

# Evaluation of factors limiting agroforestry practice and tree species used by agroforestry farmers in Adamawa State, Nigeria

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## ABSTRACT

The agroforestry system is been practiced in almost all states. This study looked at the factors limiting the practice and tree species preferred by agroforestry farmers on their farms. Data were collected through the use of a structured questionnaire. Data were analyzed using descriptive statistics. The results of the study show that 96.3% of the farmers were males, 57.7% of farmers fell within the bracket of 50 to 59 years, and 93.7% of farmers were married. The highest household size was found to be 6 to 10, 62.7% had formal education and 38.9% had farms size ranging from 1 to 5 ha. The results further indicated that 33.5% had 16 to 20 years of farming experience while 41.5% obtained their farmland through inheritances. Twelve percent of the agroforestry farmers preferred mango tree (*Mangifera indica*) on their agroforestry farms while 13.5% preferred banana (*Musa spp*) on their aquaforestry farms. The study further revealed the factors limiting agroforestry practices to include transportation (16.5%) pests and disease (13.6 %). It is therefore recommended that government should promote extension services by allocating funds to facilitate extension staff to reach agroforestry farmers to teach new ideas in eradicating pests and diseases.

**Keyword:** Agroforestry, challenge, preferred, tree species.

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## INTRODUCTION

Agroforestry is a form of sustainable land use that combines trees and shrubs with crops and/or livestock in a way that increases and diversifies farm and forest production while also conserving natural resources (Mbwambo et al., 2013). The ecological and socio-economic importance of agroforestry systems in preventing land desertification is now widely recognized (Abdi et al., 2013). It can be a way to increase crop yields and diversity of species grown, but an additional benefit is the creation of a carbon sink that removes carbon dioxide from the atmosphere, or maintenance of carbon in existing vegetation and, therefore, has implications for climatic change (Akinwalere, 2017). Agroforestry is a dynamic, ecologically-based natural resources management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and

sustains production for increased social, economic and environmental benefits for land users at all levels (Alao and Shuaibu, 2013). Agroforestry has the potential to reduce poverty and can efficiently be used in poverty reduction strategies in Nigeria and Africa at large. The practice varies according to the agro-climatic zone and socio-economic status of the farmers. They generally enhance biological diversity, provide wood and non-timber products, promote healthy ecosystems, regulate soil and water resources and maintain carbon cycles (Ufiobor, 2017). Agroforestry also provides various useful products for household and national economies including food and medicinal products for humans and animals, wood for construction and fuel, and cash income (Lambert and Ozioma, 2011). Agroforestry farming is a profitable system compared to monocropping as it can

generate income from the proceeds which include agriculture crops, tree sales and carbon trading programmes such as REDD+ schemes (Abdi et al., 2013). Apart from the sector's contribution to the Gross Domestic Product (GDP), it is also the largest non-oil export earner, a key contributor to wealth creation and poverty reduction as well as the largest employer of labour in Nigeria (Ladipo, 2010). Ufiobor (2017) observed that a large percentage of Nigeria's population derives their income from agriculture and agricultural-related activities of which over 75% of rural inhabitants are farmers.

The practice naturally has a direct impact on the lives of the people and it stands out as a welcome solution to all lovers of progress and scientific advancement in areas of food, wood production and environmental protection (Bayard et al., 2007).

Agroforestry is the most sustainable way that not only solves the socio-economic problems of rural beneficiaries but also reduces environmental degradation. Agroforestry provides jobs, reduces migration, and in many cases affects the income and also welfare and food security of the farmer (Jose, 2009). Pretty et al. (2006) showed that agroforestry practices can result in increased yields and land preservation in the long run.

With time, agroforestry has evolved not just as a livelihood sustenance strategy within the farm but also as a global strategy to mitigate and halt deforestation. Several agroforestry interventions such as alley cropping, improved fallow, live fence and windbreaks have been developed and introduced in the tropics to stop further agricultural expansion and support forest conservation (Jose, 2009; Meyer et al., 2015). With all these attractive advantages of agroforestry practices, it is not without challenges. According to Lambert and Ozioma (2011), poor extension delivery was the factor that limited the adoption of agroforestry in Imo state, Nigeria.

