



Editorial

Agricultural and agroindustrial development generates large amounts of many different sorts of organic waste, particularly in tropical environments where the temperature and rainfall gradients allow the growth of a huge range of plants. The development of animal production, which has been spectacular in the past decade, inevitably produces effluent. Population growth and increasing quantities of urban waste are additional factors that are forcing decision-makers to look long and hard at how to use this organic matter.

As part of overall strategies aimed at preserving the environment, the merits of recycling organic matter by returning it to the soil are now recognized. However, applying insufficient amounts or associated pollutants can have an adverse effect on soil and water quality, and can in some cases be a public health risk. There are other possible uses, such as energy generation. Rationalizing organic matter recycling on a territory-wide scale means determining the state of the available resources and their location, and having the necessary tools to plan the application, treatment and transfer of those resources.

CIRAD is well aware of the environmental issues, and is working to develop ways of using agricultural and agroindustrial waste, animal production effluent and sewage farm sludge more efficiently. Please don't hesitate to get in touch if you are interested in working with us on the topics covered in this special "Waste management" issue.

Jean-Luc FARINET

Environmental Risks of
Recycling, CIRAD

Help with identifying weeds

CIRAD, in partnership with the *Institut Français de Pondichéry* (India), the Rice and Wheat Consortium for Indo-Gangetic Plains and the University of Wageningen (Netherlands), has developed a tool to assist in identifying weeds in Southern Asia. The software is available on open access and can be used on a pocket computer. The project, known as OSCAR, was funded by the European Community and has just been awarded the Manthan Foundation prize under the auspices of the World Summit Award, a global competition for innovative multimedia applications.

For further information: <http://www.oscarasia.org>

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Mediterranean exchanges

In October 2007, CIRAD and the *Société Européenne de Traitement des Eaux* (near Perpignan, France) received around thirty specialists in rural engineering and from consultancy firms in Morocco, Algeria, Tunisia and Lebanon, within the framework of the Mediterranean exchanges for water, forestry and development association. The presentation of the Agrifiltre prototype, a unit for treating and composting liquid effluent from small sewage treatment plants (fewer than 5000 inhabitant equivalents) aroused considerable interest.

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Upcoming training in organic matter

CIRAD, with the support of ADEME, the French Environment and Energy Management Agency, is organizing another training session in optimum use of local organic matter in Martinique in March 2008. The session is open to rural development staff in the West Indies, with a conference open to the general public on agricultural recycling of urban waste. In addition, a distance-learning module that fits into a Masters course will be available in 2008, within the framework of a virtual university on the environment and sustainable development.

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Future start-ups

Two new businesses are currently being set up as a result of research by CIRAD and CEMAGREF (Agricultural and Environmental Engineering Research): in Montpellier, LISODE, which will work on the design, implementation and assessment of participatory approaches, has just been chosen by the business incubator Languedoc-Roussillon Incubation and approved by the European Business and Innovation Centre in Montpellier; in Réunion, in partnership with CIRAD, SYNAPTIC, on the problems encountered when setting up stakeholder networks, has been approved by the Réunion regional business incubator.

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The tropical fruit market is on line

To mark the 150th issue of its journal *FruiTrop*, CIRAD is launching a new version of its website <http://passionfruit.cirad.fr>. The site includes full-text versions, in English and French, of all the articles and studies produced by the Fresh and Processed Citrus, Tropical Fruits and Vegetables Market News Service since 1994.

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Science

► BURN OR SPREAD?

Recycling poultry litter (on wood chips) as an agricultural fertilizer is becoming a major issue for poultry farmers in Réunion. They depend on market gardeners as an outlet for their litter, and the small areas concerned are posing a problem.

With a view to developing the poultry production chain under optimum conditions, CIRAD and the Réunion poultry farmers' cooperative are looking at the possibility of burning this litter to generate electricity in thermal power stations. This is technically and economically difficult in the existing thermal

burning the poultry litter to generate electricity in thermal power stations

power stations that use bagasse and coal, since specific equipment is required for litter (feed system, smoke treatment, etc). However, it could be worthwhile in a unit specific to litter, generating

both electricity and heat, in which case the return on investment would be satisfactory. There are plans to characterize different types of litter so as to improve their energy yield in 2008. ■

►► Are you interested in energy generation?

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► MEMBRANE BIOREACTOR

Shrinking water resources and the ongoing reduction in their quality mean that it is now necessary to introduce non-polluting, non-energy intensive treatment processes capable of supplying good quality water. Membrane bioreactors, which combine a biological reaction and a membrane filtration process, perform exceptionally well in terms of treated water quality, making them a promising option for the treatment of urban and industrial waste water.

CIRAD, in conjunction with the University of Montpellier II (bioproduct manufacturing process engineering Laboratory), now has considerable experience of membrane bioreactors. It is involved in several international research projects on waste water recycling in Europe and China. The aim is to provide reusable water, while keeping coproduct and byproduct generation to a minimum. ■

several international research projects on waste water recycling in Europe and China

►► Are you interested in our expertise?

