Range Management Practices Addressing Problems Inherent in the Northern Plains Grasslands

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Range management practices that are biologically effective address the inherent problems and conditions of the geographic region in which the practices are implemented. In the Northern Plains grassland ecosystems, the vegetation is characterized by three major features that have implications for animal production: 1) plant growth is limited by several environmental factors, 2) ungrazed grasses are low in nutritional quality during the latter portion of the grazing season, and 3) plants grazed too early in the growing season or late in the growing season suffer negative effects. The twice-over rotation grazing system on native rangeland with complementary domesticated grass spring and fall pastures was developed with consideration of these features and has been successfully implementated on the Northern Plains.

In this region, the most important of the environmental factors limiting plant growth (Manske 1998) are moderate annual precipitation, limited distribution of precipitation during part of the growing season, cool temperatures in the spring and fall, and hot temperatures in summer. The seasonal precipitation pattern is characterized by a period of maximum precipitation in late spring and early summer, tapering off to a moderately light amount during fall and winter. Periods with precipitation levels sufficiently low to place plants under water stress and limit growth occur frequently. Herbage production within grassland communities is also limited by temperature. The frost-free period is usually short, from 120 to 130 days. Perennial grassland plants can sustain growth for longer than the frost-free period, but they require temperatures above the level that freezes water in plant tissue and soil. Plant growth is greatly limited by low air temperatures during the early and late portions of the growing season and by high temperatures, high evaporation, drying winds, and low precipitation during mid summer.

The growing season for perennial grasses covers about six months, from mid April to mid October. However, because favorable precipitation and temperature conditions occur during May, June, and July (Manske 1998), most plant growth in height is attained within this three-month period (Goetz 1963). Peak aboveground herbage biomass is usually reached during the last ten days of July. Herbage biomass of ungrazed plants increases in weight during May, June, and July; after the end of July the weight of the herbage biomass decreases because the rate of senescence (aging) of the grass leaves exceeds growth and the cell material in aboveground structures is being translocated to the belowground structures. This translocation causes a decrease in the nutritional quality of the aboveground structures. Ungrazed plants of the major upland sedges, cool-season grasses, and warm-season grasses drop below the 9.6% crude protein level around mid July (Whitman et al. 1951), as they attain maximum growth in height and weight.

The nutritional quality of the native vegetation during the latter portion of the grazing season is a limiting factor in animal performance. A 1000-pound lactating cow requires a crude protein level of at least 9.6% (NRC 1996). Most ruminant animals require a daily dry matter intake of about 2% (1.5-3.0%) of their body weight (Holechek et al. 1989). Cows may be able to compensate for lower-quality forage for a short time by increasing intake and/or selecting plant parts higher in nutritional quality than average plant parts. However, cows on seasonlong and deferred grazing systems lose weight from early or mid August to the end of the grazing season (Manske et al. 1988). The loss of weight does not hurt the animals but does cause decreased milk production (Landblom 1989) and a subsequent reduction in the daily gain of calves (Manske 1996).

The negative effects suffered by plants on a seasonlong system with grazing begun too early include great reductions in herbage biomass production, which cause reductions in stocking rates and animal production per acre. Data from three studies indicate that if seasonlong grazing is started in mid May on native rangeland, 45-60% of the potential peak herbage biomass will be lost and never be available for grazing livestock. If the starting date of seasonlong grazing is deferred until early or mid July, nearly all of the potential peak herbage biomass will grow and be available to the grazing livestock, but the nutritional quality of the available forage will be at or below the crude protein levels required by a lactating cow. If the starting date is deferred until after mid July, less than peak herbage biomass will be available to grazing livestock because of senescence and the translocation of cell material to belowground parts (Campbell 1952, Rogler et al. 1962, Manske 1994a), and the crude protein levels of the available forage will be insufficient to meet the nutritional requirements of a lactating cow.

The phenological growth stage of the grass plants is the best indicator of appropriate grazing starting dates. Grazing plants before the third new leaf stage causes negative effects in grass growth, while starting grazing after the third new leaf stage stimulates tiller production, a process that leads to increased aboveground herbage biomass and increased nutritional quality of available herbage. Most native cool-season grasses reach the third new leaf stage around early June, and most native warm-season grasses reach the third new leaf stage around mid June. This phenological development indicates that within each management system, starting grazing on each pasture sometime between early June and early July would produce the fewest negative effects on herbage biomass production and nutritional quality of the available forage. Seasonlong grazing management systems on native rangeland should wait until mid June to begin grazing, but rotation grazing systems could start in early June.

