

Sustainable intensification of smallholder farming in central Mozambique: Benefits from better integration of crops and livestock

Background

The Government of Mozambique gives particular importance to strategies for sustainable intensification of agriculture in the smallholder-farming sector, accounting for more than 95% of the total agricultural land. Better integration of crops and livestock is key to sustaining vital smallholder farming, rewarding higher agricultural production and improving the overall wellbeing of smallholder farms, especially in provinces like Tete and Manica, with high potential for crops and livestock.

Farmers with animal draft power can cultivate larger parts of their land in time and are thereby able to also produce more feed, critical for improving animal performance. Better-managed and fed animals reproduce more, provide better draft services and avail manure as important source of locally available organic fertilizer. Farmers thereby increase production at reduced costs and risk, overall farm net returns increase more than through single technologies.

These benefits can be harvested over large areas, and with different agro-ecological potential. Farmers with cattle cultivated more land than those without cattle: in Dororo, Manica province, with high agro-ecological potential, 4.4 ha as compared to 2.9 ha cropland; in drought prone Marara, Tete province, 3.1 ha of as compared to 2.1 ha. On average farmers with cattle made 20% higher cereal yields in Dororo, and 30% higher cereal yields in Marara. Yet 52% and 45 % of the households don't have cattle in Dororo and Marara respectively.

This leaflet illustrates the benefits from better integration of crops and livestock. We describe forage production and draft power animal management as two complementary technologies critical for sustainable intensification of smallholder farms, demonstrated in the MOREP project. These technologies are useful for farmers in similar environments like in Tete and Manica provinces.

Benefits from crop-livestock integration

- Improved food and nutrition security: Better-fed animals are in better conditions to provide draft power for cultivation. They allow farmers to cultivate larger land area of cereals and legumes and plant their various crops in time. This increases crop and biomass yields and quality, for food and feed.
- Source of income: Feeding livestock with crop residues and supplementary high protein forage, eg, mucuna, reduces dry season mortalities and enhances reproduction. Farmers can sell more animals, and maintained in better conditions they can fetch higher prices.
- Building resilience: Increasing diversity in agricultural production, sharing information and knowledge, pooling resources for accessing markets strengthens capacities of the communities to self-organize.
- Sustainable soil fertility management: Using animal manure or green manure like mucuna improves soil fertility and structure at low costs, while also reducing dependency on inorganic fertilizer.
- Transport for household needs and farm activities: Animals are often the sole source of transport for farmers to bring water to homesteads, manure to the fields, harvest to storage facilities and produce to markets.
- Multiple benefits for women: Draft animals can reduce women's workload, provide them with local sources of organic fertilizer, and through increased production they allow women to sell high value crops like legumes.

What is mucuna?

Mucuna (*Mucuna pruriens* (L)) is a vigorous and trailing annual (sometimes biannual) legume herb. It is capable of fixing atmospheric nitrogen, in association with Rhizobium bacteria. It is relatively disease resistant. Mucuna is commonly used as forage, silage, and hay, and the seeds for concentrate feed. It can also be used to improve crop production in rotation systems or as green manure.

How can smallholder farmers use mucuna as a forage?

Mr Felix Marizane. Marara, realized from his demonstration plot that mucuna is an important source of animal feed. "Mucuna produces more biomass than other crops, in the dry areas of Marara. We feed mucuna to cattle after they come back from grazing, which keeps the animals in better conditions during the lean periods." He has plots of mucuna for different reasons: a portion of the land under mucuna is for feeding cattle, the other for multiplying mucuna seed on his farm. Farmers also multiply mucuna seed on a nearby forage bank. "Growing mucuna in a forage bank allows more people to learn about these important technologies, and also to multiply mucuna seed for the larger communities", says Mrs Regina Gule, Provincial Agricultural Extension

Services (DPA) in Tete. After the first year of producing mucuna, a few farmers started selling mucuna seed to their peers. Markets for mucuna seed are evolving, also as local development organizations have requested to buy seed from these farmers.

What benefits can be expected?

