Effective Microorganisms for Sustainable Animal Production in China

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Abstract.

China is a country with a large and expanding population but with limited natural resources to support its needs. Therefore, it has been necessary to develop more efficient agricultural production systems, especially for animals. The excessive use of antibiotics to ensure animal health, and environmental pollution from improper management of animal wastes, are serious problems which have restricted the development of sustainable animal production in China. Consequently, studies were initiated in 1992 to determine whether Effective Microorganisms (EM) could help to overcome these problems. Controlled feeding trials were conducted with EM added to the rations of chickens, ducks and pigs. Results have shown that EM increased the microbiological activity of the feed and its nutritive value (especially amino acids); increased the resistance of animals to disease, decreased the animal mortality level, decreased the need for antibiotics; and improved the quality of animal products. The application of EM to animal wastes also helped to stabilize the material, effectively controlled malodors, and improved their value as organic fertilizers for agriculture.

Introduction

China is a developing country with a large and growing population, but with limited natural resources. Therefore, it is essential that China develop more efficient agricultural production systems, particularly as they involve the animal. Two problems which have become major constraints to the development of more sustainable animal production are: 1) excessive use of antibiotics for health maintenance and disease control and 2) extensive environmental pollution from disposal (i.e., non-treatment) of animal wastes particularly in the urban sectors. For example, some 5 million tons of animal manures are generated each year in suburban Beijing City. Improper management of these wastes have generated monumental malodor and fly problems that have adversely affected human health and environmental quality. Consequently, in 1992 the Beijing Agricultural University in cooperation with the International Nature Fanning Research Center (INFRC), Atami, Japan commenced controlled feeding trials to determine whether EM could a) improve the production, health and quality of broiler chickens, laying hens, broiler ducks and pigs, and b) decrease the need for antibiotics in animal production systems. The effect of EM on suppression of malodors from animal wastes was also investigated. This paper reports on the results of these studies.

Results and Discussion

Effect of EM on the Health, Disease-Resistance and Mortality Rate of Chickens and Ducks

Production of Egg-Laying Chickens.

An experiment was conducted with 500 birds fed with and without EM-treated feed for 400 days (June 1993 to August 1994). Results showed that the mortality of the birds which received EM decreased more than 35 percent compared with the control group (i.e., non-EM treated birds). EM significantly decreased the incidence of contagious intestinal diseases such as bacillary white diarrhea. The mortality level of the EM-treated birds during early growth, i.e., 0 to 6 weeks, decreased by 80 percent compared with the control group. During the later growth stages, i.e., 7 to 20 weeks and 21 to 57 weeks, the mortality level of EM-treated birds decreased by 59 and 14 percent, respectively, compared with the control group.

Cannibalism among egg-laying hens has been a continuing problem resulting in a rather significant mortality level. An experiment involving 5,000 hens showed that after consumption of EM-treated feed for 7 to 10 days there was a dramatic cessation of cannibalism compared with the non-EM treated control. The farmer, who is a veterinarian, was very surprised at this result because he had been unable to control cannibalism with antibiotics, herbal medicines, and growth hormones.

Production of Broiler Ducks.

A study was conducted with 30,000 ducklings fed at different growth stages with EM-treated and untreated feed. The mortality level of the EM-treated ducks was less than 3.5 percent compared with the control group which approached a 5 percent mortality level.

Effect of EM on Egg Production by Laying Hens; and Growth Rate of Broiler Chickens and Pigs

Egg Production by Laying Hens.

In the experiment discussed earlier involving 500 birds fed 400 days with and without EM, results showed that the average laying rate for a period of 237 days was 68 percent for the EM-treated group compared with 62 percent for the control group. The average egg weight for the EM group was 56.6 grams compared with 55.0 grams for the control group. The average weight per egg-laying hen for the EM group was 9.12 kg compared with 8.03 kg for the control. The feed consumption weight to egg weight ratio was 2.52 for the EM group and 2.64 for the control. In another experiment involving 800 hens, the results indicated that the EM-treated feed extended the peak egg-laying period by 4 months (i.e., the peak was extended from age 5 months to 9 months) with an overall egg-laying rate of 82 percent due to EM. In one experiment with 400 hens and EM applied only to the drinking water, the egg-laying period was extended from 2 months to 4 months with an egg-laying rate of more than 90 percent.

Production of Broiler Chicks.

The average weight of birds that were fed EM-treated feed during a growth period from 8 to 56 days was 2.8 percent greater than the control group. EM also increased the efficiency of food consumption to body weight which increased the net return by almost 30 percent.

Pig Production.

In a number of trials it was shown that pigs which consumed EM-treated feed for only 7 to 8 days were healthier in appearance and had higher growth rates compared with the control group. The total gain per pig in the EM group over a 4-month period was 8 to 10 kg greater than the control group.

Effect of EM on Control of Malodors from Animal Wastes

In addition to the beneficial effects of EM applied in feed or drinking water on the health, growth and quality of animals, EM can suppress malodors in animal wastes and enhance their stability and value as organic fertilizers.

In a study on the production of broiler chickens it was shown that the concentration of toxic ammonia (NH_3) inside a poultry house accommodating the EM-treated birds was 26.5 ppm compared with 87.6 ppm for the non-EM control group. This suggests that EM can effectively transform NH_3 into less toxic constituents, thereby maintaining a safer environment for the birds. In other studies with egg-laying hens it was shown that EM applied in the feed caused a substantial reduction in the concentrations of NH_3 and H_2S (hydrogen sulfide) both of which are toxic gases that are harmful and even lethal to animals. EM decreased the concentration of these gases inside poultry houses by 30 to 50 percent compared with the non-EM controls.

The control of malodors and flies in pig farm operations with EM applied in feed and drinking water, or by periodic spraying, has been widely demonstrated and documented in China.

Conclusions and Perspectives

The beneficial effects of EM on many aspects of animal production systems in China have been widely demonstrated. However, the exact mechanisms of how EM, once ingested, elicits beneficial effects on animal health, growth and metabolism is not known. In a preliminary study where pigs were fed EM-treated feed, there was a concomitant increase in the amino acid content of the feed. If some of these were essential amino acids it may help to explain some of the beneficial effects. Also, EM ingested by animals may create a 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 malodors of wastes, inhibit pathogens, and improve product quality. Future research needs to focus on the modes and mechanisms of action for EM in animal production so that we can better predict the effect of vital parameters of mode/method, time. rate and frequency of EM applications to animals and their environment.

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