# Silage production from sweet potato vines and tubers

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**Summary**

Processing leftover vines and small/twisted tubers of sweet potato into silage provides a high quality fodder for all class of ruminants and pigs, and helps to avoid that these resources perish under moist and hot conditions and to bridge persistent or intermittent gaps in fodder availability for farmers. The fermentation of feedstocks that takes places is enhancing their digestibility and conserves all proteins and carbs, making it an excellent complement to grass feeds. Adding silage to the normal rations of ruminants helps them to grow fast because it has a large nutrient content, and fills their stomachs so they do not feel the pangs of hunger and start spending body reserves.

**Technical Description**

Sweet potato silage is made by chipping residues of vines and tubers with no commercial value into small pieces and fermenting these under moist and air-free conditions. The process causes the breakdown of trypsin enzymes that are found in fresh vines and reduce the digestibility and nutritional value for ruminants. Putting silage into plastic sheets or containers has several advantages compared to traditional open pit systems because there are no losses of nutrients through drainage and degassing, as well as much lower risks of spoiling the silage during storage and feeding. Manual compacting drums and mechanized baling presses are available that enable to achieve optimal moisture contents and high storage densities for silage, suitable for subsistence and commercial farmers. These improved forms of silage can make leftover sweet potato vines and tubers ready-to-eat for livestock in a minimum of three weeks and allows to keep it stored for up to a year whereby providing farmers and breeders various opportunities to better manage fodder supply.

**Uses**

Sweet potato silage is ideally suited to complement grass-based feeds like Napier cuttings and maize stover for lactating dairy cows, beef breeding cows, pigs (sows), sheep and goats, and can be fed to heifers and piglets of three months. Farmers in Kenya have found that using this mixture of feedstocks in silage lead to a 10% larger milk production compared to sole grass feed regimes. Proper conservation of sweet potato residues can help address the shortage of nutritious feeds during dry seasons and related price fluctuations that many livestock farmers are struggling with. It also

provides avenues to reduce waste in rural and urban areas that can open up business opportunities for youth and women.

**Composition**

Residues from vines and poor quality tubers from sweet potato are collected when harvesting the crop. Freshly gathered vines need to be chopped into pieces of 5 - 7 cm long (2 - 3 inch) and fresh roots need to be made into chips/chunks of less than 1 cm (0.4 inch). For the fermentation process to go on well, chopped vines and chipped tubers should be mixed in the right ratio (usually 70:30), and soaked in water containing molasses (10:1 ratio) and some salt (0.05 percent).

**Means of application**

Cutting of vines and chipping of tubers can be done by hand but takes a lot of work, an electric chipper can allow to process large amounts of feedstock into optimal sizes for silage. Sheet plastic with a thickness of 0.1 mm or plastic containers can be used in various ways to create air and water tight conditions; the most recommended being ‘bag silos’ where silage is compressed into tubes that are sealed on both ends, ‘stack silos’ where silage is piled up into mounds, and ‘trench silos’ where pits of up to 2 m are dug. Silage can be compacted using a metal drum fitted with tubes for draining air and excess water on which people and weights push down the feedstock which is suitable for small scale silage production. There are medium to large sized mechanized press systems available that can be operated by grid electricity or generator. Once silage has been opened it needs to be fed to livestock in a short enough time to avoid it getting spoiled, as for this the size and means of storage have to be adapted to the different contexts of subsistence and commercial farmers.

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| **Agroecologies** | All Agroecologies. |
| **Regions** | Africa. |
| **Developed in Countries** | Kenya,  Mozambique,  Uganda. |
| **Available in** | Kenya,  Mozambique,  Uganda. |
| **Solution Forms** | Management. |
| **Solution Applications** | Feed/Fodder Production. |
| **Agricultural Commodities** | Sweet Potato. |
| **Target Beneficiaries** | Small-scale farmers,  Commercial farmers. |

## Commercialization

### Commercialization Category

Commercially available

### Startup Requirements

1) Sensitization of farmers and fodder producers on the comparative advantages of sweet potato silage systems, 2) Identifying the right mixtures and set-ups for silage production depending on feedstock availability and demand, 3) Rental or purchase of chipper, and compacting drums or press systems (optional), 4) Investment in plastic sheets or tubes, sealing materials and digging of trenches (optional), 5) Collection or buying of fresh vine and tuber waste from sweet potato, and 6) Organize on-farm use of silage fodder or sales on local markets.

### Production Costs

Based on real-world data, piloting projects in Uganda have estimated that the materials and labour required for making 500 kilogram of sweet potato silage with the plastic bag method cost less than USD 30, next to a one-time capital investment for a compacting drum of USD 50. Using trench silo method the cost of materials and labor for producing 500 kg of sweet potato silage in Uganda was estimated at USD 55.

### Customer Segmentation

Sweet potato farmers, Livestock breeders, Fodder manufacturers and traders

### Potential Profitability

Making silage from like sweet potato vine residues and low quality tubers that are left behind after the crop has been harvested enables farmers to reduce purchases of livestock fodder from external sources and thereby increase profit margins of animal rearing activities. The gains in milk and meat production, as well as nutritional health of livestock, which are achieved by complementing diets with sweet potato silage allow to repay for the investments in materials and labor for generating the fodder, or its purchase from local sources. A survey of smallholder pig farmers in Uganda with a majority of women in the sample found that the mean willingness-to-pay price for sweet potato silage amounted to 0.20 USD per kilogram. Based on this the study estimated that the total annual demand for silage by pig farmers in two districts (17,679 tons) has a marketable value of approximately USD 3.59 million. This demonstrates that the production of sweet potato silage has a large business potent

### Licensing Requirements

No license needed

### Innovation as Public Good

Regional public good, International Potato Center is responsible for development and dissemination.

## Solution Images









a) Digging a trench and lining it with plastic sheets



b) Filling the pit with material and compressing it for removing air



c) Closing the silage by wrapping and fixing the plastic sheets

## Institutions




## Accompanying Solutions

Orange-fleshed sweet potato (Bio-fortified, Drought and virus tolerant)