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Feeding Broiler Litter to Beef Cattle

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Cattle and other ruminants have a unique digestive system that allows them to use by-products as sources of dietary nutrients. The cattle-feeding industry has been built largely using by-products and other materials that can be digested only by ruminants. One by-product which can be used as a cattle feed is broiler litter.

Litter is a good source of protein, energy and minerals, especially for brood cows and stocker cattle. Beef producers can use large amounts of broiler litter, provided that it is of reasonably good quality and suitable for feeding.

Throughout the country, broiler litter has been used as feed for more than 40 years without any recorded harmful effects on humans who have consumed the product of these animals. So, the possibility of any human health hazard, either real or imagined, is remote.

Broiler litter as a cattle feed offers three primary advantages:

1. It is an environmentally responsible use of a by-product.
2. It provides an incentive for the proper management of this by-product by poultry and cattle producers alike.
3. It economizes the production of beef cattle.

Regulations on Feeding Litter

In 1967, when the FDA issued a policy statement which discouraged the feeding of litter and other types of animal wastes, there was relatively little knowledge available on feeding broiler litter. In 1980, after extensive testing by researchers at universities and USDA facilities, the FDA rescinded its earlier policy statement and announced that the regulation of litter should be the responsibility of the state departments of agriculture.

Presently, no federal laws or regulations control the sale or use of broiler litter as a feed ingredient. However, federal law (1996 feed rule) prohibits feeding ruminant meat and bone meal back to ruminants. As a result, litter derived from flocks fed ruminant meat and bone meal as a component of the diet should not be fed to cattle. Several states have regulations that govern the sale through commercial markets of these products intended for sale as a feed ingredient.

The beef producer, regardless of government regulation of the feedstuffs used, has the responsibility of selling a wholesome animal that is free from drugs and toxic substances. **To minimize risks from drug residues in the tissues of beef cattle that are fed litter, all litter**

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feeding should be discontinued two weeks before the animals are marketed for slaughter.

Litter should not be fed to lactating dairy cows, because there is no opportunity for a withdrawal period to ensure the elimination of residues from milk. Because of the sensitivity of sheep to copper, litter containing high concentrations of copper should not be fed to these animals.

Feeding alum (aluminum sulfate) treated litter to cattle – Beef cattle feeding trials with alum-treated litter have shown mixed results. Alum binds phosphorus and may result in a phosphorus deficiency. Further research is needed on the feeding value of litter treated with additives that reduce environmental emissions. Avoid feeding treated litter if possible.

Feeding PLT-treated litter to cattle – PLT is a common name for a poultry litter treatment product used to control ammonia in poultry houses. The chemical component of PLT is sodium bisulfate. Sodium bisulfate is approved for use in pet foods, and although not practical, PLT could be applied when poultry houses are occupied. Research comparing feeding PLT-amended litter to non-amended litter has not been published in scientific literature. However, given the application conditions and approval for use in pet food, sodium bisulfate would likely pose less of a production risk in comparison to the excessive mineral content of litter.

Nutritional Value of Broiler Litter

Bedding materials used in broiler houses include straw, wood shavings, sawdust and rice hulls. Poultry house owners use these products in varying amounts for the initial bedding and as additional bedding after each batch of birds. The bedding material alone is a low-quality feed ingredient. However, with the addition of feathers, wasted feed and excrement from the birds, the nutrient quality of the litter improves.

The kind of bedding material used in a broiler house has little effect on the quality of the litter when it is used for feeding cattle. Because the amount of bedding used and the number of batches of birds housed on the litter are not standardized or regulated, litter quality can vary considerably from one producer to another. Other factors such as broiler house management, the method of litter removal and moisture content can add to the variation in litter composition and quality. The average nutrient content of broiler litter is shown in Table 1.

Moisture

The amount of moisture in broiler litter is determined by the management of watering systems in the broiler house. The moisture content of the litter does not vary significantly between fresh litter and litter that has been stacked for six months.

