

Analysis of Tea Agroforestry System: The Case of Kyenjojo District in Uganda

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ABSTRACT

Uganda is one of the countries in east Africa where agroforestry farming system has spread in twelve agro-ecological zones. Agroforestry practices are critical in all agro-based sectors like tea industry because of benefits like provision of fuel wood for curing tea. The purpose of this study was to understand the current agroforestry practices adopted by smallholder tea estate farmers and investigate options for scaling up the technology to alleviate the fuelwood scarcity faced by tea industries. The study involved a survey that was conducted in Kyenjojo district located in Western Uganda in June 2020. A total of 65 small holder tea farmers (respondents) were interviewed during the study. A purposive sampling method was used and data analyzed with SPSS to generate descriptive statistics that included frequencies, percentages, tables, graphs and charts. Results showed that shade was the most benefit of agroforestry trees by a proportion of 33% towards tea growing and followed by climate modification at 24%. Protection of the environment was also revealed as one of the leading benefits of tea agroforestry with a proportion of 34%, as well as trees acting as a source of poles at 23%. Eucalyptus at 34% was the most dominant agroforestry tree used at tea farm level as a woodlot, followed by *Grevillea robusta* at 28%. The most dominant adoption method of tea agroforestry practices at tea farm level was through farmers learning from fellow farmers at 34%, followed by adoption by trainings at 23%. Planting of agroforestry trees was the only remedy stated by farmers as an effort done to retain trees on farm. As a recommendation towards increased uptake of agroforestry at farm level, farmers identified certification and other factory-based incentives such as Rain Forest Alliance being the most important. Based on the identified benefits of tea-agroforestry systems, efforts should be made by Public, Private and Development partners to make all tea farmers aware of the existing and appropriate agroforestry practices while developing appropriate incentive models for increased adoption of tea agroforestry system in Uganda.

Keywords: Agroforestry, Farmers, Industry, Tea, Uganda.

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I. INTRODUCTION

Agriculture is the mainstay of Uganda's economy, with over 72% of the population engaged in activities linked to either food or cash crop value chains [1]. Tea (*Camellia sinensis*), a perennial beverage plant, was among the first introduced cash crops in Uganda and is currently responsible for 2.8% of the country's export value [1]. It is one of the 12 prioritised commodities in Uganda's Vision 2040 and second in the third National Development Plans [2]. Tea is Uganda's third most important export earner and oscillates between coffee and fish, with tea earning 90 to 104 million USD [3]. Approximately, 1,000,000 people directly derive their livelihood from tea growing in Uganda [3]. The area of active tea production was estimated to be 41,152 hectares in 2015, producing 66,000 MT of made tea [3]. Tea estates produce 54% of the tea, while the small holder tea growers contribute 46% of the total acreage [2]. The smallholder farmers tea yield is estimated at an average of 1,500 kg made tea per

hectare per year, while estate yield is estimated at 2,500 kg per hectare per year, but this is still below potential yield of about 3,000 kg per Ha per year [2]. The land suitable for tea production in Uganda is estimated to be 200,000 hectares [3]. Traditional tea growing districts are: Mukono, Buikwe, Mubende, Mityana, Masaka in the central region, Kyenjojo, Kibale, Hoima and Kabarole in the western region, Bushenyi, Buhweju, Kanungu and Kabale in southwestern Uganda. Recently, tea growing has expanded to new Districts like Kabale, Kisoro, Rubanda, Rukungiri, Sheema, Nebbi, Zombo, Isingiro, Ntungamo, Mitooma, Rubirizi, Kamwenge and Mbarara. The potential to increase tea production is enormous in both the old and new districts [4].

