Grazing Effects On Nutrient Distribution In Pastures

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Livestock grazing is scrutinized for its contribution to nutrient loading of water bodies. However, livestock do not create nutrients, they merely consume nutrients that are already in the biological pools and return most of them to the soil. In a pasture situation, livestock can actually export nutrients (Shewmaker 1997 and 1999) if they gain body weight during grazing and they or their products, e.g. milk are removed. Livestock excretal patterns are influenced by water, stocking rates, shade, topography, and social behavior. Improvements in grazing management can reduce potential nutrient loading by improving plant vigor, resulting in less erosion and runoff, and produce better dung and urine nutrient distribution patterns. An understanding of the magnitudes and flows of nutrients within the soil, plant, animal, and microbial pools is essential for land managers to limit nutrient loading in surface water.

In a system without herbivores, nutrients cycle from soil to soil water, to plants, to vegetative litter, and back to soil. Erosion of soil or leaching through the ground water transports nutrients to streams and reservoirs. When herbivores are added to the ecosystem, nutrients may be found in more chemical and organic forms with varying solubility.' Urine and feces return unabsorbed or unretained nutrients to the soil surface to continue cycling. Also, soluble nutrients from plant leachate can move in overland flow into streams and reservoirs.

Much of the nutrients cycled through animals returns to soil as dung pats bur patterns of dung and urine deposition are not uniform. Such patterns may be more distinct with sheep where from 1 to 2 kg P/ha annually may be transported to ridges where sheep camp at night (Haynes & Williams 1993). Theoretically a BMP of high-intensity and short-duration grazing should provide more uniform dung and urine distribution. However, in a Florida study, soil P redistribution was not different among short-duration, long-duration, and continuous grazing systems on Bermuda grass, bur accumulated in the third of the pastures closest to shade and water, probably a result of urine and feces deposition by cattle (Mathews et al. 1993).

Pasture areas near shade and water sources receive the greatest inputs of feces and urine which result in greater nutrient accumulation. Soil organic C and N were greater in the area from 1 to 10m from shade and water. Particulate organic C and N were greater in the zone from 1 to 30 m from shade and water sources (Franzluebbers et al., 1999). Increases in pH below dung patches can decrease P adsorption and result in movement of P to greater depths in soils with low buffering capacity (During and Weeda, 1973; Weeda, 1967).
Grazing animals retain small quantities of K and since plants can take up luxuriant quantities of K, the net effect of grazing is to concentrate K into areas where livestock spend more time. Mineral contents for the soil profile were about 5.0 times greater for K, 2.4 times greater for P, and 1.1 times greater for Mg at 1 m from shade and water sources, compared with the remaining areas of the pasture (Schomberg et al., 2000). They concluded that animal effects were limited to the areas within 10 m of shade and water.

Concentrations of F and K within 10 m of water sources have been reported to be 5 times greater than other areas of pasture after 4 or 5 grazing seasons (West et al., 1989; Gerrish et al., 1993) and the zone of influence may extend 30 to 45 m when grazing activity is managed in a similar pattern for more than 20 yr (Gerrish et al., 1993). Soil properties, clay types, organic matter content, climate, and animal behavior all affect nutrient accumulation.

Recommendations-Off-stream water development has been shown to reduce by 90% the time cattle spent in a stream (Sheffield et al., 1997). Movement of portable shade and water will improve nutrient distribution within a pasture. Rotational grazing can provide for more vigorous plant growth, which results in more nutrient uptake, minimizes soil erosion, and reduces runoff potential. The use of best management practices such as rotational grazing, buffer strips next to wetlands, and proper irrigation management should reduce overland flow and streambank erosion.

Abreviations: C, carbon; P, phosphorus; N, nitrogen; K, potassium; Mg, magnesium

References Cited


