



Chapter 12: Cut-and-Carry Livestock Management



Although alternatives to open grazing, such as rotational grazing, support both animal and pasture health, these methods are often not practical for the poorest of the poor due to investment and equipment requirements. An alternative for animal farmers in the tropics is to produce forages of higher quality in an intensive way and to bring the food to the animals instead of sending the animals to the food.



Cut-and-carry represents a smart, blended management approach that is healthier for the animals, more profitable for the farmers, and better for our planet. In a cut-and-carry system in the developing tropics, animals are penned in a specific area. Families use walls, thorny branches, poles or multi-purpose living fences to keep cows, sheep, and/or goats enclosed. This protects them from other people, pests, diseases, and the hot sun, and it keeps them from wandering. Forage must be brought to animals, since penned livestock do not roam as freely as open grazers. This gives the owner the opportunity to select the best food for the animal.

Penning animals with cut-and-carry feeding allows farmers to control diets and minimize animals' stress, but these animals are also sometimes allowed to roam free. Most farmers have ample space on fallow croplands or uncultivated communal lands where animals can stretch their legs. High quality forages can even be grown in and around the same penned areas where the animals spend most of their time.





Because the animals are restricted to specific areas, daily management is far easier. Sickness and other problems can quickly be identified and remedied before it is too late. Livestock waste far less energy than animals that spend their lives walking around in the hot sun, irritated by insects and eating grasses nutritionally equivalent to cardboard. They are comfortably housed with forage, clean water and minerals. Exposure and spread of disease are greatly reduced, and manure is more effectively collected and managed. Animals in heat can be quickly spotted and bred, or isolated and quarantined from other animals. The end result is that animals raised in these comfortable conditions have a far lower minimum daily nutritional requirement, and a higher percentage of the energy and nutrients consumed is converted into meat, milk and healthy calves. Cut and carry livestock management systems help animals avoid wasting their energy sweating in the hot sun, swatting insects and scouring fields for something to eat.

Though animals are usually penned in this system, it should not be confused with confinement rearing and animal intensification in the developed world. In the developed world confinement rearing has evolved into modern, intensive factory farming where animals are packed into small spaces. These cruel living conditions, combined with unhealthy diets meant to accelerate animals' marketability, leads many to view confinement rearing systems as unethical.

Livestock Management In Forest Gardens

In the **protection** phase, farmers learn to incorporate fodder trees into the green walls that surround each Forest Garden. The trees serve as windbreaks inside the protection of thorny living fences, and they serve as barriers around gardens and orchards to control pests. They are also planted along contours to stop erosion.



In the **diversification** phase, fodder trees help meet several needs of farmers. They are often planted in woodlots for fuelwood or in rows across the field for fertilizer. They are also planted around gardens and segments of orchards to control pests.



In the **optimization** phase, Nitrogen fixing fodder trees are planted near gardens and fruit trees. Gaps in the field are filled in with these trees, and species that provide quality fodder in the lean season are planted.



When fodder trees are planted in rows, lines, perimeters and contour strips, they are usually spaced between 30 cm and 2 meters apart depending on species and the purpose of the agroforestry formation. When planted as living fences, fodder trees are typically planted in two staggered rows with trees spaced 30-50 cm apart. In windbreaks they are often planted at 1 meter intervals, similar to many grass forages.

The advantages of instituting cut-and-carry livestock management systems in Forest Gardens include:

- More efficient use of available land
- Improved gains and productivity
- Decreased time for marketability
- Ability to continuously improve soil productivity
- Reduced risk of damaging the ecosystem
- Increased feed efficiency
- Reduced input cost and replacement of costly animal feed
- Healthier for animals, better disease management
- Efficient manure management
- Increase quality of certain products such as meat and milk
- New market opportunities
- Able to be implemented with 100% appropriate (i.e. locally available) technology
- Social benefits such as freeing children from herding responsibilities and more time for school

Disadvantages of cultivating fodder in Forest Gardens may include:

- High labor requirements
- Difficulty determining smart, balanced rations from diverse sources
- Difficulty knowing how to maximize fodder production from different trees
- Pushback from the animal feed industry
- “Not free range” possibly perceived as less ethical
- Changes in milk taste and quality as well as lactation
- Potential need for mineral supplements
- Period of adjustment for animals
- Production constraints in the dry season
- Lack of tools for proper pruning and harvesting of fodder trees
- Processing and storage constraints in the rainy season

Selecting Forage Species

The ultimate goal of rearing animals is to provide them with living conditions that will help them stay healthy and reproduce quickly. Just like people, animals need a well-balanced diet. Grass alone is not enough. Animals need protein, macro and micronutrients, minerals, and plenty of clean water.

