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NORTHERN GREAT PLAINS

INTEGRATOR

USDA-ARS Northern Great Plains Research Laboratory *Mandan, ND*

USDA ARS

Northern Great Plains Research Laboratory

Our Vision:

An economically sustainable and environmentally sound agriculture.

Inside this issue:

Carbon Sequestration in Northern Great Plains Grasslands

Bruce Boehm measures soil carbon dioxide flux from a grazed pasture.

There is considerable uncertainty about future global change and its impact on natural and agricultural ecosystems. Atmospheric carbon dioxide is increasing at about 1.5 ppm per year due to burning of fossil fuels and land use changes. However, scientists have been unable to balance the global carbon cycle, as a substantial sink for atmospheric carbon dioxide remains unaccounted for. It has been suggested rangeland vegetation, and grasslands in particular, may be sequestering more atmospheric carbon dioxide than is commonly assumed. Rangelands in poor condition are often assumed to contribute to atmospheric carbon dioxide, whereas, those in good condition either sequester carbon dioxide or are in equilibrium.

At Mandan we are currently involved with the ARS Rangeland Carbon Dioxide Flux Project, a multi-location effort to investigate the role grasslands have in the global carbon cycle. Grasslands occupy a large area in the USA, but data is lacking on the magnitude of grasslands as a sink or source for atmospheric carbon dioxide. The Bowen ratio/energy balance technique is being used to measure carbon dioxide fluxes over grazed, seeded, and non-grazed pastures.

Carbon dioxide fluxes for a nongrazed mixed-prairie grassland were determined from 24 April to 26 October over 4 years, 1996-1999. Dormant season soil carbon dioxide fluxes were estimated from soil temperatures. The four-year growing season flux (or carbon dioxide sequestered) by the grassland averaged 3080 lb carbon dioxide/ac. Dormant or winter season flux estimated from soil temperatures averaged 2831 lb carbon dioxide /ac, the difference resulting in a net annual flux of 250 lb carbon dioxide/ac/yr. These results suggest properly managed Northern Great Plains mixed-prairie grasslands can provide a small sink for atmospheric carbon dioxide, but the carbon cycle for the grassland studied was near equilibrium overall.

The benefits of carbon dioxide sequestration are fully realized only when carbon is stored in stable forms in the soil. It will take many years to accurately determine the quantity of carbon being stored under grasslands. Application of proper management to degraded grasslands will provide the best opportunity for increasing carbon storage in grassland soils.

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History of Northern Great Plains Research Laboratory: 1945-1969

After the substantial increase in personnel at the Northern Great Plains Research Laboratory during the 1930s and early 40s, the Soil Erosion Service plant propagation nursery was relocated off station in 1948. Shortly thereafter, the nursery and soil testing laboratory were moved under the administration of the Soil Conservation Service. In 1955, the dairy research program was eliminated and in 1956, a substation was established to study saline soils in the Red River Valley.

Field equipment display at the 1962 NGPRL field day.

During the late 40s and early 50s, the station switched from using horses as primary draft power to tractors, some of which are used today. The bunkhouse was converted into office and laboratory space due to increasing numbers of personnel. Despite the loss of housing, seven families and a number of single men continued to live on the station.

Nordan Crested Wheatgrass, a forage grass with continuing popularity, was released in 1953. The rangeland research program increased during this period into half the land previously used by the dairy unit. The rest of the land was released back to the state.

The 1960s brought needed additions and renovations to the station. The current main office building was constructed between 1964 and 1966 and several cottages used as residences were torn down to make room. The former mess club was also torn down during this time.

The fruit tree program ended in 1965, and the orchards with over 1,000 trees were removed. Furthermore, the windbreak program was eliminated in 1967, only to be reopened a year later.

Research programs in nutrient cycling, dryland systems, water conservation, irrigation and drainage, and range and forage were all underway during the 1960s. By 1969, there were 15 ARS scientists and over 30 support staff at the Northern Great Plains Research Laboratory. The station had 28 buildings, owned 1,120 acres, and leased 1,064 acres.

(This is the second installment of a three-part article.)

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NGPRL Update

New Scientist

Dr. Scott Kronberg joined NGPRL in October as a Animal Nutritionist. Before coming to NGPRL, Dr. Kronberg was an associate professor in the Animal and Range Sciences Department at South Dakota State University.

