TARGETING PRIORITIES FOR RESEARCH TO IMPROVE AGRICULTURAL PRODUCTIVITY AND HOUSEHOLD LIVELIHOOD IN BUKEDI SUBZONE

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Correct citation

Gidoi, R., Owoyesigire, B., Eneku, G., Wasukira, A., and L. Owere. 2015. Targeting priorities for research to improve agricultural productivity and household livelihoods in Bukedi subzone. Available online at: http://www.buginyanyazardi.org/

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About Buginyanya ZARDI

Buginyanya Zonal Agricultural Research and Development Institute (BugiZARDI) is one of the National Agricultural Research Organization (NARO) Institutes. BugiZARDI's main office is situated in Masira Sub county, Bulambuli district. BugiZARDI's mandate is to conduct agricultural research for development (R4D) in the Uganda's south eastern agro-ecological zone (U'SEAEZ). This comprises twenty four districts divided into three sub zones of Mt Elgon (districts), Busoga (districts) and Bukedi (districts). In fulfilling her mandate, BugiZARDI functions through developing technologies for improved food security and economic gains; promoting technologies and knowledge to support scaling up/out of improved agricultural production in U'SEAEZ. In addition through building partnerships and linkages for development and promotion of agricultural Research products; Producing and availing to uptake pathways basic/foundation "seed" (planting/stocking materials) of key commodities in the zone and develop capacity, both human and infrastructure to support Research and Development in U'SEAEZ.

Abstract

Bukedi sub zone is one of the agro ecological areas within Uganda's south eastern agro ecological zone (U'SEAEZ). A farming systems and livelihoods analysis study was conducted in the six districts of Budaka, Busia, Butaleja, Kibuku, Pallisa and Tororo**.** The purpose of the study was to generate an updated information and knowledge on the emerging farming systems and livelihoods of the people in the sub zone and develop an adjusted research agenda that responds to the current demands of clients in Bukedi sub zone. A Participatory and inclusive process involving research scientists, district technical teams, local government leaders and development partners was used to select the study sites and to develop a roadmap for collecting and collating data for the study. Two sub counties were selected from every district each constituting either wet or dry farming systems.. Pre-testing was conducted in Naboa Parish of Budaka district with 30 respondents. Enumerators were recruited and trained to collect data. FGD's and key informant interviews were also conducted in each survey site to obtain expert view and information on various aspects of farming systems and livelihood options. 20% of the respondents were female because the study targeted male headed households Most of the respondents were in the 38 -47 age group indicating majority of the respondents are productive youth in Bukedi. Busia district (25%) had the highest fraction of elderly > 58 and Budaka (11.4%) the least. Mahabile *et al*., (2005) highlights that age of the household head measures accumulated farming experience and social standing in rural communities. The study found out that the main constraint in the marketing system across the six districts was low market prices (20.8%) and lack of market information (15.6%). Challenges limiting crop production in Bukedi sub zone are Weeds, Pests and diseases were the most cited challenges hindering crop production. Respondents also acknowledged drought/floods, lack of labour, lack of inputs and low prices among others. Results showed that livestock production faces a number of challenges which included diseases, poor breeds, lack of veterinary services and lack of grazing land. Decline of agricultural productivity in Uganda could be as a result of little use of modern inputs, yet about 30% of Ugandan soils are categorized as being of low productivity. The low level of modern input use is due to lack of an efficient distribution system that would ensure timely availability of inputs at reasonable prices. There is need to carry out studies on productivity efficiency and input use to determine product-input combination and product-product mix to increase productivity. The research needs identified from the study include studies on return to

factors of production of key enterprises, determining cost-effective production systems adaptable by farmers, proper assessment of weather pattern relative to these zones , understanding why farmers have failed to control *Striga hermonthica* despite the existing interventions. The opportunities that exist in the sub zone are availability of development partners for example Action AID Uganda, World Vision, Multi-stake holder Innovation platforms for key priority commodities such as cassava and rice have been established to improve marketing service delivery and enabling policies. Sustainable land management (SLM) techniques/technologies that are ready for scaling up in the appropriate farming systems like terracing to control soil erosion .It was recommended that Research should be intensified in the area of identifying well adapted, high yielding varieties of crops within the sub zone of sustainable farming systems approach to boost productivity and livelihoods of small holder farmers. There is need to carry out studies on productivity efficiency and input use to determine product-input combination and product-product mix to increase productivity and to establish the major constraints limiting on-farm production and determine cost-effective production systems adaptable by farmers.

Table of contents

List of tables

List of figures

CHAPTER ONE

1.1 Introduction

In Uganda, agriculture employs about 75% of the 15 million labor force with 68% of them being youth of 15 - 34yrs (World Bank, 2013). Agricultural sector accounts for 20.9% of the Gross Domestic Product (GDP) in Uganda in the Fiscal Year 2013/14 (UBOS, 2014). With reference to agriculture, Uganda is divided into various agro-ecological zones. Agro-ecological zones are defined according to growing period, temperature regime and nature of predominant soils (Steinfeld, 1996). Wortman and Eledu (1999) divided Uganda into ten (10) agro-ecological zones based on soil types, rainfall patterns, temperature, topography, forest cover, lakes, rivers and land use patterns. In every agro-ecological zone different farming systems emerge. Dixon et al., (2001) defines a farming system as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household activities and constraints, and for which similar development strategies and interventions would be appropriate.

MAAIF (1996) divides Uganda into six broad farming systems which included Banana/coffee, Banana /Millet/cotton and Montane systems among others. However, Sandra Mwebaze (2002) highlights that farming systems are dynamic and change overtime. Ebanyat (2009) also reports that farming systems are dynamic with producers and consumers continuously responding to changes in crop and livestock yields, food prices, input prices, resource availability, and technological change in order to cope with population pressure as well as external political and economic factors. In addition, NARO and other regional and international research institutions have generated various technologies geared towards improving the livelihoods of stakeholders. However, these productivity-enhancing technologies have not been adequately utilized especially by the rural poor (ASARECA, 2013). Therefore, understanding and updating information concerning farming systems within USEAEZ is necessary to determine and establish which agricultural technologies are appropriate and where they could be applied to improve household incomes and livelihoods.

Over time, farmers have adapted agricultural practices and systems to changing economic and physical conditions. This has been accomplished by adopting new technologies, changing crop

mixes and cultivated acreages. Farmers have evolved farming practices that are suited to a diverse set of enterprises, primarily serving local or regional markets. This enterprise mix may not have produced the highest expected net returns, but may be more tolerant to prevailing conditions and other factors that affect the different elements of the system.

Improved crop varieties and other technological advances have resulted from intensive programs of research and development (R&D), driven by ongoing investments by both the government of Uganda and the international partners. Various interventions have generated and promoted demand driven, proven technologies and innovations for uptake by end users. It remains surprising that these technologies have had little or no impact on the targeted beneficiaries. This is attributed to farm systems; farmer characteristics and preferences; performance of technologies, technology delivery and management mechanism, access to extension and other support services, commercialization of commodities, effectiveness of marketing systems gender based constraints and overall policy/institutional processes (ASARECA, 2013).

The problem

Much of the research conducted in agriculture has focused principally upon intensifying crop and livestock production with less effort to integrated technologies for diversifying the livelihoods of small holder farmers and increasing the sustainability of land use. This is because there is limited information to guide in updating the agricultural research agenda to cater for the dynamism in people's interests, enterprises and market opportunities. The challenge of researchers therefore, is to provide information, knowledge and technologies that can contribute to improved agricultural growth and development. Better understanding and interactions with the stakeholders to bridge the gap of knowledge between Research and users of the developed technologies is a critical issue. BugiZARDI conducts technology tracking studies in the zone for its intervention from time to time to identify the research needs, constraints and opportunities of the stakeholders. Such studies provide a bench mark against which appropriate research interventions are based and subsequent assessment of how efficiently the technologies generated are adopted.

Objectives of the study

The purpose of the study was to generate and update information and knowledge on the emerging farming systems and livelihoods of the people in Bukedi sub zone. This will lead to understanding the current farming systems, sources of livelihood, challenges and coping mechanisms in the sub zone. The study will in addition lead to development of an adjusted research and development agenda that responds to the current demands in Bukedi sub zone.

CHAPTER TWO
METHODOLOGY

2.1 Description of the study area

Bukedi sub zone is one of the agro ecological areas within Uganda's south eastern agro ecological zone (U'SEAEZ) composed of six districts namely: Budaka, Busia, Butaleja, Kibuku, Pallisa and Tororo (Figure 1). Bukedi has an estimated population of 1,729,800 people (UBOS 2012) and land size of 4426 square kilometers. Arable land is approximately 3449.75 Km^2 and wet land 845.5 Km^2.The soils are categorized as sand to sandy clay loams. Bukedi sub zone receives a bimodal type of rainfall of between 800mm-1500mm annually between March and June and August toNovember and dry seasons in (November-March dry period) and (2nd dry period July-August) temperature range of to 27^{o}C (IPC-2014) . Bukedi sub zone is located between $34^{0}18'48.25''$E: $1^{0}11'32.05''$N and $33^{0}\,23'40.60''$E:$1^{0}20'48.09''$N.

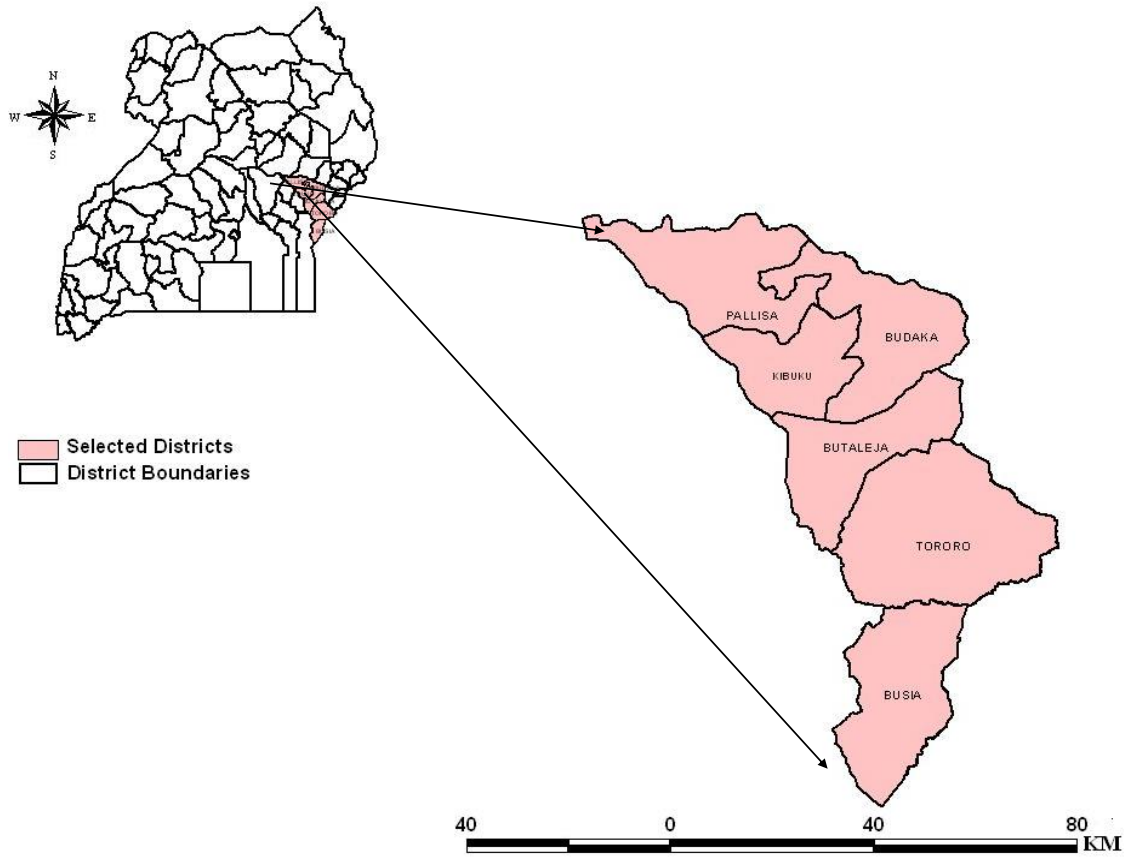


Figure 1: Map of Uganda showing districts of Bukedi sub zone

2.2 Selection of the study sites

A Participatory and inclusive process involving research scientists, district technical teams, local government leaders and development partners was used to select the study sites. The team also developed a roadmap for collecting and collating data for the study. Bukedi zone was broadly divided into two parts namely the wetlands comprising of swamps and the dry lands. Each district team participating in the workshop was tasked to identify areas which are either dryland or wetlands in addition to land use. Using GIS, the maps were overlain on the soil map for the region, the natural resources map, the cropping and communication network map to show the perceived farming systems in the zone. Two sub counties selected from every one district with each constituting largely either wet or dry systems for the data collection.

Map of Bukedi showing the study sites

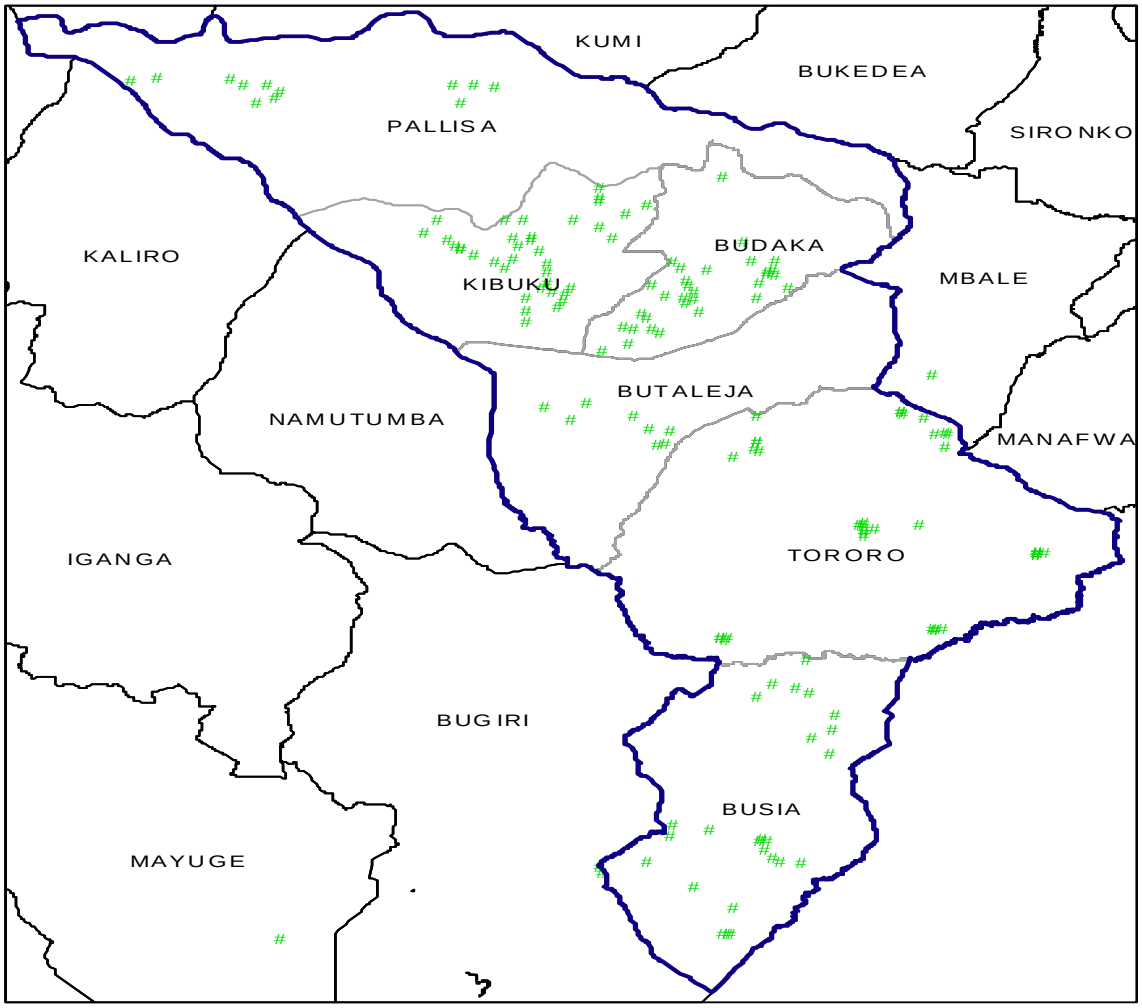


Figure: 2.Showing study sites in green

Districts Sub-counties and crops aggregated in “Wet” and “Dry” land system

Map of Selected study sites categorized “Wet Land and Dry Land”

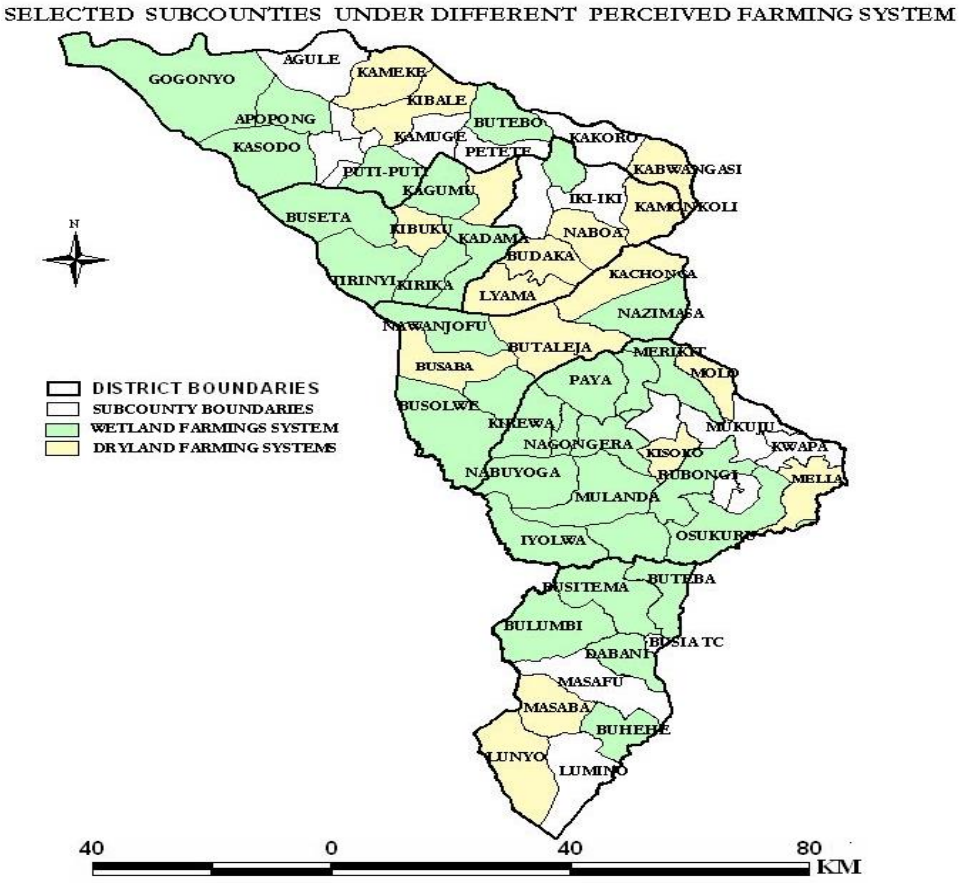


Figure 3: Map of Bukedi sub zone showing survey sites

2.3 Sampling

Multistage sampling refers to sampling plans where the sampling is carried out in stages using smaller and smaller sampling units at each stage. In a two-stage sampling design, a sample of primary units is selected and then a sample of secondary units is selected within each primary unit. A multi-stage sampling technique involving a combination of purposive and simple random sampling procedures were used to select a representative sample of respondents. The first step involved purposive selection of two sub-counties for the study sites using “wet” and “dry” lands in each category. The second stage involved simple random selection (SRS) of two parishes per sub-county and two villages per parish where data was collected. This was done to ensure every possible sample of a given size had the same chance of selection and also to reduce bias .This brought the number of parishes to 24 and that of villages to 48. The final stage was the use of simple random sampling of household heads from the selected villages. Names of respondents

were picked from village lists provided by the sub county NAADS coordinators (SNCs). A rotary system was used to select 7 respondents to be interviewed in each village making a total of 56 respondents per District. 302 respondents out of target respondent population of 336 household heads were interviewed in the whole of Bukedi sub zone.

