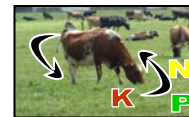


# Alternative Fertilizer: Poultry Litter



Recent rising price of inorganic fertilizers and increasing demand for organic agricultural products are raising interests about the use of poultry litter as an alternative fertilizer. Poultry litter is a convenient source of nutrients and organic matter because of its relatively higher content of nitrogen and phosphorus and usually high dry matter content, which translates into lower transportation and application costs compared to other manures. Spreading poultry litter onto croplands is often a way to provide nutrients required for crops and pasture production. However, as for any fertilizer, application rates should be calculated based on crop demands and soils test results. Here are a few aspects to consider before purchase and application of poultry litter.

## 1. Nutrient Value:

**Large Variations in Quality:** Variations of nutrient concentrations in poultry litter reflect the nature of manure based fertilizers. Poultry litter is a mixture of manure, feed, feathers, and bedding materials used in poultry farms. It is a mixture of waste after several batches of bird are raised. The different types of bedding materials and management practices can result in large variations in nutrient composition. Poultry litter can be found commercially as fresh, pelletized, or composted. Those forms can also affect nutrient composition and availability. Pelletized and composted tend to contain less nitrogen than fresh poultry litter. Table 1 shows ranges in macronutrient contents of poultry litter.

**Composition of Macronutrients:** In addition to major macronutrients (nitrogen, phosphorus and potassium), other macronutrients in poultry litter, such as calcium, potassium, and sulfur, as well as micronutrients including copper, iron, manganese, zinc, and boron may adequately support plant growth. A concern regarding poultry litter application is the balance of macro nutrients. Usually, the amount of phosphorus uptake by grasses is only one tenth of the amount of nitrogen (10:1), while the ratio of N to P (as total phosphorus not phosphate) in poultry litter is only 1.5:1. Therefore, long-term poultry application may cause P build-up in soil and increase the risk of environmental problems.

**Table 1. Typical ranges of poultry litter nutrient composition.<sup>1</sup>**

| Broiler litter                               | Dry Matter       | Total Nitrogen<br>(N) | Ammonia N<br>(NH <sub>3</sub> -N) | Phosphate<br>(P <sub>2</sub> O <sub>5</sub> ) | Potash<br>(K <sub>2</sub> O) |
|--|------------------|-----------------------|-----------------------------------|---|------------------------------|
|  | ----- % -----    | ----- lbs/Ton -----   |                                   |   |                              |
| Missouri <sup>2</sup>                        | ---              | 45 to 75              | 8 to 20                           | 50 to 80                                      | 35 to 75                     |
| SE Station Forage<br>Laboratory <sup>3</sup> | 79<br>(41 to 96) | 58<br>(17 to 78)      | ---                               | 87<br>(49 to 111)                             | 58<br>(12 to 93)             |

<sup>1</sup> The wide ranges of nutrient contents shown in Table 1 indicate the potential for variation in fertilizer quality among batches of poultry litters. Adequate sampling technique and reliable nutrient analysis of litter and soils should be performed before spreading on the land.

<sup>2</sup> Modified from <http://muextension.missouri.edu/xplor/agguides/soils/g09340.htm>.

<sup>3</sup> Average and range of nutrient contents of 173 poultry litter samples analyzed in the Southeast Research Station Forage Quality Laboratory between 1999 and 2007.

**Effects on Soil Physical and Chemical Characteristics:** Poultry litter is a good source of organic matter which contributes to increase productivity of soils by improving soil structure and timely release of nutrients. Organic matter in litter enhances cation exchange capacity and water holding capacity (drought resistance), and reduces soil erosion. Calcium in poultry litter also helps neutralize acidity of soils.

## **2. Application Management:**

Applying litter at the right time is fundamental to maximize the fertilizer value in poultry litter. Application timing should correspond to or immediately before the growing seasons, when crops and pastures require most nutrients. Applying manures, just as well as inorganic fertilizers, when crops are not actively growing is a waste of resources (poultry litter, labor, time, fuels, and machineries) and may result in surface and ground water contamination.

Nutrient release from soils amended with poultry litter can be unreliable. Ammonia-nitrogen ( $\text{NH}_3\text{-N}$ ) is immediately available for plant uptake and part of the organically bound nitrogen in poultry litter will become available through mineralization during the first year. Research has shown nitrogen availability to range from 30 to 80%, but usually one can assume that 50 to 60% of the nitrogen in poultry litter can be available for crop growth during the application year. Ammonia-nitrogen plays a major role in the proportion of nitrogen availability for crop production and soil microorganism activity, but it can also be easily lost by volatilization. Up to 100% of the manure ammonia-N can be lost by volatilization if management practices are inappropriate. It is important to avoid poultry litter application under several conditions to prevent excessive nutrient losses. **AVOID** spreading litter immediately prior to significant rain events, after liming (high soil pH), or during periods of drought (low soil moisture) and high temperature. Phosphate and potash in poultry litter are usually presumed to be 90% available in the application year. Manure incorporation into the soil within hours of the application sharply reduces volatilization and runoff losses, and increase nutrient availability.

