ANIMAL WASTE MANAGEMENT IN VIETNAM –PROBLEMS AND SOLUTIONS

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Approximately 93% of the dairy cattle are raised in private holders and 7% in state farms. Surveying of dairy cattle farms in Ho Chi Minh City (HCMC) showed that farms of less than 20 dairy cattle accounted for 98.9% of the population. Similarly, 97% of pigs are raised in private farms whereas state farms work as breed suppliers. As parts of the AWI (area-wide integration) project in Vietnam during 2001-2002, which was conducted in the four city/provinces Binh Duong, Dong Nai, HCMC and Long An, we surveyed and noted practical measures in handling animal wastes from private small- and middle-scaled farms (several hundreds of pigs, or less than 20 cattle, and several thousands of chickens).

Current management of animal wastes

Chicken wastes are considered as high-value source of organic fertiliser and are mostly sold fresh to marketers (no treatment) at the price of VND 4000 to 6000 per 20 kg per bag (rate: USD 1 = VND 15 000). In general, the price often goes up and down depending on the price of coffee grain and others. Farmers and fertiliser manufactories may buy solid manure directly at chicken farms or from middlemen. Chicken manure is utilised as fertiliser for coffee, pepper, or fruit plants such as longan, grape-fruits. Besides, chicken manure is widely utilised in one of the following ways (i) biogas plants; gas generated is used for family cooking or for warming small chicks; (ii) feeding fish; in some farms chicken pens are built above fish pond, so it saves labour for collection.

Cattle solid wastes are almost collected and utilised for agriculture. Cattle manure is widely used as fertiliser due to its softness, high content of fibers and lower concentration of protein compared to pig manure. It does not have offensive odour. One cubic meter of fresh manure costs VND 40,000 to 50,000. Cattle manure can be utilised as fertiliser for (i) elephant grass; and (ii) bonsai that has strongly developed in HCMC; (iii) coffee, pepper, or fruit plants. Cattle solid wastes may go through one of the following treatments before being utilised: (i) land-spreading for dehydration (for approximately 3-4 days) is the most popular method; and (ii) manure is dried, then mixed with lime, rice straw, rice husk ash, or/and coconut husk dust. Cattle liquid manure may be used for biogas and/or irrigation of elephant grass or gardens.

So far, a pig manure market has not developed. The price of pig manure is low: it can go up to approximately 1000-3000 VND for a bag of 20 kg. However, in the rainy season, many farms give out pig manure for free but usually no one takes it. Unlike chicken and cattle manure, pig solid wastes are not widely used for fertilisation. It may be due to the following reasons: (i) pig manure is quite wet (watery) and bulky, so it requires significant labour to collect it and its transport is relatively expensive; (ii) it has offensive odour; (iii) according to farmers, pig wastes are "hot" and so may damage the vegetables, crops or plants; (iv) high numbers of pigs are raised, which produce large amounts of wastes.

Before utilisation as fertiliser, pig solid wastes may be processed as follows: (i) mixing with

rice husk or rice husk ash and then incubated for 2-3 weeks; (ii) mixing or spraying with microbiological products (such as Enhanced Micro-organisms) to increase the efficiency of treatment; (iii) sun-drying for 1-2 weeks; and (iv) treatment by black soldier flies.

Disposal of liquid wastes in swine production has remained a headache to enterprise owners as well as the authorities. It would be due to the following reasons: (i) large amounts of liquid wastes are generated due to high numbers of animals and a high volume of water used to cool and wash the animals as well as to flush out solid manure (100 L of water/day/pig of 50 kg); (ii) pig wastes are highly odorous; (iii) pig farms are often located in areas of high population, close to markets with shortage of land for wastewater treatment, cropping, or gardening; (iv) there is no real markets for pig manure as discussed above.

The following are successful measures of pig waste management: (i) biogas; (ii) fish feeding; (iii) through canals to fertilise or improve quality/structure of vegetable or crop land; and (iv) transporting (in tankers) to crop or fruit-tree areas.

Table 1. *Various waste treatments applied by livestock farms in the study site (%) (The survey was done at 360 farms).*

Waste treatment	Solid waste	Liquid waste
1) Biogas	21	25
2) Fresh manure storage	26	0
3) Composting	10	0
4) Discharge to fish ponds	8	12
5) Discharge to land/stream	19	60
6) Selling fresh manure	7	0
7) Give away	2	0
8) Others	7	3
Total	100%	100%

Source: Hoa et al. (2004)

Possibilities to deal with liquid wastes

The following discussion is just a first attempt to outline some possibilities to cope with the liquid wastes issue. Details must be worked out for their feasibility.

First, awareness should be raised among farmers about the value of pig manure and its potential environmental impacts. Studies and demonstration of composting and utilisation of pig manure for different plants or crops would be helpful.

Second, the development of pig manure markets could be promoted. It should be noted that marketers or middlemen play a very important role in this issue, as they can persuade farmers to use pig manure and promote pig manure recycling by providing technical advices. In a first phase, this role may be subsidised by local authorities.

Finally, government should enforce legislation on waste management to force farmers to take responsible for the generated animal waste, especially the liquid one.

