



Using Poultry Litter as a Forage Fertilizer: Management and Application Cost

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In Mississippi, poultry litter has been valuable as fertilizer on pastures and hayfields. The volatile cost of commercial fertilizer nutrients especially nitrogen (N) over the past year has encouraged the transportation and use of poultry litter (**Fig. 1**). Increased poultry litter use has created a decrease in availability, and at the same time increased prices. Poultry litter contains most plant nutrients including nitrogen, phosphorus and potassium, calcium, magnesium, sulfur, and some micronutrients. However, nutrient values of litter vary depending on type of bird, feed and moisture content, and the clean-out technique and schedule of individual operations (**Table 1**). Three considerations when applying poultry litter as a source of fertilizer includes: (1) cost; (2) pasture nutrient needs; and (3) potential runoff.

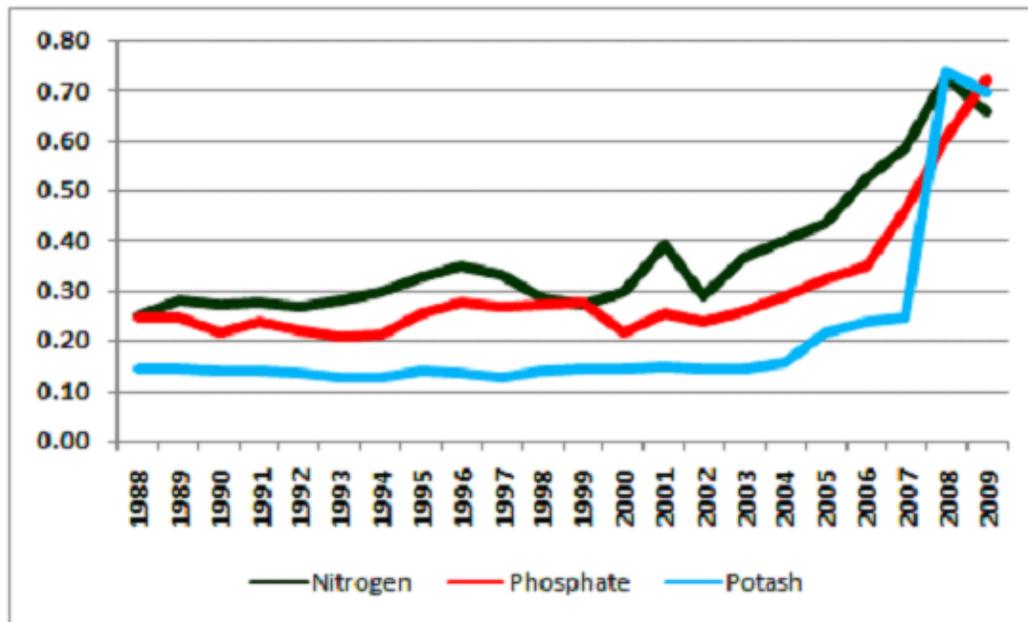


Figure 1. Historical changes on fertilizer prices (\$/lb) from 1988 to 2009.
Source: Oldham, R. 2009. Mississippi State University.

When making the decision you need to consider:

- 1) What nutrients (Nitrogen, Phosphorus, and Potassium) are needed based on soil test recommendations?
- 2) What is the nutrient content of the litter being considered for application?
- 3) What is the material cost plus spreading of commercial fertilizer that will meet soil needs?
- 4) What is the cost to have poultry litter delivered and spread to meet crop nutrient needs?

Nutrient Content

Price of nutrients should be determined based on the nutrient analysis of the poultry litter and the necessary amount of nutrients to be applied based on soil test recommendations. Soil sampling each



field will be essential to the analysis. If several fields could be fertilized using poultry litter, sampling each field accounts for variability in the soil nutrients needed and could save money. This will give the producer a spatial fertilizer application instead of a uniform rate across the whole fields. A grower purchasing poultry litter should always request a poultry litter analysis to get an assurance of its nutrient content. In Mississippi when poultry litter is not tested, a good rule of thumb is to assume that the poultry litter is 80% dry matter and containing 3.56% N, 1.81% P₂O₅, and 3.69% K₂O. The fertilizer grade is 3-2-3 (57-29-59 pounds of N-P₂O₅-K₂O per ton). The nutrients in poultry litter are in both mineral and organic forms. This means a proportion of the nitrogen, phosphorus and potassium is immediately available to plants while the remainder (organic) must react in the soil to change into a form which is available for plant use. However, nutrient availability of litter can vary 30 to 50% depending on the type of application method. If the poultry litter is incorporated, assume that 70% of the N is available and 50% is available if poultry litter is broadcast.

Table 1. Average nutrient content of different types of poultry litter.

Nutrients	Broiler Type		
	Litter	Stockpiled	Cake
	----- lb/ac -----		
Macro-			
<i>Primary</i>			
Nitrogen (N)	63	55	47
Phosphate (P ₂ O ₅)	55	57	59
Potash (K ₂ O)	47	47	46
<i>Secondary</i>			
Calcium (Ca)	43	36	54
Magnesium (Mg)	9	10	81
Sulfur (S)	15	12	91
	----- ppm ¹ -----		
Micro-			
Manganese (Mn)	334	362	340
Copper (Cu)	319	313	366
Zinc (Zn)	265	286	22

¹ppm = parts per million.

Source: Gaskin et al., 2007. Univ. of Georgia.; Chamblee and Todd, 2002. Mississippi State Univ.

