Evaluation of Effective Microorganisms (EM) as Foul Odor Eliminator in Pig and Poultry Farms, Growth Stimulant in Broilers, and as an Organic Fertilizer

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Abstract

A three-year research project was conducted to encompass four studies where EM was evaluated. These were the effects of EM on (1) Eliminating foul odor in poultry and pig farms, (2) The weight gain of broilers, (3) The growth and yield of some vegetables and (4) Plants and animals in terms of pathogenicity.

The application of EM technology in swine was evaluated after one year of study. Evaluation was done on urine and faeces, pigpens, drain canals and septic tanks. Initial results showed that foul odor in pigpens was greatly reduced by EM application. Using the hedonic scale, 67% of the evaluators rated the treated test sites as odorless, 23 % said that these were slightly odorous, and 10% evaluated as moderately odorous. In poultry, the effects of EM as a foul odor eliminator after one growing cycle of broilers was not very favourable. With the same scale used in swine, 73 % of the evaluators rated moderately odorous, 20% rated slightly odorous, and 7% rated strongly odorous.

In vegetables, the mean yield responses of test crop fertilized with sludge and effluent coming from pigpens with and without EM application were similar. As to pathogenicity, no distinct disease or pest, problems were observed in the test crops and animals regardless of treatments.

Introduction

Under Philippine conditions, foul odor is common in poultry and pig farms. Bad odor is often associated with unsanitary environments. Unfortunately, people living near these places often complain about the objectionable odor. Although a healthy environment is never ensured with air pollution, the poultry and pig farms cannot be closed as these are important agricultural industries. Thus a solution needs to be developed to eradicate the foul odor. The introduction of EM technology might be a timely response to this problem. It is proper and appropriate to test this technology and find out its effects under the Philippine conditions.

EM microbes, with an acid producing nature, has the ability to maintain a fit and efficient digestive system. It also enhances the digestive, nutrient absorption and assimilation abilities of animals by its addition to feeds and drinking water. EM has the ability to absorb toxic gases (eg. hydrogen sulphide and ammonia) and convert them into organic acids thereby eliminating foul odor. EM could turn solid wastes into organic fertilizer in a short period of time. EM has the ability to purify waste water effectively to pass discharging criteria with some modifications of current waste water treatment facilities. Likewise, in crop production, EM is reported by many to be a root growth stimulant. The anaerobic microorganisms multiply in the soil and create a suitable environment and a synthetic fermentable soil, which

supports for plant growth. Soil deterioration due to repeated cultivation is reduced. The growth of harmful bacteria and injurious insects are kept to a minimum. Therefore, the use of agricultural chemicals can be limited.

Premised with the results of some researchers that EM enhances the availability of nutrients from organic wastes and is an effective control of some soil-borne organisms, the effect of EM-treated organic wastes was also tested on tomato, eggplant and pechay to validate previous findings.

Methodology

Pig Farm

A selected unit at Balamban Breeding Centre of the Department of Agriculture Cebu Province was chosen as the test site. The Unit was thoroughly cleaned and disinfected before the inception of the study. The drainage canals and septic tank were also cleaned.

A total of twelve pigs were used in the study. Immediately upon the arrival of weanling, EM was introduced into their feeds and drinking water. The practice of incorporating EM into the feeds and drinking water continued daily until the pigs were disposed.

The EM solution was prepared by diluting 10 ml of molasses in 1 liter of water. This mixture was then added with 19 liters of water and 10 ml of the prepared EM-1. The EM solution was mixed thoroughly before using as a feed and additive.

EM was also used as a spray to clean the pigpen, drainage canals, ceiling, and septic tank. This solution was also used to bath the animals.

The EM spray was prepared by diluting 100 ml of molasses in 1 liter of water. The mixture was added with 19 liters of water and 100 ml of EM-1. This was mixed thoroughly before using for spraying.

The pigs were disposed after six months. New weanlings were again placed in the same pigpen. The same experimental procedure was adopted with the new replacements.

