Center for Grassland Studies

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UNL Research Towards Biological Control of Turfgrass Diseases – Part I

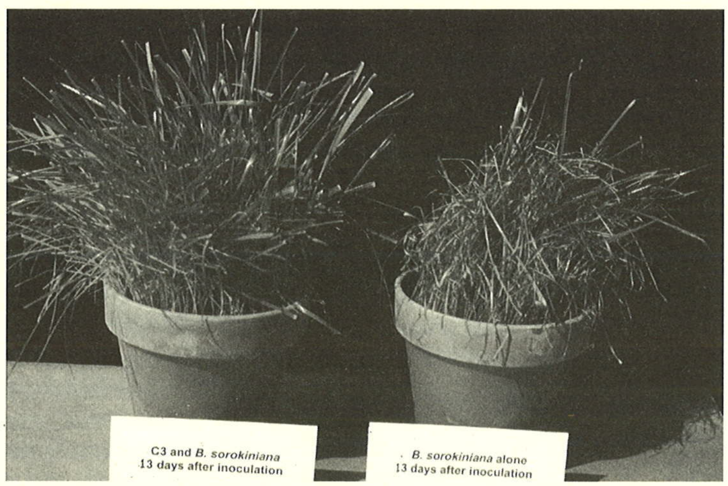
by Gary Yuen, Department of Plant Pathology, UNL

Editor's Note: This is the first in a two-part series summarizing research at UNL on a biological control agent for diseases of turfgrass. Part I discusses the importance of biological control and presents the investigations that led to the discovery of the agent. In the next issue, Part II will present some of the findings regarding the ecology of the agent and the mechanisms by which it inhibits disease.

Why biological control and what is it?

Turfgrass in home and landscape lawns contributes to the beauty of our communities. Turfgrass planted in recreational fields and golf courses adds to our enjoyment of sports. To attain lush, green turf, however, we apply cultural practices that also contribute to disease caused by fungi. The most common of these practices, regular watering and fertilization, cause moisture to be retained in the turfgrass canopy even when conditions outside of the canopy may be dry. Long moisture periods allow fungi that infect grass foliage to remain active throughout the growing season. Growth of fungi and infection of leaves by pathogenic fungi intensify when temperatures in the canopy are optimal for the microorganisms, leading to damage and death of the grass. Planting of disease-resistant grass varieties is one strategy to control disease, but this option is useful only when reseeding or when establishing new lawns. Furthermore, current turfgrass varieties do not have resistance to all diseases, and a high level of resistance is not available against some destructive diseases, such as brown patch caused by *Rhizoctonia solani*. The use of fungicides, therefore, is the primary method for controlling fungal diseases in turfgrass.

There are drawbacks associated with regular fungicide use. These include the selection for fungicide resistance in the pathogen population, causing the fungicide to be less effective. Fungicides also eliminate beneficial fungi that would otherwise keep pathogenic fungi in check. As a consequence, some disease problems can be aggravated by regular fungicide use. Lastly, there is a concern that fungicide residues in turfgrass might be injurious to humans, animals and the environment. Although there is no good research evidence to substantiate this concern, it must be noted that fungicides used on turfgrass are the same as those applied in agriculture under strict regulations to minimize exposure to applicators and nearby inhabitants. Turfgrass fungicides, on the other hand, are typically applied with fewer restrictions and are mostly used in urban areas, so the chances for acute and long-term exposure to turfgrass fungicides are high.



Effects of biocontrol bacterium C3 on leaf spot and blighting, caused by *Bipolaris sorokiniana*, on tall fescue. Left – Turf sprayed with C3 prior to inoculation with the pathogen. Right – Inoculated turf with no C3 treatment.

Because of the need for new strategies to augment disease resistance and fungicides, biological control (or biocontrol) using microorganisms–bacteria and fungi–has been the subject of research by university and industry scientists in the U.S., Europe and Asia. One biocontrol tactic is to exploit and enhance naturally occurring communities of microbes. An example is the application of certain

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The Center for Grassland Studies is a unit within the University of Nebraska-Lincoln Institute of Agriculture and Natural Resources. It receives guidance from a Policy Advisory Committee and a 50–member Citizens Advisory Council. This newsletter is published quarterly.

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From the Director

Considerable discussion is occurring these days about global warming, climatic change, and the "greenhouse effect." The "greenhouse effect" occurs when gases, predominately carbon dioxide (CO_2), are released into the atmosphere, thus keeping radiation from the earth's surface escaping into space and then reflecting it back to earth–causing a warming effect. The "greenhouse effect" is essential for life, but there is concern that increasing amounts of these gases are having a negative environmental impact. The atmospheric concentration of CO_2 has increased by about one-third since the beginning of the industrial revolution (around 1850), according to some authorities.

Fossil fuels are heavily laden with carbon derived from a carbon cycle millions of years ago. Today, as coal and oil are extracted from the earth in increasing amounts and burned, greater amounts of CO_2 are released than are needed in the carbon cycle. A large percentage of CO_2 in the atmosphere comes from auto exhausts and power plants. Although agriculture contributes a small percentage of atmospheric CO_2, it also has potential to be a moderating influence.

