

Adoption of Soil Biodiversity Conservation Measures and Sustainable Agriculture Production in Wakisi and Nagojje Sub Counties, Buikwe District

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Abstract: Human beings are in economic conflict with soil biodiversity for a life struggle. The need for increased food production to match the demand for the ever increasing human population in Uganda has led to agriculture intensification. This however is associated with a high level of ecological disturbance by poor methods of farming that upset the balance of soil biodiversity, especially in Wakisi and Nagojje Sub Counties. A study of 60 households in Wakisi and Nagojje to determine factors affecting adoption of soil biodiversity conservation measures revealed that education and household size (number of active adults in the household) were statistically significant for the adoption rate. Results of the logistic regression model showed that education predisposes farmers to new knowledge and therefore enhances their potential to their adoption while big households are good indicators of labour supply which is vital in labour intensive technologies. Researchers therefore, recommended that farmers should be educated using practical methods to increase literacy about technologies, government should provide incentives to farmers and support organizations that have shown interest in the technologies and that, farmers should always be involved in the technology right from the development stage in order to capture their perceptions about new technologies.

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INTRODUCTION

Agriculture, Uganda's economic back bone is one of the major threats of biodiversity^[1]. Biodiversity, the

diversity of genes, organisms and ecosystems^[2] is diminishing attributed to change by human agricultural activities^[3]. Soil biodiversity which is the variability among living organisms in the soil-ranging from the

myriad of invisible microbes, bacteria and fungi to the more familiar macro-fauna such as earthworms and termites^[4-6] plays a key role in determining soil quality. It is fundamental for agricultural production and food security as well as environmental conservation which human wellbeing depends on^[7, 8]. Human survival is inextricably linked to the survival of numerous other species on which intact ecosystems depend^[7]. Therefore, man's war against biodiversity is inevitably war against himself.

Uganda's increasing human population has led to increased pressures on land for settlement and intensification of agriculture which has triggered overgrazing, deforestation and use of inappropriate farming practices^[9]. In Wakisi and Nagojje Sub Counties, high population pressure and high market demands for a variety of products from Kampala and Jinja has increased encroachment on marginal areas with poor farming practices. These in turn have resulted in general land degradation and soil erosion on the higher slopes. Extensive use of agro chemicals, especially, for horticultural crops has intensified pollution of the soil and water, thus, toxins are being introduced in the food chain and posing danger to health of consumers and other living organisms^[10].

Past and current agricultural practices in Wakisi and Nagojje Sub Counties such as charcoal burning, bush burning, mono-cropping, use of synthetic chemicals like herbicides continue to threaten soil biodiversity and even kill them if such chemicals are abused^[11]. Uganda loses up to 12% of her natural resources worth over \$500 million per year due to natural resource degradation. Consequently, forest cover and biodiversity are decreasing due to pressure exerted by the increasing demand for forest products and agricultural expansion^[12].

The growing concern about the soil productivity and wider environmental implications of conventional agricultural practices has prompted governments and farmers to explore alternative production methods that maintain soil structure and productivity^[13]. One of the most significant factors influencing a new ideas or technologies is the degree to which they tailor an innovation to meet the needs and interests of a community^[14]. It is generally agreed that the natural physical environment, together with social, economic and institutional factors is responsible for the Soil Biodiversity Conservation (SBDC) decision behavior both in the developed and developing world. However, the specific socio-economic and institutional variables affecting decision behavior may differ between developed and developing countries, different sites within the same region and country as well as between different farm households and plots^[15].

Research on the adoption of soil biodiversity conservation measures began in the 1950's^[16]. The magnitude and direction of influence of different variables vary between different types of conservation practices^[15].

Farmer's behavior toward adoption is influenced by social and economic factors. Gender of the respondents, training in soil conservation and per capita income are found to be positively and significantly influential in the adoption of SBC measures^[9].

Adoption of soil biodiversity conservation at the farm level is associated with lower labour and farm power inputs, more stable yields and improved soil nutrient exchange capacity. Crop production profitability under SBC tends to increase over time relative to conventional agriculture^[17].

The personal and household attributes include factors like education, age, family size, gender among others^[18, 9]. In general, education has been observed to have positive effects on conservation. However, education might offer alternative livelihood opportunities in off-farm activities thereby increasing the opportunity cost of labour and competing with labour use for agricultural production. The attitudes and behaviour of farmers towards certain technologies tend to influence the discrete choice decisions of their neighbours^[19].

