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Farmers' Perceptions and Knowledge of Crop and Livestock Production in Bukedi Subzone of Uganda

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Abstract
This study was conducted to investigate farmers' knowledge and challenges encountered in order to inform stakeholder's decisions and recommend priorities for improved livelihoods in Bukedi subzone. Data was collected from 336 respondents through face to face household interviews using pre-tested semi-structured questionnaires and analyzed using SPSS software. Results showed that rice and cassava were the most important crops in wetlands and dry lands respectively. Most of the livestock species kept were of indigenous genotype. The number of cattle and goats owned per household were not significantly different ($P < 0.05$). Busia district had the highest number of cattle owned per household. Animal draught power was important for opening up land in all districts. The proportion of households keeping farm records was still very low although Tororo district had the highest number of famers who kept records. Lack of awareness and limited capacity were key reasons for failure to keep farm records. Proliferation of parasitic weeds like *Striga* spp, pests and diseases, frequent droughts, lack of farm labour, low market prices and remoteness of some villages were among the most reported challenges limiting crop productivity. Livestock diseases, inadequacy of veterinary extension services and poor quality pastures were the most reported challenges limiting livestock production. Therefore future agricultural research investments should aim at control of crop parasitic weeds like *Striga spp,* developing high yielding varieties of cassava, rice, maize and millet and identify least cost interventions which can prevent or reduce prevalence of livestock diseases and promotion of high quality pasture species for improved livestock production in the region.
Keywords: Challenges, crop and livestock, Farmers, knowledge, Uganda

1. Introduction

In Uganda, agriculture contributes about 21% of national gross domestic product (GDP) and provides employment to over 70% of the entire population (UBOS, 2014). The country is divided into seven major agro-ecological zones which are defined according to economic and social backgrounds, ecological conditions (soil types, topography, rainfall) and farming systems and practices that are fairly homogeneous (Mwebaze, 2002). Among the seven zones is the South-Eastern agro-ecological Zone (SEAEZ) which encompasses areas surrounding Bukedi, Busoga and Mt. Elgon sub zones in Eastern Uganda. In all subzones, agriculture (crop and livestock production) is main livelihood activity. However, agricultural productivity has largely remained low and poor compared to other areas in the country (UBOS, 2014) inspite of all efforts by Uganda government and her development partners to increase production. For example, Apac, Isingiro, Iganga and Ntungamo districts were the highest producers of cassava, banana, maize and beans respectively (UBOS, 2014). Elsewhere studies have shown that farmers have knowledge and measures to improve agricultural productivity (Okoba and Graaff, 2005) despite the fact of the various challenges encountered. Moreover, developing appropriate sustainable agricultural interventions the level of farmers' knowledge and skills is very critical. The study was therefore undertaken to: (i) establish farmers' perceptions and the level of knowledge and skills in existing agricultural enterprises and (ii) ascertain challenges limiting agricultural production in Bukedi sub zone. Establishing farmers' knowledge and challenges limiting agriculture production could inform the decision making processes when designing and developing appropriate interventions to ensure sustainable agricultural development in the region.

2. Materials and methods

2.1 Description of the study area

The study was conducted in six districts of Uganda's south east agro-ecological zone. The 6 districts included; Budaka, Busia, Butaleja, Kibuku, Pallisa and Tororo (Figure 1). This area is commonly known as Bukedi sub-zone, which is located between $34^0 18'$E $1^0 11'$N and $33^0 23'$E and $1^0 20'$N. Bukedi subzone comprises of land area of about 845.5 Km^2 which is interrupted with wetlands. Major soils are characterized as sandy clay loams. Bukedi subzone experiences a bi-modal rainfall pattern with maximum peaks during May and October while annual rainfall ranges between 1130 mm and 1720 mm. Minimum and maximum temperature ranges between

16.2 and 28.7 degrees Celsius respectively.