Agroforestry is an efficient and integrated land use management system that involves raising of certain agricultural crops, forest tree species and or animals simultaneously or sequentially on the same land unit with appropriate management practices which result in overall increase in production under particular set of climatic, edaphic conditions and socio-economic status of local people

[5]. Today, Uganda is one of the counties in East Africa where agroforestry has spread in twelve agro-ecological zones. According to the World Agroforestry Center [6], the high rate of advancement of agroforestry technologies in Uganda is due to its ability in provision of fuel wood, wind breaks, green manure, and poles for building or construction of houses in our communities in general. Agroforestry practices have played a big role to all agro-based sectors like tea industries, sugar cane industries and such industries have been forced to establish agroforestry technologies to provide benefits like fuel wood for curing tea.

II. OBJECTIVE

The objective of this paper was to investigate the current agroforestry practices adopted by smallholder tea estate farmers and recommend the best options for scaling up tea farming systems in Kyenjojo district of Uganda.

III. METHODOLOGY

A. Study Area

The study was conducted in Western Uganda in Kyenjojo district (58.01° N, 17.00° E) in June 2020. Western Uganda was selected as a study area because it has the leading tea-growing districts in Uganda. This has been attributed to the availability of land for growing tea, the ecological suitability of soils in the area, and the out-growers scheme at large.

B. Research Design

The study involved observation, gathering information through questionnaires and checklists from Key Informant Interview. The questionnaires were used to collect data from the respondents with both closed and multiple questions were filled by the field enumerators.

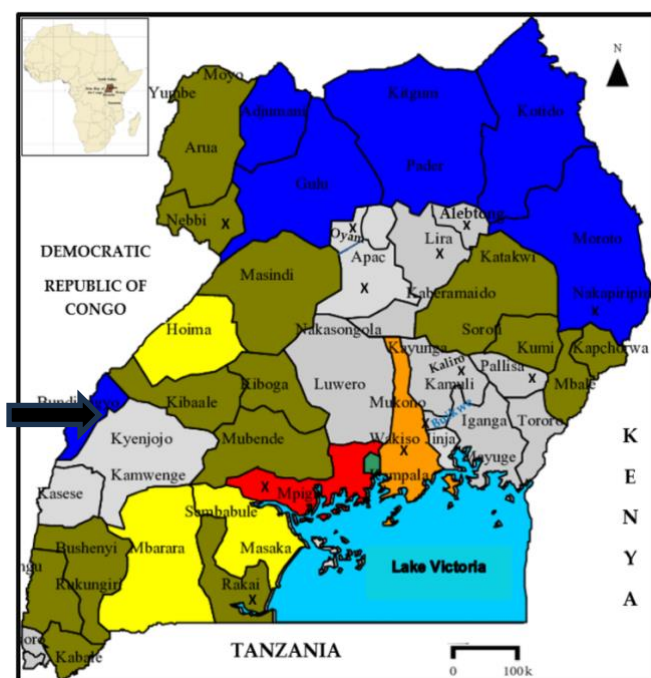


Fig. 1. Map of Uganda showing Kyenjojo district where the study was conducted.

The questionnaires covered the socio – demographic details (gender, education, marital status, income sources and land ownership) as well as the agroforestry practices being implemented by tea smallholder farmers.

C. Sampling Design

A purposive sampling method was used to select the smallholder tea farmers from Mabale Growers Tea factory that was considered in the study. A total of 65 smallholder tea farmers were interviewed during the study from Mabale Tea Growers factory area of operation in Bugaki, Kyarusizi and Butiiti sub-counties in Kyenjojo district. A total of 56 and 9 tea smallholder farmers considered during the survey were male and female, respectively. Ten Key Informant Interviews were also conducted at factory level in this study.

D. Data Analysis

Data was coded, entered, and analyzed in SPSS to generate descriptive statistics that included frequencies, percentages, tables, graphs, and charts.

IV. RESULTS

A. Community Characteristics

Table I shows a summary of the respondents' socioeconomic characteristics of smallholder tea farming communities in Kyenjojo district of western Uganda. It shows a summary of the gender characteristics of the tea farmers that were interviewed during this study.

