Feeding Value of Rations Containing Sewage Sludge and Oakwood Sawdust

C. B. AMMERMAN and S. S. BLOCK
Departments of Animal Science and Chemical Engineering, University of Florida, Gainesville, Fla.

A corn meal–cottonseed meal type ration containing 20% of either precomposted or composted sewage sludge–oak sawdust mixture or Bermudagrass hay was fed to lambs for 70 days. Digestibility of nutrients in the mixed rations was obtained. Feed consumption, body weight gains, and digestibility of crude protein, fat, crude fiber, and nitrogen-free extract were lower for the rations containing the sludge-sawdust mixture than for the ration containing hay. Composting the sludge-sawdust mixture resulted in a more palatable ration as indicated by feed intake. Although not as valuable nutritionally, the sludge-sawdust mixture furnished adequate roughage to the concentrate mixture to allow normal function of the digestive system and to permit body weight gains by the lambs. The results suggest that these waste materials may find a place in animal feeding, particularly under conditions where sources of nitrogen and roughage are in limited supply, and thus provide an economical means of disposal.

THE SANITARY DISPOSAL of organic wastes is an ever increasing problem. With larger urban populations, sewage sludge is becoming more abundant and its value as fertilizer does not pay for its disposal. In 1957, Washington, D. C., produced 120 tons of damp, digested sludge daily. Flash drying equipment was available but was not used because of the inability of the city to market the sludge at a price that would cover the cost of drying (*2*). Sawdust is another organic material produced in large quantities but generally wasted. Annually in the United States, 20 million tons of sawdust from manufacturing, and additional tons from logging (*14*) are wasted. Processed wood pulp has been shown to be useful as a source of roughage in ruminant rations (*10*, *12*), and new growth of chamise (*Adenostoma fasiculatum*) and interior live oak (*Quercus wislizenii*) have been shown to have feeding value for sheep and deer (*3*).

Sewage sludge has claimed wide interest as a source of vitamin B_{12} (*4*, *6*, *7*, *9*), and a plant has been built to reclaim this vitamin from sludge (*8*). In addition to vitamin B_{12}, sewage sludge contains folic acid and folinic acid factors (*13*). The protein of sewage sludge has been studied in animal feeding (*4*, *5*). The relatively low digestibility and low biological value did not favor sludge as a source of protein for swine or poultry but appeared of value as a nitrogen source for ruminants. Studies with sheep showed that a ration incorporating 18% of the total nitrogen as sludge was equal to rations of similar crude protein content containing either soybean meal or urea (*5*).

The objective of the present study was to compare the feeding value of rations containing either a precomposted or composted sewage sludge–oakwood sawdust mixture with Bermudagrass hay for lambs.

Experimental

The sewage sludge–sawdust mixtures were prepared as follows. Sewage sludge from the trickling filter process followed by anaerobic digestion was removed from the sand drying beds, completely dried in a hot air kiln, and ground in a Wiley mill. It was mixed with an equal weight of oak sawdust and fortified with 2.0% urea and 1% KCl. Water was added to give 80% moisture, and one batch was dried and termed "precompost." The other batch was put in a special composting bin (*11*) where it underwent composting for a period of 17 days. During this period the temperature rose to 182° F. and the pH rose from 6.8 to 8.8 as NH_3 was released and finally returned to 7.1. There was a 24% shrinkage in weight resulting from composting, with darkening and tendering of the wood fibers. After composting, the material was dried and both "precompost" and "compost" were ground again before using in the feeding trials. Chemical determinations were made on the precompost and composted material to ascertain the effect of composting on nutrient composition.

The experimental rations contained, in per cent: corn meal, 59.0; cottonseed meal (41% protein), 20.0; defluorinated phosphate, 0.5; and trace mineralized salt, 0.5. The remaining 20% consisted of either ground Bermudagrass hay, precompost, or compost. All rations were fortified with 4400 I.U. vitamin A palmitate and 440 I.U. vitamin D_2 per kilogram. Each of the three rations was offered to two individually fed wether lambs for 70 days, and feed consumption and body weight gains were determined. Following the feeding period, the lambs continued to receive the same rations, and a conventional digestibility trial was conducted. Collections of total feces were made in metabolism stalls for 7 days. The feces were dried and ground, and an aliquot was taken for chemical analysis. All chemical determinations were made according to methods as outlined by A.O.A.C. (*1*).

Results and Discussion

The nutrient composition of the Bermudagrass hay, precompost, and compost, and the experimental rations is shown in Table I.

As shown in Figure 1, the composted sewage sludge–sawdust ration was not as well consumed as the hay ration initially but after the first week was essentially as palatable to the lambs. The precompost ration, however, was much less palatable, and it became necessary during the first week to mix more palatable feed with the precompost ration to encourage consumption. Within the second week the lambs consumed the precompost ration alone, but consumption was never completely satisfactory for this ration during the entire study. Body weight gains as related to feed intake are shown in Figure 1. During the 14th to 42nd day period of the trial when feed consumption was essentially equal for the three treatments, average daily weight gains were 195, 210, and 154 grams for the hay, compost, and precompost rations, respectively.