Though moisture content is not an important measure of nutrient value, it will determine the physical quality of the feed. If the moisture content of a feed mix is 25 percent or more, it will not flow easily through an auger. However, if the broiler litter is 12 percent moisture or less, the ration may be dusty and less palatable to cattle. Litter should contain at least 20 percent moisture to process properly.

Table 1. Nutrient Content of Broiler Litter (Dry Matter Basis)

Nutrients	No. Samples	Average	Range
Dry Matter, %	222	79	54-96
Total Digestible Nutrients, %	222	50	33-57
Crude Protein, %	222	23	12-35
Bound Nitrogen, %[1]	106	15	5-64
Crude Fiber, %[1]	106	24	11-52
Acid Detergent Fiber, %	222	28	12-51
Minerals			
Calcium, %	46	2.9	.7-5.3
Phosphorus, %	47	1.6	1.0-3.7
Potassium, %	45	2.7	1.5-4.0
Magnesium, %	39	.7	.5-1.7
Sulfur, %	37	.9	.5-1.5
Copper, ppm	42	569	75-1149
Iron, ppm	38	453	22-2185
Manganese, ppm	38	718	512-1083
Zinc, ppm	34	509	331-947
Ash (minerals)[1]	106	25	9-54

[1] Values of broiler litter samples collected throughout Alabama. All of the other values shown were from broiler litter samples collected throughout Arkansas.

TDN

Total Digestible Nutrients (TDN) value of broiler litter is fairly low in comparison to grain. However, litter that has a calculated value of 50 percent TDN is comparable to medium-quality hay. Litter could be a valuable source of energy for both stocker cattle and brood cows.

Crude Protein

The crude protein in broiler litter is usually a very inexpensive source of protein for cattle. The average crude protein level of the samples analyzed was 23 percent. More than 40 percent of the crude protein in litter can be in the form of non-protein nitrogen. The non-protein nitrogen is mostly uric acid which is excreted by poultry. Young ruminants do not utilize non-protein nitrogen as readily as more mature beef cattle. So, for best performance, feed broiler litter to beef cattle weighing over 400 pounds.

Bound Nitrogen

When feed ingredients overheat, the nitrogen becomes insoluble (bound) and cattle can digest it less easily. The bound nitrogen in the litter samples analyzed in this study averaged 15 percent of the total nitrogen. In litter that showed signs of overheating, more than 50 percent of the total nitrogen was bound nitrogen.

Studies have shown that as the amount of bound nitrogen increases, the dry-matter digestibility decreases. Thus, overheating significantly reduces the feeding value of the litter. Methods for managing the temperature of stored litter are discussed in the section on processing and storing broiler litter.

Crude Fiber or Acid Detergent Fiber (ADF)

Crude fiber averaged 24 percent in the samples analyzed. The fiber comes mainly from chicken bedding materials such as straw, rice hulls, wood shavings and sawdust. ADF is more highly correlated to digestibility; therefore, some laboratories analyze feedstuffs for ADF in lieu of crude fiber.

The fiber in litter cannot effectively meet the ruminant's need for fiber, because cattle also need long roughage to properly maintain their digestive systems. Cattle fed litter naturally crave and readily consume long roughage. Even though the fiber content of litter is high, cattle should receive a daily minimum of 2 pounds of long hay per animal or cottonseed hulls may be included in a litter-grain mix at 10 percent of the total mix to eliminate the need for long hay. If hay is ground, the screen size should be 0.75 inch or greater to maintain effective fiber.

Minerals

Broiler litter is an excellent source of minerals. In fact, brood cows fed a daily diet of 80 percent litter and 20 percent grain with 2 to 3 pounds of hay consume five times more calcium and phosphorus than required.