A total of 86% of the respondents were male, while 14% of the total respondents were female. A total of 38% of the respondents had Secondary level of education, followed by 27% with Upper Primary, 18% with tertiary level of education, and 17% lower primary level. Respondents totaling to 88% were married, 6% single, 5% widowed, and 1% divorced. A total of 86% were male-headed households. This was followed by 12% that were female-headed households. The least is 2% that is child-headed households. Furthermore, a total of 85% of respondents were engaged in farming (agriculture) as their main source of income.

TABLE I: RESPONDENTS’ SOCIO-DEMOGRAPHIC DETAILS

Attribute	Percentage
Gender	
Male	86
Female	14
Level of Education	
Lower Primary	17
Upper Primary	27
Secondary	38
Tertiary	18
Marital Status	
Married	88
Single	6
Widowed	5
Divorced	1
Household Head	
Male headed	86
Female headed	12
Child headed	2
Income Sources	
Civil Service	3
Farming	85
Shop Keeping	5
Others	7

This corroborates with the fact that agriculture remains Uganda's key sector for economic growth and household livelihood (income generation, food, and nutrition security), employment and a major source of raw material for manufacturing.

B. Land Ownership and Use

A summary of the respondent's' land ownership and use characteristics of smallholder tea farming communities in Kyenjojo district in western Uganda was presented in Table II.

TABLE II: LAND OWNERSHIP AND USE	
Attribute	Percentage
<i>Land Tenure System</i>	
Customary land	78
Mailo land	11
Free hold land	8
Others	3
<i>Land Covered by Tea Farming</i>	
≥ 1 ha	34
≥ 3 ha	26
≥ 5 ha	22
≥ 10 ha	12
Others	6
<i>Number of Agroforestry Trees on Tea Farms</i>	
≥ 10 ha	40
≥ 50 ha	25
≥ 100 ha	6
≥ 150 ha	9
Others	20

A total of 78% of tea farming households have a customary land tenure system. The second common land tenure system was mailo land, with 11% tea farming households, followed by 8% having freehold land tenure system. Furthermore, 34% of tea farming households were dedicating tea growing on one hectare or less of land for tea farming. A total of 26% of tea farming households were dedicating tea growing on 3 hectares of land, 22% have tea on 5 hectares of land, 12% have tea on 10 hectares of land while 6% grow tea on more than 10 hectares of land. In addition, 40% of tea fields had less than 10 agroforestry trees per hectare yet 20% of tea fields had no agroforestry trees planted per hectare. This implies that a grand total of 60% of tea fields owned by different tea farmers need urgent attention so that they are sensitized on the various benefits of tea agroforestry on their tea fields, the climate, and entire community livelihood. A total of 25% of tea fields were having 50 agroforestry trees per hectare. Furthermore, 9% of tea fields had 150 agroforestry trees per hectare, while 6% of tea fields had 100 agroforestry trees per hectare.

C. Dominant Agroforestry Tree Species Used at Smallholder Farmer Tea Farm Level

The dominant agroforestry tree species used at tea farm level were summarized in Fig. 2. A total of 34% of the respondents stated that eucalyptus was the most dominant agroforestry trees used at tea farm level. The tea small scale holder farmers further stated that eucalyptus was the dominant tree because it was being used a lot in curing tea at factory level. The second dominant agroforestry tree was *Grevillea robusta* as stated by 28% of the farmers having it on their tea farms. A total of 23% of the tea smallholder farmers

could not identify the trees grown on their farms. Furthermore, 13% of the respondents stated that they grow *Maesopsis emnii*, because it provides good shade for the tea crop. A few smallholder tea farmers 2%, stated that they grow pine caribea species, possibly because it does not shade a lot of its leaves on the tea crop.