After one year, a group of ten evaluators were invited to rate the degree of foul odor in the test site. This was compared with the foul odor produced by pigpen without EM application. The urine and faeces, pigpen, drainage canals and septic tank were evaluated using the hedonic scale. The following were measured.

Odorless	having no odor
Slightly odorous	one can resist the smell for a long period of time
Moderately odorous	one can resist the smell for a short period of tune
Strongly odorous	no one can resist the smell in a definite period of time

In addition to the odor determination, the test animals were also observed closely to identify the occurrence of pest and disease that may develop due to EM application.

Poultry

The EM study was conducted in a poultry farm in the Municipality of Naga, Cebu province.

The selected birds were broilers with a minimum growing cycle of 45 days.

The following inputs were procured before the conduct of the study: 100 heads of Lohman broiler chicks, 3 bags of broiler starter mash, 2 bags of broiler starter crumbles, 2 bags of broiler finisher crumbles, 1 vial of BIBI vaccine, molasses, and EM solution.

The day-old birds were brooded for ten days and immunized intranasally with BIBI vaccine. While brooding, two growing cages were thoroughly cleaned and disinfected. After ten days of brooding, the chicks were transferred into two separate growing cages. Each cage had 50 heads.

The birds in one growing cage were immediately introduced to EM in their feeds and drinking water. The EM solution was also sprayed to dropping. EM solutions were prepared as for the earlier study. The other growing cage was free from any EM intervention and designated as the Control.

One week after the introduction of EM, birds in both cages were weighed, For recording purposes, one contained the average weight of ten sample birds. Since the study had three replications, a total of thirty (30) sample birds were weighed in both cages. Identification marks were provided in sample birds for convenience in the next weighing. After weighing, all birds were vaccinated with La Sota vaccine.

The second weighing was done two weeks after the introduction of EM. The same sample birds were weighed in the EM-treated and EM-free cages. In order to minimize stress in birds, subsequent weekly weighing was not continued. Instead, the final weight of the sample birds was obtained when the birds were disposed at fifty seven (57) days. The live weight gain of birds were analyzed statistically.

Two to three days before the birds were finally disposed, a group of fifteen (15) evaluators rated the degree of foul odor in the two cages under study. The hedonic scale of measurement used was:

Odorless	having no odor
Slightly odorous	one can resist the smell for a long period of time
Moderately odorous	one can resist the smell for a short period of time
Strongly odorous	no one can resist the smell in a definite period of time

Vegetable production

The sludge and effluent from EM-treated and EM-free pigpens were comparatively used as organic fertilizers to eggplant, tomato and pechay. Two garden plots of 6 square meter were laid-out in each test crop to accommodate the two treatments of the study. The treatments were as follow:

Treatment 1

Tomato, eggplant and pechay were fertilized with 3 kilograms of decomposed EM-treated pig manure as basal application. One part of effluent coming from the EM-treated pigpen was diluted in ten parts water and added to the plants once a week. Two months after transplanting, tomato and eggplant were side-dressed with two more kilograms of decomposed EM-treated

pig manure.

Treatment 2

The test crops were supplied with sludge and effluent from the EM-free pigpen. The method and time of application and the quantity of manure used were the same as in treatment 1

The experiment was set-up m a randomized design with three replications. The garden plots planted with tomato, eggplant and pechay were all divided into two main plots, which were sub divided into three replications.

Similar cultural and management practices were employed in all treatments and replications.

The data gathered in all replications were the average harvests of ten (10) sample plants located at the center of each plot.

Pathogen Determination

Possible occurrence of pests and diseases was observed regularly in the experimental crops, swine and poultry. Measures undertaken to eliminate common pests and diseases were also recorded.