There is a wide range of great animal forages that farmers utilize around the world. But which species of trees are useful for forage production? Almost every country in the tropical world has many types of trees, bushes, grasses and other vegetation whose leaves and soft plant matter can be used as quality animal forage.



Picking the right fodder trees to plant requires consideration of the needs of livestock, the needs of the farm, and the needs of the family. The best fodder sources can address several needs on the farm, including fuel wood, green manure and wind and soil erosion control, protection and even food for human consumption. Important characteristics include adaptability to specific climatic and soil conditions, growth characteristics, nitrogen fixation, versatility of usage (e.g., fuel, honey, and charcoal, etc.), protein content, digestibility and palatability. It is important to note that digestibility is often related to tannin or other secondary chemical compound content which, if high enough, can interfere with digestibility and metabolism of nutrients in certain animal species. In some cases consumption of certain amounts of fodder high in secondary chemical compounds can cause illness or even death. If no specific guidelines are provided for fodder diet percentages, one single species should provide no more than 30% of ruminants' total diet and no more than 5-10% of total diet for non-ruminants.

Grazing systems are especially difficult to maintain in tropical areas with distinct rainy and dry seasons. It is particularly important to select trees that produce leaves through long dry seasons without requiring extensive irrigation. Regions with particularly long dry seasons may require additional land to produce forage, or a greater share of the Forest Garden dedicated to fodder species.

Processing and Storing Leaf Fodder

Forage trees should first be cut or coppiced when they reach 2 meters, and then again after every 0.5-1 meter in new height when re-growth is optimal. Cutting during the rainy season can be as frequent as every 2 weeks (6-8 times over the season). During the dry season, harvests may be reduced to accommodate unfavorable growing conditions.

Some farmers may choose to let the trees grow and then harvest them when the stems have reached a useful size for other purposes, such as fuel or stakes.

Processing and storing fodder takes into account many considerations such as: the time of year (dry or rainy season), animal preference and tolerance, available technology, type of final product (leaves, meal, cakes or pellets, etc.), market availability and even mode of transportation to market.



Feeding fresh forage to livestock is usually the best as it generally contains the most nutrients. However, this may not be an option all the time due to seasonal constraints, limitations in quantity and quality, and other factors. Although many tree-based fodder species produce during the dry season, they are often not as prolific as during the rainy season. Therefore, processing and storage is necessary to ensure proper supplies all year round. This also opens the door to possibilities for market options as demand for affordable, high quality feed rises during the dry season.

Options include drying forages, cutting and storing them, and/or processing them for later use either alone or mixed with other crop by-products. Other parts of the plant aside from edible leaves and petioles (herbage mass) may include seed pods, seeds, fruits and young branches.



Agroforesters around the world, and here in Ghana, have found ways to grow forage trees to feed livestock

When drying forages for storage, it is best to dry them in the shade on screens or other raised platforms that get plenty of ventilation. It may be necessary to check the material and turn it from time to time so as to prevent molding. Drying may increase the digestibility in some species by reducing the fiber content. Drying during the rainy season may be problematic due to spoilage. It should be done in accordance with weather forecasts or with improved drying methods that provide low-humidity heat. Making silage (usually fermented grasses) in bags or holes provides a more digestible product, particularly to non-ruminants, which can be easily stored.



A farmer in Kenya with a screen drying table for Calliandra processing

Forage Agribusiness Opportunities

Leaf meal can be marketed, but usually depends on equipment such as grinders and requires a binding agent (usually molasses). These types of feed supplements are more expensive to make but are very nutritious and can have a high resale value. Leaf meal is typically part of a feed ration mixed with other food. However, leaf meal may be bulky and expensive, especially during the dry season. Leaf meal and stored forages need to be compressed to increase transportation efficiency for both short and long-range transport. Typically, leaf meal is a dry season feed supplement and provides employment for producers and traders in leaf meal. This is a high-value good and has a lot of potential if processing can be made affordable and easily accessible to rural populations.

A major question is whether forage-based leaf meals can substitute for typical dairy meal in terms of not just quality and benefits, but also price and availability. Forage grown on trees can be either a supplement or a substitute.

Monetary considerations that go into forage production and/or purchasing decision making include the cost of the purchase (including transportation) versus the cost to raise and manage the forages (labor, seed, less land for other crops), the difference in outputs and market options such as changes in quantity and quality of the meat or dairy products that result, and market availability and costs of feed. All of these factors determine the strategy: substitution, supplementing and/or purchasing.

