Effective Microorganism (EM) for Animal Production

Bhola Kumar Dahal

Institute of Agriculture and Animal Science
Rampur Campus, Chitwan, Nepal

Abstract: *Potential of EM in agriculturally dominated Nepal is high where livestock is an integral part the of agricultural system and plays an important role in the nutrition and economy of the people. The role of EM to enhance production, to control malodor and to induce immune response against diseases seems promising. To evaluate the effect of EM on production and health of broilers and the economical feasibility of its use in broiler farming, two demonstration trials were conducted in 1997 and 1999 at a village farm and Institute of Agriculture and Animal Science (IAAS) livestock farm respectively. Another trial was conducted at IAAS livestock farm to see the effect of EM on growth performance of goat in 1997. Further, a demonstration trial on use of EM in the pigsty was conducted at a village farm in 1998. The results of trials on broilers indicated that EM promoted growth, improved health, reduced cost of production and controlled malodor in the farms. Out of different methods of EM applications (EM solution through drinking water, EM Bokashi through feed and both of them) tested, EM solution through drinking water was found to be cost effective and labour saving. In goat, the body weight gain was highest with feed mixed with 10 % EM Bokashi as compared to 5 % and control. In pigsty, EM effectively controlled malodor resulting in a healthy and socially acceptable environment. The economic analysis of using EM in broilers indicated that EM was a cheaper product and could be used profitably in broiler farming.*

Introduction

Nepal has a farming based economy and livestock is an integral part of the agricultural system. Livestock has been reared principally for manure and provides almost all the draft power used in cultivation. This contribution together with production of food (meat, milk, egg), fibers, hides/skin and transportation amounts to 15 percent of GDP (LMP 1993). This sector, on the other hand, contributes about 1/3rd of agricultural GDP (NPC 1998). As the present status of the country indicates that the consumption of meat, milk and egg is very low by Asian standards this sector is facing pressure to commercialize itself in order to meet the nutritional demand of the growing population. However, the sustainability of the existing farming system has remained the issue of concern, because of many problems associated with the modern system moving towards chemical based farming.

Notwithstanding the potential of income generation for rural farmers, the poor management, unhygienic conditions, the low immune status and digestibility prevailing in the livestock and poultry farms are attributed to the reduced appetite, greater incidence of health problems, poor growth and consequently high mortality. All these lead to great economic loss to the farmers. Moreover the use of antibiotics and other drugs to treat the animals increases the cost of production as well as creates other problems like drug residues and drug resistance, which is of serious concern to public health. But the benefits of using EM in livestock farming were such that it eradicated odours, keeps the animals healthy, does away with the need to use antibiotics and cuts down the unnecessary labour (Higa, 1994). Ahmed et al. (1996)

has concluded in his report that EM is a safe product and this technology can be applied for promoting growth and for inducing immune response in broilers. Use of EM in layers showed increased resistance, reduced mortality, increased egg production and average egg weight rate whereas in pig rearing it showed not only even growth and quicker growth speed but also hog's skin and hair gradually turned to luster (Li Wei-Jionge et al.1994). EM contains many naturally occurring beneficial microorganisms, which are both oxybiotic and anaerobic microbes. After entering the body of animals as foodstuffs these microbes may multiply rapidly and they not only check the growth of other pathogenic microbes but also form the normal microbial group within the host body to produce main vitamins for the host, provide nutrients and prevent attack of the pathogens (Li Wei-Jionge et al.1994). So EM can be used in livestock farming especially more effectively in biological animal husbandry to address the above mentioned problems in Nepal. Thus, a few demonstration trials were conducted to observe the influence of EM on performance of broilers, goats and on pigsty.

