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EFFECT OF YUCCA EXTRACT (DEODORASE) ON ENVIRONMENTAL AMMONIA LEVELS AND GROWTH PERFORMANCE OF RABBITS

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Abstract

The effect of Deodorase, a commercial product prepared from yucca extracts, on environmental ammonia levels in an enclosed rabbit building was determined. Deodorase at levels of 125 mg/kg diet and 250 mg/kg diet, or sprayed on the manure once per week, resulted in ammonia levels 35 cm above and below the cages that were markedly lower than for controls not receiving Deodorase treatment. Average daily gains and feed conversion efficiency were significantly ($P < 0.05$) improved with dietary Deodorase supplementation. The results indicate that Deodorase can lower environmental ammonia levels in enclosed rabbitries and significantly increase animal performance.

Introduction

Atmospheric ammonia build-up is a major problem with animals raised in confinement. Urinary nitrogen in the manure is converted by microbial action to ammonia, which is volatilized into the air. Ammonia in the air is toxic to both the animals and humans working in the building. In rabbits, excessive ammonia is a major factor contributing to respiratory disease caused by Pasteurella multocida. This organism colonizes the nasal passages when the mucosal surface has been damaged by exposure to ammonia (Morisse, 1979; Patton et al., 1980). Pathological effects of ammonia buildup in confinement animal buildings have been reviewed by Carlile (1984).

Yucca extract preparations, when added to the feed or sprayed on the excreta, have been shown to reduce atmospheric ammonia in poultry and swine confinement facilities (Crober, 1991; Headon et al., 1991). The active ingredient was originally thought to be sarsaponins, which have ammonia-binding properties (Johnston et al., 1981). However, recent work indicates that glycoproteins are the active fraction (Lyons et al., 1991).

The objective of this study was to determine the effect of a source of yucca extract (Deodorase) on atmospheric ammonia levels, at cage level, in a confinement rabbit building, and to determine the effects of dietary Deodorase on growth performance and feed conversion efficiency of weanling rabbits.

Materials and Methods

Experiment 1.

Replicate 1.

Ninety-six New Zealand White (NZW) weanling rabbits of 5-6 weeks of age were randomly assigned to one of 4 treatments, with 3 cage replicates per treatment of 8 rabbits per cage. Each treatment was set up in a separate room in a broiler house containing a series of identical rooms, of dimensions 4.9 m x 4.9 m. The hanging wire cages were suspended over a plastic sheet, on which all the excreta were collected. A layer of shavings was placed on the plastic before the experiment began. The manure accumulated throughout the experiment, and was not disturbed in any way. Feed and water were provided ad libitum. The composition of the control diet is shown in Table 1. The feed was prepared in a commercial feed mill (Pendleton Grain Growers, Inc., Hermiston, OR) in 1 ton batches. The diets were pelleted.

Table 1. Composition of the control diet.

Ingredient	%
Alfalfa meal	56.5
Wheat mill run	37
Meat meal	0.8
Molasses	3
Bentonite	1.25
Trace-mineralized salt	0.5
Vitamin premix	0.95

The treatments were as follows:

Treatment 1: Control diet
Treatment 2: Control diet + 125 mg Deodorase per kg diet
Treatment 3: Control diet + 250 mg Deodorase per kg diet
Treatment 4: Control diet; excreta sprayed with Deodorase once per week.

The Deodorase spray solution contained 125 mg Deodorase per l, to provide 14 g per 100 sq feet. The manure was sprayed 24 hours before ammonia readings were taken. Air ammonia measurements were made with Drager 8-hour diffusion tubes. The tubes were placed an equal distance (35 cm) above and below the center cage in each battery of

three cages, for 8 hours, on days 7, 14, 21, 35, 40 and 50. The animals were kept on the treatments for 50 days. The two animals which died were replaced, to keep the same stocking density.

Animal performance was statistically analyzed using one-way analysis (SAS, 1985) of variance with Duncan's multiple range test used to determine significant differences between means.

Replicate 2.

A second replicate was conducted, using the same facility and the same treatments. The excreta from Replicate 1 was left undisturbed on the plastic sheets, and the second replicate begun as soon as replicate 1 was completed. Ammonia measurements were taken on days 1, 10 and 35.

Experiment 2.