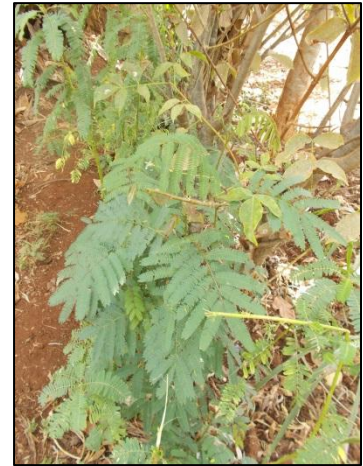
Popular Highland Fodder Trees

Calliandra calothyrsus

Calliandra leaves, with 24% protein content, are wildly popular in highland communities. *Calliandra* does not tolerate frost yet is adaptable to various soil acidities, and it is partially shade tolerant, fixes nitrogen, and likes well-drained soil that is not waterlogged. Its forage is high in protein (17-22% crude protein), and is relatively digestible (35-40%). Trees may produce between 6 and 16.7 tons of dry material per hectare per year. However, the high tannin levels limit digestibility so one needs to limit percentage in diet. Goats love *Calliandra* while cattle need an adjustment period. Ruminants tolerate it more than non-ruminants. Rabbits and fowl should only have 5%, and in general no more than 30% of a diet should be comprised of *Calliandra*.

Leucaena trichandra

L. trichandra does not tolerate frost, it does not do well in acidic soils, and it prefers well drained soils. It fixes nitrogen. Its forage is high in protein (17-33% crude protein), and the tannin content varies as does digestibility. This species is disease resistant, adapted to cooler climates but without frost tolerance, and has multiple uses. It is written that it is not well adapted to hot tropical environments,² but in the Kenya highlands, where temperatures are kept at bay because of the altitude, it is popular among farmers.

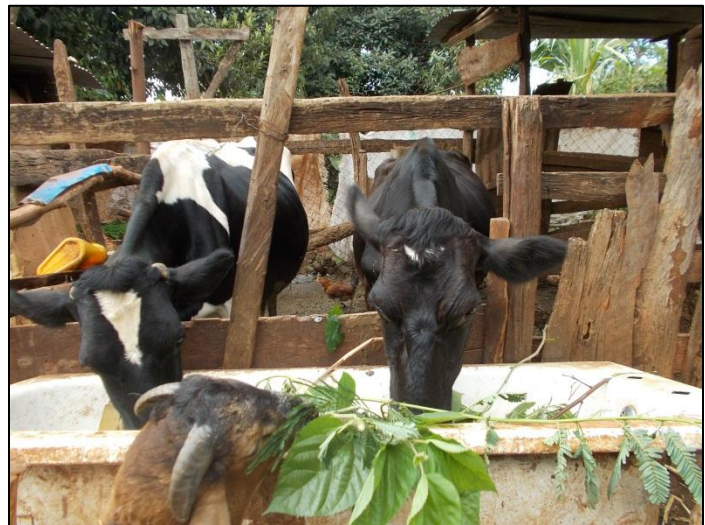


Sesbania sesban/grandiflora

Sesbania tolerates light frost and a wide variety of soil conditions, it fixes Nitrogen, and it is high in protein (15-20 % crude protein) and in vitro digestibility (75-90%). *Sesbania* trees produce around 20 tons/ha/yr dry matter. However, it should only be harvested five or fewer times per year and it is short lived. This is a popular fodder species and used for rotational fallow and honey production. It is often combined with lower protein sources to provide a complete forage regime.

Morus alba

Mulberry can tolerate frost and prefers alkaline well-drained soils but does not fix nitrogen. It has a high protein content (15-25 % crude protein) and very high digestibility (75-80% in vitro digestibility). They produce 5.6-11.2 tons/ha/yr dry matter. This tree may compete with crops due to its need for Nitrogen and other soil nutrients, so they should be integrated with nitrogen fixing species when planted in Forest Gardens. It is valuable due to its high protein, palatability, frost tolerance, edible fruits and silk worm production.



Popular Lowland Fodder Trees

Leucaena leucocephala

Leucaena grows well under a wide range of conditions, particularly in lowlands, and it quickly grows back when cut and produces a large quantity of leaves, even during the dry season. *Leucaena* leaves have the ability to greatly increase growth rate and milk

production thanks to their high levels of protein. An average herd of dual-purpose cattle needs a ration of about 11-12% protein. Local grasses have about 6% protein in the rainy season and 4% in the dry season. Leaves of the *Leucaena* tree have about 27.5% protein, high levels of vitamins A & B, and are palatable for animals.

Sesbania sesban/grandiflora

Description above.



Leucaena pallida

L. pallida tolerates light frost and prefers neutral to alkaline and well-drained soils. It does not tolerate waterlogging and is particularly at-home in very dry areas. It fixes nitrogen and, like other *Leucaena* species, has a very high protein content (29-35% crude protein) and very high digestibility (55-64 % in vitro digestibility). This *Leucaena* species is psyllid resistant, easy to grow and establish and tolerates more acidic and cooler sites than *L. trichandra*. However high tannin levels may limit digestibility and utilization of nutrients, so moderate amounts should be used as fodder.