Financial returns might not be the only or even the major, consideration that provides incentive to subsistence farmers for investment in soil biodiversity conservation. Socio-economic and institutional factors operating from the level of the national economy through the individual farm household all play a strong role in shaping farmer's incentives for SBDC investment^[15]. Farmers with higher per capita income seem more likely to invest in SBDC than low income farmers. Larger farms and group membership inhibit the adoption of SBDC.

Institutional factors such as land ownership, membership in farmer's organizations and technical assistance have been found in some studies to influence on-farm adoption of conservation practices. Limited resource farmers whose survival depends on the piece of land they operate are more likely to adopt SBDC measures, since, their livelihood depends on the productivity of the land because of limited alternative employment opportunities in the area^[18].

Many of the problems in conserving biodiversity are associated with the lack of recognition of the importance it plays in agricultural production. Although, many farmers and the farming community have a profound knowledge of their agriculture, training and education is often needed to highlight the roles of the soil biota at various levels of the ecosystem/landscape (Sustainable crop production intensification, n.d.).

Capacity building for the farmers on appropriate soil biodiversity conservation practices/technologies could

enhance farmer's knowledge and skills for adoption^[11]. Farmers should get educated or trained through campaign or adult education to encourage them to realize full potential of good agricultural practices and the majority to be brought on board if adoption of conservation technologies is to be realized^[20]. The researcher's specific objectives to this study were:

- To determine agricultural practices that conserve soil biodiversity
- To establish the advantages of conserving soil biodiversity in Wakisi and Nagojje Sub Counties
- To determine factors responsible for the low adoption of soil biodiversity conservation measures
- To establish ways of enhancing adoption of soil biodiversity conservation in Wakisi and Nagojje sub counties

Description of study area: Wakisi and Nagojje are two of the 8 Sub Counties of the then Buikwe County in Mukono District but now a District of herself. It is surrounded by Lake Victoria and farming is the major economic activity, especially to small holder farmers. It is about 12 km East of Kampala city in Central Buganda region^[10]. Wakisi and Nagojje were purposely chosen because the Makerere University Conservation and sustainable project of below ground biodiversity had been establishing a number of demonstration sites about conservation measures and funded this research.

MATERIALS AND METHODS

This was a case study conducted through a descriptive survey research design. It was concerned with determining the adoption rate of soil biodiversity conservation measures in Wakisi and Nagojje Sub Counties in Buikwe County Mukono District.

Descriptive approach was used in order to gather information about the present existing condition and utilize observations in the study. The research study partially based its findings through both quantitative research methods in order to permit a flexible and iterative approach. It also employed qualitative research method in order to find and build theories that would explain the relationship of one variable with another variable through qualitative elements in research. A total of 60 respondents were randomly determined using a probabilistic sampling design specifically simple random sampling.

Researchers used both administered questionnaire, interviews, observations and documentary analysis as the main tools for collecting data. They were concerned with views, perceptions, opinions, attitudes and behaviours of the respondents^[21]. Questionnaires were administered by the interviewer, especially where concepts were difficult

to interpret by farmer respondents. The data obtained through a questionnaire was similar to that obtained through an interview because of the open ended questions.

Descriptive statistics for the survey items was summarized in the text and reported in tabular and chart forms. Frequencies analyses were conducted to identify valid percent for responses to all the questions in the survey. To determine factors that could enhance adoption of soil biodiversity conservation measures, a binary logit model was run using Statistical Package for Social Sciences (SPSS) Version 21.0.

RESULTS AND DISCUSSION

Socio-demographic characteristics of respondents: The socio-demographic characteristics of respondents were tabulated from questionnaires describing bio-data, education background and occupation of respondents in the study area (Table 1).