Every form of agroforestry practice has its peculiar challenges. It, therefore, becomes pertinent to examine these challenges to provide solutions to them. Agroforestry farmers preferred different tree species on their farms for one reason or the other, it is, therefore, necessary to examine the tree species preferred by agroforestry farmers.

## MATERIALS AND METHODS

### Study area

Adamawa State lies between latitude 7° 15' and 10° 58' N of the equator and between longitude 11° 09' and 13° 14' E of the Greenwich Meridian. The state is located in the North-Eastern part of Nigeria and shares boundaries with Taraba State in the South and West, Gombe State in its North West and Borno State to the North. It also shares an international boundary with the Cameroon Republic along its Eastern border. The state had a population of 3,175,950 (NPC, 2007) with a landmass of about 38,741 km. Adamawa state is divided into twenty-one (21) Local Government Areas (Figure 1) (Adebayo and Tukur, 2020). The major vegetation

formations in the state are southern Guinea Savannah, northern Guinea Savannah and Sudan Savannah (Akosim et al., 2020).

Agriculture forms the major occupation of the inhabitants while the major food crops cultivated include maize, sorghum, rice, groundnuts, cowpea, yams, cassava, sugarcane and cotton. The major livestock reared are cattle, sheep and goats (Adamawa State Economic Empowerment and Development Strategy (ADSEEDS), 2004).

### Data collection

Primary data were collected through the administration of a well-structured questionnaire with open and closed-ended questions. Data were collected from agroforestry farmers in the study area. The information elicited from the farmers includes socio-economic characteristics, farming experience, farm size, labour, level of education, family size, age of farmer, challenges limiting agroforestry practices and preferred tree species on agroforestry farms.

### Sampling techniques

A multistage random sampling technique was employed in sampling the respondents. The entire state was stratified based on three ecological types – Northern Guinea savanna, Southern Guinea savanna and Sudan savanna. One Local Government Area was randomly selected from each ecological zone. Two council wards were randomly selected from each of the three selected Local Government Areas and two communities were randomly selected from each council ward. A total of 540 respondents were randomly selected.

