MDP-IFAD INTERNSHIP REPORT

GENDER ANALYSIS OF THE DISPARITIES IN THE LEVEL OF ADOPTION OF CLIMATE SMART AGRICULTURAL PRACTICES AND THE IMPACT ON HOUSEHOLD NUTRITION OF SMALLHOLDER FARMERS IN UGANDA

By:

POLLYN GABRIEL ABINYE

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ABSTRACT

The global demand for food and agricultural products is fast increasing because of a growing global population and changing diets. Production is low as crop yields fall in many parts of the world, especially developing countries in Africa, due to their total dependence on natural resources and agriculture, yet extremely vulnerable to climate change. These result in tragic crop failures, reduced agricultural productivity, increased hunger and gender inequality, malnutrition and diseases. Climate smart agriculture (CSA) has been identified as an important pathway to achieve agricultural development priorities in the face of climate variability and change, and serves as a bridge to other development priorities, including gender inequality. Despite the gains arising from CSA, adoption is low among smallholder farmers and its impact on nutrition security is not fully known in Africa. This research was initiated to investigate gender disparities in the adoption of CSA practices and the impact on household nutrition of smallholder farmers using Uganda as case study.

A multi-stage, mixed method data collection approach was adopted. 100 questionnaires were administered to one district officer, six local council officers, 4 sub-county heads and 84 households randomly selected from four sub-counties. Two focus group discussions and 6 key informant interviews were held to improve reliability of information gathered. Data collected helped to determine the level of CSA adoption by gender, preferred CSA practices, challenges/barriers to adoption by gender, productivity as well as impact on food and nutrition security

Findings indicated farmers' awareness of CSA practices, however, adoption is low among male and female farmers. Most widely adopted practices are row planting and intercropping with very little disparities in adoption level among the gender groups, while least adopted practices are minimum tillage and mulching. Adopted practices were found to be poorly implemented by farmers, thus does not have noticeable impact on productivity as well as food and nutrition security. knowledge deficiency, technical know-how, unreliable weather information and lack of adequate factors of production (land, labour and capital) were observed as major reasons for low adoption among farmers.

To upscale CSA government, donor agencies, research and agricultural institutions should work together to address these challenges and proffer localized and indigenous solutions. Environmental, gender and socioeconomic factors should be taken into account. Farmers should be provided with continuous education, training, information, improved extension services and access to credits; existing policies should be enforced and amended to align with future challenges and opportunities; farmers should mobilize to form associations that will assist members.

Keywords: Climate change, climate variability, climate smart agriculture.

CHAPTER ONE

1.1 INTRODUCTION TO THE PROBLEM

Climate change and food security are two of the most pressing challenges facing the global community today. Improving the smallholder agricultural system is a key response to both. The number of chronically hungry people in the world reached a total of 925 million and not much has changed since then (FAO, 2010 SOFI). About 75% of the worst-affected people reside in rural areas of developing countries, their livelihoods depending directly or indirectly on agriculture. Strengthening agricultural production systems is a fundamental means of improving incomes and food security for the largest group of food insecure in the world (McCarthy et al, 2011). As the key economic sector of lowest income developing countries, improving the resilience of agricultural systems is essential for climate change adaptation. And improvements in agricultural production systems offers the potential to provide a significant source of mitigation by increasing carbon stocks in terrestrial systems, as well as emissions reduction through increased efficiency (McCarthy et al, 2011).

One important way to ensure nutrition security and economic growth in Africa is to promote agricultural practices that help farmers to adapt, as well as reduce agriculture's contribution to climate change. Climate smart agriculture (CSA) has been identified as an important pathway to achieve agricultural development priorities in the face of climate variability and change, and serves as a bridge to other development priorities, including gender inequality. Climate smart agriculture (CSA) is agriculture that sustainably increases productivity, enhances resilience (adaptation), reduces/removes greenhouse gases (mitigation) where possible, and enhances achievement of national food security and development goals (FAO, 2010).

The emerging of CSA can be noted to have started in 2010 after The Hague conference where countries met to discuss the adverse effect of climate change and how to mitigate the effects. This conference led to a number of actions and policies to be implemented in order to achieve its objectives (FAO, 2015). As a result, the use of CSA technology has been widely campaigned for because it is considered to be an efficient way of high productivity in agriculture and is said to be an approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change (Kitsao, 2016).

CSA technology helps in increasing adaptive capacity through efficient use of resources and creating agricultural systems that can stand the threats of climate change. The focal point in CSA is proper use of land, soil and water conservation and residual management since these are the factors that determine the productivity as well as they are affected by climate change.

In spite of the development of several CSA technologies and the positive gains arising from these technologies, wide scale adoption remains problematic in Africa. There are several barriers that prevent smallholder farmers in Africa from adopting CSA technologies and so far, existing policies and actions to remove these barriers remain inadequate. A good understanding of what these barriers are, how they impinge on adoption of CSA practices by women and men farmers as well as the impact on nutrition security is essential.

This report identified the level of adoption of CSA practices, barriers to scaling up/out climate smart agriculture practices by gender and proposed strategies and practical actions to remove the barriers and enhance adoption in Africa. Section one of the report provides the background, rationale and objectives. Section two discussed the method adopted for the research, research location and tools used. Section three identified and discussed the level of CSA adoption, barriers that limit scaling-up of CSA practices and the impact on food and nutrition security as well as strategies and practical actions to remove the barriers. Section four presented the conclusions reached and outlined possible recommendations.

1.2 BACKGROUND OF THE STUDY

Uganda is an agro-based, land-locked country with a young and fast growing population of estimated 34 million people and high human population growth rate of 3.2% per annum. Worldwide, it is the leading country with the youngest population of 78 % below age 30 years while 52% of the population is 15 years and below (Mutambi 2013). It is well endowed with natural resources and salubrious climate, with low industrialization and value addition and facing challenges of poverty alleviation, a high human population growth rate, low science and technology, environmental impacts and climatic change; with the trio of population increase, environmental impacts and climate change being of global concern and to which the world is seeking lasting solutions and which have seriously affected smallholder farmers and undermined progress in agricultural development in most developing countries.

The Inter-Governmental Panel on Climate Change (IPCC) forecasts that agricultural production, including access to food, in Africa and other regions would be severely compromised by climate variability and change (IPCC, 2007). The area suitable for agriculture, the length of growing seasons and yield potential, particularly along the margins of semi-arid and arid areas are expected to decrease. This would further adversely affect food security and exacerbate malnutrition in these regions. In some countries, yields from rain-fed agriculture could be reduced by up to 50 percent by 2020 (IPCC, 2007). With 95 per cent of agriculture dependent on rainfall, a 20 per cent decrease in length of crop growing season and a 50 percent decrease in yields from rain-fed agriculture, the projected losses in potential for cereal production in Sub-Saharan Africa (SSA) are estimated at about 33 per cent. Local food supplies would be negatively affected by reduced productivity of livestock (feed and fodder availability) and decreasing fisheries resources in large lakes due to rising water temperatures, which may be exacerbated by continued over-fishing (Bernard et al, 2015).

Many actors are promoting key agro-ecological farming technologies and practices that are highly suited to enable farmers to adapt to climate change. These include agro-forestry, crop rotation, intercropping, minimum tillage, soil cover maintenance, residue retention, water conservation, rice systems that reduce methane emissions, improved management of livestock and soil carbon as well as breeding plants and animals adapted for future climate conditions. These practices have been documented to generate higher and more stable crop yields and incomes and enhance resilience to climate change in some countries compared to conventional agricultural production methods. Although these practices are not necessarily new, when used in the context of climatic change, they have been proved to be innovative for farmers, herders and fishermen (www.fao.org/climatechange/micca/79527, da 25/02/2015). These technologies and practices are referred to as Climate Smart Agriculture (CSA).

CSA has been identified as a way to achieve short and long term agricultural development priorities in the face of climate variability and change, and serves as a bridge to other development priorities, including gender inequality. It sustainably increases productivity, enhances resilience (adaptation), reduces/removes greenhouse gases (mitigation) where possible, and enhances achievement of national food security and development goals. It seeks to support countries and other actors in securing the necessary policy, technical and financial conditions to enable them to sustainably increase agricultural productivity and income generation in order to meet national food security and development goals; build resilience and the capacity of agricultural and food systems to adapt to climate change; mitigate emissions of greenhouse gases and increase carbon sequestration (FAO, 2010).

CSA practices in general encompasses conservation agriculture, integrated soil fertility management, small scale irrigation, agroforestry, crop diversification, improved livestock feed and feeding practice, as well as early warning systems and improved weather information. This study focused on the five CSA practices that were selected by farmers in Nwoya and which was implemented in the training during the demonstration programme. This project seeks to strengthen resilience of smallholder farmers and increase nutrition security by fostering wide scale adoption of climate smart agricultural practices in Uganda. The goal is to improve the livelihoods of poor rural smallholder farming households in Nwoya District, Northern Uganda and may be generalized to similar areas in Northern Uganda and other regions in the country.

1.3 **RESEARCH PROBLEM**

Climate change poses new challenges to the fight against poverty and sustainability of agrarian livelihoods in Sub-Saharan Africa. Predictions indicate that climate change will adversely affect agricultural production in Africa through declining crop yields and livestock productivity caused by rainfall variability, rising temperatures, drought and increased pest/disease incidences; with increase in population while production is struggling to keep up in Africa where many smallholder farmers (who make up bulk of the population) are dependent on natural resources and agriculture for livelihood; have low level of coping capabilities and are facing food insecurity, poverty, the degradation of local land and water resources. These vulnerable farmers depend on agriculture for income generation, food and nutrition security and as a way of coping with climate change.

If agricultural systems are to meet the needs of these farmers, they must evolve in ways that lead to sustainable increases in food production, at the same time strengthen the resilience of farming communities and rural livelihoods. In 2014, 12.9% of the population in developing countries was undernourished, while 2016 estimates found that one in nine people suffers chronic hunger (FAO, 2015). Uganda is one of these developing countries. Food and nutrition security remain Uganda's most fundamental challenge for human welfare and economic growth (USAID, 2016) and women who are primary nutrition providers continue to face discrimination and often have less access to power and resources, including those related to nutrition.

Gender and nutrition are inextricable parts of the vicious cycle of poverty. Gender inequality can be a cause as well as an effect of hunger and malnutrition. Higher levels of gender inequality are associated with higher levels of undernutrition, both acute and chronic undernutrition (FAO, 2012).

The food security challenge will only become more difficult if problems of gender inequality that reduces women's role as primary nutrition providers is not addressed urgently. Food demand is projected to rise by at least 20% over the next 15 years (WBG, 2017).

Women smallholder farmers have for a long time been known to be the backbone of many families in developing countries and the main source of income from this groups being agricultural products. As a results the effects of climate change on agriculture has affected negatively on food security especially on the rural people because they are highly dependent on agriculture as a source of income. Hence this makes it important to look at the CSA adoption on gender basis since it will identify the adoption level of- and unique challenges to adoption that each gender group face, particularly women, and provide solutions to upscale CSA not just in Uganda but other developing countries as well.

Evidences show that CSA is one of the ways of enhancing sustainable increase in food production, income generation, promote gender equity, increase nutrition security while strengthening the resilience of farming communities to adapt to climate change (Rioux et al. 2016). However, despite the development of several CSA technologies and the positive gains arising from its practice, wide scale adoption remains low among smallholder farmers in Africa, and its impact on household nutrition is not fully known. There are further indications of a downward trend in adoption levels if urgent actions are not taken to identify the differences in the level of adoption by women and men farmers as well as factors responsible for such adoption levels, which is a prerequisite to understanding the barriers that each group face in order to foster wider adoption and increased impact on nutrition security.

Much of the research reports on CSA have been focused on challenges to adoption with little or no regard to the differences in the level of adoption by gender groups. These partial assessments often consider challenges to adoption with respect to farmers in general, without consideration to gender differences that exist in adoption and its impact on nutrition. This research has filled this knowledge gap by analyzing gender disparities in the adoption of CSA practices as it has systematically determined the specific challenges to wider adoption that is common to women and men smallholder farmers as well as how the adoption rate has impacted household nutrition using Uganda as case study.

1.4 OBJECTIVES OF THE STUDY

The objectives of this study were:

1. Determine the level of adoption of climate smart agriculture by women and men farmers in Nwoya District, Northern Uganda;
2. Identify factors/barriers limiting wide scale adoption of climate smart agriculture among smallholder farmers (women and men);
3. Assess the impact of climate smart agriculture on nutrition security.

1.5 RESEARCH QUESTIONS

The following were the research questions for this study:

1. Which of the five preferred CSA practice(s) are being implemented by the respondent?
2. What are your reasons for preferring the selected practice(s)?
3. Who are decision makers in the household?
4. Have the selected practice(s) increased productivity?
5. Have the selected practice(s) increased income generation?
6. What are the challenges with other CSA practices not selected?
7. Are the respondents' household food secure?
8. Are the respondents' household nutrition secure?

