Sorghum and millet for livestock production

The productivity of Napier grass (elephant grass), a basal forage in smallholder dairy production systems in Uganda is affected by pests and diseases such as Napier stunt and smut diseases and improper agronomic practices. There is a need to introduce alternative forages which have the potential to compete favorably with other available feed resources, in terms of dry matter yield and nutritive value.

Sorghum is the third most important staple cereal food crop after maize and millet in areas of Eastern, Northern and South Western Uganda. Sorghum is mainly used for food, brewing and as a livestock feed. Serere Sorghum 1 (SESO 1) variety is grown in Uganda solely for grain. SESO 3 was developed for forage production. Nutrifeed pearl millet variety has been recommended for livestock feeding.

Nutrifeed (*Pennisetum glaucum*), a pearl millet is rich in protein and energy with no potential for cyanide poisoning making it an excellent pasture for livestock, especially when fed at the correct height and harvesting time.

Nutrifeed

Sugargraze (*Sorghum bicolor x S. bicolour*), a late flowering sorghum cultivar has a high sugar content that improves its ensiling quality, increased palatability hence minimal feed wastage. Sugargraze and Nutrifeed varieties produce good high-quality silage.


Sugargraze

SESO 3 (Serere Sorghum 3) is a local variety developed at the National Semi-Arid Resources Research Institute (NaSARRI), Serere located in Eastern Uganda. SESO 3 matures in 100 days. SESO3 which is brown in colour is good for food when mixed with cassava while SESO 1 is for beer production. SESO 3 can produce of grain 3000 kgs per hectare. Brewer's spent grain is used as a supplement in dairy production systems.

SESO 3

Currently Sorghum is mainly grown in Serere, Teso, Acholi land and West Nile among others. The crop is grown on large scale under contract farming in which farmers come in to partnership to produce directly for a particular brewery with a few kilos consumed in their homes.

Sorghum grain is used as an energy source in formulating livestock rations. Sorghum contains hydrogen cyanide, high levels of which may poison ruminants. When wilted, sorghum can be fed *ad libitum*, although the animal will require other protein, energy and mineral supplements.

Advantages of sorghum as livestock feed

- Sorghum is drought tolerant when compared to other fodder crops such as maize and Napier grass. It can grow well in both high and low potential areas with poor soils, where maize cannot do well.
- As a fodder crop it can be used in adequate supply when maize and other feed sources fail.
- Most sorghum varieties such as Supergraze produce much more forage than maize.
- Unlike maize, the lower leaves do not dry out as the plant matures; they remain green and therefore retain a higher crude protein content.
- It can replace maize one-to-one as green chop, silage for feeding to cows.
- Sorghum and maize grain are very comparable in terms of energy.
- Sorghum grain can be utilized in the rations of dairy cattle as a replacement for maize grain.
- Sorghum can regenerate (grow again) after cutting the plants for fodder and harvesting the grain (second crop or ratoon); The ratoon crop will mature early in the following season but yield slightly less than the first crop – depending on level of plant feeds available. This way the farmers can reduce the cost of replanting, land preparation, seeds and time.

Disadvantages of sorghum as livestock feed

- Some sorghum varieties, especially those with brown seeds, contain high levels of anti-nutrients which can poison ruminants; hence there is a need to wilt the fodder before feeding it as green chop.
- Sorghum grain should be ground for optimal digestibility.
- At its early stage, sorghum does not compete well with weeds so a weed-free field is necessary.
- Bird damage can lead to serious, even total loss of grain; thus, scaring birds is necessary from milky stage to grain maturity.

Sorghum forage establishment and management

Land Preparation: For both forage and food varieties of sorghum, start preparing the land at the end of the rains following a crop season. Sorghum does well in sandy soils. Forage sorghum requires a very fine seedbed but it can also be grown where the soils are not disturbed much (where conservation tillage is practiced).

Seed rate and spacing: Planting is done by drilling seeds in the soil at depth of 2cm; seed rate of 6kg/ha and a spacing of 60cm between lines.

Sorghum can withstand dry conditions (600 mm annual rainfall) and remain green at very low moisture levels.

Sowing: Sorghum should be sown at the onset of the long rains. Seeds should be planted 3 cm deep when dry planting to avoid germination in false rains, but 2 cm deep if the ground is wet. Drill seeds along the furrows (trenches). Fodder varieties of sorghum should be planted at a spacing of 75 cm x 10 cm.

Manure application: Well-composted manure should be applied during land preparation and worked into the soil. Organic foliar feeds can be added when the plant is knee high. Sorghum yield is improved with application of about 100 kg/ha/year of Urea fertilizer equivalent of 46 kg/ha of N/year) depending on soil fertility.

