Sweetpotato crop– An Excellent Source of Food, Livestock Feed and Income

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Introduction

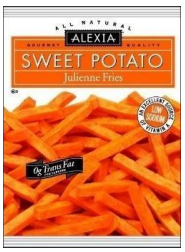
Many developing countries including Uganda are under increasing pressure to make more effective use of available resources in the agricultural sector both to satisfy the growing demand for livestock products and to raise household incomes by generating additional value through processing. The cost of balancing domestic demand for livestock products with feed or livestock imports has become prohibitively expensive. The prospects for increase in the output of cereals of the magnitude required to meet livestock and human requirements remain problematic. Consequently, **alternative** sources of livestock feed both to spur domestic livestock production and to free cereal supplies for human consumption are receiving closer attention. Interest in the potential for an expanded use of sweetpotatoes as animal feed in Uganda has arisen in this context.

Sweet potato (*Ipomoea batatas*)

Sweetpotato is an important food and cash crop in Uganda. Sweetpotato is a drought tolerant crop with the potential to enhance food and nutrition security. Sale of sweetpotato roots, vines and their products contribute to household income. Sweetpotato vines are sold as a source of planting materials while the same vines can be sold as feed for livestock.


Sweetpotato vines and roots

Sweetpotato roots may be eaten boiled, steamed or processed into products such as chips, biscuits, bread, local brew/drink, juice, pancakes and composite flour (mixed with maize, millet and soya flour.

Sweetpotato leaves are prepared much like vegetables such as spinach. Sweetpotato residues (vines, non-commercial roots and peels) contribute about 20% of total crop residues fed to livestock.

1. Use of sweetpotato vines in pig feeding

(a) Feeding sweetpotato leaf meal to pigs

Feeding non-commercial sweetpotato roots and vines to pigs offers a good opportunity to convert undesirable and often unmarketable crop residues into pork which is a high value commodity. You can feed the pigs any amount of fresh vines without restriction. You can also dry the vines and grind them into leaf meal. By drying 100 kg of fresh vines, you can get about 30 kg of dried vines.

Pigs waste a lof of sweetpotato vines

Sweetpotato leaf meal

You can use sweetpotato vine meal in compounded pig rations, but only at not more than 5% levels. If you are mixing a 10 kg ration, the maximum amount of vine meal that you can use is 500 gms. In the diets for growing pigs, sweetpotato vines can replace 13% of protein from fish meal and soybean meal without affecting performance of pigs.

(b) Feeding sweetpotato vine silage to pigs

Farmers rearing pigs can reduce the cost of production by over 50% through adopting **sweetpotato vine silage technology** developed by the International Potato Center (CIP) in collaboration with Makerere University and the International Livestock Research institute. After harvesting, sweetpotato vines are chopped to 2.5 cm length and wilted in the sun for 4 hours to reduce moisture content.

Sweetpotato silage production by Bavubuka Twekembe Group in Luwero district

The wilted material is thoroughly mixed with 10 percent maize bran, cassava root meal, sweetpotato root meal or sugarcane molasses (1 part molasses mixed with 2 parts water) as additives. The mixture is compacted and fermented under controlled conditions in impermeable plastic bag where air cannot come in contact with the silage. A good sweetpotato vine silage is brownish-green in colour. It has a pleasant fruity smell.

- A pig consumes 3-6 percent of its body weight per day.
- Weigh the pig on weekly basis to know how much feed to provide.
- Sweetpotato vine silage is best fed to pigs which are over 3 months and weigh more than 25 kgs.
- The silage (main feed) should be supplemented with an ideal feed (supplement). The silage should comprise of 60% and 40% pig feed supplement shown in Table 1.

Table 1: Composition of pig feed supplement

Ingredient (kgs)	Quantity (kgs)
Maize bran	76
Soya bean cake	20.5
Shells	2
Lycine	0.5
Vitamin mineral premix	0.5
Salt	0.5

- Farmers can record an increase of over 400grams/day body weight.
- Farmers should note that this does not completely replace commercial feeds, it only enhances the pigs' growth rate hence one sells his pigs faster as it is taken to be a snack.
- Water is of great importance for pigs and should always be available for the animals otherwise they will not be able to feed properly hence growth rate will be affected.
- Control diseases and pests.

(c) Feeding pigs on compressed complete sweetpotato vine silage feed block

Maintaining airtight condition during transportation of silage is difficult. Once the seal of a silage bag is broken, e.g. a hole in the plastic or the silage is opened then the silage will start to heat and spoil.

To maximize profitability from the animals, one needs to ensure that these animals must receive the required quantity of protein, energy, minerals and vitamins, preferably from locally available feed resources. All these nutrients can be supplied by an innovation called **Compressed Complete Feed Block (CCFB)**, which can help farmers in balanced feeding of pigs and thereby, increasing profit.

