

## **SUSANE - Sustainable, sanitary and efficient management of animal manure for plant nutrition**

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In this third issue of the newsletter Dr. Tran Thuc Son gives a short presentation of the background for NISF commitment in the SUSANE-research project objectives of the SUSANE-research and the institutes taking part in the project. The challenges of increasing fertilizer value of manure used for fertilizing crops and the objective of NISFs activities in the project.

Further, Dr. Jean-Michel Médoc (CIRAD) has most kindly sent us a brief presenting the ideas of how models on manure management can be adapted to Vietnamese conditions and used for decision support. The intention is to seek the French government for support to use the concept of these models for the development of manure decision support tools that can be used in Vietnam.

### **Use of animal manure for plant nutrition in Vietnam**

Dr. Tran Thuc Son, National Institute for Soils and Fertilizers

It is a traditional practice for Vietnamese farmers to utilize animal manure as fertilizer. However, if animal manure is used as the only fertilizer as has been the case up till now, plant yield will become low, food security is not ensured and only limited amounts of products will be available for export.

Inorganic fertilizers ensure a high plant yield but they affect the quality of the product and, like pesticides and herbicides, strongly affects soil and water environment.

Use of agricultural organic products like animal manure increases day by day worldwide. Farm yard manure (FYM) is not only a balanced nutrient resource (macro secondary and micro elements) and a splendid nutrient for plants but also an important mean to improve soil fertility, particularly due to factors relating to the physical, chemical and biological properties of the soil: Animal manure might

- improve cation exchangeable capacity (CEC)
- improve soil Ph-buffer capacity
- improve water field capacity of soil
- improve the structure of the soil by increasing water stable aggregates
- decrease soil density and increase soil porosity.

### **An experiment**

A long term experiment conducted on degraded soil in the Bac Giang province showed that the agronomic efficiency of FYM is 71-110 Kg of rice; 41-48 Kg of soybean and 42-45 Kg of

## SUSANE Newsletter No 3, January 2007

winter maize per 1 T of FYM when applying 10 T of FYM/ha for rice and winter maize, and 8 T of FYM/ha for soybean, compared with no fertilizer applied.

The agronomic efficiency of FYM was clearly decreased when combined with inorganic fertilizer, applied for rice and soybean: 40-48 Kg of rice and 24-28 Kg of soybean/1 T of FYM; while for winter maize the agronomic efficiency of FYM increased to 66-76 Kg of maize/1 T of FYM.



### **Economical and social advantages**

An increase in livestock development and production will accomplish progress in the social and economic development of Vietnam, provided that livestock production is effective, sustainable and 'clean'.

A more effective and environmentally careful use of animal manure for plant nutrition will not only increase the economic value through decrease of inorganic fertilizer cost, but also lead to a better maintenance of soil fertility for sustainable production.

### **The problems to be solved**

SUSANE research focus on the problems of the present use of animal manure, which can be described as below:

1. In traditional practice it still occurs that farmers apply fresh manure directly to the crop. Using fresh manure may enhance the nutrient value but the practice also causes a risk of spreading of pathogens to animals or humans.
2. When livestock production develops and becomes the main farming production, separated from cultivation of the land, the mass of manure will increase into

## SUSANE Newsletter No 3, January 2007

industrial production scale. This increase creates a need for new methods to produce fertilizer.

3. Response of FYM in crops is slower than that of inorganic fertilizer. This means that some farmers prefer to use mineral fertilizer to get a quick effect on the plants.
4. Some perennial crops, such as coffee and tea, respond highly when applied FYM. But the production area is usually sloping soil and located far from livestock farms, leading to difficulties in transport and application.

### **Major objectives**

The main objective of the project is to

- study the methods of treating manure to ensure clean and highly nutrient fertilizer applicator to crops
- study the amount, the timing and the application methods to find the optimal use of FYM to ensure the highest possible agronomic efficiency
- study the optimum ratio of inorganic and organic fertilizer supplied to the main crops
- study the influence of animal manure in maintaining and improving soil fertility.