1.6 SIGNIFICANCE OF THE STUDY

Increase in global population, especially in Africa and increased incidents of climate change of which smallholder farmers are vulnerable to and have limited coping capabilities and which have resulted in reduced productivity, acute food shortage, pronounced poverty and nutrition deficiency which remains one of Uganda's most fundamental challenge for human welfare and economic growth necessitated this study. This study is important in that it reveals the factors limiting wider adoption of CSA practices by gender, challenges faced on adopted CSA practices and its impact on food and nutrition security. This is very crucial to understanding the unique challenges of smallholder farmers as well as ways of fostering wider adoption. This report is a useful tool to agricultural policy makers; local and international institutions, government at all levels and NGOs who seek to foster wider adoption of CSA by upscaling and out-scaling the practice for sustainable development.

1.6 RESEARCH SCOPE

The focus of this study was Ugandan smallholder farmers who are highly vulnerable to environmental effects as well as climate variability and change and have least coping capabilities, particularly in the war ravaged northern region that is still struggling to cope with the aftermath of the crises that lasted over a decade. To enhance the research results, the author examined successfully implemented CSA projects from other African and Asian countries. Focus was on the five implemented CSA practices (row planting, intercropping, improved varieties, minimum tillage and mulching) that was used to train farmers on various demonstration plots and compared practices on the demonstration plots with current implementation practice. The study compared farm practices of eighty-four (84) households from four (4) sub-counties in Nwoya District.

CHAPTER 2

MATERIALS AND METHODS

2.1. INTRODUCTION

This chapter highlights the specific methodologies and procedures that were used in the study. The methodologies include the description of the study area, sampling criteria and study instruments used. Data collection methods, data analysis and data interpretations for the study are also described.

2.2. STUDY AREA

The study was conducted in Nwoya district which is one of the districts in the Acholi Sub-region of Northern Uganda. It has a total area of 4,736km^2, a density of 33.68km^2 with latitude $2^o30^I35.1^{II}$ (2.5097^o) N, longitude $31^o53^I4.1^{II}$ (31.8845^o) E and an elevation of 928 metres (3,045 feet) (Mapcarta, 2017). The district has two agricultural seasons (March-June & August-November); the main crops grown include cassava, sweet potato, beans, groundnuts, sesame, sorghum and millet. The district comprises a population estimate of 159,500 (UBS, 2016) with 50.4% (that is 67,279) of the population as women while 49.6% (that is 66,227) of the population are men. In terms of urbanization, 89.8% (119,913) of the entire population are rural dwellers while 10.2% of the population are urban dwellers (Brinkhoff,2016).

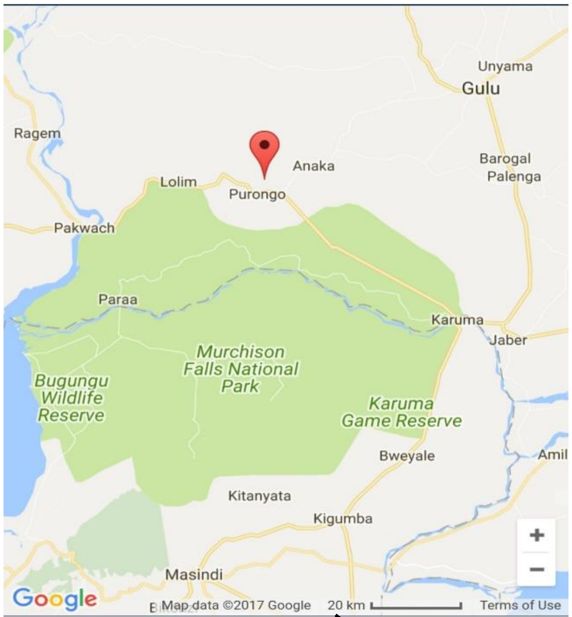


Fig. 2-1:Map of Nwoya District

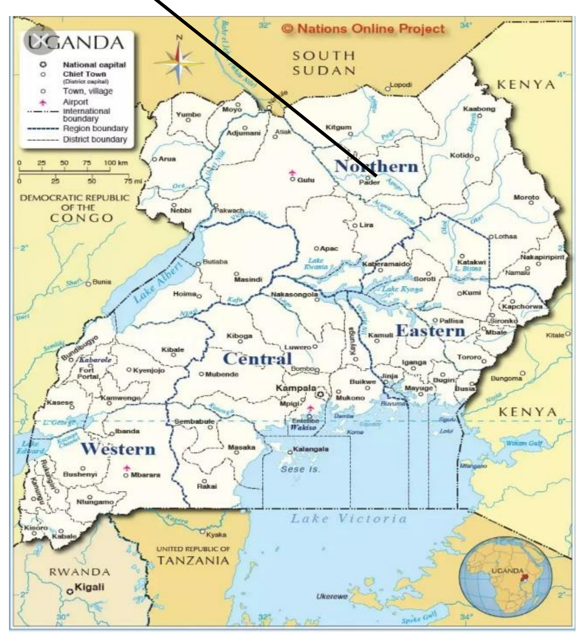


Fig. 2-2: Map of Uganda

2.3. RESEARCH DESIGN

The research design adopted was inspired by Participatory Action research and interactive model of mixed methods based on undertaking both theoretical and empirical (qualitative and quantitative) analyses. From the research objectives, the first part focused on analyzing secondary data of published materials and studies on CSA technology and practice as well as adoption. Secondly, it involved use of interviews and surveys from different stakeholders and experts in the field within Uganda. It is both practice and theory driven research for potential benefits. The respondents are agricultural officers from Nwoya district headquarters and local councils, sub-county heads and smallholder farmers (single headed and dual-headed households) from the four (4) sub-counties.

2.3.1. Participatory action

Participatory action research is known by many other names, including participatory research, collaborative research (on the part of scientists, practitioners, service users etc), action learning, and contextual action research, but all are variations on a theme. Participatory research approaches are mostly utilized at the level of applied and adaptive research or even technology transfer. The common aim of these approaches is to change social reality on the basis of insights into everyday practices that are obtained by means of participatory research (Mutambi 2013). "Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction. Accomplishing this twin goal requires the active collaboration of researcher and client, and thus it stresses the importance of co-learning as a primary aspect of the research process. Participatory Action Research provides means to measure results against initial goals and identify critical elements within a project to advance the desired outcome (Mutambi 2013).

Against this background, the methodological approach was inspired by the Participatory Action Research (PAR), as a collaborative approach, which involves all partners in the process, with the aim to produce knowledge and recognizes partners' strengths, weaknesses, threats and opportunities (SWOTs). The aim of the study is broad but was guided by various concepts and methods. The research adopted both quantitative and qualitative methods. They include observation, participation, interviews and document analysis in this category confirms that observations, field notes, journals, interviews (structured, semi-structured and unstructured) and analysis of documents are used for gathering qualitative information. Exploration is also made empirically which takes a variety of forms such as case studies, personal experience and participation, interviews, texts, etc.

2.4. DATA COLLECTION

Multiple data collection methods were employed for data collection from the primary data and secondary data sources. For primary data, the methods used included; administered questionnaire administration, interviews and conversations with stakeholders, and focus group discussions.

2.4.1. Secondary data review

An extensive literature review from a wide range of selected articles from journals, government and international agencies policies and publications, technical documents, reports and books was carried out to inform both the approach used, the focus of the work and analysis of the content. This involved conceptual and literature review on agriculture, climate change and climate smart agriculture. This led to an in-depth understanding of the topic and helped in identification of the problem and the mitigating factors to improve the situation in Uganda. The analysis also informed the design and conduct of interviews and surveys.

2.4.2 Primary data collection

Primary data collection covered surveys and interviews methods used. Expert opinions and Informal group discussions from my supervisor, International Centre for Tropical Agriculture (CIAT)- Kenya and International Institute of Tropical Agriculture (IITA)- Uganda in different meetings attended introduced the research topic and the scope applied. Semi-structured questionnaires for the interviews and surveys were developed, pretested and used to collect data face –to – face from the stakeholders in Nwoya to enable the collection of in-depth quantitative and qualitative information i.e. views and experiences from farmers, farmers' association, extension/support service providers (Uganda) and experts from CIAT and IITA. Informal sessions with stakeholders were organized whereby stakeholders were randomly selected and interviewed according to the set questionnaires. Site visits were made to the demo plots and some farmlands in all the four counties.

Data for this study was collected from 100 randomly selected households. Of the 100 randomly selected households, responses from 21 households were discarded because of poor quality of data.

Four focus group discussions were held at four villages of the three sub-counties. About 4 key informants' interviews were also conducted. In order to have a good representation of all the relevant groups, purposive sampling techniques were used in selecting the respondents for FGD and key informant interview. A structured questionnaire was administered to smallholder farmers to collect information on farmers' perceptions of climate smart agricultural practices adoption, constraints/barriers, productivity, income generation, impact of adopted CSA on food and nutrition security as well as willingness and ability to adopt more CSA practices. In addition, the key informant interviews were conducted as part of in-depth interviews to acquire more information on the subject matter. This technique was used to acquire more information on the perception of smallholder farmers and the view of the key people in the community. A total of two FGDs, were conducted. Besides, field observation was also used to collect additional data and used to verify some of the information collected.

Fig. 2-3: Data collection from young farmers at Alero Sub-county

Fig.2-4 Data collection from young farmers at Purongo Sub-county

Fig. 2-5: Data collection from a dual-headed household at Koch-Goma Sub-county

Fig. 2-6: Focus group discussion with women farmers at Agonga A village

Fig. 2-7: Focus group discussion with men farmers at Nwoya village

Fig. 2-8: Woman sieving sesame seeds as an off-farm activity

2.4.3. Sampling Size and Sampling Procedure

2.4.3.1 Sampling size for households

According to Uganda Bureau of Statistics (UBS, 2016) the total population of Nwoya District is 159,500. A total of 84 farming households with an average of 5 people per household were surveyed.

2.4.3.2. Sampling procedure for households

Sampling procedure was predetermined based on the approach used during the climate smart agriculture demonstration programme held in 2014. The field officer from IITA directed my research assistant and I to farmers who were trained on CSA implementation and who took part in the demonstration programme.

2.4.3.3. Sample size for key informant interview

Table 3-1 shows the distribution of key informants per section. The pool of professional key informants comprised of Sub-county officials, extension officers and farmers.

Table 2-1: The sample size of key informants

Section	Number of Key Informants
Sub-county officials	4
Extension officers	8
Farmers	20
Total	**32**

Positive responses were received from four sub-county officers, eight extension officers and twenty farmers who responded positively in the study.

2.4.3.4. Sampling of key informants

Purposive sampling was used to select those to be interviewed for Key Informant Interview. This sampling method was used because it could give in-depth understand and valid points for recommendation purposes. Key informant interview thus helped in getting detailed information on agricultural yield capacity of the preferred CSA practices implemented, frequency and reliability of information received on agricultural activities, types of constraint faced by women and men farmers and effectiveness of farmers' association and government/donor agencies support.

2.5. DATA ANALYSIS

Data analysis was used to organize, inspect and transform data with the aim of highlighting required information, suggest conclusion and support decision. Analysis of the data collected helped to develop strong evidence from the investigations. A multi-stage Sampling method was used with a sample size of 100 households and an average of 25 households sampled from each of the four sub-counties. Due to additional information added to the questionnaire to improve on the quality of the survey outcome of 84 questionnaires were considered to suit the purpose of the study and was analyzed. Data was analyzed using Stata and Microsoft excel while data description was done using percentages and frequencies.

2.5.1. Data Management, Analysis and Presentation

Procedures were kept in place to keep accurate and complete record of the respondents. These included the number of participants in the study. Questionnaires were screened to identify incomplete, incorrect and inaccuracies in data and errors were corrected. The data were entered into a computer excel spreadsheet in a standard format. Each study participant was entered with a unique code and variables name. the data was imported into Stata version 4.0 for further analysis.

2.5.2. Statistical tools

The tools that were used in data analysis included Microsoft Excel and Stata.

2.5.3. Descriptive statistics

Descriptive statistics was used to simplify large amounts of data in a sensible way. Descriptive statistics was used in this research due to its effectiveness in reducing huge amounts of data in a simple way (Otieno, 2016). This helped in generating a summary of the collected data in terms of frequencies, tables, graphs and charts.

2.5.4. Inferential statistics

The inferential analysis of data was done using Stata version 4.0. inferential statistics were applied in the study to help make inferences from the data collected.

CHAPTER 3

RESULTS AND DISCUSSIONS

3.1. INTRODUCTION

The study was undertaken to examine the level of adoption of climate smart agriculture technology and practices among smallholder farmers in northern Uganda in order to understand their challenges as well as barriers to wider adoption for an upscale of CSA. The purpose of this chapter is to present the general finding based on careful analysis of survey information and discuss the results. This thesis has indicated a wide range of issues that are related to the desired upscale of CSA in Uganda.

3.2. DEMOGRAPHY OF RESPONDENTS

Survey was carried out on 145 respondents from 79 randomly selected households. This comprised 65 men and 80 women. About 24 (17%) of the respondents are youths less than 40 years. The higher number of women farmers from the households surveyed implied that there were more women practicing small scale agriculture than were men. All respondents were household heads and their spouses for dual-headed households or male or female household heads for single-headed households. The average household size was 6.51.

There were two types of households, a single-headed and a dual-headed household identified. These was made up of 63 dual-headed households, where the home is headed by two people that mostly comprised of a husband who is the household head and a wife who is the spouse, and 16 single-headed households where either a male or a female heads the household. The single-headed household was sub-divided into male-headed households (3 in total) and female-headed household (13 in total). The reason for more female- headed-single household was because their husbands had died.