The excess minerals are not a problem except under specific conditions. The calcium level in litter of over 2 percent in the presence of an imbalance of other minerals can cause milk fever in beef cows at calving. This risk can be reduced 30 days before calving by removing brood cows from a litter ration or by providing at least half of their feed as hay or other roughage. Researchers have tried altering the dietary cation-anion difference (DCAD) in litter-based diets to reduce the probability of milk fever. Altering the DCAD of diets for dairy cattle has been effective at reducing milk fever. The research with poultry litter, however, suggests reducing litter may be a more effective approach. Cattle producers have also had success in reducing milk fever by adding magnesium oxide (1 to 2 ounces per head per day) or salt (70 pounds per ton of mix) to the litter-corn ration. **Brood cows consuming broiler litter at calving should be checked often.**

Other minerals – copper, iron, manganese and zinc – are also present in larger amounts compared to conventional feed ingredients. Copper, for example, is usually not fed at more than 100 ppm in beef cattle diets. Higher levels can cause copper toxicity. The excess copper builds up in the liver tissue, but it is usually not harmful. The copper tissue level usually returns to normal after the litter is removed from cattle diets.

Young stocker cattle fed a growing ration of 50 percent litter and 50 percent grain consume copper in excess of 225 ppm of diet. Young cattle, especially those compromised by disease, can tolerate this high level of copper for only 180 to 200 days. Feeding stockers on broiler litter for less than 180 days significantly reduces copper toxicity problems.

Ash

Ash in litter is made up of minerals from feed, broiler excrement, bedding material and soil. Ash content is one of the important measures of the quality of litter. The samples analyzed contained an average of 25 percent ash. Be careful to keep the ash content, especially the soil percentage, as low as possible if the litter is to be used for cattle feed. Most soil is incorporated into litter during removal from the broiler house and loading on trucks for transportation.

Processing and Storing Broiler Litter

Broiler litter, like any other feed ingredients, has potential hazards associated with its use. Those hazards include pathogenic bacteria, such as *Salmonella*, and residues from medicated poultry rations, such as antibiotics, coccidiostats, copper and arsenic. **All litter, regardless of its source, should be processed to eliminate pathogenic organisms.**

Some broiler producers compost dead birds in piles of broiler litter. Although this method might acceptably solve the problem of dead bird disposal, litter processed and stored in this way should not be used as a feed source for beef cattle. The potential for disease transmission to the cattle has not been determined, and until research is complete, it is recommended that such litter not be used as a feed ingredient.

Processing of broiler litter as a feed ingredient can be accomplished by any one of several methods:

1. Litter can be mixed with other feed ingredients and ensiled to encourage acid production which is common with corn or sorghum silage. When ensiling litter with corn or sorghum silage, add litter at 20 to 30 percent of the dry matter of the silage crop.

2. Litter can be heat-treated as would occur during mechanical drying or pelleting of feeds.

3. **The most economical and by far the most practical method of processing litter is deep stacking.** Litter should be stacked 6 to 8 feet deep for proper heat development. (Average quality litter weighs about 32 pounds per cubic foot. Therefore, litter stacked 6 feet deep would weigh about 192 pounds per square foot of floor space.) A temperature of 130°F or higher will occur in the stack within five days. To ensure the elimination of *Salmonella* and other potential pathogens, the litter should not be used for at least three weeks. Studies have demonstrated that pathogenic bacteria (intentionally added to litter at levels higher than encountered in infected litter) were killed when litter was deep-stacked for five days. Longer stacking times are recommended to ensure a good margin of safety from pathogens.

At 140°F, bacteria such as *Salmonella*, tubercule bacilli (associated with avian and bovine tuberculosis) and pathogens excreted with feces are killed within an hour. There is essentially no risk involved with transmitting diseases through the feeding of litter **if the litter has been deep-stacked for a period of three weeks or more, and the stack has reached an internal temperature of 130°F or more**.

Ideal litter contains about 25 percent moisture at the time of deep-stacking. If moisture is below 20 percent, litter will not process properly. Litter moisture above 30 percent may result in blackened litter or fire (much like wet hay). If litter contains less than 20 percent moisture, add water to increase the moisture level to 25 percent. This can be accomplished by sprinkling the litter inside the house before clean out.

When selecting litter for feeding, avoid wet and "caked" litter around waterers. Avoid picking up dirt, glass, rocks, metal and other foreign objects with the litter. The litter around feeders should be higher in TDN value.

