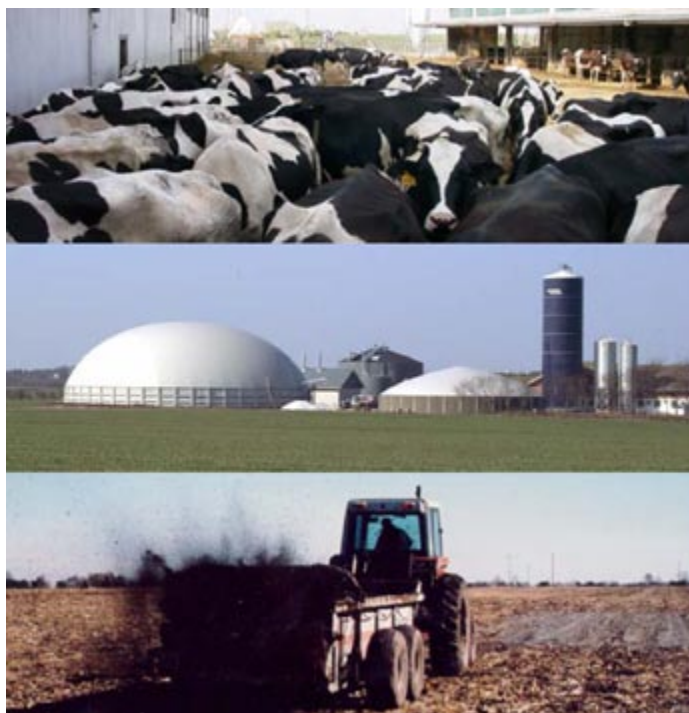


## **12th Ramiran International conference**

Technology for Recycling of Manure and Organic Residues in a Whole-Farm Perspective. Vol. II



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## **Technology for Recycling of Manure and Organic Residues in a Whole-Farm Perspective. Vol. II**

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## About RAMIRAN

The Network on Recycling of Agricultural, Municipal and Industrial Residues in Agriculture (RAMIRAN) is part of ESCORENA - the European System of Cooperative Research Networks in Agriculture. ESCORENA was established by the FAO Regional Office for Europe (REU) in 1974. It is a form of voluntary research cooperation among interested national institutions involved in research in food or agriculture in European countries. Over the years, ESCORENA has expanded its field of activities to include topics and themes of interest to other countries, particularly those from the Near East and Mediterranean area.

### The objectives of ESCORENA are to:

- Promote the voluntary exchange of information and experimental data on selected topics.
- Support joint applied research on selected subjects of common interest according to an accepted methodology and an agreed division of tasks and timetable.
- Facilitate voluntary exchange of experts, germplasm and technologies.
- Establish close links between European researchers and institutions working on the same subject to stimulate interaction.
- Accelerate the transfer of European technology advances to, and in cooperation with, developing countries.

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Much of the detailed work of the network is undertaken by the Working Groups. There are currently 7 Working Groups within RAMIRAN including 2 new groups that were established at the last Workshop in Gargnano.

The titles, chairmen and contact details for these groups are listed below.

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# **Explaining the diversity of environmental performances according to a typology of farming practices combinations: the case of the dairy cattle breeding in Réunion Island**

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A farm-gate budget is the most integrative measure of environmental pressure and seems most suitable as environmental performance indicator (Oenema *et al.*, 2003). The farm-gate budget can also be used to identify farming practices which are not environmentally sustainable (Goodlass *et al.*, 2003). Taking the case of the Réunion Tropical Island, and focusing on the nitrogen (N) element, this paper applies the nutrient budget method to answer the question "Are some dairy farming models in the island more environmentally friendly than others?"

After an exceptional development period, the dairy sector (23,850,000 liters, 4,290 cows, 135 farmers) in Réunion Island (21°06'S, 55°32'E, 2700 km<sup>2</sup>, 774,000 inhabitants) has to integrate environmental questions in the developmental orientation of the whole production chain, at the farm level in particular. However, development of grasslands is really limited by relief and dynamics of urbanization. In the majority of cases, the total utilised agricultural area (UAA) per dairy farm available to produce forage and spread manure is limited, with high stocking densities (often > 3 LU ha<sup>-1</sup>). Therefore the farming models are generally based on high levels of inputs. Hence, it is important, to analyse the environmental impacts of the dairy farming practices in Réunion.

