SUGGESTION ON UTILIZATION OF FECES AT LARGE SCALE CATTLE FARM AND IMPROVEMENT OF ENVIRONMENT

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ABSTRACT

Waste management is an important factor on a cattle farm. Wastes of cattle farm enable environmental pollution (soil, water and air). They have been implicated as a cause of decrease quality of life for neighboring communities, with additional possible negative consequences on human health and welfare. Outputs of wastes should be managed to minimize adverse effect and maximize beneficial effects in the production system and environment. The output from large cattle farm operations has higher contributory risk to the public health and the environment than from smallholders. Therefore, large scale cattle farms should become pioneers to continue contributing towards environmental improvement, they must be having motivation to initiate and persist in environmentally friendly practices. One of many methods of waste handling is delivery liquid waste into central water treatment and/ or biogas digester systems. Several benefits of biogas digester system are eliminating greenhouse gas, reduction of nuisance odors, betterment of fertilizer, production of heat and power. These utilizations would be economically viable because of rising price of fossil fuel and inorganic fertilizer. Moreover, to motivate environmental concern on farming practices, this requires a new method for assessing yield from a farming operation. It would include some form of credit or subsidy for operations that contributed in some way to environmental improvement or a penalty tax on those with any detrimental effects.

Keywords: waste management, biogas digester system, cattle farm, environment

INTRODUCTION

Increasing income of Indonesian people has tended to hike meat consumption up. The need of meat especially beef is shown in Figure 1. Recently,

meat consumption is about 2.3 kg/person/year. However, with domestic beef production of 400 hundred ton/year, it is not sufficient to supply the need [1,2]. Therefore, efforts to eliminate beef deficit are conducted by two strategies. In a short term, to fulfill domestic consumption and to protect draining of local cow population, a strategic way should be taken by import cattle from abroad. Livestock import may in form of cattle breed, feeder cattle and beef. In long term, the efforts are conducted by strengthening domestic production [7]. Population of beef cattle, milk cow and beef cattle import, are shown in Figure 2.

Indonesia is one country that free from such diseases like as *Bovine Sponge Encephalopathia* (BSE) and *foot and mouth*. Indonesia also has excellent genetic of local cow. It is conducive for animal husbandry development. Increasing domestic need of meat and milk changed agribusiness development scheme from small scale to be medium or large scale. In several specific regions were established village cooperatives for milk, cattle rising by nucleus plasma scheme (Pola Inti Rakyat), regional development for animal husbandry and crop livestock system (CLS) [3,4]. These developments will have consequence impact on environmental pollutions if a good waste management is neglected.

The output from large cattle farm operations has higher contributory risk to the public health and the environment than from smallholders. Thus, large scale cattle farms should become pioneers to continue contributing toward environmental improvement, they must be having motivation to initiate and persist in environmentally friendly practices.

In other hand, fossil fuel dependency is still high for activities of agricultural production and processing of agricultural products. Regulation on energy such as rising electricity tariff and prices of *Liquefied Petroleum Gas* (LPG), premium, kerosene, gasoline, and diesel oil influenced to productivity of agricultural sector. It also affected to agricultural infrastructure, like the price of inorganic fertilizer became expensive. It has urged a development of cheap alternative energy with sustainable and environmentally friendly ways by utilizing biomass from agricultural waste. However, some constraints related to

development of a renewable energy, including biogas, are its availability, security of supplies, price, ease of handling, and ease of its utilization. Moreover, external factors like technological development, introduction of subsidies, environmental constraints and legislation play the role on bringing its development [10].

Based on literature studies, field studies of animal husbandry production in Indonesia (Figure 3. a,b,c and Figure 4. a,b,c) and Japan, and experiences of Chugai Technos, Co., Japan on waste management and minimizing environmental impact, it could be concluded some suggestions to utilize cattle farm waste wisely for improving environment.

Environmental Problems at Livestock Production

a. Manure and Effluent as Source of Pathogens

On-farm manure treatment and disposal vary greatly between temperate and tropical conditions in terms of control of microbial pathogens. Manure composting treatment in the wet tropics may have little or no lethal or inhibitory effect on pathogenic micro-organisms when present. Under both conditions, the health protecting benefits of high dilution rates can be lost when too large quantities of effluent need disposing from intensive production units. The range of pathogens span from bacterial e.g., *E. coli O157:H7, Campylobacter jejuni, Salmonella spp., Leptospira spp., Listeria spp.,* and *Shigella spp*.); protozoan (e.g., *Cryptosporidium spp.* and *Giardia spp*.), human viruses (e.g., *Hepatitis A,* and *Norwalk virus*).