- **Feed:** Farmers who feed their animals benefit more from livestock production. Good quality hay increases feed intake. Supplementary feeding thereby mitigates animal weight loss during lean times, increase animal live weight and improve body condition. Experiments with goats have shown that feeding on a maize residue - mucuna ratio these animals gained similar weight (70g day⁻¹) as with commercial feed (78g day⁻¹). Better-fed animals also reproduce faster.
- **Organic soil fertility:** Cereals planted after mucuna, on fertile soil and well managed, can double grain and biomass yields. In areas with less fertile soils or if not well managed the crop yields increases will be less.
- **Source of income:** Production and selling mucuna seed provides a source of income, also for households who don't own livestock. Mucuna seed is commonly sold at US\$2/kg.



Photos: Julio Onofre Rainde, Sabine Homann-Kee Tui

Farmers learn about mucuna on demonstration plots, increasing biomass per unit area with tutors, mucuna as a feed and as green manure.



Photo: Patricia Masikati

Mucuna biomass dry enough for bailing.

Attainable biomass yield (t/ha)	Crude protein content (%)	Digestibility (%)
3-12	11-23 highest at flowering	60-65 (leaf and stem) >95 grain, 78 husk

What are good conditions for Mucuna? Mucuna grows best on well-drained, medium to high fertility soils. It also grows on sandy soils and tolerates a very wide soil acidity range. Mucuna prefers hot, humid climates with annual rainfall of 1,000–2,500 mm, but also grows with as low as 400 mm annual rainfall. It is moderately drought tolerant, but does not do well on soils that are prone to waterlogging.

How should mucuna be grown? Mucuna does not require much land preparation, land can be prepared as for other crops. Sow mucuna as early as possible after first rains. Inter-row spacing should be at 75 cm (same as for maize), and 20 cm between plants, seed rate of 50–60 kg/ha. Seeding depth should be 3–7 cm. Seed does not require scarification or inoculation with rhizobia prior to planting. Weed once, 2-3 weeks after seeding, thereafter mucuna covers the soil.

How to harvest and process mucuna? Make a stacking frame using wood; it can be made in the shape of a tripod and can be thatched or covered with plastic. This stack is suitable for small fields and livestock can be fed directly from the stack or forage can be carried for livestock. Stack the herbage on the stack frame. It is important to make sure that the stack is more than 2 meters above ground for good air circulation; a small tripod can be made in the middle of the stack for air circulation also.

How to make hay with mucuna?

Cutting is done at the first stages of flowering, to ensure quality hay in terms of nutrient content. Cut forage approximately 10–15 cm above ground preferably in the morning to allow the herbage to dry. Turn herbage to allow even drying after 6–8 hours in sunny and windy weather or turn the herbage the next day after dew has dried. After 1-2 days in hot weather conditions the herbage can be dried from 70–80% to 25–30% moisture. The desired moisture content is reached when the herbage feels crisp and does not show moisture especially on the stem when twisted. When herbage has reached desired moisture content it can be baled or put on stacks.

For bailing get or make a box or alternatively dig a hole in the ground of the same measurements (Figure 1). Put bale twine in the box or hole. Put the stover in the box or hole and compact it as much as possible, eg, using your own body weight. Then tie up the stover. Remove the bale, stack and store.