Thinning: The crop should be thinned when it is 30 cm high or 30 days after planting, whichever comes first, to ensure a spacing of 75 x 10 cm between rows for fodder sorghum and 60 x 20 cm between rows for dual-purpose varieties. The spacing for dual purpose varieties allows for higher grain to herbage ratio.

Weeding: A sorghum field should be kept weed-free especially at early stages of growth.

Pest and disease control: Control of cutworms, aphids, shoot-fly and stalk borer is important. Birds like sorghum especially at milk stage; they prefer white-seeded varieties. Sorghum is generally disease tolerant. Control disease when necessary.

Harvesting: Sorghum meant for feed can be cut when still green and fresh. For good regrowth, use a cutting height of 10 cm above ground level and a cutting frequent of 8 weeks.

Leave the harvested material in sun to allow wilting for 12 hours then chop and feed the animals. To make silage, start harvesting at dough stage (between milky and hardening stage).

Dry matter yield and nutritive quality

In a study conducted at NaLIRRI, mean dry matter yield of 4 cuttings at a cutting height of 10 cm above ground was 20,422.2; 7,668.2 and 4,391.0 kg/ha/yr of Sugargraze, Nutrifeed and SESO 3, respectively.

Mean crude protein was about 18.7; 14.4 and 9.5 percent for Nutri-feed, Sugar graze and SESSO 3, respectively when harvested at a cutting frequency of 8 weeks.

Ratooning

The ability of sorghum to regrow (ratoon) increases total annual yield of herbage per unit area and also provides reserve feed for cut-and-carry during the dry period when lack of soil moisture makes reseeding impossible. You can get two or more ratoons economically, depending on how you manage the crop.

Post-harvest regrowth in a perennial sorghum trial at NaLIRRI in 2015.

Utilization of sorghum grain in lactating dairy cow diets

Sorghum and millet can be used in different ways as: green chop, stover, brewer's waste, and silage.

(i) Green chop

Sorghum green chop can help to improve feed supplies during the dry season. Freshly cut sorghum should be wilted first to prevent the formation of Hydrogen Cyanide.

(ii) Stover

Sorghum stover and millet straw should be chopped before feeding the fodder to livestock to avoid wastage. The stover and straw must be supplemented with energy and protein sources to improve livestock production.

(ii) Silage

Sweet sorghum used for silage should be cut before the seeds mature; otherwise a large portion of the small hard seeds will be wasted, as they are not easily digested. Forage sorghum silage ferments similar to maize.

Sorghum contains hydrogen cyanide and nitrites, which may be toxic for animals if they are ingested at a high level. Sorghum silage is often promoted as a replacement for maize silage for lactating and dry dairy cows. Utilization of sorghum forage as a total replacement for maize silage in the diets of lactating cows is possible in some cases.

(iii) Brewers' spent grain

Brewers' spent grain is a major by-product of the brewing industry, representing around 85% of the total by-products generated.

Brewers mash

The short lifespan of the wet brewery grain associated with its high moisture content is the critical problem of farmers in utilizing the by-product. On the other hand, cost of drying is one challenge which leads farmers to directly use wet brewery grain. Ensiling wet brewery grain alone or with other feeds is ecologically acceptable, economically feasible and easily applicable technology to dairy farmers.

Though barley is the main grain used for brewing, beers are also made from wheat, maize, rice and sorghum. Brewers grains are a highly variable by-product whose composition and nutritional value depend on the grain used, on the industrial process (temperature, fermentation) and on the method of preservation.

Making silage from wet brewers' grain

Wet brewer's grains contain 75-80% water and deteriorate rapidly due to the growth of bacteria, yeasts and fungi. It is mandatory to use them as soon as possible after reception and to make sure that they are in good condition before utilization. The palatability of brewers' grains decreases with storage time. Feed mixtures containing brewer's grains spoil quite rapidly, so any excess feed that animals have not consumed should be discarded. Silage is a good method for storing wet brewers' grain for a long period, particularly since ensiling does not alter their nutritive value. Brewers' grains silage can be done without additives or other raw material provided that the grains are put in the silo as soon as possible. The silo should be protected from rain and tightly packed. The silo should have proper drainage to collect runoff. Storage time can be improved by storing in a shaded or cool place, and by covering the surface with plastic or some other covering material that minimizes surface spoilage. Brewers' grains silage is ready within 3 weeks and can be used during 6 months, and even more if a silage additive is used. Adding carbohydrates accelerates fermentation, releasing more acids and resulting in stable silage.