Results and Discussion

Foul Odor Elimination

Results of the evaluation showed that 70% of the evaluators rated the faeces and urine as odorless while 30% rated slightly odorous. The pigpens and drain canals were rated 100% odorless. Sixty percent (60%) rated the septic tank as slightly odorless and 40% as moderately odorous. On the overall performance, 67.5 % of the evaluators rated the pigpen as odorless; 22.5% as slightly odorous; 10% as moderately odorous; and nobody rated strongly odorous (Table 1).

Table 1. Evaluation of the degree of odor in pigpen with application

Measurements	Rating of evaluators					
	Urine & faeces	Pigpens	Drain canal	Septic tank	Total	%
Odourless	7	10	10	-	27	67
Slightly odorous	3	-	-	6	9	22.5
Moderately odorous	-	-	-	4	4	10.0
Strongly odorous	-	-	-	-	-	-
Total	10	10	10	10	40	100.0

Using the same scale, the foul odor in pigpen without EM application was also evaluated by the same evaluators. Consolidated results showed that 50% of the evaluators rated the pigpen as strongly odorous, 42.5 % rated moderately odorous, and 7.5% rated slightly odorous. Majority of the evaluators rated the septic tank as strongly odorous (Table 2).

Table 2. Evaluation of the degree of odor in pig pen without EM

Measurements	Rating of evaluators					
	Urine & faeces	Pigpens	Drain canal	Septic tank	Total	%
Odourless	-	-	-	-	-	-
Slightly odorous	-	2	1	-	3	7.5
Moderately odorous	5	4	4	4	17	42.5
Strongly odorous	5	4	5	6	20	50.0
Total	10	10	10	10	40	100.0

In poultry, the effects of EM technology as foul odor eliminator after one growing cycle of broilers of fifty-seven (57) days was not very favourable. Within two weeks after EM application, the odor of the dropping became objectionable which prompted the cooperator to shovel the faeces away from the cages. The cage was sprayed with more EM and kept to dry. With the rating scale used in swine, the fifteen (15) selected evaluators rated the poultry cage treated with EM in the following manner: 73% moderately odorous, 20% slightly odorous, 7% strongly odorous, and 0% rated odorless. On the contrary, the poultry cage with no EM application, 40% of evaluators rated cages to be moderately odorous and 60% rated strongly odorous. These observations were gathered a day before harvesting the birds (Table 3).

Table 3. Evaluation of the degree of odor in poultry

Measurement	Rating of evaluations			
	T1-with EM		T2-without EM	
	No.	%	No.	%
Odourless	0	0	0	0
Slightly odorous	3	20	0	0
Moderately odorous	11	73	6	40
Strongly odorous	1	7	9	60
Total	15	100	15	100

Growth Stimulant in Poultry

The average live weight gain of birds one week after the application of EM was marginally greater (Table 4).

Table 4. The average live weight of birds (g) one week after the application of EM. Each observation was an average weight of ten birds

Treatments	Mean Wt. (g)
With EM	305
Without EM	300
Mean	303

C.V.=0.23%

After two weeks of treating the birds with EM they were weighed. The birds treated with EM

had a heavier live weight gain when compared to the birds in the control. The marketable live weight of birds treated with EM were significantly heavier than the birds in the control when weighted at 57 days (Table 5).

Table 5. Average live weight of birds (g) two weeks after EM application and at 57 days. Each observation was an average weight of ten birds

Treatments	Mean & Weight	
	2 weeks	57 days
With EM	594a	2397a
Without EM	544b	1947b
Grand Mean	569	2172

Means within a column followed by same letter are not significantly different

C.V.=0.68%

The mean yield of pechay fertilized with EM treated pig manure was 0.372 Kg (Table 6). This treatment mean was not significantly different from the yield of pechay fertilized with EM free pig manure (0.337 Kg). This observation initially suggested that the quality of pig manure as organic fertilizer was not affected by EM.

Marketable fruits of eggplants (*Solanum melongena* L) were harvested approximately two and one-half month after transplanting. Harvesting marketable fruits lasted for more than three month at weekly intervals. The average number of fruits per plants was 10-16 with fruit size varying from 250 to 500 g per fruit.