2.4 Tool development and pretesting

Data was collected through face to face interviews using a semi-structured pre-tested questionnaire (Annex ..). Pre-testing was conducted in Naboa Parish of Budaka district by interviewing 30 respondents. A code sheet was then developed after the pretesting for purposes of data entry and analysis. Enumerators were recruited and trained to implement the tools in data collection. Data was validated through focus group discussions (FGD) involving 8-15 respondents with both women and men freely participating as guided by a checklist. This gave an in-depth understanding of the field observations. FGD's were conducted in the sub counties of Kamonkoli (Budaka District), Busitema (Busia District) and Bulangira (Kibuku District). Key informant interviews were also conducted in each survey site to obtain expert view and information on various aspects of farming systems and livelihood options. The participants were selected based on their level of engagement with the community, affiliation to technical institutions and leadership positions held in the community as described in USAID (2011). Among the informants were the NAADS coordinators, Local council three (LCIII) chairpersons, district marketing and commercial officers and District Natural Resource Officers. This category was targeted for collection of relevant information on aspects of agricultural productivity, marketing, policies and investment in soil and water conservation. Observation was also used to complement the other tools in understanding the type of soils, land use patterns, road network constraints and markets.

2.5 Data Management and Analysis

Data cleaning was carried out by individual enumerators at the end of each session with the supervision of the team leader. Data was coded and entered into the MS –Excel.and analysed using descriptive statistics in SPSS version 17.0

CHAPTER 3
RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of households

3.1.1 Gender and age distribution

Twenty percent of the respondents were female and 80% male (Table 1). Overall most of the respondents were in the 38 -47 age group representing 26.2% of the population closely followed by the 28 - 37 (21.5%) age group. This indicates that majority of the respondents are productive youth in Bukedi. Busia distirct (25%) had the highest fraction of elderly > 58 and Budaka (11.4%) the least. Mahabile *et al*., (2005) highlights that age of the household head measures accumulated farming experience and social standing in rural communities. However, in the study areas age of the household head reflected on household characteristics such as family size, household assets and experience in rural agriculture.

Table 1: Gender and age distribution in Bukedi

	District	Busia	Tororo	Butaleja	Pallisa	Budaka	Kibuku	Average
Gender	**Male (%)**	73.2	90	85.2	70.9	75	82.9	80.1
	Female (%)	26.8	10	14.8	29.1	25	17.1	19.9
Age distribution	**18-27**	15	11.7	8.2	7.3	18.2	14.6	12.5
	28-37	20	15	26.2	20	18.2	29.3	21.5
	38-47	27.5	31.7	26.2	27.3	25	19.5	26.2
	48-57	12.5	23.3	19.7	23.6	27.3	14.6	20.2
	>58	25	18.3	19.7	21.8	11.4	22	19.7

3.1.2 Main occupation

Farming is the main stay of the people in Bukedi with 83% of the respondents giving it as the main occupation. Business also employs 11% of the respondents with the rest reporting as students or civil servants. However, it should be noted that although the average of laborers is zero, some of the respondents occasionally work as laborers on larger farms (Table 2).

Table 2: Main occupation of the households

	District					
Occupation	**Busia**	**Tororo**	**Butaleja**	**Budaka**	**Kibuku**	**Pallisa**
Farmers	82.9	88.3	93.4	80	79.5	75.6
Business	12.2	10	6.6	10.9	11.4	17.1
Student	4.9	0	0	5.5	4.5	0
Civil Servants	0	0	0	3.6	4.5	7.3
Laborers	0	1.7	0	0	0	0

3.1.3 Education level

Secondary education had been attained by 45% of the respondents whereas 39% had attained primary education (Table 3). In all districts, respondents who had attained university education were few. Interestingly, in Pallisa and Tororo districts all respondents had attained some level of education. Kibuku did not record any respondents who had attained University education. Formal education includes training at all levels of primary, secondary, and tertiary levels. Informal education trains beneficiaries in basic skills like reading, writing, and numeracy.

Table 3: Education level per district

	District					
Education level	**Busia**	**Tororo**	**Butaleja**	**Budaka**	**Kibuku**	**Pallisa**
None formal	4.9	0	4.9	12.7	9.1	0
Primary	41.5	51.7	42.6	41.8	29.5	24.4
Secondary	48.8	40	45.9	34.5	50	51.2
Tertiary	2.4	6.7	4.9	7.3	11.4	22
University	2.4	1.7	1.6	3.6	0	2.4

It has been emphasized that agricultural education is one of the priority areas for the farmers to adopt any technology for improved livelihoods. The utilization of information/knowledge requires modest levels of literacy to enable them make well informed decisions.

Further analysis of education level by gender of the respondents indicates that more males (47.5%) attained secondary education as compared to females. More females have attained primary education (63%) than males and there were no females reported to have attended university education (Figure 4).

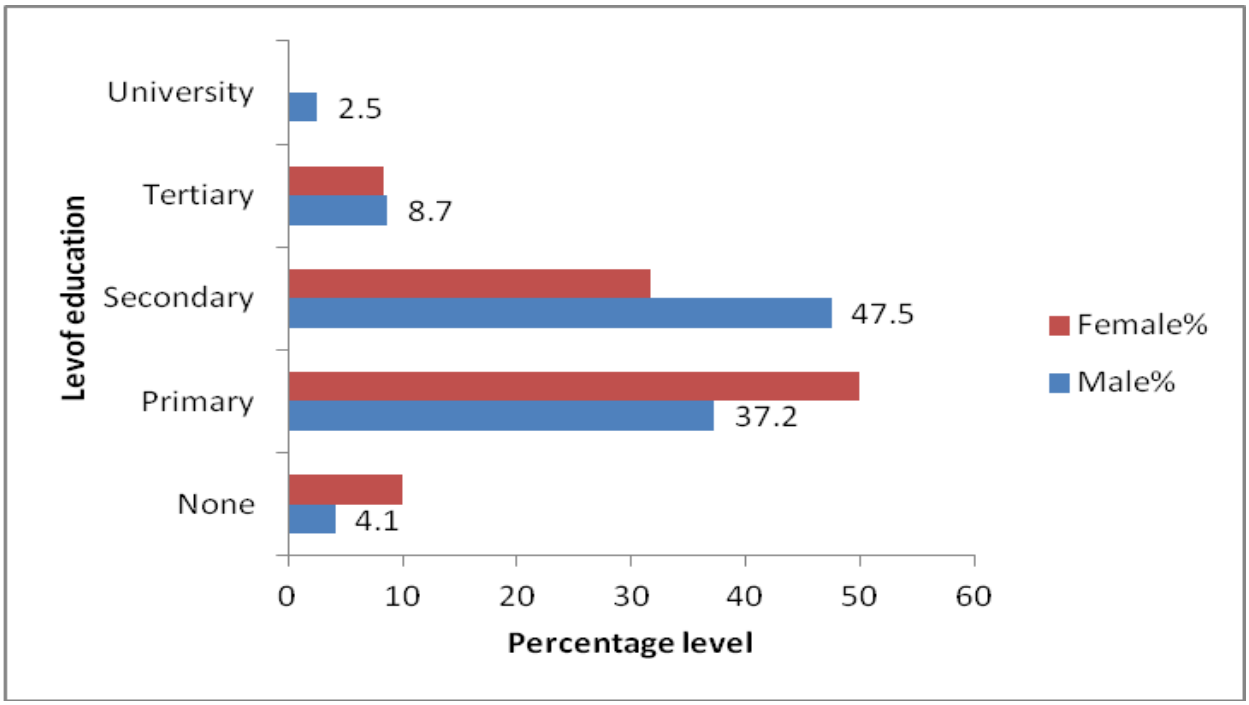


Figure 4. Education level by gender in Bukedi sub zone

3.1.4 Household size and composition

Average household size was 8 in Budaka.Household size range of 7 - 9 people per household was the most common at 32%. This is higher than the national average family size (5 persons per family) (UBOS, 2014). The households with more than 12 people was the least at only 6% of the respondents. A household, as defined by the 2002 population and housing census refers to people who live and eat together. Composition of the household plays a big role in agricultural production by ensuring sufficient labor during peak periods of weeding and harvesting of labor intensive crops such as rice and millet.

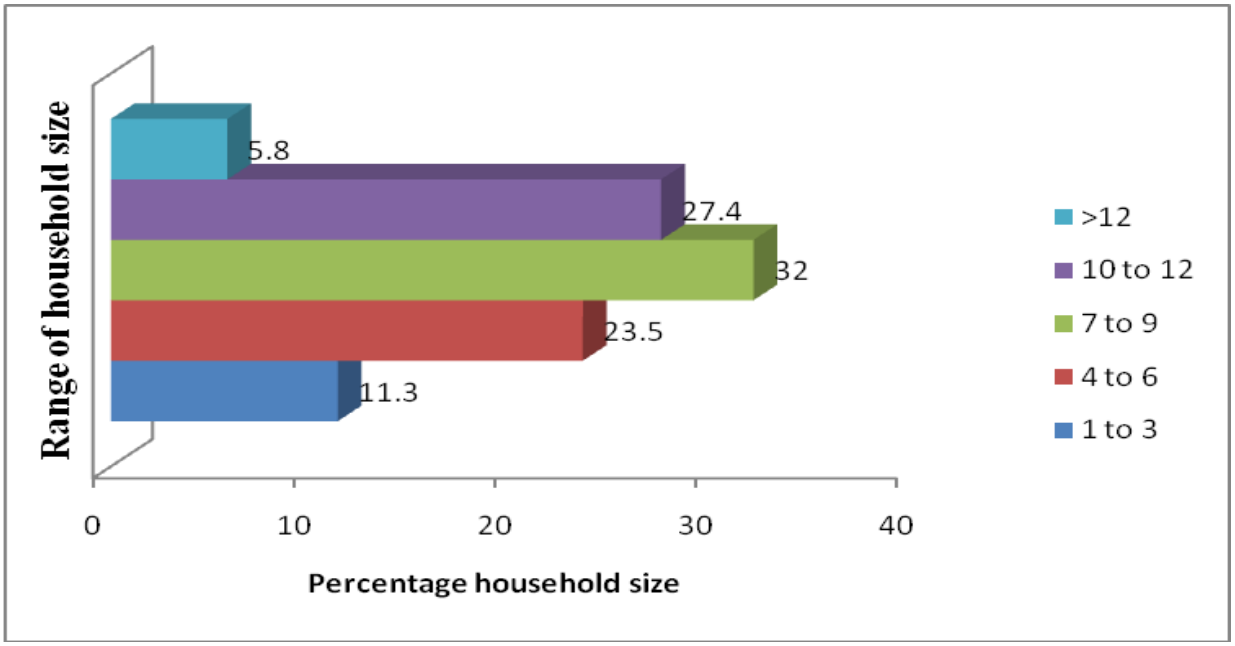


Figure 5. Number of persons per Household in Bukedi sub zone

3.1.5 Household Incomes

Average monthly income per household from all income generating activities was recorded to be Two Hundred Eighty Three thousand four hundred shillings (Shs. 283,400/-) or US$ 100.

Table 5: Estimated household income per month in each district

District	*UGX*	
Budaka	283,620	100
Busia	250,285	88
Butaleja	282,901	99
Kibuku	328,378	115
Pallisa	286,037	100
Tororo	270,759	95

The average income for the households per districts ranges from US$ 88 to 115 (Table 3.20). When computed, this income is reflected as 3.8 dollars per day which is slightly above the poverty line measured at one dollar per day. Kibuku District respondents earn highest and Busia the least.

3.1.6 Major sources of income in Bukedi

The major sources of income in Bukedi include hiring out of labor, regular employment and running own business. The sale of woodlot and sale of pasture are the least popular alternative sources of income..

Table 6: Sources of income per district

Source	Busia	Tororo	Butaleja	Budaka	Kibuku	Pallisa
Hiring out labour	32.1	26.5	17.5	11.6	15.6	13.5
Regular employment	21.4	18.4	12.5	16.3	21.9	10.8
Running own business	28.6	18.4	25	30.2	28.1	29.7
Non-farming employment	0	14.3	15	9.3	6.3	16.2
Sale of wood lot	0	2	5	0	0	0
Sale of pasture	0	0	5	0	6.3	0
Remittance	10.7	6.1	7.5	9.3	6.3	16.2
Hire of transport facility	0	6.1	5	9.3	6.3	5.4
Sale of livestock	7.1	8.2	7.5	14	9.4	8.1

Busia and Tororo lead in hiring out labour to get other source of income for the household compared to other districts. Regular employment as represented by civil servants is also common across the districts with Pallisa having the least income from regular employment. This is also in line with the level of education of the sampled households; Pallisa scored low for those who attended tertiary and university level.

3.1.7 Control of the Income

Results show male household heads dominate in resource control. However, only 7.2% of the income is controlled by the female spouse and 38.5% by both. Income under the control of women is more likely to be used to improve family welfare – women spend up to 90% of their income on their families, while men spend 30-40% (FAO, 2011). More gender equity sensitization is needed to encourage women participate fully in decision making. Gender

inequality is still a major hindrance to reducing women's power to act independently, participate in decision making and escape reliance on men in the community.

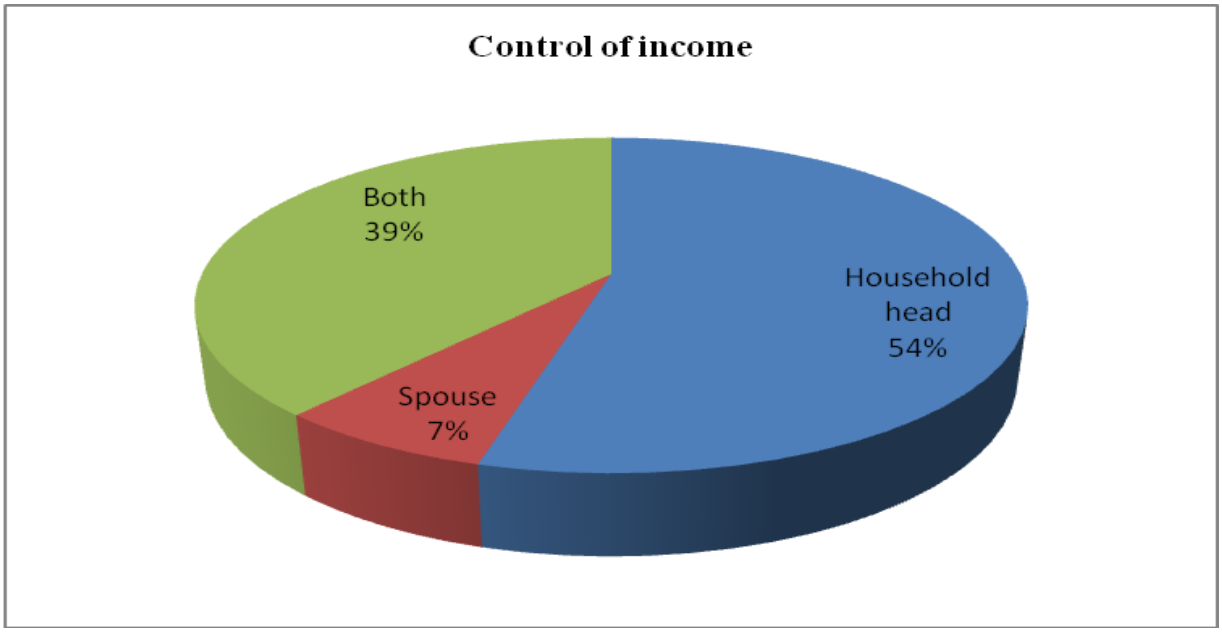


Figure 6. Pie chart showing control of household income

3.1.8 Access to credit services

Financial services play an important role in improving agricultural productivity. In Bukedi sub zone, 84% of the sampled households are small- and medium-scale farmers who are usually constrained by availability of and/or access to credit for increasing investment in agriculture. Among the factors that could be limiting access and use of credit by small holder farmers include limited access to financial institutions. Where credit institutions exist, collateral requirements for individuals to get credit are enormous and the high risks for financial institutions, both the formal and informal. They then have to rely on their personal wealth or internal resources to invest in farming which limits their full potential leading to the cycle of persistent inequality and diminished growth. Figure 7 shows those respondents who have had access to credit (27.6%) and those who did not (72.4%).

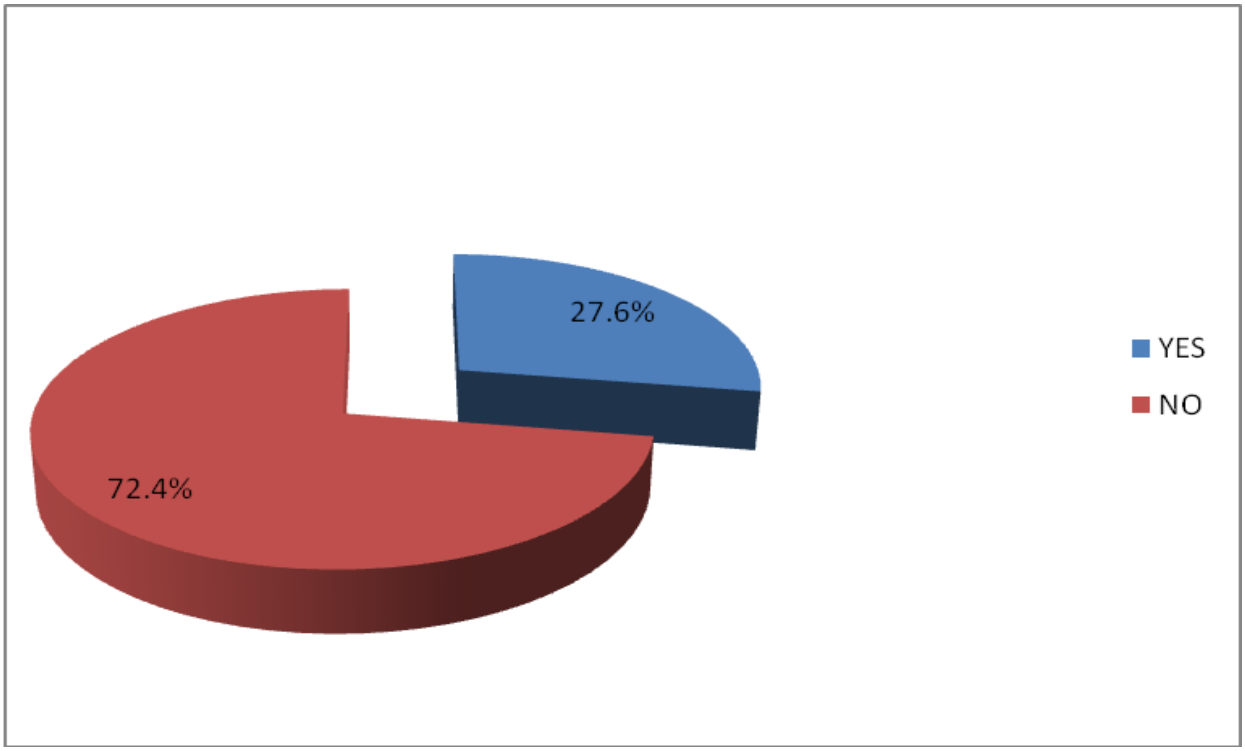


Figure 7. Access to credit service responses

Duration of the loan

The loan services offered to farmers are categorized into long term and short term loans. (87.4%) had access to short term loans while (12.6 %) had access to long term loans. Terms of repayment are dictated by local money lenders. Agricultural loan repayment for small holder farmers has always remained a big challenge because of the risks and uncertainties farmers face such as drought, pests and diseases, floods, hailstones. These factors cause loss of yields and low returns to investment. Farmers end up failing to pay back the loan they received on time.