Table 1: Socio-demographic characteristics of respondents (N = 60)

Characteristics	Frequencies	Percentage
Age		
10-19	2	3.3
20-29	13	21.7
30-39	20	33.3
40-49	11	18.3
50-59	8	13.3
≥60	6	10.0
Gender		
Male	29	48.3
Female	31	51.7
Marital status		
Single	2	3.3
Married	48	80.0
Divorced	5	8.3
Widowed	5	8.3
Dependants		
1-5	18	30.0
6-10	37	61.7
11-15	5	8.3
Highest education level		
Primary	32	53.3
O' level	15	25.0
A' level	0	0.0
College/University	5	8.3
Never to school	8	13.3
Land ownership		
Customary	26	43.3
Land lease	17	28.3
Free hold	17	28.3
Land size (ha)		
1-5	52	86.7
6-10	5	8.3
≥11	3	5.0
Farming experience (Years)		
1-9	13	21.7
10-19	20	33.3
20-29	12	20.0
30-39	9	15.0
≥40	6	10.0
Household leader		
Male spouse	49	81.7
Female spouse	11	18.3

About 58.4% of household respondents were between 10-39 years which suggests that farming has become an occupation for the youth. As seen in Table 1 above, 48.3% were male while 51% were female which is a fifty-fifty situation that indicates an equal understanding between man and women in decision making.

More than a half of respondents were female (51.7%) indicating gender sensitivity and farming dominance by female. Over $\frac{3}{4}$ of respondents were married (80%) and had over six dependants (70.1%) (Table 1). This indicates that the most of households acquire responsibility through marriage that stimulate them to join farming to produce food to survive their household members and generate income to help them fulfill their needs and responsibilities^[22]. Also, these large households are able to provide labour required to implement the technology^[29].

Over three quarters of household respondents (86.6%) attended formal education. This shows that they had the capacity to attend seminars intended to educate and sensitize them about new technologies and implement them effectively.

Over $\frac{3}{4}$ of farmers had land ranging from 1-5 hectares indicating such a small land that cannot be allowed to rest under fallow. This land is obtained through customary ownership (43.3%), land lease (28.3%) and free hold (28.3%). This shows that culture plays an important role in the agriculture sector. This is manifested by the majority of household respondents whose occupation was farming with over 10 year's experience (78.3%) (Table 1). This further indicates that most farmers have got the ability to decide and adapt new agricultural technologies that seem to help them.

Soil biodiversity conservation measures: About 66.7% of farmers didn't have any idea about soil biodiversity. 33.3% knew some soil living organisms like termites, rodents but not the subject matter. Over a half percent of respondent farmers did not even know the advantages of soil living organisms (53.3%) and their disadvantages (51.7%). This alone signifies that these farmers have no knowledge about soil biodiversity.

All farm activities take place on land. Any fault in soil properties interfere with crop production. Farmers were asked whether they were facing problems with their soils. 41.7% faced the problem of crop pests and diseases, 36.7% soil infertility, 3.3% soil erosion, 5% poor or low yields and 13.3% reported other ideas (Table 2).

These problems were due to poor farming practices and poor management or ignorance of farmers about better farming practices.

The farmers were further interrogated about whether their soils were fertile. Less than a half (33.3%) had fertile soils while 66.7% had infertile soils (Table 2).

Table 2: Farmer's adoption indicators in Nagojje and Wakisi Sub County (N = 60)

Variables/Indicators	Frequencies	Age (%)
What decomposes plant and animal remains		
Soil living organisms	14	23.3
Rainfall and temperature	16	26.7
All the above	10	16.7
Not aware	20	33.3
Do you know soil living organisms		
Yes	20	33.3
No	40	66.7
What would you do after knowing organisms involved in rotting process		
Conserve them	26	43.3
Adapt the advice	26	43.3
Neglect them	8	13.3
Is your soil fertile		
Yes	21	35.0
No	39	65.0
Indicators of soil fertility		
Stunted growth	17	28.3
Yellowing of leaves	11	18.3
Crop vigor	15	25.0
Yielding capacity	11	18.3
Not aware	6	10.0
What soil related problems do you face		
Pests and diseases	25	41.7
Soil infertility	22	36.7
Soil erosion	2	3.3
Poor yields	3	5.0
Other ideas	8	13.3

Farmers determine their soil fertility by stunted growth of their crops (28.3%), yellowing of leaves (18.3%), high crop vigour (25%), yielding capacity (18.3%) and not aware (10%). This justifies the fact that the farmers with their experience know symptoms of soil fertility by using morphological characteristics of crops but not soil properties analysis. They do not know that presence of soil living organisms like termites, etc. is a sign of fertility.

Table 3 showed that 43.3% apply fertilizer into their fields to boost fertility and 56.7% do not apply claiming that artificial fertilizers are expensive to buy and spoil their soils. It was also noted that 65% have livestock from which 40% apply fertilizer in form of animal dung. Less than $\frac{1}{4}$ (15%) out those who have livestock just heap and abandon it and yet, they claim that their soils are infertile.

