A review of Sweetpotato (*Ipomoea batatas*) residues as feed resource for ruminants

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Introduction

The agricultural sector dominates the Ugandan economy. According to 2014 National Housing and Population Census, 80 percent of the households in the country are involved in agriculture (UBOS, 2016). The sector accounts for 90% of export earnings and provided 44% to Gross Domestic Product in 2014. Moreover, the 2.5 million smallholdings and scattered large commercial farms provide the majority of their own and the rest of the country's staple food requirements.

Livestock is one of the most important economic sub-sectors of Uganda's agriculture that is rapidly developing. It contributes 18% to the agricultural Gross Domestic Product (GDP) and 5% to the national GDP, with the dairy sub-sector contributing about 50% of the total output from the livestock. (UBOS, 2016). Furthermore, 75 percent of agricultural households were engaged in crop growing, while 58% in livestock farming. Livestock includes cattle, sheep, goats, pigs and chicken. Goats recorded the largest herd size with 15 million compared to cattle with 14 million followed by sheep and pigs with 4 and 3 million respectively in 2015 (UBOS, 2016).

Livestock and livestock products play important roles in many families, including raising household incomes, a source of protein and manure. Keeping livestock is an important risk reduction strategy for vulnerable communities, and livestock are important providers of nutrients and traction for growing crops in smallholder systems. Livestock serve as a bank account which can be drawn upon when cash money is needed. The Uganda Vision 2040 aims to transform subsistence farming to commercial agriculture (NPA, 2015). The beef and dairy cattle were identified as strategic agricultural commodities for the country (NPA, 2015). It will make agriculture profitable, competitive and sustainable to provide food and income security to all the people of Uganda as well as create employment opportunities along the entire commodity value chain of production, processing and marketing.

Dairy products notably milk provide a significant nutritional supplement to vulnerable groups such as infants, pregnant mothers and the sick; increase the resilience of smallholder households in the face of food crises and; help to maintain traditional social safety nets. Women and youth are the major contributors to and beneficiaries of small-scale dairy cattle production systems, which, unfortunately, is gradually being devastated as a result of climate change and extreme weather conditions (Kabirizi *et al.,* 2015).

If properly managed, dairy cattle can make a positive contribution to environmental quality. For instance, ownership of dairy cattle is a great motivation to plant fodder trees and shrubs, grass contours and pastures, all of which help to control erosion, conserve water and increase plant biodiversity and hence reduce global warming. Crop production gives rise to considerable amounts of crop residues and agro-industrial by products that may be environmentally unsafe. These residues, if properly supplemented could provide a source of feed for dairy cattle.

Feed shortages and fluctuations lead to inefficiencies in nutrient supply as farmers feed unbalanced diets leading to poor production and productivity in cattle (Kabirizi *et al.,* 2015).

Feeding costs represent 62-70% of the variable costs in smallholder farms in peri-urban and rural settings (Kabirizi *et al.,* 2014). As a result, smallholder farmers make extensive use of crop residues and agricultural by-products but need advice for better use.

Sweetpotato is considered a priority crop and its importance in Uganda has increased significantly over the years. It is the third most important food crop after cassava and bananas in the country. In Africa, Uganda is the leading producer of sweetpotato (about 2.2 million tons/year) and second only to China in the world (Mutetikka *et al.,* 2016). Increased production has been driven more by expanded area under cultivation than from higher yields, which over the past decade have remained consistent at a national average of approximately 4.5 ton /ha. Women generally play the dominant role in the production and utilization of sweetpotato in Uganda, from cultivation activities (planting, weeding, and harvesting) to preparation (peeling, slicing, drying and cooking) (Kabirizi *et al.,* 2017). Men are typically more involved in the transportation and sale of marketed sweetpotato.