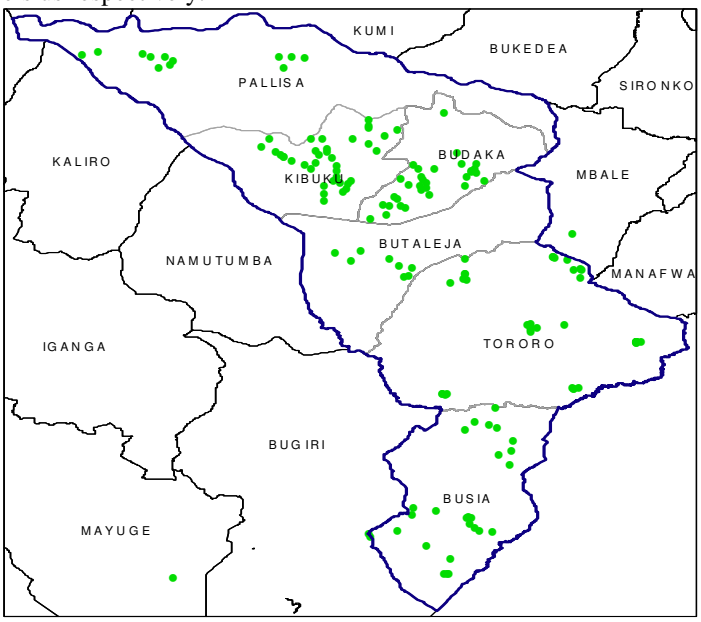

Figure 1. Bukedi subzone districts (boundaries marked with dark blue line)

2.2 Study design, data collection and analysis

A household survey which involved use of multi-stage sampling techniques with a combination of purposive and simple random sampling procedures was conducted in Bukedi subzone. The first step involved purposive selection of two sub-counties for the study sites carrying out agricultural activities in "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 raising a total of 24 parishes and 48 villages in the study area. The final stage was the use of simple random sampling of household heads from the selected villages. Respondents were finally selected from village lists provided by the respective sub county Coordinators of the National Agricultural Advisory services programme and the Community Development Officers (CDOs). Fifty six respondents per district were randomly selected raising a total of 336 respondents. Data was collected through face to face interviews with household heads using pre-tested semi-structured questionnaires. Collected data was then cleaned to ensure consistency and no missing values. Data was coded and entered into SPSS software version 18 (SPSS Inc, 2009) spreadsheet and analyzed.

3. Results

3.1 General household demographics

Majority (over 70%) of the households were male headed. Overall most of the respondents were in the 38 - 47 age group representing 26.2% of all the households. In all districts, respondents who had attained tertiary education were less than 30% (Table 1). Additionally in Budaka and Tororo districts all respondents had attained some level of education. Busia district had the least of the respondents who had attained education beyond secondary level. Formal education included training at all levels of post-secondary education.

Table 1. Household demographics of the surveyed households

	Busia	Tororo	Butaleja	Pallisa	Budaka	Kibuku
Gender (%)						
Male	73.2	90	85.2	70.9	75	82.9
Female	26.8	10	14.8	29.1	25	17.1
Family size	7.7	7.1	7.3	7.3	8.0	9.2
Age (years)						
18-27	15	11.7	8.2	7.3	18.2	14.6
28-37	20	15	26.2	20	18.2	29.3
38-47	27.5	31.7	26.2	27.3	25	19.5
48-57	12.5	23.3	19.7	23.6	27.3	14.6
>58	25	18.3	19.7	21.8	11.4	22
Education level						
No-formal	4.9	0	4.9	12.7	0	9.1
Primary	41.5	51.7	42.6	41.8	24.4	29.5
Secondary	48.8	40	45.9	34.5	51.2	50
Tertiary	4.8	8.4	6.5	10.9	24.4	11.4

3.2 Available land resources

The amount of land owned per household directly influences the cropping patterns and other land use activities. Results showed that the amount of land available per household in all six districts was appreciably small, an average of less than 3 Ha (Table 2). However, households in Pallisa district had relatively large sizes of land compared to other districts while Kibuku had the smallest land sizes owned per household. High standard deviation values across all districts provide evidence that some households which didn't own land also existed.

Table 2. Average land size per household in hectares

District	Hectares
Busia	2.0 ±2.9
Tororo	2.1 ±3.1
Butaleja	1.9 ±2.2
Budaka	2.6 ±3.4
Kibuku	1.2 ±2.1
Pallisa	2.7 ±3.9

3.3 Livestock production

Cattle, goats, pigs and poultry were the most livestock species kept in the study areas. In all districts the number of cattle and goats owned per household were not significantly different (Table 3). However, there was a significant ($P < 0.05$) difference in the average number of pigs kept per household in Busia, Budaka, Butaleja, Pallisa and Kibuku districts. The number of chicken kept per household was higher compared with other livestock species. There was no significant difference in the number of chicken kept in the districts of Kibuku, Pallisa, Tororo and Busia. Busia district had the highest number of chicken kept compared with other districts while Tororo had the least number of chicken per household (Table 3).

