Technology Transfer
for the
USDA-ARS Northern Great Plains
Research Laboratory

June 2003

NORTHERN GREAT PLAINS

INTEGRATOR

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

NORTHERN GREAT PLAINS RESEARCH LABORATORY

Our Vision:

An economically sustainable and environmentally sound agriculture.

Inside this issue:

Carbon Sequestration	1
Russian Wildrye	2
2003 Friends & Neighbors Day June 26th Don't Forget!	3
New Faces: Kris Nichols Soil Microbiologist	4
Youngest Scientist at NGPRL is a Success!	4
Dynamic Cropping System Symposium	4

CARBON DIOXIDE SEQUESTRATION BY A GRAZED MIXED-GRASS PRAIRIE

Agriculture is increasingly taking on the role of mitigating carbon dioxide emissions into the atmosphere. Grasslands may serve as a significant sink for atmosphere carbon dioxide because grasslands occupy a large area and also contain nearly 80 percent of their biomass below ground, which suggests that grasslands can play an important role in the global carbon cycle. The large below ground root biomass serves as storage for carbon dioxide taken from the atmosphere by photosynthesis. The Bowen ratio/energy balance technique has been used to measure carbon dioxide fluxes over grazed mixed-grass prairie grasslands at the Northern Great Plains Research Lab since 1995. Net carbon sequestration has varied greatly over the years due to rainfall and ranged from 134 lbs carbon dioxide/acre in 1998 to 2197 lbs carbon dioxide/acre in 2001. The cumulative flux over these seven years totaled 7859 lbs carbon dioxide/acre (Fig. 1).

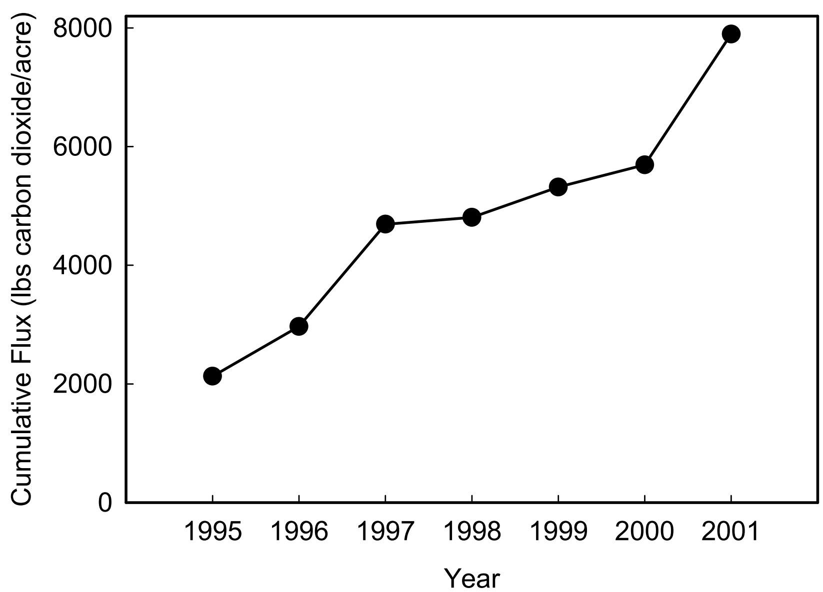

Fig. 1. Cumulative CO_2 flux over seven years for a grazed mixed-grass prairie at Mandan, ND.

The results from this long-term study show the carbon storage potential for this grazed prairie site to be quite small, but considering that the site was grazed and still remains a sink for atmospheric carbon dioxide is significant.

Al Frank,
Plant Physiologist
701.667.3007
franka@mandan.ars.usda.gov

IMPROVED RUSSIAN WILDRYE BEING DEVELOPED

Research at the Northern Great Plains Research Laboratory has resulted in genetically improved experimental strains of Russian wildrye grass that exhibit significantly improved seedling vigor and utilize moisture more efficiently. This new experimental grass germplasm will have the potential to significantly improve forage yields of seeded pastures.