Carbon sequestration is the long-term storage of carbon in any living or dead vegetation, and as organic matter in the soil. It offsets the CO_2 released into the atmosphere. Removing CO_2 from the atmosphere through photosynthesis and storing it in plant tissue or the soil is one way to reduce atmospheric CO_2. During photosynthesis, green plants take in carbon dioxide from the atmosphere and release oxygen. The carbon is stored in the plant tissue until the plant dies and decays; carbon is then released back into the atmosphere. Since grasses carry out photosynthesis during all or a large part of the year, depending on location and the kind of grass, and the soil is usually not tilled or disturbed where they are growing, grasses are among our most effective plants for sequestering carbon. Other potential benefits of increasing the acres of grassland include reduced erosion, improved water quality, and better wildlife habitats.

Reducing the use of oil, coal, and other fossil fuels is the long-term solution, but this takes time. Improved management of grasslands and agricultural systems could help provide some of that time. Certain utility companies and other industries emitting greenhouse gases are already buying carbon credits from landowners or are searching for other ways to offset carbon emissions in a cost effective manner. Eventually, people with grasslands and agricultural producers could have additional income by being paid for storing extra carbon in their plants and soils.

There is an increasing interest in research and management systems to sequester more CO_2. For instance, this year the Nebraska Legislature passed LB 957 creating the Carbon Sequestration Advisory Committee. That committee is to advise and assist the Director of Natural Resources, recommend policies or programs to enhance the ability of Nebraska agricultural landowners to participate in systems of carbon trading, encourage the production of educational and advisory materials regarding carbon sequestration on agricultural lands, and identify and recommend areas of research needed to better understand and quantify the processes of carbon sequestration on agricultural lands.

There are many good sources of information on this topic on the Web. One is from the international conference "Carbon: Exploring the Benefits to Farmers and Society" held in Iowa this past August; see conference abstracts at http://www.cvrcd.org/carbon.htm.

We will be hearing much more about carbon sequestration in the future.

M. A. Massengale

Annual Forage Production and Quality Trials

by Burt Weichenthal (Department of Animal Science) and David Baltensperger (Department of Agronomy) at Panhandle Research & Extension Center, and Kenneth Vogel, USDA-ARS and Department of Agronomy, UNL

Editor's Note: This article appears in the *2001 Beef Report* (see Resources) and is reprinted here with permission.

Summary

Two-year forage trials showed higher dry matter yields for winter triticale than for winter wheat while forage qualities were similar. Likewise, a spring triticale cultivar had higher dry matter yields than spring barley or oat cultivars when harvested for forage after heading, and forage qualities were similar. In summer trials, dryland forage sorghum and sorghum x sudangrass hybrids had higher crude protein, digestibility, and energy values than irrigated forages because they were not as mature. Lower lignin content and higher digestibility resulted when the brown midrib trait was present in forage sorghum or sorghum x sudangrass hybrids.

Introduction

Data are limited on the forage production and quality potential for currently available annual forages. Changes in production potential and feed quality have occurred, such as lower lignin content and higher digestibility associated with the brown midrib (BMR) trait that has been crossed into some forage sorghum, sudangrass, sorghum x sudangrass and corn hybrids. Forage trials were conducted over two years to compare some of the newer forage cultivars with some that have been around long enough to be considered standards. Forage production and quality were evaluated for cereal forages grown under dryland management and for sorghum, sorghum x sudangrass, and pearl millet forages grown under dryland or irrigated management systems.

Procedure

Dryland winter wheat and triticale cultivars were harvested for forage at Mead, McCook, and Sidney in 1997 and 1998 after producing a seed head. Ten wheat cultivars were planted, including Arapahoe, Lamar, Longhorn, Pronghorn, and 6 experimental cultivars. Five triticale cultivars were planted, including Trical, Newcale, and 3 experimental cultivars. There were 4 replications of each cultivar at each location.

Dryland spring-seeded cereal crops were harvested as forage at Sidney in 1998 and 1999 after most of the cultivars had produced a seed head. There were 2 triticale, 2 barley, and 3 oat cultivars, with 4 replications of each cultivar. All annual forages were planted in 6-row plots with a double-disc grain drill with 12 inches between rows. All forage plots were harvested with a plot swather that cut the center 4 rows. Mechanical chopping of the forages allowed subsampling for dry matter and forage quality analyses. Quality results were available from 1998 trials only at the time this paper was prepared.

Summer dryland forages were planted at Sidney and included 1 sudangrass, 6 sorghum x sudangrass, and 8 forage sorghum cultivars. Forages were harvested after the majority of cultivars had headed in growing seasons of 78 and 75 days in 1998 and 1999, respectively. The plots were fertilized with 60 lb of N and 40 lb of P_2O_5 in 1998 and 45 lb of N in 1999.