Total number of children less than 5 years in all households surveyed was 100 while the average number of children less than 5 years per household was 1.27. This implied that there is at least one child in each household who is in need of balanced nutrition for proper growth and development.

The total farm size of the sampled household was 393.3 acres while the average farm size per household is 4.44 acres. This result confirmed that the respondents were smallholder farmers with small land size for cultivation less than 2ha according to Sarah et al 2016.

3.2.1. Villages surveyed

The survey was carried out in 3 sub-counties (Purongo, Alero and Koch Goma), 8 parishes (Pawatomero, Paibwor, Bwobonam, Orum, Agonga, Coorom, Paramo and Patira) and 11 villages (Pawatomero East, Lulyango, Bwobonam A, Goro, Agonga A, Okir, Obul, Nwoya, Patira East and Lodi). Survey locations were predetermined based on previous baseline study carried and demonstration project that were carried out in these locations.

3.2.2 Education level of respondents

Survey result on education indicated that there are more male farmers with at least a primary education than there are female farmers in all. Of the 65 male respondents, 44 men have primary education, 18 men have secondary education, 1 man have superior education (higher institution of learning) while 2 men have had no form of education. Also, of the 80 female respondents, 56 women have primary education, 4 women have secondary education, 1 woman have superior education while 19 women have had no form of education. See Fig. 3.1 below.

3.2.6. Respondents access to cell phone

Use of cell phone by farmers was considered vital as it is one of the means of receiving important information, for example weather information, information on pests and diseases among others; via text messages from agricultural institutions, government agencies and donor agencies. Of the 145 sampled population, 40 out of 65 men had access to cell phone and 21 out of 80 women had access to cell phone. Percentage of men with access to cell phone was 61.5% while percentage of women with access to cellphone was 26.3%.

This implied that more male farmers have access to direct information such as text messages than female farmers. Thus less than half of the male farmers relied on word-of-mouth information while about two-third of the female farmers also relied on word-of-mouth information. This mode of information transmission would have possibly lost some credibility and might not be able to fully serve its purpose.

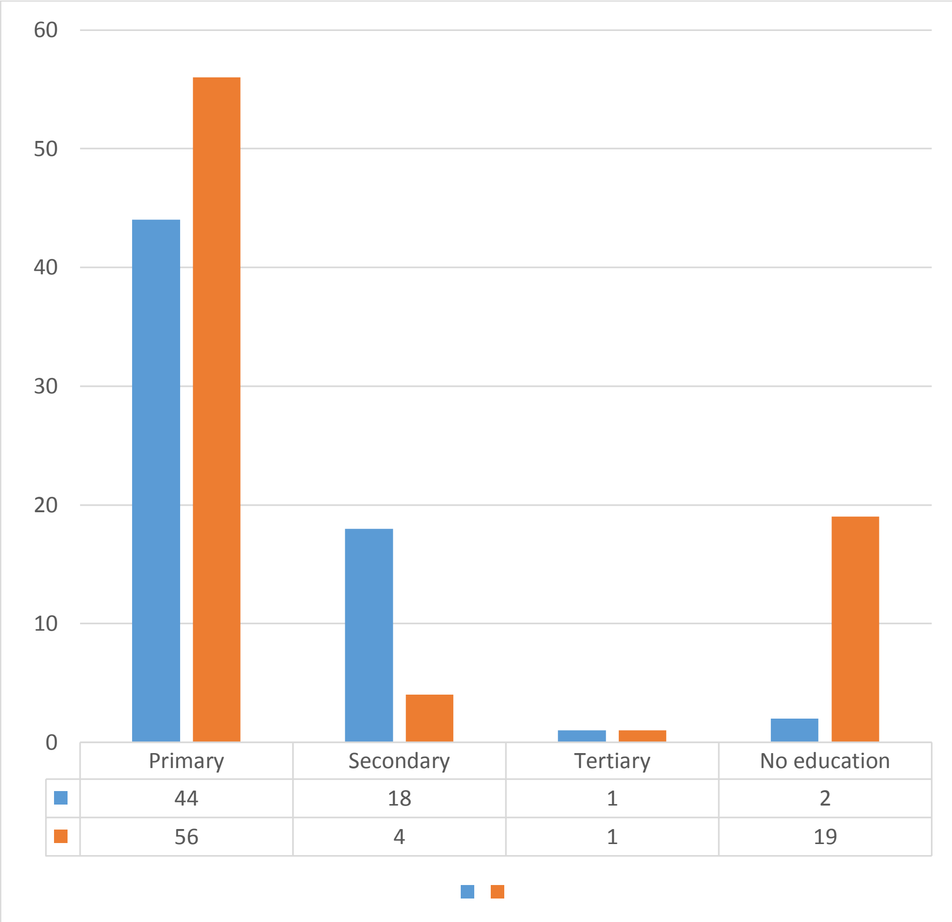


Fig. 3.1: Education level of respondents

3.2.7. Household decision making

How decisions are made in the households was considered vital as it would help to understand the pattern of decision making as well as the role of gender in decision making. That is, who makes decisions on size of farm to be cultivated, type of crops to plant, choice of CSA practice to implement, what to do with harvested produce, what quantity to sell and what to do with the income. The aim was also to understand if decisions were made solely by household heads or with contributions from their spouses or other members of the family, and if the decisions can help improve livelihood of the households. Out of the 63 dual-headed households 48 make decisions jointly with their spouses, in 10 households decisions were made separated by household heads and their spouses, while in 5 households the women were not part of the decision making.

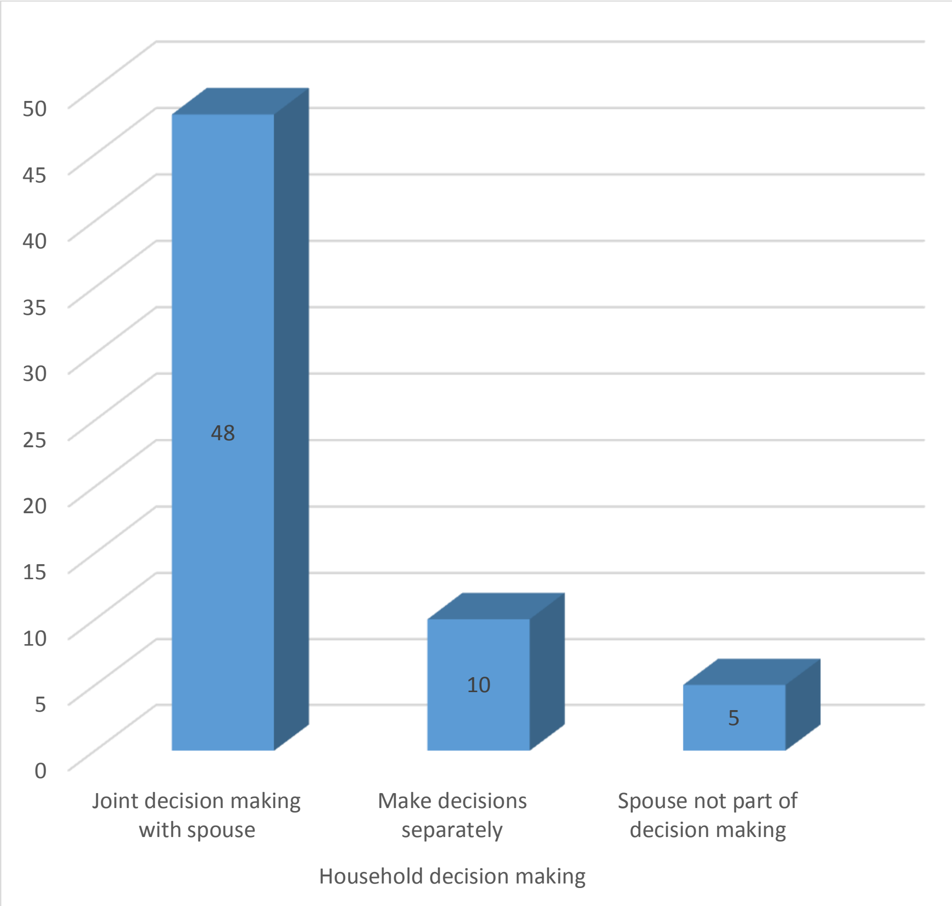


Fig. 3.2: Household decision making pattern

3.3. TYPES OF CROPS CULTIVATED

The three main crops commonly grown within the survey location were maize, beans and groundnut. All 79 households planted maize, beans and groundnuts this planting season. however, during the survey it was discovered that only 58 households had maize in the farm, 75 households had beans in the farm while 42 households had groundnuts in the farm (fig. 3.3). The reason from the reduction in the number of households that still had all three crop types was primarily due to the effects of climate change. Respondents stated that the rains did not come at the appropriate time this season which badly affected their groundnuts farm. Farmers also complained of infestation of maize and beans by army worms.

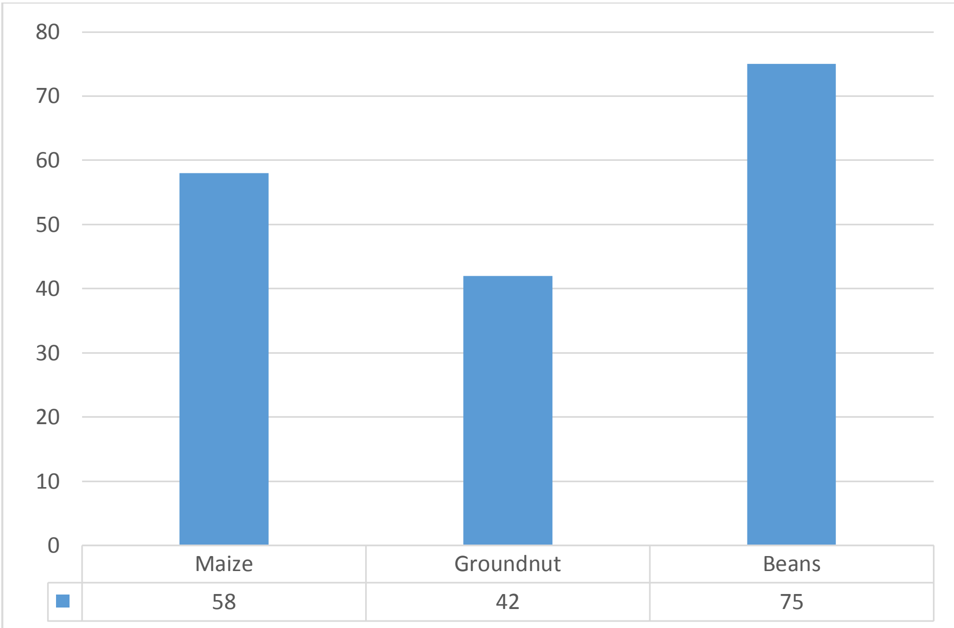


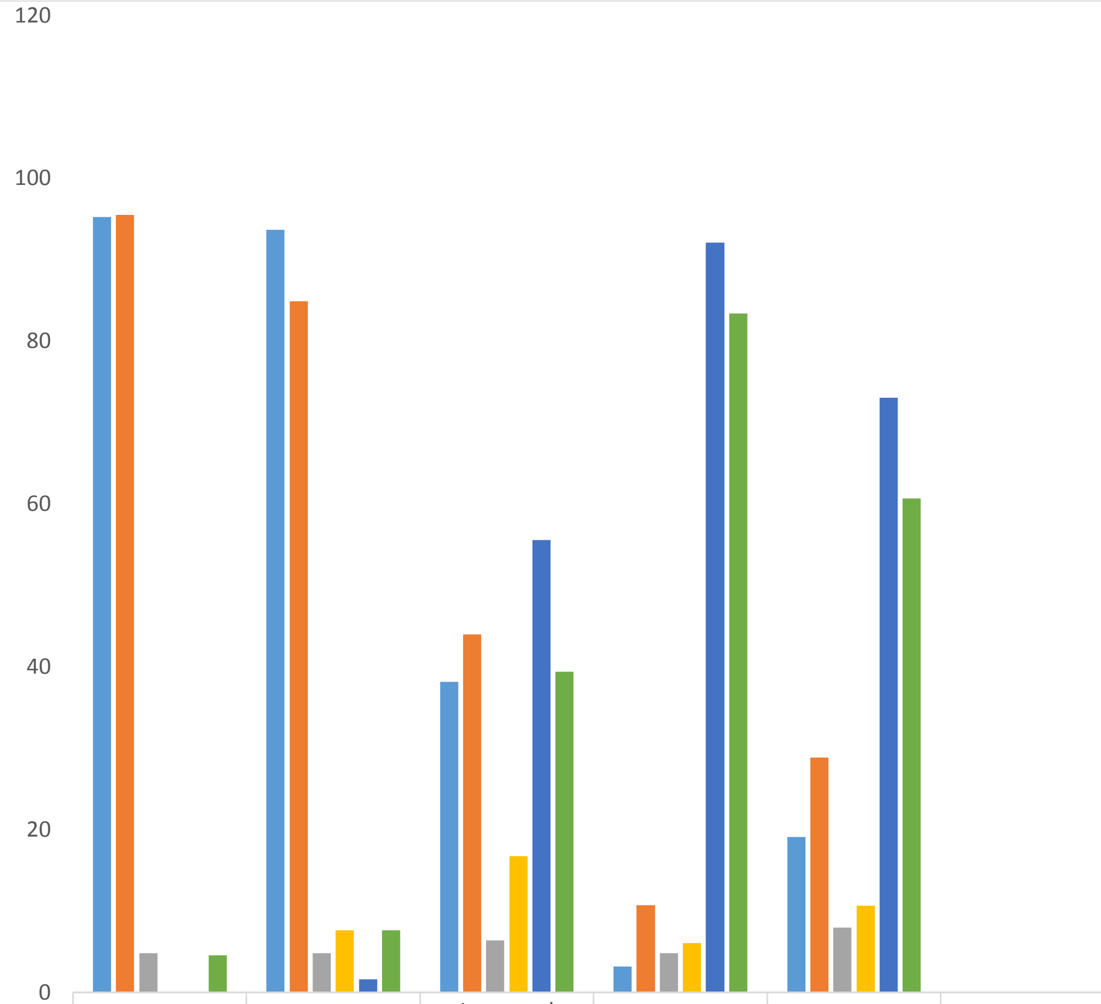
Fig. 3.3: The three common crops cultivated

3.4. RATING OF ADOPTION OF CSA PRACTICES BY GENDER

The study revealed that smallholder farmers had adopted various agricultural practices to overcome several environmental problems such as diminishing soil fertility, climate change and variability etc. The aim was to enhance productivity and food security as well as improve household income. In all the study areas, smallholder farmers practiced climate smart agriculture. This was as a result of training they had received during CSA demonstration programme two years earlier. However, most farmers were not fully aware of the benefits of the selected practices as they relied on third party information and observation from friends, neighbours and other family members' farms to select the practices.