About 81.7% carry out crop rotation but do not know better sequences to follow. Most of them do not include fallow periods. 43.3% mulch their land using grass specie. They mulch specific crops including tomatoes and banana but not all crops. Most of them say that not every crop is mulched.

About 15% carry out composting meaning that 85% are ignorant about the technology. 76.7% plant their crops early in order to benefit from early rains. 65% carry out intercropping. Majority of them carry out this practice because of little land while some of them want to get a variety of crops but not for its purpose.

Table 3: Farming practices carried out by farmers in Nagojje and Wakisi Sub Counties (N = 60)

Practice	Yes/No	Frequencies	Age (%)	Reason	Frequencies	Age (%)
Land fallowing	Yes	30	50.0	Soil fertility	25	41.7
	No	30	50.0	Little land	23	38.3
				Not aware	12	20.0
Improved fallowing	Yes	3	5.0	Soil fertility	3	5.0
	No	57	95.0	Not aware	57	95.0
Fertilizer application	Yes	26	43.3	Soil fertility	5	8.3
	No	34	56.7	Expensive	25	41.7
				Spoil soil	2	3.3
Crop rotation	Yes	49	81.7	Not aware	28	46.7
	No	11	18.3	Soil fertility	11	18.3
				Proper crop growth	14	23.3
Mulching	Yes	26	43.3	Food variety	11	18.3
	No	34	56.7	Avoid diseases	8	13.3
				Not aware	16	26.7
Composting	Yes	10	16.7	Soil fertility	1	1.7
	No	50	83.3	Soil moisture	5	8.3
				Prevent weeds	3	6.7
Early planting	Yes	46	76.7	Avoid rots	6	10.0
	No	14	23.3	Conserve biodiversity	1	1.7
				Not aware	43	71.7
Intercropping	Yes	39	65.0	Make manure	5	8.3
	No	21	35.0	Not aware	49	81.7
				Early rains	25	41.7
Mixed cropping	Yes	19	31.7	Early harvests	10	16.7
	No	41	68.3	High yields	6	10.0
				Time	3	6.7
Relay cropping	Yes	33	55.0	Not aware	15	25.0
	No	27	45.0	Soil fertility	1	1.7
				Proper crop growth	3	5.0
Multistory cropping.	Yes	10	16.7	Food variety	2	3.3
	No	50	83.3	Little land	18	30.0
				Not aware	36	60.0
Cover cropping	Yes	8	13.3	Soil fertility	6	10.0
	No	52	86.7	Proper crop growth	1	1.7
				Food variety	1	1.7
Nurse cropping	Yes	3	5.0	Not aware	52	86.7
	No	57	95.0	Quick harvest	7	11.7
				Not aware	53	88.3
Shifting cultivation	Yes	17	28.3	Food variety	3	6.7
	No	43	71.7	Provide shade	2	3.3
				Not aware	54	90.0
	Yes	8	13.3	Avoid soil erosion	2	3.3
	No	52	86.7	Not aware	58	96.7
				Support weak crops	1	1.7
	Yes	3	5.0	Not aware	59	98.3
	No	57	95.0	Enough land	7	11.7
				Soil fertility	3	6.7
	Yes	17	28.3	Not aware	49	81.7
	No	43	71.7			

A few farmers practice mixed cropping, relay farming, multistory cropping, cover cropping, nurse cropping and shifting cultivation (28.3, 23.3, 16.7, 11.6, 1.7 and 28.3%, respectively). Most of those who do not practice claim that they are totally ignorant about the above technologies but would adopt if they are sensitized.

Almost all farmers faced the problem of pests and diseases (98.3%), however, the biggest percentage leave these pests and some of them use pesticides but claim that pesticides are expensive to buy. Most farmers use hand hoe to open up their fields and during weeding which is good but during the process of cultivation, they disturb soil so much. This signifies that they do not know

conservation tillage measures as shown by a 51%. After harvesting, 40% leave crop trash in the field while some even burn them. This therefore, indicates that farmers have little knowledge about soil biodiversity conservation measures.