The survival of pathogens in livestock waste treatment systems may present serious problems of environmental pollution and public health if the waste is discharged into rivers, streams or contaminates groundwater. Pathogens may be amplified in one livestock raising system and then infect another species when manure is mixed with feed. Animal health may be adversely affected if recycled waste-water is re-used in washing animal housing, for further flushing of effluent or for irrigation of food crops. As agronomic areas are more compressed and the proximity of animal production units comes closer to areas used to grow crops that receive minimal processing, such as fresh produce, the potential for

contamination of irrigation water or soils and subsequent cross-contamination of food crops increases. Increasingly water- and food-borne disease outbreaks are being associated with the use of contaminated irrigation water or manure containing.

b. Water Pollution

When farm wastes get into a waterway, they are broken down by microorganisms. This process uses oxygen needed by river life, including plants and fish, to survive. Biochemical oxygen demand (BOD) is a measure of the amount of oxygen needed by these microorganisms to break down the organic material. BOD is therefore a measure of the polluting strength of organic wastes. Cattle slurry has BOD of 17000 (mg/liter of oxygen) while maximum BOD permitted of manure effluent in large animal housing are 200 ppm (for more than 1000 heads of pigs) and 400 ppm for smaller scale.

Absence of nitrate from manure could affect on quality of water. It causes surface waters becoming enriched with nutrients leading to enhanced growth of algae and aquatic plants (eutrophication). Depletion of oxygen concentration endangers life in water ecosystem.

c. Air Pollution

Manure malodor results from the anaerobic decomposition of organic material. During anaerobic degradation, odorous intermediate metabolites (over 200 identified) are formed which can ultimately be degraded to less odorous and non-odorous end products such as methane, carbon dioxide, water, ammonia, and hydrogen sulfide. Failure to provide a balanced system whereby odorous compounds are formed and metabolized at equivalent rates leads to the accumulation of these compounds and malodor. While the decomposition process begins prior to manure excretion, freshly excreted manure is less odorous than manure that has been stored for one or two days indicating that malodorous compounds begin to accumulate immediately following excretion [8].

Dried manure in form of dust (particulate matter) able to pollute the air. Air pollution around cattle raising feedlot was more than 6000 mg/m^3 at peak time, this value is over than freshness standard of air 3000 mg/m^3 [11]. Methane from

fermented manure also has negative environmental impact because methane as one of greenhouse gases, contributes perhaps 20% to total warming. Since ruminant animal produce methane as a by-product of their digestive fermentation, they contribute to a greenhouse effect.

Waste Management

Outputs of wastes should be managed to minimize adverse effect and maximize beneficial effects in the production system and environment. Good waste management is important for three reasons: (a) maintaining the health of the animals and the operators; (b) preventing adverse effects on land, water and plant resources; and (c) exploiting wastes as an input resource [5].

We recognize the fact that there are a wide variety of farms depending on their size. They vary in their resources in terms of access to capital, skilled labor, land and resources, management ability, and market. These resources play a major role in their decision to adopt a manure management practice. These practices include daily spreading, storage, odor control, solid separation, composting, bio-drying, anaerobic digestion, high solids anaerobic digestion, and lagoon treatment. However, depending on the perception about their personal values and available resources, each farm can have a different environmental concern.

It was recommended that in a short-term solution, low cost sealed (cement) floors for drying manure, cement drains to deliver liquid waste into sewage tanks. In the longer term, delivery into central water treatment and/ or biogas digester systems would transform polluting waste into a resource. In some systems, effective use has been made of fermentable waste in a biogas digester system. Several benefits of biogas digester system are eliminating greenhouse gas, reduction of nuisance odors, betterment of fertilizer, production of heat and power. These utilizations would be economically viable because of rising price of fossil fuel and inorganic fertilizer [6,12].

Other utilizations of digester slurry are as feed for fish pond and refeeding to animals. When digester slurry is used in ponds, the nutrients stimulate the growth of both phytoplankton *(algae)* and zooplankton *(daphia and crustaceans)*,

which the fish harvest. Refeeding of digested animal wastes to cattle, hogs and poultry has been demonstrated to be potential use of the effluent product. When organic materials are digested anaerobically, a significant fraction is reduced to ammonia, some of which is taken up by growing bacterial biomass and converted to new amino acid [6].

Yield Assessment of Farming Operation

If livestock production is to continue contributing towards environmental improvement, farmers must be motivated to initiate and persist in environmentally friendly practices. Wherever industrialized practices prevail, this requires a new method for assessing yield from a farming operation [9]. Currently, most systems would use the formula:

$$\text{Yield} = \frac{\text{Total received for commodity sold}}{\text{Total cost of all inputs}}$$

This is certainly an incomplete calculation for intensive farms. The entire region, both rural and urban, subsidizes many of their inputs and suffers from any undesirable social effects or environmental degradation resulting from the operation. Whenever high input agriculture is practiced, the individual farm boundary extends far beyond even the geographical region. A better formula that should be adopted for future evaluation is

$$\text{Yield} = \frac{\text{Total received for commodity sold} \pm \text{Credit of penalty for environmental impact}}{\text{Total cost of all inputs}}$$

This would include some form of credit or subsidy for operations that contributed in some way to environmental improvement or a penalty tax on those with any detrimental effects. Many of our current farms might be assessed neutral and receive no credit or penalty. The goal should be to modify all of these to a credit status. One problem would be agreeing who or what body should determine status and evaluate impact. A logical candidate would be government but this is perhaps not the best agency. Modern farming has moved from a life-style to a profession and it is time that farm operators began viewing themselves as

professionals. This could lead to the formation of a professional organization with responsibility for regulating members. Such a group would be in a better position than government bureaucrats to pass judgment on other farmers for both environmental and animal welfare concerns.