Based on household survey and key informant interviews, farmers practiced the methods which were perceived to be feasible, less stressful, least costly and could increase yield and food security. The study found that of all the CSA practices known, row planting and intercropping received the highest priority as 95.24% women, 95.45% men and 93.65% women, 84.85% men were reported to have adopted both practices respectively (Figure 3.4). These was followed by other practices such as improved varieties (38.1% women and 43.94% men), mulching (19.05% women and 28.79% men). The least adopted practice is minimum tillage (3.17% women and 10.67% men). Mulching and zero/minimum tillage received the lowest priority. It was further revealed that farmers had acquired knowledge through experience. According to Gwambene et al (2015) farmers understand their environment and develop their practices through the observed environmental parameters that limit the practices. Developing an appropriate and feasible climate-smart and climate-resilient agriculture practice reduces hunger and improve food security and income. The most important option for smallholder farmers is to build sustainable food systems, improve productivity and income.

Furthermore, the low adoption of minimum tillage and mulching was due to complaints by farmers over low yield of minimum tillage and the associated difficulty in securing mulch to practice mulching. Both women and men had almost the same adoption rate for row planting because of the perceived ease of weeding and monitoring as well as possibility of high yields; while women were reported to adopt intercropping more than men because of the desire to have two or more crops in one garden and increase household food variety and to ease their activities on the farm. Improved varieties ware adopted by nearly half of the respondents and complained of the high cost of procuring seedling as well as need to always fumigate and monitor the crops as their major challenges.

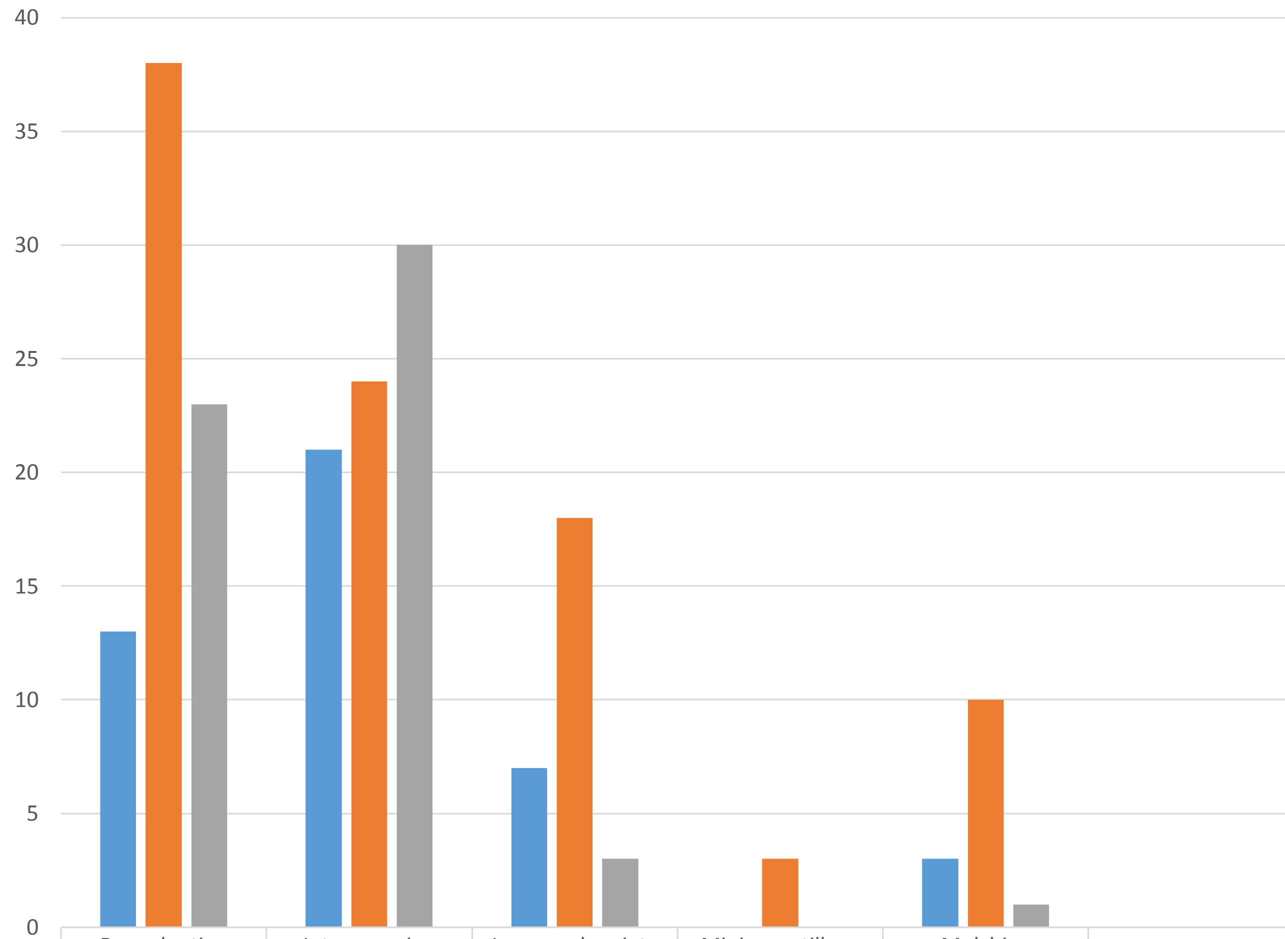


	Row planting	Intercropping	Improved varieties	Minimum tillage	Mulching	
Currently practiced (%)	95.24	93.65	38.1	3.17	19.05	
Currently practiced (%)	95.45	84.85	43.94	10.67	28.79	
Practiced in the past (%)	4.76	4.76	6.35	4.76	7.94	
Practiced in the past (%)	0	7.58	16.67	6.06	10.61	
Not practiced at all	0	1.59	55.56	92.06	73.02	
Not practiced at all	4.55	7.58	39.39	83.33	60.61	

Fig. 3-4: Rating of adoption of CSA practices by gender

3.5. SOURCES OF KNOWLEDEG AND INFORMATION ON CSA PRACTICES

Survey revealed the sources of knowledge and information on selected CSA practices by households. This helped to determine how farmers got knowledge and information on the selected practices and how it affects their ability to implement the CSA practices effectively. For example, it was determined during focus group discussions and key informant interviews that farmers who got their knowledge about CSA practices from demonstrations by CIAT/local partners were able to implement the practices better than farmers who had gotten their knowledge from family or neighbor and existing knowledge or tradition (fig.3.5).



	Row planting	Intercropping	Improved variety	Minimum tillage	Mulching
■ (blue)	13	21	7	0	3
■ (orange)	38	24	18	3	10
■ (grey)	23	30	3	0	1

Fig. 3.5: Sources of knowledge and information about CSA practices

3.6. RATING OF BARRIERS/CHALLENGES TO IMPLEMENTING CSA PRACTICES

The five major constraints to CSA practice implementation were poor knowledge and information about practice (78.5% women and 46.7% men), followed by factors of production- (31.6% women and 26.7% men) including land, labour, access to capital, modern tools and machinery as well as improved seedlings; this was followed by lack of technical know-how and skills (26.6% women and

18.7% men); and difficulty with implementing CSA practices (20.3% women and 16% men); while the least constraint was reported to be poor yields (11.4% women and 10.7% men), see Fig 3.6.

Majority of smallholder farmers had been limited in their farming activities because of inadequate factors of production. Some farmers had very little land to farm on and so are restricted in the number of practices they can adopt in one farming season. Others had challenges of getting additional farm labour, purchasing needed modern tools, hiring of tractors as well as purchasing improved seedlings because they cannot afford it. So they cultivate very small portion of the little land available to them. Local seedling germination rate is sometimes poor, giving little output; inability to hire tractors means land is burnt and this reduces the soil's nutrient over time, as well as cause other environmental damages. With small family size many smallholders have difficulties getting the needed labour to help cultivate their fields and this further contributes to a reduction in the size of cultivated land.

Farmers' knowledge about the practices were grossly inadequate. Most of the farmers did not implement row planting and intercropping very well because of poor knowledge and inadequate information about the practices. A lot of farmers depend on information from family members, friends and neighbours on the various practices and this information were found to be mostly inaccurate and inadequate. Over 70% of women farmers and 45% of men farmers do not have means or access to mobile phones, therefore cannot receive information about weather or other vital early warnings.

From the survey 26.6% of female respondents and 18.7% of male respondents lacked technical knowledge and skill to implement the practices adequately. But through in-depth interviews and focus group discussions it was discovered that nearly all the farmers are implementing their preferred CSA practice inappropriately due to lack of technical know-how and skills (as in the case of row planting). Explanations from farmers who claimed to understand the practices and can appropriately implement them (especially row planting, intercropping and mulching) negates the actual way these farm practices are expected to be implemented. Most of them still apply these techniques by the long old traditional ways handed them by their ancestors.

The study indicated that 11.4% female respondents and 10.7% male respondents cited poor yields as constraints to implementing some of the CSA practices and increased adoption. It was discovered that most of these farmers refused to implement practices reported to have resulted in poor yields for some particular crops by other farmers, especially from families, friends and neighbours.

The study also indicated that 20.3% female respondents and 16.0 male respondents cited difficulty in implementing some of the CSA practices as their major constraints to increased adoption. They complained about row planting requiring much time during measurements as major constraints, others cited difficulty in weeding on intercropped farm, difficulty in sourcing and preparing mulch and lack of access to credit facilities to purchase improved seedlings as well as the problem of having to always spray improved seedlings as their major constraints.

It was noticed that more women faced more challenges than men in all five CSA practices. The reason for this is primarily because of some level of discrimination by women in the society. Although the demonstration programme factored in some of these challenges, however, there still persist some level of discrimination as only 21.5% of women farmers as against 53.3% men had mobile phones from which they can received message about weather forecast and other vital information. Women are also disadvantaged when it comes to access to means of production (land, labour, credit facilities, etc); training and so on. Because of the additional burden of taking care of the household women are easily fatigued and might not be able to fully implement some of the practices (fig. 3.6).

3.7. RATING OF DIFFICULTIES WITH IMPLEMENTING CSA PRACTICES

This study indicated that mulching (32.9% women and 36% men) as the most strenuous CSA practice because of the associated difficulty in getting and preparing mulch. This was followed by intercropping (31.6% women and 25.3% men) and was said to be because of overcrowding, stunting in growth because of competition for nutrients, difficulty in weeding and one crop outgrowing the other. This was followed by row planting (10.1% women and 20.0% men) due to sourcing for material to carry out measurement and the actual measurement as well as too much spacing required that limits the quantity of crops that can be planted on a farm. Other such as minimum tillage and improved varieties were not seen as strenuous by both women and men farmers (fig. 3.7).