The digestibility of the nutrients in the experimental rations is shown in Table

Table I. Nutrient Composition of Bermudagrass Hay, Precompost, and Compost, and of Experimental Rations Containing These Ingredients

	Per Cent					
Ingredients	Dry matter	Ash	Crude protein[a]	Ether extract	Crude fiber	Nitrogen-free extract
Bermudagrass hay	92.4	2.3	8.0	6.7	30.0	45.4
Precompost	93.8	17.5	15.4	5.4	25.4	30.1
Compost	93.2	20.3	13.6	6.9	19.8	32.6
Rations						
Bermudagrass hay	90.9	5.2	14.5	3.6	10.2	57.4
Precompost	90.4	7.6	16.2	3.4	10.7	52.5
Compost	90.6	8.9	16.8	3.3	9.1	52.5

[a] *Kjeldahl nitrogen* × *6.25.*

Table II. Average Digestion Coefficients and Total Digestible Nutrients for Experimental Rations

	Digestibility, %				
Ration	Crude protein	Ether extract	Crude fiber	Nitrogen-free extract	Digestible nutrients[a]
Bermudagrass hay	72.2	84.3	34.1	85.4	76.8
Precompost	66.9	76.0	13.7	79.9	66.4
Compost	62.1	69.5	7.3	75.5	61.6

[a] *Expressed on the moisture-free basis.*

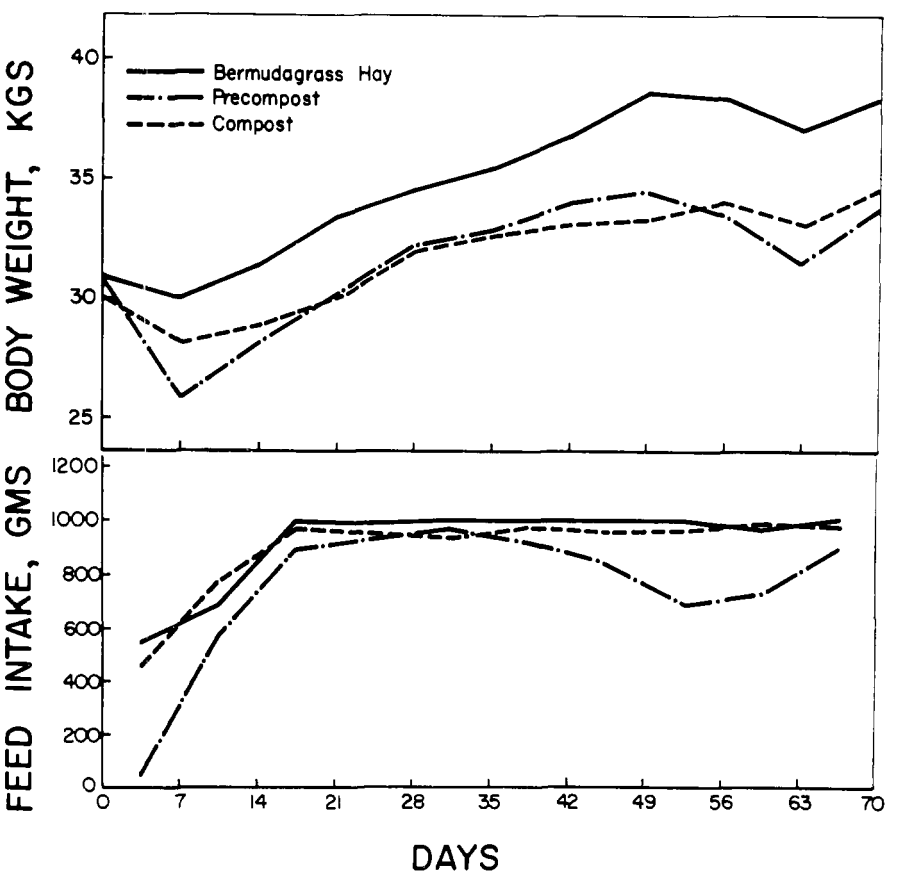

Figure 1. Average daily feed intake and average body weight of lambs fed rations containing Bermudagrass hay, precompost, or composted materials

II. The digestibility of the crude protein, ether extract, and nitrogen-free extract was slightly higher, and the digestibility of the crude fiber was considerably higher for the hay ration than for the compost and precompost rations.

These preliminary experiments indicate that on the basis of total body weight gains (Figure 1), the sewage-sawdust mixture, whether composted or not, was inferior to Bermudagrass hay as a feed for lambs. A part of the problem with the precompost ration was the unpalatability of this material. This was overcome by composting, but at the expense of losing nutrients as shown in Table I and decreasing digestibility as indicated in Table II. The reduced digestibility of the composted ration may be a consequence of the utilization of the more readily available nutrients by the bacteria during the composting process. The sludge-sawdust rations fortified with urea provided digestible crude protein in amounts essentially equal to that provided by the hay ration. However, the sludge-sawdust rations provided less digestible ether extract, crude fiber, and nitrogen-free extract than did the hay ration. The total digestible nutrient values for the hay, precompost, and compost rations were 76.8, 66.4, and 61.6%, respectively (Table II).

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