Farmer

$TTS$ = Total Technology-Use Score Obtainable

$AAI$ = Average Adoption Index

Smallholder agroforestry farmers were categorized based on adoption index following Alabi, *et al*.[10] and Farid *et al*.[11] as follows:

Low Adoption ≤ (Mean–1SD)

Medium Adoption = (Mean±1SD)

High Adoption ≥ (Mean+1SD)

This was used to achieve specific objective three, which is to estimate the adoption index of agroforestry production technologies among smallholder farmers in the study area.

### Probit Dichotomous Regression Model

The dichotomous response model is defined as follows:

$$Y=\alpha_0+\alpha_1 X_1+\alpha_2 X_2+\alpha_3 X_3+\alpha_4 X_4+\alpha_5 X_5+\alpha_6 X_6+\alpha_7 X_7+U_i \quad (4)$$

$Y$ = Dichotomous Response Model (1, High and Medium Adopters; 0, otherwise),

$X_1$ = Age of smallholder agroforestry farmers years,

$X_2$ = Farm size in hectares,

$X_3$ = Household size in units

$X_4$ = Gender (dummy, 1, male; 0, otherwise)

$X_5$ = Education level (Likert, 0, non-formal; 1, Primary; 2, Secondary; 3, tertiary)

$X_6$ = Access to extension services (Dummy, 1, Access; 0, otherwise)

$X_7$ = Membership of cooperative organizations (Dummy, 1, Member; 0, otherwise)

$U_i$ = Error term,

$\alpha_1$–$\alpha_7$ = Regression coefficients,

$\alpha_0$ = Constant term.

This was used specifically to achieve objective four, which is to evaluate socioeconomic factors influencing adoption of agroforestry production technology among smallholder farmers in the study area.

### Principal Component Model

The constraints facing smallholder farmers and militating against adoption and practice of agroforestry production technology were subjected to principal component analysis (PCA). This was used to achieve specific objective five.

## RESULTS AND DISCUSSION

### Socioeconomic Profiles of Smallholder Agroforestry Farmers

Table 1 presents the results of the socioeconomic profiles of the smallholder agroforestry farmers in the study area. The results show that 75% were male, while 35% of the agroforestry farmers were female. This result in in line with Oladele *et al*.[12] who reported that the male dominancy in agriculture is expected especially due to great energy required in carrying out farming activities. The result is also in line with Akinwalere[13] who also reported male dominance among farmers in South-west, Nigeria. About 23.3% of sampled agroforestry farmers were single, while 5.83% of the farmers were divorced and majority 70.83% were married in the study area. This result collaborates with the findings of Obasi *et al*.[14] and Orisakwe and Ogomou[15] who found in their separate studies that the majority of agroforestry farmers in Nigeria were married. This implies that there will be enough labor supply by the families for agroforestry production activities. About 37.5% of the agroforestry farmers were within the age range of 31–40 years, while 54.17% were within the age bracket of 41–50 years, the average age of the agroforestry farmers was 46 years in the study area. The implication is that the agroforestry farmers were young, energetic, and still in their active age of productivity. This is in consonance with Oladele *et al*.[12] who reported that the farmers are in their active age group may influence their willingness to adopt agroforestry practice, innovate, and adopt innovation. About 33.3% of the sampled

agroforestry farmers had no formal system of education, while about 77.3% had formal education, this result implies that the agroforestry farmers were mostly educated which enables them to make an informed decision on appropriate use of farm inputs in agroforestry farming. Majority 65% of the sampled agroforestry farmers had family size range of 6–10 persons per household with an average family size of 7 persons per household; also about 18.3% of agroforestry farmers had 11–15 members per family. The implication of this result is that the farmers had enough labor supply for their agroforestry farm activities. The result further show that 20.83% of the sampled agroforestry farmers had farming experience ranging from 6 to 10 years, while 47% of the farmers had 11–15 farming experience, the average agroforestry farming experience attained by the farmers was 15 years. Farming experience equips farmers with more knowledge of agroforestry practice that could improve their total output. This is in line with Vihi *et al*.[16] who reported that the farmers are capable of adopting agroforestry technologies since many may have been practicing it for a long time. Majority (65.8%) of the sampled farmers had access to extension services, extension services provide farmers with opportunity of learning the guidelines of how to use inputs appropriately to improve their productivity and maximize profit. About 66.7% of the agroforestry farmers were members of cooperative association, been a member of any cooperative organization could help farmers to have access to farm inputs easily as they can pull their resources together and also market their farm produce collectively which could eventually enable them to make more profit. Furthermore, Table 1 further indicated that 30.83% of the agroforestry farmers had a farm size of about 1hectare, while 33.3% had farm size ranges between 1.1 and 2 ha and 27% had farm size of between 2.1 and 3.0 ha, with an average farm size of 2.6ha in the study area. This is in line with Vihi *et al*.[16] which reported a mean farm size of 3.5 hectares, this signifies that most of the farmers were smallholders and subsistence farmers.