Creating novel grass cultivars through traditional methods is difficult and requires a long-term commitment. Scientists at the USDA Agricultural Research Service (ARS) lab at Mandan, have been working toward this advance since 1984. It may yet be another five years until an improved Russian wildrye cultivar can be released to the seed trade for increase and another few years until it is available commercially.

Russian wildrye is a cool-season bunchgrass used for seeding improved pastures. It produces an abundance of basal leaves that maintain relatively high levels of digestibility late in the grazing season and remain high in nutrient value for dormant season grazing.

Russian wildrye is a cool-season bunchgrass used for seeding improved pastures. It produces an abundance of basal leaves that maintain high levels of digestibility late in the grazing season and remain relatively high in nutrient value for dormant season grazing.

Poor seedling vigor has been a major factor limiting widespread use of Russian wildrye. Seedlings develop slowly and the probability of establishment failures from inadequate soil moisture, excessive seeding depth, weed competition, and other adverse conditions is greater than for many forage grass species. Increasing the size of experimental Russian wildrye germplasm has resulted in considerably increased seedling vigor and emergence potential.

To address the seedling establishment problem of Russian wildrye, Dr. John Berdahl of the ARS laboratory treated embryos of selected plants with nitrous oxide to change the number of chromosomes present. This treatment resulted in the chromosomes being doubled from a "diploid" with seven pairs, to a "tetraploid" with 14 pairs. The new progeny had larger cell size, tissues and organs. Seed weight was increased by over 70 percent over normal diploid plants.

Most grasses are recommended to be seeded 1/2 to 3/4 inches deep. Over a three-year period, testing at an extreme 2 1/2 inch soil depth showed an average of 10 percent emergence for Vinall Russian wildrye and 46 percent for the new tetraploids. Vinall Russian wildrye and the experimental tetraploids were field tested in a controlled moisture environment at the Northern Great Plains Research Laboratory.

Water treatments were applied to provide 50 percent and 150 percent of Mandan's 30-year average precipitation. The improved tetraploid plants were found to use water more efficiently than traditional diploid Russian wildrye. Dr. Al Frank of the Northern Great Plains Research Laboratory has reported in the journal *Crop Science* that water-use efficiency was good in both Vinall and the tetraploids, but in trials with 50 percent reduced soil water, the improved tetraploid plants produced 28 percent greater forage yields than the traditional cultivar. At the 150 percent water treatment, forage yields were similar.

Berdahl has found that seedling height is considerably greater for the tetraploids over Vinall as a result of greater leaf length. Large leaf size is important in assimilating atmospheric carbon into the soil and providing greater competition for weeds. Both traditional and tetraploid plants, he explains, produce seven to eight leaves after seeding in establishment year. They develop leaves early and rapidly. In the second and succeeding years after seeding, heading of both diploid and tetraploid plants is completed prior to June 1 at Mandan.

When released, the new tetraploid Russian wildrye has the potential to improve the forage base and forage quality of improved seeded pastures in the semiarid areas of the northern Great Plains where annual precipitation averages less than 16 inches. Scientists at the Northern Great Plains Research Laboratory believe the improved seedling vigor and significantly improved water-use efficiency of the new tetraploid germplasm will make Russian wildrye a vast improvement in the water deficit environments of the northern Great Plains states.

Tetraploid Russian wildrye developed at the USDA-ARS will also provide scientists with a unique new germplasm pool from which future improvements can be accomplished that are not possible through continued selection of traditional diploid Russian wildrye germplasm. This new development did not involve use of sophisticated biotechnology and did not involve gene transfer from other species.