Table 3. Average livestock herd size per household

Livestock type	Budaka	Busia	Butaleja	Kibuku	Pallisa	Tororo
Cattle	4.9 ±5.01^{a}	6.2±6.74^{a}	5.7±4.91^{a}	4.6±4.45^{a}	4.0±3.57^{a}	6.1±5.2^{a}
Goats	3.9 ±3.39^{a}	5.86±5.9^{a}	4.8±4.4^{a}	4.7±4.6^{a}	3.8±3.61^{a}	4.1±2.5^{a}
Swine	4.8±3.8^{a}	13.6±26.0^{b}	0.4±0.9^{a}	4.5±2.1^{b,a}	4.1±3.4^{a}	6.2±7.6^{a,b}
Poultry	16.3±17.4^{a}	12.7±9.4^{b}	17.7±16.9^{a}	15.6±13.9^{b}	12.6±12.0^{b}	14.3±19.4^{b}

***** Row figures with different superscripts are significantly different *($P<0.05$).*

Most of the livestock kept were of indigenous types (Figure 2). However, cases of improved genotypes especially in cattle, goats and poultry exist in most districts. Kibuku district had more farmers keeping improved genetic crosses in cattle than any other district. Improved genetic crosses of goats were the most common in all districts compared to other livestock species.

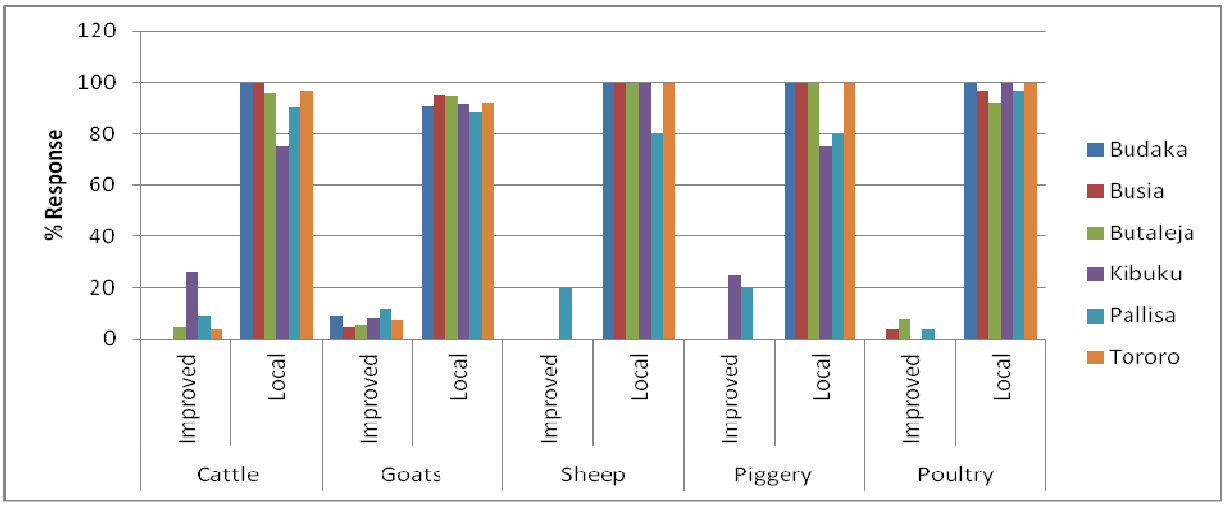

Figure 2: Type and breeds of livestock kept in percentages

3.4 Crop production

Maize and cassava were the most common crops grown (Figure 3). Millet and rice were also commonly grown in most districts. Sorghum, ground nuts and cotton were also reported though at a small scale.