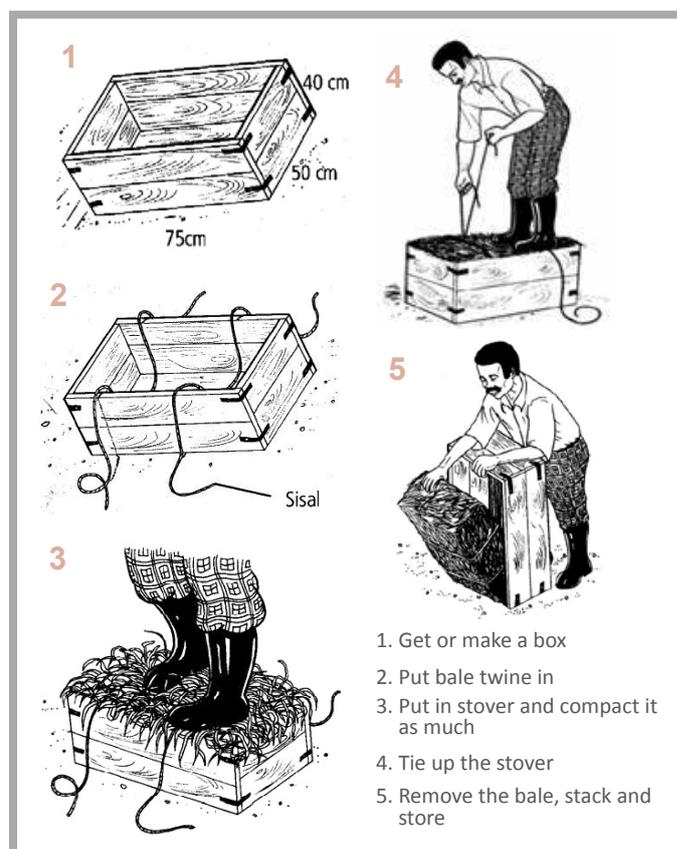


Figure 1. Bailing of biomass like mucuna. (<http://www.foodwewant.org/eng/GAP/Manual-box-baling>)



Photo: Sabine Homann-Kee Tui

Storage of mucuna at a dry aired place.

For farmers to have strong animals for draft power, it is critical that they invest in their health, nutritional and general welfare. “The same way a person who uses a tractor for cultivation, and regularly changes the engine oil, the oil filter, the tires, farmers should look after their draft power animals, and take care of them, especially by improving feed and health management,” says Elisabeth Specht, Agricultural Research Institute of Mozambique (IIAM).

Adequate draft animal use

- Animals used for traction should be no younger than 2 years. Start working with the animals when they are young. Regular routine of work, eg, carting, keeps them trained and reduces stress at the start of the new growing season.
- Draft cows, producing milk and calves, actually use food energy more efficiently than oxen. However, they should not be used for ploughing two months before calving and three months after calving; cows should also not plough on heavy soils.
- Use animals for traction during the cooler hours of the day to avoid heat stress. Well-fed oxen can work for up to 5 hours per day, cows up to 3 hours per day, for 5 days per week. They need 2 days rest.
- Draft power animals should be used to humans, and treated with kindness and patience.

How to manage draft animals?

Currently most farmers in Central Mozambique do not have sufficient animals for what they require in terms of draft power. Not everybody has draft power animals; those without own animals have to wait long to borrow the animals from their neighbors, which delays planting time and results in lower yields. Hence farmers often over-use the draft power animals, eg, by ploughing with pregnant cows or animals that are either too young or too old. As a result these cattle loose body conditions, and the reproduction declines; farmers undermine the productivity of their own herds.



Photo: Alex Ruane

Animal traction to reduce labor in farming.

Key messages

Integrating crops and livestock builds resilience and food security across large areas of central Mozambique. Farmers with crops and livestock are more capable to diversify and intensify production on their farms and are less vulnerable to various sources of shocks. While farmers would like to venture into integrated crop livestock farming, about half of the farmers don't have access to draft animals.

There is need to proactively promote improved feed technologies and draft animal management for smallholder farmers to successfully engage in livestock production, and for livestock to contribute to improving agricultural production levels. Strategic partnerships are required, that bring these technologies closer to farmers, and link farmers to agricultural markets so that farmers can realize greater benefits.

National programs are challenged to reach out and support the development of the crop and livestock sectors through adequate investments in infrastructure and service delivery, including market development for crops and livestock, rewarding higher market participation and investments.

Improve animal health management and reproduction

- Provide draft power animals with supplementary feed (protein, nutrient blocks). Supplementary feed should already be given during the dry season to prepare for the draft power activities at the end of the dry season. Increase feeding particularly for draft cows and oxen during peak working periods. On a daily basis, allow draft power animals enough time to feed and ruminate.
- Rigorously ensure good husbandry practices (eg, vaccinations, mating of draft cows), and in conjunction with work requirements.
- Observe the animal's conditions and behavior, during the exit and return from traction work. Over-working the animals can cause stress and predispose to further health problems.

- Identify weak animals and investigate the causes; provide veterinary care as required.

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