



Making Silage in Vichada

by Dexter B. Dombro

La Pedregoza is a 2,650 hectare (6,545 acre) tree plantation and natural reserve in the Colombian department (state or province) of Vichada, in the Orinoco River basin. The plantation uses sustainable practices and natural silviculture, seeking whenever possible to emulate the climax vegetation of the region, using organic fertilizers and biological controls. The focus of the plantation is to produce forest products that do not contaminate the soil or water systems, while actively practising conservation and biodiversity preservation.



Worker harvesting elephant grass.
Source: Dexter B. Dombro

La Pedregoza is making as many natural fertilizers as possible to support the trees we cultivate, which include *Acacia mangium*, *Eucalyptus pellita*, *Pinus caribaea* and over 40 species of native trees, such as *Acosmium nitens*, *Copaifera pubiflora*, *Simarouba amara* and *Vochysia lehmanii*. Quality manure is a very important fertilizer, which is why we maintain a stable with Zebu cattle. The nutritional content of the feed our cows eat has a direct bearing on the quality of their manure, so we are looking at ways to enhance their diet during the dry season (January to April), when native grasses dry up and are little better than cellulose. Silage can be a helpful solution during the dry season; this article explains the process we are employing at our plantation.

For our purposes, silage is made from fresh grass or other green fodder that is chopped, mixed with molasses, compacted and then stored and fermented under airtight conditions, to be used as animal feed when climatic conditions are appropriate. Silage is important because it



Feeding elephant grass through the chopper.
Source: Dexter B. Dombro

retains up to 80% of the nutritional value of the fresh grass or fodder; by contrast, hay or dried fodder will lose up to 80% of its nutritional value. Silage is a better feed for cattle than dried fodder, and also results in better quality manure that can be used to prepare compost or other fertilizers.

We plant a variety of grasses at La Pedregoza. The most productive one is African elephant grass (*Pennisetum purpureum*), which can grow to be 4 meters tall, spreads well in the pasture, and produces up to 40 metric tons of biomass per hectare per year. This high rate of biomass production means that elephant grass is not just a useful animal feed, but could also be ploughed into poor soils to enhance the soil's organic matter, carbon and nitrogen content. While it produces and grows from seed, elephant grass is more efficiently propagated using stem cuttings when the plant has matured. The grass is tolerant of poor soils and low rainfall, which is advantageous in some tropical locations.



Worker dwarfed by elephant grass.
Source: Dexter B. Dombro

We cultivate two other grasses in our silvopasture project, both of which have reasonable protein contents and can be



Brachiaria pasture at La Pedregoza.
Source: Dexter B. Dombro

used for silage. *Brachiaria decumbens* tastes bitter, while *Brachiaria humidicola* is sweeter and more nutritious, especially when cultivated with other legume plants. Having a variety of grasses and fodders enhances the cows' menu and improves the quality of the manure. Nevertheless, this article focuses on making silage with elephant grass.

We harvest using machetes, much the way sugar cane is harvested. The bundles of cut elephant grass are carried to and fed into the chopper, which is powered off the tractor's PTO, and which casts the chopped grass into a wagon. One full wagon holds about 1,200 kg of chopped material, which is a reasonable amount for one day's silage making. It represents two hours of harvesting and chopping by two to three farm hands. If we harvested and chopped any more than this at one time, we might end up with drier and less nutritious material even one day later.

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Honoring God by empowering the undernourished with sustainable hunger solutions.

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Filling a trailer with chopped elephant grass.
Source: Dexter B. Dombro



Source: Dexter B. Dombro

Our next steps are to mix the chopped grass with molasses, then stuff the material into bags and seal them. For packing the grass, we use a two-barrel manual silage press, which allows for a fast work flow. Each barrel accommodates a heavy gauge

plastic bag that can take 40 kg of chopped grass. Our daily target is 30 bags of silage weighing around 40 kg each. The 40 kg bags are easy to carry and transport, and they stack well. We store them in a shed. This part of the process takes three farm hands four hours to complete.

Silage must be mixed evenly to ensure good fermentation. We add 10 kg of molasses



Source: Dexter B. Dombro

to every 200 kg of chopped grass; we also add about 1 kg of cattle salt. We use shovels and rubber boots to mix until the molasses is well distributed throughout the grass. Next, we fill the bags. We compress the grass mixture in each bag to remove as much oxygen as possible. We start with 10 kg of mix in the bag and compress it, before adding more material and compressing again.

Silage must be fermented anaerobically (without air). If air is left in the bag, the silage will spoil and will smell horrible, at which point it is only useful as compost. The secret of good silage is to remove as much air as possible before sealing the bags. To do so we fill the bags in 2 or 3 stages, applying compression with a silage press at each stage, as air can get trapped if the bag is filled all at once. Within days of making silage, the storage area should have a nice aroma, similar to that produced when making beer or wine.