### Data analysis

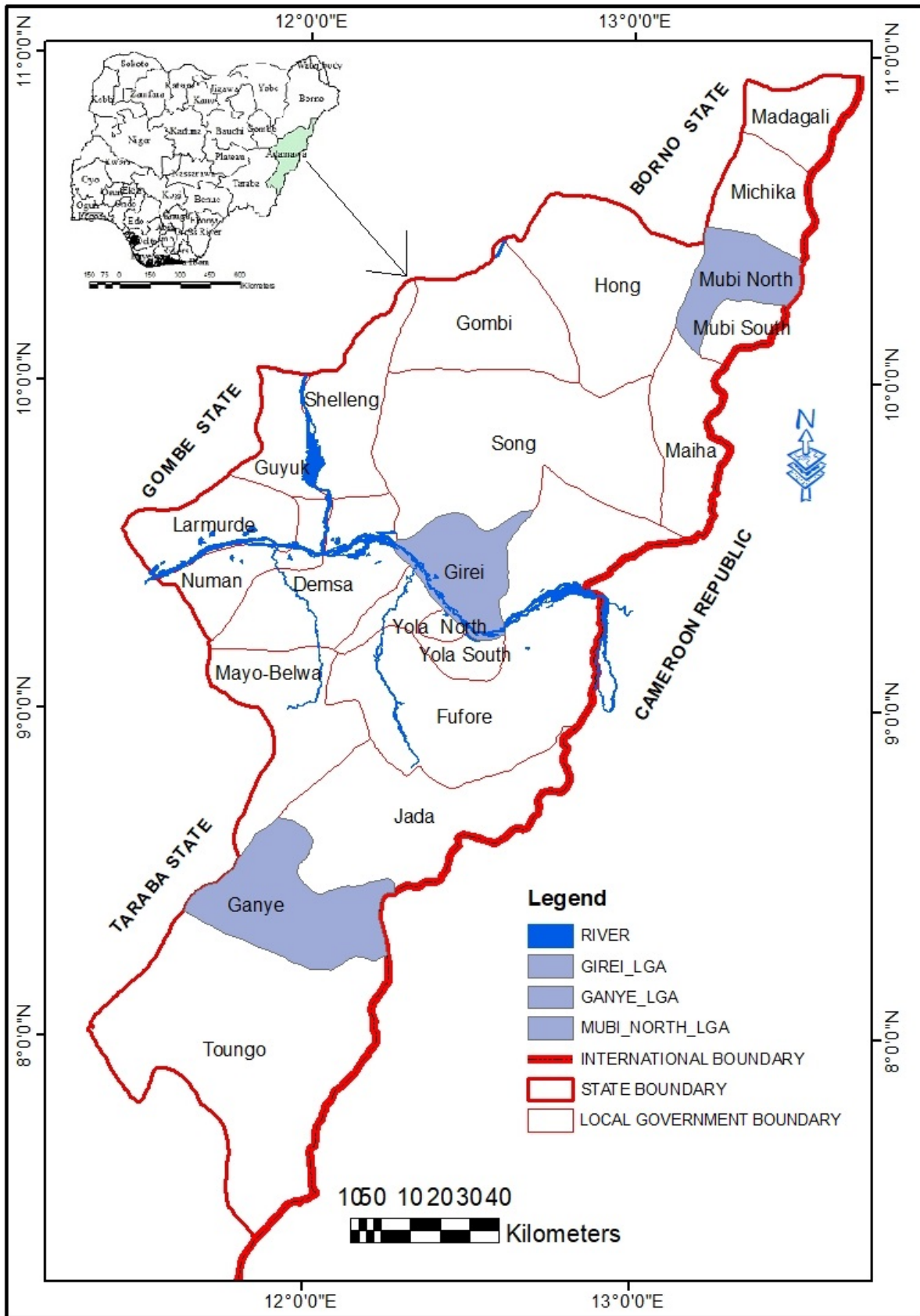
Descriptive statistics, involving the use of tables, charts and percentages, were used in analyzing the data.

## RESULTS AND DISCUSSION

### Socio economic characteristics of respondents

Table 1 shows that 96.3% of agroforestry farmers were males while 3.7% were females. The analysis indicates that males participated more in agroforestry practice than their female counterparts. This may be connected to the culture, traditions and literacy level of the people which predispose men to more economic activities. United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation [UN-REDD] (2013) stated that Women only contribute more hours of labour to cultivation, livestock rearing and agricultural goods. The differences in the observations of Food and Agriculture Organization [FAO] (2010) and UN-REDD (2013) may be due to the influence of culture in the ownership and inheritance of farmland which women are at a disadvantage in the study area.

Table 1 shows that the modal age of the agroforestry farmer in Adamawa State falls between 50 and 59 years. It also revealed that the active agroforestry farmers are between the ages of 40 to 59 years. This age range



**Figure 1.** Map of Adamawa State showing the study area. Source: Department of Surveying and Geoinformatics, MAU, Yola (2020).