Compressed Complete Sweetpotato Vine Silage Feed Blocks are made by mixing sweetpotato vine silage with a supplement (see Table 1) in a ratio of 60:40 (silage to supplement). Molasses (10%) is added to serve as a binder to the mixture to obtain a moist, cohesive mash. The mixture is put in a feed blender to get a uniform mix and later transferred into a manual feed blocking equipment. The blocks are dried in a solar dryer.

Compressed sweetpotato complete feed block

Solar dryer

The sweetpotato silage feed block is designed to be the only source of feed in a compressed form. Apart from being an economically viable technique, silage feed blocks are easy to transport, cheaper to store, they correct multi-nutritional deficiency, easy to handle and reduce feeding cost as locally available feed ingredients can be utilized. The blocks can be stored for almost a year and therefore are helpful in seasons of feed scarcity.

2. Use of sweetpotato vines in rabbit feeding

Sweetpotato leaves provide protein needed for growth of rabbits. You can rear the rabbits on sweetpotato leaves and grasses and get good growth. You can also use the sweetpotato leaf meal to formulate high quality rabbit feed. Rabbits can be fed on sweetpotato silage.

3. Sweetpotato as feed ingredient in poultry diets

On many chicken farms, fresh green leaves are chopped and given to birds, in addition to mash. Sweetpotato vines supply yellow pigment in the egg yolk; and minerals and vitamins. You can reduce amount of mash given to the chickens when you give additional greens. Sweetpotato vine meal can be included in compounded chicken rations at low levels. In a 10- kg ration, you can use about 300 gm of sweetpotato vine meal. The optimum levels of inclusion of sweetpotato leaf meal in the diets are 27% and 30% for starting and finishing broiler chickens, respectively.

Research shows that the performance of broiler chickens fed mashed and milled formulations of sweetpotato based diets at 50 percent inclusion with a concentrate mix are able to reach market weight of 2 kg at 42 days of age. Broilers fed on the 50% sweetpotato and 50% low energy concentrate could reach market weight of 1.8 to 2 kg in less than 42 days, and input costs are reduced by 30 percent.

4. Use of sweetpotato vines in dairy cattle feeding

A cow can consume 30 to 50 kg of fresh chopped sweetpotato forage in a day and could be substituted for other forages. It is better to mix sweetpotato vines with grass hay. A lot of vines fed to a cow can causes diarrhoea. Sweetpotato forage has a great potential for improving milk yield.

Sweetpotato vine silage offer dairy cattle crude protein of up to 18 percent. This is significantly higher than common Napier grass varieties. A study conducted by CIP and other collaborators showed an increase in milk yield of about 1.5 litres per cow per day when dairy cows fed a basal diet of Rhodes grass hay (*Chloris gayana)* were supplemented with sweetpotato vine silage at a rate of 10% of the daily feed intake and 4 kg/cow/day of a homemade dairy concentrate (14% protein). Supplementing led to a profit of Ushs 1,290 per cow per day. To prevent tainting the milk (off-flavour), do not feed sweetpotato vine silage to lactating dairy cows within 30 minutes of milking.

5. Sweetpotato vine-based partial milk pelleted substitute for dairy calves

An economically viable livestock sub-sector depends on a reliable supply of replacement stock. In this context, the calf is important for viable dairy cattle enterprise. Many farmers cull bull-calves at birth to reduce cost of feeds and feeding. The use of complete milk replacers is untenable in Uganda due to technical and socio-economic reasons. Commercial milk replacers themselves are unavailable and their use would not be economically justified for the majority of our dairy farmers who are predominantly small scale zero-grazers.

A sweetpotato vine-based partial milk substitute is an appropriate technology developed by the National Livestock Resources Research Institute (NaLIRRI), Nakyesasa. The substitute was formulated using sweetpotato vines, a low-cost plant-protein source to suit existing farm situations. Sweetpotato vine-based partial milk pelleted diets (about 15% protein) can be used as substitute to reduce the cost of rearing a calf without adversely affecting its health and yet save more milk for consumption and processing. Sweetpotato vine-based diets as partial milk substitute reduces the amount of milk consumed per calf by 120 litres over the 70-day period. Weaning weights (about 65 kg) are higher among calves fed sweetpotato vine-based diets compared to about 54 kg for unsupplemented calves.

Composition of sweetpotato vine -based partial milk pelleted substitute

Ingredients	**Proportion (%)**
Sweetpotato vine meal	60
Maize bran	30
Dairy mineral powder	1
Fish meal	9
Total	**100**

Net variable cost per unit of gain was more than halved when the calves were fed sweetpotato vine-based diets comprising 30 to 60% sweetpotato vines.

Why Partial Milk Substitute?

- For orphan calves
- When a farmer deliberately reduces milk offered to the calf below optimum recommendations to save for sale, processing or home consumption.
- As a tool for management of "intensive" calf weaning systems
- Economically sustaining a bull calf under zero grazing dairy production system.
- As a supplementation for the calf to achieve potential performance.
- When a cow cannot produce enough milk to feed its calf.