Reprinted from Farm & Ranch Guide

Northern Great Plains Integrator is published and distributed by the USDA-ARS Northern Great Plains Research Laboratory, 1701 10th Ave., S.W., Mandan, North Dakota. ● Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD). ● The United States Department of Agriculture prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital and family status. ● To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence, SW, Washington, DC 20250-9410 or call 202-720-5964 (voice or TDD). ● USDA is an equal opportunity provider and employer. ● Mention of trade or manufacturer names is provided for information only and does not constitute endorsement by USDA-ARS. ● **Any material in this publication may be copied and distributed in part or whole if due credit is given to the authors.** ● Editor: Cal Thorson, Technical Information Specialist, USDA-ARS Northern Great Plains Research Laboratory, PO Box 459, Mandan, ND 58554-0459 O: 701 667-3018 F: 701 667-3077 E: thorsonc@mandan.ars.usda.gov

Your Invitation...

The staff of the Northern Great Plains Research Laboratory have been busy organizing the best **Friends & Neighbors Day** in the nearly 90-year history of USDA research on the northern Great Plains. You are invited to join us on June 26th to judge if we've succeeded!

This annual event has been a "must attend" event for farmers, ranchers, agribusiness people and everyone interested in agricultural innovation since 1914!

In addition to the **Area IV SCD Research Farm Tour**, the staff has significantly increased the educational offerings on the Scientific Campus Tour. Ag innovators can bring the entire family. Everyone will find something of interest at your USDA Agricultural Research Service Laboratory this year!

Over 40 major producer and Agribusiness organizations have combined their efforts to help make this event the best ever. Even Mylo Hatzenbuhler (the rock-n-roll farmboy) has decided to join us!

Our traditional barbecue will take on a new flavor this year too! In the past we've indulged in Cajun burgers, Yak burgers and even Beef burgers. This year, the chefs at the United Tribes Technical College are cooking up "Tri-Tip" beef sandwiches and our great "Kings-of-the Grill" will be serving up big "Cowboy Hall of Fame" Beef Franks.

Please join us! We look forward to seeing you!

Friends & Neighbors Day

2003

Dynamic Agriculture for Tomorrow's Success

NORTHERN GREAT PLAINS RESEARCH LABORATORY

USDA

Highway 6 South of Heart River

Mandan, North Dakota

THURSDAY, JUNE 26

3:30 PM (CDT) REGISTRATION

PUBLIC IS INVITED — NO COST

Scientific Campus Tour

- History Of USDA Research In Our Community
- Neighborhood Trees For The Northern Great Plains
- Ornamental Grasses For Your Yard
- Attracting Beneficial Birds To Your Home
- NRCS Soil Conservation Information For Landlords
- "Science In Our Lives" Laboratory Tour
- Tree Plantings For Wildlife
- What Is This weed?

Area IV SCD Research Farm Tour

- Crop Sequence Project: Is This A Friendly Neighborhood?
  - Sequencing New Crops To Reduce Risk
  - 100 Crop Sequences: Which Is Best For Your Farm?
  - How Much Soil Water Does Your Crop Need?
- What Is In Your Soil?
  - Does Glomalin Hold Your Farm Together?
- Carbon Sequestration in North Dakota Agriculture: What do we know?
- High Quality Grazing Needed For Rapid Growth

SERVING **NORTH DAKOTA COWBOY HALL OF FAME® ALL BEEF FRANKS AND LOCALLY MADE "TRI-TIP" BEEF SANDWICHES**

SPECIAL APPEARANCE BY

MYLO HATZENBUHLER, THE ORIGINAL ROCK-N-ROLL FARMBOY

Friends & Neighbors Day Sponsors: AgriPro Wheat • AGSCO • AgWeek • AmeriFlax • ProSeed • Archer-Daniels Midland • Bayer Crop Sciences • Cooperative Agronomy Services • Cloverdale Foods • Dow AgroSciences • Mycogen Seeds • Farm & Ranch Guide • FMC • Pheasants Forever • Sygenta • KAP Custom Application • Legend Seeds • National Sunflower Association • Arvesta Corporation • North Dakota Corn Growers Association • Farm Credit Services • Northern Canola Growers Association • Monsanto • North Dakota Grain Growers • North Dakota Soybean Council • Pioneer Hi-Bred/Benchmark Seeds • Philom Bios • Northern Plains Equipment • Pulse USA • Tesoro Petroleum • West Central • Croplan Genetics • Agricore United • Agriliance • Wells Fargo Bank • Minn-Dak Growers LTD • Top Farm Hybrids • Security First Bank • Ducks Unlimited • BASF • Van Seed Hybrids