Materials and Methods

Effect of EM on Broiler Production

Two demonstration trials were conducted using EM in broiler farming in 1997 at a village farm and in 1999 at the IAAS livestock farm. In both cases the broilers were divided into four groups namely G1, G2, G3and G4. The owner of the village farm and the caretaker of poultry farm at IAAS were trained to prepare solid and liquid forms of EM for use. The liquid EM used was the secondary EM (or EM-2) which was prepared from primary EM or EM stock solution provided by the Community Welfare and Development Society (CWDS), a professional NGO involved in the extension of EM technology in Nepal. The solid form was the EM Bokashi prepared anaerobically from rice bran. Both forms were prepared by the methods as suggested by CWDS. The prepared liquid EM was given through drinking water at the rate of 1 ml. per litre of drinking water to G2, whereas G3 was given the solid form of EM at the rate of 50 gm. per kg. of feed and G4 was given both solid and liquid form of EM continuously after 10 days of age. G1 served as control. In case of village farm, chicken were fed *ad libitum* the commercial broiler ration throughout the study period but in the IAAS livestock farm equal quantity of ration was given to the broilers in all the treatments and control. The trials at village and IAAS livestock farm were conducted during summer and winter respectively. However, deep litter management system was practised in both cases.

Results and Discussions

Results from village farm showed that the live body weight of the broilers in all treatment groups were greater than the control. The average live body weight of the four groups i.e. G1, G2, G3 and G4 at 54 days of age were 1492, 1812, 1788 and 1860 g respectively (Table.1) The net weight gain of the broilers in G2 (EM solution), G3 (EM Bokashi) and G4 (both EM solution and Bokashi) over the control were 30.5, 24.6 and 30.5 per cent respectively (Table.2). In case of IAAS livestock farm the final average live body weight at 53 days of age in G1 (control), G2 (EM solution), G3 (EM Bokashi) and G4 (both EM solution and Bokashi) were 2276, 2380, 2395 and 2261 respectively (Table 3) whereas the percentage net weight gain of the broilers in G2 (EM solution), G3 (EM Bokashi) and G4 (both EM solution and Bokashi) over the control (G1) were 7.2, 7.3 and 1.3 respectively (Table 4). The average feed consumption was 4.46, 4.49 and 4.61kg in G2 (EM solution), G3 (EM Bokashi) and G4 (both EM solution and Bokashi) respectively as compared to 4.27kg. in G1; and the feed conversion ratios were 2.46, 2.51and 2.47 in G2 (EM solution),

G3 (EM Bokashi) and G4 (both EM solution and Bokashi) respectively as compared to 2.86 in G1 in the broilers of village farm (Table 5). The average feed consumption was 6.78kg. in all groups of IAAS livestock farm (Table 6). The variation in the above results in two different trials could be due to the differences in season, breed, feed and the environment of the poultry house. The variation was clearly reflected in terms of feed intake, final average live body weight and mortality of the broilers, as there were more feed intake, greater live body weight and no mortality in case of IAAS livestock farm. However, the consistent results of both trials were as follows.

- The net weight gain in the treatment groups were greater indicating that EM enhanced production.
- There was more efficient utilization of feed in the treatment groups indicating that EM helped in digestion. In both cases the feed intake was observed to be more in treatment groups.
- There was low mortality in the treatment groups observed at the village farm which was located in the disease prone area. It indicated that EM improved the immune system and produced healthy birds, which was shown by earlier study in experimental broilers (Ahmed et al., personnel communication). However, the higher mortality in G4 (both EM solution and Bokashi) as compared to G2 (EM solution) and G3 (EM Bokashi) could be due to overcrowding of birds in summer stress as the space was not sufficient to rear that number of broilers (Table. 7).
- The litter of the birds in the treatment groups were well decomposed and free from malodor indicating that EM controlled malodor and produced good quality manure for crop production.
- Economic analysis of using EM indicated that EM was a cheaper product and could be used profitably in broiler production. Moreover, it seemed that EM could decrease the cost of production by reducing the need to use antibiotics and other drugs which further could make it a more beneficial product to use in broiler production (Annex 1).

