Sustainable research management of livestock and poultry wastes for Asian small-scale farmers

APPLYING ANIMAL MANURE TO FARMLAND is a traditionally common management practice of handling excess animal wastes for livestock and poultry producers. It supplies relevant nutrients to crops, and is considered to be a key organic nutrient resource for crop production and sustainable soil management. Poultry litter is also an excellent and low-cost fertilizer for resource-limited farmers in Asia.

With the increasing globalization of world trade, and with the rising economic upturn in Asia, the dietary pattern of Asian people has rapidly shifted from grains to meat and dairy over the last decade. This dietary pattern shift considerably increased feed imports from foreign countries, and thus brought about serious imbalance in the national nutrient budget of Asian countries. This means that the nutrients brought into Asian countries as imported feeds has started to accumulate in the farmlands as animal wastes. Unless this problem is properly handled, it is detrimental not only to the region’s farmland, but also to the entire ecosystem.

It is a common practice in rural areas in Asia to use untreated animal wastes as fertilizer alternative. However, raw animal wastes frequently contains a variety of hazardous microbes, pathogenic bacteria of Salmonella and E. coli, and various organic and inorganic chemicals such as hormones, antibiotics, pesticides and even heavy metals. Some of the undesirable microbial and organic chemical residues can be pasteurized and/or detoxified in the process of composting of the raw animal excretion. However, the heat produced in the composting process is not high enough to decompose many organic chemicals, let alone heavy metals.

The amount of nutrients contained in the manure considerably varies in terms of collection method, storage facility, and animal species. In Taiwan, the approximate N:P:K values on dry matter basis of dairy cow manure are 2.19, 1.37 and 0.67%; for swine 2.91, 2.85 and 1.38%; and for chicken 4.34, 4.41 and 2.24%, respectively. The type of animal housing system and waste handling method are also considered to affect the nutrient composition of the waste. Feeds directly reflect the nutrient composition of the manure, so that variation in the nutrient values becomes greater between the local feeder and the imported feeder. Before applying animal wastes...
to farmland, therefore, farmers need relevant information on the wastes such as nutrient content, releasing and decomposition rates of the nutrients contained, contamination with hazardous compounds, and so forth.

Foul odor from animal waste is also one of the serious problems in waste-handling. One key technique is to stabilize and conserve the nutrients and organic matter in the waste and to minimize dispersion of the foul odor to the surrounding environment. Unlike large-scale farmers, small holders need to eliminate the foul odor from the sources as quickly as possible, and minimize its negative impact on his/her neighbors. There are several low-cost and promising technologies suitable for the small holders to treat raw waste efficiently, such as the three-stage waste water treatment. Lagoon is another promising system for the treatment of raw waste; effluents can be used as a good source of nutrients for crop production if it is managed properly.

Methane gas produced from animal and human wastes has been traditionally used as household fuel in the countryside of some Asian countries. Recently, with the public’s greater concern about clean environments and the effects of global warming, new attempts have been carried out to efficiently convert animal wastes into biogas for various energy uses such as electricity, heat, and vehicle fuel as substitute to commercial available natural gases. Biogas contains 50-70% of methane (CH₄) and 50-30% of carbon dioxide (CO₂) and is produced during anaerobic decomposition of the animal wastes.

In general, this international seminar aims to discuss and share the development of promising and practical technologies for the sustainable resource management of livestock and poultry wastes for Asian small-scale farmers, as well as address major issues related to animal wastes treatment and processing.

Seminar highlights, findings and recommendations
The seminar focused on the following topics: different technologies, including biotechnology for animal waste treatment and management applicable in small-scale farms; regulation and management strategies and/or laws for animal waste; current situation of animal waste treatment and management including biogas digesters; modeling for assessment of nitrogen flow in pig farms; local knowledge for animal waste treatment and the potential of using novel lytic enzymes from activated sludge metagene for various purposes.

Major findings
1) Protecting the environment from waste pollution caused by animal livestock waste and reducing global warming due to GHG emission from livestock production need technologies for reducing loss of nitrogen and phosphorus, for reducing and efficient utilization of GHG (e.g. biogas digester), for storage and treatment of solid manure, and strict regulations or loss for animal waste management;
2) There some promising cultural practices for reducing nitrogen loss and surplus of both phosphorus and nitrogen in livestock farms. They include reduction of ammonia emission by minimizing the surface areas of the slated floor; frequent emptying of slurry channels using inclining walls; cooling manure store beneath slated floor; further acidification of slurry; straw bedding and sawdust bedding in cattle housing system; slurry covered with HDPE; application of manure in the fields—shallow injection of slurry and flow of solid manure into the soil and separation of slurry to reduce surplus of phosphorus and nitrogen.
3) There are other promising models and a variety of common practices in animal waste management that can be adapted by Asian farmers. These include a nitrogen flow model in pig farms, an anaerobic lagoon, vermiculture, a three-stage waste water treatment (solid-liquid separation, anaerobic and aerobic treatment units), Biofermenters, application of livestock waste for biogas

Two questions were posed and left hanging for the participants to ponder on: What techniques can be adopted in developing countries based on big farm studies which are suitable for medium and small-scale farms? How can animal feed and nutrition
management help to reduce pollution and emission of greenhouse gases in livestock production? It was suggested and recommended that in the future, a seminar be conducted on new and applicable techniques for minimum influence of livestock production on global warming and soil pollution. This will cover animal waste management, animal feed and nutrition management and forage and animal breeding strategies.

**Sustainable research management of livestock and poultry wastes for Asian small-scale farmers**

Held in Ho Chi Minh City, Vietnam, 25-29 July 2011

No of Participating countries: 8 (Japan, Denmark, Taiwan, Thailand, Philippines, Korea, Malaysia, Indonesia)

No. of papers presented: 12

Co-sponsor: National Institute of Animal Sciences (NIAS), Vietnam

**List of papers**

**Keynote paper**

1. Biotechnology for efficient and environmentally friendly manure management
   - Sven Gjedde Sommer

**Resource papers**

1. Screening for novel lyopolitic genes from activatedsludge metagenome
   - Ren-Bao Liaw

2. A model for assessment of nitrogen flow in Vietnamese pig farms
   - Vu Khan Van

3. Current scenario and future prospects of livestock waste management in Malaysia
   - Mohammad Hariz Bin Abdul Rahman

4. Regulation and management strategies for composted animal manure use in Taiwan
   - Jen-Hshuan Chen

5. Sustainable animal waste management and utilization in Korean livestock farms
   - Heekwon Ahn

6. Livestock waste treatment and renewable resource development
   - Kiyonori Haga

7. Vermiculture technology on small dairy farms of Nongpho dairy cooperative
   - Somchai Chantsavang

8. Livestock waste treatment and renewable resource development
   - Meeng-Ter Koh

9. Indigenous biofermenters in livestock waste management farming in the Philippines
   - Rosalie Rafael

10. Application of livestock waste for biogas and fertilizer in small farms in Indonesia
    - Endang Romjali

11. Profile of pig waste management practices in different regions of Vietnam
    - Vu Chi Cuong

For further information, please contact:

Dr. San-an Lee, FFTC Consultant

---

Dr. T.R. Preston (seated on top), the Colombian consultant of the MERKAN project explains to the participants how the biogas system works. Looking on are Dr. Jen-Hsuan Chen of Taiwan’s National Chung Hsing University (left), Taiwan Livestock Research Institute’s (TLRI) former head Dr. Meeng-Ter Koh (center), and Japan’s Dr. Kiyonori Haga (right).