About 31.7% had access to soil biodiversity information while 68.3% didn't have. About 30% could get it from NGO's, 1.7% from agricultural officers while 68.3% had no idea. Over a half of farmers (70%) never got advice on soil biodiversity, though they have ever heard about organizations that promote soil biodiversity. This shows that farmers lack the drive force to attend meetings and therefore do not have enough information (knowledge) about soil biodiversity conservation.

Table 4: Farmer's activities in Nagojje and Wakisi Sub County (N = 60)

Variables/Methods used	Frequencies	Age (%)
Pest management		
Spray wit pest pesticides	17	28.3
Rotate crops	2	3.3
Remove affected plants	6	10.0
Use urine and ash	10	16.7
Leave them	25	41.7
Weeding		
Hand hoeing	57	95.0
Use herbicides	2	3.3
Leave them	1	1.7
Land preparation		
Hand hoeing	58	96.7
Use herbicides	2	3.3
Conservation tillage		
Plant in holes	7	11.7
Contour ridging	1	1.7
Terracing	1	1.7
Not aware	51	85.0
Crop debris after harvesting		
Burn it in field	9	15.0
Incorporate in soil	8	13.3
Feed to livestock	2	3.3
Use them as mulches		0.0
Fuel	6	10.0
Leave them	11	18.3
Heap them	24	40.0

However, those who attended and implemented said that there was a significant increase in yields of high quality and that their soils remained good (Table 4).

Socio-economic factors affecting soil biodiversity conservation: Most male spouses were decision makers composing 81.7%. This is because men are taken to be head of households culturally. About 76.7% produce enough food and very little for sale. This shows that most farmers are subsistent and a few are semi-commercial. According to results, 48.3% are subsistent, 48.3% are semi-commercial while 3.3% are commercial (Table 5).

About 71.7% of farmers use household labour, 20% use both household and hired while 8.3% hire labour. This reflects that most farmers are incapable of hiring labour and therefore produce many children to get the source of labour.

About 20% face the problem of size of land, 16.7% do not have enough capital, 36.7% do not have both land and capital, 5% face the problem of inadequate labour while about 21.7% have other factors that limit their farm production such as entrepreneur, market, etc., this indicates that land is a major resource that should be taken care of.

Most farmers get their income from agricultural crops like cassava (25%), coffee (18.3%), banana (10%), sugarcane (8.3%), sweet potatoes (1.7%) and others (30%) while 6.7% get most of their income from other enterprise like business, fishing, etc., this indicates that farming is a major activity in Nagojje and Wakisi sub counties.

Table 5: Socio-economic factors affecting Soil biodiversity conservation in Nagojje and Wakisi Sub County (N = 60)

Variables/Methods	Frequencies	Age (%)
Decision maker		
Male	49	81.700
Female	11	18.300
What scale of farmer are you		
Commercial	3	5.000
Subsistent	29	48.300
Semi commercial	28	46.700
Source of labour		
Household members	43	71.700
Hired	17	28.300
Source of income		
Agriculture	56	93.300
Other business	4	6.700
Factors of production		
Land	12	20.000
Capital	10	16.700
Labour	3	5.000
All the above	22	36.700
Others	13	21.700
Marketing problems		
Low prices	30	50.000
Few market centers	9	15.000
Poor transport	1	1.700
All the above	13	21.700
Other ideas	7	11.700
Household expenditures		
School fees	21	35.000
Home basic needs	33	55.000
Farm operations	3	5.000
Others	3	5.000
How do you spend on farm inputs		
Seeds	34	56.700
Fertilizers	7	11.700
Labour	5	8.300
Agrichemicals	14	23.300
Sources of agriculture credit		
Commercial Banks	28	46.700
Farmer groups	5	8.300
Not aware	27	45.000
What is your strategy to conserve soil biodiversity		
Education	49	81.700
Demonstration farms	3	5.000
No Idea	8	13.333

It was also deduced that apart from farming (93.3%), these farmers get their side income from business, 5% from fishing, 13.3% provide labour to other farmers, 13.3% from other sources while 45% do not have the source of side income. This implies that capital limits farm production to greater extent.

When marketing farm produce, 50% face the problem of low prices offered to their produce, 15% have few market centers, 1.7% poor transport facilities, 21.7% both low prices and poor transport facilities while about 11.7% reported other problems. This showed that farmers have not commercialized agriculture because of poor marketing facilities.