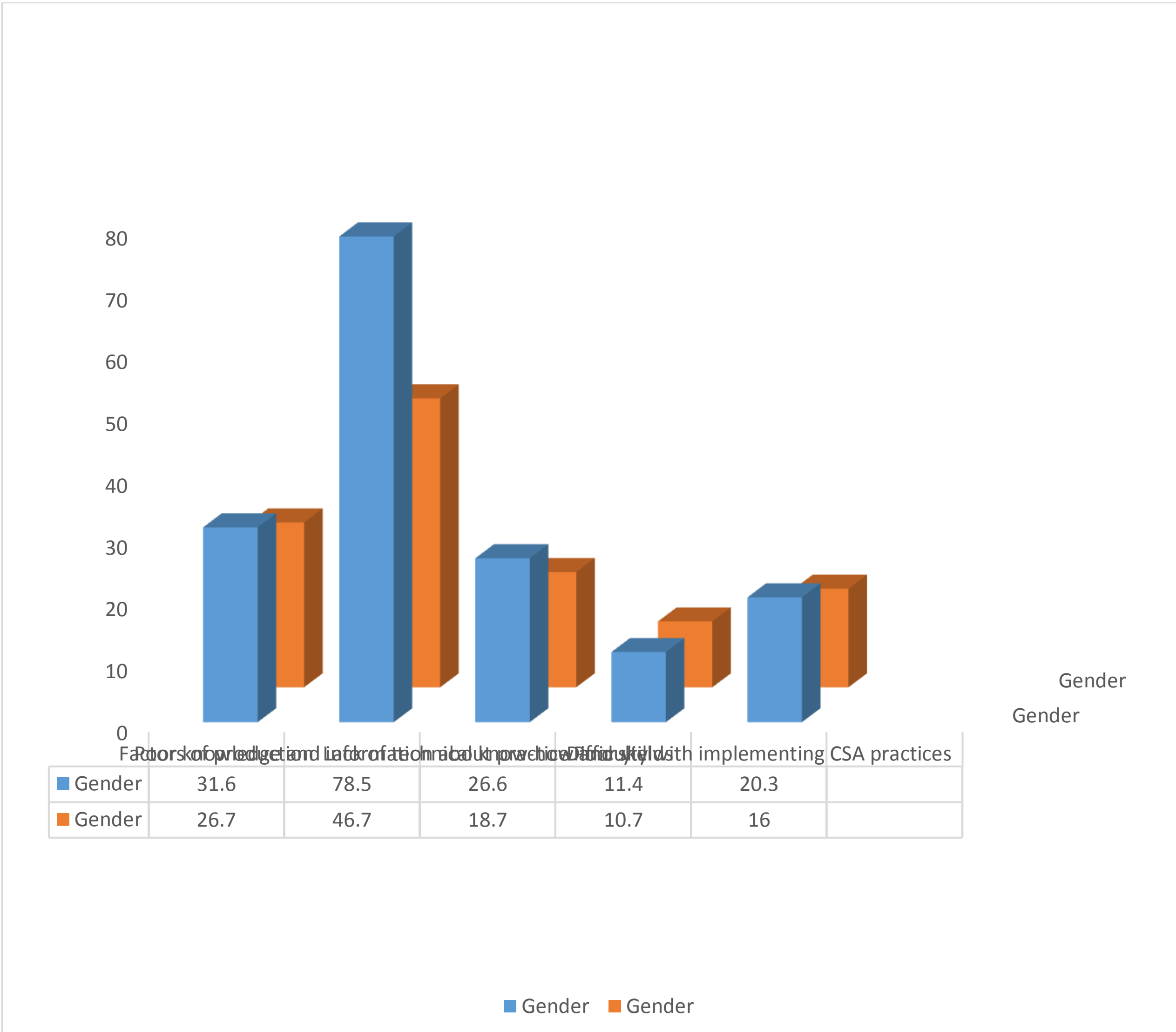


Fig. 3-6: Rating of barrier/challenges to implementing CSA practices

According to the study the 10.1% female respondents and 20.0% male respondents who found row planting as the most strenuous CSA practice said so because of the associated stress in carrying out accurate measurements on a straight line, spacing of each crop and having to plant just one crop on the farm as being difficult. 31.6% female respondents and 25.3% male respondents find intercropping as the most strenuous activities because of difficulties with weeding and planting on same field at different times. 1.3% female respondents and 2.7% male respondents cited improved varieties as the most strenuous activity because of having to spray and monitor the crops at regular intervals. 6.3% female respondents and 2.7% male respondents cited minimum tillage as the most strenuous CSA practice, though, according to them much tilling is not required which makes it labour and time saving; however, because of the need to frequently check the crops during the early stages to ensure it germinates is strenuous. 32.9% female respondents and 36.0% male respondents cited mulching as the most strenuous activity because of the difficulty associated with gathering and preparing mulches.

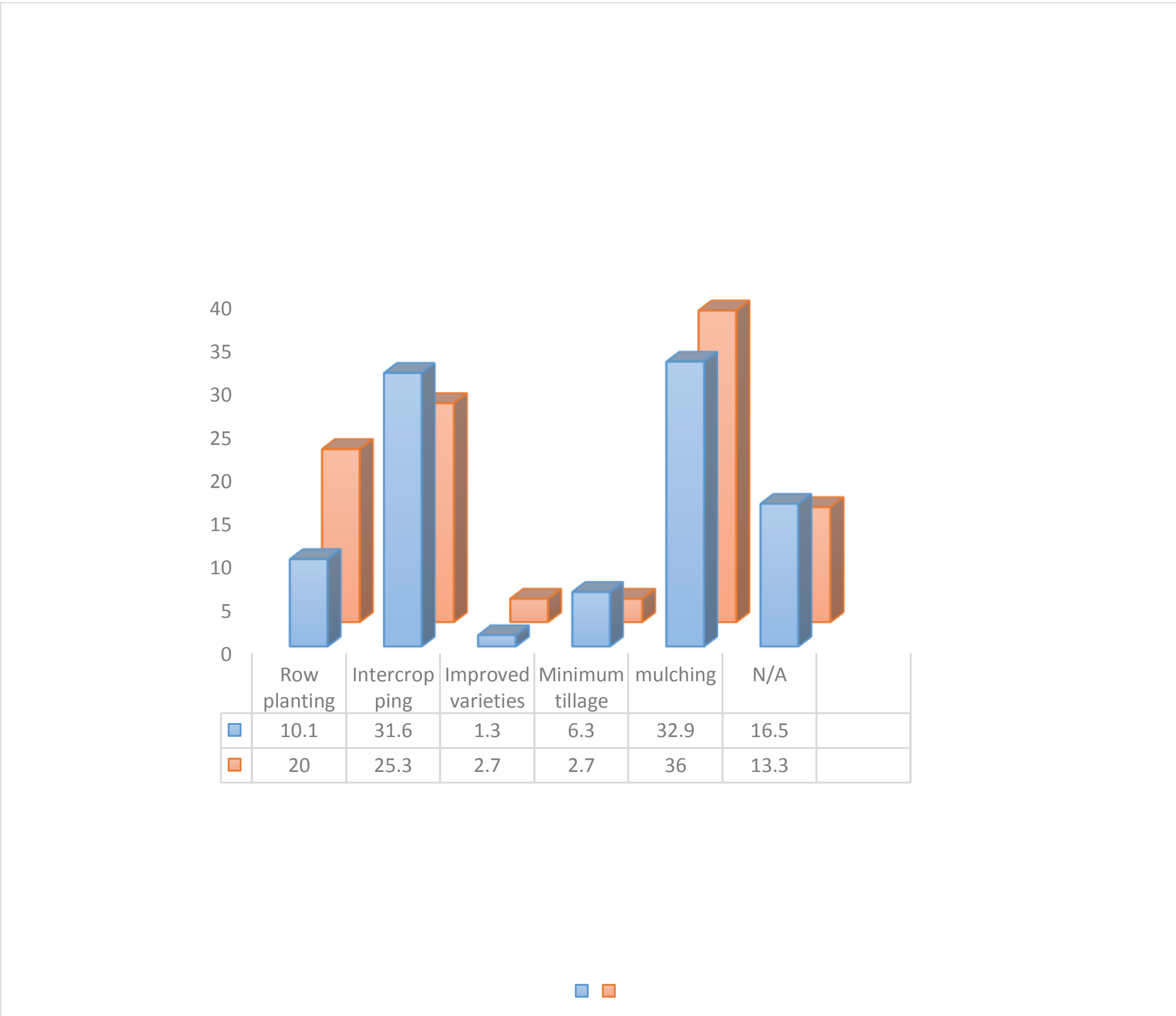


Fig. 3-7: Rating of difficulties in implementing CSA practice

3.8. INCREASE IN INCOME FROM SELECTED CSA PRACTICES

From the figure 3.8 below, out of the 73 households that implement row planting, 72 had increase income while 1 household had no increase. Of the 74 households implementing intercropping, 42 had increased income while 32 had no increase. Of the 27 households implementing improved variety, 21 had increased income while 6 had no increase. All 3 households implementing minimum tillage had increased income. Also, all 14 households implementing mulching had increased income.

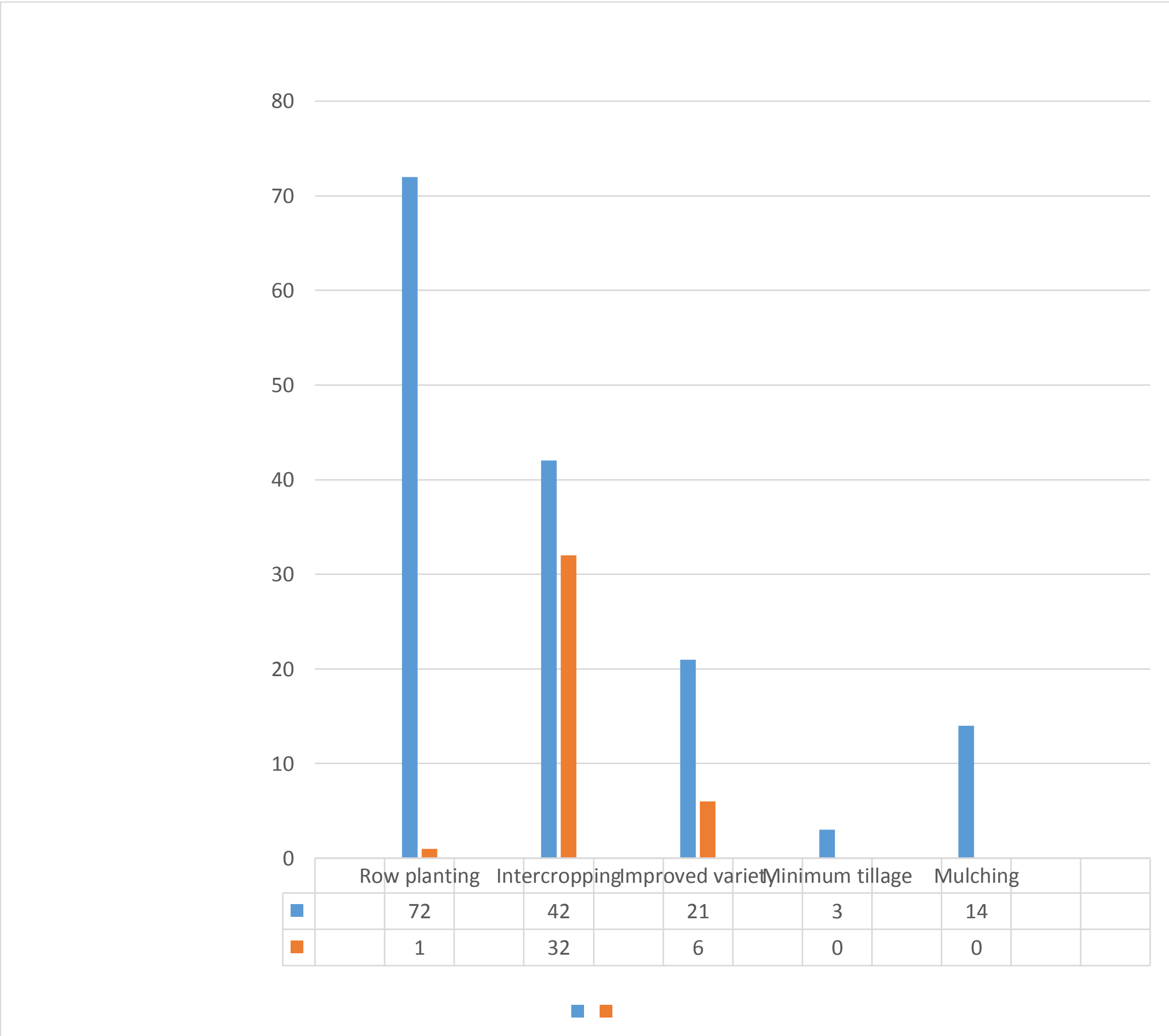


Fig. 3.8: Data on income increase from selected CSA practices

3.9. HOUSEHOLD FOOD AVAILABILITY

Climate smart agriculture was introduced in Nwoya District by 2015 and has been implemented by smallholder farmers since then and this has actually helped to improve the living condition of majority of the farmers. The report of the survey carried out on food availability and security indicated that about 66% of the households surveyed always had some form of food available while 34% (see Fig 3.9) of the households were sometimes without food. This means well over half of the population in Nwoya District have some food to eat on a daily basis which shows that CSA can help to ensure food security.

