Validation of the software "Recycling of Nutrients" in dairy-farms of western Cuba

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Introduction To maintain a good productivity in the soil-plant-animal system it is necessary to achieve an equilibrium between input and output of nutrients and energy. Models and simulation software have been proposed for this purpose. For dairy farms, models have been utilised to show the behaviour of different aspects, such as: feed utilisation, energy flow, digestibility values and daily weight gains (Freer *et al.,* 1970; Assis & France, 1983, Bruce *et al.,* 1984). However, there are few models showing the interaction between soil-plant-animal components of these systems. The objective of the present study was to validate the software "Recycling of Nutrients" proposed by Ortiz (2000) for dairy farms of western Cuba.

Materials and methods The validation was conducted in 9 dairy farms of western Cuba. Data necessary to apply the software corresponding to the year 2002 were: area of the sward, botanical composition, stocking rate, cattle categories, milk production, daily weight gain, births and sales, of animals, forages and supplements consumed, fertilisation (organic or mineral), type of soil, annual rainfall, extraction of nutrients and production by the sward, dung and urine deposition, biologically N fixation, and others.

Results There was a negative balance of P in all dairy farms (Table 1), and the application of this nutrient is necessary in order to achieve the stability of these systems. Also, K had a negative balance in the majority of the dairy farms. The N balance was satisfactory in the soils and systems where *Leucaena leucocephala* and N fertiliser were present (Figure 1).

Table 1 Annual balance of nutrients in the different dairy farms

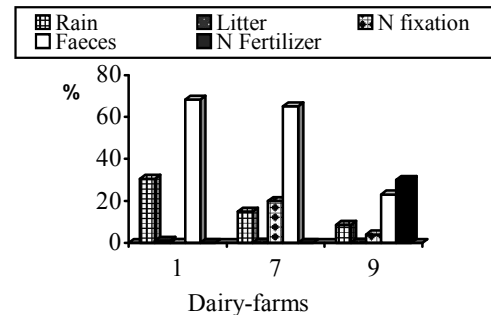| Farms	Soil			System		
	N	P	K	N	P	K
1	-17	-8	-76	22	-1	-34
2	-66	-17	-134	18	-1	-50
3	-22	-10	-64	11	-4	-28
4	-11	-10	-54	19	-3	-24
5	120	-3	-23	129	-0.1	-12
6	427	-8	-21	454	-2	5
7	99	-19	108	161	-8	-46
8	49	-8	-17	117	26	-4
9	-14	-7	-52	13	-1.0	-23

Figure 1 Different N input sources in the dairy farms 1, 7 and 9

Conclusions Software showed that faeces constitute the main source of nutrients in the systems, nevertheless the non-uniformity of deposition in the sward and the high accumulation in the cowshed constitute serious problems to obtain an efficient recycling of nutrients. Therefore, the software showed that is necessary to return to the sward the faeces accumulated in the cowshed and introduce legumes in these systems. The validation trials showed that the software could be a useful tool to manage the nutrient balances in dairy farms.

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