Leucaena diversifolia

This *Leucaena* tolerates light frost and prefers slightly acidic and well drained soils. It fixes Nitrogen, is highly palatable, and has a high protein content (25-32% crude protein). Its high tannin levels may limit digestibility. This species of *Leucaena* has a tolerance of low temperatures and is resistant to psyllid insects. It makes good charcoal and fuelwood. It is a prolific seed producer, so it should be highly harvested and maintained to limit invasiveness. No more than 30% of total diet for ruminants and unsuitable for non-ruminants (give no more than 5-10%).

Morus alba

Description above.

Senna siamea

This is a popular fodder for goats, but secondary plant compounds are highly toxic to non-ruminant animals such as pigs and fowl. This plant also has a host of other uses such as fuel, medicine and textiles.

Nutritionists have pointed out that *Leucaena* is in the *Mimosae* family, and the leaves contain an irregular alkaline (amino acid) called mimosine, which can reduce calving rates under certain circumstances. So these leaves should be fed to single-stomach animals in limited amounts (25% for goats and sheep, none for horses or mules) but can be fed to large ruminants as up to 30% of the total ration.

Other valuable animal fodder trees for East Africa

Chamaecytisus palmensis (Tree Lucerne)

Tree Lucerne tolerates frost and drought, a wide range of soil pH, and prefers well drained soil. It fixes Nitrogen and has a high protein content (20-30% crude protein) and is extremely palatable (77-82% in vitro digestibility). It produces 10 tons/ha/yr dry matter. This species improves the soil and is good for honey production. It is easily digested and palatable, but it may take animals some time to become accustomed to it, and it can be sensitive to fungal diseases.

Gliricidia sepium

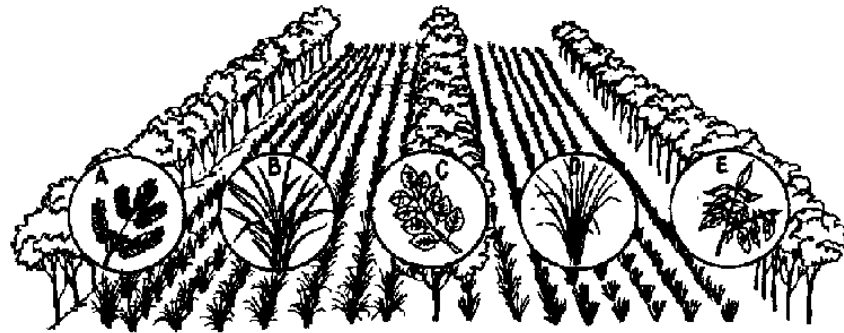
Mother of cocoa, its name translated from Spanish, does not tolerate frost or water logging, but it does tolerate a wide range of soil pH and fixes nitrogen. It offers 18-30% crude protein, 60-65 % in vitro digestibility, and 20 tons/ha/yr dry matter. It is described as having low palatability but does well when mixed with other forages. This species is especially good for ruminants and propagates easily through cuttings. It may be poisonous to non-ruminants, so do not give more than 10%. It is adapted for hot, dry sites and has a very high biomass potential. If left to grow, it offers good timber resistant to termites that is good for furniture. Its nitrogen-rich leaves are a good green manure, and it is popular among honey producers for the flowers.

Pennisetum clandestinum (Kikuyu grass)

Kikuyu grass is used for permanent pasture, grows best on fertile soils and tolerates a low pH. It may be used for hay or silage. It performs well in areas of low and high moisture regimes. A tropical plant, it does not tolerate frost. This forage needs to be cut to produce quality forage and is demanding of nutrients. It provides quality forage with high protein and digestibility levels with new growth. Caution must be used when foraging on new growth after long dry spell as over-consumption can cause toxicity.

Desmodium intortum

Greenleaf desmodium grass has a moderate protein (16-24% crude protein,) and digestibility (55% in vitro digestibility). It is an annual species that does not fare well in the dry season.



A — *Leucaena* B — napier C — *Gliricidia* D — guinea grass E — *Flemingia*

An example of how smallholder farmers can mix many of the species listed above in alleys of fodder trees and grasses (Photo: New Zealand Digital Library)

CHAPTER 12: REFERENCES

1. This section was adapted from Trees for the Future's *Trees for Livestock* publication, found at: <https://trees.org/post/trees-for-livestock-2/>.
2. Franzel, S., Wambugu, C., Nanok, T., Kavana, P., Njau, T., Aithal, A., Muriuki, J., and Kitanyi A. 2007. The production and marketing of leaf meal from fodder shrubs in Tanga, Tanzania: A pro-poor enterprise for improving livestock productivity. ICRAF Working paper No. 50. World