Addition of Legumes to Pasture Beneficial

"I want to put legumes in my pasture to fertilize my grass." How often do we hear that statement? The major reason legumes are planted into pastures is to provide nitrogen. But do inter-seeded legumes actually fertilize the associated grasses with nitrogen? The answer to this question is actually rather complex. In reality, nitrogen can be transferred from a legume to an associated grass in a number of ways.

The first method is root-to-root transfer via mycorrhizal fungi. In this method, there is often assumed to be a much higher amount of nitrogen transfer than actually occurs. Ordinarily, the amounts of nitrogen transferred in this method are quite small, only a few pounds of per acre.

Tall Fescue plant among nitrogen-fixing alfalfa plants

The second method is through the decay of legume residue after leaf dropping or trampling of unharvested foliage. The amount transferred can vary considerably depending on how much foliage is left unharvested. Grazing can leave considerable unharvested foliage (as much as 70%) that is returned to the soil surface. This becomes available to associated grass plants only after decay and mineralization of the residue, typically occurring the following growing season. Harvesting for hay results in less residue return than grazing, resulting mostly from shattered leaves during the haymaking process. Harvesting for haylage or silage leaves very little residue to mineralize.

The third method is through the return of urine during grazing. Any protein above animal requirements is metabolized into nitrogenous compounds in the urine; therefore high protein pastures (such as one with a high legume content) result in higher levels of nitrogen in the urine. The compounds in urine become converted quite rapidly into plant-available forms. There is a risk of volatilization of ammonia from urine, especially on high pH soils, depending on how well the urine penetrates into the soil. Soil tests from urine spots have indicated that the areas affected by the urine are fertilized with as much as 200 pounds of nitrogen per acre. The main problem is that urine is not deposited uniformly across the pasture.

The fourth method is through fecal deposits while grazing. Most of the nitrogen compounds in feces are slowly available over time, and the readily available compounds are subject to volatilization. How well manure contributes to pasture fertility depends much on soil biology. Where dung beetles and earthworms are active, a manure pat may be rapidly buried underground so that volatilization is minimized, and the area affected by the pat is increased, especially with an active population of tumblebugs that roll manure away from the pat. Distribution of fertility from manure is even worse than with urine. Livestock often defecate when arising from resting; thus manure is concentrated around loafing areas near shade and water. One research project indicated that on bermudagrass stocked at one cow-calf pair per acre, only 16% of the pasture was affected by manure fertility. Harrowing to spread manure more uniformly across a pasture has been tried but increases problems with internal parasites and manure-fouled forage that animals tend to reject.

Finally, the legumes present in a pasture do not require fertilizer nitrogen, thus the higher percentage of the pasture that is composed of legumes, the lower the nitrogen fertilizer requirement of the pasture.

As a matter of practicality, perhaps the question should not be whether or not legumes "fertilize" the pasture. Rather, the question should be: "Do legume-grass pastures need to be fertilized with nitrogen?" Research indicates that pastures with more than 50% legumes do not respond well to fertilizer nitrogen, as added nitrogen reduces the amount of nitrogen fixed by the legumes. Small amounts of nitrogen (30 pounds per acre or less) may be used to stimulate earlier green-up of cool-season grasses in a legume mixture, and to improve fall growth of cool-season grasses. Warm-season grasses that have had winter annual legumes inter-seeded will also respond to additional nitrogen if it is applied after growth of the legume has ceased in the spring.

In conclusion, it appears that legumes may be used with great benefit to reduce nitrogen requirements of grazed pastures, due to recycling of nitrogen from manure, urine, and trampled residue. Areas that are mechanically harvested will not have as much nitrogen cycling, and should preferably be composed of nitrogen fertilized grasses or pure legumes. However, a grass-legume mixture may still have advantages of weed suppression, erosion control, stand longevity, and more rapid hay drying over that of a pure stand of legumes.

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