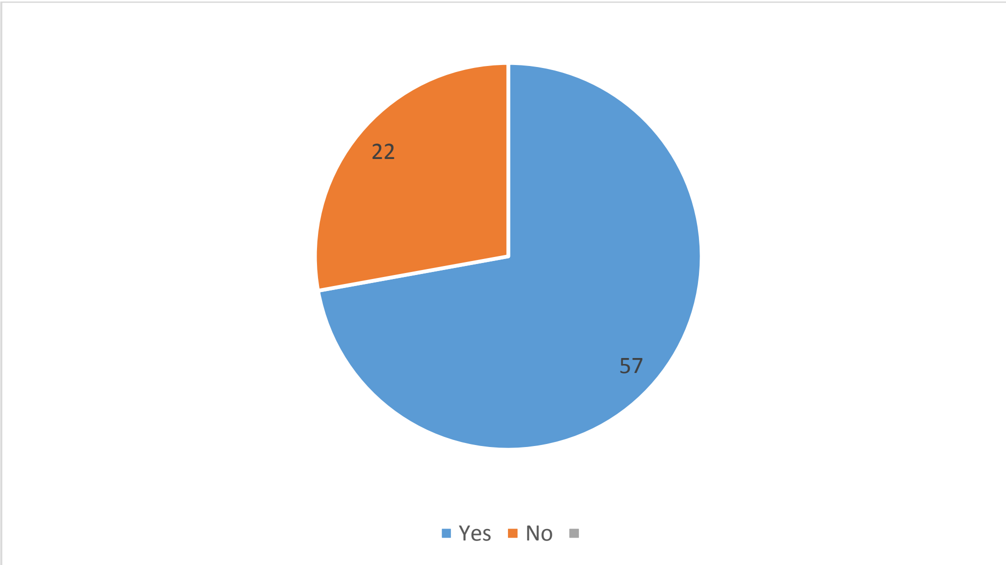


Fig.3.9: Data of households who expressed worry because of lack of food in the last four weeks

From figure 3.9 revealed the number of households who have expressed worry over lack of food in the household. It can be observed that about 30% of these households have had situations where they worried not just because there was no food, but also because there was no means of getting food according to responses from focus group discussions.

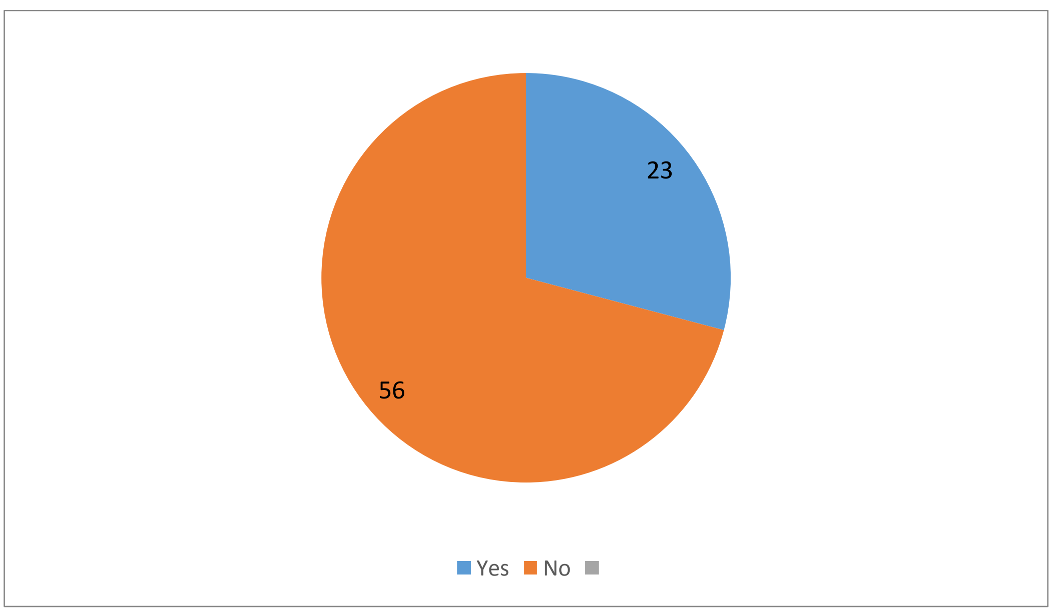


Fig. 3.10: Showing data of respondents without food of any kind due to lack of resources in the last four weeks

Figure 3.10 showed that about 30% of respondents who suffered food shortages in the last four weeks because of lack of resources. This confirms that even though farmers have recorded some increase in crop production an income generation, it still hasn't enabled the farmers to attain food security. This can be further attributed to unequal access to resources and means of production which could help increase crop yield.

From figure 3.11 it can be observed that majority of the households eats at least a meal per day. It was observed that almost all the farmers had at least cassava which is a staple and could be eaten the whole day as a meal. However, 13 of the 79 households surveyed had days and nights without any food to eat. It was observed that some smallholder farmers are still doing well in terms of farm size, access to farm inputs and other resources necessary for increase in yields than others. These 13 farming were observed to be more deficient in terms of resources needed to increase productivity and yield.

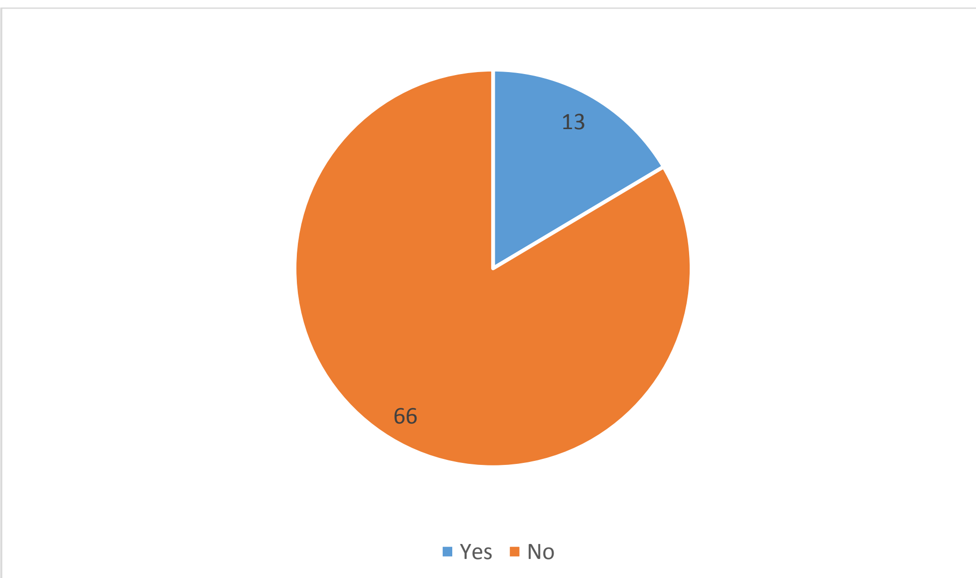


Fig. 3.11: Data of households without any food to eat in a whole day and night in the last four weeks

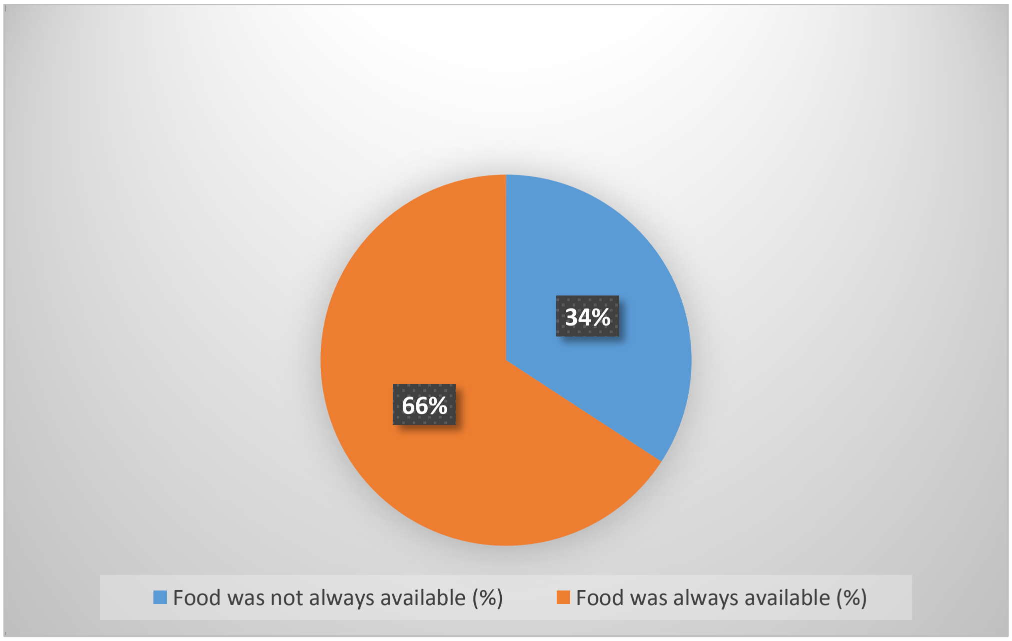


Fig. 3-12: Determination of household food availability

Results from the study indicated that about 66% of households were food insecure as they had experienced periods where there was no kind of food to eat in a whole day due to lack of resources, while in some cases they had to eat just ones in the day. Findings from in-depth interviews and focus group discussions indicated that these trends were common among smallholder farmers with the least farm size that constituted the majority of smallholder farmers and who often had limited crops to plant as well as lack access to farm inputs. Only about 34% of households have at least one kind of food available in the month of August.

3.10. NUTRITION SECURITY

Results indicated that majority of the farmers were still not nutrition secured. It was gathered that most farming households were unable to buy food from the market to meet their nutritional needs as they only rely on foods harvested from their farms for most of their diets, yet were not able to plant all crops that are necessary to meet their basic nutritional needs. Only 19% of households were nutrition secured and had access to diverse kinds of food when needed while the remaining 81% relied absolutely on their farm for food and had limited variety based on the season and what was planted in the farm (see Fig.3.13).

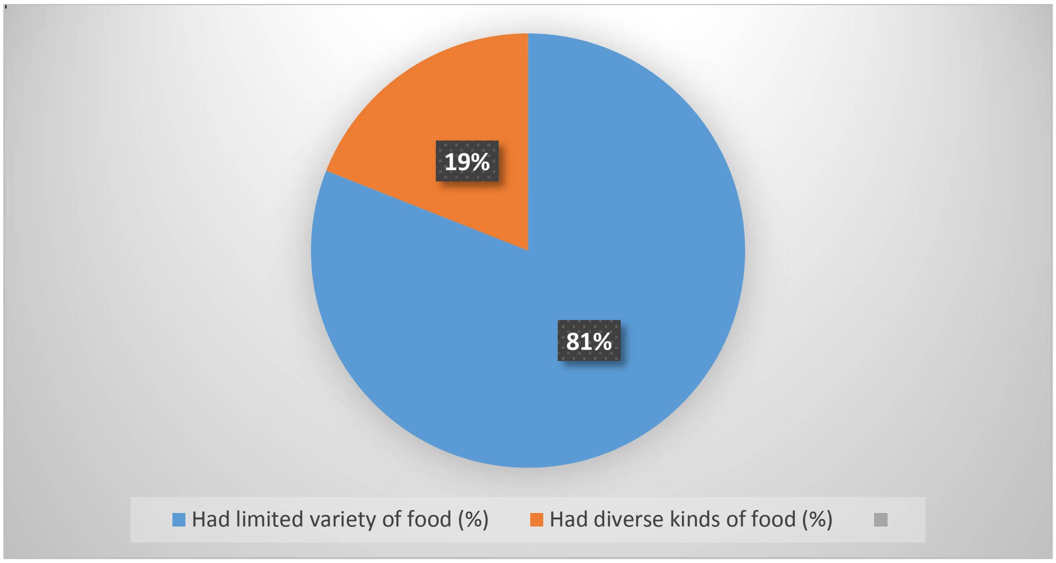


Fig. 3-13: Determination of household food diversity

Reports from all respondents indicated that about 81% of farming households had limited varieties of food and so lacked food diversity while 19% respondents had diverse kinds of foods. It was discovered that most farmers only ate what they planted on their farms which were mostly seasonal since they did not have the means to buy other foods from the market. Only few respondents had sufficient money to buy other food items needed for consumption from the market. However, when looking at nutrition security, none of the households could be said to be nutrition secured. This is because nutrition looks at both having not just diverse kinds of food available, but eating the right quantity, quality at the right time; as well as having access to clean drinking water, good sanitation and preparing meals in hygienic environment. Figure 3.13 shows the household dietary diversity survey