Antibiotics fed to broiler chickens are not a problem when the litter is fed to beef cattle. Many of the antibiotics are degraded by microorganisms present in the litter as it is processed.

Mycotoxins such as aflatoxin are not a cause for concern when feeding litter to cattle. Molds that produce mycotoxins do not grow well in litter. Litter releases ammonia which is toxic to molds. Also, the growth of molds is limited to surfaces exposed to air. Deep-stack processing of litter helps to curtail mold growth.

Broiler litter is usually handled in bulk and transported in fairly large amounts. Thus, some beef producers store litter in 100- to 300-ton stacks. With proper storage there is very little loss in quality, even when litter is stored for more than five years. However, some precautions must be taken to ensure a good quality litter at feeding time.

Heat is the one thing that reduces the quality of broiler litter in the stack. Excessive heating reduces the digestibility of the dry matter in the litter. Fresh stacked litter develops heat spontaneously.

Excessive heating (more than 140°F) can be controlled by limiting the moisture content of the litter to 25 percent and by limiting the litter's exposure to air. Some producers use farm tractors to exclude oxygen when packing broiler litter. This process reduces overheating, but it is also expensive. Storing broiler litter in an upright silo has been shown to be an excellent storage procedure. However, litter is abrasive on silage-handling equipment.

Sealing the broiler litter stack with plastic (6 millimeter polyethylene) to exclude oxygen is the least expensive method of heat control. Use plastic if the stack is likely to overheat or if it is located outside. To destroy pathogens in the litter, the temperature should reach 130°F. If the temperature is 160°F or more, the protein becomes bound and digestibility decreases.

Sealing a broiler litter stack with plastic to exclude oxygen is the least expensive method of heat control.

Suggested Rations

The two deficiencies associated with litter-grain mixes are vitamin A and fiber. Add vitamin A to litter-grain mixes at 1,500 IU per pound or inject individual cattle. Provide hay, pasture, cottonseed hulls or some other roughage to meet fiber needs. Because the nutrient levels in broiler litter are variable, the suggested rations in Table 2 should be used only as a guide. To obtain the desired animal performance, adjust litter:grain ratios and feed consumption. When 20 percent or more of the daily diet contains litter, additional minerals should usually not be needed except plain salt, which should be provided free-choice.

Corn is usually the preferred grain to mix with litter. However, other high-energy/low-protein concentrates, when properly processed, may be used, such as soybean hulls and hominy.

Some cattle producers use front-end loaders and mixer-feeder wagons or feed trucks to aid in mixing and delivering rations containing litter to feed bunks.

Litter and grain mixes may be hand-fed.

Litter should not be ground. Grinding causes the litter to be dusty and less palatable.

In Table 2, Ration 1 is for dry beef cows until 3 to 4 weeks before calving. A 1,000-pound dry cow requires 18 to 22 pounds of Ration 1 during the winter months. Provide at least 2 pounds daily of long hay or some other roughage source to maintain normal rumen function.

Ration 2 is formulated for brood cows with average milking ability. Feed approximately 22 pounds daily. This ration furnishes adequate nutrients during the winter months. Provide at least 2 pounds daily of long hay or other roughage.

Ration 3 is formulated for superior milking cows and first-calf heifers. Feed about 26 pounds daily to 1,000-pound cows and 22 pounds daily to 900-pound first-calf heifers. Provide at least 2 pounds daily of long hay or other roughage source.

Ration 4 is formulated for growing stocker cattle. Stocker cattle weighing 500 pounds will consume about 3 percent of their body weight of this ration. Healthy stocker cattle that have been dewormed, vaccinated, implanted and otherwise managed as recommended should gain an average of 2 pounds daily when fed this ration. Provide at least 2 pounds daily of long hay or other roughage source.