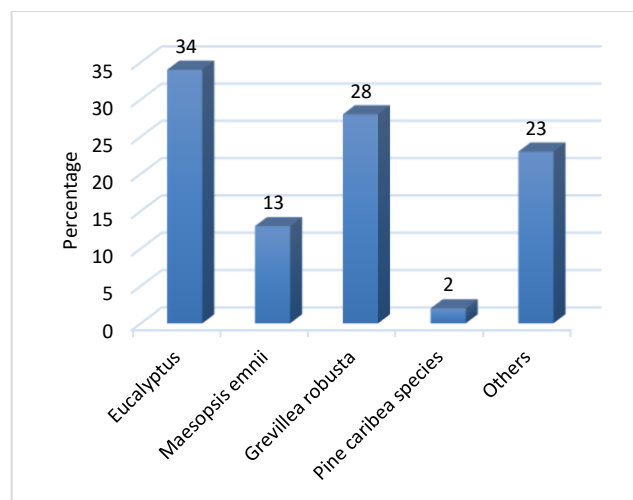


Fig. 2. Dominant agroforestry tree species used at smallholder tea farm level.

D. Agroforestry Practices in Smallholder Tea Farming in Kyenjojo District



Fig. 3. Agroforestry practices being practiced in tea farming at farm level.

The agroforestry practices in tea farming at farm level in Kyenjojo district were presented in Fig. 3. Among the practices that were given out by respondents (tea small holder farmers) and observed in the field, boundary planting as an agroforestry practice was dominating the tea plantations at 32% followed by woodlots practices with 26%, wind breaks had 17% and scattered trees on tea crop land had 15%.

E. Effects of Tea Agroforestry Practices on Tea Farming

Fig. 4 shows a summary of the effects of tea agroforestry practices in tea farming at farm level. Shade was the most benefit of agroforestry trees towards tea growing with the statistics of 33% being given by respondents who are actively participating in tea growing. Climate modification was the second benefit of agroforestry trees towards tea growing with

24%, and humus addition was the third with 16%, which is done when trees shade off their leaves and fruits, which rot and decay to form organic matter that Improves fertility in the soil for tea growth. Other benefits included control of soil erosion at 9% and rainfall formation at 7%.

F. Problems Hindering Farmers from Practicing Tea Agroforestry Practices at the Farm Level

The problems hindering farmers from practicing tea agroforestry practices at the farm level are presented in Fig. 5.

A total of 66% of the respondents stated that they were not just willing and interested in incorporating agroforestry in tea farming. Inadequate capital at 18% was the second main problem hindering tea small holder farmers from practicing tea agroforestry. Inadequate labor at 10% was the third main problem hindering tea small holder farmers from practicing tea agroforestry. A total of 5% of the respondents stated that low tea prices were part of the problem hindering tea smallholder farmers from practicing tea agroforestry.

G. Solving Problems Hindering Farmers from Practicing Tea Agroforestry Practices at Farm Level

Fig. 6 shows a summary of solutions to the problems hindering farmers from practicing tea agroforestry practices at farm level. A total of 38% of the respondents stated that planting of trees is the main solution to overcome hindrances of farmers from practicing tea agroforestry practices at farm level. Another big percentage of respondents 34% could not have clear solution to the problems hindering farmers from practicing tea agroforestry practices at farm level. This implies that there is a need to do deliberate awareness of tea agroforestry practices to tea farming communities. Furthermore, 23% of the farmers stated that training in tea agroforestry practices can act as a good solution to solving the problems hindering farmers from practicing tea agroforestry practices at farm level. On the other hand, 5% of the respondents stated that harvesting quality tea and earning premium prices could also partly help in solving the problems hindering farmers from practicing tea agroforestry practices at farm level.

H. Adoption of Tea Agroforestry Practices at Tea Farm Level

The adoption of tea agroforestry practices by tea smallholder farmers at tea farm level were presented in Fig. 7. The most dominant adoption method of tea agroforestry practices at tea farm level was through fellow tea farmers as stated by 34% of the tea small holder farmers. The second dominant adoption method of tea agroforestry practices at tea farm level was through trainings as stated by 23% of the tea small holder farmers. The third dominant adoption method of tea agroforestry practices at tea farm level was through traditional aspects as stated by 21% of the tea small holder farmers. A few respondents 5%, stated that they adopted tea agroforestry practices through media especially local radio stations.