Sixty NZW rabbits of 4-5 weeks of age were randomly allotted to 3 treatments with 5 replicates (4 rabbits per cage) per treatment. The dietary treatments were: (1) control, (2) control + 125 mg Deodorase/kg and (3) control + 250 mg Deodorase/kg. The animals were housed in hanging wire cages in an open sided naturally ventilated building and provided feed and water ad libitum for 37 days. Daily gain and feed efficiency were statistically analyzed as in Experiment 1.

Experiment 3.

Fifty-six NZW rabbits of 4-5 weeks of age were randomly allotted to 2 treatments, with 7 replicates (4 rabbits per cage) per treatment. The two dietary treatments were the control diet + 125 mg Deodorase/kg and control diet + 250 mg Deodorase/kg. The animals were housed and managed as in Experiment 2.

Results

Experiment 1.

Animal performance is shown in Table 2. Average daily gains were significantly improved ($P < 0.05$) with Deodorase treatments, either in the feed or sprayed once per week on the excreta. Feed conversion (feed/gain) was significantly improved ($P < 0.05$) with Deodorase treatments.

In Replicate 1, the initial ammonia levels were very low (Fig. 1), because the trial began in a clean, previously vacant facility. By days 40 and 50, the ammonia levels were markedly higher for the controls than for all Deodorase treatments, both above and below the cages. With Replicate 2, the initial ammonia levels were higher because the facility

contained the excreta from Replicate 1. As in Replicate 1, the control ammonia levels were markedly higher than for the treatments with Deodorase (Fig. 2).

Table 2. Effects of Deodorase on rabbit performance (Experiment 1).

Item	Treatment			
	Control	125 mg Deodorase/kg	250 mg Deodorase/kg	Deodorase Sprayed on Excreta
Replicate 1				
Avg. daily gain (g)	27.7[a]	36.0[b]	36.7[b]	36.8[b]
Avg. daily feed intake (g)	126	132	131	125
Feed/gain	4.55[a]	3.66[b]	3.57[b]	3.40[b]
Mortality (n/24)	1/24	0/24	1/24	0/24
Replicate 2				
Avg. daily gain (g)	27.7[a]	33.5[b]	33.0[b]	27.7[a]
Avg. daily feed intake (g)	112	125	126	113
Feed/gain	4.05[a]	3.72[b]	3.82[b]	4.08[a]
Mortality (n/24)	0	0	0	0

a different than b ($P<0.05$).

Experiment 2.

The performance results are shown in Table 3. The average daily gains and feed conversion were significantly ($P<0.05$) improved with the Deodorase treatments as compared to the control. There were no differences between the two Deodorase treatment groups.

Experiment 3.

As in Experiment 2, there were no differences in performance between the two levels of Deodorase (Table 3).

Table 3. Effect of dietary Deodorase on performance of weanling rabbits (Experiment 2).

Parameter	Dietary Treatment		
	Control	125 mg Deodorase /kg diet	250 mg Deodorase /kg diet
Experiment 2			
No. of animals	20	20	20
Avg. daily gain (g)	27.0 ± 0.7[a]	37.4 ± 2.5[b]	36.0 ± 1.8[b]
Feed/Gain	4.52 ± 0.16[a]	3.63 ± 0.05[b]	3.90 ± 0.13b
Experiment 3			
No. of animals	-	28	28
Avg. daily gain (g)	-	39.2 ± 0.9	39.1 ± 1.3
Feed/Gain	-	4.14 ± 0.10	4.08 ± 0.11

a different than b ($P < 0.05$).

Discussion

These experiments have shown that yucca extract, in the form of the commercial product Deodorase, lowered the atmospheric ammonia level in enclosed rooms containing rabbits. The product was effective whether added in the feed or sprayed on the manure once per week. Because of the frequent problems of high ammonia levels in enclosed rabbitries, yucca extract could play an important role in improving the environment for both the animals and their human caretakers.

The inclusion of Deodorase in the diet significantly increased ($P < 0.05$) average daily gain and feed/gain. This action is apparently independent of the effect on ammonia levels, because performance was increased in an open-sided building (Experiments 2 and 3) with very low ammonia levels because of the high degree of natural ventilation, as well as in the enclosed building (Experiment 1).

Deodorase is effective at a level of 125 mg/kg diet (125 ppm), and probably at lower levels as well. Evidently the glycoproteins have a high degree of biopotency, to affect both ammonia and animal performance at such a low dietary level.

