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Poultry litter Improves Forage Quality and Yield

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Expansion of the poultry industry in West Virginia during the 1990s led to increased use of poultry litter as a fertility amendment on state farms. A 1994 poultry producer survey showed that farmers used 82 percent of their litter as a fertilizer amendment on their hay and pastureland.

To improve poultry litter utilization and grazing management, the Extension Service established four demonstration plots in Grant, Pendleton, and Preston counties. The grazing plots consisted of four fertility treatments: **(1) high poultry litter** (4 tons per acre per year, with 2 tons applied in the spring and 2 tons in the fall); **(2) low poultry litter** (2 tons per acre per year, usually applied in the fall); **(3) commercial fertilizer and lime as required by soil test;** and **(4) lime only as required by soil test.** All plots were overseeded each spring with red clover to improve the botanical composition and reduce the need for purchased nitrogen. Forage quality and yield data were collected from these demonstration plots between 1996 and 1999.

Pastures were rotationally grazed when the pasture reached a height of 8 to 10 inches. Pasture yield was measured with a pasture plate (see photo) calibrated using clipped samples. In the spring, the pasture occasionally got ahead of us and was higher than we had planned.

The high poultry-litter treatment increased yield primarily because of its nitrogen content, compared to the commercial fertilizer programs based on proper lime and phosphorus applications and the use of legumes. However, this high-litter rate of 4 tons/acre/year is not environmentally sustainable because of the high phosphorus load it puts on the land. The 2 tons of litter/acre/year rate gave grazeable forage yields equal to the conventional fertilizer treatment of 2.3 tons forage dry matter/acre/year, compared to 3 tons for the high-litter treatment and 2 tons for the lime-only treatment. Under rotational grazing, the high-litter treatment provided one more grazing than the other treatments each year.

A summer intern measures pasture height with pasture plate.

Compared to conventional fertilizer treatments, both the high- and low-litter treatments increased the grass and reduced the legume content of the pastures.

The use of litter did not improve the distribution of forage production. In April and May, pasture production appeared to be limited mainly by soil and air temperatures. In June and July, the high-litter treatment produced the most growth. In July to October, the high-litter treatment also produced the most forage, but this depended on rainfall since soil moisture was the limiting factor for forage production response to soil fertility. In very dry conditions, the high-litter treatment produced the same as the other treatments.

Litter increased crude protein in forage because of higher soil nitrogen availability and quicker forage regrowth, resulting in younger forage at grazing based on the 8- to 10-inch pasture height at turn-in. This younger forage also resulted in lower fiber and higher total digestible nutrient content in the pasture. Since the high-litter treatment had younger forage at turn-in, it did have a lower nonstructural carbohydrate (sugar and starches) content than the conventional fertilizer treatment. The low-litter and conventional fertilizer treatments resulted in the highest nonstructural carbohydrate content. For legumes, both litter treatments resulted in reduced nonstructural carbohydrate content compared to the lime-only treatment.

Litter consistently gave forage higher in phosphorus and potassium than the conventional fertilizer treatments across both grasses and legumes. Compared to conventional fertilizer treatments, litter did reduce the content of calcium in legume forage. This may have been because the potassium uptake competed with calcium uptake in the legumes. Magnesium uptake by plants was not affected by fertilizer treatment. Plant sulfur content was highest when litter was applied.

With the exception of molybdenum, litter treatments did not affect the trace mineral content. The amount of trace minerals was affected by botanical composition, with grasses generally being lowest, legumes being moderate, and broadleaf weeds being highest in these nutrients. The level of copper was well below the maximum tolerable level for sheep. Litter treatments did increase the forage content of molybdenum.

Grassland farmers in West Virginia having soils testing low or medium in phosphorus can profitably use poultry litter as a soil amendment. Using poultry litter at the high rate (4 tons per acre per year) over a period of years is an unsustainable practice. The soils will accumulate excessive levels of phosphorus and nitrogen and risk losing these nutrients to the environment.

The low-litter rate (2 tons per acre per year) applied over several years is also unsustainable because of the excess accumulation of phosphorus in the surface layer of soils. It has the same risk of phosphorus loss to the environment.

Poultry litter should be applied until the soil test results show optimum phosphorus levels. At that point, the farmer's best option is to manage the hay or pasture for optimum legume content to ensure sufficient nitrogen for the sward's grass component. This reduces the amount of nitrogen fertilizer the farmer has to buy and improves the sustainability of the forage production system.