The content and method of the study is divided into

1. Survey: Farm survey in Vietnam
2. Basic study:
  - On compost and lab-incubation experiments in Denmark
  - Research station field experiments in Vietnam
3. On-farm research in Vietnam
4. Analysis: manure, soil and plants in Denmark and Vietnam

The expected outputs are to provide recommendations to the Vietnamese farmers of rational composting technology, which is able to provide the farmers with a clean (: free of pathogens) and highly nutrient fertilizer. An optimized timing and precision of applying FYM to selected crops to get a high agronomic and recycling efficiency for the farmers is going to be an output as well.

### **Cooperation**

The SUSANE research co-operates with other, similar research projects like

- International Plant Nutrition Institution - Southeast Asia Program “Site-specific nutrient management for maize in Vietnam “
- [JIRCAS](#), “Nitrogen cycling in agricultural ecosystem east Asia-Impact of nitrogen loss and their mitigation options - Measurement of NH<sub>3</sub> volatilization in rice field “
- Government project “Treating of animal manure for plant nutrition by using of microorganism method”.

*For further information please contact vice director Tran Thuc Son, National Institute for Soils and Fertilizers.*

**Presentation of simulation models dedicated to livestock effluents management, on-farm and between farms**

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A CIRAD research group, lead by agronomist Hervé Saint Macary, intends in cooperation with NISF, NIAH and NIVR to develop a decision support tool for sustainable management of manure at farm and district level. CIRAD will seek the French government (French Fund for Global Environment) for financial support to the project. The models supporting the decision application have been developed to solve environmental problems related to manure management at La Réunion. These models can after adaptation to Vietnamese conditions beyond doubt be used when giving advice on manure management in Vietnamese farms and between farms.



Two simulation models were presented to the SUSANE project team, during the project workshop in Hanoi on Friday the 5<sup>th</sup> of January 2007. A short presentation of the models:

**Magma: A simulation model to facilitate sustainable management of animal wastes at farm level**

Magma can simulate production of animal manure, management of animal manure or slurry, and application strategies (waste spreading on cultivated crops and fallow land, and composting). The model supports decision-makers in improving management of manure at farm level focusing on reducing environmental risk, improve agricultural efficiency and farming sustainability. The user can define farming systems (scenarios) using structural parameters, for example animal- and crop production characteristics, capacity of manure or

## SUSANE Newsletter No 3, January 2007

slurry spreading equipment, and distances from manure storages to fields. Each scenario can be tailored according to several management strategies by using switch constants.

The plan is to build an on-farm effluents flows management model in the PhD project “Animal Manure Management”. Scenarios of management will be designed and tested. These scenarios could also be tested with Magma thus allowing the comparison of the simulation results. This comparison would prove or disprove the validity of Magma in the Vietnamese context. A course training to the use of Magma would then be considered for the people concerned.

### **Biomass: A MAS model to simulate effluent transfers between farms**

In Biomass, a region (District or Province) is evaluated when deciding on manure management. Biomass encompasses several livestock farms, field/crops, treatment plants, transportation and storage facilities. Input to the model is the production of manure at livestock farms and the demand for plant nutrients in manure on crop farms. The demand has to be presented to the model in form of quality, quantity and availability conditions of animal manure.

The process enabling the matching of supply and demand is called a negotiation. Any negotiation can be initiated either by supplier or client user. The negotiations may result in a transfer of organic material from the place of storage (livestock households) to the place of use (crop producer) if - and only if - facilities for suitable transportation is available – infrastructure and lorries.

*For more information, see:*

F. Guerrin, Magma: a simulation model to help manage animal wastes at the farm level, *Computers and Electronics in Agriculture*, 33 (2001): 35-54

Rémy Courdier, François Guerrin, Fenintsoa Hary Andriamasinoro and Jean-Marie Paillat, Agent-based simulation of complex systems: application to collective management of animal wastes, *Journal of Artificial Societies and Social Simulation*, vol. 5 (2002), # 3,

<<http://jasss.soc.surrey.ac.uk/5/3/4.html>>