WWW.MANDAN.ARS.USDA.GOV ≈ CHILDREN'S ACTIVITIES ≈ CCA CEU'S AVAILABLE ≈ 701.667.3000

New Faces

Kris Nichols, Soil Microbiologist

Kris Nichols has recently joined the research group at the Northern Great Plains Research Laboratory. Nichols received Bachelors degrees in Plant Biology, and Genetics and Cell Biology from the University of Minnesota in 1995. She began her career in ARS in 1999 while completing her Masters degree in Environmental Microbiology from West Virginia University. That same year, she initiated a Ph.D. program in Soil Science at the University of Maryland. She will complete her doctorate this August. Prior to joining the staff at the Northern Great Plains Research Laboratory, Nichols was engaged in the study of arbuscular mycorrhizal (AM) fungi – a plant root symbiont at the USDA-ARS Beltsville Agricultural Research Center in Maryland. She recently has been conducting research on glomalin – a glycoproteinaceous substance produced by AM fungi. Glomalin contributes to soil structure and plant health by helping to form and stabilize soil aggregates. Nichols has found that glomalin is a major component of soil organic matter (ca. 25%) in undisturbed soils and may be an agriculturally managed soil carbon sink. At the Northern Great Plains Research Laboratory, Kris will continue her study of glomalin in the soils of the northern Great Plains region. She will also be the primary researcher in the development of native prairie grasses for potential biofuel production.

Youngest Scientist at NGPRL is a Success!

Mandan High School Senior Brian Fisher has been an inspiration to the staff at the Northern Great Plains Research Laboratory for the two years he has been provided research space at this USDA facility. Drs. Mark Liebig, John Hendrickson, and technician Mary Kay Tokach have been mentoring and advising Brian in his personal research. In May, Brian received two awards at the Intel International Science and Engineering Fair (Intel ISEF) in Cleveland, Ohio. Brian's project, "Development of a Saline Tolerant Safflower by Applying a Newly Formulated in vitro Methodology", was awarded a first place in the botany category. Brian also received the 'Best of Category' award. To help put Brian's achievement in context, there have been only six first place winners and two 'best of category' winners from North Dakota in the 60-year history of the international competition!

The Intel ISEF is the world's largest pre-college celebration of science. The fair brings together over 1,200 students from 40 nations to compete for scholarships, tuition grants, internships, scientific field trips, and prize money. Student competitors are ninth through twelfth graders who earned the right to compete by winning top prizes at regional, state, or national science fair competitions.

Dynamic Cropping Systems Symposium

Northern Great Plains Research Laboratory scientists have completed planning for the Dynamic Cropping Systems Symposium. Information and registration can be found on the NGPRL web site (www.mandan.ars.usda.gov). Check it out if you haven't done so already! Enthusiasm is high that this gathering of international agricultural scientists will lead to a new way of thinking about cropping systems research. Join us in Bismarck on August 4-7, 2003!

We're on the web: www.mandan.ars.usda.gov

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 Cal Thorson by phone (701 667-3018), fax (701 667-3077), or e-mail (thorsonc@mandan.ars.usda.gov).

NORTHERN GREAT PLAINS
INTEGRATOR

Technology Transfer Product of the Northern Great Plains Research Laboratory
United States Department of Agriculture
Agricultural Research Service

USDA-ARS-NGPRL
1701 10th Ave., SW PO Box 459
Mandan, ND 58554-0459

Phone: 701 667-3018 Fax: 701 667-3077