New Website Design

The NGPRL website has a new look and expanded directory. The most notable addition is an information systems link, which provides users with a source of information for evaluating farm and ranch management options. Check it out at www.mandan.ars.usda.gov/systems/info_system.htm

Low-Stress Livestock Handling

The North Dakota Chapter of the Society for Range Management and the USDA-NRCS sponsored a low-stress livestock handling workshop at NGPRL this September. 'Cow whisperer' experts Steve Cote and Tim McFarland, both of Butte County, Idaho coordinated the workshop with assistance from Dr. Jim Karn, a Research Animal Scientist at NGPRL. About 120 people attended the workshop, which included ranchers and NRCS personnel.

The workshop emphasized the importance of learning how cattle behave so they can be trained to do what a handler wants. Mr. Cote indicated, however, it would probably be harder to retrain cowboys than to train cows. Producers have decreased disease problems as well as death loss using this new approach.

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Hay Yields of Grass and Alfalfa-Grass Mixtures

Hay yields of Manska and Reliant intermediate wheatgrass, Nordan crested wheatgrass, and Lincoln smooth bromegrass were determined in pure stands and in simple two-species mixtures with Rangelander alfalfa from 1994 to 1999 at Mandan. The effect of nitrogen fertility on the alfalfa and grass cultivars was also investigated by applying either 0 or 45 lb N per acre annually.

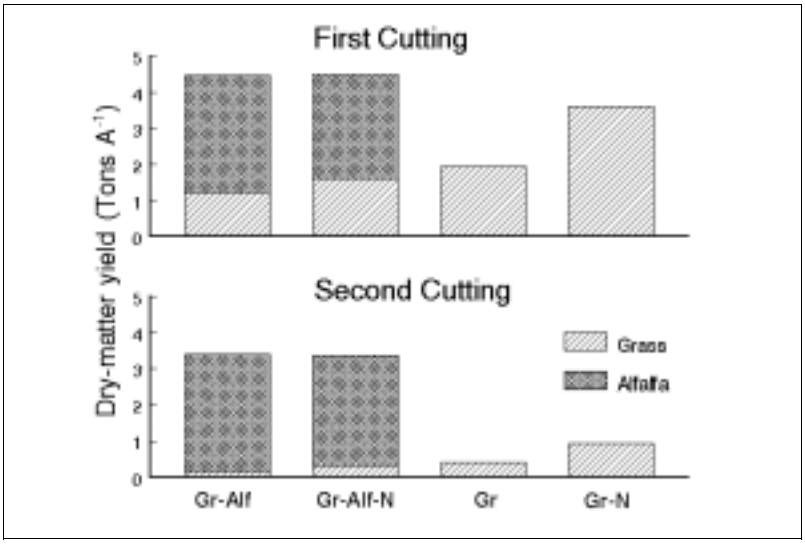
First- and second-cut yields averaged over all four grass cultivars indicated that cool-season grasses make their major contribution to forage yield early in the season. Grass contributed relatively little to overall yield in the second cutting of grass-alfalfa mixtures.

Pure stands of grass, even with nitrogen fertilizer, produced lower hay yields than grass-alfalfa mixtures at both cuttings. In pure stands, grass yields were nearly doubled as a result of nitrogen fertilization. Total seasonal hay (dry matter) yields from two cuttings averaged 7.8 and 2.4 tons per acre, respectively, for grass-alfalfa mixtures and pure stands of grass when no nitrogen fertilizer was applied. At 45 lb N per acre, grass-alfalfa mixtures and pure stands of grass averaged 7.8 and 4.5 tons of hay per acre, respectively.

Comparing hay yields of the grass cultivars in pure stands, Lincoln smooth bromegrass averaged 66 and 64% of intermediate wheatgrass at 0 and 45 lb N per acre, respectively, and crested wheatgrass averaged 59 and 64%, respectively, of intermediate wheatgrass at the two N levels.

In the fifth production year, the grass component made up about 35% of the total hay yield of the grass-alfalfa mixtures, with the cultivars all contributing about equally to total hay yields.

These findings indicate the alfalfa, intermediate wheatgrass, crested wheatgrass, and smooth bromegrass cultivars included in this study would all be suited for grass-alfalfa mixtures for dryland hay production in most sub-humid to semiarid portions of the Northern Great Plains.



