Virginia Cooperative Extension
Virginia Tech • Virginia State University

Publication 418-142

Fertilizing Cool-Season Forages with Poultry Litter versus Commercial Fertilizer

Rory Maguire, Professor, School of Plant and Environmental Sciences, Virginia Tech
Benjamin Tracy, Associate Professor, School of Plant and Environmental Sciences, Virginia Tech
Steve McGrath, Graduate Student, School of Plant and Environmental Sciences, Virginia Tech
Bobby Clark, Senior Extension Agent, School of Plant and Environmental Sciences, Shenandoah County

Introduction

The Shenandoah Valley of Virginia and some other regions produce more manure nutrients than local crops need. This manure has traditionally been applied to row crops and overapplication has led to soil-test phosphorus (P) being well above agronomic optimum in many cases. In 2008, it was estimated that nutrient-management regulations now require that approximately 85 percent of poultry litter be applied off poultry farms, as they do not have sufficient land to beneficially recycle their manure nutrients. There is a substantial area of nutrient-deficient forage production in the Shenandoah Valley that could benefit from this poultry litter. This publication summarizes two years of field research on fertilizing nutrient-deficient forages with poultry or commercial fertilizer. It also evaluates split versus single annual applications of nutrients and addresses a common misconception that poultry litter contains weed seeds.

Treatments Evaluated

Cool-season grasses have maximum growth in the spring and fall; therefore, it is recommended to split nitrogen (N) fertilization between spring and fall to match forage needs. Spring applications of fertilizer should be around mid-April, while fall applications should occur around mid-August. Based on these recommendations, experiments were designed to evaluate split versus single annual application of litter or commercial fertilizer. "Split" application refers to applications split between spring and fall, while "single" refers to a single application of nutrients in the spring. Rates of application were based on applying sufficient N in poultry litter for optimum yield and then matching this with commercial fertilizer. The five treatments evaluated were:

1. Litter split (one-half the full rate of poultry litter applied in April before first cutting, and one-half applied in August for fall growth).
2. Commercial fertilizer split (one-half the full rate of fertilizer applied in April before first cutting, and one-half applied in August for fall growth).
3. Litter single (full rate applied in April).
4. Commercial fertilizer single (full rate applied in April).
5. Unfertilized control.

Treatments No. 1 through 4 received exactly the same rates of N, P, and potassium (K); the only differences were nutrient sources and timing of applications. The rates were 120 pounds of plant-available N per acre and 104 pounds of (P_2O_5) per acre; for the litter, this was 3 tons of litter per acre. The forages were predominantly fescue. Inorganic nutrient sources used to match N, P, and K litter rates were ammonium nitrate, triple superphosphate, and potash. The same treatments were applied to field plots for two consecutive years. The Rockbridge County site was a Frederick silt loam, and the Shenandoah County site was an Endcav silt loam.

Yields

Yields were higher for all of the fertilized treatments compared to the unfertilized control by an average of 51 percent (table 1). Yields were greater in 2008 than in

www.ext.vt.edu
Produced by Virginia Cooperative Extension, Virginia Tech, 2019

VT/0819/418-142

Table 1. Annual yield and two-year cumulative yield for the five treatments at both sites

Treatment	2007 yield	2008 yield	2-year total
	---------- Ton/acre ----------		
	Rockbridge County site		
Litter split	1.5 bc*	2.3 a	3.8 b
Fertilizer split	1.8 b	2.3 a	4.1 b
Litter single	1.9 b	2.2 a	4.1 ab
Fertilizer single	2.4 a	2.1 a	4.5 a
Unfertilized control	1.2 c	1.2 a	2.5 c
	Shenandoah County site		
Litter split	1.8 bc	3.4 b	5.1 b
Fertilizer split	2.2 a	4.1 a	6.3 a
Litter single	1.7 bc	3.7 ab	5.3 b
Fertilizer single	2.0 ab	3.3 b	5.3 b
Unfertilized control	1.5 c	2.5 c	4.0 c

**Yields within a column followed by different letters indicate significantly different yields*

2007 and greater in Shenandoah County than in Rockbridge County – mainly due to greater rainfall. The split application of fertilizer produced greater yields at the Shenandoah site but not at the Rockbridge site – again probably due to greater rainfall in Shenandoah County, especially in the fall. Split and single applications of litter produced similar yields, so there was no evidence that the extra effort involved with splitting litter applications was worthwhile. Forage quality was similar among all fertilized treatments.

Changes in Soil Fertility

The Mehlich 1 soil-test level for optimum forage production is 55 parts per million (ppm) P (high), and at the start of these tests the soils were well below this with an average of 8 ppm at both sites (medium minus soil-test level). Applying poultry litter to supply sufficient N, as we did here, resulted in an overapplication of P relative to crop uptake, due to an imbalance of N to P ratio in manures. The Mehlich 1 P in soils increased over two years to an average of 61 ppm at the Rockbridge site and 20 ppm at the Shenandoah site (excluding the unfertilized control). Increases in Mehlich 1 P were identical for litter and fertilizer. The different increases at the two sites were due to different soil properties and yield, but increased fertility should improve production in following years.

Soil pH was slightly acidic at both sites, as is typical for soils in this area. After two years, the pH of the litter plots was, on average, 0.2 higher than the commercial fertilizer plots because litter has a slight liming effect, while commercial fertilizer can cause soil acidification.

Does Using Litter Increase Weeds in Forages?

This was evaluated using two methods:

Botanical composition was monitored over two years in our field plots and showed a trend for lower weed occurrence for all fertilized treatments (litter and fertilizer plots) compared to the unfertilized control.

In a greenhouse, poultry litter (broiler and turkey litter) from nine different sources was added to potting soil to see if any weeds would germinate. Not a single weed germinated.

Conclusions

Yields were similar for poultry litter and commercial

fertilizer. The choice between using poultry litter and commercial fertilizer should be based on price of nutrients, their availability, and any machinery limitations as litter and fertilizer use different spreaders.

Yields were generally similar for split and single applications of nutrients, because yields following the fall applications were low. This was due primarily to lack of rainfall in the fall.

Poultry litter does not contain weed seeds, and using litter does not lead to more weeds in forages.

After two years, the pH of the soils was about 0.2 higher for the litter treatments than the commercial fertilizer treatments.

For more information on this study:

McGrath, S. R., R. O. Maguire, B. F. Tracy, and J. H. Fike. 2010. Improving soil nutrition with poultry litter application in low input forage systems. *Agronomy Journal* 102:48-54.