Table 1. Effect of EM on Live Body Weight (g) of Broilers at Village Farm, Chitwan, 1997

Age (Days)	G1 (Control)	G2(EM solution)	G3(EM Bokashi)	G4 (Solution + Bokashi)
18	307	266	311	314
27	590.5	563	584	645.5
36	957.5	1077	1066	1085
45	1120	1338	1320	1410
54	1492	1812	1788	1860

** Each figure represents mean of 10 birds.

Table 2. Percentage Net Weight Gain (g) over the Control at Village Farm, Chitwan, 1997

Groups	Initial Weight(x)	Final Weight(y)	Net Weight Gain (y-x)	Percentage(%) Net Weight Gain
G1 (control)	307	1492	1185	----
G2 (EM solution)	266	1812	1546	30.5
G3 (EM Bokashi)	311	1788	1477	24.6
G4 (solution+ Bokashi)	314	1860	1546	30.5

******Each figure represents mean of 10 birds

Table 3. Effect of EM of Live Body Weight (g) of Broilers at IAAS Livestock Farm, 1999

Age (Days)	G1(Control)	G2 (EM solution)	G3 (EM Bokashi)	G4 (Solution +Bokashi)
11	474	448	461	435
18	675	635	615	605
25	690	690	680	653
32	960	953	928	888
39	1480	1445	1425	1410
46	1760	1905	1954	1734
53	2276	2380	2395	2261

** Each figure represents mean of 10 birds

Table 4. Percentage Net Weight Gain over Control of Broilers at IAAS Farm, 1999

Treatments	Initial Weight (x)	Final Weight(y)	Net Weight Gain(y-x)	% Net Weight Gain
G1(control)	474	2276	1802	---
G2(EM solution)	448	2380	1932	7.2
G3(EM Bokashi)	461	2395	1934	7.3
G4 (solution+ Bokashi)	435	2261	1826	1.3

Table 5. Total Feed Consumption (TFC) in Average and Feed Conversion Ratio (FCR) at Village Farm, 1997

	G1(Control)	G2(EM solution)	G3(EM Bokashi)	G4(Solution +Bokashi)
TFC	4270	4460	4492	4610
FCR	2.86	2.46	2.51	2.47

** FCR = TFC/ Total weight gain

Table 6. Total Feed Consumption (TFC) and Feed Conversion Ratio (FCR) at IAAS Livestock Farm, 1999

	G1 (Control)	G2 (EM solution)	G3 (EM Bokashi)	G4 (EM solution + Bokashi)
TFC	6780	6780	6780	6780
FCR	3.76	3.51	3.51	3.71

** FCR= TFC/Total weight gain

Table 7. Mortality of Broilers at Village Farm, Chitwan, 1997

Groups	Total No. of Broliers	No. of Broilers Dead	Mortality %
G1(control)	75	10	13.33
G2(EM solution)	75	5	6.66
G3(EM Bokashi)	75	4	5.33
G4(solution+Bokashi)	200	20	10

Materials and Methods

Effect of EM on Goat Production

A demonstration trial was conducted on use of EM in goat production at IAAS livestock farm during Aug.-Sept., 1997. Nine kids of local breed were selected and divided into three groups of three each namely G1, G2 and G3. Then G2 and G3 were given Bokashi at the rate of 5 percent and 10 percent of their feed respectively whereas G1 served as control. The Bokashi used in feeding the treatment groups was prepared anaerobically from rice bran by the same method as above. Initially the kids were dewormed and tagged. In the treatment groups Bokashi was mixed with wheat bran and commercial feed that is used by the farm to feed the goats. But the existing system of grazing was not disturbed. All kids were allowed to graze two times a day. The trial was conducted for two months and the observation was taken fortnightly.

Results and Discussions

Results showed that the net weight gain was more in both treatment groups. The net weight gains in G1 (control), G2 (Bokashi 5 percent) and G3 (Bokashi 10 percent) were 2.2, 3.64 and 5.27kg. respectively (Table.8).

Table 8. Effect of EM on Performance of Goats, IAAS Livestock Farm, 1997

S.N.	Tag No.	Trea-tments	Initial Wt.	Wt. After 15 days	Wt. after 30 days	Wt. after 45 days	Wt. After 60 days	Avg. Initial Wt.	Avg. Final Wt.	Net Wt. Gain
1	035	G1	12.5	13.1	13.65	14.1	14.5	9.8	12.0	2.2
2	09		8.0	8.7	9.3	9.8	10.25			
3	03		9.0	9.7	10.3	10.8	11.45			
4	07	G2	4.1	4.75	5.4	6.25	7.1	6.66	10.3	3.64
5	011		11.0	12.25	13.1	13.9	14.7			
6	097		4.9	6.25	7.5	8.4	9.1			
7	02	G3	4.8	6.5	8.1	9.6	11.0	5.93	11.2	5.27
8	022		3.75	5.0	6.3	7.5	8.8			
9	031		9.25	10.75	12.05	13.1	14.0			

The inclusion of Bokashi at the rate of 10 percent of feed showed better performance of goats. Thus, even in ruminants like goats, EM was shown to have positive impact on growth performance.

