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PROGRESS REPORT

Plant Responses to Grazing

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Properly managed, Northern Great Plains rangelands can be maintained at high levels of production and provide forage for livestock, habitat for wildlife and plants, clean air, clean water, open spaces for recreation and sightseeing, and food, fiber, and energy for people. Management practices that place the biological requirements of the plants as the highest priority and facilitate the operation of ecosystem functions at potential levels are usually successful in sustaining healthy, productive rangelands. Management practices that benefit only a single grassland use and grazing management systems that move livestock among pastures in an arbitrary manner not coordinated with grass plant growth stages are generally unsatisfactory at sustaining healthy rangelands over a long term. The rangelands of the Northern Great Plains are too important to the region not to be properly managed.

Proper management of rangelands requires an understanding of plant response to grazing. Grass plants have developed defoliation resistance mechanisms in response to grazing during the long period of coevolution with herbivores. Grass plants developed these biological processes about 20 million years ago in conjunction with early herbivores that are now extinct. Plants that have developed these adaptive processes, or resistance mechanisms, benefit from grazing applied during some phenological growth stages (Manske 1999). One resistance mechanism important for the development of proper management practices is the stimulation of vegetative reproduction by tiller development from axillary buds (Manske 1999). This biological process and the manipulation of the mechanism are not completely understood. The goal of this project is to increase the knowledge of manipulation of this process so that defoliation can be used to beneficially 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 eleven years and at the North Dakota State University Dickinson Research Extension Center for eighteen

years. A collaborative research project funded by North Dakota State Board of Agriculture Research and Education (SBARE) will be conducted at both the Cottonwood Research Station in southwestern South Dakota and the Dickinson Research Extension Center in southwestern North Dakota. This project will collect 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 will be conducted at the Cottonwood and Dickinson locations. Comparison of data collected at the two study sites will enhance the understanding of the relationships between defoliation and grass plant responses in the region, and these data will also help expand the core information previously collected at the respective research stations to allow its application across the entire Northern Great Plains.

Methods

Identical research trials will be conducted at the SDSU Cottonwood Research Station and the NDSU Dickinson Research Extension Center. Three exclosures will be 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 that is open at both ends will be inserted into the ground. Each western wheatgrass tiller present on the plot establishment date will be individually identified with a loop of colored wire that encircles the tiller at the base and distinguishes the tiller from the others in the microplot. New tillers will be marked in a similar manner as they develop.

Four defoliation treatments, based on actual livestock grazing patterns, and a control of no defoliation will be applied during year 1 in each of the three exclosures at both research locations. Seven microplots will be randomly assigned to each treatment, with all tillers within a microplot receiving the same timing and severity of defoliation. Two treatments to determine the effect of time of defoliation will be 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 will be conducted: 1) 25% and 2) 50% of current aboveground biomass. The five defoliation treatments will be 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 will begin in early May and continue into fall. Data will be collected weekly for each marked tiller during the regular monitoring period and will include plant height, phenological growth stage, number of leaves, plant viability (live or dead), and notation of any insect or other damage. New tillers will be included in the data set as they develop 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 exclosure will be excavated. The PVC barrier isolating the microplot will be removed, and the soil will be carefully washed from each microplot. Data collected for each marked tiller will include number and origin (e.g. node location on crown) 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 for this research project during the 2000 growing season are being analyzed.

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.

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