

Survival of indicator bacteria in the heap of composting manure in Vietnam



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Introduction

Vietnamese livestock production is increasing, so consequently large amounts of manure are produced. Pathogenic microorganisms in manure represents a potential hazard to human and animal. Few data describing the microbiological content of pig manure intended for spreading are available in the scientific literature. My work team carried out a baseline study in 2007 and collected a lot of 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 in fields or gardens or is discharged into sewage canals and fish ponds. This may be a hazard to the environment because there are many kinds of pathogens in manure, e.g. *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

Objective

This project had verified the presence and estimate the persistence of *Escherichia coli* and indicator bacteria *Enterococcus* spp in the heap of pig manure composting. Since then the intention is to develop and test the best method of compost treatment

Material and Methods



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

Presents 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(HPO ₄) ₂)
Duration	2 months	2 months	2 months
Highest temperature	45 ^o C – 46 ^o C	45 ^o C - 46 ^o C	44 ^o C – 45,5 ^o 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 sites within the composting piles. The samples were analyzed quantitatively to detect indicator bacteria (*Escherichia coli*, total *Coliform* and *Enterococcus*).

Results and discussion

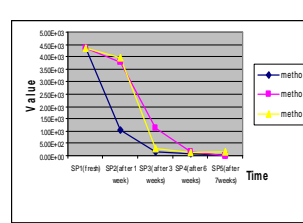


Figure 1: Number of *Enterococcus* spp at different sampling times using the composting methods described in table 1.

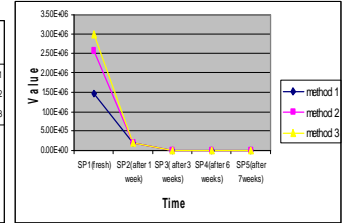


Figure 2: Number of *E. coli* found after increasing time of composting using the compost methods describe in table 1.

Our data show that the numbers of *Enterococcus* spp decreased from 4×10^3 bacterial cells (CFU)/g to $.52 \times 10^1$ 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 (2.98×10^6 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 fecal indicator bacteria between composted manure with different amendments.

We also measure the temperature in the composite heap every day. Immediately after the compost heap was established the temperature increase and the highest temperature was around 45^oC – 46^oC for eleven days (table 1).

We also set up the second trial of composting treatment method. In this trial we focused on three composting methods with different kinds of amendments like straw, CaCO₃ and urea. We obtained some interesting results about the survival of the three kinds of bacteria above. The data shows that during the composting process no clear differences were found in survival of pathogenic and micro-organisms between the two composite methods with different kind of amendments (method 1 (manure + straw) or method 2 (manure + straw + CaCO₃)) see figures. The method 3 (manure + straw + urea) reduced the pathogen numbers and we found neither *E. coli* nor Total *Coliform* at sampling time two or sampling time three even though it was present in fresh pig manure at sampling time one (from $2.06 \cdot 10^5$ CFU/g to $1.54 \cdot 10^6$ CFU/g). The addition of urea did not affect the counts of *Enterococcus* spp in method 3

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