Sweetpotato contributes about 20% of total crop residues provided by roots and tuber crops. The sweetpotato by-products that are currently used as feed resources include sweetpotato vines (SPV), non-commercial sweetpotato roots (SPR) and sweetpotato peels (SPP). One major negative attribute of sweetpotato is that although it is a good source of energy (roots) and protein (vines), they are highly perishable. To minimize their losses farmers often feed large quantities of vines to pigs, goats and cattle during the two months after harvest but this practice is wasteful of nutrients and does not achieve production in proportion with the large quantity of feed used. Recent research conducted by the International Potato Centre (CIP) in Uganda showed that sweetpotato farmers waste on average 599 kg of vines per acre per season (Mutetikka *et al.,* 2016). In order to make good use of swetpotato residues, strategies that conserve the resources during the time of abundance for use during the times of scarcity have already been developed and promoted. Sweetpotato silage has been piloted as one of the interventions to reduce on feed cost in the framework of the CIP-led RTB ENDURE project. Silage based diets have been tested both on-station and on-farm to assess the performance of pigs, and the results seem promising with users who appreciated as a cheap feed, that can be used during times of scarcity (Lukuyu *et al.,* 2016; Mutetikka *et al.,* 2016; Ojakol F., 2016). Some farmers who fed sweetpotato silage to dairy cows reported an improvement in milk production and overall dairy cattle performance during periods of feed shortages. However, no research has been done in Uganda to validate the results. This report highlights research results conducted outside Uganda to examine the potential of sweetpotato vines silage as a feed resource for ruminants.

Sweetpotato residues as a feed resource for sheep and goats

Sweetpotato vine and foliage is a common feed for pigs, and other livestock, in many countries, including China, India, Indonesia, Korea, Philippines, Papua New Guinea, Taiwan, Uganda and Vietnam as protein supplement (Sankaran Murugan *et al* (2012).

Raising dairy goats is a relatively new phenomenon as goat milk has gained popularity due to being hailed as a healing drink for HIV-AIDS patients in Kenya (Dai Peters. 2018). This popularity has pushed the prices way beyond the price of cow milk, with the price of goat milk varying between 40 and 120 Ksh/liter; the closer to Nairobi, or any major city, the higher the price. In order to introduce the sweetpotato vines (SPV) as good roughage for small ruminants in Kenya, three treatments (sun dried, silage with or without inoculants, 11C33) were carried out to come over their anti-nutritional compounds and pesticides residues contents (Yacout *et*

al, 2016). Four rations were studied, fresh SPV (FSPV), (control) (R); sun dried sweetpotato vines (SDSPV) (R); uninoculated SPV silage (USPVS) R) and inoculated with (11C33) bacteria (ISPVS) (R). All form of SPV was fed *ad libtum*, while concentrate feed mixture (CFM) was fed according to NRC (1994). The effect of treatments on concentration of anti-nutritional compounds, detoxification of pesticides residues, energetic values, rumen fermentation characteristics and degradability of roughages, blood picture and the consequently sheep performance was also studied. Digestibility trials were conducted with twelve Barki rams (three rams for each ration), while rumen fermentation trials were conducted with three fistulated female Barki ewes (Yacout *et al*, 2016). Feeding trials were applied with twenty late pregnant Barki ewes. Milk production, milk composition, feed intake and following up of the new born lambs were studied. Data showed that: (a) all silages were excellent and had a normal pH with the superiority of those inoculants, (b) crude protein (CP) content was increased by ensilage either with or without inoculants, while Crude fibre (CF), Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), hemicellulose and cellulose were decreased; (c) all anti-nutritional compounds were reduced by the sun-drying and silage making compared to the fresh one with more influence with inoculants in that respect; in the same trend, concentration of pesticide residues was decreased; (d) more Total Digestible Nutrients (TDN) value and Nitrogen-balance were resulted with ISPVS ration; (e) Rumen fermentation for inoculants SPVS lead to less ruminal NH-N, more VFA's concentrations, more effective degradability (ED) of DM, CP and CF, more microbial protein (MP) synthesis, highest cellulolytic bacteria and lowest protozoa counts values; (f) feeding ISPVS ration resulted in more lamb's weaning weight, gain and average daily gain compared with other tested rations. In the meantime, ewes had produced more milk, 4% Fat Corrected Milk (FCM), better feed conversion, feed efficiency and good economic return and (g) serum glucose, total protein and albumin concentrations was significantly higher ($P < 0.05$) for ewes fed either USPVS or ISPVS rations. On the other hand, ewes fed ration contained FSPVS was higher ($P < 0.05$) in urea; cholesterol; AST and ALT than other rations. So, feeding ISPVS ration could be successfully and economically a good roughage for lactating ewes. The author recommended more research in this respect for a long term feeding on such materials with analysis of metabolites; blood; milk and meat products for animals fed such materials.

