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

This spring 2008 has seen PhD student Dang Thi Thanh Son carrying out research with focus on solving the sanitary problems that was identified in the SUSANE baseline study. This work she will continue in 2008 and 2009. In this newsletter preliminary result of her study is presented.

Survival of faecal indicator bacteria in composted pig manure in Vietnam

Vietnamese livestock production is increasing, so consequently large amounts of manure are produced. My work team carried out a baseline study in 2007 and collected information related to manure management, including the current situation of collection, storage, transportation and treatment of pig manure in Thai Binh and Bac Giang provinces. In those provinces a large amount of pig manure is used as fertilizers in fields or gardens or is discharged into sewage canals and fish ponds. This may represent a hazard to the environment because there are many kinds of pathogens in manure, e.g. pathogenic *E. coli*, *Salmonella, Campylobacter* and *Enterococcus.* Farmers lack knowledge and adequate technologies to manage manure. This enhance the risk of polluting the environment by inappropriately use of livestock manure, and there is also the potential risk of transferring disease organisms between livestock and from livestock to humans.

In the study presented here the focus is on composting, which is a traditional method of manure treatment used in most of Viet Nam. The intention is to develop and test the best method of compost treatment. The objective is to develop a composting method that almost completely controls the spread of pathogens. We have conducted composting experiment including three trials to assess survival of faecal bacterial indicators and pathogens in composted pig manure from heaps covered by clay. There were three composting methods included in each of the trials lasting 2 months (Table 1). The first trial was conducted in Bac Giang province in collaboration with another SUSANE PhD student Mr. Tien.

Picture 1. Collecting samples from compost heaps covered by mud.

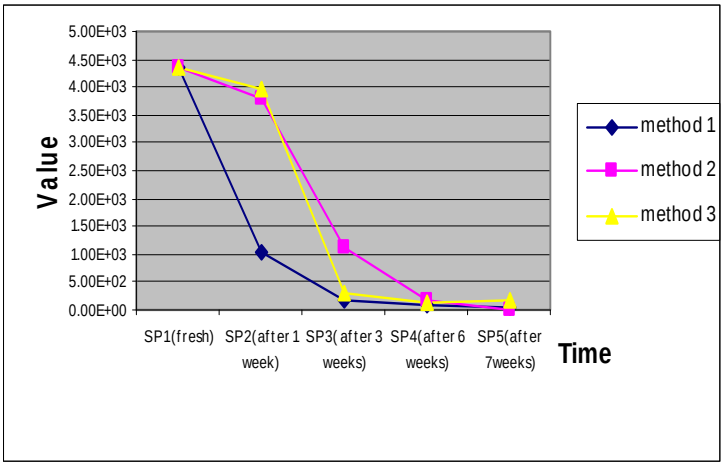
Table 1: Information of composting pig manure process at the first trial (Fertilizer for maize)

Items	Method 1 (Solid manure +10% straw)	Method 2 (Manure + 10% straw + 2% lime)	Method 3 (Manure +10% straw + 2% Ca(HPO4)2)
Duration	2 months	2 months	2 months
Highest temperature	45^0C – 46^0C	45^0C - 46^0C	44^0C – $45,5^0$C
Duration of high temperature	14 days (day: 27, 28, 29; 43 – 52 of composite process)	11 days (day: 43 - 52 of composite process)	11 days (day: 43 - 52 of composite process)
Characteristics	Covered by mud	Covered by mud	Covered by mud

The compost samples were collected at five sampling times during the composting period that lasted 60 days. The first samples were taken from fresh manure. During composting samples were taken every two weeks after initiation of the experiments. Sampling was performed from six locations within the composting piles**.** The samples were analyzed quantitatively to enumerate faecal indicator bacteria (*Escherichia coli*, total coliform bactera and *Enterococcus*).

The data shows that the numbers of *Enterococcus* spp decreased from $4x10^3$ bacterial cells (CFU)/g to $0.52x\ 10^1$CFU/g. A similar decreasing trend was seen for the number of total coliform 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 were only limited differences found in the survival rate of faecal indicator bacteria between composted manure with different amendments.

We also measured the temperature in the composite heap every day. Immediately after the compost heap was established the temperature increase and the highest temperature measured was around 45^0C –



Figur 1: Number of *Enterococcus* spp. at different sampling times using the composting methods described in Table 1.

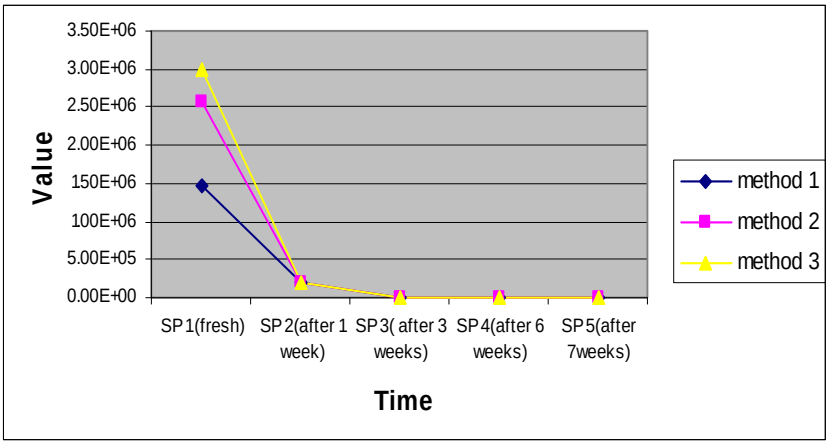


Figure 2. Number of *E. coli* found after increasing time of composting using the compost methods describe in Table 1.

The second trial was conducted in Gia Lam district. In this trial, we focused on three composting methods with different kinds of amendments including straw, $CaCO_3$ and urea. Also here interesting results were obtained on the survival of the three indicator bacteria mentioned above. The data shows that during the composting process no clear differences were found in survival of indicator bacteria between the two composting methods with different kind of amendments (method 1 (manure + straw) or method 2 (manure + straw + $CaCO_3$)) see figures. The method 3 (manure + straw + urea) reduced the numbers of indicator bacteria and we found neither *E. coli* nor total coliform bacteria at sampling time two or sampling time three even though they were present in high concentrations in fresh pig manure at sampling time one (from $2.06.10^5$ CFU/g to $1.54.10^6$ CFU/g). The addition of urea did not affect the counts of *Enterococcus* spp in method 3. Follow-up investigations are being done to further explain the findings on *Enterococcus* spp.

A third trial will be conducted by the three PhD students to measure ammonia emission, loss of nitrogen and the survival of faecal bacterial indicators (including the assessment of key factors responsible for their die-off, e.g. temperature, pH, moisture content.). We plan to conduct a third trial of experiment at NIAH for two months in late 2008 or the beginning of 2009.

Author: PhD student: Dang Thi Thanh Son

Edited by: Anders Dalsgaard and Sven G. Sommer