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

Research to date and vision for the future research activities

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The progress of the SUSANE project has been substantial and this autumn we have seen the PhD students producing exiting results of studies carried out in Vietnam and during visits to Denmark. Therefore, this seventh issue of the newsletter is devoted to presentation of results from these studies.

Manure Management in Northern Vietnam

Animal manure can provide nutrients for crop and fish production and input for biogas production but, if managed inappropriately, can also have a negative impact on the environment. A survey on 54 pig farms in two Northern Vietnamese provinces, showed that large-scale pig producers (>100 fatteners or 20 sows) had more pigs per hectare than medium-scale (19–99 fatteners, 5–19 sows) or small-scale (<19 fatteners, <5 sows) producers. The proportion of total manure applied to crops was only 5% in Thai Binh and 35% in Bac

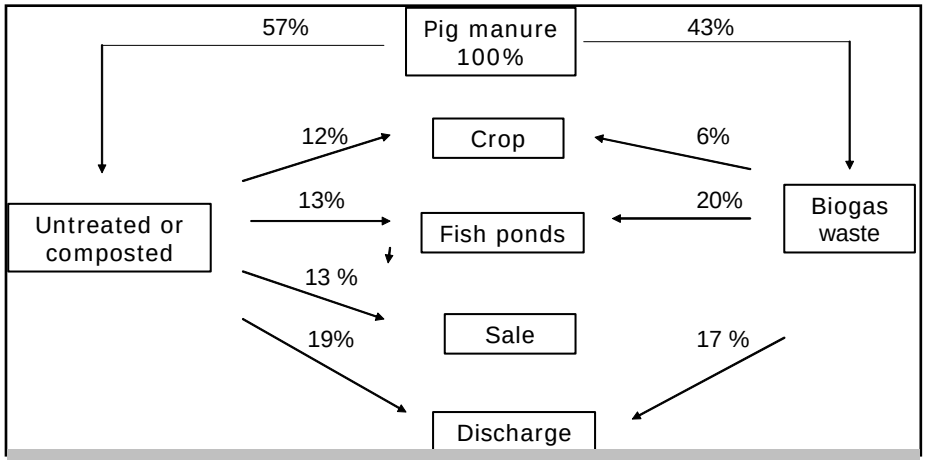

Figure 1
Manure flows as presented as average values for 54 selected pig farms in Thai Binh and Bac Giang provinces (Vu et al., 2007)

Giang. Twenty percent of pig producers reported that they raised pigs just to provide manure to feed their pond fish, this was reflected in that small pig farmers had proportional larger fish ponds than large farmers.

Farmers interviewed had little or no expertise in handling liquid manure, composting solid manure, or reducing contamination by means of microbial reduction of pollutants during manure management. Therefore, a large proportion (19 %) of the total manure produced was discharged into public sewage systems, rivers and lakes.

The study shows that there is a need of knowledge about manure management and development of technologies for using manure efficiently. In the study of Vu Van from NIAH (National Institute of Animal Husbandry), a first generation model on feed excretion was carried out in Denmark, this model can be used to assess manure composition and quantities from pig producers in Asia. In the coming year, this model will be adapted to Vietnamese condition. This second generation model will be combine with model assessing plant nutrients loss during storage and application. The combine model will be used by policy makers and extension services for planning and for efficient use of manure.

Manure Nutrients in Vietnam

Photos:
To the left - Traditional composting of manure in northern Vietnam
To the right - Field experiment in Bac Giang

A lab experiments on the effect of compost additives on losses and availability of manure nitrogen has been carried out at Department of Agricultural Sciences, University of Copenhagen, Denmark, from December 2006 to July 2007. The objective of the experiment was to determine the nitrogen (N) turnover and loss as ammonia during aerobic composting of animal manure with different additive materials and when subsequently applied to soil.

For the purpose of estimating the fertilizer efficiency of fresh manure and composts, a compost experiment has been carried out at Soil and Fertilizer Research Centre (Bac Giang province, Vietnam). The compost experiment includes 3 treatments (composted manure with straw, with

straw + lime and straw + super-phosphate). The composts from this experiment are used for the field experiment to evaluate the effect of the application rates and manure types on yield and N uptake in a three crop sequence (maize– rice–rice). This field experiment has just been set up and maize planted at the end of September 2007.

