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**BUILDING SUSTAINABLE BIOMASS-BASED ENERGY SYSTEM FOR CARIBBEAN ISLANDS**

Jean-Marc Blazy, François Causeret, Pierre Chopin, Dominique Denon, Loïc Guindé, David Hammouya, Jacky Paul, Mirza Publicol and Jorge Sierra, INRA, UR1321 ASTRO Agrosystèmes tropicaux, F-97170 Petit-Bourg (Guadeloupe), France Email: jean-marc.blazy@antilles.inra.fr

**Abstract:** Interest in renewable energy from agricultural biomass has increased in recent years. Among renewable energy sources, biomass is considered indeed as an attractive option for sustainable energy production. This is particularly true in the case of small tropical island states, where energy demand is increasing and the energy mix currently heavily relies on fossil imported resources. Diversifying and orientating the energy mix toward locally grown energy crops could therefore be a promising sustainable option. However, the introduction of such bioenergy systems under existing conditions and current agricultural models is still rather uncertain and requires achieving several sustainable goals. In order to build new sustainable energy systems, modelling the biomass supply is a critical step prior to investment. In this paper we propose an original modelling framework in order to tackle this issue in an integrated approach. Our framework consists in the linkage of three types of models: 1) a biophysical crop model to simulate agronomic options (including choice of genotypes, crop and soil management), 2) a farm scale model aimed at simulating farmer's decisions to adopt growing biomass and 3) a spatially explicit model whose aim is to simulate at the regional scale the biomass supply and sustainability indicators. The framework is applied to the building of scenarios of fibercane-based energy systems at territorial scale in Guadeloupe, a small tropical island in the Caribbean. Through an optimisation module, it is possible to identify agro-economic scenarios of biomass systems satisfying multiple objectives and constraints in a sustainable way. We finally discuss about the genericity of our approach and on factors affecting the success of biomass systems implementation in small tropical island states.

**Keywords:** energy crops, sustainability, farm model, landscape scale



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