Continuation of grazing late in the season can also produce detrimental effects on plants. Severe defoliation of grass plants during fall and winter reduces herbage production of the grasslands the following growing season. Late-stimulated tillers remain viable over winter and continue growth the following growing season. Cool-season species initiate tillers the previous fall and continue growth the following season. Defoliation of late-stimulated tillers and cool-season tillers during fall and winter reduces their contribution to the ecosystem the following season.

The twice-over rotation system on native rangeland with complementary domesticated grass spring and fall pastures times grazing to maximize vegetation and animal performance. A spring pasture of crested wheatgrass is grazed during May. The twice-over rotation grazing management system uses three to six native rangeland pastures. Each of the pastures in the rotation is partially defoliated by grazing for 7 to 17 days during the first period, the 45-day interval from 1 June to 15 July when grasses are between the third new leaf stage and flowering (anthesis) stage. The length in number of days of the first grazing period on each pasture is the same percentage of 45 days as the percentage of the total season's grazable forage each pasture contributes to the complete system. During the second grazing period when lead tillers are maturing and defoliation by grazing is only moderately beneficial, after mid July and before mid October, each pasture is grazed for double the number of days it was grazed during the first period. A fall pasture of Altai wildrye is grazed by cows and calves from mid October until weaning in mid November.

The twice-over rotation system with complementary domesticated grass pastures has a grazing season of over 6.5 months, with the available forage above, at, or only slightly below the requirements for a lactating cow for nearly the entire grazing season. It requires fewer than 12 acres per cow-calf pair for the entire 6.5-month grazing season on grassland that when grazed for 6.0 months seasonlong requires 24 acres per cow-calf pair. The cow-calf weight performance on the twice-over rotation grazing system with complementary domesticated grass pastures is improved over the performance on other systems (Manske 1994b, Manske 1996).

It is possible that no range management practice can address all the problems inherent in an ecosystem, but successful practices will incorporate adjustment for the most serious problems. The twice-over rotation system with complementary domesticated grass pastures is one system that has been shown to be well adapted to the conditions of the Northern Plains grasslands and to produce positive results in vegetation and animal performance.

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Literature Cited

Campbell, J.B. 1952. Farming range pastures. Journal of Range Management 5:252-258.

Goetz, H. 1963. Growth and development of native range plants in the mixed grass prairie of western North Dakota. M.S. Thesis, NDSU. Fargo, ND. 165p.

Holechek, J.L., R.D. Pieper, and C.H. Herbel. 1989. Range management principles and practices. Prentice Hall. NJ. 501p.

Landblom, D.G. 1989. Brood cow efficiency management study. 39th Livestock Research Roundup. Dickinson Research Center. Dickinson, ND. Sec.I. p. 20-34.

Manske, L.L. 1994a. Problems to consider when implementing grazing management practices in the Northern Great Plains. NDSU Dickinson Research Extension Center. Range Management Report DREC 94-1005. Dickinson, ND. 11p.

Manske, L.L. 1994b. Ecological management of grasslands defoliation. p. 130-136. *in* F.K. Taha, Z. Abouguendia, and P.R. Horton (eds.). Managing Canadian rangelands for sustainability and profitability. Grazing and Pasture Technology Program, Regina, Saskatchewan, Canada.

Manske, L.L. 1996. Economic returns as affected by grazing strategies. p. 43-55. *in* Z. Abouguendia (ed.). Total Ranch Management in the Northern Great Plains. Grazing and Pasture Technology Program, Saskatchewan Agriculture and Food. Regina, Saskatchewan, Canada.

Manske, L.L. 1998. Environmental factors to consider during planning of management for range plants in the Dickinson, North Dakota, region, 1892-1997. NDSU Dickinson Research Extension Center. Range Research Report DREC 98-1018. Dickinson, ND. 36p.

Manske, L.L., M.E. Biondini, D.R. Kirby, J.L. Nelson, D.G. Landblom, and P.J. Sjursen. 1988. Cow and calf performance on seasonlong and twice over rotation grazing treatments in western North Dakota. Proceedings of the North Dakota Cow-Calf Conference. Bismarck, ND. p. 5-17.

National Research Council. 1996. Nutrient requirements of beef cattle. 7th ed. National Academy Press. Washington, DC.

Rogler, G.A., R.J. Lorenz, and H.M. Schaaf. 1962. Progress with grass. N.D. Agr. Exp. Sta. Bul. 439. 15p.

Whitman, W.C., D.W. Bolin, E.W. Klosterman, H.J. Klostermann, K.D. Ford, L. Moomaw, D.G. Hoag, and M.L. Buchanan. 1951. Carotene, protein, and phosphorus in range and tame grasses of western North Dakota. N.D. Agr. Exp. Sta. Bul. 370. 55p.