Guidelines to ensure successful use of the Sweetpotato Vine-Based Partial Milk pelleted Substitute

- A sweetpotato vine based partial milk pelleted substitute is not a complete diet and must only be used to fill up for the milk denied to the calf.
- It is introduced to the calf after 2-3 weeks of normal milk consumption.
- The calf must receive adequate colostrum for the first 5 days after birth.
- Provide the calf with clean bedding and replace it whenever it is dirty.
- Gradually reduce the milk offered after the first 2 weeks to enhance consumption of the sweetpotato vine partial milk substitute. A reduction of 1 litre after 2weeks is recommended.
- Clean water must be offered all the time
- Consult a veterinarian immediately you notice any disease symptom
- A calf fed sweetpotato vine-based partial milk substitute should be weaned at 70 days old.
- From about 65 days gradually introduce the calf to good quality pasture as the partial milk substitute is gradually reduced.
- 60-75 kg of the partial milk substitute will be required for each calf over the 70-day weaning period.
- A Friesian calf or its crosses should gain 0.3-0.5 kg body weight under the above recommendations.

6. Use of sweetpotato vines in goat feeding

Goats love sweetpotato vines. Daily weight gains of 44 g to 82 g were recorded in goats fed sweetpotato vines and cottonseed meal. Sweetpotato vines provide enough raw protein and energy to support goats in milk and meat production, even during dry periods when there is less forage.

7. Potential of sweetpotato as dietary ingredient for fish production

One of the problems facing the aquaculture industry in Uganda today is the high cost of fish feed. Sweetpotato leaf meal is one of the cheapest sources of proteins that may reduce the high cost of fish feed. The leaf meal has a high protein content of about 20%, with high amino acid score. It has good mineral profile and vitamins such as A, B , C and E. Aside from its nutritive values, sweetpotato leaves can be harvested many times throughout the year thereby making the leaf meal to be abundant.

Studies have showed that sweetpotato leaf meal has good potential for use as one of the protein sources in Tilapia diet up to 15% level without compromising growth.

A survey conducted in Uganda showed that a significant proportion of fish farmers use sweetpotato leaves as a supplementary fish feed. Typically tilapias receive their daily rations of pelleted feed and after few hours, the sweetpotato leaves are provided showing that such leaves are highly palatable to tilapia.

8. Sweet potato vines silage as a service delivery and a source of income

Sweetpotato vine silage making as a service delivery is an opportunity for investment by unemployed youth who loathe agriculture as a direct employment option. The youth need technical and entrepreneurial skills in the service provision.

A number of youth groups such as: Bavubuka Twekembe (Wakiso and Luwero districts); The Next Generation Agriculture Entrepreneurs (Makindye Municipal Council); Bujuuko Youth Alive (Mpigi district); Namulonge-Kasambya Sweetpotato Growers Group (Wakiso district) and MDCO Investments Ltd (Wakiso district) are innovative youth-led business models in which young men and women offer commercial sweetpotato silage production support services to farmers. The groups are supported by the International Potato Center. Group members have trained fellow youth, men and women in different districts of Uganda and in Kwembe, Dar es Salaam, Tanzania. Mrs. Martha Matovu, (0774112810), a qualified agricultural engineer and a Director of MADCO Investment Ltd got a loan and purchased 6 motorized forage choppers to make sweetpotato silage for farmers who do not have a forage chopper or time to make silage..

Martha making sweet potato silage

She also makes sweetpotato vine silage for sale to farmers. Due to high demand from farmers, Martha has trained 15 youths who assist her to make silage.

Estimated income (Ushs/acre/season) from growing one acre of sweetpotato crop

Sweetpotato product	Average yield/acre/season	Income (Ushs)
Roots (100 kg bag)-food	50 bags	3,500,000
Sweetpotato vine silage	6,500 kgs	2,600,000
Sweetpotato roots and silage		6,100,000

9. Income from sale of sweetpotato vines from urban markets

In the city of Kampala, Uganda, over 1,000 metric tonnes of agricultural waste accumulate daily and only about 30% of this is removed and dumped into a dumpfill in Kitezi. Most of these agricultural wastes such as sweetpotato vines have high nutrient levels of Nitrogen, Potassium, and Phosphorus. Such wastes can be collected by the youth and sold to livestock farmers. This alternate method of utilisation of agricultural wastes by livestock farmers can reduce the rate of accumulation, with subsequent reduction on environmental pollution thus improving environmental health and livestock productivity and household income.

Mr. Enock Karangwa (Tel. 0777348087), a youth vendor selling sweetpotato roots in Owino market in Kampala city supplies urban and peri-urban livestock farmers with sweetpotato vines. He hires transport to deliver the vines at a cost of Ushs 40,000 to 60,000 per pick-up (Isuzu Elf Truck) depending on the distance from the market. He says that he has been able to educate his children and buy land and other household requirements using money from sale of sweetpotato vines.

Conclusion

It is therefore imperative that sweetpotato be developed and promoted as an important feed resource to support commercialisation of the smallholder poultry, pig, cattle and rabbit industries in the country.

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