Materials and Methods

Effect of EM in Pigsty

A demonstration trial was conducted using EM in the pigsty in a village farm. Diluted EM (1:1000) was prepared and sprayed in the pigsty two or three times a week in the beginning. Later the frequency of EM application was reduced to once a week and then fortnightly as the malodor of the farm was found to be reduced to a minimum.

Results and Discussions

The result showed that EM can effectively control malodor and help keep the environment healthy. This result is in corroboration with the finding of Li et al., (1995). Although the result was observed qualitatively, EM was found to be effective in controlling malodor in the diversified ethnic community of the farmers in the village.

Conclusions and Perspectives

The trials on the use of EM in animal production, though not widely conducted, have demonstrated beneficial effects not only on health and production but also on environmental pollution. The results of the trials are in corroboration with the finding that the naturally occurring microorganisms contained in EM after they enter into the body create more effective intestinal microflora with a greater synthetic capability i.e. one that can synthesize vitamins, hormones and enzyme systems that improve digestion, enhance growth, provide disease resistance, suppress malodor, inhibit pathogen and improves product quality (.Li et.al., 1994). Though many commercial products containing yeast and lactic acid bacteria are costlier and their range of beneficial activities has not been claimed to be equal to that shown by EM they are readily available in the market and are widely used by the farmers in livestock and poultry farming. On the other hand, antibiotics are unscrupulously used by the farmers as growth promoters and prevent means for diseases which could lead to public health hazard. Thus, its highly desirable that this environment friendly economical and safe technology from a public health point of view should be incorporated in the traditional animal husbandry practice with necessary amendments, instead of so called modern animal husbandry which encourages use of chemicals and drugs. However, future activities need to be focussed on scientific and applied researches in line with the concept of Kyusei Nature Farming at the research institutes of home country. Then, massive extension programs along with the basic information and literature on EM technology should be carried out to familiarize it with the large as well as the small rural farmers, so that a sustainable and nature friendly livestock farming systems could be established.

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Annex 1

Economical Analysis (for 1000 broilers)

The use of EM either through feed or through water alone is profitable both from more production and labor saving point of view. Among them, using EM through feed is costlier than through drinking water. Economic analysis of using EM through both means is given out below.

If EM given through feed

Increase in live body weight per bird	= 100 gm. (though the result shows more than 100 gm.).
Total increase in live body weight	= 100x 1000 = 100,000 gm. = 100 kg.
Average price of live body weight	= Rs.60/-
Total income through increase in live body weight (a)	= 100 x 60 = 6,000/-
Average feed consumption	=6780 gm.
Total feed consumption	= 6.78 x1000 kg. = 6780 kg.
Rice bran required to prepare bokashi	= 6780 x 5% = 339 kg.
Average price of rice bran	= Rs.10/ kg.
Total price of rice bran (x)	= 339 x10 = 3,390/-
Molasses required	= 5 kg. (maximum).
Average price of molasses	= Rs.15/-
Total price of molasses (y)	= Rs.15 x 5= Rs. 75/-
Cost of EM	
Total cost of EM (z)	= Rs.20/litre x5= Rs. 100/-
Total labor cost to prepare bokashi (w)	= Rs.500 (maximum).
Total cost incurred in preparing EM(b)	= x + y+ z+ w = 3,390+75+100+500 =Rs. 4065/-
Net income = a – b = 6000 – 4065	= Rs.1935/-
Net income per bird = 1935/1000	= Rs.1.935/-

If EM given through water

Total cost incurred in preparing EM (b)= y+z+w = 75+100+500= Rs. 675/-
Net income = a-b= 6000- 675= Rs.5325/-
Net income per bird= 5325/1000= Rs. 5.325/-