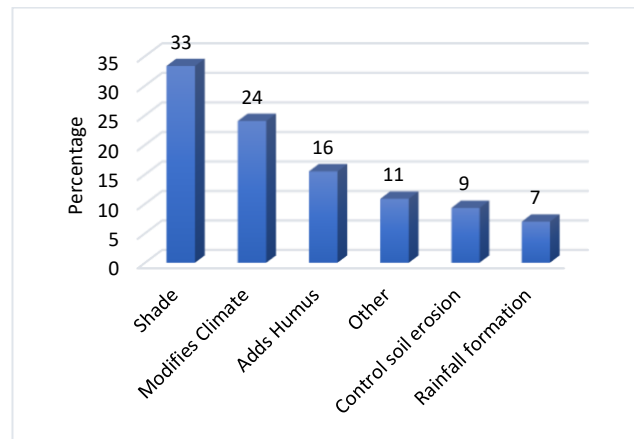


Fig. 4. Effects of tea agroforestry practices on tea farming

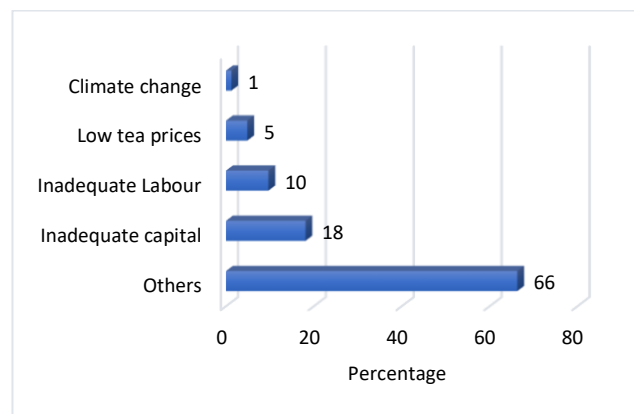


Fig. 5. Problems hindering farmers from practicing tea agroforestry practices at farm level.

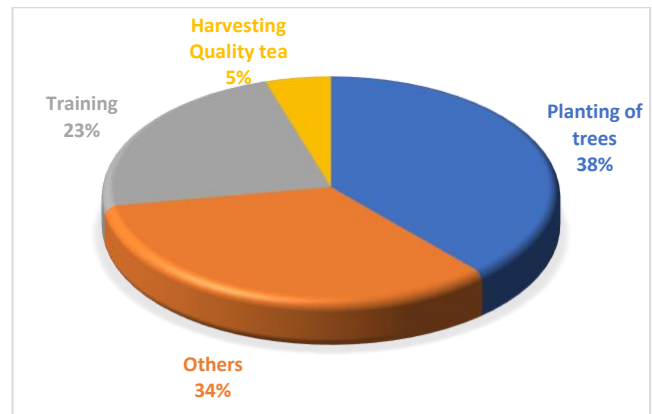


Fig. 6. Solving problems hindering farmers from practicing tea agroforestry practices at farm level.