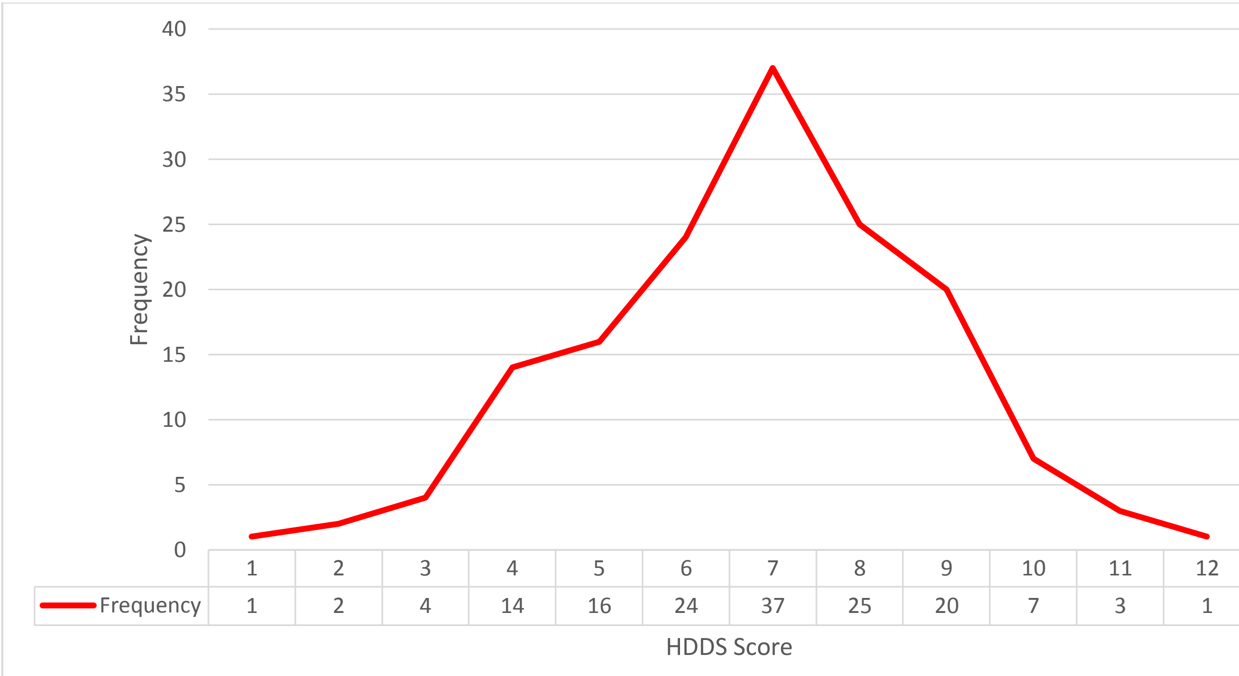


Fig. 3-14: Determination of household dietary diversity

From the HDDS score it is clear that the month with the highest number of households with diverse diets available in a given year was July. The first and fourth quarters (January to March and October to December) were usually periods with lowest food diversity in a given household. The trend increases from January to a maximum at July and started decreasing after July till when the lowest point of food diversity in December. Periods with the most food diversity can be seen to be between the months of June to September. This clearly shows that farmers do not have diverse kinds of food available all year round and are therefore not nutrition secured.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Smallholder farmers in Nwoya District have been aware and are implementing climate smart agriculture since 2014 when it was first introduced through training and demonstration as a way to increase adaptation and coping strategy with the ensuing impacts of climate change and variability. They are also keen to adopt new technologies and interventions that would transform their agricultural practices into a relatively more productive, higher-income earning, and low-carbon activity as well as to improve food and nutrition security.

All the respondents are implementing at least two (row planting and intercropping) of the five CSA practices introduced to them. Row planting and intercroppping are the two most widely adopted practices (row planting, intercropping, improved variety, minimum tillage and mulching) because of their believe that row planting and intercropping are easy, cost effective and can double yields and income.

Adoption of CSA technologies and practices among women and men farmers was observed to be almost at the same rate for all practices (especially row planting, intercropping and improved variety), with more women adopting intercropping than men because of the added benefits of growing two or more crops on the same plot and having varieties for home consumption. However, the rate of adoption between men and women farmers in terms of minimum tillage and mulching differs considerably when compared to others. This is because women find these practices to be more strenuous, thus requiring more time and energy which most women do not have because of other activities like taking care of family and other domestic chores that they are involved in.

In terms of constraints and barriers to adoption more women had one or more constraints to adopting a particular CSA practice than their men counterparts. Constraints such as factors of production, poor knowledge and information about practice, lack of technical know-how and skill, as well as poor yields from previous planting season affects women more than men. Part of the reasons are due to women lack of access to resources and inputs. Since about 61% of men and less than one-quarter (23.6%) of women have access to cell phones, it will be an uphill task to get first-hand information by the over 70% women and 38% men who do not have access to cell phones, thus relying of friends, neighbours and family members for information. Lack of access to trainings hinder women from acquiring sufficient knowledge and skill needed to increase productivity. Also, more women tend to drop a practice if it did not bring about noticeable increase in yields and might remain unwilling to try such practice further.

CSA adoption is still relatively low and among smallholder farmers, notwithstanding the tremendous benefits associated with CSA. This is because for CSA to be fully practiced by a farmer, it must comprise sound land management practices, soil and water conservation, residual management as well as growing crops that can withstand adverse weather conditions. The low adoption rate was due to lack of sound technical know-how due to training deficiencies, poor extension services, poor information about the benefits of CSA practices, poor access to resources and inputs, lack of access to markets and credit facilities, and inadequate knowledge about various CSA practices.

Even the few adopted practices are not properly implemented by the farmers. This is due to infrequent weather information and wrong implementation pattern. Their knowledge on CSA practices and implementation is still low in the area and most farmers implement selected practices more with their traditional knowledge. This is mostly evident in their method of implementing row planting and intercropping. Huge losses are recorded due to improper implementation of these two practices and have not impacted positively on food and nutrition security.

4.2 RECOMMENDATIONS

As a solution to upscaling CSA practices in Uganda there is need to critically analyze the challenges farmers face as documented here to have better understanding of necessary steps to take that will benefit farmers and facilitate adoption. These include government, donor agencies and research and agricultural institutions working together to address the challenges farmers face when trying to adopt a particular CSA practice and proffer localized solutions that are indigenous to the people. Such localized solutions should take environmental issues, gender related factors, socioeconomic and climate change factors into account. Developing appropriate and feasible climate smart and climate resilient agricultural practices will enable farmers readily adopt more CSA practices which will lead to increase in productivity, yields, income generation as well as food and nutrition security.

Farmers' awareness of the benefits of CSA practices as well as trainings on land management, soil and water conservation, residual management and growing resistant seedlings, as well as appropriate CSA practice implementation should be a top priority of development partners. Land should not just be assumed to be fertile in one area or region alone even though it appears to be so. Practices that encourage sustainable land management which includes soil, nutrient and water management to reduce degradation, as well as rehabilitation of agricultural land should be part of the training modules for farmers.

There should be continuous education, trainings and information on CSA practices through adequate extension services. The unique challenges that men and women farmers face should be taken into consideration when designing programmes to further enhance CSA uptake among smallholder farmers. interventions must be gender smart and gender considerations should be taken into account from the period of conception of such programmes till full development with focus on how these programmes will be fully accepted by the farmers for ease of adoption. This can only be achieved if the farmers fully participate in the entire process. Regular extension services should be provided to educate and give farmers current relevant information and priority should be given to women groups who have less access to information and other means of agricultural productivity.

Farmers' perception and socio-economic factors are important in developing a feasible and appropriate practice. Availability of new technologies alone is not a sufficient condition to bring about the change. Effective institutions and sustained policy support to bring the technologies within the reach of farmers, taking into considerations their perceptions and socio- economic factors play a significant role in the adoption of technology and practices. Equally important is the need to periodically appraise CSA technologies and practices with a view to understanding which practices or technologies are working as expected and which one are not. This should include action steps to correct or bridge identified gaps that will further increase the success and adoption of good practices and technologies.

Thus there is need to consider capacity building and ensure that farmers fully understand the climate problems and can apply climate information effectively through education, trainings and strong monitoring to identify success and failures. Strong and enabling local environment should be established to support strong and innovative rural institutions that will increase the uptake of good practices. This will need to consider appropriate and sustainable technologies to increase production while taking into consideration local and traditional knowledge. The extension services need to address and incorporate smallholder farmers to make use of the local knowledge and essential experience for improving agricultural production, land productivity and improve income.

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APPENDIX

APPENDIX A: QUESTIONNAIRE

CENTRE FOR SUSTAINABLE DEVELOPMENT

TOPIC:

GENDER ANALYSIS OF THE DISPARITIES IN THE LEVEL OF ADOPTION OF CLIMATE SMART AGRICULTURAL PRACTICES AND THE IMPACT ON HOUSEHOLD NUTRITION OF SMALLHOLDER FARMERS IN UGANDA

Dear Respondent,

I am Pollyn Gabriel Abinye from University of Ibadan Centre for Sustainable Development, Nigeria. I am currently carrying out MSc. Sustainable Development Practice research on gender analysis of the disparities in the level of adoption of climate smart agricultural practices and the impact on household nutrition of smallholder farmers in Uganda. In line with this, I seek your opinion on climate smart agricultural practices and household food and nutrition security. The questions are well structured and it is my hope that you will give response as per the questions posed. The answers you will give remain confidential and will not be revealed to a third party.

Thank you for your response.

RESEARCH QUESTIONNAIRE FOR RESPONDENTS

Demographic and social characteristics. Initial registration in Nwoya

The demographic survey should be conducted with one adult member of the household (either male or female)

ID of the household _____ Name of the village ______________________

A. Characteristics of the household head and spouse

1. Name of the respondent ____
2. What is your position in the household?
   1= Household head
   2 = Spouse of household
   3 = Son/Daughter
   4 = Other family members
   5 = Non family member
3. Sex of the respondent:

1= Woman
2 = Man

4. Education level of the respondent:
   0= no education
   1=Primary
   2= Secondary
   3=Superior
5. Do you own a cellphone?
   1=Yes (Go to question 6)
   2=No (Go to question 7)
6. Number of cellphone of the respondent: ____
7. Is there any other adult in the household who contributes in decision-making?
8. 1=Yes (Go to question 10)
9. 2=No (Go to section B)
10. Name of the other decision maker: ____
11. Sex of the other decision maker:
    1= Woman,
    2 = Man
12. Education level of other decision maker:
    0= no education
    1=Primary
    2= Secondary
    3=Superior
13. Does the other decision maker own a cellphone?
    1=Yes (Go to question 14)
    2=No (Go to section 2)
14. Number of the cellphone of the other decision maker:
    ____

B. Characteristics of the household

15. Number of persons in this household: __________
16. Number of persons below 5 years: ___________
17. Number of persons above 60 years: ___________

Questions for monitoring gender indicators for CSA practices. Questionnaire for the survey by cellphone

This questions should be answered by both the principal woman and the principal man of the household if possible. In others words, to the household head and the spouse registered. In case of female headed households just the principal woman can be interview and, in male headed households the principal man. For a polygamous household, ensure the responses relate to one specific spouse.

ID of the household: _____________

18. Sex of the respondent:
    1= Woman
    2= Man

Round 1. Initial questions

1. Is row planting currently used or implemented on your farm?
   1= Yes
   2= No
2. Is intercropping currently used or implemented on your farm?
   1= Yes
   2= No
3. Are improved varieties currently used on your farm?
   1= Yes
   2= No
4. Is minimum tillage currently used or implemented on your farm?
   1= Yes
   2= No
5. Is mulching currently used or implemented on your farm?
   1= Yes
   2= No
6. Tick all practices you are implementing together (on the same plot)
   - ☐ Row planting
   - ☐ Intercropping
   - ☐ Improved varieties
   - ☐ Minimum tillage
   - ☐ Mulching

Round 1.1. (For those implementing row planting)

1. Why did you implement row planting?
   1=Because of a climate change event
   2=New market opportunities
   3=Crop diseases/pests
   4=Land available
   5=Labor available
   6=Learnt from a local NGO/organization
2. How did you learn to implement row planting?
   1=Family or neighbor
   2=From demonstration by CIAT/local partner
   3=Existing knowledge or tradition
3. Have you recommended row planting to another farmer?
   1= Yes
   2= No
4. Row planting has increased the household income?
   1=Yes (Go to question 5)
   2=No (Got to question 6)

5. Have you participated in the decision on how to use the income?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
6. Has row planting increased crop yield?
   1=Yes (Go to question 7)
   2=No [Skip to question 8]
7. Have you participated in the decision on how to use the yield, for example decided how much to sell and how much to use for consumption?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
8. Has row planting allowed better control of pest and/or diseases in the crop?
   1=Yes
   2=No
9. Do you personally perform any activity related with the implementation of row planting?
   1=Yes
   2=No
10. Do you participate in the decision to implement row planting?
    1=Yes (Go to question 11)
    2=No (Go to question 12)
11. How do you participate in the decision of implementing row planting?
    1=You decide alone.
    2=You decide jointly with your spouse or partner.
    3=You decide jointly with others
12. Why did you not participate in the decision making?
    1= I do not have enough information of the practice
    2=They did not ask my opinion
    3=I trust others to make the decision
    4=I am not interested
13. Since you started row planting, do you personally spend more or less time in agricultural production activities?
    1=More
    2=Less
    3=The same

Round 1.2. (For those not implementing row planting)

1. Have you heard about row planting?
   1=Yes (Go to question 2 of round 1.2)
   2=No (Go to question 4 of round 1.2)
2. Do you know how to implement row planting?
   1=Yes
   2=No
3. Has any member of your household used row planting on your farm in the last 5 years?

1=Yes
2=No

4. Would you like to receive further information about row planting?
   1=Yes
   2=No

Round 1.3. (For those not implementing row planting, but implemented it in the past).