Removing air from silage bag is important.
Source: Dexter B. Dombro

Once the bags are filled and compressed, they are sealed tight with a cord and taken to the storage area. In tropical areas, it is best to store the silage in a shaded area, away from direct sunlight. The silage will be ready within 15 days of being bagged; it can last for up to one year, though we generally use it within four to six months. By being careful with the bags and keeping them out of the sunlight, we are often able

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Tech Note Spotlight: Biosand Water Filter

Summary by Libby Arcia

Echo regularly publishes agriculture technical notes to address important agriculture development issues. Here is a short excerpt from a tech note on Biosand Water Filter. It is available on ECHOcommunity.org (<http://edn.link/biosandwaterfilter>).

INTRODUCTION

Access to clean drinking water remains one of the greatest challenges in the world. The BioSand Filter is one method that can be used for purifying water at the household level. With this filter, contaminated water is filtered through a natural biological layer and then layers of sand, pebbles and stones. The BioSand Filter can be made using local materials and is a low-cost system that removes suspended sediments

and other impurities from water in order to make it safer for human consumption. Silage produced on-farm is already very cost-efficient, as the main ingredient (the grass) can be grown on-site. Our cost of in-house production is approximately one third of the cost of purchasing competing commercial products.



Silage bags stored in shed.
Source: Dexter B. Dombro

The process described in this article can also be used to make Bokashi, a type of Japanese fermented compost that is much richer in nutrients and quicker to produce than regular compost. Bokashi requires an extra step—preparing Bokashi bran—which is then mixed in with chopped plant material, manure, kitchen scraps and molasses. From that point the process proceeds as described in this article. The end result can be used as a soil amendment and fertilizer. Bokashi is not an animal feed. Recipes for making Bokashi bran (using wheat bran, rice water, sawdust or other ingredients) can be found on the internet.

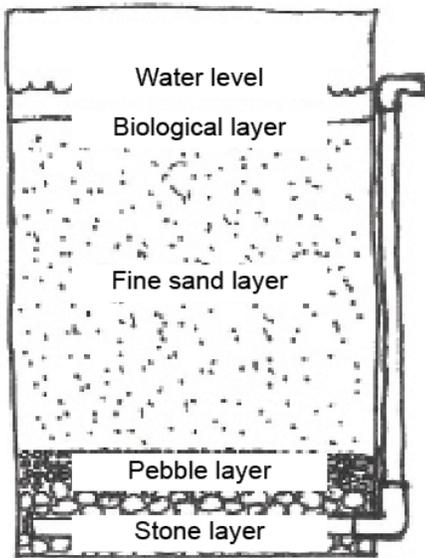


Here's to happy Zebu cows pooping a lot, so that we can fertilize lots of trees!
Source: Dexter B. Dombro

and other impurities from water in order to make it safer for human consumption.

HOUSEHOLD WATER TREATMENT

Inadequate water and sanitation services result in an estimated 4 billion cases of diarrhea and 2.2 million deaths each year (WHO/UNICEF 2000). In areas where there is no access to potable water, household water treatment can contribute significantly



The various layers in a biosand filter.
Source: ECHO Tech Note 43

to reducing water related health problems. The most effective water treatment methods follow a process of sedimentation, filtration, and disinfection to remove bacteria, viruses, helminthes, and protozoa.

FILTER DETAILS

The first known sand filter was made in Scotland in 1804 and since then slow sand filtration has been a common filtration method in the water treatment process. The BioSand Filter has adapted this technology to work at the household level, providing clean water at a maximum flow rate of

0.63qt (0.6lt) per minute. In the BioSand Filter, contaminated water is poured in at the top and is cleaned as it passes through a biological layer, a fine sand layer, a pebble layer, and a small stone layer

MATERIALS NEEDED FOR CONSTRUCTION

The complete article provides a detailed list of all material needed, including weight and measurement dimensions to construct an appropriate filter for home use.

FILTER CONSTRUCTION

Easy to follow instructions and diagrams on how to build the Filter Body and Diffuser Lid and Supply Container, makes this an attractive and easy project for a household in need of healthy drinking water to undertake.

FILTER ASSEMBLY

This step-by-step description on how to assemble to filter reads like an easy to follow recipe and is accompanied by an illustrative diagram allowing for a visual of what the product should look like when assembled.