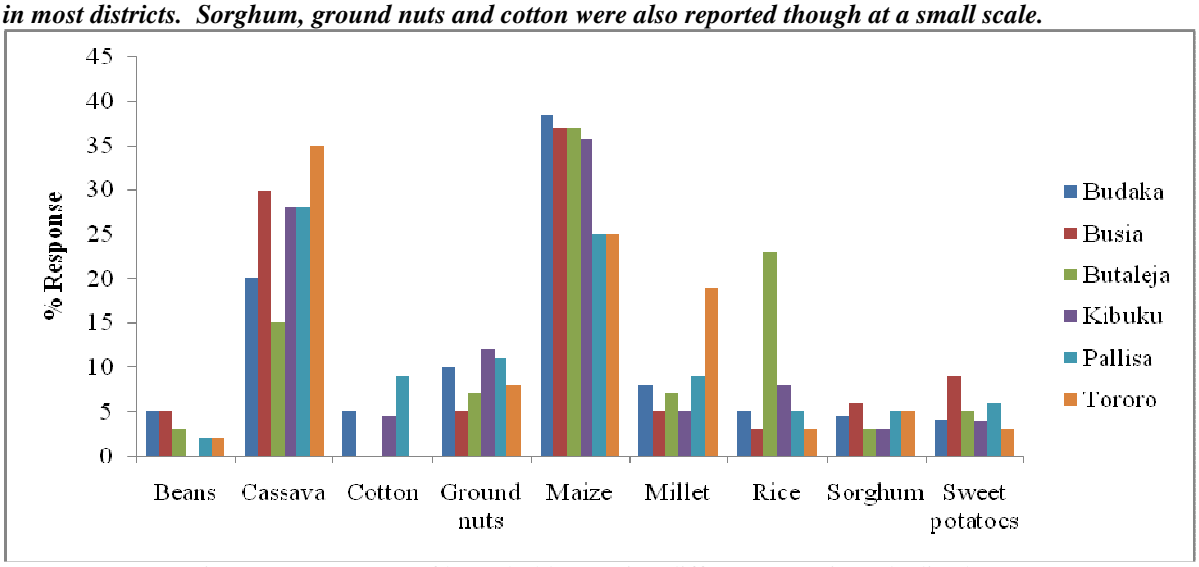

Figure 3. Percentage of households growing different crops in Bukedi subzone

However, further analysis of the most important crops revealed that Rice was ranked first in the wetlands of Budaka, Butaleja Kibuku and Pallisa district while in Busia and Tororo districts the most ranked crops were Maize and Millet respectively (Table 4). Cassava was ranked first most important crop in the dry areas of most districts except in Budaka and Butaleja where maize was ranked first compared with other crops. Overall, cassava and rice seemed to be priority crops for the dry and wet areas respectively.

Table 4. Perceived crop rankings in the dry and wetlands of selected districts

	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	Millet
Kibuku	Rice	Millet	Cotton	Cassava	Groundnuts	Maize
Pallisa	Rice	Millet	Ground nuts	Cassava	Maize	Cotton
Tororo	Millet	Rice	Beans	Cassava	Maize	Ground nuts

3.5 Sources of farm power

Figure 4 shows that draught animal power was highly used in Pallisa, Kibuku, Budaka and Tororo while in Busia and Butaleja manual labour was the most common source of farm power used when opening up land for crop production. Households using tractors while opening up land for crops were also evident mainly in the districts

of Busia, Tororo, Budaka and Pallisa while in Kibuku none of the surveyed households' reported to have ever used tractors on their farms. Other farming activities like weeding and harvesting was mainly done using manual labour.

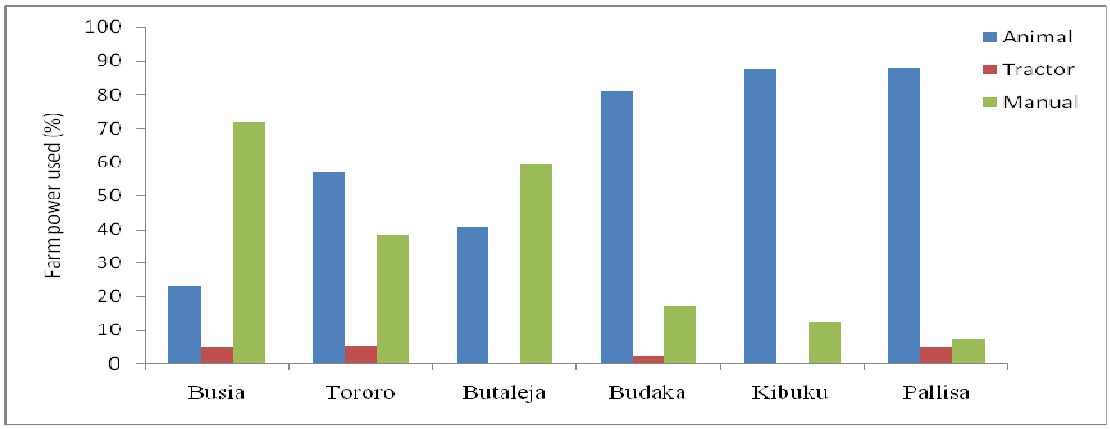

Figure 4. Types of farm power used when opening land

3.6 Major sources of household income

Provision of labour services, regular employment and running private business were among the most common sources of income (Table 5). Provision of labour services included being hired to work in crop gardens like in maize, cassava and ground nuts among others. Respondents running private businesses were majorly involved in general merchandize retail shops and working as middle men in selling crop produce. Sale of wood products like firewood, timber, poles and pastures especially to those farmers who keep cattle under cut and carry production systems and was also reported as sources of household incomes though at very small scale.