**Table 1.** Socio-economic characteristics of respondents.

| <b>Variables</b>                   | <b>Frequency</b> | <b>Percentage</b> | <b>Minimum</b> | <b>Maximum</b> | <b>Mean (<math>\bar{X}</math>)</b> |
|------------------------------------|------------------|-------------------|----------------|----------------|------------------------------------|
| <b>Gender</b>                      |                  |                   |                |                |                                    |
| Male                               | 526              | 96.3              |                |                |                                    |
| Female                             | 20               | 3.7               |                |                |                                    |
| Total                              | 540              | 100               |                |                |                                    |
| <b>Age</b>                         |                  |                   |                |                |                                    |
| 30-39                              | 29               | 5.4               |                |                |                                    |
| 40-49                              | 115              | 21.3              |                |                |                                    |
| 50-59                              | 306              | 56.7              |                |                |                                    |
| 60-69                              | 76               | 14                |                |                |                                    |
| ≥70                                | 14               | 2.6               |                |                |                                    |
| Total                              | 540              | 100               | 30             | 74             | 52.97                              |
| <b>Marital status</b>              |                  |                   |                |                |                                    |
| Married                            | 506              | 93.7              |                |                |                                    |
| Single                             | 21               | 3.9               |                |                |                                    |
| Divorce                            | 13               | 2.4               |                |                |                                    |
| Total                              | 540              | 100               |                |                |                                    |
| Total                              | 540              | 100               | 1              | 5              | 1.45                               |
| <b>Family size</b>                 |                  |                   |                |                |                                    |
| 1-5                                | 241              | 44.6              |                |                |                                    |
| 6-10                               | 256              | 47.4              |                |                |                                    |
| 11-15                              | 38               | 7                 |                |                |                                    |
| 16-20                              | 3                | 0.6               |                |                |                                    |
| ≥20                                | 2                | 0.4               |                |                |                                    |
| Total                              | 540              | 100               | 2              | 14             | 6.19                               |
| <b>Level of Education</b>          |                  |                   |                |                |                                    |
| No formal                          | 151              | 27.9              |                |                |                                    |
| Primary                            | 49               | 9.1               |                |                |                                    |
| Secondary                          | 172              | 31.9              |                |                |                                    |
| Tertiary                           | 122              | 22.6              |                |                |                                    |
| Other specific                     | 46               | 8.5               |                |                |                                    |
| Total                              | 540              | 100               |                |                |                                    |
| <b>Farm size (ha)</b>              |                  |                   |                |                |                                    |
| 1-5                                | 210              | 38.9              |                |                |                                    |
| 6-10                               | 172              | 31.8              |                |                |                                    |
| 11-15                              | 85               | 15.7              |                |                |                                    |
| 16-20                              | 35               | 6.5               |                |                |                                    |
| ≥20                                | 28               | 5.2               |                |                |                                    |
| Others                             | 10               | 1.9               |                |                |                                    |
| Total                              | 540              | 100               | 1              | 21             | 2.72                               |
| <b>Years of farming experience</b> |                  |                   |                |                |                                    |
| 1 – 5                              | 19               | 3.5               |                |                |                                    |
| 6 – 10                             | 54               | 10                |                |                |                                    |
| 11 – 15                            | 137              | 25.4              |                |                |                                    |
| 16 – 20                            | 181              | 33.5              |                |                |                                    |
| ≥20                                | 149              | 27.6              |                |                |                                    |
| Total                              | 540              | 100               | 2              | 21             | 4.85                               |

Source: Field Survey (2018).

constitutes 78% of the total agroforestry farmers in the study area while 5.4, 14 and 2.6% fall within the bracket of 30 to 39 years, 60 to 69 years and 70 years and above, respectively, with the mean age of 53 years. This implies that most of the farmers are physically active and could contribute to the economics of the area. The result agrees with Akinwalere (2017), who observed that most agroforestry farmers in the state were of middle age. This implies that most of the agroforestry practitioners are in their active ages and could participate effectively in agroforestry activities.

The majority of the farmers (93.7%) were married (50.6%), while only 3.9% were single. Furthermore, the result on the household size of the agroforestry farmers (Table 1) shows that 47.4% of them had 6 to 10 household size which constitutes the highest percentage, while 44.6% had family size ranging from 1 to 5. This result reveals that a reasonable number of agroforestry farmers in the study area had large family sizes. These findings are relevant as they determine the labour output. Family labour constitute the bulk of labour supply in agroforestry practice and tend to agree with Abay et al. (2016) report that with an increase of 1% in family size, the household of agroforestry adoption would rise by 7.8%.