It was also analyzed that 35% spend their income by paying school fees for their children, 55% buy food and

Table 6: Logistic model estimates

Models	B	SE	Wald	df	Sig.	Exp(B)
Step 1 (a):						
Education level	0.213	0.093	5.268	1	0.022	1.237
Members of household	0.236	0.128	3.399	1	0.065	1.266
Age	0.000	0.036	0.000	1	0.995	1.000
Land size	-0.011	0.065	0.026	1	0.871	0.990
Period in farming	-0.003	0.038	0.008	1	0.927	0.997
Constant	-3.632	1.460	6.192	1	0.013	0.026

A variable's entered on step 1; Education level; Members of household; Age, Land size; Period in Farming

home utensils (including; soap, fuel, medicine, etc.), 5% farm operations while 5% spend their income in other ways. On farm inputs, 56.7% buy seeds, 11.7% buy fertilizer, 8.3% pay labour, 23.3% buy pesticides and herbicides. This is a clear indication that most farmers carry out the activity to sustain the livelihood of their families, hence, subsistent.

About 46.7% could get credit from commercial banks to boost their farm production. About 8.3% could get credit from farmer groups while 45% did not know any source of credit. About 81.7% suggested that education would give them conservation knowledge about the technology. Education would sensitize them about advantages of conserving soil living organisms. About 5% suggested that use of demonstration farms could encourage them to adopt the technology, since, farmers believe by seeing, 13.3% had no ideas.

Logistic model estimates: A binary logit model of logistic regression model in statistical package of social sciences was used to determine factors that could enhance adoption of soil biodiversity conservation measures. Results in Table 6 show that education and members of household were statistically significant at 10% level.

Education was significant because it gives knowledge to farmers about soil biodiversity that will help them to understand the advantages of conserving it, make proper decisions, adapt the technology and help them to search or be able to make research about the same technology and other technologies. Therefore, education is said to be a predisposing factor for adoption of soil biodiversity conservation measures. It is widely known that literate farmers are more disposed to understand new ideas and concepts provided by extension workers and other informants.

Members of household were also significant because it is the major source of labour input in the agriculture sector, especially in Uganda.

CONCLUSION

It is important to remember that agriculture largely depend on biodiversity. Also important is that the population of Uganda is multiplying day by day there by creating pressure on agricultural soils for settlement, etc., leading to environmental degradation and hence global

warming. Results showed that most farmers in Wakisi and Nagojje sub counties did not have sufficient information about soil biodiversity conservation. Most of farmers suggested that exposure to education would predispose them to adopt the technology. Results from logistic regression model indicated that education and members in household had significant impacts on adoption of soil biodiversity. As evident, education increases literacy among farmers about a new technology and this enhances their ability to adopt new technologies. It is therefore crucial to present concerns on our environment. Soil biodiversity conservation is the foundation for total environmental conservation.

RECOMMENDATIONS

The efforts of the government of Uganda for bringing education for all and initiating the Functional Adult Literacy programme (FAL) should be applauded however these efforts should come up with clear policies and other approaches to educate elders and farmers in particular such that these farmers can easily perceive, adapt, implement and are able to make research on agricultural related disciplines hence agricultural modernization.

Relevant to the above, the government should at all time support organizations like BGBD-Makerere University and other institutions concerned about developmental technologies most especially in agriculture sector.

Proper teaching methods should always be chosen most especially. for a new technology. For example, demonstration plots, field visits seem to provide practical experience to most farmers and can quickly enhance adoption. This is because most farmers believe by seeing such that they can be able to determine whether a new technology will work. This education will provide sufficient information about conservation measures and the advantages/benefits of conserving soil biodiversity.

Provision of incentives to farmers can indeed show considerable influence on adoption. These incentives can be inform of subsidized prices of agricultural inputs, direct payments to enable farmers be facilitated with the requirements of a technology, etc.

These incentives polish up farmer's perception of the technology, since, they think that they are given at a free or fair cost.

Making farmers as part of the Programme is also important. Once farmers are involved in the technology, they can present their concerns about it and possible solutions are developed together. Under this point, one should note that farmers can only adopt a technology that suit or fulfills their needs a reason why it is important to involve them right from the development stage.

Members in household were significant because they are the main source of labour at subsistence level. There should be the introduction of simple tools and equipments to cater for this gap. These tools should be given to farmers at subsidized prices.

However, further research should be done about the relationship between termites and maize production and their management.

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