Table 5. Sources of household income per district in percentages

Source	Busia	Tororo	Butaleja	Budaka	Kibuku	Pallisa
Hiring out labour	32.1	26.5	17.5	11.6	15.6	13.5
Regular employment	20.4	18.4	12.5	16.3	21.9	10.8
Running own business	26.6	18.4	25	30.2	28.1	29.7
Formal employment	3.6	14.3	15	9.3	6.3	16.2
Sale of wood products	0	2	5	0	0	0
Sale of pasture	0	0	5	0	6.3	0
Remittance	10.2	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

3.7 Record keeping and information management

Tororo, Kibuku and Pallisa districts had the highest number of farmers who kept farm records (Figure 5). However, the proportion of famers who were not keeping records was high across all districts.

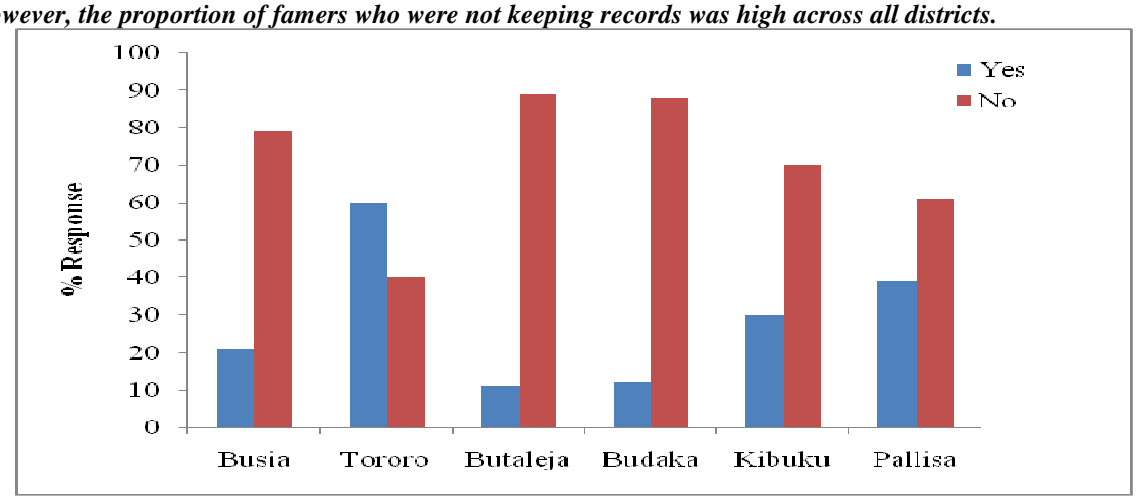

Figure 5. Percentage response of farmers keeping records

Results further revealed that the majority of farmers more than 60% in most districts were keeping production records (Table 6). Production records included information like bags of maize and cassava produced in a given

season. In Budaka, Kibuku and Pallisa districts none of the respondents acknowledged keeping sales records.

Table 6. Type of records kept in percentages

District	Type of records		
	Production	Sales	Both (production and sales)
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

3.7.2 Reasons for failure to keep farm records

Farmers reported that limited capacity and lack of awareness as the most reasons why they were not keeping farm records (Figure 6). Farmers who also thought keeping farm records was a waste of time were evident in all districts. Kibuku and Budaka districts had the highest number of farmers who reported keeping farm records was time wasting. In all districts some households acknowledged keeping farm records which they later stopped because of poor management. For example 10 and 20.2% of the households in Busia and Tororo respectively were not keeping records because they knew they could poorly manage the records (Figure 6).