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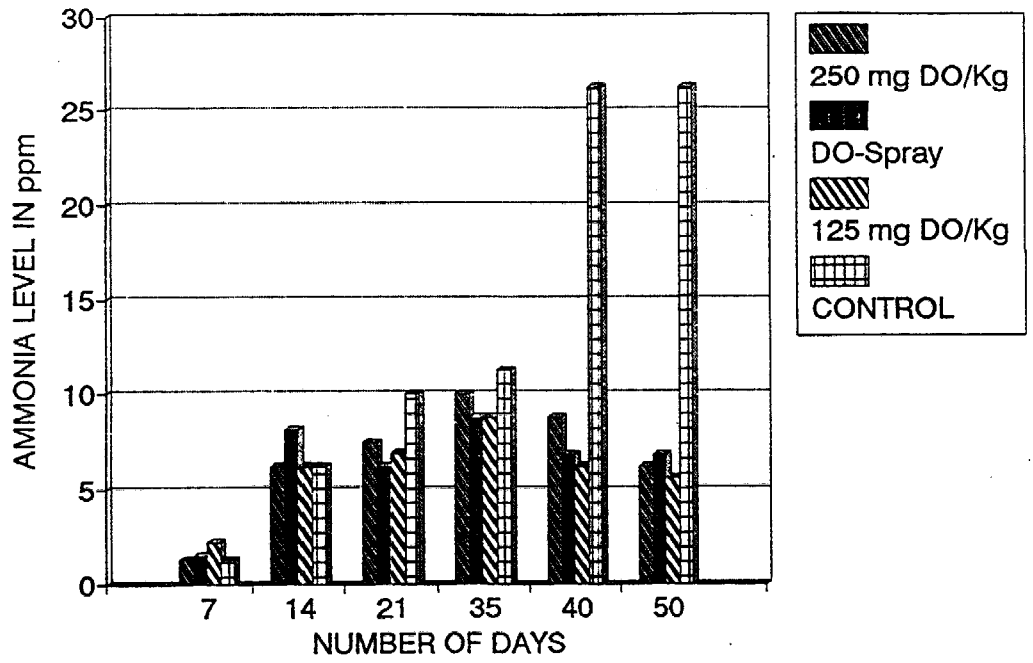

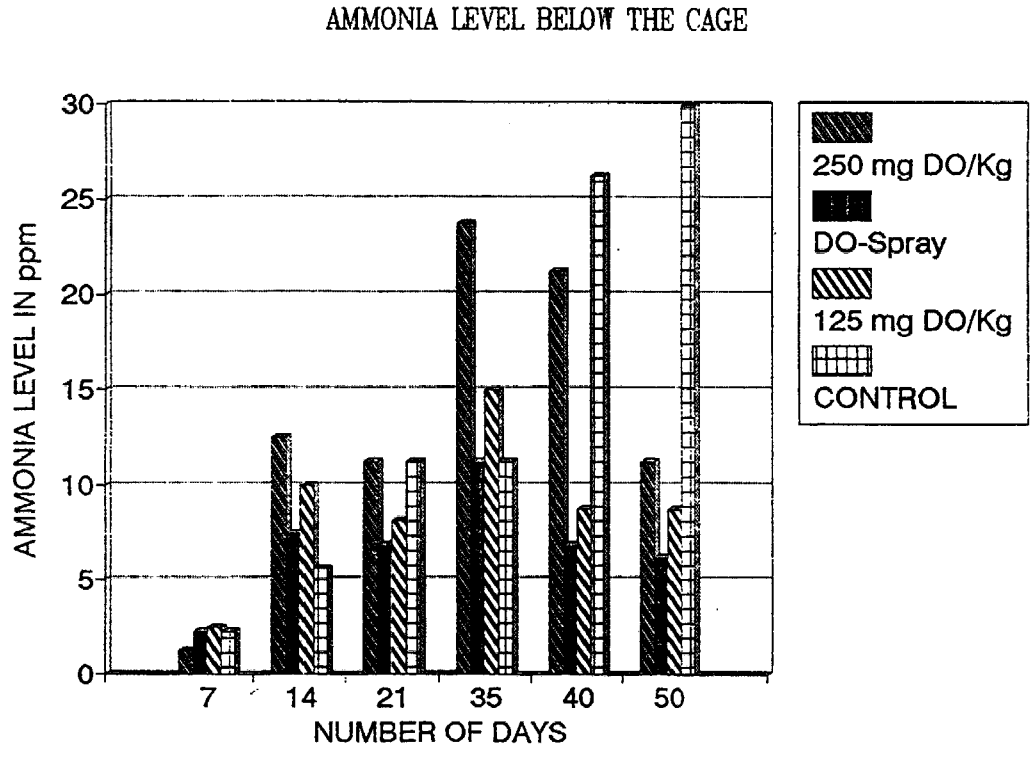

Fig. 1. Effect of Deodorase treatments on air ammonia levels in an enclosed rabbit building - Replicate 1.

