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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.

Key words: Adoption, soil, biodiversity, conservation, sustainable, households, agriculture.
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INTRODUCTION

Agriculture, Uganda's economic back bone is one of the major threats of biodiversity (Sileshi, Akinnifesi, Ajayi, Mng, & Nyoka, 2016). Biodiversity, the diversity of genes, organisms and ecosystems (Blouin et al., 2013) is diminishing attributed to change by human agricultural activities (Hole, 2005). 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 (Atina, 2007; Montanarella, 2016; Symondson, 2012) 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 (Isenring, 2010; Thrupp, 2000). Human survival is inextricably linked to the survival of numerous other species on which intact ecosystems depend (Isenring, 2010). 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 (Temu, 2013). 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(UBOS, 2009).

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 (Violet, Gachene, Ngugi, Thuranira, & Baaru, 2002). 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 (Nkonya, 2002).

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 (Bradshaw, Knowler, & Bradshaw, 2007). 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 (Kammer, 2014). 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 (Bekele, 2003).

Research on the adoption of soil biodiversity conservation measures began in the 1950s (Wauters, 2013). The magnitude and direction of influence of different variables vary between different types of conservation practices (Bekele, 2003).

Farmers' 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 (Temu, 2013).

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 (FAO, 2013)

The personal and household attributes include factors like education, age, family size, gender among others (Bayard, Jolly, & Shannon, n.d.; Nkonya, 2002; Temu, 2013). 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 (Nkegbe, 2011).

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 farmers' incentives for SBDC investment (Bekele, 2003). 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 farmers' 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 (Bayard et al., n.d.).

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 farmers' knowledge and skills for adoption (Violet et al., 2002). 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 (Melese, 2013).

The researchers' 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 (UBOS, 2009). 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 (Creswell, 2003). 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 (Atomica, 2010). A total of 60 respondents were randomly determined using a probabilistic sampling design specifically simple random sampling (Strydom and De Vos, 1998).

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 (Otieno, Buyinza, Kapiyo, & Oindo, 2013). 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 (Burns & Grove 1993).

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 DISCUSSIONS

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).

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.

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

Characteristics	Frequency	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
Gender		
Male	29	48.3
Female	31	51.7
Marital status		
Single	2	3.3
Married	48	80
Divorced	5	8.3
Widowed	5	8.3
Dependants		
1-5	18	30
6-10	37	61.7
11-15	5	8.3
Highest education level		
Primary	32	53.3
O' level	15	25
A' level	0	0
College/ University	5	8.3
Never to school	8	13.3

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Land Ownership		
Customary	26	43.3
Land lease	17	28.3
Free hold	17	28.3
Land size		
1-5 hectare	52	86.7
6-10 hectare	5	8.3
≥ 11 hectare	3	5
Farming experience		
1-9 years	13	21.7
10-19 years	20	33.3
20-29 years	12	20
30-39 years	9	15
≥ 40 years	6	10
Household leader		
Male spouse	49	81.7
Female spouse	11	18.3

More than a half of respondents were female (51.7%) indicating gender sensitivity and farming dominance by female. Over ¾ 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 (Mal et al., 2009). Also, these large households are able to provide labour required to implement the technology (Nkegbe, 2011).

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 ¾ 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 years' experience (78.3%) (Table 1). This further indicates that most famers 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 and13.3% 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: Farmers' adoption indicators in Nagojje and Wakisi Sub County (N=60)

Variables	Indicators	Freq.	%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
	No	39	65
Indicators of soil fertility			
	Stunted growth	17	28.3
	Yellowing of leaves	11	18.3
	Crop vigor	15	25
	Yielding capacity	11	18.3
	Not aware	6	10
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
	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 viguor (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: Farming practices carried out by farmers in Nagojje and Wakisi Sub Counties (N= 60)

