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Feeding Poultry Litter to Beef Cattle

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Beef cattle have the ability to digest low-cost feedstuffs that are not usable by other livestock species. One such feedstuff is poultry litter, which provides opportunities for both the poultry producer and the beef cattle producer. The large quantities of litter produced during modern poultry production are expensive to dispose of safely; moreover, protein is typically the most expensive ingredient in ruminant diets. Feeding poultry litter is a means of disposing of a waste product while concurrently supplying a low-cost protein feed to beef cattle.

Regulations on feeding poultry litter

Poultry litter can be used as a feedstuff, but it presents special consumer issues that must be addressed. There are currently no federal or Missouri regulations governing the use of poultry litter as a feedstuff; however, certain common-sense guidelines apply. Poultry litter should not be fed to dairy cattle or beef cattle less than 21 days before slaughter. The reason for this prohibition is that the residues of certain pharmaceuticals used in poultry production may be present in poultry litter.

As a result of the first case of bovine spongiform encephalopathy (BSE) in the United States in December 2003, the Food and Drug Administration (FDA) temporarily banned the feeding of poultry litter to beef cattle. The temporary ban was put in place to allow the FDA time to assess the risks to human health associated with the practice. Ruminant protein was permitted to be fed to poultry at the time the temporary ban was put in place. Some scientists were concerned that the infectious agents of BSE could be passed to beef cattle via spilled feed or manure. Since that time, FDA has mandated the removal of all tissues that have been shown to carry infectious agents of BSE (i.e., specified risk materials) from poultry diets. As a result, the practical possibility of transmitting BSE to beef cattle via poultry litter was deemed to be zero by FDA. Poultry litter was again approved as a feedstuff for beef cattle in October 2005.

Processing of poultry litter

To control pathogens that could be present in raw poultry litter, litter should be processed before it is fed to beef cattle. The following processing methods may be used:

1. Ensiling with chopped, whole-plant corn or another roughage. Fermentation increases the acidity of the ensiled mass, lowering the pH to 4.7 or below, which kills pathogens that might be present. The moisture content of litter should be about 40 percent for ensiling. Poultry litter should be mixed with roughage at 30 percent or less of the dry weight of the ensiled mass during silo filling.
2. Spraying with propionic or acetic acid to lower the pH to 4.7. This provides an additional energy source for cattle.
3. Pelleting will heat the poultry litter to temperatures that kill potential pathogens.
4. Deep stacking to a height of 6 to 8 feet for a minimum of 3 weeks. Microbial processes will cause the poultry litter to heat to temperatures of 140 degrees F or more. Temperatures above this level kill pathogens.

Deep stacking

Deep stacking poultry litter involves piling litter in a 6- to 8-foot stack, where it undergoes a fermentation process analogous to ensiling. The litter should contain at least 20 percent moisture by weight for optimal deep stacking. The litter will spontaneously heat to 130–160 degrees F in the stack, killing any pathogenic organisms in the litter. Temperatures higher than 160 degrees should be avoided because a spontaneous chemical reaction will render protein in the litter less digestible to beef cattle. This chemical process, termed the Maillard reaction, involves the irreversible binding of certain amino acid residues in proteins with sugars. The result is that the protein becomes impervious to attack by digestive enzymes. Limiting the amount of oxygen in

the deep stack by packing the litter with a tractor and by covering the litter with plastic sheeting (6-mil polyethylene) will prevent the poultry litter from getting too hot during fermentation. Poultry litter can be stored in this form for up to five years with little loss of quality.

Common storage structures for deep-stacked poultry litter include open-sided pole barns, three-sided commodity sheds, free-standing clamp silos covered with 6-mil polyethylene and weighted with discarded automobile tires, and bunker or trench silos. To minimize the probability of spontaneous combustion, avoid stacking poultry litter beyond 4 to 5 feet high in areas where the litter will be in contact with wood or other potentially combustible material.