**Table 1: Socioeconomic profiles of smallholder agroforestry farmers**

| Variables | Frequency | Percentage | Mean |
|---|---|---|---|
| Sex | | | |
| Male | 90 | 75.00 | |
| Female | 30 | 25.00 | |
| Marital status | | | |
| Single | 28 | 23.33 | |
| Divorced | 7 | 5.83 | |
| Married | 85 | 70.83 | |
| Age (years) | | | |
| 31–40 | 45 | 37.50 | 46 |
| 41–50 | 65 | 54.17 | |
| 51–60 | 10 | 8.33 | |
| Level of education | | | |
| Non-formal | 40 | 33.33 | |
| Tertiary | 20 | 16.67 | |
| Secondary | 35 | 29.17 | |
| Primary | 25 | 20.83 | |
| Household size (units) | | | |
| 1–5 | 20 | 16.67 | 7.0 |
| 6–10 | 78 | 65.00 | |
| 11–15 | 22 | 18.33 | |
| Farming experience (years) | | | |
| 1–5 | 15 | 12.5 | 15 |
| 6–10 | 25 | 20.83 | |
| 11–15 | 57 | 47.50 | |
| 16–20 | 23 | 19.17 | |
| Extension contact | | | |
| Yes | 79 | 65.83 | |
| No | 41 | 34.17 | |
| Memberships of cooperative | | | |
| Yes | 40 | 33.33 | |
| No | 80 | 66.67 | |
| Farm size (hectares) | | | |
| <1.0 | 37 | 30.83 | 2.6 |
| 1.1–2.0 | 40 | 33.33 | |
| 2.1–3.0 | 33 | 27.00 | |
| 3.1–4.0 | 10 | 08.33 | |
| Total | 120.00 | 100.00 | |

Source: Field survey (2022)

## Types of Agroforestry Production Technology Adopted by Smallholder Farmers

Table 2 showed the types of agroforestry production technology adopted by smallholder farmers in the study area. The results revealed that 8.33% of the sampled farmers practiced alley farming system, 27.5% practiced taungya agroforestry

**Table 2: Types of agroforestry production technology adopted by smallholder farmers**

| Agroforestry production technologies | Frequency | Percentage |
|---|---|---|
| Alley farming | 10 | 08.33 |
| Taungya system | 33 | 27.50 |
| Shelter belt and wind break | 20 | 16.67 |
| Aquaforestry | 5 | 04.17 |
| Retaining trees on farmland | 37 | 30.83 |
| Boarder planting | 5 | 04.17 |
| Home garden | 10 | 08.33 |
| Total | 120 | 100 |

Source: Field survey (2022)

farming system. About 16.67% practiced shelter belt and wind break agroforestry system, while 4.17% were involved in aquaforestry system of agroforestry farming. Mostly 30.83% of the sampled farmers practiced retaining trees on farmland. The results also show that 4.17% of the sampled agroforestry smallholder farmers practice boarder planting and 8.33% were into home garden system of agroforestry in the study area. This agrees with the findings of Oladele *et al.*[12] who reported similar report on types of agroforestry among smallholder farmers in Kaduna State Nigeria.

## Adoption Index of Smallholder Agroforestry Farmers

Table 3 presents the adoption index of the smallholder agroforestry farmers in the study area. The results show that 15% of the farmers were within the adoption index of 0.0–0.20, while about 18.33% fall within 0.21–0.40 level of adoption index. Furthermore, 37.5% of the sampled farmers fall within the adoption index of 0.41–0.60. The results also revealed that 16.67% of the farmers fall within 0.6–0.80 adoption index level. About 12.5% of the farmers were within 0.81–1.00 level of adoption index which is the highest level of adoption of agroforestry among the smallholder farmers in the study area.