Forms of credit facilities

The biggest proportion of the credit facility was in the form of cash (99%) and the rest as input credit. It was noted that farmers in Bukedi access credit in form of loans from traders or local money lenders. For such an arrangement, respondents observed that money lenders can use agricultural products as collateral or repayment. However respondents complained of cheating and yet they cannot sell to anybody else for fear of being denied the credit next time.

Source of credit

Cooperatives/SACCOs are recorded to be the highest source of credit facility with (17.4%).This is because SACCO's are closer to the farmers as they have been formed by groups in the rural

areas where farmers belong followed by microfinance (14.7%) and commercial banks. This also implies that farmers have realized the importance of accessing credit from financial institutions. Borrowing from friends was observed as the least source of credit.

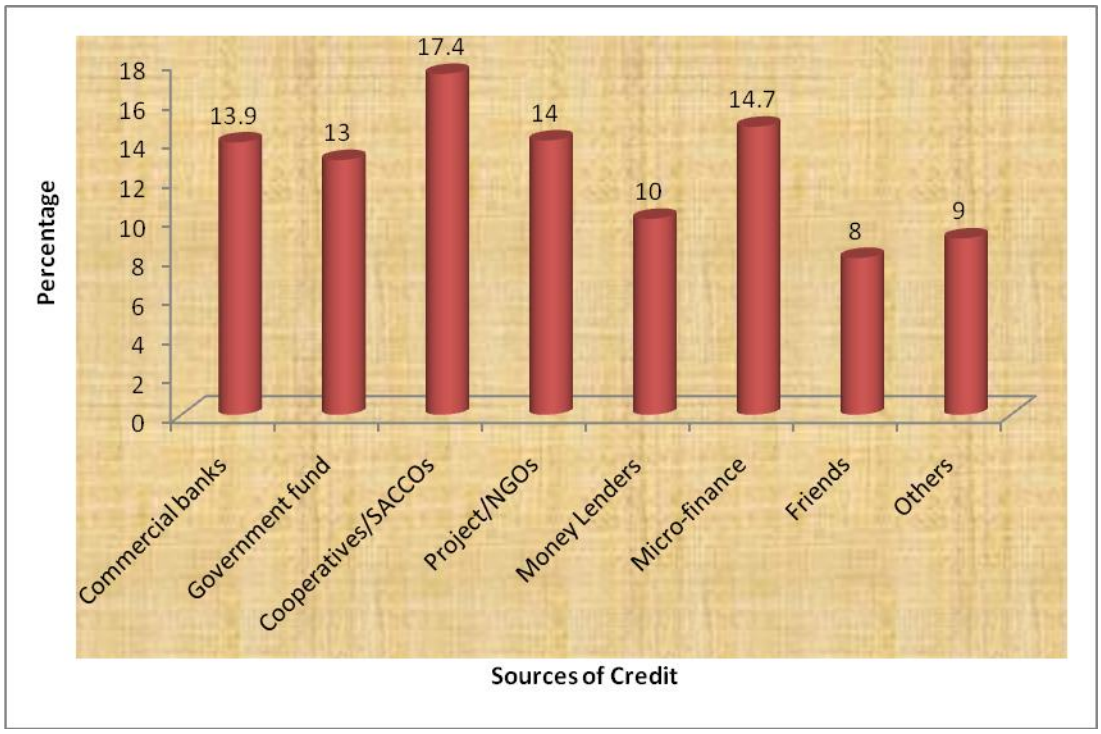


Figure 8. Sources of credit in Bukedi subzone

3.2 PRODUCTION RESOURCES

3.2.1 Land ownership and utilization

The drivers of land use change in Bukedi include land access, prevalence of pests and diseases, soil fertility and demographic factors. In Tororo (45.5.1%) of the respondents interviewed did not own the land they farm on (rent in). In Budaka district, most of the sampled respondents had on average 2.4 acres of land on which they grow crops, build a home and other farming activities. This small acreage of land has a negative impact on productivity and livelihoods as farmer produce on subsistence scale because of the small fragments which have been divided and subdivided. These natures of land holdings limit mechanization and commercialization of farming.

3.2.2 Rental value of land

The rental value of land from the sampled households was at 300,000 Uganda shillings per hectare (Figure 9. In Butaleja it was at 1,500,000 shillings for paddy fields for one season. It was

noted that rice is grown as a cash crop and farmers fetch more money from it than any other crop. On average a farmer who harvests 4.5 tons of grain from an acre and after milling with a loss of 35% during processing gets a gross of United States dollars ($2340) if he or she sells a kilogram at 2200 Uganda shillings at farm gate. This high return to investment has contributed to high demand for paddy land and high renting price.

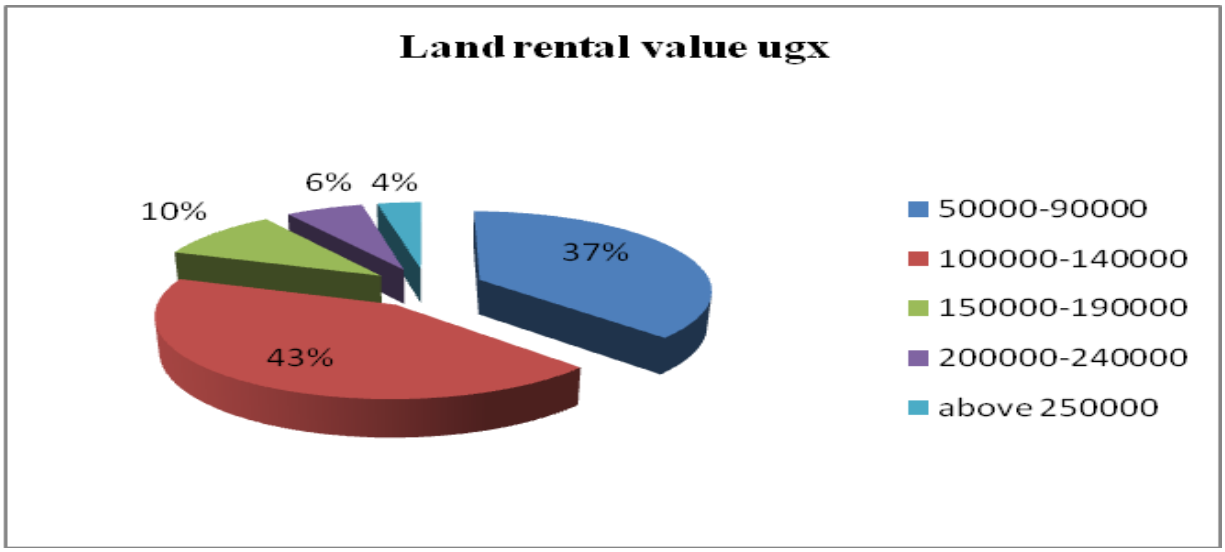


Figure 9: Land rent value

Results further indicated that 43% of rent land in range of 100,000 - 140,000 Ug shillings while only 4% could afford to hire land at more 250,000 Ug shillings. This shows that land for cultivation is a big challenge which affects agricultural production. The resultant consequence is the food shortage.

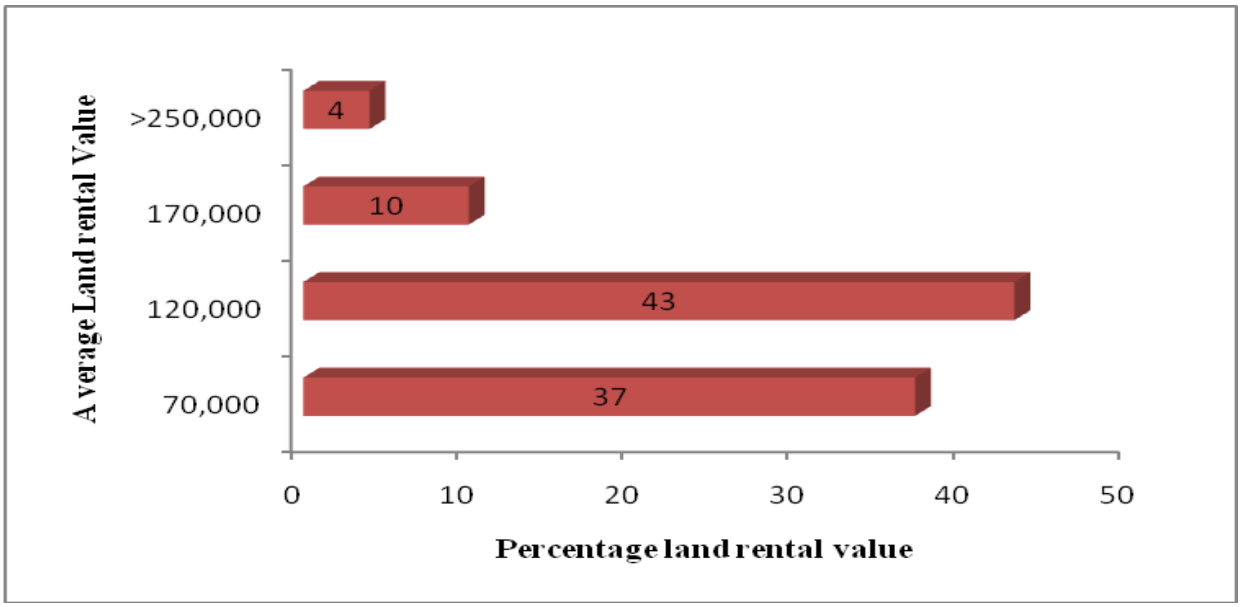


Figure 10. showing the average land rental value

3.7 Decision making in selling the crop land

Decision-making is identifying and choosing alternatives based on the values and preferences of the decision maker. Every decision-making process produces a final choice that may or may not prompt action. This relates to appreciating gender equity which requires that all human beings, both women and men are free to develop their personal abilities and make choices without the limitation set by stereotypes, rigid gender roles or unfairness. It was recorded that decision making in the household for aspects of utilization of crop land, utilization of grazing land, hiring of labor, acquisition of household assets and agro-inputs is through consultative efforts by both the husband and wife (62%). in some instances it was observed that generally female spouses make only 4% of the independent decisions in the household activities. Furthermore it was noted that in Tororo, Budaka and Kibuku Districts, none of the household activity decisions are made by female spouses independently (Figure 11).

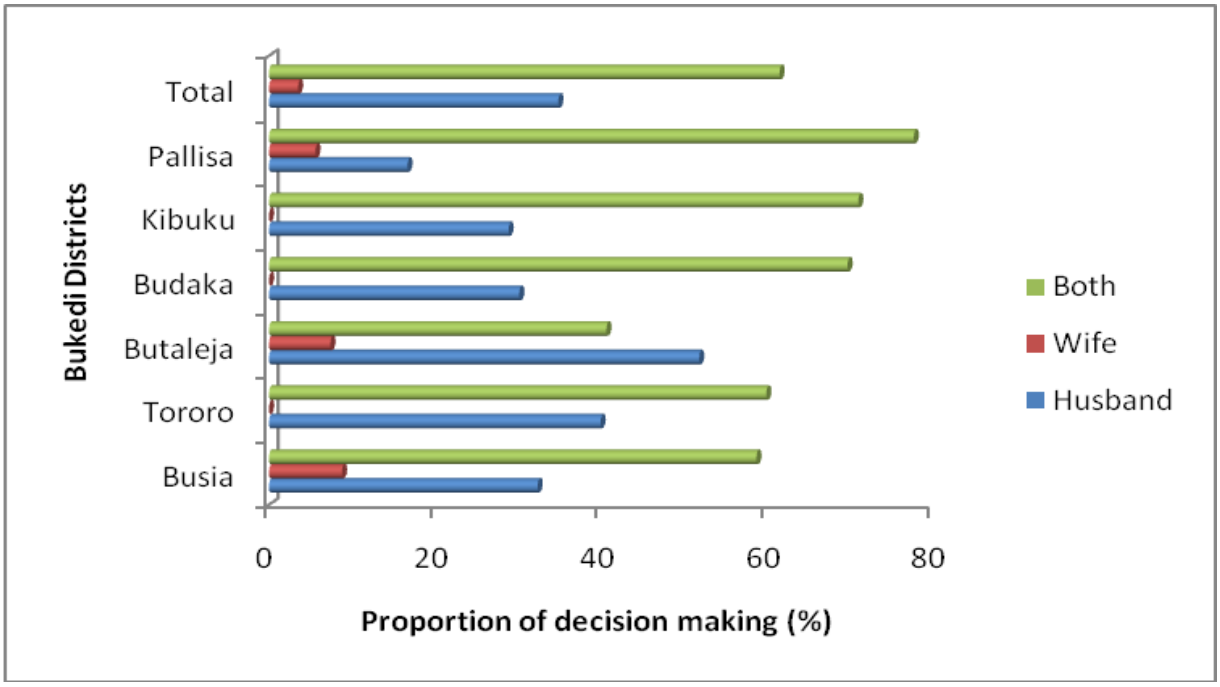


Figure 11. Decision making in selling crop land

3.2.3 Livestock Production

Figure 12shows a detailed analysis of the type and breed of livestock kept in the sub zone. It was evident that most of the livestock kept were of indigenous genotype for example cases of 100% indigenous breeds being kept were common. This gives a clear picture that farmers prefer local

breeds than the improved breeds which they said were resistant to parasites and diseases, tolerance to harsh conditions such as drought and also require low maintenance costs.

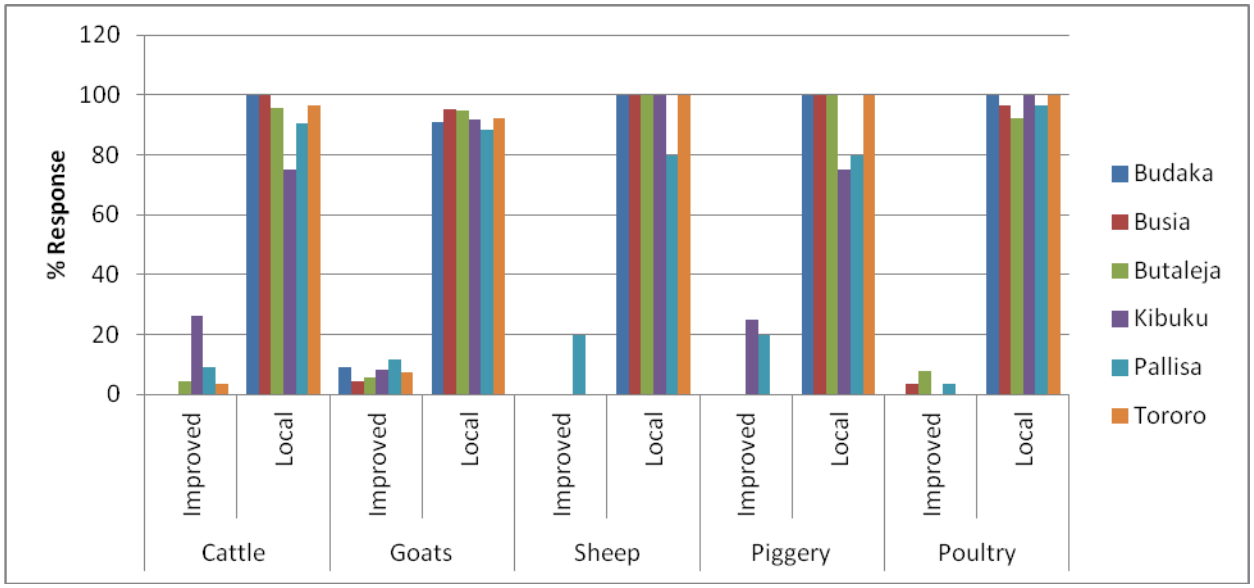


Figure 12. Type and breed of livestock kept in the sub zone

Livestock contributes to household livelihoods through a variety of direct and indirect pathways. Livestock provides a source of income through sale of animals or livestock products such as milk, meat, and eggs. Livestock also is form of savings (capital growth through herd growth) and insurance. In addition, livestock also provide manure, draft power and transport services which can be used on the household farm or exchanged on the market (for example, hire of oxen for ploughing).Since livestock such as poultry can be kept close to the homestead and require few labour inputs, it was noted that small flock of birds were tended to by women while managing other time-consuming activities such as cooking or child care.

3.2.4 Number of livestock sold annually

Figure 13shows that poultry was the most often sold followed by goats. Perhaps this can be explained by the fact that poultry was the most common type of livestock kept and in addition can easily be sold as the procedure is not difficult and the monies involved are usually small compared to other livestock.

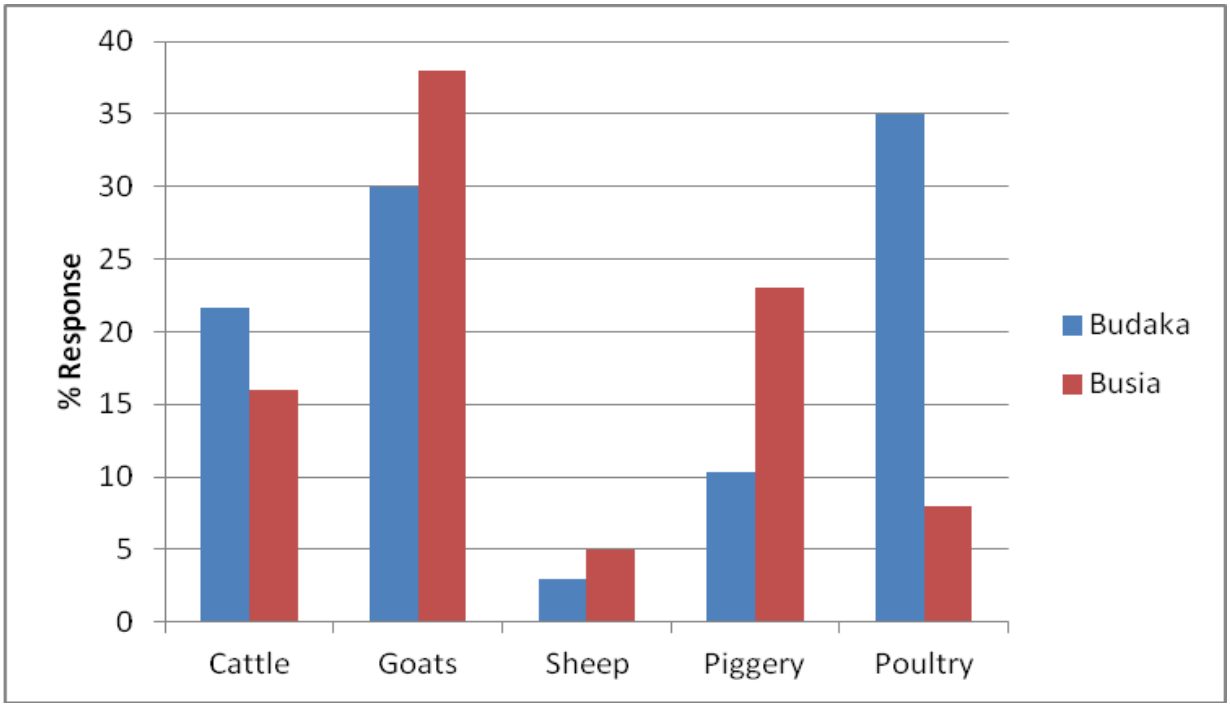


Figure 13: Number of Livestock sold

3.3.1 Crop production

Figure 14 shows that maize and cassava were the most crops grown in Bukedi subzone. Maize was dominant in all the six districts of Bukedi but from the sampled households, Busia grows more (52.5%) followed by Tororo (48.1%). Pallisa was leading in cassava production (41.4%) followed by Tororo (38.8%) and Busia (30%). Other crops were grown mainly for food. Butaleja district produced more rice than any other district while cotton was chiefly grown in Pallisa and Kibuku.