Feeding Ration 4 to stockers during the typical winter deficit grazing period has been shown to improve total gain. Research has also demonstrated that stocking rates can be increased and rates of gain maintained by feeding the ration free-choice on

Table 2. Suggested Rations[1]

Ration Number	1 Dry Brood Cows	2 Average Milking Cows	3 Superior Milking Cows and First-Calf Heifers	4 Stockers[2]
Ingredients	**- Pounds Per Ton -**			
Broiler Litter	1600	1400	1300	1000
Corn	400	600	700	1000
Vitamin A[3]	+	+	+	+
Broiler Litter:Corn Ratio	80:20	70:30	65:35	50:50
	- - - - - - - - - - - - - Nutritional Content, % As-Fed and Dry Matter ( ) Basis - - - - - - - - - - - -			
Dry Matter	82	82	83	84
TDN	48 (59)	52 (63)	54 (66)	60 (72)
Crude Protein	18 (22)	17 (20)	16 (19)	14 (17)
Acid Detergent Fiber	20 (24)	18 (21)	17 (20)	13 (16)
Calcium	1.5 (1.8)	1.3 (1.6)	1.2 (1.5)	.9 (1.1)
Phosphorus	1.1 (1.3)	1.0 (1.2)	.9 (1.1)	.8 (1.0)

[1] In addition to these rations, provide daily per animal at least 2 pounds long hay or other roughage source.
[2] Bovatec or Rumensin can be added to feed at 150 milligrams per day for animals weighing less than 700 pounds and 200 milligrams per day for animals weighing more than 700 pounds. For finishing cattle, increase grain to 70 percent and add 10 pounds of limestone per ton of mix.
[3] Add vitamin A at 1,500 IU per pound of feed or inject individual animals with 1 to 2 million units of vitamin A when the feeding period starts and every 2 to 3 months thereafter.

Growing stocker cattle often gain 2 pounds or more daily when fed rations containing litter and grain. Some cattle may not readily accept broiler litter. (Note animals standing away from the feed bunk.)

winter grazing crops. On summer pasture alone, stocker cattle have produced only 1 pound daily gain. Providing Ration 4 free-choice increased the rate of gain to more than 2 pounds daily and increased the total pounds of beef produced. So, supplementing both winter and summer grazing for stocker cattle with the broiler litter ration often results in an increased economic return.

The rations in Table 2 or broiler litter alone may be self-fed to cattle by adding 8 to 15 percent salt to restrict intake to a desirable level.

Some cattle, especially calves (up to 5 percent or more of the herd), may not readily accept broiler litter. Separate these and adapt them slowly to litter by feeding more grain or adding molasses to the litter-grain mix. In some cases, animals may have to be sold or fed other feedstuffs. However, very few animals fail to adapt to litter-grain mixtures when given adequate time.

All litter should be tested for nutrient content before it is fed to cattle. Litter fed to beef cattle should have a minimum crude protein content (dry matter basis) as follows: dry brood cows, 13 percent; average milking cows and stockers (over 600 pounds), 15 percent; and superior milking cows, first-calf heifers and stockers (400 to 600 pounds), 18 percent.

The nutrient content of broiler litter can be determined by submitting a litter sample for an analysis through your local Cooperative Extension Service.

Hardware Precaution

Cattle producers who intend to utilize litter as a feedstuff should use precaution to avoid hardware disease. Mechanical and structural repairs can result in pieces of wire, cable or nails being dropped and lost in litter. A magnet installed in mixing equipment can help capture metals; however, copper wire or glass from broken light bulbs will not be collected by magnets.

Conclusion

Broiler litter has been used as a cattle feed ingredient for more than 40 years without any harmful effects. The purpose of this publication is neither to promote nor to condemn the feeding of litter, but rather to provide information on using litter as a feed ingredient.

Due to the unique ability of ruminant animals to digest forages, other fibrous materials and inorganic nitrogen such as urea, there is a growing awareness worldwide that by-products of agriculture and the food processing industry can serve as low-cost, alternative feed sources for these animals. Broiler litter as an alternative feedstuff may become more widespread as the need for economy in agriculture and for responsible waste management becomes more urgent.

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