An experiment was conducted to evaluate the effect of feeding sweetpotato vines silage on performance and milk production of Nubian goats (Khalid *et al.*, 2013). Twenty-seven newly giving birth lactating Nubian goats at about 2 years of age were used in a 3x3x3 arrangement. Group A were fed on Abu-70 variety of *Sorghum vulgare* silage, group B fed on sweetpotato (*Ipomoea batatas*) vines silage and group C fed on Clitoria (*Clitoria ternate*) silage. Results showed that treatments only significantly affect ($p< 0.001$) daily fodder intake. Group B showed the highest fodder intake (1.69±0.004) followed by group A (1.06±0.004) then group C (0.54 ±0.004). Final body weight, weight gain and feed conversion ratio showed no significant differences ($p > 0.05$) due to treatment effects. Group B performed a heavier final weight (28.45±6.67 kg) and weight gain (3.82±0.72) and the best feed conversion ratio. Treatment effect was highly significant ($p<0.01$) in daily milk yield. Group B, performed the higher milk yield (0.38±0.006 litre) followed by group A (0.31 ± .005 then group C (0.26 ± 0.002). Milk protein, milk fat and total solids were not significantly ($p > 0.05$) different among the three treatments. The daily dry matter intake was higher for group B (16.22 kg), group C is the lowest (5.19 kg). According to the results obtained sweetpotato leaves can either be fed fresh or ensiled, as the preservation method had revealed no effect on its nutritive value. The nutritional value of sweetpotato roots and vines are improved through the silage process. Results obtained from this study indicated that sweetpotato vines silage has a potential for improvement of milk production.

Effect of supplementing Hawassi-83 sweet potato silage (SPS) containing 70% vine and 30% tuber on growth performance and carcass traits of grazing lambs were evaluated through on-farm feeding trial in Tembaro district, SNNPR, Ethiopia. Treatment diets formulated were: T1= grazing alone; T2, T3 and T4 were grazing plus SPS supplemented (DM basis) at 1, 2 and 4% of lamb's body weight, respectively. At the age of 120 days after planting, vine cuttings were harvested at 3 cm above the ground and wilted under sunlight for 12 hrs. The tubers and vines were then chopped and mixed at the ratio of 70%:30% (vine:tuber) and put in an air tight linen sack lined with plastic sheet, compacted with wooden stick, tightened with a rope and covered with plastic sheet to ensure anaerobic fermentation and ensiled for 30 days. Samples of natural pasture (NP) from the grazing area were harvested at the beginning and end of the trial. Five lambs (5-6 month-old; 14.3±0.5kg) were randomly assigned to each of the four treatment diets and fed for 84 days. Crude protein content of SPS was 14.07% and that of the NP at the beginning and end of the trial were 10.73 and 8.13%, respectively; and in-vitro DM digestibility of SPS was 84.74% and that of NP at the beginning and end of the trial were 65.4 and 51.77%, respectively. The DM intakes of lambs significantly ($p<0.05$) increased from 151.4 to 620.2g/head/d as the level of supplementation increased from T2 to T4. Average daily body weight gain (36.7, 60.5, 87.1 and 119.5 g/head/d) among treatments (T1<T2<T3<T4) were significantly different ($P<0.05$). Higher ($P<0.05$) slaughter (23.3kg) and hot carcass weights (11.5kg) and thus higher dressing percentage (49.4%) were obtained from T4 than those of the other treatments. As the level of SPS supplementation increased body weight gain and dressing percentage improved. Therefore, supplementing local lambs that are grazing the NP with sweet potato silage up to 4% of body weight (DM basis) is recommended.

Sweetpotato as a feed resource for dairy cattle

Alternative sources of dairy cattle feed to spur dairy cattle production and to free cereal supplies for human consumption are receiving closer attention. Sweetpotato has higher biological efficiency as food and shows highest productivity (35-45 ton/ha) (Etela and Anyanwu 2011). It has relatively short vegetative cycle (4-5 months). Hence, fits nicely into tight cropping systems. It also competes better with weeds than other root and tuber crops. The dry matter (DM) content of sweetpotato varieties ranges from 21.70 to 34.78% which is more than cassava (Sankaran Murugan *et al.*, 2012.). Its tubers can be given to all ruminants as fresh, chopped tubers, dried chips and silage for energy supplements along with locally available grasses during the dry season. Fresh vines can be preserved as sweetpotato vine silage and fed during lean season when fodder availability is inadequate (Etela and Anyanwu 2011).

Sweetpotato silage contains comparatively higher protein (13-14%) (Lutwama and Ssentambi, 2016) (Table 1).