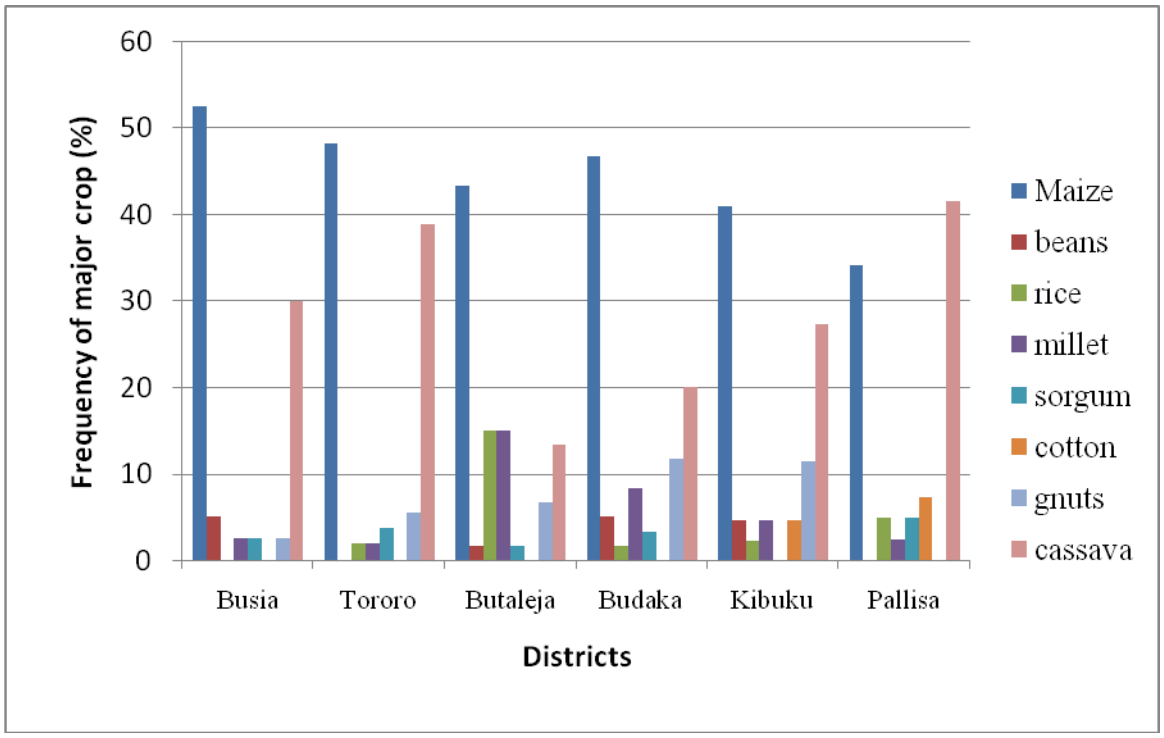


Figure 14. Crops grown in the districts in last season of 2012

3.3.2 Area under crop production

Most of the land under crop production was for G-nuts, maize and cassava (Table 7)

Table 7: Average area and yield of major crops grown in Bukedi sub zone

Crop	*Mean (area) acres*	*Mean Yield Kg/acre*	*Mean Yield ton/ha*
Maize	2.0 ±1.8	2351	2.9
Beans	0.8 ±0.2	496	1.0
Rice	1.0 ±0.5	2157	5.4
Millet	1.5 ±1.2	970	1.6
Sorghum	1.4 ±1.3	1500	2.6
Cotton	2.8 ±2.0	974	0.9
G/nuts	2.5 ±2.0	1200	1.2
Cassava	2.0 ±2.7	8184	10.2

Agricultural productivity in Uganda is low with both crop and livestock yields being a quarter or half of potential yields. In Bukedi sub-zone there is no exception as presented in (Table 8.). The Per capita food production is declining despite increase in acreage under cultivation (NEMA, 2010). The National Development Plan (NDP) identifies agriculture as a vital contributory growth sector capable of reducing poverty and stimulating economic growth. Accordingly, in FY2011/12, priority interventions focused on increasing production and productivity**.**

During the focus group discussion at Busitema and Kabwangasi sub counties in Busia and Pallisa districts, farmers mentioned the average yield of the following crops both improved and local..

Table 8: Comparison of average yields of local and improved crops

Crop	Qty of planting material Kg/acres	Unit cost (Shs)	Average Yield Kg/acre	Expected Yield Kg/acre
*Maize	Improved=10	5000	750	1500
	Local=20	1500	300	600
Beans	30	2500	150	500
Rice	30	1000	800 milled	2500 milled
Millet	5	4000	400	600
Sorghum	10	2000	250	500
Cotton	6	1000	120	300
G/nuts	Sere nut series 25	3500	1000 unshelled	1200 unshelled
	Red beauty "Kabonge" 30	4000	600 unshelled	900 unshelled
Cassava	4800-6000 cuttings(8-10 bags)	10,000/bag	**20 bags dry	**30 bags dry

***Maize varieties: Longe 5, 6, 7**

****3 bags of fresh cassava give one bag of dry cassava on average.**

In another focus group meeting at Bulangira Sub County in Pallisa district, farmers acknowledged that only 10% use improved seed and were able to compare the production of their yield as in (Table 9). The results indicate a drastic decline in both production and productivity. They attributed the decline to use of poor quality seed, late planting, drought, pests, weeds and diseases. It was also observed that the only cash crop in Pallisa was cotton but it faces many challenge which among others is inadequate extension staff, inputs and above all low market price which has discouraged farmers.

Table 9: Trend of crop yields in Bulangira Sub County in Pallisa district

Crop	Year	Yield /acre	Yield/acre in 2012
Maize	1995	1000Kg	300
Ground nuts	2008	12 bags	3 bags
Rice	2011	600kg	300kg
Cassava	2000	2000kg (dry)	500kg (dry)
Beans	1998	800kg	200kg

3.3.3 Major Crops in order of importance

Farmers were requested to rank the crops they grow in order of importance to determine which crops are the most important. Three top ranked crops for each district are presented in (Table 3.9. Maize is the most highly ranked crop in all the districts of Bukedi for both dry and wet areas. The drier sub counties, cassava seems to be priority crop and rice is the most important crop for the wet sites. This therefore implies that any research and development efforts to address the needs of the farming community

Table 10 Perceived crop rankings in the wet and drylands of Bukedi

	Wet			Dry		
District	**Rank1**	**Rank 2**	**Rank3**	**Rank1**	**Rank 2**	**Rank3**
Budaka	Rice	Maize	Beans	Maize	Cassava	Ground nuts
Busia	Maize	Sorghum	Ground nuts	Cassava	Maize	Beans
Butaleja	Rice	Maize	Cassava	Maize	Cassava	Finger millet
Kibuku	Rice	Millet	Cotton	Cassava	Groundnuts	Maize
Pallisa	Rice	Millet	Ground nuts	Cassava	Maize	Cotton
Tororo	Millet	Rice	Beans	Cassava	Maize	Ground nuts

3.3.4 Type of labour used in opening land for crops

Animal power is dominantly used in land opening (61.9%) followed by manual labour with (35.3%) and least by tractor with (2.8%). This implies that mechanization using tractor in the sampled households is low and this has a direct effect on farm production and productivity. Animal power is mainly used in Pallisa (87.8%), Kibuku (87.5%), Budaka (80.4%) and Tororo Districts. In Busia and Butaleja manual labour on farms is most common whereas there is tractor use reported in Butaleja and Kibuku District. Animal power is influenced mainly by the availability of animals and grazing land as well as water for the animals.

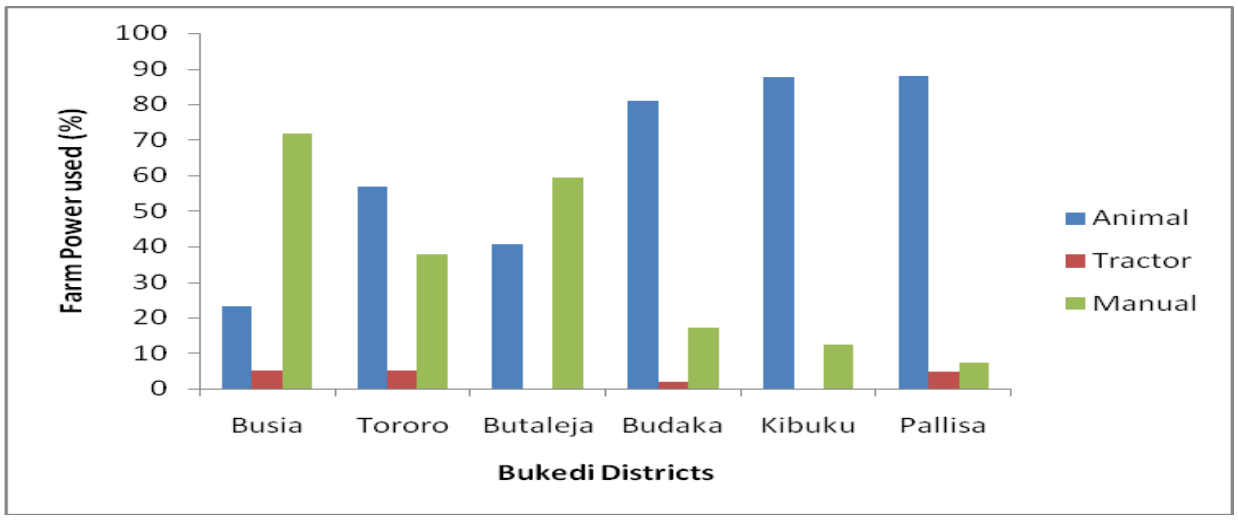


Figure 15. Common type of farm power use in Bukedi

Where manual labor is used in Busia (71.8%) and Butaleja (59.3%), labor groups operate on a commercial basis where young men and women are hired as casual laborers in the field. This

serves as a good source of employment for youth for social development. Households that rely only on family labor are among the poorest as compared to those households hiring draught animals.

3.4.1 Marketing of farm produce

Figure 16shows that most farmers sell their farm produce at the farm gate. Marketing involves getting the right product at the right price, and sold in the right place. Farm gate marketing is whereby farmers sell agricultural produce mostly foodstuffs directly to the consumer. In Bukedi it accounted for 72% of marketing. Only 9% of the produce was sold at the designated markets, and the remaining proportion was sold along the road sides. The roadside stand can be a portable truck or table. It was observed from comments that location is critical for a roadside marketer's success.

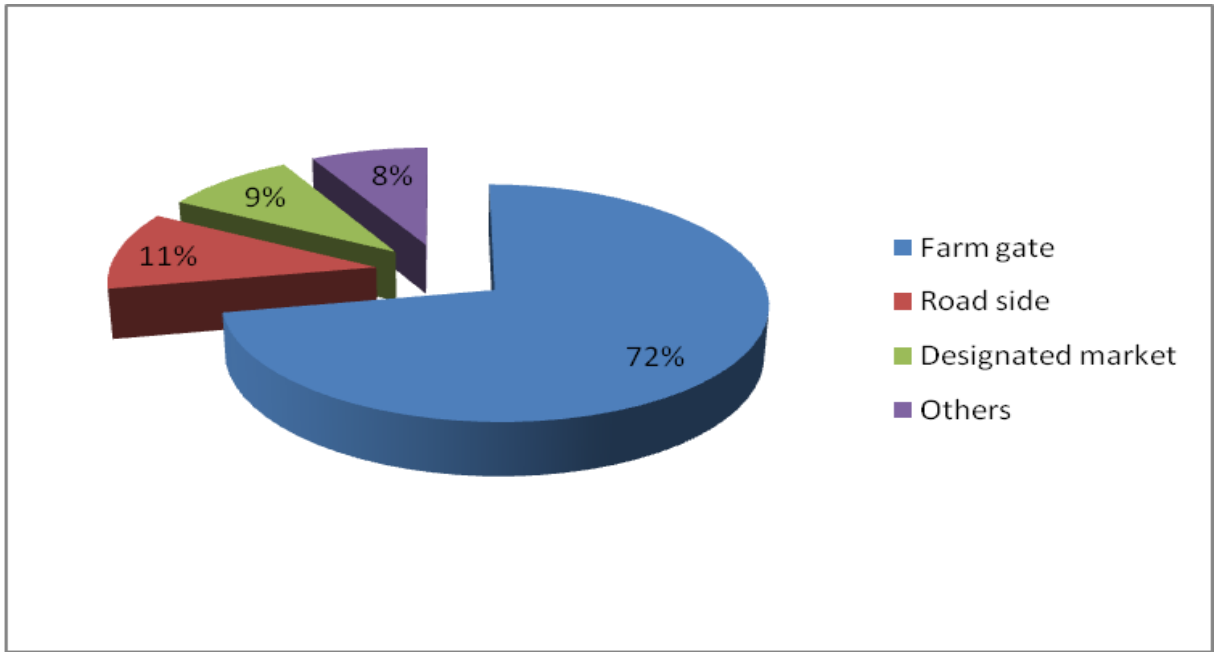


Figure 16. Market sources for produce in Bukedi

3.4.2 Mode of transport

The most commonly used mode of transport (45%) is hiring so as to transport the farm products from farms to the markets or storage facilities. Trekking was common with farmers who reside within their farms or stay some few meters from home.

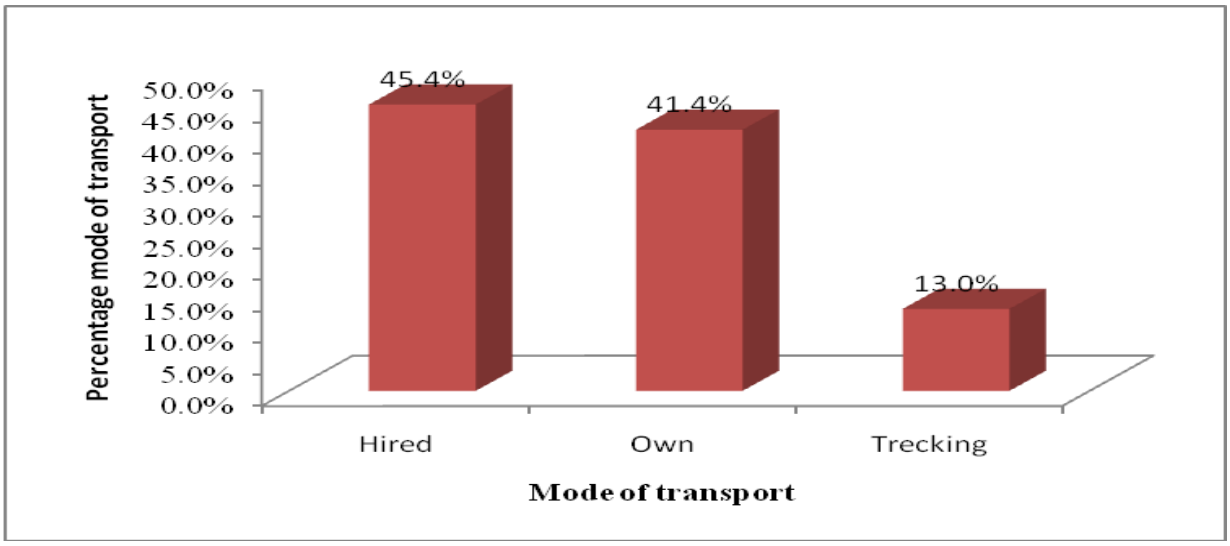


Figure 17: Mode of transport to the market

A transportation mode is the means of mobility used to carry goods and persons from one place to another in this case from village/market to farm and vice versa. Rural transportation mostly include animal traction, car, truck and other intermediary means of transport such as motorcycle, bicycle, mostly adapted for local transport problems with low and medium loads (Sieber, 1999). Intermediary modes of transportation are crucial to farmers 'in Bukedi for timely access to farm, markets and agro-services (Oyatoye, 1994). An effective demand for transportation arises also from the presence of markets and the use of Intermediary Mode of Transport would be viable only if distances are not too lengthy, while a multimodal system could be the best approach to rural transportation challenges.

3.4.3 Type of buyers for agricultural produce

Farmers sell most their agricultural produce to traders who constituted (44.7%) of the buyers followed by the consumers (20.3%). The other categories of buyers included the processors (12.4%) and institutions (10.2%).

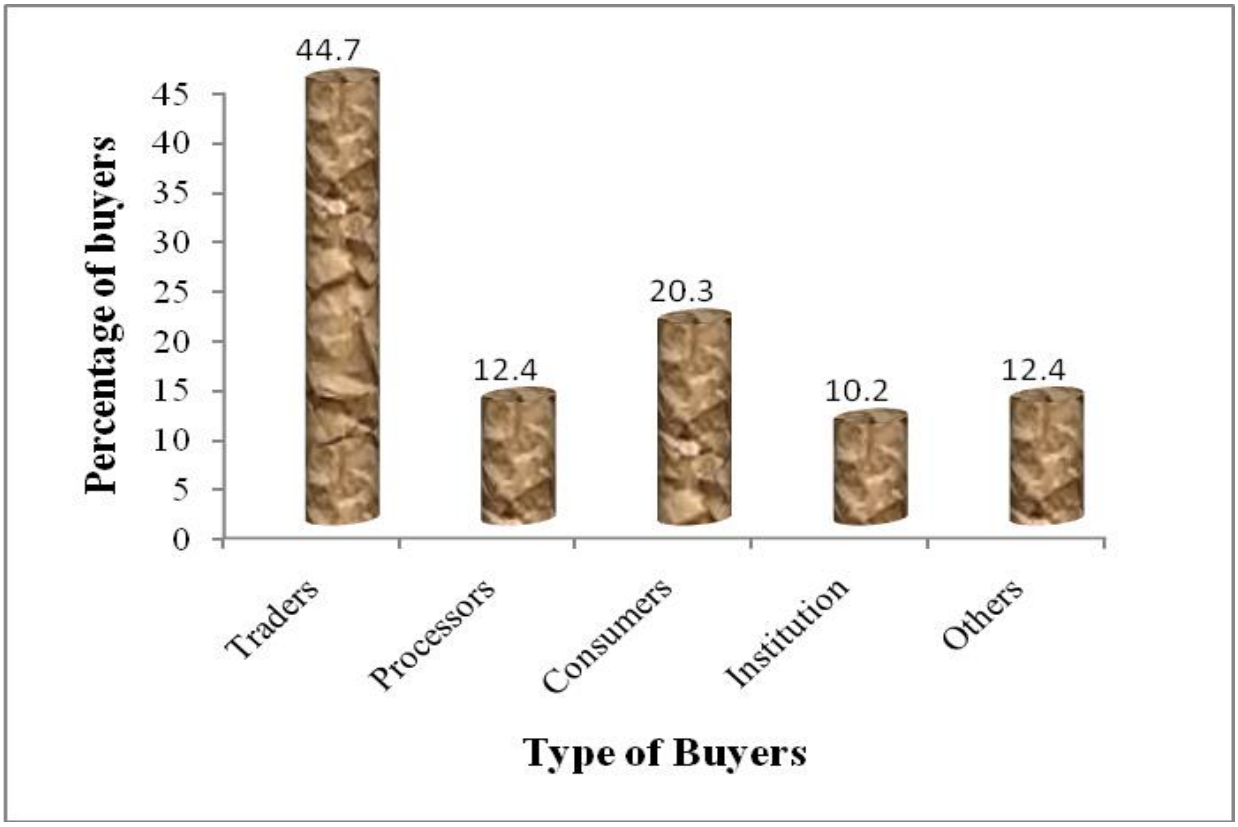


Figure 18: Type of produce buyers

3.4.4 Purpose for selling Crops

Medical care (41%) was the most important purpose for selling crop produce according to respondents in Bukedi sub zone. Other reasons include purchase animal feeds (18%) and food (14%). This means that health problems high in the sub zone and more sensitization on good hygiene and intervention in control of diseases is needed.