Findings on the educational status are presented in Table 1. It revealed that 27.9% had no formal education, while 9.1, 31.9 and 22.6% had formal education which constitute 62.7% of the total farmers in the study area. Education plays a vital role in agroforestry practice as revealed by the study. The involvement of farmers with formal education in agroforestry practices shows that farmers can easily identify problems and tree species that can thrive well and give them more income. The finding agrees with Abdullahi and Tsowa (2014) in their study on the economics of cowpea production under small-scale cowpea enterprise revealed that 53.80% of the sampled farmers had one form of education or the other. The finding implies that the level of education of agroforestry farmers could influence easy comprehension of technical information that would enhance their profit efficiency.

Results of agroforestry farm size cultivated by the farmers (Table 1) indicates that 38.9% had a farm size range between 1 to 5 ha of land used for agroforestry, 31.8% had 6 to 10 ha and 15.7, 6.5 and 1.9% fell within the range of 11 to 15, 16 to 20 and  $\geq 20$  ha respectively. The mean agroforestry farm size was 2.71 ha. This may be as a result of the poverty of various cycles in the rural area of Nigeria. This agrees with the assertion of Izeke and Oumese (2010) who reported that small-scale farmers are characterized as those farmers who cultivate land size between 0.1 and 5.99 hectares and produce on a subsistence level.

Farming experience as indicated in Table 1 shows that 33.5% of the farmers had 16 to 20 years of experience, 27.4% of them had more than 20 years of experience. The study revealed that most of the agroforestry farmers had 16 to 20 years of farming experience. This means that the more years of experience of a farmer the more

output he gets from the farm. This finding is in line with Iwala (2004) who reported that farming experience is related to the ability of the farmer to obtain and use information relevant to production.

### **Tree species on agroforestry farms**

Table 2 shows that 12.0% of the agroforestry farmers preferred mango, 9.4% preferred moringa and 7.8% preferred orange on their agroforestry farms. The result also reveals that 7.0, 6.6, 6.3, 5.5 and 5.3% preferred pawpaw, cashew, banana, locust bean and guava respectively and these are fruit trees that are in high demand. It can also be deduced from the study that 5.0, 4.9, 4.6 and 4.3% of the farmers preferred tamarind, gum arabic and eucalyptus. The study shows that agroforestry farmers prefer different species of tree for either boundary, fruit, fuelwood, recreation, or serve as a windbreak on their farm estates and also to serve as a source of additional income. This finding agrees with Rotich et al. (2017) who strongly observed that diversity of agroforestry trees species exist on agroforestry farms in Kapsaret. These trees had the potential to supply a wide range of products and services desired by the local people. This study also agrees with Mulukh et al. (2017) who reported that every farmland contains a combination of different tree species. But farmers generally prefer to grow fruit trees because they can provide more income.

### **Preferred tree species use in aquaforestry**

Table 3 shows that 13.5% of the agroforestry practitioners preferred banana on their aquaforestry or aquafisheries farms, while 11.1% preferred orange, 10.6% preferred moringa, 10.1% preferred host tamarind, 9.4% preferred cashew and 8.3% preferred pawpaw. It is also observed that the most preferred tree species had roots that do not affect the pond used by the farmer to raise fish. 6.5, 5.2 and 3.2% preferred shear butter, guava and mango respectively, only 3.7 and 2.6% preferred locust bean, African oak and gum Arabic. The study revealed that agroforestry farmers preferred banana, orange, moringa on their aquafisheries farm because they serve as a source of shade to fish and as another source of income to the farmer. These findings are in line with that of Mulukh et al. (2017) who reported that agroforestry farmers preferred fruit trees on their farms because they serve as a source of getting more income, fuelwood, and fodder for their livestock.