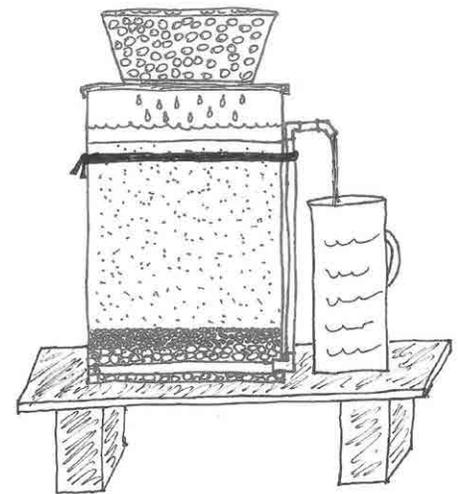
FILTER USE

It takes approximately 3 weeks before the water is sufficiently filtered to be consumed

without further disinfection. For best results use water from the same source to maintain the biological layer; keep the filter protected from dust and sunlight; keep the outlet clean; use a clean container for catching the filtered water. If the water to be filtered has lots of sediment or is very cloudy it should be allowed to settle before pouring it into the filter.

FILTER MAINTENANCE

Over time the top of the fine sand layer will become clogged with sediment and debris and the flow rate will decrease. Cleaning frequency will depend on the amount and quality of water used.



Placemtn of media inside a biosand filter.
Source: ECHO Tech Note 43

ECHOES FROM OUR NETWORK

Member Highlight

Meet Adria and Job, ECHOCommunity.org members who work in Honduras through God makes it grow, a ministry committed to serve God as His workers while He makes things grow. Through agriculture, business, and water projects God Makes It Grow aims to develop discipleship. Adria and Job have attended ECHO conferences and classes which are available to all our community members.

Adria and Job serve through the local church, Iglesia Evangélica Centroamericana Eben-Ezer, which has several different ministries. One such ministry, "Cultivadores del Reino" or "Kingdom Growers", works with small-scale coffee farmers that live in the Siguatepeque area to train them in efficient production while building relationships and

presenting the gospel. Job was asked to serve as President of "Junta de Vigilancia", the team responsible for accountability. The role of this group is to ensure all activities and commitments within the ministry are faithfully fulfilled. In addition, Job is involved in trainings and transportation of crops to processor, as many coffee producers do not have a vehicle to transport their harvest to market.

If you would like to learn more about Adria and Job's work please visit the blog: <https://godmakesitgrow.wordpress.com/>



Lessons learned in the garden will bring to life trainings based on "You reap what you sow". The gardens are fertile ground for teaching points for the Christian life!
Source: Adria

FROM OUR ECHO TECHNICAL RESPONSE TEAM

Appropriate forage crops for clay soils

Question from our Network

"In Honduras, I am dealing with a very challenging soil situation. It is at 4000 feet of elevation. It is a clay that packs very tight almost impossible to dig when dry. About half of the year it is very dry and a few months of the year it is very wet. Can you recommend forage trees or shrubs that could be used as cut and carry for sheep in this location? In other words, what forage plants tolerate both drought and water logged situations at an elevation of 4000 feet?" - Tom Braak

Suggestions from ECHO Interns Melissa Larson and Meg Robel

Here is a list of forage trees that will be excellent fodder for sheep (I have used both the gliricidia and lucaena with good results in Honduras). These should be able to withstand the over wet and then over dry clay soils, and should be readily found throughout the country.

1 - *Gliricidia sepium* – Madreado

Family: Fabaceae (alt. Leguminosae) subfamily: Faboideae tribe: Robinieae. Also placed in: Papilionaceae.

Madreado is a native to the seasonal forest areas of Mexico, Central America and Belize. Among its many uses are living fences, hedges, cut and carry feed for ruminants and alley farming. In its native range it is found on highly eroded soils of volcanic nature. It is also found in sandy and heavy clay soils.

It is highly tolerant of draughts retaining its leaves in areas which retain humidity year round. Its high nutritive quality is valued as green forage and protein supplement to lo-quality tropical forage products for cattle, sheep and goats. Following is the link to the information sheet:

http://www.tropicalforages.info/key/Forages/Media/Html/Gliricidia_sepium.htm



Sheep eating *Gliricidia sepium*.
Source: Brad Ward

2 - *Leucaena leucocephala* – Leucaena / Guaje:

Family/tribe: Fabaceae (alt. Leguminosae) subfamily: Mimosoideae tribe: Mimoseae. Also placed in: Mimosaceae.

The Yucatan Peninsula and the Isthmus of Tehuantepec in southern Mexico are its native areas. It is also widely distributed throughout the tropics. Native inhabitants of Mexico and Central America have used the unripe pods and seeds of all subspecies as food and medicine. In its native range it grows in shallow limestone soil, sandy and seasonally dry soils. Its foliage has very high nutrient value for ruminants. It is highly palatable to most grazing animals. Below is the link to the fact sheet:

http://www.tropicalforages.info/key/Forages/Media/Html/Leucaena_leucocephala.htm

3 - *Albizia lebeck* – Lengua de mujer:

Family: Fabaceae (alt. Leguminosae) subfamily: Mimosoideae tribe: Ingeae.