1. Why did your household stop practicing row planting?
   1=It took too much work or time.
   2=It cost too much.
   3=It did not generate enough income.
   4=You did not have the enough resources to do it properly.
   5=The decision maker decided to do another practice
2. Did you participate in the decision to stop using row planting?
   1= Yes
   2=No
3. Would you like to implement row planting again?
   1= Yes (Go to next question)
   2=No (Finish round)
4. What do you need to implement row planting again?
   1=Training
   2=Information
   3=More time
   4=More money / Access credit

Round 2.1. (For those implementing intercropping)

1. Why did you implement intercropping?
   1=Because of a climate change event
   2=New market opportunities
   3=Crop diseases/pests
   4=Land available
   5=Labor available
   6=Learnt from a local NGO/organization
2. How did you learn to implement intercropping?
   1=Family or neighbor
   2= From demonstration by CIAT/local partner
   3=Existing knowledge or tradition
3. Have you recommended intercropping to another farmer?
   1= Yes
   2= No
4. Has intercropping increased the household income?
   1=Yes (Go to question 5)
   2=No (Got to question 6)
5. Have you participated in the decision on how to use the income?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse

3=Yes, you decided with others
4=No, you have not decided

6. Has intercropping increased crop yield?
   1=Yes (Go to question 7)
   2=No (Go to question 8)
7. Have you participated in the decision of how to use the yield, for example decided how much to sell and how much to use for consumption?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
8. Has intercropping allowed better control of pest and/or diseases in the crop?
   1=Yes
   2=No
9. Do you personally perform any activities related with the implementation of intercropping?
   1=Yes
   2=No
10. Do you participate in the decision to implement intercropping?
    1=Yes (Go to question 11)
    2=No (Go to question 12)
11. How do you participate in the decision of implementing intercropping?
    1=You decide alone.
    2=You decide jointly with your spouse or partner.
    3=You decide jointly with others
12. Why did you not participate in the decision making?
    1= I do not have enough information of the practice
    2=They did not ask my opinion
    3=I trust others to make the decision
    4=I am not interested
13. Since you started intercropping, do you personally spend more or less time in agricultural production activities?
    1=More
    2=Less
    3=The same

Round 2.2. (For those not implementing intercropping)

1. Have you heard about intercropping?
   1=Yes (Go to question 2 of round 2.2)
   2=No (Go to question 4 of round 2.2)
2. Do you know how to implement intercropping?
   1=Yes
   2=No
3. Has any member of your household used intercropping on your farm in the last 5 years?
   1=Yes
   2=No
4. Would you like to receive further information about intercropping?

1=Yes
2=No

Round 2.3. (For those not implementing intercropping, but implemented it in the past).

1. Why did your household stop implementing intercropping?
   1=It took too much work or time.
   2=It cost too much.
   3=It did not generate enough income.
   4=You did not have the enough resources to do it properly.
   5=The decision maker decided to do another practice
2. Did you participate in the decision to stop using intercropping?
   1= Yes
   2=No
3. Would you like to implement intercropping again?
   1= Yes (Go to next question)
   2=No (Finish round)
4. What do you need to implement intercropping again?
   1=Training
   2=Information
   3=More time
   4=More money

Round 3.1. (For those implementing improved varieties)

1. Why did you implement improved varieties?
   1=Because of a climate change event
   2=New market opportunities
   3=Crop diseases/pests
   4=Land available
   5=Labor available
   6=Learnt from a local NGO/organization
2. How did you learn to implement improved varieties?
   1=Family or neighbor
   2=From demonstration by CIAT/local partner
   3=Existing knowledge or tradition
3. Have you recommended improved varieties to another farmer?
   1= Yes
   2= No
4. Has improved varieties increased the household income?
   1=Yes (Go to question 5)
   2=No (Got to question 6)
5. Have you participated in the decision on how to use the income?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
6. Has improved varieties increased crop yield?
   1=Yes (Go to question 7)

2=No

7. Have you participated in the decision of how to use the yield, for example decided how much to sell and how much to use for consumption?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
8. Has improved varieties allowed better control of pest and/or diseases in the crop?
   1=Yes
   2=No
9. Do you personally perform any activities related with the implementation of improved varieties?
   1=Yes
   2=No
10. Do you participate in the decision to implement improved varieties?
    1=Yes (Go to question 11)
    2=No (Go to question 12)
11. How do you participate in the decision of implementing improved varieties?
    1=You decide alone.
    2=You decide jointly with your spouse or partner.
    3=You decide jointly with others
12. Why did you not participate in the decision making?
    1= I do not have enough information of the practice
    2=They did not ask my opinion
    3=I trust others to make the decision
    4=I am not interested
13. Since you started improved varieties, do you personally spend more or less time in agricultural production activities?
    1=More
    2=Less
    3=The same

Round 3.2. (For those not implementing improved varieties)

1. Have you heard about improved varieties?
   1=Yes (Go to question 2 of round 3.2)
   2=No (Go to question 4 of round 3.2)
2. Do you know how to implement improved varieties?
   1=Yes
   2=No
3. Has any member of your household used improved varieties on your farm in the last 5 years?
   1=Yes
   2=No
4. Would you like to receive further information about improved varieties?
   1=Yes
   2=No

Round 3.3. (For those not implementing improved varieties, but implemented it in the past).

1. Why did your household stop implemeting improved varieties?
   1=It took too much work or time.
   2=It cost too much.
   3=It did not generate enough income.
   4=You did not have the enough resources to do it properly.
   5=The decision maker decided to do another practice
2. Did you participate in the decision to stop implementing improved varieties?
   1= Yes
   2=No
3. Would you like to implement improved varieties again?
   1= Yes (Go to next question)
   2=No (Finish round)
4. What do you need to implement improved varieties again?
   1=Training
   2=Information
   3=More time
   4=More money

Round 4.1. (For those implementing minimum tillage)

1. Why did you implement minimum tillage?
   1=Because of a climate change event
   2=New market opportunities
   3=Crop diseases/pests
   4=Land available
   5=Labor available
   6=Learnt from a local NGO/organization
2. How did you learn to implement minimum tillage?
   1=Family or neighbor
   2=From demonstration by CIAT/local partner
   3=Existing knowledge or tradition
3. Have you recommended minimum tillage to another farmer?
   1= Yes
   2= No
4. Has minimum tillage increased the household income?
   1=Yes (Go to question 5)
   2=No (Got to question 6)
5. Have you participated in the decision on how to use the income?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
6. Has minimum tillage increased crop yield?
   1=Yes (Go to question 7)
   2=No
7. Have you participated in the decision of how to use the yield, for example decided how much to sell and how much to use for consumption?

1=Yes, you decided alone
2=Yes, you decided with your spouse
3=Yes, you decided with others
4=No, you have not decided

8. Has minimum tillage allowed better control of pest and/or diseases in the crop?
   1=Yes
   2=No
9. Do you personally perform any activities related with the implementation of minimum tillage?
   1=Yes
   2=No
10. Do you participate in the decision to implement minimum tillage?
    1=Yes (Go to question 11)
    2=No (Go to question 12)
11. How do you participate in the decision of implementing minimum tillage?
    1=You decide alone.
    2=You decide jointly with your spouse or partner.
    3=You decide jointly with others
12. Why did you not participate in the decision making?
    1= I do not have enough information of the practice
    2=They did not ask my opinion
    3=I trust others to make the decision
    4=I am not interested
13. Since you started minimum tillage, do you personally spend more or less time in agricultural production activities?
    1=More
    2=Less
    3=The same

Round 4.2. (For those not implementing minimum tillage)

1. Have you heard about minimum tillage?
   1=Yes (Go to question 2 of round 4.2)
   2=No (Go to question 4 of round 4.2)
2. Do you know how to implement minimum tillage?
   1=Yes
   2=No
3. Has any member of your household used minimum tillage on your farm in the last 5 years?
   1=Yes
   2=No
4. Would you like to receive further information about minimum tillage?
   1=Yes
   2=No

Round 4.3. (For those not implementing minimum tillage, but implemented it in the past).

1. Why did your household stop implementing minimum tillage?
   1=It took too much work or time.
   2=It cost too much.

3=It did not generate enough income.
4=You did not have the enough resources to do it properly.
5=The decision maker decided to do another practice

2. Did you participate in the decision to stop using minimum tillage?
   1= Yes
   2=No
3. Would you like to implement minimum tillage again?
   1= Yes (Go to next question)
   2=No (Finish round)
4. What do you need to implement minimum tillage again?
   1=Training
   2=Information
   3=More time
   4=More money

Round 5.1. (For those implementing mulching)

1. Why did you implement mulching?
   1=Because of a climate change event
   2=New market opportunities
   3=Crop diseases/pests
   4=Land available
   5=Labor available
   6=Learnt from a local NGO/organization
2. How did you learn to implement mulching?
   1=Family or neighbor
   2=From demonstration by CIAT/local partner
   3=Existing knowledge or tradition
3. Have you recommended mulching to another farmer?
   1= Yes
   2= No
4. Has mulching increased the household income?
   1=Yes (Go to question 5)
   2=No (Got to question 6)
5. Have you participated in the decision of how to use the income?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided
6. Has mulching increased crop yield?
   1=Yes (Go to question 7)
   2=No
7. Have you participated in the decision of how to use the yield, for example decided how much to sell and how much to use for consumption?
   1=Yes, you decided alone
   2=Yes, you decided with your spouse
   3=Yes, you decided with others
   4=No, you have not decided

8. Mulching has allowed better control of pest and/or diseases in the crop?
   1=Yes
   2=No
9. Do you personally perform any activities related with the implementation of mulching?
   1=Yes
   2=No
10. Do you participate in the decision to implement mulching?
   1=Yes (Go to question 11)
   2=No (Go to question 12)
11. How do you participate in the decision to implementing mulching?
   1=You decide alone.
   2=You decide jointly with your spouse or partner.
   3=You decide jointly with others
12. Why did you not participate in the decision making?
   1= I do not have enough information of the practice
   2=They did not ask my opinion
   3=I trust others to make the decision
   4=I am not interested
13. Since you started mulching, do you personally spend more or less time in agricultural production activities?
   1=More
   2=Less
   3=The same

Round 5.2. (For those not implementing mulching)

1. Have you heard about mulching?
   1=Yes (Go to question 2 of round 5.2)
   2=No (Go to question 4 of round 5.2)
2. Do you know how to implement mulching?
   1=Yes
   2=No
3. Has any member of your household used mulching on your farm in the last 5 years?
   1=Yes
   2=No
4. Would you like to receive further information about mulching?
   1=Yes
   2=No

Round 5.3. (For those not implementing mulching, but implemented it in the past).

1. Why did your household stop implementing mulching?
   1=It took too much work or time.
   2=It cost too much.
   3=It did not generate enough income.
   4=You did not have the enough resources to do it properly.
   5=The decision maker decided to do another practice
2. Did you participate in the decision to stop using mulching?
   1= Yes

2=No

3. Would you like to implement mulching again?
   1= Yes (Go to next question)
   2=No (Finish round)
4. What do you need to implement mulching again?
   1=Training
   2=Information
   3=More time
   4=More money

Gender Disparity

1. Why have you not included other farm practices? This should be asked where some practices are not ticked.
2. Have these practices helped to reduce the workload on you?
   Yes
   No
3. Is there any of the farm practices mentioned that you find strenuous?
   Yes
   No
4. Which of the activities do you find most strenuous?
5. What other constraints do you face that if addressed can lead to increased productivity for you?
6. Do you have sufficient time to rest after each days' activity?
7. What other activity do you partake in aside farming?

Food Security and Nutrition:

Food Security

1. Did you worry that your household will not have enough food in the past four weeks?
   Yes
   No
2. Were you or any household member not able to eat the kinds of foods you prefer in the last four weeks because of lack of resources?
   Yes
   No
3. Did you or any household member have to eat a limited variety of foods in the last four weeks due to lack of resources?
   Yes
   No
4. Did you or any household member have to eat a limited variety of foods that you really do not want to eat in the last four weeks because of lack of resources to obtain other types of foods?
   Yes
   No
5. Did you or any household member have to eat a smaller meal than you felt you needed in the last four weeks because there was not enough food?
   Yes

No

6. Did you or any household member have to eat fewer meals in a day within the last four weeks because there was not enough food?
   Yes
   No
7. Was there ever no food of any kind to eat in your household because of lack of resources in the last four weeks?
   Yes
   No
8. Did you or any household member go to bed without food in the last four weeks because there was no food?
   Yes
   No
9. Did you or any household member go a whole day and night without eating anything in the last four weeks because there was no food?
   Yes
   No

Nutrition

Different Food Types Eaten in the Last Seven Days

Could you please tell me how many days in the last four weeks that your household has eaten the following foods?

S/No	Food Item	Very often	Often	Rarely	Not at all
1	Sorghum				
2	Maize				
3	Cassava				
4	Other cereals (millet, wheat)				
5	Pulses (legumes, groundnut, beans, sesame)				
6	Vegetables including wild vegetables and leaves				
7	Fruits including wild fruits				
8	Meat and poultry (including bush meat)				
9	Eggs				
10	Fish				
11	Milk and milk products				
12	Sugar, honey, sweets				
13	Oils and fat				
14	Rice				
15	Sweet potato				
16	Other root crops (yams, cocoa yams, etc)				

Key:

Very often = eaten at least thrice in a week

Often = eaten at least twice in a week

Rarely = eaten not more than ones in a week

Not all all = not eaten in the last four weeks