

PROGRESS REPORT

Plant Responses to Grazing

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Northern Plains rangelands can sustain high levels of production when the health and productivity of the prairie ecosystem are maintained with management strategies that place grass plant biological requirements and ecosystem processes as the highest priority.

Proper management of rangelands requires an understanding of plant response to grazing. Grass plants developed defoliation resistance mechanisms over 20 million years ago, in response to grazing during the long period of coevolution with early herbivores that are now extinct. A resistance mechanism important for the development of proper management practices is the stimulation of vegetative reproduction by tiller development from axillary buds (Manske 1999). Grazing applied during some phenological growth stages of grasses triggers the adaptive processes, or resistance mechanisms, and therefore has beneficial effects on grass plant growth (Manske 1999). The biological processes and the manipulation of the mechanisms are not completely understood. The goal of this project is to increase the knowledge of these processes so that defoliation can be used to stimulate vegetative tillering in grass plants.

Tiller development of grass plants as a response to timing and frequency of grazing has been studied at the South Dakota State University Cottonwood Research Station for twelve years and at the North Dakota State University Dickinson Research Extension Center for nineteen years. A collaborative research project funded by North Dakota State Board of Agricultural Research and Education (SBARE) was conducted at both the Cottonwood Research Station in southwestern South Dakota and the Dickinson Research Extension Center in southwestern North Dakota. This project collected detailed data to evaluate grass plant response to changes in time of defoliation and differences in severity of defoliation. These data will assist in the refinement of grazing management practices so that the biological requirements of the grass plants can be met. Identical defoliation treatments were conducted at the Cottonwood and Dickinson locations. Comparison of data collected at the two study sites enhances the understanding of relationships between defoliation and grass plant responses in the region.

These data expand the core information previously collected at the respective research stations and allow its application across the entire Northern Plains.

Methods

Identical research trials were conducted at the SDSU Cottonwood Research Station and the NDSU Dickinson Research Extension Center. Three exclosures were established on native rangeland, with 35 microplots located within each exclosure. To isolate each microplot and the grass tillers within it from the surrounding plant community, a 15 cm deep section of 8 cm diameter PVC conduit barrier open at both ends was inserted into the ground. Each western wheatgrass tiller present on the plot establishment date was individually identified with a loop of colored wire that encircled the tiller at the base and distinguished the tiller from the others in the microplot. New tillers were marked in a similar manner as they developed.

Four defoliation treatments, based on actual livestock grazing patterns, and a control of no defoliation were applied during year 1 in each of the three exclosures at both research locations. Seven microplots were randomly assigned to each treatment, and all tillers within a microplot received the same timing and severity of defoliation. Two treatments to determine the effect of time of defoliation were conducted at critical phenological stages of development: 1) before apical meristem elevation (mid May) and 2) during apical meristem elevation (mid June). Two treatments to determine the effects of severity of defoliation were conducted: 1) 25% and 2) 50% removal of current aboveground biomass. The five defoliation treatments were A) no defoliation, control, B) defoliation, mid May-25%, C) defoliation, mid May-50%, D) defoliation, mid June-25%, and E) defoliation, mid June-50%.

Data collection in years 1 and 2 began in early May and continued into fall. During the regular monitoring period, data for each marked tiller were collected weekly the first year and biweekly the second year; data included plant height, phenological growth stage, number of leaves, plant viability (live or dead), and notation of any insect or other damage.

New tillers were included in the data set as they developed during the growing season and early fall.

At the end of data collection in year 2, three randomly selected microplots of each treatment in each enclosure were excavated. The PVC barrier isolating the microplot was removed, and the soil was carefully washed from each microplot. Data collected for each marked tiller included number and origin (i.e., location from lead tiller) of crown and rhizome tillers, rhizome length, number and length of rhizome branches, total number of tiller crown nodes, and number of active nodes with axillary bud growth.

Results

Data collected during this study are being analyzed at South Dakota State University, Brookings, SD.

Literature Cited

Manske, L.L. 1999. Can native prairie be sustained under livestock grazing? p.99-108. *in* J. Thorpe, T.A. Steeves, and M. Gollop (eds.). Proceedings of the Fifth Prairie Conservation and Endangered Species Conference. Provincial Museum of Alberta. Natural History Occasional Paper No. 24. Edmonton, Alberta.