At the farms, farmers should (i) limit water volume used in house cleaning by collection solid manure before house washing and apply air cooling system to minimise the water volume used to cool animals; (ii) collect liquid wastes: for farms having land, wastewater or biogas effluent should be biologically treated, or used for fish. For farms without land, liquid wastes should be led to and stored in tanks or containers placed underground, and would be periodically collected. How to collect the liquid wastes? There are two options. Firstly, there should be a unit/company at the Department of Agriculture and Rural Development or other related departments who would be responsible for collecting animal liquid wastes to a transfer depot or treating place. From these places, the wastewater would be treated or transported to farms. Another

optional collector is middleman. However we must think of how this persons get profit from the business (who; e.g. farmer, pays him). Otherwise, this option is unfeasible.

Biogas plant

In the attempt of popularisation of biogas plants as methods of biological treatment of animal wastes, extension programs have periodically been conducted to transfer techniques as well as to partly financially support farmers to build-up house-hold biogas plants or install biogas plastic bags. According to farmers, the main advantages of biogas plants are the following: (i) less environmental pollution; (ii) biogas effluent producing no offensive odour, not attracting flies, and that can be used for irrigation or for fish production; (iii) production of biogas that is used for family cooking (saving approximately 100,000 VND per month for a family of 4-5 people), warming chicks, boiling water for nursery piglets, or for liquor production.

However, biogas plants also have important limitations: (i) it requires large areas, so is not suitable for farms without land or ones having limited areas; in addition, building underground biogas tanks needs high initial investment; (ii) it may be not able to treat all the wastes produced from big farms or the gas from bigger plants might not be fully utilisable; (iii) it can not be practised for farms that have very small numbers of animals (less than 2 cattle or less than 5 grower pigs); (iv) in some areas, flooding happens every year from July to October; so at those areas biogas plants can not be maintained and (v) the biogas digestor has almost no effect on the of nitrogen and phosphorus content of the effluent, which means that the effluents still have to be managed adequately.

Relocation of livestock farms

Some provinces and cities have the master plan for animal production areas. Few state-owned farms and many private pig farms have been moved and rebuilt in those areas. Government has some programs to support and encourage the relocation of state farms. For example, the People Committee of Ho Chi Minh City issued Decision No. 80/2002 (on 6 July 2002) to approve the plan of relocation of pollution-creating enterprises to industrial parks and sub-urban areas, including two state-owned livestock farms. To support for the relocation, the People Committee also issued Decision No. 81/2002 (on 8 July 2002) which focused on policies to give financial support for relocation, such as to supply the loans with favourable interest rates for reconstruction, to impose favourable tax conditions, or to help in finding new places for relocation.

The following reasons pled for the relocation of animal farms: (i) large farms have to be relocated to prevent pollution and adverse affects on public health; (ii) the new areas for relocation of large farms will be selected in order to offer enough land for establishing new farms and manure management systems, including high potential for manure application on crops (e.g. poor grey soil), (iii) areas will be selected, where the low level of the water table will limit the threat of groundwater contamination by animal waste in the case of mis-management; and (iv) farms relocation is the opportunity to create disease free zones, with higher potential for export oriented production.

Experiments of utilisation of pig manure as fertilisers

Using animal wastes for crop production is a sole but promising way to reduce environmental risks and establish a sustainable nutrition balance. In this project, experiments using pig manure for fertilisation of a dominant local cultivation were carried out. The results showed that manure treatment did not bring any advantage for rice. On the other hand, either pig compost or

biogas sediment at rate between 10 and 20 tons per hectare induced an increase in peanut yields up to 25%. The difference between the treatment of 10 and 20 tons either compost or biogas sediment was trivial, so that we would strongly recommend an application of 10 tons of manure per hectare of peanut, while further experiments should be conducted on rice.

Pig manure also improved yields of vegetable up to 53%. For small farms, if the farm owner himself has pigs, the use of manure will be less trouble. However, vegetable is usually grown in concentrated areas in the suburb of big cities. Around Ho Chi Minh City, these areas established a "green belt", from which vegetable is delivered to the whole city. Demand of fertilisers for the "green belt" is great. Farmers have to purchase manure from other areas. Besides, the inter-farms road system in vegetable cultivation areas is usually in bad condition, which makes transportation of manure difficult.

The rubber tree trials were located on a low soil fertile area, in the suburb of Ho Chi Minh City. In Vietnam, rubber tree is planted largely in Northern and Eastern Ho Chi Minh City where soil fertility is poor, and so the effect of nutrients supplement was obvious. The obtained results showed that both the solid pig compost and biogas sediment manure positively influenced tree growth. The experiment was conducted on 4-5 years old trees: at this phase trees are still in vegetative growth and latex production is in its starting stage. In our experiment, manure application has not shown a clear effect on latex production, though this would need further (medium term) experiments. Nevertheless, it was quite clear that no revere effects can be found on the trees after manure treatment. Thus, even if it is not economically beneficial, rubber tree plantations might be an important area for pig manure utilisation

The experiments showed that manure played an important part in yield enhancement of longan. We suggest that one of the benefits of using manure was to compensate mineral nutrients in the soil. This result clearly suggested that the use of liquid waste is applicable and benefitable on longan gardens. Dosing and long-term effects should however be further investigated.

CONCLUSION

In summary, waste management from pig production in Vietnam is seeking for solutions. Solid manure may be locally utilised as fertiliser for regional main crops. Technical supports are needed for manure treatment and organic fertiliser formulation to meet requirements for each crop. Ways to deal with pig liquid wastes should be worked out. One suggestion is to transport and utilise such wastes in cultivation areas. However details on techniques, transport, management and legislation must be carefully discussed for operation of the systems. Relocation of animal farms to remote and agriculture areas is also an on-moving solution. The solution of this issue requires further analysis and financial support.

REFERENCES

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