The study will include an examination of the optimal timing and application methods to optimise vegetable yield, further the effect of using fresh manure on nitrate content and yield in vegetable was studied. The experiment with different timing and application methods to a vegetable crop will be carried out at Soil and Fertilizer Research Centre (Bac Giang) from spring 2008. Furthermore, an experiment to determine the effect of pig feeding and composting methods on properties of manure and composts will also be set up at NIAH (National Institute of Animal Husbandry) in collaboration with Mrs. Van in the spring of 2008.

Manure Pathogens in Vietnam

Composting of pig manure is traditionally practiced by Vietnamese farmers. A preliminary study was conducted to assess survival of fecal bacterial indicators and pathogens in composted pig manure from heaps covered by clay. The numbers of *Enterococcus* spp. decreased from $4x10^3$ bacterial cells (CFU)/g to $1.52x\ 10^1$CFU/g. A similar decreasing trend was seen for the number of total bacteria. The concentration of *E. coli* was as expected high in fresh manure ($2.98x\ 10^6$CFU/g), but following two weeks of composting no *E. coli* could be detected. There was found only limited differences in the survival rate of faecal indicator bacteria between composted manure with different amendments. Survival of faecal bacterial indicators and pathogens will be further investigated, including the assessment of key factors responsible for their die-off, e.g. temperature, pH, moisture content.

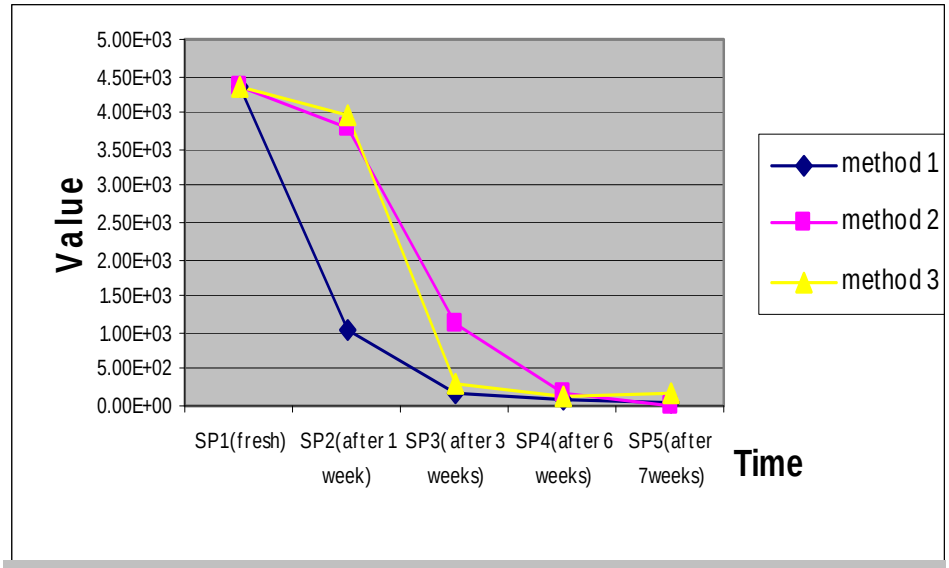

Figure 2
Reduction of the faecal indicator bacterium Enterococcus spp. in three different types of composted manure.

Photo: Collection of composted pig manure samples

The PhD thesis research of Son will in addition to the composted manure experiments include the following studies:

- Survival of bacterial faecal indicators, pathogens and parasites in integrated pig-fish pond systems
- Development of bacterial antimicrobial resistance in integrated pig-fish pond systems
- Microbiological food safety of fish raised in integrated pig-fish pond systems

Two nationally enrolled MSc students will carry out their thesis research as part of these studies. Experiments will be carried out in collaboration with the two others PhD students at NIAH and SFI to study whole farm plant nutrient balances and pathways of pathogen transfer with manure of typical agro-ecosystems.

Reference:

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2. Vu T. K. V., Prapaspongsa T., and Jørgensen H., 2008. Prediction of manure Nitrogen and Carbon output from growing - finishing pigs. Agronomy for Sustainable Development (in preparation).

3. Prapaspongsa T., Vu T.K.V., Jørgensen H. and Poulsen H.D. Prediction of Nitrogen, Phosphorus and Carbon in Excretion from Growing Pigs Fed Typical Danish and Simulated Asian Diets. Asian-Australasian Journal of Animal Science (in preparation).