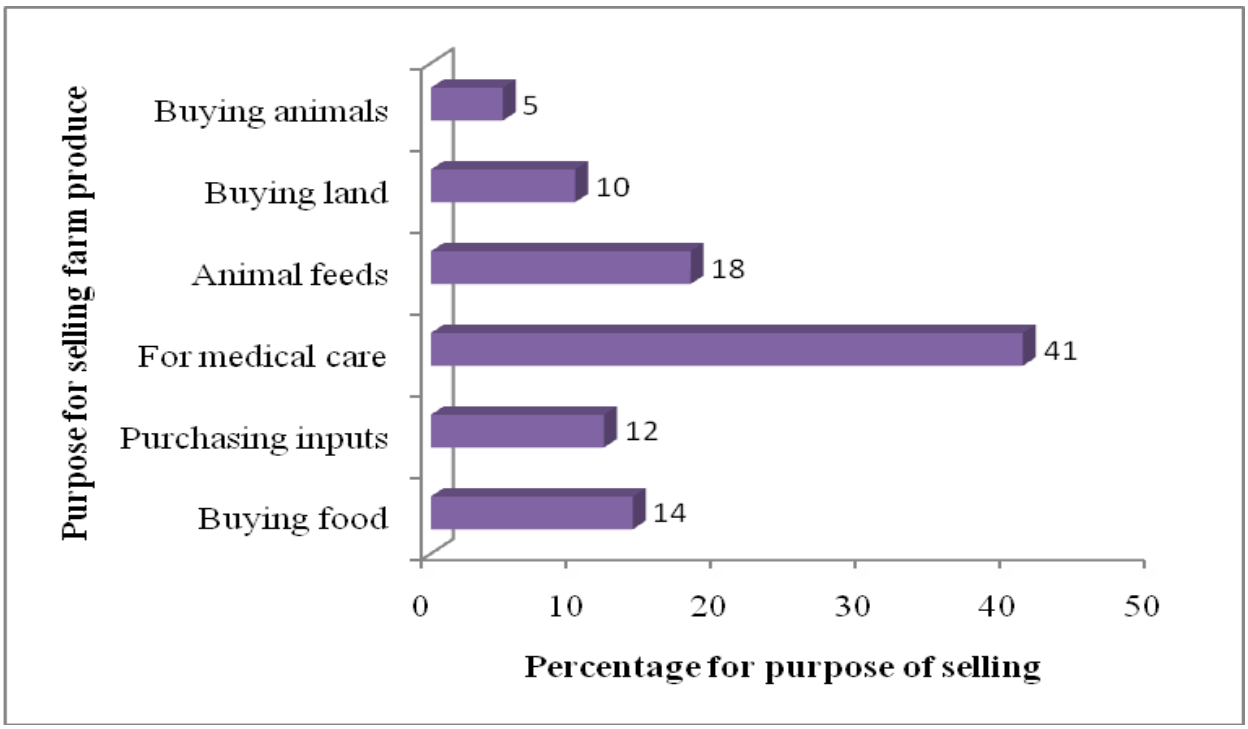


Figure 19: Purpose of selling produce

Marketing contributes to improvement of small scale farmers' livelihoods as farmers can exchange their produce for cash and use it to meet household demands. One of the major causes of high levels of poverty among small scale farmers are low producer prices. In the study conducted in Bukedi sub zone, the main constraint in the marketing system across the six districts was low market prices (20.8%) followed by lack of market information (15.6%).The analysis of these constraints is summarized in the (Table 11)

Table 11: Constraint to crop marketing

Constraint	***Percent***
Low market price	20.8
Lack of market information	15.6
Quality problems	8.9
High processing cost	8.3
Poor storage facilities	9.6
High local tax	10.0
High transport cost	12.9
Poor road and long distance	14.5

3.4.5 Type of storage facility

Sixty seven percent of the sampled households store their agricultural produce in the room in the house where they sleep while only (10.6%) store produce in the traditional granary (Figure 20)

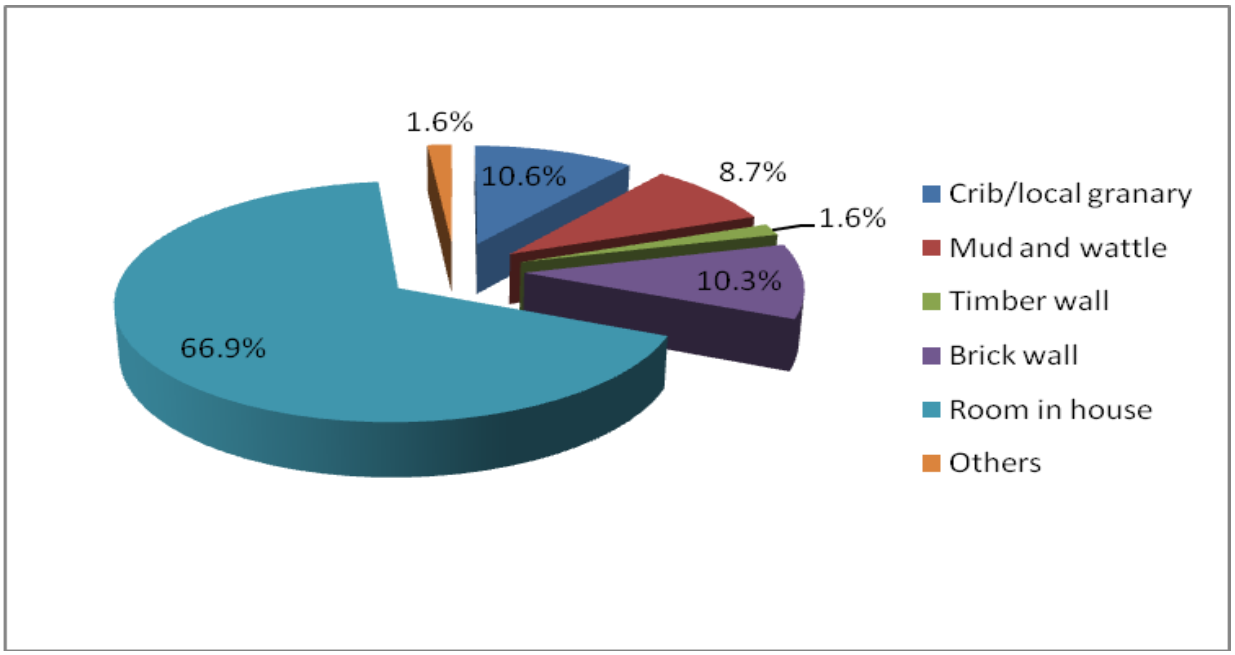


Figure 20. Type of storage facility

This is an indication that improved methods of storing produce is low as well as the change in the farming systems. Granaries were useful for storing food security crops such as millet, ground nuts and other crops which would be stored for more than one season. There has been rising popularity for storage of farm produce in polythene bags that are stacked in the house. Such bags have an intermediate ventilation rate depending on where they are located in the house. Farmers in Bukedi sub zone explained that polythene commonly known as "Kavera" are increasingly admired, as these bags are more portable in case of emergencies (e.g. floods, fires), available and affordable. They are always ready for marketing and they take up less space in the house proportionately, as opposed to a large woven granary that fills a whole room, whether empty or full. Farmers reported that when grain is in sacks, it is easier to monitor quality, and sacks are more secure as they are typically kept in the room in the house.

3.4.6 Capacity of the storage facility

Figure 21 shows that (29%) use storage facilities of between 600-1000kg while (27.5%) of the facilities were of greater than two tons. It was observed that in some households, the agricultural

produce is stored in small granaries made of local materials such as sticks and grass. Losses due to insects, rodents, birds and moisture uptake were reported to be high in these traditional farm storage facilities in Bukedi sub zone.

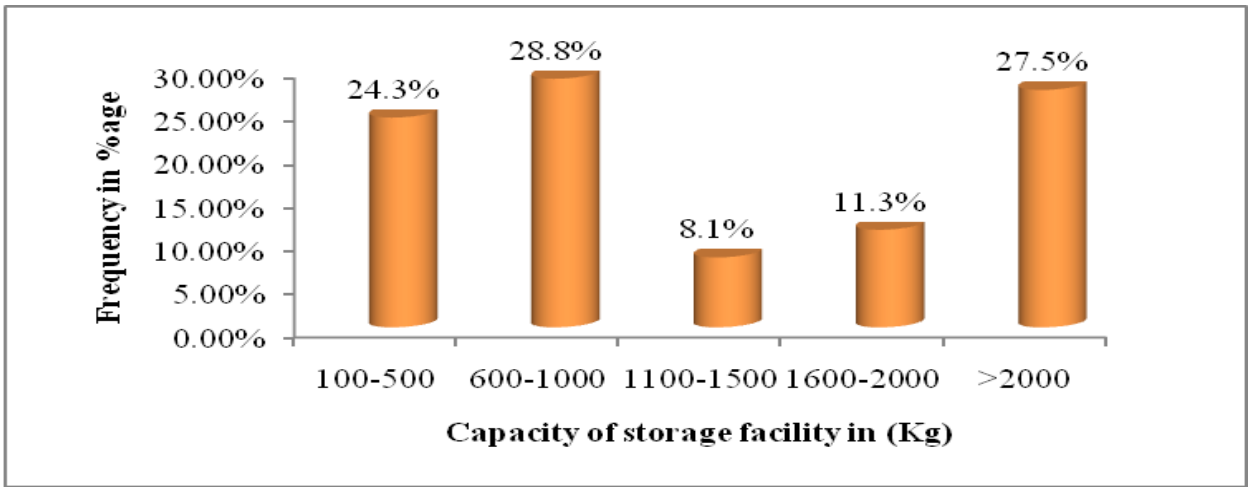
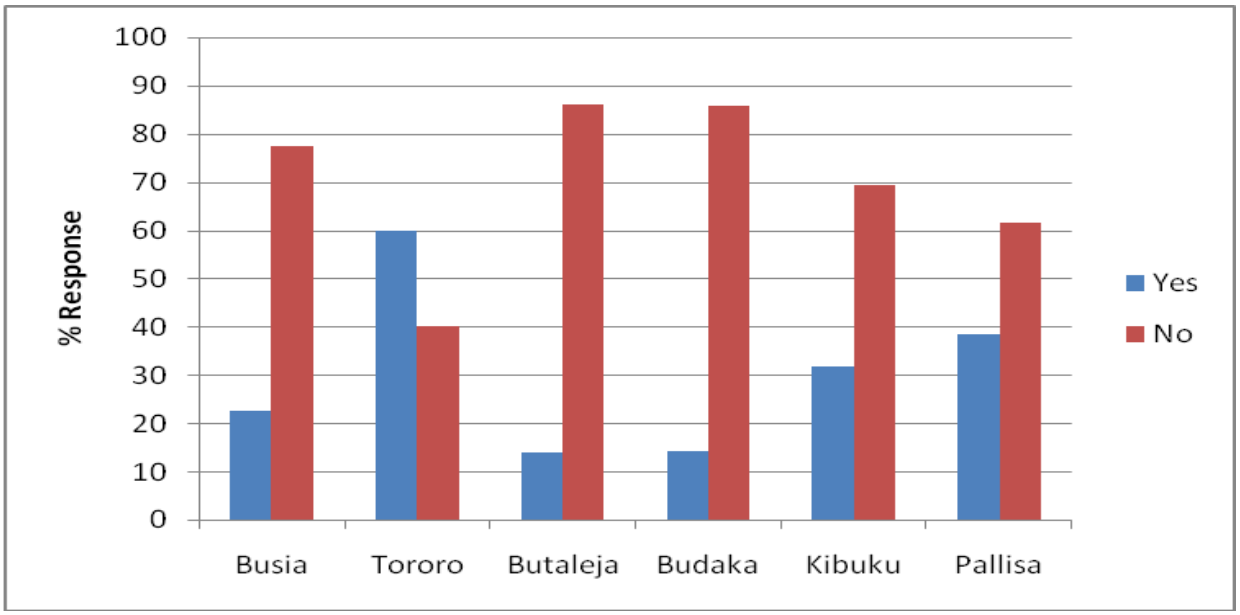


Figure 21: Capacity of storage facilities

Storage" means the phase of the post-harvest system during which the products are kept in such a way as to guarantee food security other than during periods of agricultural production. The main objective of storage in Bukedi at the farmer level is to permit delayed use (on an annual and multi-annual basis) of the agricultural products harvested.

3.5.1 Record keeping and management of information

Results from the study revealed that the proportion of farmers who keep farm records was low (Figure 22). Farmers who kept records cited a number of reasons including easy access to credit since they can improve the confidence of lenders, tracking farm performance among others.



Further analysis revealed the types of records kept by farmers which included; production, sales and management (Table 12). Most farmers acknowledged keeping some form of records especially those that relate with production such as bags of maize and cassava produced in a given season. Surprisingly, in Budaka, Kibuku and Pallisa districts none of the respondents sampled acknowledged keeping sales records. Failure to keep sales records is very dangerous since the farmer has only to rely on his /her memory thus becoming very difficult to determine the market margins. Consequently it becomes almost impossible to ascertain whether a farmer is making losses or profits in running any agricultural enterprise of interest.

Table 12: Type of records kept in percentages

District	***Type of records***		
	Production	**Sales**	**Management records**
Busia	50	0	50
Tororo	66.7	16.7	16.7
Butaleja	62.5	12.5	25
Budaka	100	0	0
Kibuku	50	0	50
Pallisa	50	0	50

3.5.2 Reasons for failure to keep farm records

Figure 12shows that limited capacity of farmers and lack of awareness were the most cited reasons why farmers failed to keep records. Perhaps this explains why agricultural productivity in this subzone has remained low since farmers don't keep records and as such cannot measure the benefits they derive from their respective agricultural enterprises. This implies that building farmers' capacity in record management will encourage more to realize the benefits and adopt the record keeping culture. Records inform the farmer on the progress of the returns to investment and which enterprise is doing well where more resources could be directed for increased profitability

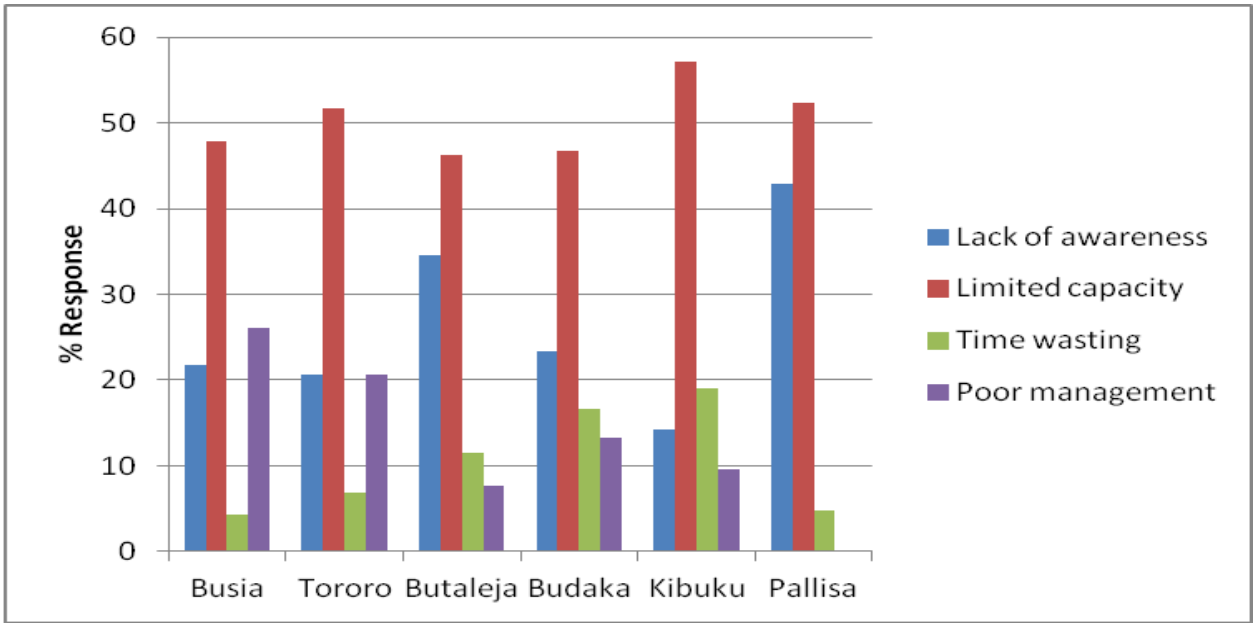


Figure 23. Reasons for failure to keep farm records

3.6.1 Belonging to any organized group

A farmer group is a collection of farmers with a common objective or problem to solve, which is often associated with the production and marketing of agricultural products. Farmer groups are important in extension and contribute to agricultural development in several ways namely: Farmers, particularly the disadvantaged (poor, women and youth) can get access to advisory services, technology, credit, markets and information. The study found that (56.3%) of the sampled households belong to organized groups where they reported that groups act as security for loans, get members voices heard to influence policy, empowers farmers to manage own

resources as well as building capacity of local communities to plan and manage their resources profitably. Farmer groups provide fora to share experiences and learn from one another. Group pressure tends to stimulate adoption of knowledge and change in adoption of best agricultural practices. Groups increase farmers' opportunities for participation in government development programmes such as National Agricultural Advisory Services (NAADS), Northern Uganda Social Action Fund (NUSAF) and others.

Most of the farmer groups that have been formed are based on the farmers initiatives as in (Table 13) as guided by government programmes. It is easier and cheaper to reach farmers in organized groups with services, opportunities and resources. Also groups are formed to create good inter-personal relationships and collaboration. Other groups were formed by development partners based on their mode of implementation of the project designs.