The average yield of marketable fruits of eggplant per plant was 1.22 Kg with the application of EM treated pig manure (Table 6). This yield was marginally higher in plants applied with EM free pig manure (1.18 kg).

After three month of weekly harvesting marketable fruits, the average yield of tomato (*Lycopersicon esculentum* mill.) was 1.15 kg per plant in plots fertilized with EM treated pig manure. A mean yield of 1.03 kg was obtained from plants fertilized with EM free pig manure (Table 6).

Table 6. Average yield of pechay, eggplant and tomato treated with EM and organic manures.

Treatment	Pechay	Egg plant	Tomato
Fertilized with EM treated manure	0.372	1.22	1.55
Fertilized with EM free manure	0.377	1.88	1.03
%	2.23	8.60	10

The ill-effects of using EM in swine, poultry and vegetables, were monitored by periodic pathogenicity observations on test plants and animals. It was found that there were no pests or diseases to be observed from the inception of the study. In fact, the test plants and animals

were healthy (Table 7).

Table 7. Pathogenicity observation due to EM application

Commodity	Observations
Swine	Negative
Poultry	Negative
Egg plant	Negative
Pechay	Negative
Tomato	Negative

The problems encountered during the conduct of the study were also recorded. Among the problems were:

Administrative

1. Due to change in the administration of Balamban Breeding Center, the pig farm will be transferred to another test site by January 1996;
2. Due to limited funding, the tests for poultry and vegetables were conducted only for one growing season. Another set of experiments has been initiated in another test site;
3. Delayed releases of requested research supplies and materials:
4. Transport problem especially in hauling research materials;
5. Inadequate manpower to handle the care and maintenance of test animals;

Technical

1. Availability of EM is sometimes irregular at the test sites of even in Cebu as EM is prepared in Manila;
2. In poultry, the farmer cooperator finds the application of EM very laborious because feed need to be sprayed daily since feeding was ad libitum. In chicken dropping, the same complaint was expressed by the farmer cooperator.

Conclusions

The effects of EM technology in swine, poultry and vegetables may be summarized as follows:

1. Initial results showed that foul odor in swine was greatly reduced after one year of continuously incorporating EM in feed and drinking water of swine and mixing EM in water used for cleaning the cages. An average of 67 % of the evaluators rated the pigpen tested as odorless; 23 % rated slightly odorous; 10% evaluated moderately odorous; and none gave a score of strongly odorous.
2. In poultry, the effect of EM technology as foul odor eliminator in broiler production was not very favourable. After one growing cycle of 57 days, 20 % of the evaluators rated the poultry as slightly odorous, 73 % rated moderately odorous, and 7 % rated strongly odorous.
3. An increase in weight gain of broilers was observed with the addition of EM in the feed and drinking water. The increase in live weight gain was observed as early as after one week of EM application and become highly significant during harvesting time when the

birds were 57 days old.

4. In vegetables, the mean yields of tomato, eggplant and pechay were not significantly different in plots fertilized with sludge and effluent coming from pigpens with and without EM application. This may suggest that the quantity of pig manure as organic fertilizer was not affected with the introduction of EM. Although, there were a slight increase in the yields of tomato and eggplant when applied with EM treated manure. their mean yield differences were not significant.
5. With the addition of EM technology, no pest or disease was initially observed to in the test crops and animals.

From the initial findings of the study, the following recommendations may be drawn

1. For as long as EM is available, this technology is highly recommended to be introduced in pig farms;
2. There is a need to refine EM technology application in poultry to attain the desired results;
3. A follow-up studies on the effects of EM treated manure as orange fertilizer on the growth and yield of different cultivars under varied agro-climatic conditions are strongly recommended to confirm the veracity of the initial report and to explore benefits and findings from the technology.
4. A study applying EM solution directly to treat crops is also recommended. At present, however, this is already conducted with high-valued vegetables.