The sampling of the enquired farms was based on a technical-economical typology. 35 dairy farms were selected to represent all the farm types (assuming that the management style-diversity was covered). Semi-structured questionnaires were administered to the 35 farmers. They were questioned about their management practices which correspond to technical operations that generate biomass flows. As discussed by

Hedlund *et al.* (2003), these interviews with local farmers were the basis for quantifying the biomass flows on a yearly basis.

In the present study, the chosen method of nutrient budgeting was the "farm gate balance" (Simon *et al.*, 2000). Total "N in" was the sum of N inputs in purchased biomass: concentrates, forages (including straw for mulching), animals, mineral fertilisers and manure. Total "N out" was the total amount of N in exported biomass: milk, animals and manure. The whole farm N surplus was calculated as (total N input – total N output)/ UAA. The farm N use efficiency was defined as N output/ N input. N contents of the different types of biomass were derived from data of previous works conducted in Réunion.

A principal components analysis was carried out on data from the 35 farms characterised by their practices. The two first axes (data not shown) could be interpreted as axes of "land desintensification". i) The first axis characterised the "feed autonomy" of the farms. Feed autonomy can be defined as low use of concentrate and no import of forages by valorisation of on-farm produced forage. ii) The second axis expressed the "fertiliser autonomy" of the farms. Fertiliser autonomy is low use of mineral fertiliser per unit of UAA, significant on-farm recycling of manure. We propose a farm classification of 5 types. Type 1 and 2 cluster farms that have land intensive and technically intense practices. Farms of type 4 and 5 have land extensive practices. Type 3 is intermediate to 1-2 and 4-5 types.

Concentrates and mineral fertilisers are the main sources of N input (average values for all farm types: 51 and 41% of the N imports, respectively), similar to regions with intensive dairy farming systems (Hedlund *et al.*, 2003). The average N surplus per hectare UAA among Réunion's dairy farms is higher than that found in the intensive milk production in other regions of the European Union (Kelm and Taube, 2003), like Flanders (Nevens *et al.*, 2006). But this significant potential environmental impact has to be contextualised by considering the low density of dairy farms in Réunion (1% of the total area of the island). Moreover, Réunion farms have a better N efficiency (see Table 1) than Western European farms.

Table 1. Means of farms' characteristics per type (2004).

	Type 1	Type 2	Type 3	Type 4	Type 5	Average	Flanders <sup>1</sup> (2001)
UAA (ha)	15.7 +/- 11.1	8.2 +/- 0.7	17.3 +/- 11.1	23.1 +/- 25.9	30.3 +/- 25.7	18 +/- 14.5	32.5
Stocking density (LU ha <sup>-1</sup> )	5.3 +/- 11.1	5.1 +/- 0.7	4.0 +/- 11.1	2.7 +/- 25.9	3.0 +/- 25.7	4.2 +/- 2.1	3.0
N surplus (kg N ha <sup>-1</sup> yr <sup>-1</sup> )	660 +/- 225	505 +/- 290	480 +/- 255	365 +/- 170	220 +/- 135	490 +/- 260	240
N Efficiency	0.27 +/- 0.13	0.31 +/- 0.13	0.21 +/- 0.18	0.21 +/- 0.20	0.36 +/- 0.16	0.25 +/- 0.16	0.22
Milk productivity (kg cow <sup>-1</sup> yr <sup>-1</sup> )	6720 +/- 1355	6310 +/- 1155	5650 +/- 1180	5690 +/- 1255	5995 +/- 950	6020 +/- 1230	5830

<sup>1</sup> (Nevens *et al.*, 2006)

Extensive practices (types 4 and 5) appear to further lower N surplus. But N importation (intensification) is necessary to have higher milk productivity (types 1 and 2). Farms of types 1 and 2 compensate those N imports by exporting solid manure so they have a higher N efficiency.

From an economical point of view, if subsidies are linked to milk production, farmers will still have to aim at a high level of milk production. Therefore, considering only land limitation the intensive models (with high milk productivity) would really be defensible. Whereas if subsidies become decoupled or in the case of pluriactivity development (type 4), the extensive model could be retained, also for land limited systems.

Combining the typology of practices with environmental performances of the farm types revealed "environmentally positive practices", like export of manure. Knowing the importance of sugar cane crop (59% of the total UAA of the island vs. 5% for dairy farming), there is a high potential capacity of the sugar cane sector for accepting organic fertilisers from the dairy sector.

The current study was a first attempt to identify "environmentally positive practices" among dairy farms of Réunion. A whole farm model is being developed to simulate the influence of management practices on the N cycle in the dairy production system and the resulting sustainability of this system.

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