## **3. Environment:**

**Excessive Nutrients and Pathogens:** Nutrients can be harmful to health and the environment when applied in excess. Excessive rates of nitrogen fertilization (regardless of fertilizer source) can increase nitrate content in plants and may lead to animal mortality. Moreover, high soil nitrates can leach into groundwater causing contamination. Excess phosphorus left in soils or phosphorus rich soils may contribute to phosphorus runoff into surface freshwaters promoting harmful algae blooms. Pastures rich in potassium can increase the risk of milk fever in cows approaching calving period (transition cows). Poultry litter, as well as other manures, can be a source of pathogens. Proper litter application management should minimize the risk of contamination.

**Potential Arsenic Problem:** Many organic as well as conventional crop producers consistently rely on poultry litter as major fertilizer resource. Years of poultry litter application can cause arsenic to build up in the soil. Arsenic-based products are used as feed additives in commercial broiler operations to control parasites and increase weight gain, but most is excreted in waste. Unlike other plant nutrients, heavy metals such as arsenic may not be taken up in large amounts by the crops and can reach high soil concentrations. Land application of poultry litter needs to be conducted considering soil effect. Loamy or clay soils, with neutral or semi-acid pH, not subject to frequent water logging are relatively non-toxic because arsenic is relatively stable in the soil. In contrast, arsenic toxicity increases when soils are wet, alkaline, or have a sandy texture. Under those conditions, there will be high potential for contamination of ground or surface water through leaching and runoff. Plant uptake of arsenic becomes excessive in sandy soils with low to moderate levels of organic matter and excessive amounts of phosphorus or nitrate.

## 4. Final Recommendations:

Here are a few suggestions to help you realize the most benefits from poultry litter fertilizer:

- Soils should be analyzed and application needs to follow precise recommendations made for the specific crop intended for a field. Consider nutrient release from the previous year litter or manure application. Consult a qualified agronomist.
- Collect samples that represent the litter to be used. Laboratory analyses only reflect composition of the received samples. Samples should be adequately collected, stored, sealed, and sent to the laboratory without delay. Remember that volatilization will be slowed in an air-tight, refrigerated container, but not stopped. Time is of essence.
- Choose a reliable laboratory that can provide fast litter analysis. Request test for at least dry matter and major macronutrients (nitrogen, ammonia, phosphate and potash). Remember that analysis reports represent total nutrients. They often do not include nutrient availabilities.
- Poultry litter should be brought in the operation and spread onto fields shortly before planting. If time and equipments allow, consider a prompt incorporation of poultry litter into the soil to minimize nutrient losses by volatilization or runoff. Storing poultry litter can lead to nutrient losses, especially if stored litter is unsealed and exposed to hot or rainy weather conditions. On the other hand, stacking litter may reduce weed seed viability.
- Spreader calibration is always important. Avoid spreading manures near surface waters or near rain events. Establish buffer (riparian) zones to absorb unwanted run-off from fields to surface waters.
- Make sure to take costs of transportation and spreading into consideration, when evaluating cost/benefit in comparison to inorganic fertilizers. Though expensive, inorganic fertilizers may be more economical under certain circumstances. Evaluate your options carefully.

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### For more information visit:

- **LSU AgCenter:**  
<http://www.lsuagcenter.com/>
- **LSU AgCenter Southeast Research Station:**  
[http://www.lsuagcenter.com/en/our\\_offices/research\\_stations/Southeast/](http://www.lsuagcenter.com/en/our_offices/research_stations/Southeast/)
- **University of Missouri Extension:**  
<http://muextension.missouri.edu/xplor/agguides/soils/g09340.htm>
- **University of Minnesota Poultry:**  
<http://www.ansci.umn.edu/poultry/resources/manure.htm>
- **Alabama Cooperative Extension System:**  
<http://hubcap.clemson.edu/~blpprt/Aub+244.html>
- **Alabama Cooperative Extension System:**  
<http://hubcap.clemson.edu/~blpprt/Aub+244.html>
- **The National Organic Program. Program Standards:**  
[www.ams.usda.gov/nop/NOP/standards.html](http://www.ams.usda.gov/nop/NOP/standards.html)
- **ATTRA Publication: By Barbara C. Bellows:**  
[http://attra.ncat.org/attra-pub/arsenic\\_poultry\\_litter.html](http://attra.ncat.org/attra-pub/arsenic_poultry_litter.html)

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