Practice	Yes/No	Freq.	%age	Reason	Freq.	%age
Land fallowing	Yes	30	50	Soil fertility	25	41.7
	No	30	50	Little land	23	38.3
				Not aware	12	20
Improved fallowing	Yes	3	5	Soil fertility	3	5
	No	57	95	Not aware	57	95
Fertilizer application	Yes	26	43.3	Soil fertility	5	8.3
	No	34	56.7	Expensive	25	41.7
				Spoil soil	2	3.3
				Not aware	28	46.7
Crop rotation	Yes	49	81.7	Soil fertility	11	18.3
	No	11	18.3	Proper crop growth	14	23.3
				Food variety	11	18.3
				Avoid diseases	8	13.3
				Not aware	16	26.7
Mulching	Yes	26	43.3	Soil fertility	1	1.7
	No	34	56.7	Soil moisture	5	8.3
				Prevent weeds	³	6.7
				Avoid rots	6	10
				Conserve biodiversity	1	1.7
				Not aware	43	71.7
Composting	Yes	10	16.7	Make manure	5	8.3
	No	50	83.3	Not aware	49	81.7
Early planting	Yes	46	76.7	Early rains	25	41.7
	No	14	23.3	Early harvests	10	16.7
				High yields	6	10
				Time	³	6.7
				Not aware	15	25
Intercropping	Yes	39	65	Soil fertility	1	1.7
	No	21	35	Proper crop growth	3	5
				Food variety	2	3.3

				Little land	18	30
				Not aware	36	60
Mixed cropping	Yes	19	31.7	Soil fertility	6	10
	No	41	68.3	Proper crop growth	1	1.7
				Food variety	1	1.7
				Not aware	52	86.7
Relay cropping	Yes	33	55	Quick harvest	7	11.7
	No	27	45	Not aware	53	88.3
Multistory cropping.	Yes	10	16.7	Food variety	³	6.7
	No	50	83.3	Provide shade	2	3.3
				Not aware	54	90
Cover cropping	Yes	8	13.3	Avoid soil erosion	2	3.3
	No	52	86.7	Not aware	58	96.7
Nurse cropping	Yes	3	5	Support weak crops	1	1.7
	No	57	95	Not aware	59	98.3
Shifting cultivation	Yes	17	28.3	Enough land	7	11.7
	No	43	71.7	Soil fertility	³	6.7
				Not aware	49	81.7

Table 3 above 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 ¼ (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.

Fifteen percent 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 car you this practice because of little land while some of them want to get a variety of crops but not for its purpose.

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% and28.3% 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.

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

Variables	Method used	Freq.	%age
Pest management			
	Spray wit pest pesticides	17	28.3
	Rotate crops	2	3.3

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	Remove affected plants	6	10
	Use urine and ash	10	16.7
	Leave them	25	41.7
Weeding			
	Hand hoeing	57	95
	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
Crop debris after harvesting			
	Burn it in field	9	15
	Incorporate in soil	8	13.3
	Feed to livestock	2	3.3
	Use them as mulches		0
	Fuel	6	10
	Leave them	11	18.3
	Heap them	24	40

About 31.7% had access to soil biodiversity information while 68.3% didn't have. 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. However those who attended and implemented said that there was a significant increase in yields of high quality and that their soils remained good.

Socio- economic factors affecting soil biodiversity conservation

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

Variables	Methods	Freq.	%age
Decision maker			
	Male	49	81.7
	Female	11	18.3
What scale of farmer are you			
	Commercial	3	5
	Subsistent	29	48.3
	Semi commercial	28	46.7
Source of labour			
	Household members	43	71.7
	Hired	17	28.3
Source of income			
	Agriculture	56	93.3
	Other business	4	6.7
Factors of production			
	Land	12	20
	Capital	10	16.7
	Labour	3	5
	All the above	22	36.7
	Others	13	21.7
Marketing problems			
	Low prices	30	50
	Few market centers	9	15
	Poor transport	1	1.7
	All the above	13	21.7
	Other ideas	7	11.7
Household expenditures			
	School fees	21	35
	Home basic needs	33	55
	Farm operations	3	5
	Others	3	5
How do you spend on farm inputs			
	Seeds	34	56.7
	Fertilizers	7	11.7
	Labour	5	8.3
	Agrichemicals	14	23.3
Sources of agriculture credit			
	Commercial Banks	28	46.7
	Farmer groups	5	8.3
	Not aware	27	45
What is your strategy to conserve soil biodiversity			
	Education	49	81.7
	Demonstration farms	3	5
	No Idea	8	13.333

Most male spouses were decision makers composing 81.7%. This is because men are taken to be head of households culturally. 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.

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.

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 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. 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. 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 below show that education and members of household were statistically significant at 10% level.

Table 6: Logistic model estimates

		B	S.E.	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	0.036	0	1	0.995	1
	Land size	-0.011	0.065	0.026	1	0.871	0.99
	Period in farming	-0.003	0.038	0.008	1	0.927	0.997

Constant	-3.632	1.46	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

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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