Conclusion

Wastes of cattle farm enable environmental pollution (soil, water and air). They have been implicated as a cause of decrease quality of life for neighboring communities, with additional possible negative consequences on human health and welfare. Outputs of wastes should be managed to minimize adverse effect and maximize beneficial effects in the production system and environment. Evaluation and determination of environmental impact should be included into yield assessment of a farming system to ensure environmental and animal welfare concerns.

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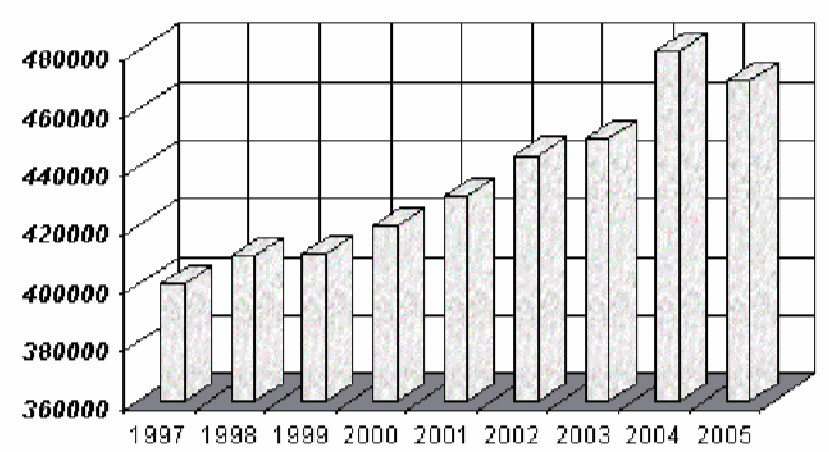

Figure 1. The Need of Beef (ton)

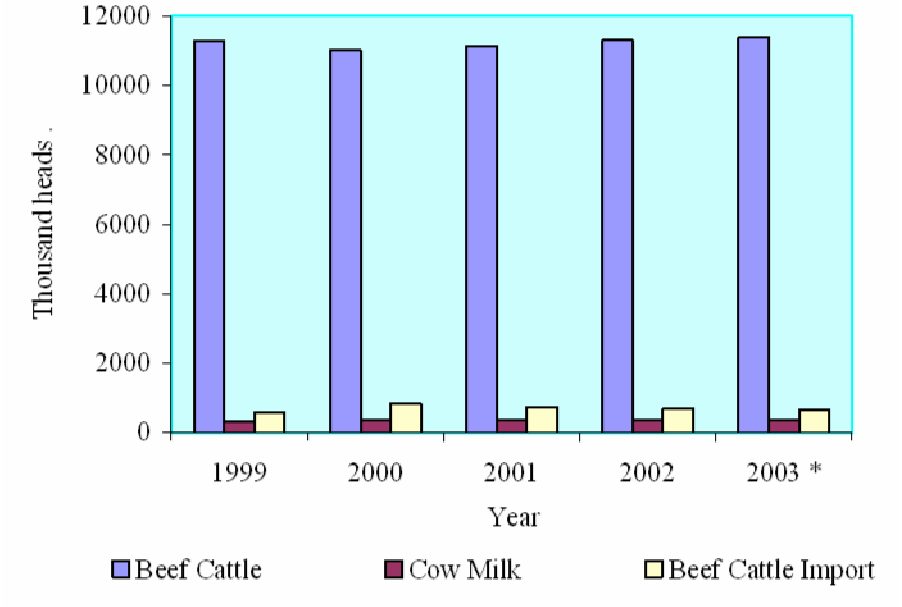

Figure 2. Population of Beef Cattle, Milk Cow and Beef Cattle Import

Figure 3.a.
Cattle Farm

Figure 3.b.
Cement drain

Figure 3.c.
Central waste
treatment

Figure 3.a, b, c. Waste Handling at Cattle Farm
(PT. Tanjung Unggul Mandiri, Tangerang, Banten, Indonesia)

Figure 4.a.
Input tank
for biodigester

Figure 4.b.
Biodigester

Figure 4.c.
Composting
facility

Figure 4 a, b, c. Waste Handling Facilities at Indonesian Research Institute for Animal Production, Bogor, Indonesia.