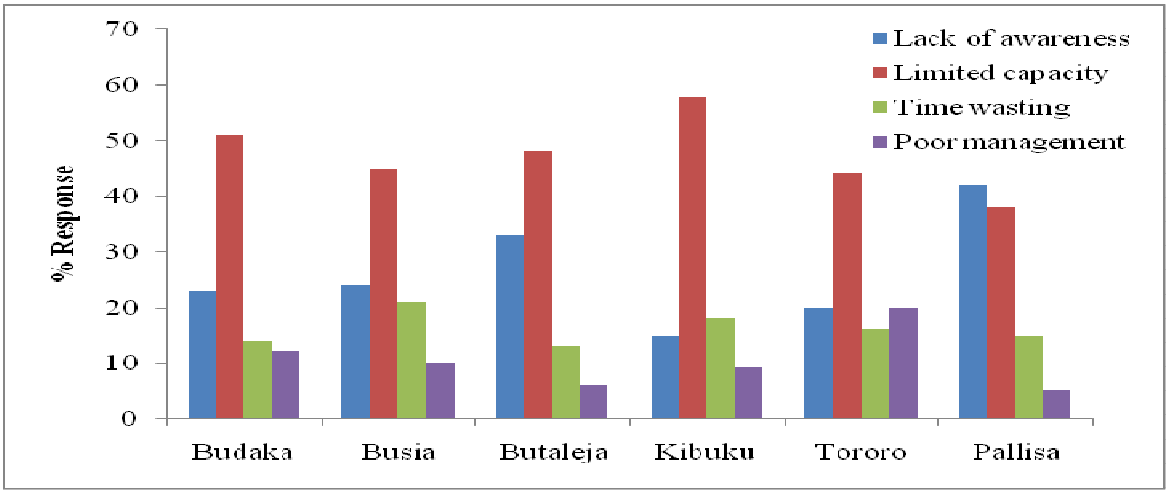

Figure 6. Reasons for failure to keep farm records

3.8 Use of irrigation on farms

Irrigation was mostly done in rice paddies with water diversions to the rice fields (Table 7). Off rice paddies, irrigation is confined to what the community considers "High Value, Short term Crops" like onions, tomatoes, carrots, egg plants and cabbages. Over 89 % of the sampled households were not using any form of irrigation on the farms.

Table 7. Use of irrigation on farms

District	Use Irrigation on farm	
	No	Yes
Busia	94.4	5.6
Tororo	40.0	60.0
Butaleja	90.0	10.0
Budaka	92.1	7.9
Kibuku	81.5	18.5
Pallisa	94.7	5.3

Type of Irrigation used

The major form of irrigation used was the sub-surface irrigation mostly used in rice farming (Figure 7) 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 included drip irrigation and sprinkler system.

Table 8. Types of Irrigation used

	Irrigation type			
District	Drip	Sprinkler	Surface	Subsurface
Busia	0	0	100	0
Tororo	0	0	100	0
Butaleja	0	0	40	20
Budaka	50	0	50	0
Kibuku	50	0	50	0
Pallisa	0	100	0	0

3.9 Challenges limiting crop productivity

Majority of the farmers cited pests and diseases as the most important challenge limiting increased crop production (Figure 8). Respondents also acknowledged drought, floods, limited labour, high cost of inputs and low prices of farm produce among others. Cases of theft of crop produce were only reported in Butaleja. High incidences of weeds, pests and diseases were reported in Busia, Kibuku and Pallisa districts than the rest of the districts.