### **Challenges of agroforestry practices**

#### ***Factors limiting agroforestry practices***

Table 4 presents factors limiting agroforestry practices in

**Table 2.** Tree species on agroforestry farms in the study area.

| S/N  | Tree species common name | Scientific name               | Local names | Frequency | Percentage |
|------|--------------------------|-------------------------------|-------------|-----------|------------|
| 1.   | Mango                    | <i>Mangifera indica</i>       | Mangoro     | 445       | 12.0       |
| 2.   | Moringa                  | <i>Moringa oleifera</i>       | Zogale      | 350       | 9.4        |
| 3.   | Orange                   | <i>Citrus spp</i>             | Lemu        | 291       | 7.8        |
| 4.   | Pawpaw                   | <i>Carica papaya</i>          | Gwanda      | 260       | 7.0        |
| 5.   | Cashew                   | <i>Anacardium occidentale</i> | Yazawa      | 246       | 6.6        |
| 6.   | Banana                   | <i>Musa spp</i>               | Ayaba       | 233       | 6.3        |
| 7.   | Shea butter              | <i>Vitellera paradoxum</i>    | Kadanya     | 230       | 6.2        |
| 8.   | Locust bean              | <i>Parkia biglobosa</i>       | Dorawa      | 240       | 5.5        |
| 9.   | Guava                    | <i>Psidium guajava</i>        | Gwaiba      | 197       | 5.3        |
| 10.  | Tamarind                 | <i>Tamarindus indica</i>      | Tsamiya     | 187       | 5.0        |
| 11.  | Gum Arabic               | <i>Acacia spp</i>             | Dakwara     | 180       | 4.9        |
| T12. | Eucalyptus               | <i>Eucalyptus spp</i>         | Zaiti       | 172       | 4.6        |
| 13.  | Africa oak               | <i>Afzilia africana</i>       | Kawo        | 162       | 4.3        |
| 14.  | West African copal       | <i>Daniellia oliveri</i>      | Bafur       | 119       | 3.2        |
| 15.  | Neem                     | <i>Azadirachta indica</i>     | Dogon yaro  | 130       | 3.5        |
| 16.  | Host tamarind            | <i>Leucaena lencocephala</i>  | Kaifibedi   | 116       | 3.2        |
| 17.  | Black plum               | <i>Vitex doniana</i>          | Dinya       | 96        | 2.6        |
| 18.  | Mahogany                 | <i>Khaya senegalensis</i>     | Madacci     | 93        | 2.5        |
|      | Total                    |                               |             | 3,711     | 100        |

Source: Field Survey (2018).

**Table 3.** Preferred tree species on aquaforestry.

| S/N | Tree Species Common Name | Scientific Name               | Local Names | Frequency | Percentage |
|-----|--------------------------|-------------------------------|-------------|-----------|------------|
| 1.  | Banana                   | <i>Musa spp</i>               | Ayaba       | 283       | 13.5       |
| 2.  | Orange                   | <i>Citrus spp</i>             | Lemu        | 232       | 11.1       |
| 3.  | Moringa                  | <i>Moringa oleifera</i>       | Zogale      | 222       | 10.6       |
| 4.  | Host tamarind            | <i>Leucaena lencocephala</i>  | Kaifibedi   | 211       | 10.1       |
| 5.  | Cashew                   | <i>Anacardium occidentale</i> | Yazawa      | 196       | 9.4        |
| 6.  | Pawpaw                   | <i>Carica papaya</i>          | Gwanda      | 173       | 8.3        |
| 7.  | Eucalyptus               | <i>Eucalyptus spp</i>         | Zaiti       | 136       | 6.5        |
| 8.  | Shea butter              | <i>Vitellera paradoxum</i>    | Kadanya     | 119       | 5.7        |
| 9.  | Guava                    | <i>Psidium guajava</i>        | Gwaiba      | 108       | 5.2        |
| 10. | Mango                    | <i>Mangifera indica</i>       | Mangoro     | 79        | 3.8        |
| 11. | Locust bean              | <i>Parkia biglobosa</i>       | Dorawa      | 78        | 3.7        |
| 12. | Gum Arabic               | <i>Acacia spp</i>             | Dakwara     | 55        | 2.6        |
| 13. | Africa oak               | <i>Afzilia Africana</i>       | Kawo        | 54        | 2.6        |
| 14. | Black plum               | <i>Vitex doniana</i>          | Dinya       | 51        | 2.4        |
| 15. | Tamarind                 | <i>Tamarindus indica</i>      | Tsamiya     | 36        | 1.7        |
| 16. | Mahogany                 | <i>Khaya senegalensis</i>     | Madacci     | 28        | 1.3        |
| 17. | West African copal       | <i>Daniellia oliveri</i>      | Bafur       | 22        | 1.1        |