The Price of Nutrients

Unless the litter is tested, assume about 57 pounds of N per is present in the poultry litter. The litter will be broadcast, meaning that only 50% of those 57 lbs will be available. That means that out of the 57 lbs of N in the poultry litter, only 28.5 lbs of the N is available the growing season of application. Assuming N prices for ammonium nitrate at \$0.57 per pound (\$385 per ton), then a ton of poultry is worth \$32 per ton just for the N. Transportation costs vary with vendor, but expect to pay around \$2 per mile for a 20-ton truckload. Today poultry litter costs between \$50 and \$60 per ton. To illustrate this point, let's use the following scenario. A producer can buy poultry litter for \$50 a ton. No poultry analysis is provided (assume 57 lbs N per ton of poultry litter) and it will be spread (50% available to plants = 28.5 lbs N). The producer has 20 acres of hay production and it calls for 200 lbs/ac of nitrogen, 40 lbs/ac of phosphate, and 60 lbs/ac of potash to soil test recommendations. Poultry litter will be applied based on N recommendations. This will require 84 tons of poultry litter to satisfy the N requirement (4.2 tons per acre). The cost per acre is \$257.10. The total cost for 20 acres will be \$4214.

On the other hand, if ammonium nitrate (34-0-0) is used, the total amount needed will be meet the N requirement will be 352 lbs of ammonium nitrate per acre. The cost per acre will be 67.94. The total cost



will be \$1358.82. The difference between ammonium nitrate and poultry litter is very large. That means that the price has almost tripled making the utilization of poultry litter not economically feasible in forage production. For a producer to obtain the price of commercial fertilizer, poultry litter price has to be \$16 per ton.

Soil pH Effects

Poultry Litter could increase pH because of the amounts of calcium found in poultry feed. The type of poultry manure determines their effect on soil pH because poultry feed contains varying amounts of calcium carbonate. All poultry rations contain some ground limestone. Broiler feed may contain less than 1% ground limestone whereas layer and breeder rations may contain 7 to 10% ground limestone.

Poultry Litter Applications

One of the disadvantages of poultry litter is that large quantities have to be applied in hay and pasture production to meet the species need (**Table 2**). Excessive nitrogen should not be applied to pastures. It may leach into groundwater or wash into surface waters. Excessively high nitrogen levels in pasture may also cause livestock health issues due to nitrate accumulation in pastures or hay. Although most of the P in the litter is available, approximately 13% (range 6%–30%) of the phosphorus in poultry litter is in a water-soluble form, which means that it is immediately available for plant use. Using large quantities of poultry litter could also create a P loading issue if the soil test does not call for P applications. There is a disconnection between the nutrient ratio in the litter versus the nutrient ratio in forage uptake, especially for P. In Mississippi, recommendations for litter use are based on the N requirements which results in an over application of P (**Table 2**). As a general rule, assume that about 90% of the P and K will be available the first year and the remainder will become available the following year.

Spreading litter onto a recently grazed or harvested pasture with 3-5 inches of stubble will help to hold the litter in place and reduce runoff. To further protect waterways, maintain a vegetated buffer 30 to 90 ft wide around all boundaries and next to any water sources. The width of the buffer will depend on slope, groundcover and sensitivity of the waterway to pollution.

Poultry litter can be used to fertilize all types of pasture and can be applied at any time of the year, but, like all fertilizers, it is best to apply near the time of crop uptake. This means in the spring for summer pastures and in the early fall for winter pastures. The best results are obtained from mixed pastures comprising grasses and legumes. In general, forage yields with poultry litter are comparable to those with commercial fertilizer, assuming the poultry litter is applied at an equivalent nitrogen rate (**Table 2**). Producers should use nutrient management planning and recommended rates to ensure poultry litter is used in ways that maximize its benefits without harming the environment and creating possible P loading issues. There are many benefits when poultry litter it is used wisely.

The final question is poultry litter right for your farm operation?

That will depend on the price and your individual soil test results. If your soil is high in P and K, poultry litter will probably not be economical since you do not need those nutrients and they make up a large portion of the product (**Table 1 and 2**). If your soil is low or medium in these nutrients, it may be economical to use poultry litter if it is economically feasible. Most of the cost of poultry litter is in transportation and application. The closer you are to the source, the cheaper the product should be.



Table 2. Common poultry litter applications rates for different forages to meet nitrogen fertilizer requirements.

Forage	Utilization	Target N (lbs/ac)	Poultry Litter (tons/ac) ¹	Comments
Warm-season				
<i>Hybrid bermudagrass</i>	Pasture	100-150	4.2 – 5.3 (126 – 159) ²	Application should be split with half applied in early spring and other half in midsummer.
	Hay	200 - 350	7.0 – 12.2 (210 – 366)	Higher application rates will cause excess phosphorus accumulation in the soil.
<i>Bahiagrass, Common Bermuda, or Dallisgrass</i>	Pasture	75 - 120	2.6 – 4.2 (78 – 126)	Depending on grazing management application may be split between early spring and summer.
Cool-season				
<i>Fescue/Clover Mix (30 – 40% clover)</i>	Pasture	50	1.8 (54)	Low N rates will benefit N fixation, P and K utilization.
<i>Annual ryegrass, Small grains (wheat, oats, rye)</i>	Pasture	60 - 100	2.1 – 4.2 (63 – 126)	The higher rate should be split between fall and late winter.

¹Based on average nitrogen content of 57 lbs/ton and only 50% available (28.5 lbs per ton).

²Pounds of P₂O₅ applied.

Source: Gaskin et al., 2007. Univ. of Georgia.