It is found monsoon forests, and rainforests of its native habitat, and in a variety of situations in the humid and semi-arid tropics and subtropics. Prefers well drained soils with high to mild fertility but will grow in less fertile soils. It is draught tolerant. Green leaf, fallen leaf and flowers have all been shown to be highly palatable and of high nutritive value for sheep. To access the fact sheet visit:

http://www.tropicalforages.info/key/Forages/Media/Html/Albizia_lebeck.htm

4 - *Erythrina poeppingiana* – Coral Bean / Pito Extranjero

Family: Fabaceae (alt. Leguminosae) subfamily: Faboideae tribe: Phaseoleae subtribe: Erythrinae. Also placed in: Papilionaceae.

It is cultivated as an introduced species in Central America, the Caribbean and south Asia. Tolerates low soil fertility and soil textures from heavy clays to coarse sand. It has adapted to humid and sub-humid regions and can be used to drain soils. Fodder is used as a ruminant feed. It is well accepted by pen-fed goats. For greater detail on its use as animal feed visit the link below.

http://www.tropicalforages.info/key/Forages/Media/Html/Erythrina_poeppigiana.htm

FROM ECHO'S SEED BANK

Forage peanut

Forage peanut is a perennial herb native to Brazil that is found throughout South America and has many uses. It is used as a cover crop because of its thick growth and strong root which make it effective for erosion, weed and fire control. In addition to its many uses, perennial peanuts are resistant to most peanut diseases. Their nuts and leaves are inedible for humans,



Flower structure and leaf canopy of forage peanut. Source: ECHO Staff

but livestock graze easily in perennial peanut vines. For complete information on this important grass visit:

<https://www.echocommunity.org/resources/31dab8f5-b8f6-4453-8d4d-4224638667bd>

UPCOMING EVENTS

Course: Handle of stingless bees

April 19, 2017 - April 22, 2017

Agroecology and Permaculture Center , México
Presented by: Las Cañadas

Stingless bees (also called Meliponinos) represent a group of highly social insects, with perennial colonies and inhabitants of tropical and subtropical areas. Its importance emphasizes from the environment as pollinators to the productive part, passing through the social, traditional aspects, of inclusion of gender, non-timber exploitation of the forest, among others.

Permaculture Design Certification Course

April 25, 2017 - May 08, 2017

Rancho Mastatal Sustainability Education Center, Costa Rica
Presented by: Rancho Mastatal

Join Rancho Mastatal's diverse team of permaculture instructors Scott Gallant, Mitch

Haddad, Santiago Miranda, Rachel Jackson, Sam Kenworthy, and Laura Killingbeck for this annual life-changing 2-week experience. The course covers the core Permaculture Design curriculum and emphasizes creating diverse multi-functional human landscapes based on ecological patterns. Utilizing Rancho Mastatal as a living classroom, the class will mix lectures and hands-on work, exploring design solutions for both temperate and tropical regions.

Seed Saving: A Practical Overview for Small-scale Seed Banking

May 08, 2017 - May 12, 2017

ECHO Global Farm, USA
Presented By: ECHO

ECHO offers over 350 varieties in its Florida seed bank requiring diverse approaches to growing, processing, and storing seeds. This five-day course will begin in ECHO's seed production plots to help participants better understand how crops are managed and harvested. Techniques related to both wet and dry processing of seeds will be practiced, as well as, essential tasks such as germination testing. Long-term seed storage

approaches including vacuum sealing and cold storage will be explored, emphasis will be placed on seed saving technologies and approaches for challenging tropical locations.

Tropical Agricultural Development I: The Basics

July 24, 2017 - July 28, 2017

ECHO Campus, United States
Presented By: ECHO

Those interested in preparing for short/long-term involvement in agricultural development internationally are encouraged to participate in this one-week course held four times a year. Course participants will gain an introduction to aspects of poverty and community development and an orientation to ECHO. They will also receive instruction on proven agricultural principles/practices and practical techniques, systems and technologies to meet agricultural and nutritional needs of small-scale, impoverished farmers. There will also be time for hands-on work on the farm, visits with staff, and study in the library. Course content is presented from a biblical perspective.

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PLEASE NOTE: At ECHO we are always striving to be more effective. Do you have ideas that could help others, or have you experimented with an idea you read about in *LACN*? What did or did not work for you? Please let us know the results! cac@echonet.org