

## **Well-Timed Grazing Can Stimulate Grass Growth and Tiller Development**

Llewellyn L. Manske PhD, Range Scientist  
Amy M. Kraus, Composition Assistant  
Thomas C. Jirik, Agriculture Communication Editor  
North Dakota State University  
Dickinson Research Extension Center

Coordinating grazing periods with appropriate grass growth stages can enhance plant growth and reproduction by tillering, says a North Dakota State University range scientist.

"Carefully timed grazing can stimulate beneficial activity of soil organisms and vegetative reproduction of grasses," explains Lee Manske, range scientist at NDSU's Dickinson Research Extension Center. "Stimulation of these biological responses can improve the health of grassland ecosystems and increase herbage production."

Grass plants evolved 20 million years ago with early herbivores that are now extinct. During this time, grasses developed biological processes that help the plants withstand and recover from defoliation, Manske explains. This complex of processes, called defoliation resistance mechanisms, accelerates both the growth rate of the grazed plant and its development of foliage and roots. Two biological processes of primary concern to grassland managers are the increased beneficial activity of soil organisms and the stimulation of vegetative reproduction by secondary tiller development from axillary buds.

Plant response to defoliation depends on the amount of material removed and the growth stage of the plant, Manske emphasizes. Removing too much leaf area or grazing too early or too late in the seasonal development of the plant diminishes the plant's ability to recover. Grazing that removes a small amount of leaf area from the grass plant between the third-leaf stage and flowering stage can trigger the beneficial responses.

There is a mutually beneficial relationship between the grass plant's root system and soil organisms, Manske explains. Properly timed grazing can enhance that relationship.

The narrow zone of soil around the roots of perennial grassland plants, the rhizosphere, contains bacteria, protozoa, nematodes, mites, springtails, and mycorrhizal fungi. The grass plant's roots release carbon compounds, including sugars, to these organisms, and the organisms release mineral nitrogen that the plant's roots absorb. The mycorrhizal fungi also provide phosphorus, other mineral nutrients, and water that the plant needs for growth. Activity of the soil microorganisms increases with the availability of carbon compounds in the rhizosphere, and the elevated microorganism activity results in an increase in nitrogen available to the grass plant.

Grazing lead tillers between the third-leaf stage and the flowering stage can increase the amount of carbon compounds the defoliated plant releases into the rhizosphere, Manske explains. The increase in nitrogen produced by elevated rates of microorganism activity allows the plant to accelerate growth and recover more quickly from defoliation. This beneficial activity does not seem to occur when grazing is conducted during the middle and late growth stages of the grass plant.

Grazing that removes a small amount of young tissue from the aboveground portion of lead tillers after the three-leaf stage and before the flowering stage reduces the amount of the hormone that tissue produces to control the growth of axillary buds on the plant crown. With that growth-controlling hormone reduced, vegetative reproduction is stimulated and secondary tillers develop from the previous year's axillary buds.

If no defoliation occurs, the lead tiller inhibits tiller development through a process called lead tiller dominance until inhibitory hormone production declines around the flowering stage. Usually only one secondary tiller develops from the potential six to eight axillary buds because this secondary tiller asserts dominance by producing inhibitory hormones.

All grass species in the Northern Plains have strong lead tiller dominance except Kentucky bluegrass and meadow bromegrass, which have low levels of inhibitory hormones and relatively higher levels of tiller development. Plants with these growth characteristics have greater demands for water than do grasses with strong lead tillers, which produce one set of lead tillers and one set of secondary tillers. Lead tillers of cool-season grasses begin growth during fall, overwinter, and resume growth the following spring. Proper grazing management can increase the number of secondary tillers that develop, but the growing season length does not permit the development of a third set of tillers, Manske states.

The number of sets of tillers determines the number of times each pasture in a rotation system can be grazed, Manske explains. Two sets of tillers permit two rotation grazing periods. Rotation systems that graze each pasture more than two times are not coordinated with grass plant growth and do not meet grass plants' biological requirements. Rotating cattle in an arbitrary sequence that is not coordinated with grass plant developmental stages and that does not meet the biological requirements of grassland plants does not produce satisfactory results, Manske stresses.

Compared to six-month seasonlong grazing systems, rotation strategies coordinated with plant growth requirements show 23 percent greater calf average daily gain and 148 percent greater calf gain per acre. Net return per cow-calf pair over pasture costs is increased by 630 percent and net return per acre over pasture costs is increased by 1872 percent.

Compared to grazing strategies with arbitrary rotation periods, rotation strategies coordinated with plant growth requirements show 4 percent greater calf average daily gain and 11 percent greater calf gain per acre. Net return per cow-calf pair over pasture costs is increased by 11 percent and net return per acre over pasture costs is increased by 19 percent.

Manske emphasizes that grassland managers can increase beneficial activity of soil organisms in the rhizosphere and activate secondary tiller development from axillary buds by implementing grazing management strategies that start after the third-leaf stage, have two grazing periods in each of three to six pastures, and coordinate grazing periods with grass growth stages.