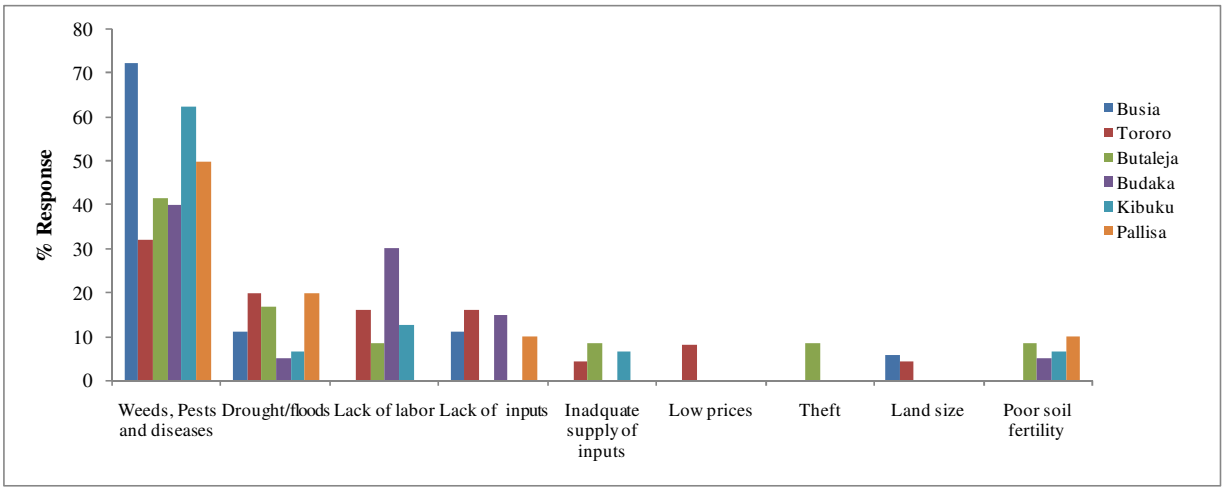

Figure 7. Challenges limiting crop production

3.10 Challenges constraining livestock production

Livestock diseases, poor grazeable pastures, inadequate veterinary services and prevalence of livestock parasites were the most reported challenges constraining livestock production (Figure 8). Busia, Butaleja and Tororo had the highest incidences of parasites especially ticks, tsetse flies and worms. However, in Busia and Butaleja districts quality of grazeable pastures was not reported as constraint for livestock production.

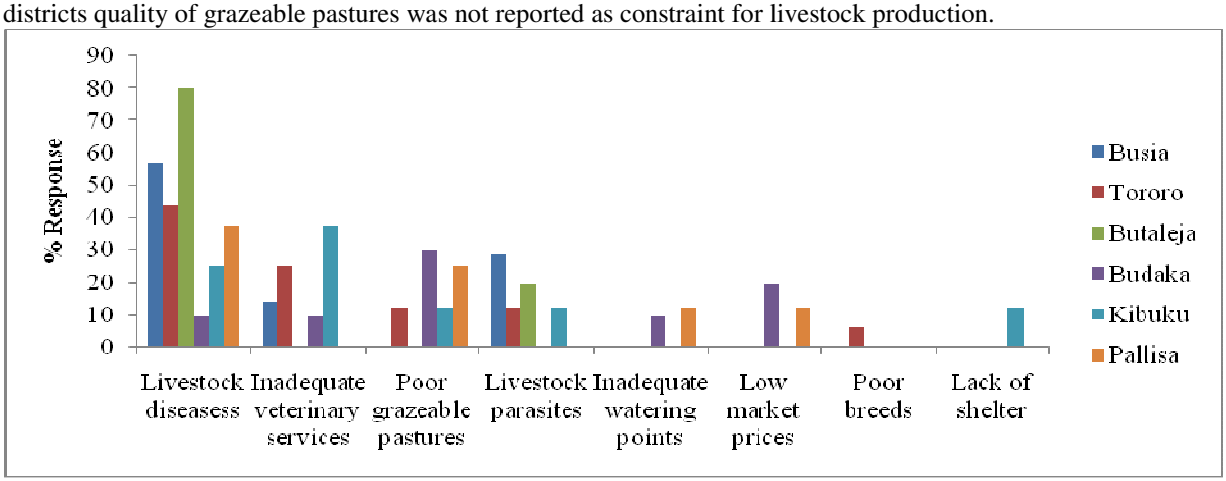

Figure 8. Challenges facing livestock production

4. Discussion

The study investigated farmers' knowledge, perceptions and challenges limiting increased productivity of different agricultural enterprises in Bukedi subzone. Maize, cassava, rice and millet remained among the most important crops grown. However, cassava and rice were priority crops for the dry and wet areas across all

districts respectively. High incidences of weed infestation like as *Striga spp*, pests and diseases, frequent droughts, lack of labour, low market prices and remoteness of some villages from Urban markets were among the most reported challenges limiting crop productivity (Figure 7). Infestation of parasitic weeds like Striga remains a serious challenge in production of cereals in Eastern Uganda. For example Bisikwa, et al (2010) reported losses of 30-100% in cereals due to *Striga hermonthica*. Strategies to control Striga exist (Berner *et al.,* 1995) however; farmers are reluctant to use them since most are un-economical and laborious (Kaiira *et al.* 2014; and Lagoke *et al.* 1991). Khan *et al.* (2003), reported that *D. uncinatum* roots posed an allelopathic mechanism which could inhibit development of haustoria of *Striga hermonthica*. Therefore efficacy of such control strategies needs to validated and popularized to control proliferation of Striga.

The study further revealed that although irrigation was practiced in all the surveyed districts, it was at very low scale (Table 7) except in Tororo district where 60% of the households reported using surface irrigation measures. Farmers reported using irrigation in high value crops like tomatoes and rice. Different irrigation methods were being used which included; drip, sprinkler, surface and subsurface. Surface irrigation where farmers dig channels to divert water from the main stream/river was the most common method of irrigation used in the majority of the households. Cases of farmers using high level automated irrigation measures like sprinkler methods were also evident especially in Pallisa. This was attributed to the National Agricultural Advisory services (NAADS) which had procured and installed the irrigation facility in model farms in Pallisa district. Irrigation remains the most feasible intervention that can guarantee farmers increased crop productivity in events of droughts and could sustain crop production throughout the year. Moreover, droughts were also reported among the key challenges constraining crop production in all the districts (Figure 7). In a related study, Hussain (2007) reported that irrigation significantly reduces income poverty. Therefore least cost irrigation interventions that can ensure availability of water for production during dry periods should be indentified and popularized in order to ensure increased crop productivity.