Table 1: Nutritive value of sweetpotato vines, Napier grass, sweetpotato vines-Napier mixture and silage

	Dry matter	**Crude protein**	**Acid Detergent Fibre**	**Neutral Detergent Fibre**	**Ether Extract**
SPV	22.2	12.1	35.6	46.8	1.7
SPV silage	26.2	13.3	27.5	40.1	4.2
Napier	16.9	13.2	31.9	59.0	0.8
Napier silage	16.4	10.3	27.2	46.2	5.9
SPV-Napier	19.8	14.2	35.2	51.4	1.0

SPV-Napier silage	22.8	13.1	25.5	37.2	4.0

Source: Lutwama and Sentambi (2016) Napier was harvested at 7weeks of age, SPV-Napier was mixed at a ratio of 1:1

Tubers also contain essential amino acids, with the exception of the sulfur-containing amino acids, especially cystine/cysteine (Dahlanuddin, 2001). The digestibility of sweetpotato carbohydrate fraction is reported to be above 90%. Selections of varieties with low trypsin inhibitor activities helps in expand the plant's potential for wider use as an animal feed. Sweet potato roots are the good source energy (3500 kcal kg) for poultry. Main reasons for adoption of dual-purpose sweet potato are economical viability, net returns and crude protein (CP) content of the fodder.

Fresh sweetpotato vines can be fed to cattle without any restriction (Dahlanuddin, 2001). When sweetpotato vines are fed to milking animals or fattening animals, there is no need to give any other protein supplement as vines alone can supply all the protein needed by these animals (Dahlanuddin, 2001). Orodho *et al*. (1996) reported that sweetpotato foliage could be used as starter feed and partial milk replacer for calves. Kariuki *et al*. (1998) working in Kenya fed sole diets of fresh sweetpotato vines to dairy heifers and concluded that sweetpotato vines contained nutrient levels that would sustain acceptable growth in heifers. Feeding of Bunaji and N'Dama cows in early lactation with sweetpotato foliage had lower milk yield than the dried brewers grains and cottonseed meal, but the metabolizable energy intakes were higher from the sweetpotato foliage than the other diets (Etela *et al*, 2009). Another study by Etela *et al*. (2008b) reported that the performance of pre-weaned crossbred calves supplemented with sweetpotato foliage was comparable to those fed dried brewers grains and cottonseed meal. Karachi (2008) reported that the weaners (Born calves) supplemented with the sweetpotato vines had similar growth to those fed cottonseed cake and consumed 30% more total DM than those fed grass alone. Therefore, compounding feeds with sweet potato vines would be a feasible alternative to the more expensive cotton seed cake.

Scott (1992) reported that expanded use of sweetpotato as animal feed appears to be promising for both agro-biological and socio-economic reasons. On the agro-biological side, sweetpotato has a relatively short vegetative cycle (4-5 months). Hence, it fits nicely into tight cropping systems. It therefore also produce much more dry matter per hectare and per day than cassava. Improvements in yield, dry matter content, and digestibility of the crop should make sweetpotato increasingly more attractive as a source of animal feed. As pressure mounts on farmers to raise productivity, the potential gains to be made from improved sweetpotato varieties and modern inputs should be more widely realized. Improved digestibility of sweetpotato varieties through bio-technology, "through selection of varieties with low trypsin inhibitor activities", should also help expand the plant's potential for wider use as an animal feed in developing countries (Scott, 1992).

A review by Seath *et al*. (1947) showed that sweetpotatoes are a good carbohydrate feed for dairy animals. They further observed that when used freshly chopped or dehydrated. sweetpotato vines are also of value as a feed. Sweetpotato vines when used as a supplemental pasture for milking cows have shown increases in milk production averaging 19 per cent over that from cows on permanent pasture. Freshly chopped sweetpotatoes have been found to be 2.5 times as valuable as silage in the dairy rations. In feeding experiments dehydrated sweetpotatoes made from whole tubers were palatable, while a product of poor quality made

from culled, bruised, and sectioned potatoes was slightly unpalatable. For milk production, dehydrated sweetpotatoes contained 88% of the value of yellow corn meal, and they were approximately 17% more valuable than ground ear corn, including cob and shuck. Digestion trials showed that the good quality dehydrated sweetpotatoes contained from 76 to 81% total digestible nutrients, while a poor-quality product contained 71 per cent Total Digestible Nutrients (TDN) on the dry basis. The high carotene content of Porto Rico varieties of sweetpotatoes increases the vitamin A value of the butterfat.

