Forage News

MISSISSIPPI STATE UNIVERSITY EXTENSION
Center for Forage Management and Environmental Stewardship

Nutrient Cycling from Manure Can Improve Forage Production in Pastures

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The increase in fertilizer prices has producers looking for alternative ways that help them maintain forage production and grazing efficiency. Approximately, 80 to 90% of some nutrients such as phosphorus and potassium enter the pasture via manure deposition. However, improper grazing management can affect the nutrient distribution and cycling. The manure distribution can be affected by pasture topography, the placing of shade, water, and resting areas.

Pasture systems are complex cycles of nutrients. Most nutrients are cycled through soil microbes (earthworms, bacteria, and fungi), pasture plants, and livestock. The partitioning of nutrients can be affected by urine and manure. Nutrients such as phosphorus, magnesium, and calcium are mainly cycled back to the soil through manure deposition. On the other hand, urine contains nitrogen, potassium, and sodium. Nitrogen in the manure will be released more slowly and microbial activity breaks down the organic matter. Cattle manure is a dilute fertilizer due to its high content of water and organic materials. A 1,000-pound cow can produce approximately 22,000 lbs (11 tons) of wet manure (85% moisture) and 208 gallons of urine per year (Ball et al., 2015). This is equivalent to 154 pounds of nitrogen (N), 44 pounds of phosphorus (P), 99 pounds of potassium, 19 pounds of sulfur, 26 pounds of calcium, and 22 pounds of magnesium. On the other hand, cow urine contains approximately 95% water, 2.5% urea, and 2.5% minerals, salts, hormones, and enzymes. It also contains small traces of iron, calcium, phosphorus, salts, manganese, sulfur, phosphate, and potassium. The amount of N is 2.3 gallons of nitrogen per year in urine. Nutrient cycling from manure is equivalent to a yearly application of 337 pounds of urea, 165 pounds of potash, and 96 pounds of phosphate. The economic value is equivalent to $273.90 in fertilizer value.

Breaking manure piles during the high microbial activity will help to increase nutrient cycling and nutrient distribution while reducing phosphorous concentrations that could aid in weed germination and competition.

The manure nutrient cycle (food soil web) has many interconnected players and processes. This web includes fungi, bacteria, nematodes, and arthropods. Several bacterial species such as *Proteobacteria*, *Bacteroidota*, and *Firmicutes* has known to be beneficial to cattle manure decomposition and nutrient cycling. Microbes such as mycorrhizal fungi play a big part in supplying nutrients to plants. These fungi can mine nutrients and make them available to plant roots in exchange for nutrients (sugars) from the plant root. It is also important to maintain a healthy insect population such as dung beetles to help with manure degradation. Dung beetles play an important role in nutrient cycling by the removal and burial of manure from the soil surface in the form of food for their young insects through the dwelling, rolling, and tunneling. Dung beetles or other tunneling species are the most beneficial insects to pasture health by increasing percolation, introducing organic matter into the soil, and increasing nutrient cycling.

How many pastures do you have with grasses growing in manure piles and not touched by the livestock? Many of the nutrients consumed by livestock through grazing are returned to the soil through manure and urine. Grazing management affects the rate and timing of nutrient cycling. Nutrient cycling is faster on grazed than ungrazed pastures because most of the nutrients in manure have been converted from organic (plant material) to inorganic, plant-available forms during digestion. Short grazing rotations with high stocking density result in more uniform forage utilization and manure deposition. On the other hand, the trampling of forages might slow the cycling process since decomposition might require greater microbial activity. Forage growth on manure piles tends to be avoided by livestock creating a heterogenous forage distribution and decreasing forage utilization. It can take from six months to two years for manure piles to break down and release nutrients. Breaking pile manures can increase forage availability from 1,000 to 2,500 pounds per acre. Breaking up manure piles will distribute the nutrients (nitrogen, phosphorus, potassium) attached to the organic matter in the manure and make them available for plant growth. Dragging will also help incorporate these nutrients into the soil and prevent nutrient losses through runoff.

Cattle manure is a valuable source of key macronutrients including nitrogen (N), phosphorus (P), potassium (K), sulfur (S), magnesium (Mg), and calcium (Ca). An efficient and environmental use of livestock manure can be a valuable source of organic matter, nutrients, and carbon to pastures in the southern USA. It is important to keep in mind that using just manure as a nutrient management practice will require a good grazing management approach to increase the uniformity of distribution and sometimes the nutrient level might not match the nutrient requirement of the forage crop being grown. It is not possible to customize a fertility program based on manure applications since nutrient availability can vary during the growing season based on microbial activity, animal species, forage species, feed ratio, organic matter decomposition, and nutrient uptake and cycling. The availability of nutrients and efficiency of utilization of these nutrients by a forage crop is also influenced determined by soil type and climate conditions.

Upcoming Events

Cool-season Grazing Management Field Day—March 17, 2023 | Starkville, MS
Beef Cattle Field Day—March 30, 2023 | Newton, MS
Small Ruminant Workshop—April 4, 2023 | Ripley, MS

For upcoming forage related events visit: ***http://forages.pss.msstate.edu/events.html***