**Table 3: Adoption index of smallholder agroforestry farmers**

| Adoption index | Frequency | Percentage |
|---|---|---|
| 0.00–0.20 | 18 | 15.00 |
| 0.21–0.40 | 22 | 18.33 |
| 0.41–0.60 | 45 | 37.50 |
| 0.61–0.80 | 20 | 16.67 |
| 0.81–1.00 | 15 | 12.50 |

Source: Field survey (2022)

## Factors Influencing Adoption of Agroforestry Production Technology among Smallholder Farmers

Table 4 the results of the maximum likelihood estimates of the probit regression model analysis that determined the factors influencing the adoption of agroforestry production technology, the study shows that six variables were statistically significant factors influencing the adoption of agroforestry in the study area. The variables were: Age of the farmers, farm size, household size, gender, education, and access to extension services. The likelihood ratio statistics as indicated by $\chi^2$ statistic (21.39) value is statistically significant at ($P < 0.01$) probability level, which suggested that the model has a strong combination of explanatory power. The Pseudo –$R^2$ of 0.8236 shows that 82.3% of the variability in the willingness of the smallholder farmers to adopt agroforestry practice in the study area was explained by the independent variables included in the model. This corroborates the findings of Oladele *et al.*[12] Age of the smallholder farmers influences the likelihood of the farmers to adopt agroforestry production technology positively and was statistically significant at ($P < 0.01$). The marginal effect of the age of farmers is 0.0899, the implication of this signifies that a unit change in the age of farmer will result in increase by 8.99% probability of the smallholder farmers to adopt agroforestry technology. The magnitude of the farm size influences the likelihood of the smallholder farmers to adopt agroforestry technology positively and statistically significant at ($P < 0.01$). The marginal effect of the farm size was 0.1406 which implies that a unit increase in the farm size will result in the increase in willingness to adopt of the agroforestry production technology by 14.1% of probability level among smallholder farmers in the study area. Household size influence adoption of agroforestry production technology positively and was statistically significant at ($P < 0.05$). The marginal effect of the household size was 0.0315; this implies that a unit change in

**Table 4: Maximum likelihood (MLE) estimates of the probit dichotomous regression model**

| Variables | Coefficients | Standard error | Z-score | Marginal effects |
|---|---|---|---|---|
| Age ($X_1$) | 1.3201*** | 0.3793 | 3.48 | 0.0899 |
| Farm size ($X_2$) | 0.1552*** | 0.5385 | 3.47 | 0.1406 |
| Household size ($X_3$) | 0.0187** | 0.0096 | 2.04 | 0.0315 |
| Gender ($X_4$) | 0.0087*** | 0.0032 | 2.70 | 0.1367 |
| Education level ($X_5$) | 0.0147** | 0.0112 | 2.20 | 0.0633 |
| Access to extension services ($X_6$) | 0.0041* | 0.0022 | 1.93 | 0.0257 |
| Membership of cooperative organizations ($X_7$) | 0.0235 | 0.0122 | 0.19 | 0.0021 |
| Constant | 8.8549*** | 3.3230 | 2.67 | |
| Log likelihood | 21.3997 | | | |
| LR $Chi^2$ | 199.89 | | | |
| Prob >$Chi^2$ | 0.0000 | | | |
| Pseudo $R^2$ | 0.8236 | | | |

Source: Field survey (2022). *-Significant at 10% probability level, **-Significant at 5% probability level, ***-Significant at 1% probability level

**Table 5: Principal component model of constraints encountered by smallholder agroforestry farmers**

| Constraints | Eigen value | Difference | Proportion | Cumulative |
|---|---|---|---|---|
| Problem of land tenure system | 3.51964 | 1.12831 | 0.2707 | 0.2707 |
| Agroforestry is capital intensive in nature | 2.39133 | 0.637794 | 0.1839 | 0.4547 |
| Lack of extension services to farmers | 1.75353 | 0.311996 | 0.1349 | 0.5896 |
| Inadequate capital | 1.44154 | 0.36676 | 0.1109 | 0.7005 |
| Inadequate technical know-how of the practice | 1.07478 | 0.231426 | 0.0827 | 0.7831 |
| Bartlett test of sphericity | | | | |
| Chi-square | 763.21*** | | | |
| KMO | 0.8102 | | | |
| Rho | 1.00000 | | | |