Table 13: Type of groups and how they were formed

Name	***Percentage***
Projects	9.3
Government officials	9.9
Farmer groups	66.2
NGO	8.6
Others	6.0

3.6.2 Objectives of the farmer groups in Bukedi

All groups are formed with varying objectives depending on the challenge to be addressed or the opportunities available. (29.4%) of the sampled households were formed for savings purposes. This clearly indicates that access to agriculture finance especially for small scale farmers is still a big development challenge. The new trend is formation of savings and credit organizations where it is a requirement to start with their own savings/financing to access credit at affordable interest rates. Crop production and other enterprises were some of the other objectives for the group's formation in Bukedi.

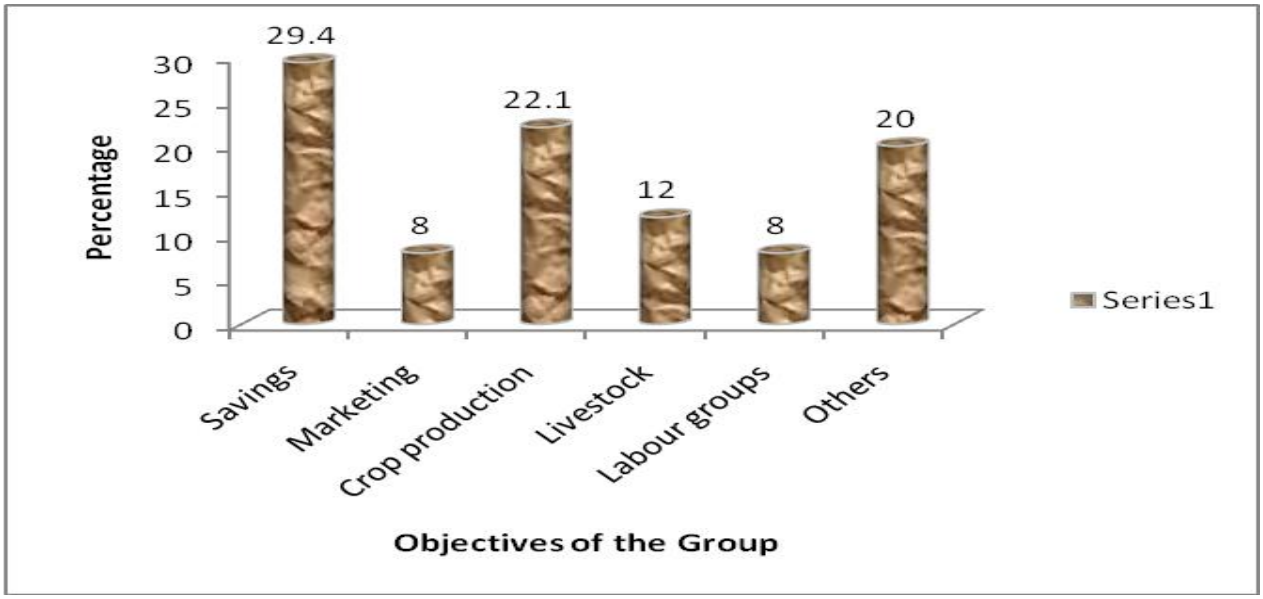


Figure 24. Main purpose of group formation

3.6.3 Forms of contribution

All groups are formed with a purpose in their set up although there are forces that influence group development and sustainable functioning which may include participation, and personality. (46.6%) of the participants joined the group to make a contribution in form of money such that they could pull resources together and empower themselves financially. (18.6%) made a contribution in form of inputs and physical resources.

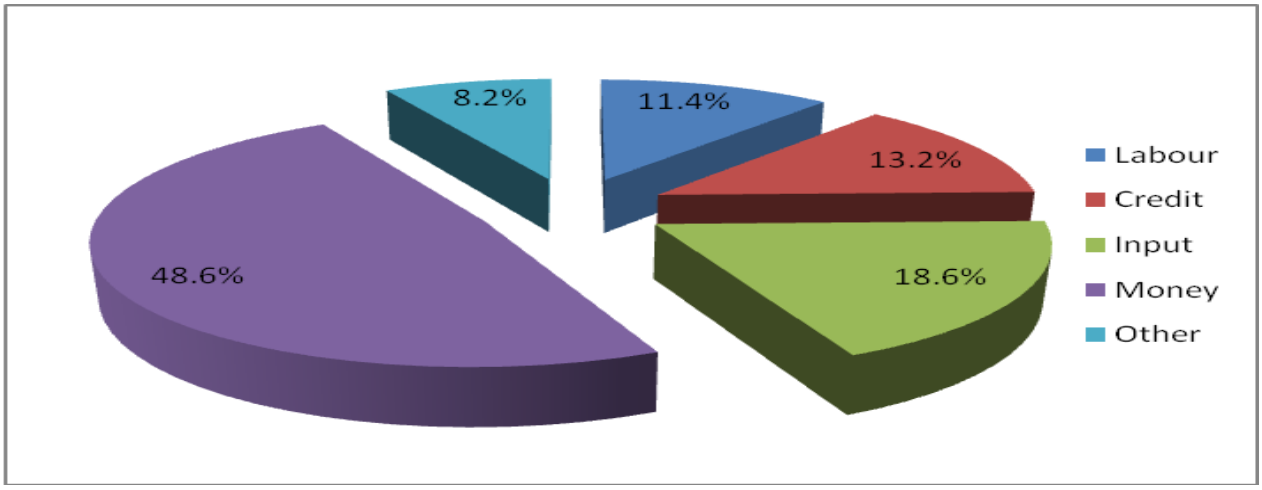


Figure 25. Forms of contribution of the group members

Land use and environment interactions in Bukedi sub-zone

Land use and environmental interactions were analyzed remotely with satellite imagery using ArcGIS. The geo-maps identified the major land use and land forms as built up areas, degraded wetlands, open water source and small scale farms. Similar land use patterns are spread across the entire sub-zone with small scale farms constituting over 80% of the farming land use, scattered trees on farms are predominant in all the districts as well as degraded wetland especially in the districts of Butaleja, Kibuku and Budaka (Figure 26).

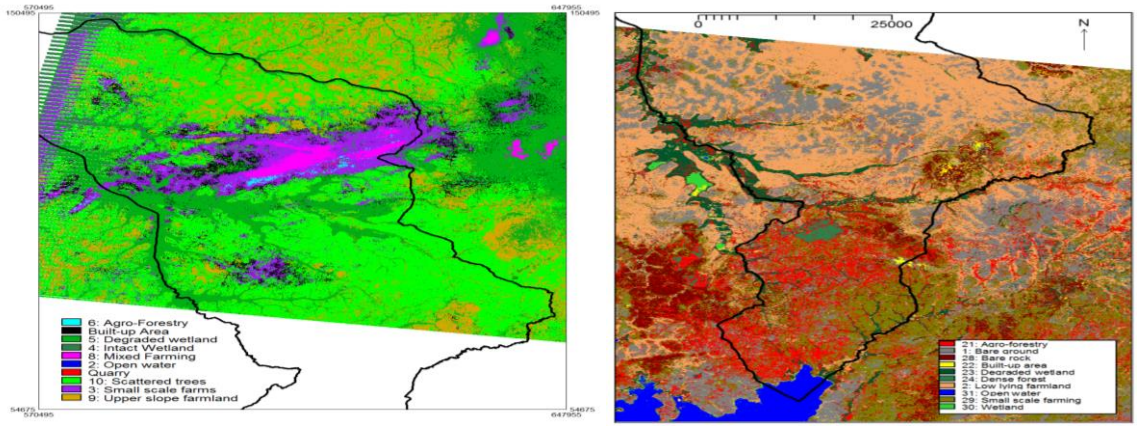


Figure 26. showing land use forms in upper and lower Bukedi Sub-zone

Land use and distribution

Twelve land use forms were generated from the satellite imagery LANDSAT 2103 for Bukedi sub zone. Small scale farming in open fields constituted half of the land in the zone (50.9%). This was closely followed by small scale agro-forestry systems with trees scattered in farmlands (23.2%). Other land use forms include intact wetlands (10.9%), mixed farms (4.5%), grass land (4.3%) degraded wetland (2.8%), Open Water (1.3%), Large Scale Farming (1.2%), Forest (0.5%) and Woodland (0.3%).(Figure 26). These land use patterns are indicative of diverse agro-ecologies in the sub-zone and also communities' strategies to cope with the changing conditions to meet the daily need for food and income. Conversion of wetlands to farms is on increase especially in rice producing areas of Butaleja and Budaka thus presenting a major environmental challenge in the sub-zone.

Figure 27. Map showing land use / cover in Bukedi sub zone

3.8 Natural Resources management

3.8.1 Types of natural resources in Bukedi

Natural resources denote any naturally occurring material that man can use to derive a livelihood. Mans survival and indeed growth and development of any economy has a direct connection with use and management of natural resources. Natural resources occur in many forms but the most recognized forms of natural resources include; land, forests, water, air and the many biological resources incidental to the aforementioned. In Bukedi and indeed in almost all parts of Uganda, livelihoods are directly derived from natural resources. Agriculture which is the back-bone of the sub-zone is dependent on natural systems and thus natural resources and their sustainable management is of critical importance for the development of Bukedi sub-zone.

The major types of natural resources in Bukedi include the following,

Land: In the study, land in Bukedi was categorized as dry and wet. The dry lands represent parcels in the main land used for cultivation purposes mainly when environmental conditions are favorable for crop cultivation. They also include land under forests, land used for grazing and marginal areas such as those occupied by rocks and land use for construction. Wetlands are areas that are in most part of the year under water or water logged. They include areas in river banks and are used for cultivation of mainly rice and horticultural crops during dry season.

Forests: Forest is a large area of land under tree cover or other woody vegetation. Food Agricultural organization defines forests as Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ (FAO, 2015). Bukedi hasa central forest reserveslocal forest reserves and private forest reserves. Besides forests are trees integrated in farms with crops used for various purposes by the community ranging from fuel wood, construction, food, soil fertility management, fodder and environmental amelioration.

Soils: Soil is a natural body upon the earth on which crops grow, and its quality varies widely, ranging from very old, weathered and leached rocks to soils inherently low in nutrient because of their clay and organic matter content (DFID, 2002). Soils especially fertile soils are a critical factor in farming and agricultural production. The type of soils and the manner in which they are used can make a difference between good agricultural yields and poor yields. Bukedi sub-zone like other parts of the zone is bestowed with rich fertile soils.However, continuous use coupled

with management practices has had a varying impact on the quality and indeed the productivity of the soils in the sub-zone.

3.8.2 Perceived soil types in the sub-zone

The soils in the zone were categorized by farmers as red, black, rocky and white (Table 14). Majority of the farmers reported soils to be of mixed in colour and texture as well.

Table 14: The perceived types of soils in Bukedi sub-zone

Soil Type of land	*Percentage*
Red	7.9
Mixed	51.3
Black	23.8
Rocky	5
White	7
Others	5

Soil colour is among the indicators of soil fertility. About (51%) confirmed that the type of the soil they had was mixed (Figure 28). Although pure black was still available in some parts of the zone, many farmers say the soils are now mixed up with varying levels of fertility. Rocky soils and white soils had on average to poor fertility according to the farmers.

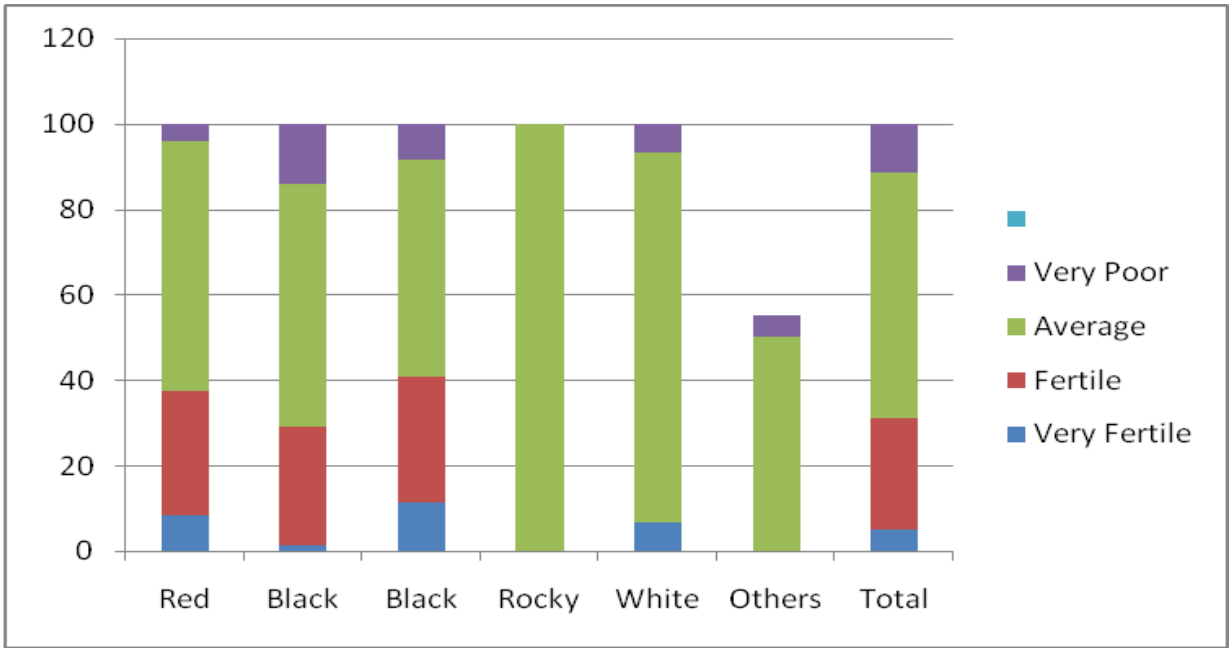


Figure 28. Soil types and perceived fertility in Bukedi sub zone

3.8.3 Land degradation

Land degradation is the temporary or permanent lowering of the productive capacity of land. It covers the various forms such as soil degradation, water resources degradation, degradation of wetlands, and forest degradation in form of deforestation. Land degradation can be caused by natural processes but often catalyzed and facilitated by anthropogenic activities and decisions. Farming activities are one of the major contributors of land degradation as practices like over cultivation, overgrazing, deforestation exert pressure on land thus resulting into lowering its ability to support livelihoods. Land is a key factor of production. In Bukedi almost all the families sampled depend on farming in one way or the other. Land utilization in the sub-zone has presented numerous challenges and opportunities for development including agricultural development.

There are various forms of land degradation at various scales in the Bukedi sub-zone. Among the most important in the sub-zone was surface compaction mainly due to drought and by grazing animals, siltation of water ways by deposits from erosion and inappropriate management of farm wastes especially in rice production systems. Soil erosion was the most significant form of degradation experienced in over (78%) of farm holdings in the sub-zone and is the highest form of degradation in all the six districts of Bukedi (Figure 29)

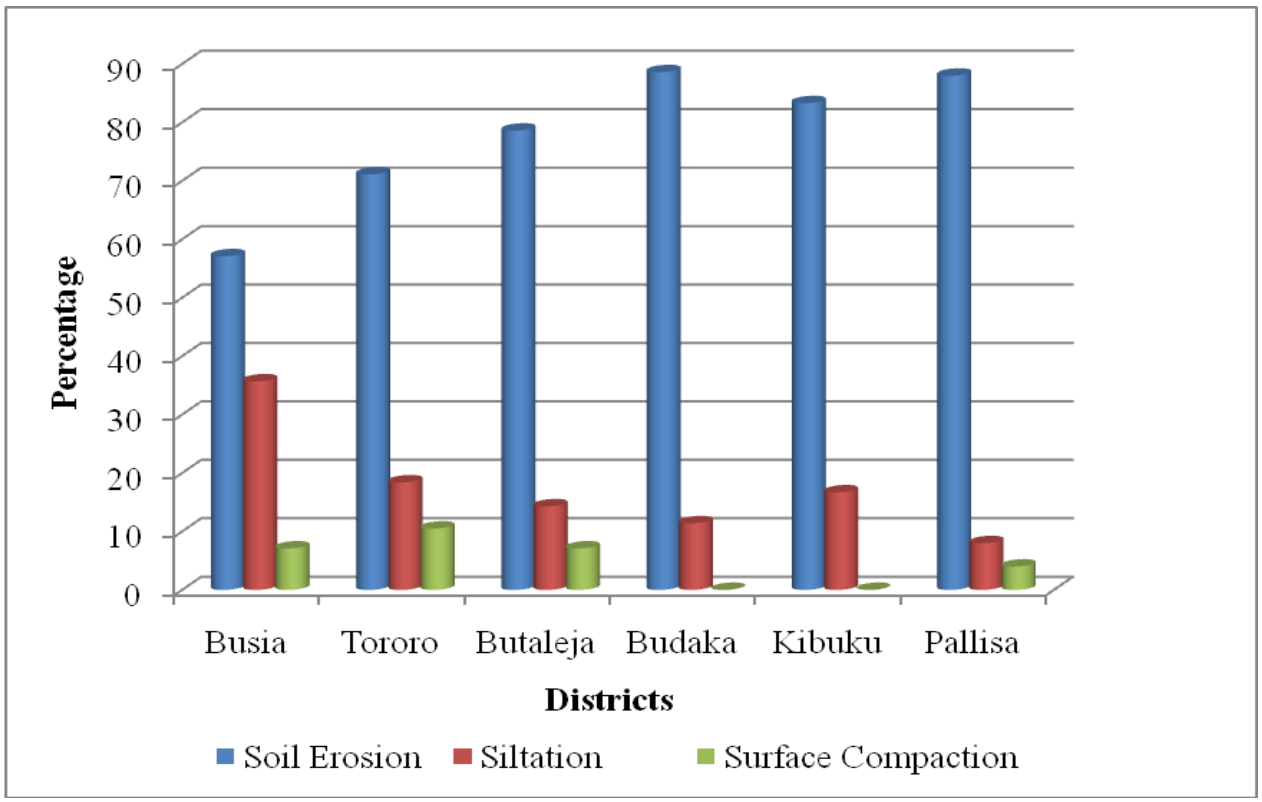


Figure 29: Land degradation in Bukedi sub zone

3.8.4 Major cause of land degradation

The major causes of land degradation were human orchestrated with over cultivation as the largest contributor to degradation (53.3%). This was closely followed by soil fertility mining (16.6%) through practices like using agricultural wastes as alternative fuel for cooking, cultivation of high nutrient demanding crops together, tree cutting including deforestation (15.5%). Other causes include indiscriminate bush clearing, bush burning, over grazing, too much rainfall that causes flooding especially in Butaleja and Tororo, drought, land fragmentation and lack of information on appropriate sustainable land management technologies which makes farmers stick to traditional and dangerous practices that do not lead themselves in the current dynamics of farming.