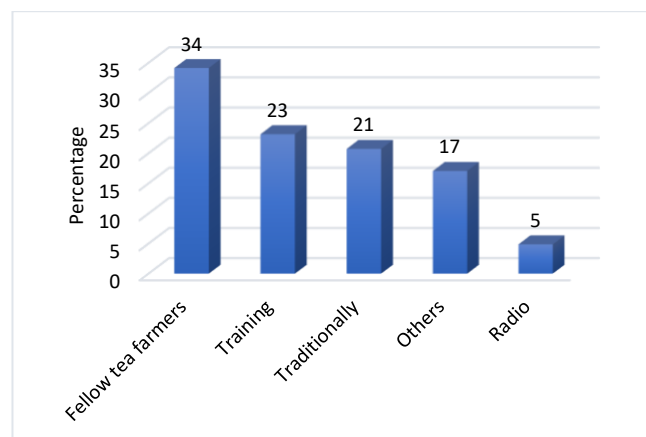


Fig. 7. Adoption of tea agroforestry practices at tea farm level

I. Usage of Tea Agroforestry Technologies on Tea Growing and People's Livelihoods

Table III shows a summary of the usage of tea agroforestry technologies on tea growing and people's livelihoods. A total of 34% of the respondents stated firewood as the most important use of agroforestry technology on tea growing and people's livelihoods. The second most usage of agroforestry technologies was the provision of shade as stated by 31% of the respondents. Furthermore, these respondents claimed that tea grown under agroforestry trees has unique cup quality characteristics. The fourth usage of tea agroforestry technologies was control of erosion as stated by 8% of the respondents. The least usage of tea agroforestry technologies was fencing as stated by 5% of the respondents. Furthermore, there was a category of respondents 10% that could not specify the usage of tea agroforestry technologies and looked at it as a minor aspect in tea farming.

J. Tea Certification Trainings Attended

Tea certification trainings attended by tea small holder farmers has been summarized in Fig. 8. A total of 47% of the respondents stated that they have attended International Organization for Standardization (ISO) certification training. The second certification training attended by tea small holder farmers was Rain Forest Alliance Certification Training, as stated by 35% of the respondents during this study. The third and fourth certification training attended by tea small holder farmers was fair trade and UNBS certification as stated by 6% of the respondents, respectively.

TABLE III: USAGE OF TEA AGROFORESTRY TECHNOLOGIES ON TEA GROWING AND PEOPLE'S LIVELIHOODS

Usage of tea agroforestry technologies on tea growing and people's livelihoods	Frequency	Percentage
Firewood	22	34
Shade	20	31
Add Humus	8	12
Others	7	10
Erosion control	5	8
Fencing	3	5
Total	65	100

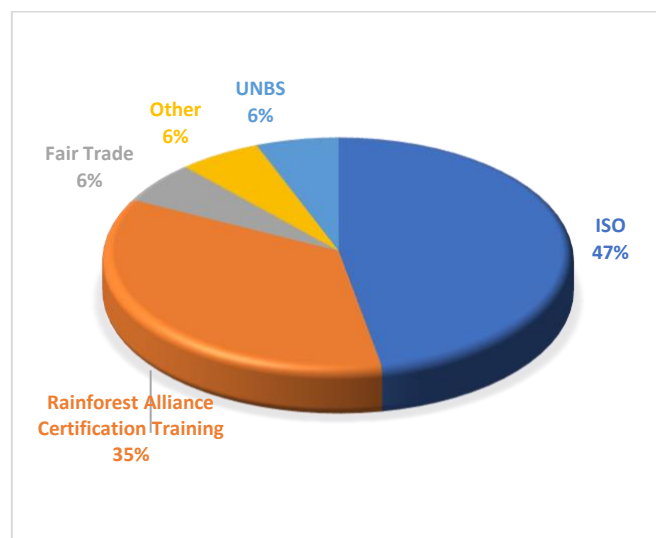


Fig. 8. Tea certification trainings attended by tea small holder farmers.

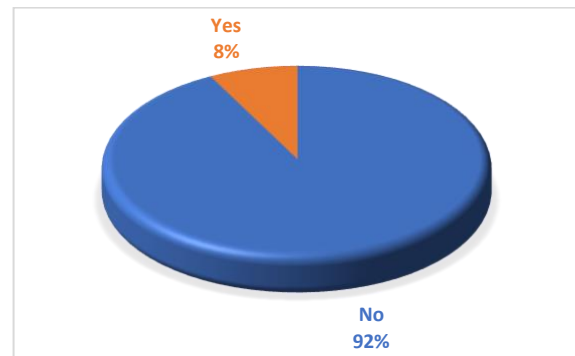


Fig. 9. Benefits of tea certification to farmers.

K. Benefits of Tea Certification to Farmers

Farmers stated the different benefits of tea certification as indicated in Fig. 9. A total of 92% of the respondents stated that they have not benefited from tea certification. The tea smallholder farmers further stated that they do not receive a better price or additional bonus or premium even if their factories where they deliver tea have been certified by Rainforest Alliance Certification training, UTZ Certification Training, Fair Trade, ISO, and others. Furthermore, 8% of the respondents stated that they have benefited from tea certification.