Hay yields of grass-alfalfa mixtures and grass in pure stands at two cutting dates with 0 or 45 lb N per acre applied annually. Gr-Alf=grass-alfalfa-0 lb N per acre, Gr-Alf-N=grass-alfalfa-45 lb N per acre, Gr=grass-0 lb N per acre, Gr-N=grass-45 lb N per acre.

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Research Notes

NGPRL Staff Team-Up with Erosion Specialists

Scientists from the ARS National Soil Erosion Research Lab in West Lafayette, Indiana cooperated with soil scientists at NGPRL this August to carry out a soil erosion experiment on CRP land converted to crop production. Rainfall simulators were used on small plots of gently sloping land. Erosion was monitored by measuring runoff and sediment emerging from the lower ends of the plots. Rainfall rates, up to 4 inches per hour, were applied to CRP land cropped with a spring wheat-winter wheat-dry pea rotation under no-till and conventional-till management. Erosion tests were also run on CRP land converted to hay production at the same site.

Grasses Evaluated in Regional Performance Trial

Three experimental strains of Russian wildrye, including one tetraploid, and three experimental strains of intermediate wheatgrass were entered into an 8-location regional performance test seeded in the fall of 1999. Experimental strains from Mandan as well as Mandan check cultivars Manska and Reliant intermediate wheatgrass, Mankota Russian wildrye, Rodan western wheatgrass, and Nordan crested wheatgrass had good to excellent initial stand establishment. Establishment of the tetraploid Russian wildrye entry was equal to crested wheatgrass, a significant improvement in establishment capacity compared with normal diploid Russian wildrye.

Modeling Effort Underway for Alternative Crops

Data was collected throughout the 2000 growing season to support the addition of 10 new crops in the Root Zone Water Quality Model (RZWQM) and the Great Plains Framework for Agricultural Resources Management (GPFARM). The modeling effort is being done in collaboration with the Great Plains Systems Research Unit (USDA-ARS) in Fort Collins, Colorado. All elements are in place to refine these models for the Northern Great Plains. These models will save research time and money as well as affording all groups a better understanding of agricultural systems.

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Newsletter of the Northern Great Plains Research Laboratory

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Upcoming Events

Area IV SCD/ARS Research Results Workshop

January 24, 2001
Seven Seas Hotel
Mandan, ND

Get workshop info at:
(701) 667-3001 or
www.mandan.ars.usda.gov

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6th Prairie Conservation & Endangered Species Conference

'Sharing Common Ground'
February 22 – 25, 2001
Winnipeg, Manitoba

Get conference info at:
(204) 489-2739 or
http://iisd.ca/wetlands/

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Feel free to pass on this issue of *Northern Great Plains Integrator* to others interested in agricultural research in the Northern Great Plains.

To be added to our mailing list, request a copy through our website or contact Audrey Myers by phone (701 667-3001), fax (701 667-3054), or e-mail (myersa@mandan.ars.usda.gov).

Research Notes, cont'd

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Intermediate Wheatgrass Grazing Study Initiated

An intermediate wheatgrass grazing study was initiated this past May. The study was designed to determine the most appropriate developmental stage for grazing intermediate wheatgrass, which typically exhibits reduced grazing tolerance. Eight varieties of intermediate wheatgrass seeded in 1997 were grazed at three different growth stages (vegetative, stem development, and boot stage). Effects of grazing on tiller demography, litter decomposition, and soil quality indicators will be evaluated over the course of the study.

Switchgrass Biofuel Projects

Research activities at NGPRL related to the evaluation of switchgrass for use as a biofuel kicked into high gear in 2000. Cultivar evaluations were initiated in Streeter and Dickinson, ND to complement those established at Mandan in 1999. Work continued at Mandan to develop a carbon budget for switchgrass, tracking above- and below-ground biomass production, plus soil respiration rates and levels of soil organic carbon. The cultivar trials also afforded the opportunity to monitor and identify disease problems associated with growing switchgrass in the Northern Great Plains. This fall, soil samples are being collected under switchgrass stands and nearby cropland at 44 locations in ND, SD, and MN to evaluate differences in soil carbon. A greenhouse study is planned for this winter to determine the effects of nitrogen and calcium on switchgrass growth.

Livestock Impacts on Soil Quality

Infiltration rate, penetration resistance, soil bulk density, and other soil quality indicators were measured this fall on an integrated crop/livestock experiment where cattle are being overwintered on swathed forages. The same measurements will be made in the spring to evaluate the impact of cattle on surface soil properties.