Silvopasture in Martinique: a lever to promote carbon neutral local energy and mitigate forage shortage in a climate change context

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Introduction

Today more than 93% of the electricity in the Martinique Island (French West Indies) is produced from fossil fuels. The regional scheme for the implementation of the French law on energy transition for green growth, which is part of the French commitment in the 2015 Paris agreement, targets 50% of renewable sources for power generation in 2020. The new 36.5 MW power plant GALION 2 project, under construction, will supply from 2017 15% of the electricity needs of the island, and all the energy needed by the nearby sugar plant, only from biomass combustion. The promotor, Albioma, has committed itself to incorporate about 150,000 tons of local feedstock per year.

As none energy biomass market exists in Martinique, Albioma has launched various studies to evaluate the opportunities of sourcing biomass from residues, forest and various agricultural sectors.

Martinique is a limited territory where human activities and needs have to coexist with an unique environment in a context of awareness of social and environmental responsibility. The biomass production schemes to be developed will have to consider the current practices and, as much as possible, seek for positive synergies. Due to the climate change context, animal production is facing increasing problems of forage sufficiency in the dry season.

An Albioma's study in progress is devoted to the assessment of pre-working trials for silvopasture schemes, to match the combined objectives of improvement of animal production and of making value of the ligneous biomass.

Material and Method

Analyzing the local constraints

- Martinique is an 1,100 km² island ➔ limited land area
- Volcanic island ➔ rugged terrain
- Tropical context: 14°N, 61°W; two seasons (rainy/dry)
- Decrease of farming area in favor of urbanization ➔ priority to food crop and livestock
- Biodiversity hot spot ➔ vegetal and animal introduction is restricted
- EU laws application ➔ environmental restrictions higher than other tropical territories

Extensive farm, Domaine de Roches Carrées, Martinique

Swietenia macrophylla in silvopasture, Hacienda El Pidio, Dominican Republic

Taking a leaf out of Caribbean examples of biomass production integrated into food production[1]

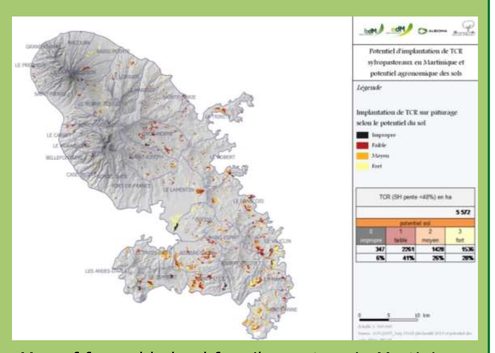
- Colombia
- Costa Rica
- Dominican Republic

➔ Several productive models identified to integrate biomass production into food crop production

Assessing potential for silvopasture by analyzing land distribution in Martinique

Evaluating the actual land destination and which schemes can fit to the current agro-systems established.

- Pastures ➔ most on the south side (dry area)
- Slope degree less than 40% making mechanization possible ➔ 5,500 ha identified
- Plus 6,000 ha of non productive fallow land ➔ silvopasture as an opportunity to take this land back to production.



Map of favorable land for silvopasture in Martinique

View of one of the plot identified for the project, Sainte Luce, Martinique

Finding land for testing models in Martinique and involve farmers

Finding motivated farmers who want to convert their land to a double production system: food and energy biomass. Analysis of their current systems:

- Cattle density : low
- Rotation frequency of livestock on pastures : low
- Food supplements brought : high
- Selling weight : low

➔ Making up a model to improve the current conditions
➔ Creating a new paradigm

Selecting vegetal species

Several constraints:

- Highly productive tree species for both biomass and forage
- Non-invasive species
- Regulatory, environmental and social pressures

➔ No *Acacia*, no *Eucalyptus* ➔ only local/endemic species chosen:

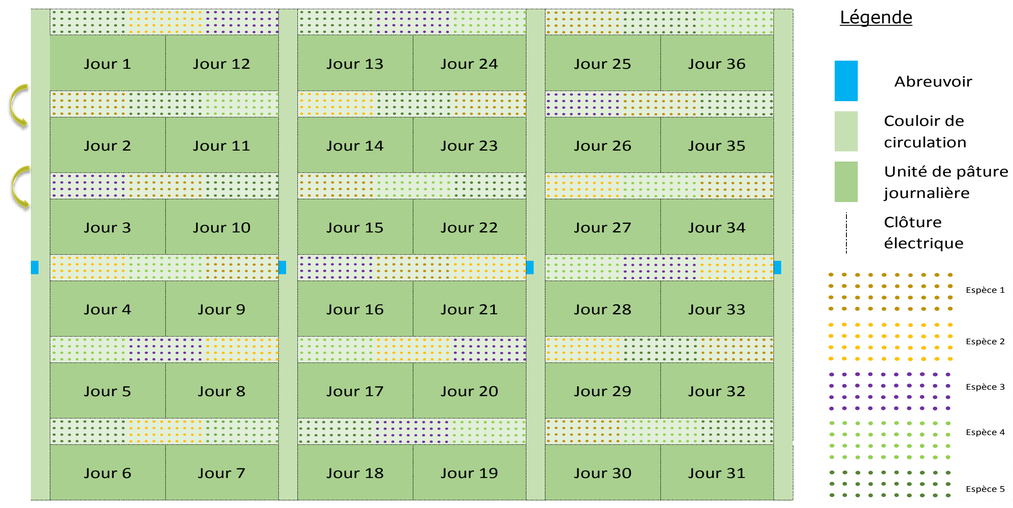
- ➔ *Cordia sulcata*
- ➔ *Acnistus arborescens*
- ➔ *Gliricidia sepium*
- ➔ *Guazuma ulmifolia*
- ➔ *Inga ingoides*

Gliricidia sepium (Fabaceae) in Martinique

Drawing the silvopastoral models[2]

With the expert assessment of ONF International Andina, considering the farmers needs:

- Improved pasture ➔ replanting the grass stratum with *Brachiaria decumbens*
- More forage ➔ planting forage lines with *Gliricidia sepium*
- More shade and biomass production ➔ planting tree lines



Model pattern to be implemented on testing pastures in Martinique

Validating the silvopastoral models

By gathering a Scientist Committee made of:

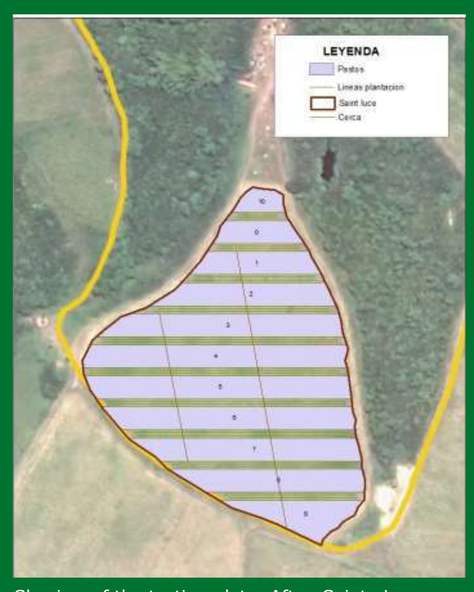
- Local experts: Agriculture Chamber, IKARE, SIMA-PECAT consultants
- National experts: IDELE, INRA, CIRAD
- International experts: CATIE (Costa Rica)

Plus a participative working group in association with farmers representatives

Results

Converting the plots

Skyview of the testing plot – Before, Sainte Luce, Martinique



Skyview of the testing plot – After, Sainte Luce, Martinique

4 years monitoring

- Tree growth and biomass yield
- Combustion characteristics of biomass
- Forage growth
- Cattle weight and growth

March 2016: Land prospection and models production → April 2016: Scientist Committee for models validation → May 2016: Project manager consulting → August 2016: Land preparation → September 2016: Plantation

Discussion

The trials would give their first usable data on livestock system after one year of implementation, and on biomass production between the third and the fourth anniversary of the plantation.

The success of these silvopastoral trials directly relies on the economic viability of the biomass finally produced to supply the power plant, including the whole supply-chain: plantation, maintenance, harvest and transport. But it also relies on the positive impacts on the livestock production system: higher daily weight gain, less supplementation bought, higher livestock density. The intensification provided by the model may solve the issues that faced cattle breeders such as lack of land or expensive clearing authorization procedures.

Finally, in this logical integration of energy biomass to current agro-systems, the need of local feedstock generated by Albioma should create a magnet effect on the territory that would be beneficial to all agriculture sectors, provided the concerned sectors themselves seize the issue to come.

References
[1] SIMA-PECAT, Développement des cultures énergétiques en Martinique, Lot 2, September 2015
[2] ONF Andina, Expérimentations de modèles sylvopastoraux en Martinique, April 2016

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