Foreign objects

Poultry litter should be free of any metal, glass, rocks, and other foreign objects if it is to be fed to beef cattle. These materials are usually incorporated into the poultry litter during removal, loading, and transport of the poultry litter from the poultry production facility. Care must be taken to avoid incorporating foreign objects into poultry litter intended for cattle feed. Accidental consumption of metal objects or glass by beef cattle can result in decreased animal performance and death. Metal can be removed from poultry litter with magnetic plates on the discharge chute of a mixer wagon. Producers feeding small numbers of cattle can pass the litter through a screen to remove large objects.

Poultry litter often contains high levels of ash. Ash is composed of inorganic mineral matter. A high level of ash in poultry litter is usually caused by contamination with soil and gravel. Poultry litter should not be fed to beef cattle if the level of ash is greater than 28 percent. Large amounts of soil and gravel in poultry litter may cause impaction of the rumen or abomasum. Addition of metal, glass, soil, rocks, and animal carcasses should be avoided in removing the poultry litter from the production facility. Care in this stage of handling can minimize poultry litter contamination.

Pathogens

Several pathogenic organisms, such as *Salmonella typhimurium, Escherichia coli,* or *Clostridium botulinum,* may be present in poultry litter. The presence of these pathogens usually results from inclusion of animal carcasses in the poultry litter. Poultry litter with a pH between 7.2 and 8.6 and heated to a temperature above 130 degrees F will inactivate *C. botulinum* toxin in approximately 5 days. Heating of poultry litter to 140 degrees for 5 days will kill most other pathogens that may be associated with poultry litter. To ensure that pathogenic organisms are destroyed, poultry litter should be deep-stacked for at least 21 days.

Mycotoxins, such as alflatoxin, are not a problem in poultry litter because pH is usually unfavorable for mold growth, but other bioresidues may be cause for concern. Heart failure has been observed in cattle consuming extremely high levels of poultry litter (22 pounds per head per day) with little or no hay or pasture. Heart failure, in that particular case, was caused by high coccidostat residues in the poultry litter and by a deficiency of vitamin E and selenium.

Table 1. Nutrient values of 106 poultry litter samples from Alabama and 86 poultry litter samples from Georgia.

Nutrients (dry basis)	Georgia		Alabama	
	Average	Range	Average	Range
Moisture, %	21.9	10.1–43.4	19.5	4.70–39
TDN, %	N/A	N/A	50.0	36–64
Crude protein, %	27.9	15.0–41.5	24.9	15–38
Bound protein, %	4.1	1.4–13.2	N/A	N/A
Crude fiber, %	N/A	N/A	23.6	11–52
Minerals				
Aluminum, ppm	3,957	684–9,919	N/A	N/A
Ash, %	30.4	14.4–69.2	24.7	9–54
Calcium, %	3.0	1.1–8.1	2.3	0.81–6.13
Copper, ppm	557	52–1,306	473	25–1,003
Iron, ppm	N/A	N/A	2,377	529–12,604
Magnesium, %	0.63	0.27–1.75	0.52	0.19–0.88
Manganese, ppm	N/A	N/A	348	125–667
Phosphorus, %	2.1	1.0–5.3	1.6	0.56–3.92
Potassium, %	3.0	1.0–4.7	2.3	0.73–5.17
Sodium, ppm	8,200	3,278–14,344	N/A	N/A
Sulfur, %	N/A	N/A	0.5	0.22–0.83
Zinc, ppm	484	160–1,422	315	106–669

Note: N/A = not available.
Source: Adapted from Ruffin, B. G., and T. A. McCaskey. 1991. *Feeding broiler litter to beef cattle.* Alabama Cooperative Extension Service ANR-557, and from Martin, S. A., M. A. McCann, and W. D. Waltman. 1997. *Microbiological survey of Georgia poultry litter.* UGA Animal & Dairy Science 1997 Annual Report.

Nutritional value of poultry litter

The nutritional value of poultry litter varies greatly across time and among sources. Table 1 summarizes the nutritional value of poultry litter samples from Alabama and Georgia. Generally, the total digestible nutrient (TDN) value of poultry litter approximates 50 percent and crude protein averages 21 to 28 percent. The protein in poultry litter may be extensively bound in Maillard reaction products when litter is improperly ensiled or deep-stacked. This spontaneous process decreases the availability of the protein in the rumen and small intestine of beef cattle. Additionally, much of the nitrogen in poultry litter is in the form of non-protein nitrogen (uric acid, urea, and ammonia) and is therefore of lower biological value than true protein.