A study was conducted to evaluate the nutritive value and productivity of Sweet Potato Vines (SPV) and Sorghum Silage (SS) as feeds for dairy production in the dry highlands of Kenya during the years 2002 and 2003 (Akuja *et al.,* 2006). Data on yield parameters of SPV and SS were collected. Both On-centre and on-farm work involved evaluation of milk production by dairy cattle fed on varying proportions of SPV with SS while demonstration and popularisation of SPV and SS utilization technologies were conducted on farms. Mean grain and dry matter (DM) yields of sorghum were 5.5 and 23 t ha-1, respectively. The Dry Matter (DM), Crude Protein (CP), Neutral Detergent Fibre (NDF) and Acid Detergent Lignin (ADL) contents of SS were 308, 60.3, 622 and 61.6 g kg-1, respectively. Corresponding values of SPV were 160, 131, 341 and 64.5 g kg-1. Average daily milk yield was 3.44 l day-1 when SS alone was fed dairy cows and the yield was 26 l day-1 when a combination of SPV, SS and home made dairy meal was supplied. Improved and sustained milk production in most of the farms was observed when sorghum ratoon was fed as green chop alongside SS especially during the dry season. This showed that sorghum fed together with SPV had great potential in enhancing milk production.

Mather *et al.* (1948) reported that dehydrated sweetpotatoes when fed to dairy cows in a 75-day double change-over experiment were found to have 91.4 % the value of ground yellow corn when they replaced all of the corn. When they replaced only half of the corn, they were 94.8% as valuable. In a digestion trial using four mature dairy cows, the main constituent, nitrogen-free extract, was found to have a digestibility of 90.08 ± 0.43 per cent. On the basis of the digestion coefficients found in this experiment, the total digestible nutrient value was found to be 70.4 per cent on a 12 per cent-moisture basis. Dehydrated sweetpotatoes were found to excel corn in maintaining a high level of carotene and vitamin A in the blood plasma and milk. Therefore, they sometimes would have special values which would counteract their slightly lower milk-producing value.

Ashiono *et al.* (2006) conducted a study to evaluate the nutritive value and productivity of sweetpotato vines (SPV) and Sorghum Silage (SS) as feeds for dairy production in the dry highlands of Kenya during the years 2002 and 2003. Both on-station and on-farm work involved evaluation of milk production by dairy cattle fed on varying proportions of SPV with SS while demonstration and popularisation of SPV and SS utilization technologies were conducted on farms. The DM, CP, NDF and ADL contents of SS were 308, 60.3, 622 and 61.6 g/kg, respectively. Corresponding values of SPV were 160, 131, 341 and 64.5 g/kg. Average daily milk yield was 3.44 litres/day when SS alone was fed dairy cows and the yield was 26 litres/day when a combination of SPV, SS and homemade dairy meal was supplied. Improved and sustained milk production in most of the farms was observed when sorghum ratoon was fed as green chop alongside SS especially during the dry season. This showed that sorghum fed together with SPV had great potential in enhancing milk production.

Smallholder dairy production is a key economic activity in Kenya, responsible for the improvement of nutrition and livelihoods of many. Tropical (C4) grasses and stovers, which

frequently form the bulk of cattle diets have poorer digestibility, lower energy and less protein than is required to sustain milk production and smallholders frequently purchase commercial dairy meal (CDM – a grain-based concentrate) to supplement their animals' diets and so lift production Jesse Gakile *et al.,* (2017). They further reported that a less expensive alternative to CDM would have immediate, positive effects on profitability and household income. A feeding trial was conducted to evaluate the effect of feeding sweet potato vines silage as an alternative to CDM on productivity of lactating dairy cows by Jesse (Gakile *et al.,* 2017). Fourteen Friesian cows in late lactation fed a basal diet of Napier grass, were supplemented with either CDM or sweet potato vines silage mixed with wheat bran (SPVS). Milk production, feed intake, live weight (LW) change and income per liter of milk were monitored for a period of 56 days. Milk production for CDM was greater than for SPVS (7.6lday-1 vs 6.25lday-1; $p < 0.05$). Cows on CDM had a higher dry matter intake than those on SPVS (9.01 and 7.78kgDMd-1 respectively; $p < 0.05$). LW change per week was not different between the two treatments. Gross margin per liter of milk was greater for SPVS than CDM (11.72 vs 0.26Kenyan ShillingL-1; $p < 0.05$). Our results showed clearly, that while supplementation with SPVS supports a lower level of production than CDM, its much lower cost means that sweet potato vine silage mixed with wheat bran is a viable and financially attractive alternative to commercial dairy concentrate and is suitable for adoption by smallholder farmers.