V. DISCUSSION

A. Community Characteristics

Based on gender results, there are more men involved in tea farming in Kyenjojo district because it is a perennial crop; hence, ownership of tea fields is mostly for the men. This also implies that men have a greater say in tea farming among tea growing communities. The high potential of agroforestry in sub-Saharan Africa is also confirmed in gender research. But among women farmers, of whom there are many, the adoption rate is slower. Gender, as a fundamental aspect of social organisation, determines the distribution of land titles, labour resources, women's heavy workload, their time poverty and possibly also their higher risk aversion in relation to technology adoption, like that of agroforestry [7]. Based on level of education results a big number of tea small scale farmers received some sort of formal education; therefore, they can be able to easily comprehend any message given to them regarding agroforestry, climate-smart tea practices, and good agricultural practices to enhance their tea farm yields and livelihood incomes. Based on marital status results a big percentage of tea small scale farmers being married means that they do have stable families and therefore any knowledge of tea agroforestry can easily be taken up by these tea farming communities. Based on household type results, the future tea agroforestry and climate smart tea practices should consider the vulnerable households that are female headed.

B. Land Ownership and Use

Based on land tenure system results, the majority of tea farming households have customary land and there were minimal issues of land conflicts with the tea farming communities. This implies that in order for the 34% of tea farmers that own less than one hectare of tea land to earn profits from tea farming, there is a need to encourage these

farmers to improve their productivity of tea farming per unit area. This will be achieved by training farmers in the knowledge of tea agroforestry, climate-smart tea practices, and other good agricultural practices that can easily be taken up by these tea farming communities. A grand total of 66% of tea farmers can easily break even (profitability in tea business) since they own or cultivate tea on more than 3 hectares of land. This can also be achieved through increased productivity of tea yield per unit area of tea land in tea farming communities.

C. Agroforestry Practices in Tea Farming

Based on agroforestry practices in tea farming results, currently boundary planting is a dominant agroforestry practice in tea farming at farm level. Therefore, it acts as fence, demarcation between tea fields as well as shade for tea which is the most required for tea growing. Native trees can be planted throughout tea farms without hurting the other agricultural activities. Planting of woodlots would produce firewood while maintaining a diversity of native species. Some of these were lacking [8].

The benefits farmers and communities obtain from using tea agroforestry practices results, the findings are in agreement with findings from a study conducted by [9], on contribution of agroforestry to climate change mitigation and livelihoods in Western Kenya who found that tree provided benefits for household consumption and for sale including use of trees for firewood, poles for construction material, shade, fruit and timber. The wood collected from shade tree branches or when the shade tree is removed can be sold or used as firewood. Therefore, as per the respondent's responses several benefits of tea agroforestry (protection of environment, source of poles, source of timber, employment, and provision of food) have been unearthed from tea growing communities.

The problems hindering farmers from practicing tea agroforestry practices at farm level results indicated that the majority of tea farmers were not just willing and interested in incorporating agroforestry in tea farming. This finding was in line with work conducted by [10], who also provides partial support for the hypothesis that attitudes towards tree planting affect tree planting behavior. Farmers with a more positive attitude towards tree planting also had a higher density of planted trees on their land. This implies that there is a need to conduct a massive campaign to sensitize tea farming communities about the importance and various benefits of tea agroforestry. Inadequate capital was the second main problem hindering tea small holder farmers from practicing tea agroforestry in Uganda. This is also highlighted by [11], who state that the expense of establishment of agroforestry technologies was one of the major challenges for adoption. Inadequate capital leads to inability to procure inputs (Planting materials and agro inputs) that would be utilized in incorporation of agroforestry. [10] also found out that poverty to be one of the barriers to planting agroforestry trees in which the available resources are committed to meeting the immediate needs. Tree planting activities could be promoted by providing farmers with more training, good quality planting material, equipment, and access to markets.