Livestock diseases for example East cost fever (ECF), Foot and mouth (FMD) disease, New castle, and swine fever were the most reported challenge limiting livestock productivity. High prevalence of livestock diseases consequently lead to massive loss of livestock in the region to the extent that occasionally government had to enforce district quarantines as a measure to curb some of the devastating effects. In a related study Kirunda *et al.* (2012) reported that diseases especially ECF were the most common challenge 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. Similar findings of high incidences of ECF were also previously reported (Ocaido *et al.* 2009) and Rubaire- Akiiki *et al.* 2004). Butaleja, Busia and Tororo districts reported the highest incidences of livestock diseases. This could be explained by high incidences of tsetse flies and ticks prevalent in the area which is exacerbated by the existing grazing system and scarce of veterinary services. Elsewhere Anderson and Robinson (2009) also reported that due to scarcity of veterinary services farmers always resort to use of inappropriate methods in control of livestock diseases. Perhaps this calls for increased veterinary extension services and research investments in livestock disease control in order to ensure increased livestock survival rates and improved productivity.

In addition, the study revealed that animal draught power was mainly used by farmers to facilitate production and reduce human drudgery. These results are consistent with Obuo and Barton (2006), who reported that adoption of draught power weeding technologies (DAP) in sorghum fields reduced the time spent, compared to hand weeding from 157 to 34 hours/hectare. Animal draught power was mainly used by farmers in Pallisa, Kibuku, Budaka and Tororo districts (Figure 4). In Busia and Butaleja districts the use of manual labour for opening up land for crops was evident. However, cases of farmers using tractors were also evident but very rare in some districts for example Kibuku. Animal power is influenced mainly by the availability of animals and grazing land as well as water for the animals. There was a high positive correlation between source of labour and level of household poverty for example households that rely only on family labor were among the most poor as compared to those households hiring draught power services. Perhaps this can be explained by the fact that households which have access to draught power services open up more land for crop production and as such harvest more crop produce which can be easily sold to increase household incomes. Therefore improving crop productivity may mean enhancing the contribution of draught power through breeding of superior genotypes of animals which can provide high traction/draught power and improved livestock nutrition and feeding by introducing high quality improved pastures and appropriate feeding regimes.

Results from the study have also revealed that the proportion of farmers who keep farm records was very low less than 40% of the surveyed household except in Tororo district (Figure 5). There are a number of advantages accruing from keeping records for example farmers who kept records cited a number of reasons including easy access to credit since records improve the confidence of lenders to farmers and tracking farm performance among others. Limited capacity of farmers and lack of awareness were the most cited reasons why majority of the respondents acknowledged limited capacity of farmers in keeping records and lack of awareness as the most reasons for failure to keep farm records (Figure 6). 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. Failure to keep records should be highly discouraged since farmers have only to rely on their memory which makes it 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. Therefore 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.

5. Conclusion

The study has revealed that maize, cassava and rice were the main crops for the dry and wetlands of Bukedi sub-zone respectively. However, high levels of weed infestation like *Striga hermonthica*, pests and diseases, increasing frequency of droughts and lack of inputs especially improved planting material were among the key challenges limiting crop productivity. Therefore interventions that reduce proliferation of crop parasitic weeds like *Striga hermonthica*, utilization of early maturing and water efficient crop varieties are urgently required in Bukedi subzone. Research investments should in addition identify well adapted, high yielding varieties of cassava, rice, maize and millet in order to enhance crop production with appropriate management aspects. Key livestock species kept were; cattle, goats, swine and poultry. In all districts, cattle and goats herd sizes kept per household were not significantly different. The number of indigenous chicken kept per household was higher compared with other livestock species. This provided evidence that improving productivity of the indigenous chicken genotypes in Bukedi subzone could steadily increase households' incomes. Newcastle, Foot and mouth disease, tick borne diseases and those transmitted by tsetse flies were the most important diseases affecting livestock production. Therefore least cost interventions that can prevent or reduce prevalence of livestock diseases and promotion of good quality pasture seeds pose strategic pathways of ensuring sustainable livestock production in Bukedi subzone.

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