Moisture

Although moisture level does not affect the nutritional value of poultry litter, water content of about 20

percent is desirable for several reasons. Litter with moisture levels greater than 25 percent will not move efficiently through augers or other feed-handling devices and is prone to excessive heating when deep stacked. Poultry litter with moisture levels below 20 percent will not generate sufficient heat when deep-stacked to destroy organisms that may potentially be pathogenic. Poultry litter rations with moisture levels of 10 percent or less will be excessively dusty, causing the litter to be unpalatable to cattle.

Moisture can be added to poultry litter to facilitate storage, handling and feeding by sprinkling it with water in the poultry house before removal. Alternatively, water can be added to extremely dry poultry litter rations just prior to feeding to increase consumption by cattle.

Vitamin A

Poultry litter is normally low in vitamin A. Poultry litter rations should be supplemented with vitamin A to ensure an intake of 1,500 IU vitamin A per pound of feed consumed by beef cattle. Supplementation of the diet with high-quality forage (i.e., more than 12 percent crude protein and more than 60 percent TDN) or allowing poultry litter-fed cattle to graze can also ensure that the cattle receive sufficient dietary vitamin A.

Calcium

Feeding poultry litter before calving may predispose cows to milk fever, also known as parturient paresis or hypocalcemia. Although nutrient analyses in Table 1 do not indicate a calcium-phosphorous imbalance, cases of milk fever in brood cows consuming poultry litter are common enough to cause concern. Removal of poultry litter from the diet of gestating cows 30 days before calving will reduce the risk of milk fever. Milk fever can continue to be a problem after calving in cows with high genetic potential for milk production. Safety concerns dictate that all cows consuming poultry litter during late gestation or early lactation be observed frequently for signs of milk fever. Symptoms include muscle stiffness and tremors, extreme weakness and loss of consciousness.

Copper

Poultry litter is normally high in copper (Table 1). The excess copper can accumulate in the liver of litter-fed cattle and result in potentially fatal toxicity, symptoms of which include jaundice and extremely dark blood. A mature cow can be fed up to 600 ppm copper for 120 days. To prevent copper toxicity, poultry litter should be fed to cows only for short periods. Periodic interruptions in poultry litter feeding will allow the excess copper to be cleared from the liver and toxicity problems can be avoided. Poultry litter can be fed to stocker cattle for up to 180 days before copper toxicity becomes a risk. Poultry litter should not be fed to sheep because of that species high susceptibility to copper poisoning.

Rations

Poultry litter should be supplemented with an energy source. Although several different energy sources can be used, corn is most common. The production level of the cattle being fed poultry litter and the quality of the poultry litter influence the amount of energy needed in the ration. General guidelines for poultry litter rations are to supply 10 to 20 percent, 30 to 35 percent, and 50 percent, of the dry diet as corn for dry cows, lactating cows, and stocker calves, respectively. The addition of corn will increase the palatability and acceptance of the poultry litter ration. The corn added to poultry litter rations should be cracked or rolled to improve mixing characteristics and prevent sorting and wastage. Poultry litter-corn rations of this type should also be supplemented with vitamin A and a high- to moderate-quality forage. Bovatec or Rumensin can be added to poultry litter rations to improve feed efficiency.

Summary

Poultry litter is an acceptable source of protein for beef cattle, and it is typically inexpensive relative to other high-protein feedstuffs. Rations containing poultry litter should be carefully balanced to ensure that nutritional requirements of cattle are met and that the potential for mineral excesses is minimized. Keep in mind that feeding poultry litter to beef cattle, while a sound nutritional management option, carries with it certain stigmas that may cause beef consumers to become alarmed. Proper processing and storage to inhibit growth of pathogenic organisms and prevent incorporation of pharmaceutical residues are essential to ensure that poultry litter is a safe and high-quality feed for beef cattle.

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