A study was conducted to determine the potential of sweet potato vine-based diets as partial milk substitute (PMS) for dairy calves (Taabu *et al.,* 2016). Twenty five Friesian bull-calves weighing 38.7 ± 4.56 kg were fed composite meals containing 0, 30, 40, 50 and 60% air-dried sweet potato vines (SPV) as partial milk substitutes in a completely randomized design (CRD) over a seventy day period. Dietary treatments were introduced 15 days after calving. Milk offered was reduced by one litre every fortnight until 70 days after birth. Proximate and mineral analyses were carried out for ingredients and dietary treatments. Feed intake (FI), average daily weight gains (ADG), feed: gain ratio and variable cost per unit of gain were computed over the experimental period. The use of the PMS reduced the amount of milk consumed per calf by 120 litres over the 70-day period. Mean daily intake of dry matter was higher ($p<0.05$) for calves fed PMS (1.09×10^3 gd^{-1}) than those fed on milk and pastures (912 g/day). Daily crude protein intake for calves fed PMS (216 g/day) was comparable to the 220 g/day among calves fed milk + grazing (M + G) while daily energy intake increased from 9.91 to 11.4 MJ d^{-1} respectively. The ADG of calves were higher ($p<0.05$) among calves fed PMS (299 g/day) than those fed milk and grazing (175 g/day). Feed: gain ratio decreased from 21.7 (control) to 10.2 (PMS). Weaning weights were higher among calves fed PMS (64.9 kg) compared to 53.9 kg for the control. Net variable cost per unit of gain was more than halved when the calves were fed PMS comprising 30 - 60% SPV. Farmers can reduce costs of calf rearing and increase their income from sale of milk by using SPV meals as partial milk substitutes. The results of this study show that sweet potato vine-based partial milk diets can be used as substitutes to reduce the cost of rearing a calf without adversely affecting its health and yet save more milk for consumption and processing. The results further demonstrate that the Friesian bull-calf can be raised with minimum resource input to add to the financial benefit of livestock farmers.

Sweetpotato vines for beef production

Sweet potato (3.5 ha) were used to feed 30 crossbred Brahman bulls with an average weight of 184 kg and approximately one year old in an experiment to study the use of sweet potato in beef production (Backer *et al*, 1980). The five treatments were allocated to the experimental units in an unrestricted randomized block design. Treatments contained 0:100, 25:75, 75:25, 50:50 ant 100:0 ratios of tubers to sweet potato forage (on a try matter basis) supplemented with urea to provide 0, 18, 35, 53, and 71% of total nitrogen respectively. An additional treatment of 38.6% molasses, 60.2 of the aerial parts of sweet potato and 1.2% urea was also used with. the aim of comparing its effect with the 100% tuber treatment under the same conditions of energy and protein. All the rations contained 11.25% of crude protein. Food intake did not vary averaging 2.37 and 0.29 kg/100g LW/d for dry matter and crude protein respectively. The mean energy intake was 5.57 Mcal metabolizable energy/100 kg LW/d and this increased as the proportion of tubers in the ration increased. In addition, dry matter digestibility increased from 62 -92% as the proportion of tubers increased, The molasses treatment resulted in slightly higher intakes (2.75 kg/100 kg LW) even though its in vitro digestibility was lower (56%). Liveweight gain did not differ significantly between treatments. The mean being 0.767 kg/animal/d. The mean feed conversion efficiency was 7.06kg DM/kg LW gain. In the molasses treatment liveweight gain and feed conversion efficiency were poorer compared to the 100% tuber treatment, the values obtained were 0.623 kg/animal/d and 9.0 kg intake/kg gain. Economic considerations revealed that 12% of the tubers had no commercial value. The use of this material together with the sweet potato forage for feeding to the cattle, could produce a profit of 38% thus providing a new' alternative for the livestock producer. From these results we can conclude that the forage and the tuber of sweet potato can be considered as a very useful feed for cattle; that the addition of tubers and urea to forage improves liveweight gain and feed conversion efficiency and that the we of forage and west. tubers of sweet potato as a feed for livestock has economic advantages for the small producer.

Many smallholder farmers in Uganda have reported an increase in milk yield when dairy cows are fed sweetpotato silage as a supplement to low quality grass hay. However, some farmers have reported cases of diarrhoea in cows fed high levels of sweetpotato silage. There is therefore a need for on-farm and on-station studies to determine the effect of feeding various levels of sweetpotato silage on the performance of dairy cows.

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