One of the clear solutions to the problems hindering farmers from practicing tea agroforestry practices in this

study was lack of knowledge. This in agreement with [12], who contend that education may be the most important factor for adoption, as many studies on the adoption of conservation practices cite lack of access to information and technical assistance as one of the primary barriers. Training in agroforestry therefore builds capacities of farmers to appropriately manage the trees. This is consistent with a study by [13], who highlighted that farmers' ability to adopt and manage agroforestry was enhanced with access to required information and skills.

Based on dominant agroforestry tree species used at tea farm level results (eucalyptus and *Grevillea robusta* being the most dominant), the finding was consistent with [14], who found the same agroforestry trees on farm amongst other trees. Absence of other suitable agroforestry trees in and around the tea farmer fields could be lack of knowledge on their existence or suitability (depending on soil and land types), for which information should be provided to the farmers by extension workers.

The adoption of tea agroforestry practices at tea farm level results revealed the most dominant adoption method of tea agroforestry practices at tea farm level was through farmer to farmers. This finding was corroborated by work done by [10], who found out that farmers feel encouraged by others, such as their spouse, village chief, farmers group, extension workers and peers, to plant trees. This implies that farmers who engage in tree planting behavior feel more encouraged by others to plant trees and also experience fewer hindrances when planting trees. This means tea agroforestry message could be passed on from one generation of tea farmers to another.

Firewood was stated as the most important use of agroforestry technology on tea growing and people's livelihoods. This implies that tea agroforestry was providing an indirect contribution to energy sources in the form of firewood, thus reducing on aspects of deforestation and improving the climate. This was in agreement with [15], who stated that wood fuel production in agroforestry systems may provide a more sustainable alternative to collection from natural forests and woodlands and could provide multiple benefits for smallholder farmers while limiting land degradation and deforestation.

D. Tea Certification

Based on tea certification results, the benefits which would be exploited by the small holders' tea farmers from the different certification bodies include learning new techniques to farm more effectively, protect their workers and the environment, and ultimately earn better, more sustainable income as provided by UTZ improved well-being of farmers, workers, and their families if they grow tea in accordance with the strict guidelines of the Rainforest Alliance. Sustainable Agriculture Standard which consists of a wide range of good agricultural practices and rigorous social and environmental criteria and conserving biodiversity and natural resources as better trading conditions to and the rights of marginalized producers and workers including negotiation for fair prices and support in production investment by the producer organisations by Fair trade certification [16].

VI. CONCLUSION

The study revealed that currently boundary tree planting as an agroforestry practice was dominating the tea smallholder farmers' fields in Kyenjojo district in western Uganda. Shade was the most benefit of agroforestry trees towards tea growing and followed by climate modification aspect. Results also indicated protection of the environment as the leading benefit of tea agroforestry to farmers and communities using tea agroforestry practices and trees acting as a source of poles was the second stated benefit. A majority of tea smallholder farmers were not aware about the need to incorporate agroforestry in tea farming. Eucalyptus was the most dominant agroforestry trees used at tea farm level. The second dominant agroforestry tree was grevillea robusta at tea farm level. The most dominant adoption method of tea agroforestry practices at tea farm level was through fellow tea farmers followed by trainings of agroforestry. Firewood was stated as the most important use of agroforestry technology on tea growing and people's livelihoods. The second most usage of agroforestry technologies was the provision of shade. Planting of agroforestry trees as the only remedy stated by farmers as an effort, they currently do to retain trees at farm level. A majority of respondents stated that they have never attended any training on tea certification. ISO and Rain Forest Alliance Certification Training were the topmost training attended by farmers. A large number of the respondents stated that they have not benefited from tea certification. The tea smallholder farmers further stated that they do not receive a better price or additional bonus or premium even if their factories where they deliver tea has been certified by Rainforest Alliance Certification training, UTZ Certification Training, Fair Trade, ISO and others. In conclusion the study has revealed the current tea agroforestry practices and their benefits to tea farmers and livelihoods. However, gaps have also been identified including the need to make efforts by Public, Private and Development partners to make all tea farmers aware of the existing and appropriate agroforestry practices in Uganda.

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