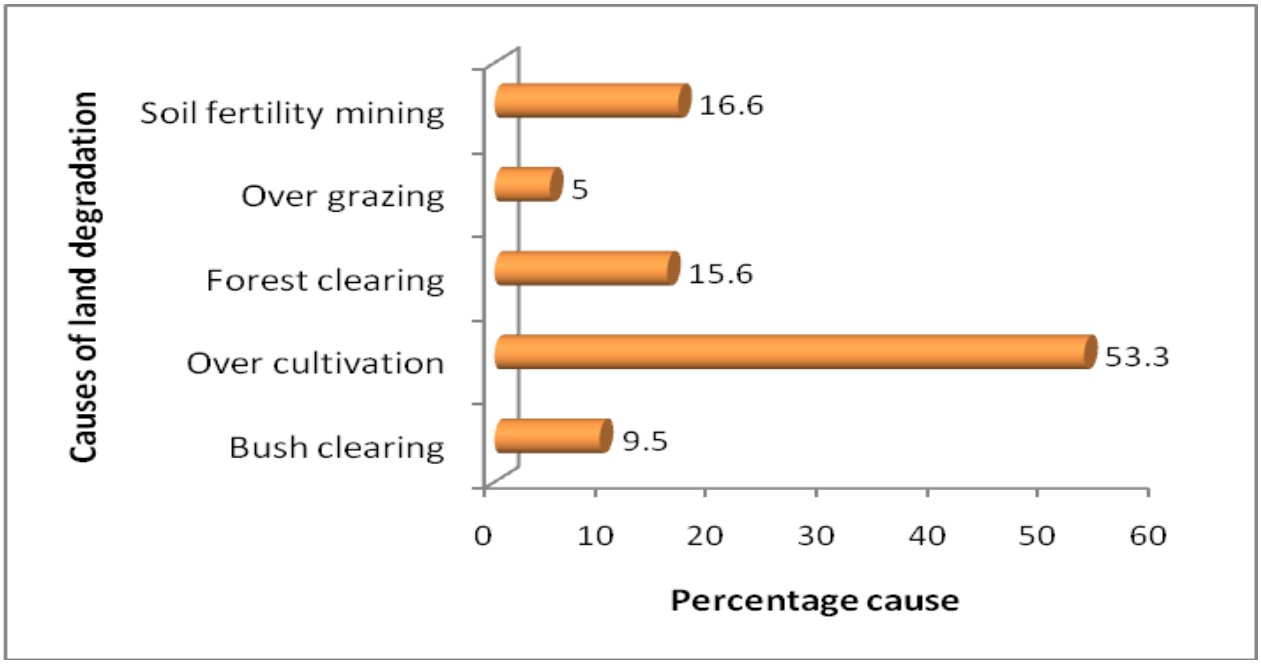


Figure 30. Major causes of land degradation

3.8.5 Measures for control of land degradation

Soil and water conservation measures exist to control land degradation. Farmers in Bukedi sub-zone have adopted to some extent soil and water conservation practices to help reverse and cope with the land degradation problems encountered in the sub-zone. The main forms of soil and water conservation (SWC) practices used by the farmers included; draining of fields (25.3%) especially in wetlands and in case of flooded fields, crop rotation (19.3%), tree planting and management (16%), intercropping with legumes and practicing zero grazing to reduce surface run off.

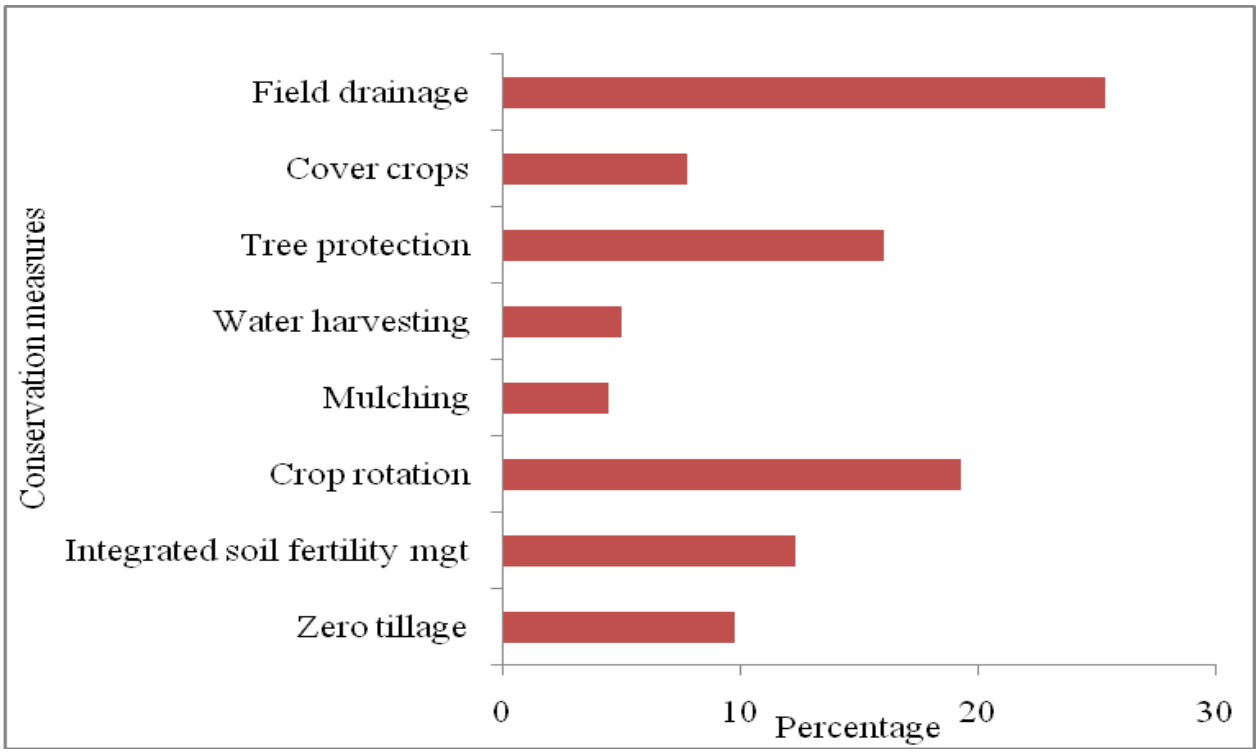


Figure 31. Conservation Measures

3.8.6 Water sources

One of the major challenges befalling agricultural productivity in Uganda is over dependence of the farming community on rainfall. This has restrained farming only in wet seasons making the farming community vulnerable to climate shocks in form of erratic and prolonged droughts. Use of water for production is one of thekey strategies in the Development Strategic Implementation Plan (DSIP) to increase production and productivity in Uganda. Irrigation systems can bring into production areas which have moisture stress and also enable production during off seasons which is most likely to earn more money for the farmer. But for this to be accomplished there is need to have reliable water source in the vicinity. This study sought to find out the available water resources in the sub-zone and how farmers use the water resources for production purposes through irrigation. The survey reveals that the major source of water (63.2%) for the people in the zone is bore hole followed by unprotected wells (5.6%). Other sources include protected and unprotected springs, piped water, seasonal streams and rivers (Table 15). This shows that the potential for irrigation is very low and unreliable due to the fluctuation of the water table of the mentioned water sources..

Table 15: Available water sources in Bukedi subzone

Water sources	*Percentage*
Well	10.6
Rivers	5
Protected Springs	3
Non protected Springs	5
Piped	5
Bore hole	63.2
Others	8.2

3.8.7 Use of irrigation on farms

Despite the erratic rainfall patterns in the sub-zone and a number of water resources available, the use of irrigation systems is limited in Bukedi sub-zone. Where irrigation is done, it is confined mostly in rice paddies with water diversions to the rice fields. Off rice paddies, irrigation is confined to what the community considers "High Value, Short term Crops" like onions, tomatoes, carrots, egg plants and cabbages. (89.7%) of the sampled households were not using any form of irrigation on the farms. This means farmers are still relying mainly on Mother Nature for their farming activities season after season. The (10.3%) who are engaged in irrigation only do it at a minimumscale and mainly in Tororo District.

Table 16: Use of irrigation on farms

District	***Use Irrigation on farm***		***Total***
	No	Yes	
Busia	94.4	5.6	(*n*=36)
Tororo	40.0	60.0	(*n*=5)
Butaleja	90.0	10.0	(*n*=50)
Budaka	92.1	7.9	(*n*=38)
Kibuku	81.5	18.5	(*n*=27)
Pallisa	94.7	5.3	(*n*=38)
Total	89.7	10.3	(*n*=194)

3.8.7.2 Type of Irrigation used

The major form of irrigation used in the sub-zone is the sub-surface irrigation mostly used in rice farming where water is diverted into channels and allowed to sip into the soil directly to the roots of the crop. Surface irrigation was used mostly on horticultural crops and also on trees especially newly planted seedlings. Other irrigation technologies used include drip irrigation and sprinkler system (Figure 32)

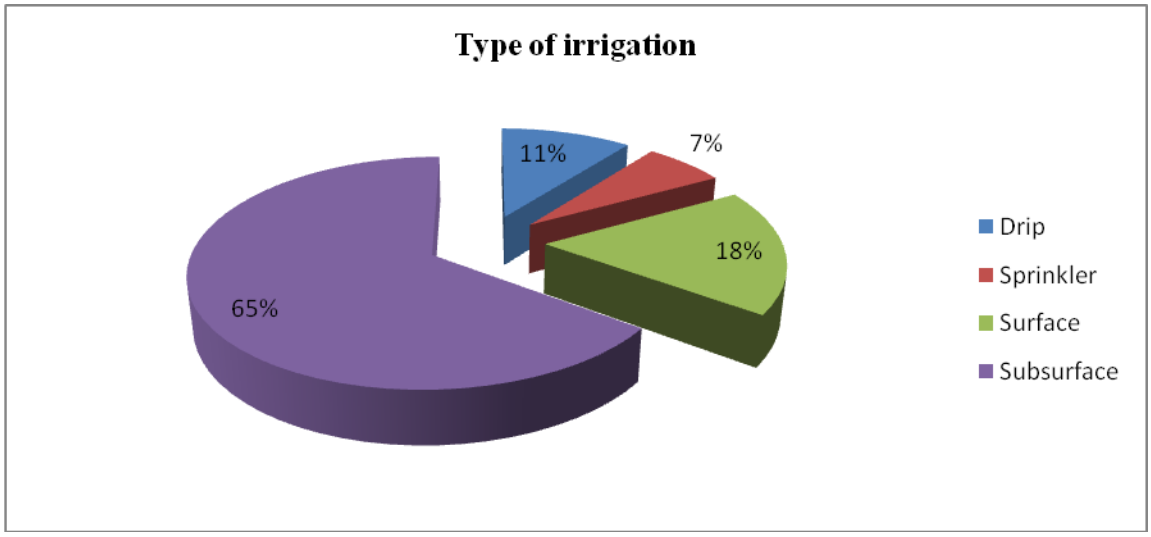


Figure 32. Type of Irrigation used in Bukedi sub-zone

3.9 Agro-forestry activities

3.9.1 Purpose for planting trees

The trees around us are extremely important and have always been necessary for improving the human condition - both during its life and after harvest. It is not a mistake to believe that without trees, humans would not exist on this beautiful planet. The modern human community has other, more practical reasons to admire and honor trees. According to the Arbor Day Foundation, "a mature leafy tree produces as much oxygen in a season as 10 people inhale in a year.".

Trees are mainly grown for fruits/ food, timber and soil improvement (Figure 33). Trees help cleanse air by intercepting airborne particles, reducing heat, and absorbing such pollutants as carbon monoxide, sulfur dioxide, and nitrogen dioxide. Trees remove this air pollution by lowering air temperature, through respiration, and by retaining particulates. Trees fight soil erosion, conserve rainwater and reduce water runoff and sediment deposit after storms

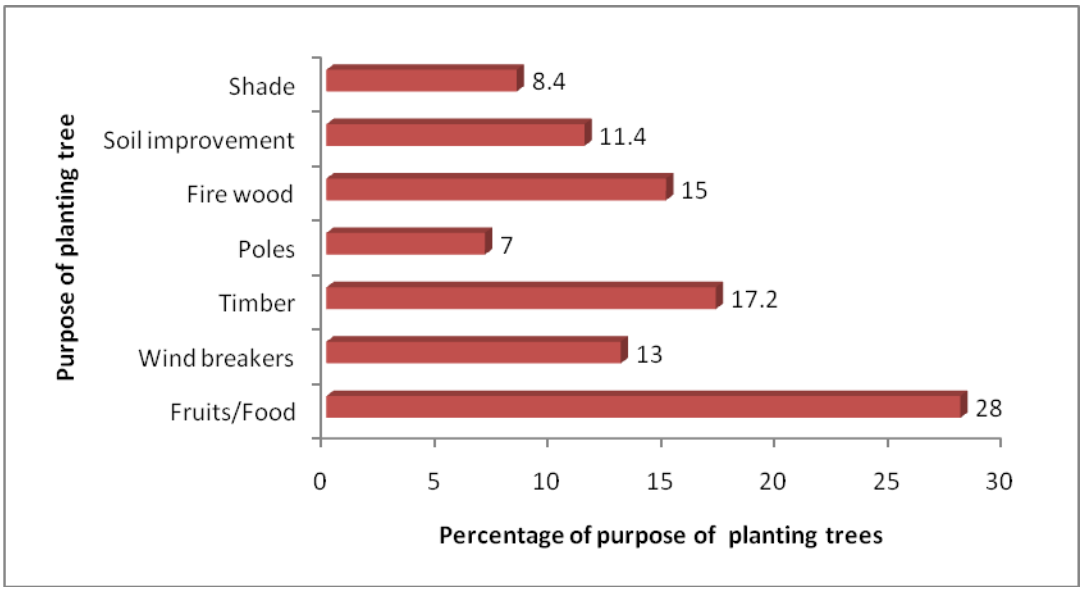


Figure 33. Reasons for planting trees in the sampled households

3.9.2 Crops intercropped with trees in Bukedi region

There is now general agreement about the magnitude and scale of the integration of trees into agricultural lands and their active management by farmers. Agro forestry systems include both traditional and modern land-use systems where trees are managed together with crops and/or animal production systems in agricultural settings. Coffee was observed as the major crop where integration with trees was common constituting (22%), sorghum 18% and cassava (13.6%). This is because trees create a micro-environment for the proper growth of the crops especially coffee. Tree leaves on falling decompose and form humus in the soil which influences cation exchange capacity (CEC) of useful minerals in the soil which is a very important soil property influencing soil structure.

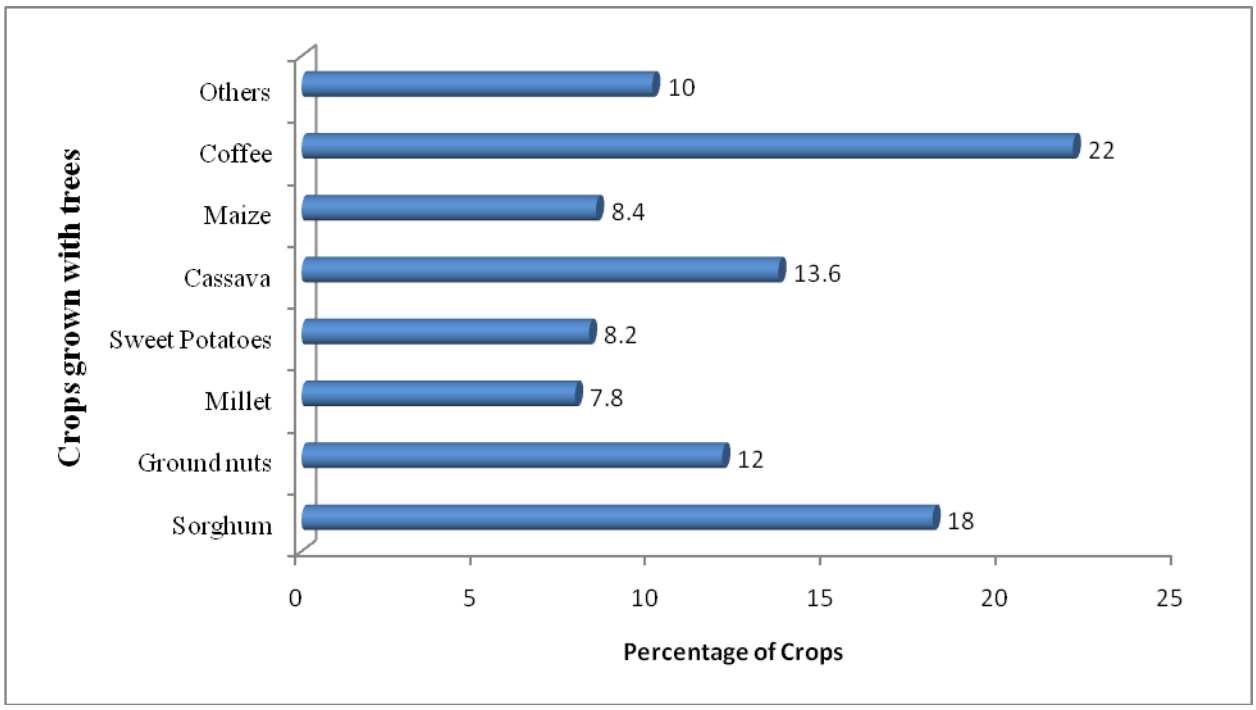


Figure 34. Crops grown with trees

3.9.3 Management practice of tree crops

Tree establishment in Bukedi sub zone and elsewhere has become a lucrative business because of the high demand for their products such as timber, charcoal, firewood and poles. However, this undertaking has been affected by poor management practices.among the management practices carried out on trees, watering (41%) was the most common management practice especially when the trees are in the early growing stage at nursery. Although farmers have been using the traditional methods to establish trees, it has been observed that raising tree nurseries has improved using local practices. Nevertheless, none has shifted from the old labour intensive operations of employing manual power as watering, under-cutting (root pruning), weeding and spraying to some extent. In the study conducted in Bukedi sub zone farming system, trees constituted part of the farming system although on scattered plots.

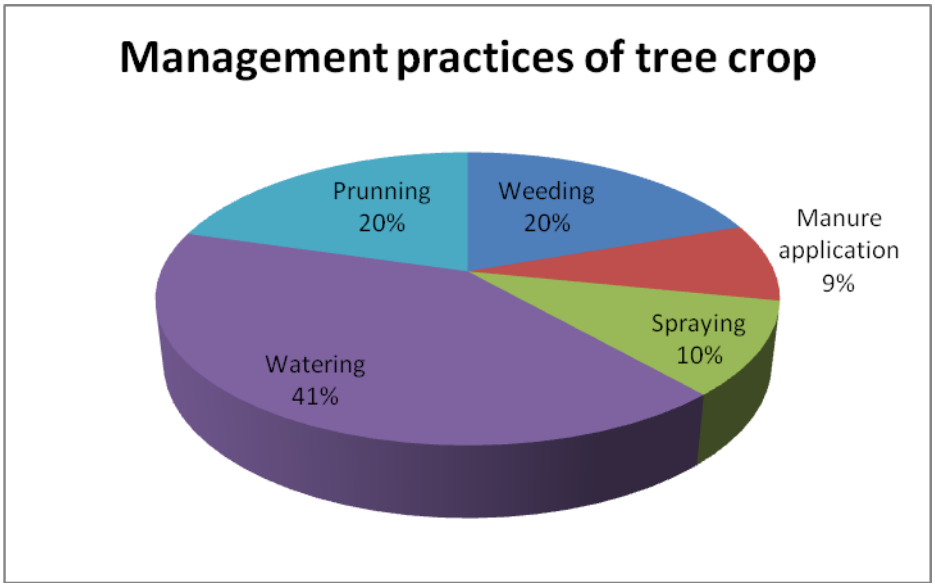


Figure 35. Management practices of tree and crops

3.9.4 Type of tree and Species preferred

Further analysis of the most preferred tree types and species indicated that about (41%) of the respondents cited mangoes as a key tree crop followed by Eucalyptus and Jack fruit. Musizi and Mvule were also grown at a percentage of (6%) and (6.6%) respectively. Mangoes dominated because they are the Indigenous fruit trees that since time in memorial have been used as an alternative source of food and nutrition for many people in Bukedi. Commercialization of improved mango fruit varieties (i.e. Tommy, Pinero, Florigon, Boribo, Bire, Purple Mango, etc) for improved livelihoods and household is becoming a common practice in Bukedi especially in Pallisa, Budaka and Kibuku districts.