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► TRACE METALS

Recycled waste use in agriculture is growing, and can be very worthwhile in both economic and agricultural terms. However, it can also result in environmental contamination, particularly by trace metals (TMs) such as cadmium, mercury, etc, most of which are toxic to animals and plants.

To limit the environmental impact of waste recycling, CIRAD and partners in Réunion have been working on TMs since 2003. The TM contents of waste, plants and soils are being analysed. TM bioavailability following waste applications is being monitored with

avoiding contaminating water resources or the food chain through crops

a view to avoiding contaminating water resources or the food chain through crops. Lastly, the changes in

their chemical form or substrate (mineral or organic) are being determined. The results obtained in eastern Réunion could serve to adjust the regulations on sewage farm sludge applications. ■

►► Do you want to know more about TMs?

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Spreading compost in the rice fields of Vietnam.

Market

► PIG FARMING AND ENVIRONMENTAL RISKS IN VIETNAM

Pig farming is booming in Vietnam. Pig manure recycling is a big issue for the future of the pig production chain in the Red River Delta, since the risks of environmental pollution are high and have not yet really been addressed.

Pig farm effluent is currently dealt with in a range of ever-changing ways. To understand the different pig farming systems, CIRAD and the Vietnam Institute of animal husbandry have developed a simplified method for estimating nitrogen surpluses, capable of assessing the environmental risk posed by animal production effluent at farm level.

a grid for classifying farms according to the risk they pose The local authorities now have a grid for classifying farms according to the risk they pose.

This classification serves to identify trends in terms of changes and to target priority operations as regards the environment. ■

►► For further information: <http://pigtrop.cirad.fr>

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► WASTE CHARACTERIZATION AND POTENTIAL

As far as possible, organic waste is spread directly in the field or composted. However, it is necessary to determine its composition and possible toxicity beforehand.

CIRAD has experience of determining whether it is appropriate to apply a given type of waste on a given soil. The product is first characterized to determine its nutrient content (N, P, K, trace elements), and also the levels of undesirable elements (trace metals, organic micropollutants, etc). Its harmlessness for



Technology

► LIQUID WASTE PURIFICATION

Spreading large quantities of liquid effluent on the soil results in environmental pollution due to an excess of organic matter.

growing bamboo on polluted soils removes pollutants the bamboo needs for its growth

To purify the manure, sludge or vinasse spread on tropical soils, CIRAD and the PHYTOREM® firm (Bouches du Rhône, France) are working to adapt the “Bambou Assainissement®” waste water treatment technology to the conditions in Réunion. In effect, growing bamboo on polluted soils removes pollutants the bamboo needs for its growth, while reducing the risks of leaching. Comparative tests are under way using tracer bamboo or cespitose plants and animal production effluent or waste water, on volcanic or sandy soils. In each case, water, nitrogen and heavy metal analyses are carried out so as to select resistant bamboo varieties capable of purifying those types of effluent. ■

►► Are you interested in this technology?

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agrifood industry effluent, compost and sugar mill skimmings have been studied in this way

crops is checked. Its agronomic potential is assessed by incubating a soil-product sample under

controlled conditions: monitoring mineral nitrogen production, nitrogen losses through volatilization or denitrification, etc. Agrifood industry effluent, compost and sugar mill skimmings have been studied in this way. ■

►► Do you have organic waste you want to recycle?

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► ORGANIC FERTILIZER QUALITY

The wide range of organic fertilizers, including composts, and the lack of references as to their efficacy are obstacles to their use. They therefore need to be assessed using reliable, standardized analysis methods.

CIRAD and Phalippou-Frayssinet SAS, the leading French organic fertilizer manufacturer, have developed quality indicators to model the changes in organic fertilizers and build production decision-support tools (raw material choice, mixtures, etc). Near-infrared spectroscopy, a quick, non-destructive technique, was used to build biochemical databases relating to organic applications and soils.

These studies led to the revision of AFNOR standard 44 051, which covers the sale of organic ameliorators,

an index of the potential for conversion to humus and of nitrogen release dynamics

notably as a result of the development of an index of the potential for conversion to humus and of nitrogen release dynamics, calculated based on

a biochemical profile and allowing an enlightened decision on the part of organic fertilizer users. ■

►► Do you want to know more about organic fertilizers?

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► SPREADING ORGANIC MATTER OVER A TERRITORY

On a whole-territory scale, some regions produce too much organic matter (animal production, agrifood industry, sewage works, etc), while others consume it (crops). Rationalizing organic matter applications or exchanges between regions means knowing what resources are available and pinpointing their location.

computer tools that provide a picture of organic matter distribution balances... and imbalances

By coupling geographical information systems showing organic matter sources and sinks with models of nutrient use by crops, CIRAD has developed computer tools that provide a picture of organic matter distribution balances... and imbalances. This makes it possible to simulate the consequences of building a waste treatment plant, of changing a given regulation or of the appearance of new organic matter sources.