Source: Field Survey (2018)

the study area. It shows that 16.5% of the agroforestry farmers indicated that transportation is the major factor limiting the practice. Most of the rural roads/feeder roads were in bad shape making it impossible for cars to ply rural areas where agroforestry farms were located; 15.0% of them reported that poor capital base hindered them from the practice while 13.6% observe that pests and diseases encountered by some farms were their major problems. The attitude of people toward land use constituted 11.4% of the challenges, gestation/ time

factor constituted, 11.0% of the problem hinder the practice while 5.1% showed that lack of knowledge about the importance and benefit of the practice, was the main issue 5.0% of the respondents reported of seed/ seedling scarcity.

### Challenges in agroforestry farming

Table 5 shows problems faced by agroforestry farmers in

**Table 4.** Factors limiting agroforestry practice.

| Factors                                | Frequency | Percentage |
|--|-----------|------------|
| Flood                                  | 15        | 0.7        |
| Drought                                | 65        | 3.0        |
| Poor capital base                      | 322       | 15.0       |
| Storage facilities                     | 293       | 13.7       |
| The attitude of people toward land use | 243       | 11.4       |
| Gestation/time factor                  | 234       | 11.00      |
| Transportation                         | 252       | 16.5       |
| Seed/seeding availability              | 107       | 5.0        |
| Pests and disease                      | 290       | 13.6       |
| Lack of knowledge                      | 108       | 5.1        |
| Other                                  | 105       | 4.9        |
| Total                                  | 2134      | 100        |

Source: Field Survey (2018).

**Table 5.** Problems encountered by agroforestry farmers.

| Problem                     | Frequency | Percentage |
|-----------------------------|-----------|------------|
| Drought                     | 116       | 7.4        |
| Pests/disease               | 464       | 29.6       |
| Late application fertilizer | 203       | 13.0       |
| High cost of seed/seeding   | 193       | 12.3       |
| Flood                       | 66        | 4.2        |
| High cost of labour         | 186       | 11.9       |
| High cost of fertilizer     | 167       | 10.        |
| Fire                        | 95        | 6.0        |
| Other                       | 75        | 4.8        |
| Total                       | 1565      | 100        |

Source: Field Survey (2018).

the study area 29.6% of the agroforestry farmers faced problems of pests and diseases that seriously affected their output. About 13.0% of them complained about the late application of fertilizer to some crops in agroforestry farms while 12.3% faced the problem of the high cost of seed/seeding which force some of the farmers to sell their seeds, 11.9% indicated high cost of labour and 10.7% complain of the high cost of fertilizer this force some of the farmers to apply a low quantity of fertilizer on their farms. Drought and fire outbreaks were indicated by 7.4% while 6.0% of the respondents indicated thither problems. Agroforestry now considered as a sustainable agriculture system is being faced with numerous factors which limit the practice as revealed by the study in the study area, transportation, poor capital base of farmers as well as pest and disease constitute the highest percentage. These findings agree with that of Kiptop and Franzel (2012) who reported that uncontrolled livestock grazing, insects, fungal attack, and other damages reduce success rates of planted seedlings and have prevented the success of agroforestry on the scattered fields far from the homestead.

## Conclusion

This study revealed factors limiting agroforestry practice in the study area which are transportation, pests and diseases. Farmers preferred different trees species on their farms, 12% preferred mango on their agroforestry farms while 13.5% preferred banana on their aquaforestry farms. It was recommended that government should promote extension services by allocating funds to facilitate extension staff to reach agroforestry farmers to teach them new ideas on how to eradicate pests and diseases.

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