Table 17: Types of trees and Species preferred

Tree type	***Percentage***
Mangoes	41
Eucalyptus	23.2
Jackfruit	17.9
Musizi	6.0
Mvule	6.6
Others	5.3

3.9.5 Why these species are preferred

Growth and market attributes were the most important factors farmers consider while growing tree crops (Figure 36). Additionally results showed that about (28.%) grow trees to market the

products like fruits and (13.4%) grow the trees because they provide good timber and also for multip purpose (13.4%) .Others preferred them because they are fast growing for example eucalyptus, improved mangoes, Gravellea, Calliandria and Cordia africana. This implies that farmers can harvest them early and get income from their products.

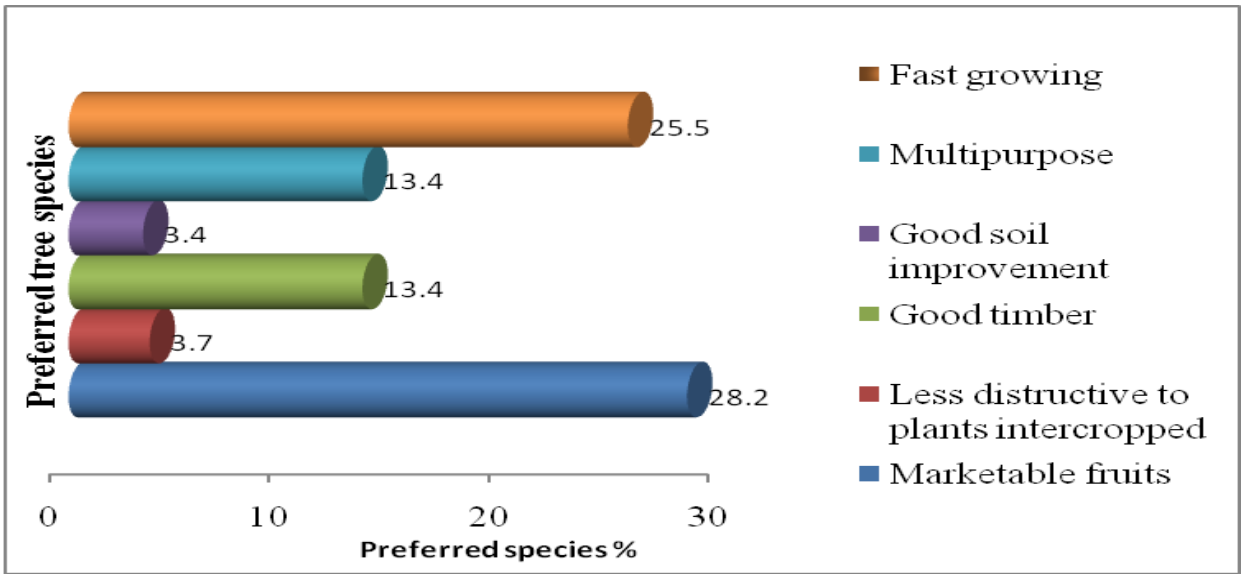


Figure 36. Why prefer the tree species

3.9.6 Marketing of tree products

Figure 37 shows that the largest proportion (72%) of the tree products are sold at the farm gate, (11%) is sold along the road side and only (9%) is taken to the designated markets. 8% is sold in other areas. According to mango growers and sellers along Tirinyi road, the biggest buyers of mango fruits are wholesale buyers from Kampala who buy fresh fruits from the farmers' fields in large quantities at negotiable price of between shillings 150,000 to 250,000 per bag translated to (US dollars 60 to 100) depending on the variety, quality and distance from the road.

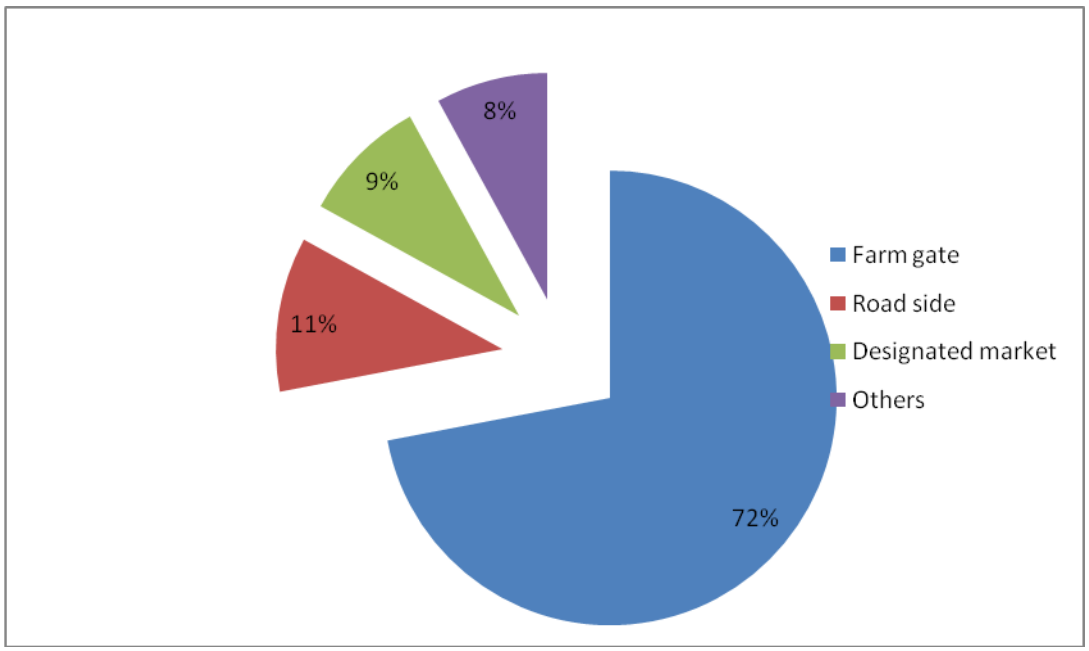


Figure 37. Marketing of tree products

Emerging farming systems

Traditionally the system has for long been known as cassava-ground-nuts-millet farming system. However, the study has revealed new farming systems are emerging for example apiary and fish farming are increasingly becoming integrated thus changing the system (ANNEX ….). Beekeeping was observed in Pallisa and Budaka districts with Pallisa registering more progress in the sub counties of Agule, Apopong, Butebo and Olok. It was also noted that farmers in these sub counties have combined beekeeping with citrus production to enable the bees get nectar and also for improvement of household income as they are able to benefit for both enterprises. (CHECK ON THE NEW FARMINGSYSTEMS IN TORORO)

4. CHALLENGES AND OPPORTUNITIES FOR RESEARCH

4.1 Challenges limiting crop production

Figure 38 shows the various challenges limiting crop production in Bukedi sub zone. Weeds, Pests and dieases were the most cited challenges hindering crop production. Respondents also acknowledged drought/floods, lack of labour, lack of inputs and low prices among others. Cases

of theft of crop produce were rampant and only reported in Butaleja. Low prices were only reported in Tororo. Perhaps this can be explained by the fact that some farmers in a peri-urban setting of Tororo municipality were not happy with the prices they are offered.

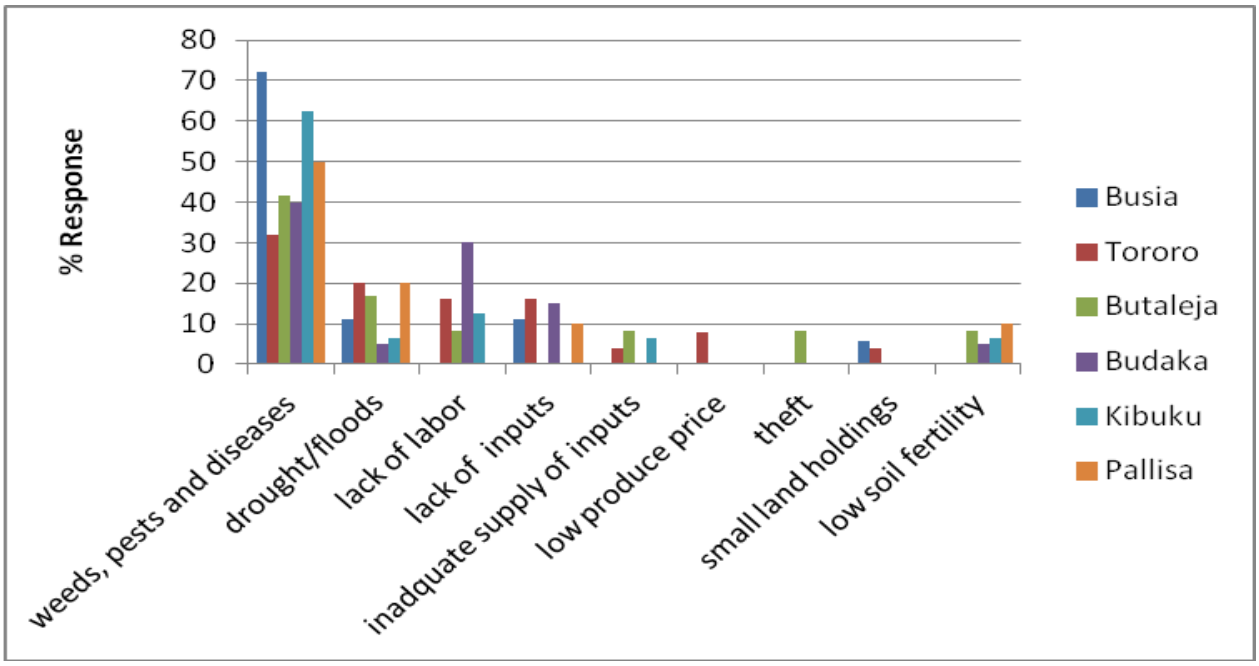


Figure 38: Challenges limiting crop production

4.2 Challenges constraining livestock production

Results showed that livestock production faces a number of challenges which included diseases, poor breeds, lack of veterinary services and lack of grazing land among others (Figure 39). Livestock diseases was the most cited challenge encountered by farmers accounting for (25%), followed by poor grazing land (15%), parasites and low market prices for animals and animal products (12%) respectively. The common diseases mentioned during the focus group meeting included Foot and mouth disease (FMD), East coast fever (ECF), and New castle disease (NCD). Participants in a focus group discussion also mentioned key parasites such as tsetse flies, ticks and worms among the key constraints hindering livestock production. Other constraints pointed out include poor breeds. All these constraints mentioned a have caused or contributed to massive loss of livestock in the region to the extent that government had to introduce quarantine as a measure to curb some of the devastating effects. In a related study Kirunda *et al.* (2013) reported that diseases especially ECF were the most common challenges facing livestock keepers in the western rangelands. The same authors reported that prevalence of livestock diseases was highly

influenced by seasons and existing management practices. Perhaps this calls for improved livestock management in Bukedi subzone in order to improve livestock productivity.

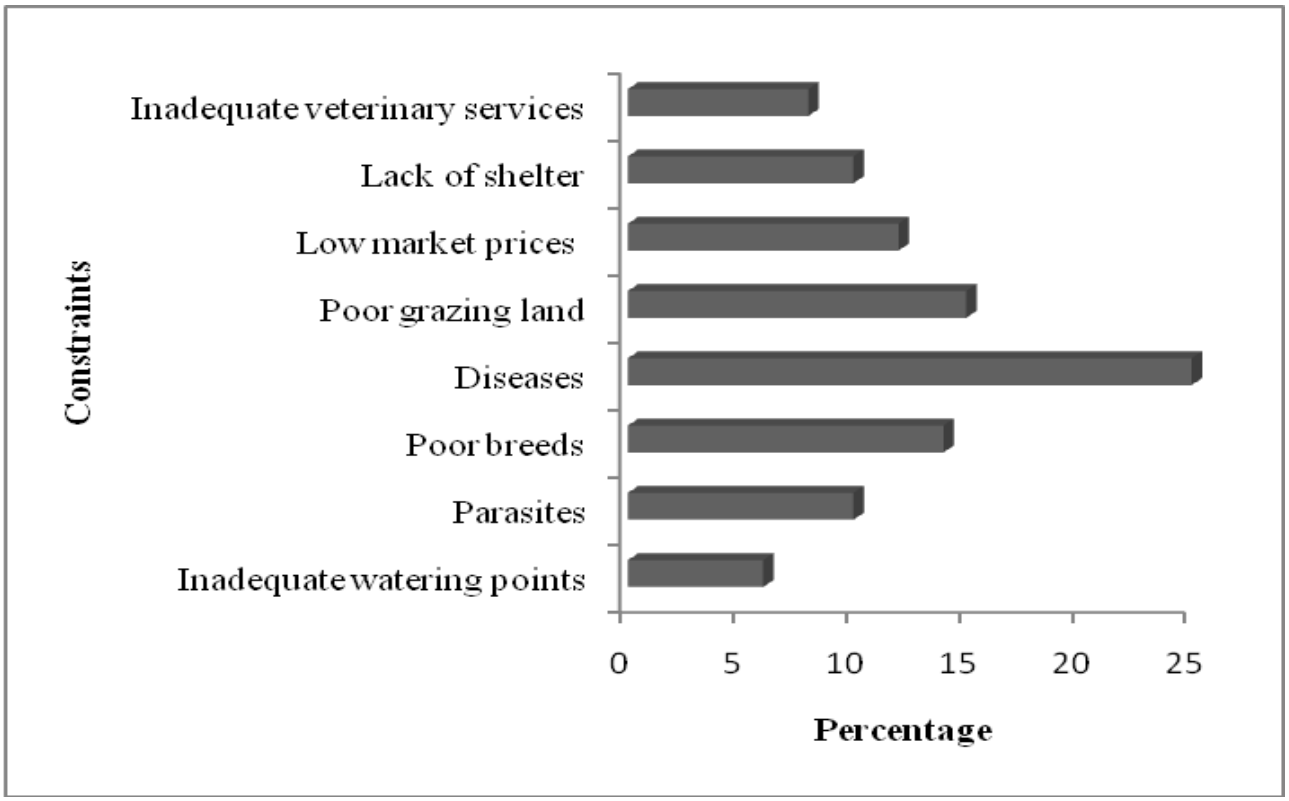


Figure 39. Livestock constraints in the sampled households in Bukedi

- Inadequate livestock feed resources Results indicate that shortage of good quality pastures/feeds for livestock was among the most referred to challenges. Availability of pastures highly depends on rainfall indicating that availability of pastures in all surveyed districts is seasonal. Because of erratic rainfalls, shortages of available pasture are frequent and a major constraint to livestock production in the Bukedi sub zone. A pasture improvement programme involving local people should therefore be considered. The planting of stunt resistant Napier grass and high fodder yielding indigenous trees and shrubs is one strategy being undertaken by NaLIRRI in the sub zone to increase the dry matter output of the local grass and increase intake by the livestock.
- High cost of veterinary drugs and related services. The government effort to control animal diseases and parasites has registered limited progress in the sub zone as a result of

inadequate personnel and inputs. Private veterinary services are expensive and inaccessible since those farmers with sufficient income are only those who can afford.

- Poor extension advice is considered to be a major constraint in improving farmers' skills and therefore proper husbandry practices in livestock management must be done to ensure higher productivity.

4.4 Research Needs

- It has been widely believed that the decline of agricultural productivity in Uganda could be as a result of little use of modern inputs, yet about 30% of Ugandan soils are categorized as being of low productivity. The factors underlying the low level of modem input use is lack of an efficient distribution system that would ensure timely availability of inputs at reasonable prices. To increase agricultural productivity, use of productive inputs like fertilizer, pesticides, high-yielding crop varieties, and improved livestock breeds is the answer. There is therefore need to carry out studies on productivity efficiency and input use to determine product-input combination and product-product mix to increase productivity.
- Return to factors of production is very low in Uganda. Most farmers in Bukedi sub zone are not able to realize a return to their efforts .This is primarily due to low market prices, poor yields, poor record keeping and poor access to markets. Difficult market access restricts opportunities for income generation. Remoteness increases uncertainty and reduces choice: it results in more limited marketing opportunities, reduced farm-gate prices and returns to labour and capital, and increased input costs.

Enhance crop-Livestock integration production

Results from the study have provided evidence that both crop and livestock production in all participating districts was low. Probably this can be explained by poor husbandry practices and lack of good or superior genetic materials.

Inadequate farming skills have also limited the extent of traditional farmers to practice proper husbandry in Bukedi sub zone. Insufficient extension advice is also a major constraint in improving farmers' skills in proper crop and livestock husbandry practices. There is need to carry out on-farm research to determine the major constraints limiting

on-farm production and determine cost-effective production systems adaptable by farmers. Research-extension-farmer linkages need to be improved through on-farm demonstration and farmer field schools.

Climate change

Climate change and its environmental implications pose serious impacts on production of crops and livestock resulting into severe famine and food shortage. Consistent monitoring of the weather patterns, rainfall, and general climatic changes is necessary. Studies to determine the likely occurrence of drought or excessive rains are crucial. In addition, given the ecological zoning of the country, proper assessment of weather pattern relative to these zones is fundamental.

Weed encroachment

Notorious weeds like *Striga hermonthica* are seriously limiting crop productivity. - Weeds show allelopathic effects on desired crops by secreting chemicals that inhibit their germination and growth. The cost of removing weeds increases the costs of production. *Striga hermonthica* was the most devastating weed in the sub zone; this was mostly observed in Busia, Tororoand Butaleja districts. Interventions to control *Striga hermonthica* exist (Bisikwa *et al*., 2010). However, farmers have not adopted the interventions consequently *Striga* has continued to be a serious menace in cereals. Perhaps, this calls for an investigation to understand why farmers have failed to control *Striga hermonthica* despite the existing interventions.

4.5 Opportunities

- Existence of District Adaptive Research Support Teams (DARST) in each district to improve research-extension links with the Zonal Agricultural Research and Development Institutions such as National Livestock Research Resources Institute (NaLIRRI) in Tororo which builds the capacity of both Field Extension Workers and farmer institutions.
- Availability of development partners for example Action AID Uganda, World Vision, SNV, FEDE-EU,PREFA, Star In, BAILOR College of Medicine, VECO East Africa,IFDC, UCA, NUSAF, CAIIP and external donors which are promoting livestock improvement and are also providing animals to farmers as well as inputs and market information.

- Multi-stake holder Innovation platforms for key priority commodities such as cassava and rice have been established to improve marketing service delivery and enabling policies.
- There exists a wide range of experiences on sustainable land management (SLM) techniques/technologies that are ready for scaling up in the appropriate farming systems liketerracing to control soil erosion, mulching and contour ploughing, agro forestry,conservation agriculture and integrated nutrient management (INM)

Recommendation

Research should be intensified in the area of identifying well adapted, high yielding varieties of crops within the sub zone of sustainable farming systems approach to boost productivity and livelihoods of small holder farmers.

The demand for forest products is increasing due to the increasing population, therefore improving the technologies in forest production by availing seed and planting materials and management of the forests in Bukedi sub zone need urgent attention.

There is therefore need to carry out studies on productivity efficiency and input use to determine product-input combination and product-product mix to increase productivity
There is need to carry out on-farm research to establish the major constraints limiting on-farm production and determine cost-effective production systems adaptable by farmers. Research-extension-farmer linkages need to be improved through on-farm demonstration and farmer field schools.

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