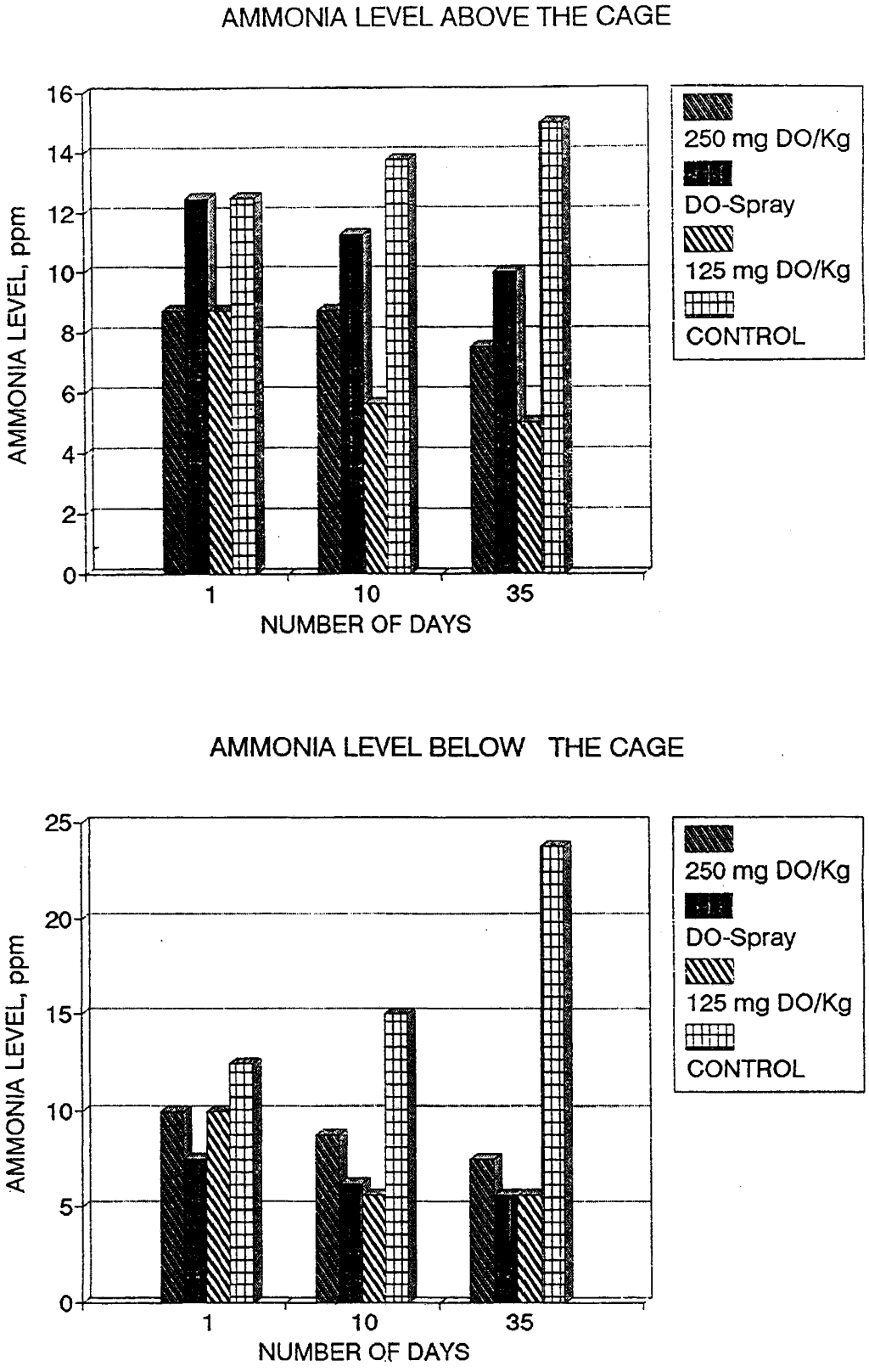

Fig. 2. Effect of Deodorase treatments on air ammonia levels in an enclosed rabbit building - Replicate 2.