Intercropping maize with a legume cover crop such as *Cajanus cajan* during the dry season ensures good yields
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biomass that can be used to feed dairy animals during the dry season. However, the long-term advantages, such as fertility improvement and weed control, have yet to be appreciated by the farmers involved.

In addition to its work on innovative cropping systems, the project has begun to develop an approach for building innovations in close partnership between research and local stakeholders. Through a cycle of debate and training, multi-stakeholder dialogue and experimentation mechanisms are gradually changing. Experience shows that these processes have their difficulties, but has also revealed what needs to be done to ensure that they run smoothly. An analysis of farmers' groups and how they operate enabled an assessment of the relationship between local organizations and public rural development policies on a municipal and inter-municipal level, in the light of the latest federal territorial development programme..

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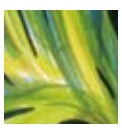

Mafate, modelling and analysing matter flows

on a territory scale

CIRAD's work on animal farm effluent management in Réunion has led it to develop a generic approach for modelling and analysing matter flows on a territory scale. The approach sheds light on farmers' practices and helps them draw up strategies for managing such flows.

CIRAD worked with its partners to develop the "Mafate" approach for modelling and analysing matter flows on a territory scale by looking at animal farm effluent management in Réunion. Using surveys of 200 farms throughout the island, 26 typical farms were identified based on their natural environment, structural characteristics and management strategies. An action model was then built. It described the structural parameters of farms and the management rules applied, according to five functional modules: production, storage,

Partners

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spreading, treatment, import and export. This preliminary work resulted in three simulation models. The first, Magma, simulates transfers between animal production units and crops within a farm. The second, Biomas, simulates organic matter transfers within a small region, between farms with surpluses and farms with shortages. The third, Approzut, simulates supplies to a collective effluent treatment unit from a number of farms. Calculation tools were also developed, to compare the performance and cost of different effluent treatment processes, and a geographical information system was built to establish fertilizer balances.

These models simulate matter transfers between production units—animal farms, crops, treatment units—represented by stocks connected by flows. They provide answers to the usual questions relating to flow management: which unit should export its matter stocks? To which other unit? Based on what calendar or event? Using which type of transport or labour? In what amounts? The approach was subsequently adapted by integrating biophysical models so as to simulate every type of biomass flow within dairy farms.

Based on a system management scenario, these models were used to test various improvement strategies, by proceeding gradually to change the management rules, physical elements and production methods used on farms. These modifications of increasing importance correspond to the questioning of very short-term operational choices (less than one cycle), medium-term tactical choices (at least one production cycle) and longer-term strategic choices (several production cycles). This demonstrated the merits of working on system dynamics rather than calculating annual balances for managing animal production effluent. In effect, simulation makes it possible to synchronize the dynamics of effluent supply and demand, which are not taken into account in annual balances.

Decision support models intended to help agricultural players are currently being validated under two projects: one on supplies to the treatment unit at Saint-Joseph agricultural college in Réunion, and the other on collective spreading plans in the Ille-et-Vilaine département (mainland France). Simulated management strategies have yet to be assessed in terms of their environmental impact, notably by integrating models that simulate flows towards the environment and using multicriteria environmental evaluation methods, such as life cycle analysis.

Spreading pig manure in Brittany by injection, in the foreground, and spraying, in the background
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