This approach was applied to the island of Réunion as a whole, where it showed that it would be possible to distribute organic matter more efficiently. It is also being applied to an agricultural region in Vietnam. ■

►► Are you interested in this distribution method?

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► SUPPLYING WASTE TREATMENT PLANTS

Intensive animal production zones produce large volumes of effluent, which can pollute the environment. One way of treating surplus effluent, if there is not enough land available on which to spread it, is to set up collective treatment units supplied by several animal farms.

To help agricultural players manage the logistics of these treatment units, CIRAD has developed a software, Approzut. By simulating various management methods, it is possible to design a supply chain that guarantees regular supplies of matter for treatment and prevents any surplus stocks. Farmers can determine when to deliver their effluent and in what quantity.

farmers can determine when to deliver their effluent and in what quantity

In Réunion, Approzut has been applied to a group of 51 pig farms, and is to be used to study the possibility of supplying poultry litter to thermal power stations. It is also being tested on a collective pig manure spreading scheme in Brittany. ■

►► Are you interested in Approzut?

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EVIALIS

EVIALIS is a Breton company specializing in animal health and nutrition. CIRAD and EVIALIS, formerly called GUYOMARC'H, have been working together since 1994 on pig manure treatment and recycling.

Interview with Mr Alain Guyonvarch, Research and Development Manager at EVIALIS



© A. Guyonvarch

○ What does EVIALIS do?

EVIALIS makes livestock feed and animal health products. It also provides livestock farmers and industrial feed manufacturers with technical advice. EVIALIS markets its products and services in more than 50 countries, and its overseas operations account for a quarter of its turnover.

○ How did you get to know CIRAD?

Very early on, our group began looking into environmental issues, to find solutions to excessive pig manure applications in Brittany. At the 1994 POLLUTEC waste treatment exhibition, we met Francis Forest and Jean-Luc Farinet from CIRAD, who were exhibiting an original manure filtration process using straw, and in 1995, the Montpellier prototype set off for Brittany!

○ What might the future hold for the Agrifiltre process?

Six years later, CIRAD and EVIALIS patented Agrifiltre, a new manure treatment process by filtration through straw including all the improvements made to the initial process. Agrifiltre was designed to treat liquid effluent, which may either be pig

EVIALIS at a glance

Nationality: French

Status: limited company with a capital of 10 million euros

Founded: 1954

Staff: 3047 worldwide

Turnover: 637 million euros in 2006

Field: animal health and nutrition

manure on farms or urban effluent. It is suitable for small production units. Straw handling issues are currently hampering its development, and an automatic version is being looked at.

○ Do you also work in countries in the South?

EVIALIS works in many such countries, notably Vietnam, South Africa and Brazil. Animal production is booming in these countries, and animal production effluent treatment is now a pressing issue, with growing awareness of ecological concerns. The socioeconomic situation is propitious, and there is considerable potential for developing Agrifiltre.

○ What are the most significant results of your collaboration with CIRAD?

We have developed a simple, sturdy and economical process. The equipment can be made anywhere in the world, the process works with any type of straw (wheat, rice, etc), its treatment efficiency is excellent and the compost produced can be used for farming. Agrifiltre was awarded an Innov'Space prize at the French livestock show in 2000 and approved by the Loire-Brittany Water Board in 2001. This recognition gives our company a positive image.

○ Do you have any plans for new projects with CIRAD?

We are currently building an experimental farm with 160 sows in Vietnam, which should have many visitors. With the help of CIRAD, we are planning to install an Agrifiltre unit to treat the manure. In a country where pig farming is a major production sector, but where pig manure is often discharged into the environment without any prior treatment, this is a prime opportunity to promote the technology.

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South Africa



In South Africa, rural development

in former Bantustan areas, poverty alleviation, and training new management staff are all priorities for the government. For some ten years now, CIRAD has been conducting research with partners in South Africa, on small-scale agriculture and public policy-making, environmental resource economics and biodiversity management, product quality, animal health and biotechnologies.

► CIRAD in South Africa

has nine researchers, including seven assigned to the Universities of Pretoria and Kwa-Zulu Natal and the South African Sugarcane Research Institute. Their integration into those universities enables CIRAD to help determine teaching requirements, implement training courses and supervise graduate students from throughout southern Africa. CIRAD researchers provide an average of 280 hours of university teaching a year, and have supervised or co-supervised 31 MSc students and eight PhD students.

CIRAD has research, higher education and appraisal operations centring on:

- water policy reform;
- land and agricultural policy reform;
- agricultural product marketing and the development of geographical indications;
- sugarcane production;
- agroforestry;
- animal disease epidemiology;
- African trypanosomiasis control.

► Specific experience of environmental economics

CIRAD's researchers are working on new modes of water resource governance in South Africa, to ensure sustainable rural development despite water shortages and competition for use with non-agricultural sectors. Their research centres on the social, economic and institutional aspects of water management. They use economic models and participatory methods to facilitate collective decision-making processes.

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