Source: Field survey (2022). KMO: Kaiser-Meyer-Olkin

the number of household size results in the increase in adoption of agroforestry production technology by 3.2% probability level. Household size provides required labor for agroforestry activities which could reduce the cost of hired labor. Education level of the smallholder farmers has positive influence on the adoption of agroforestry production technology positively and it was statistically significant at ($P < 0.05$). The marginal effect of education level of the farmers was 0.0633; this implies that a unit change in the level of education of the farmer will lead to 6.33% probability of the likelihood of the farmers to adopt agroforestry production technologies in the study area. This is consonance with Vihi *et al*.[16] who posited that the level of formal education attained by an individual farmer goes a long way in shaping his personality, attitude to life and adoption of new and improved agricultural practices. The coefficient of the extension services was also positive and it was statistically significant at ($P < 0.10$). The marginal effect of extension services was 0.0257 the implication is that a unit increases in access to extension services by the farmers will result in increased by 2.57% probability in the likelihood of the smallholder farmers to adopt agroforestry production technologies. Extension services provide farmers with the opportunity to acquire knowledge about improve agroforestry production system which could lead to increase in their income and adopt sustainable system of agricultural practice. This is in line with Vihi *et al*.[16] who reported extension services as a factor influencing adoption of agroforestry production that it enables farmers to acquire training on agroforestry practice and farmers with the higher number of contacts with extension agents will adopt agroforestry technologies more than farmers with less contact with extension agents.

### Constraints Encountered by the Smallholder Agroforestry Farmers in the Study Area

Table 5 presents the results of the PCA to identify the constraints encountered by agroforestry farmers in the study area, the PCA is one of the important statistical tools which is likely related with the principles of factor analysis procedure which has the ability to transform the variables that interrelated in survey data that comprises so many variables into nearest minimum or few number of variables that are uncorrelated. The output result of the number of principal components retained using the Kaiser-Meyer-criterion was five (5) based on the Eigen values that are >1. The components that were retained explained about (0.7831) 78.3% of the variations in the component included in the model. The Kaiser-Meyer-Olkin (KMO) measures of sampling adequacy KMO for agroforestry farmers were 0.8102 and the Bartlett test of sphericity of 763.21 and was statistically significant at 1% probability level this justified the subjection of the data set for PCA. Problem of land tenure system had an Eigen value of 3.51964 and it was ranked 1$^{st}$ in the order of importance based on perception of the agroforestry farmers, while agroforestry is capital intensive in nature, lack of extension service to farmers had an Eigen values of 2.39133 and 1.75353, respectively, was ranked 2$^{nd}$, 3$^{rd}$, respectively. Inadequate capital and inadequate technical know-how of the practice with Eigen values of 1.44154 and 1.07478, respectively, were also ranked 4$^{th}$ and 6$^{th}$ in the order of its occurrence measured based on the perception of the agroforestry farmers as the constraints agroforestry production technology adoption in the study area, which were chosen in order of their occurrence and severity, respectively. This result is in line with the following authors Alabi, *et al*.[10] who use similar approach to identify the constraints encountered by farmers in crop production. The results are also consistent with Coker *et al*.[17]

## CONCLUSION AND RECOMMENDATIONS

Based on the findings emanating from this research work, the study concludes that majority of the sampled agroforestry farmers were male, most of the agroforestry farmers were young, energetic, and active in their age of productivity and most of them had formal education, the average farm size under cultivation by the farmers is 2.6ha. Most of the farmers practice taungya system and retaining trees on the farm land

types of agroforestry production technologies. The agroforestry production was profitable among the smallholder farmers in the study area. The following significant factors influence the adoption of agroforestry production technology: Age ($P < 0.01$), farm size ($P < 0.01$), household size ($P < 0.05$), gender ($P < 0.01$), education level ($P < 0.05$), and access to extension services ($P < 0.10$). The smallholder agroforestry farmers were faced with problem of land tenure system, agroforestry is capital intensive, lack of extension services to farmers, inadequate capital, and inadequate technical know-how of the practice. Therefore, the study recommends that inputs such as improved seed varieties, fertilizers, and chemical input should be provided to farmers by government or NGOs at a subsidized rate and timely, extension services should also be provided to train smallholder farmers on the improved agroforestry production technologies, training on farm demonstration, workshops, seminars including media broadcasting, and symposium should be properly organized for adequate training of smallholder agroforestry farmers to understand the technicalities of agroforestry production practices and smallholder agroforestry farmers should be encouraged to join cooperative organizations for them to have access to credit facilities to boost their capital and production capacity that will make them have the ability to adopt agroforestry production technologies which will in turn increase their income and improve their livelihood in the study area.

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