Summer irrigated forages planted at Scottsbluff included 1 sudangrass, 5 sorghum x sudangrass, 9 forage sorghum, and 3 pearl millet cultivars. The plots were harvested after the majority of cultivars had produced a seed head in growing seasons of 82 and 88 days in 1998 and 1999, respectively. They were fertilized with 120 of N and 80 lb of P_2O_5 as a side dress in both years.

Forage quality tests included percentages of dry matter for total and nitrate nitrogen, neutral detergent fiber, acid detergent fiber, acid detergent lignin, and *in vitro* dry matter digestibility (IVDMD). The acid detergent fiber (ADF) values were used to calculate energy values as TDN, net energy, and metabolizable energy by using equations listed by the National Forage Testing Association. Least significant differences at the 5% probability level of incorrectly stating a difference were determined for each trait by using the general linear model in the Statistical Analysis Services computer program.

Results

Fall- and spring-seeded cereal forage results are shown in Table 1. Averages are shown for the 10 winter wheat and 5 triticale cultivars harvested at each location in 1997 and 1998. Although differences in dry matter forage yields were not large, the top yielding winter wheat cultivar at all three locations was Pronghorn, and the top yielding winter triticale cultivar at McCook and Sidney was Newcale. Both of these cultivars were developed by plant breeders in the University of Nebraska system. Forage crude protein (CP) and ADF levels were similar among the wheat and triticale cultivars at each location, making energy levels calculated from ADF similar also.

The top yielding spring cereal forage was triticale cultivar 2700. The barley cultivars ranked second and third in dry matter yields. Forage CP levels were similar with an average of 8.7% of dry matter. Energy levels were also similar with an average of 65% TDN, which was the same as in the winter forages.

Dry matter yields for dryland summer forages in Table

Table 1. Production and quality of dryland small grain forages in University of Nebraska trials in 1997, 1998, 1999[a].

Winter Forages, 1997-98[b]		DMYLD	CP	NDF	ADF	IVDMD	TDN	NE_m	NE_g	ME
Crop	Location	lb/acre	%	%	%	%	%	Mcal/lb	Mcal/lb	Mcal/lb
Wheat	Mead	6000	8.5	61	29	68	67	.70	.43	1.10
Wheat	McCook	8000	8.8	63	32	70	66	.69	.42	1.09
Wheat	Sidney	5200	9.7	64	35	67	66	.68	.41	1.07
Wheat	Mean	6400	9.0	63	32	68	66	.69	.42	1.09
Triticale	Mead	6800	7.6	65	33	65	66	.68	.41	1.08
Triticale	McCook	9400	8.6	67	36	66	65	.67	.40	1.07
Triticale	Sidney	6400	10.1	68	37	64	65	.67	.40	1.06
	Mean	7500	8.8	67	35	65	65	.67	.40	1.07
Spring Forages, 1998-99[c]										
Crop	Cultivar									
Triticale	2700	4900	8.2	67	37	66	65	.67	.40	1.06
Barley	Horsford	4310	8.8	66	33	70	66	.68	.42	1.09
Barley	Westford	4090	7.9	63	32	66	66	.69	.42	1.09
Oat	Monida	3760	8.9	68	35	70	65	.67	.41	1.07
Oat	Russell	3580	8.4	68	36	66	65	.67	.40	1.07
Oat/Pea	Russell/Pea	3320	9.6	67	36	69	65	.67	.40	1.07
Triticale	Grace	3310	9.2	66	36	68	65	.67	.40	1.07
Oat	Magnum	3120	8.7	67	35	73	65	.68	.41	1.07
	Mean	3800	8.7	67	35	69	65	.68	.41	1.07
	LSD .05	350	1.0	1.3	.9	3.0	.3	.01	.01	.01

[a]Abbreviations are: DMYLD = dry matter yield, CP = crude protein, NDF = neutral detergent fiber, ADF = acid detergent fiber, IVDMD = in vitro dry matter digestibility, TDN = total digestible nutrients, NE_m = net energy for maintenance, NE_g = net energy for gain, ME = metabolizable energy, LSD = least significant difference.
[b]There were 10 wheat and 5 triticale cultivars grown at each location each year in the winter forages.
[c]Dry matter yields are averages for two years, but quality is from 1998 only in the spring forages.

Table 2. Production and quality of dryland summer forages at the University of Nebraska High Plains Ag Lab, Sidney, NE, 1998-99[a].

Crop[b]	Cultivar	DMYLD[c] lb/acre	CP %	NO_3N ppm	NDF %	ADF %	ADL %	IVDMD %	TDN %	NE_m Mcal/lb	NE_g Mcal/lb	ME Mcal/lb
SXS	SX8	6780	11.8	1450	58	30	2.8	76	67	.70	.43	1.10
FS	X24442	6210	11.2	1300	56	28	2.5	79	68	.71	.44	1.11
FS	Sweet N Red	6120	11.3	1450	55	27	2.2	81	68	.71	.44	1.11
SXS	Att-A-Graze	5890	10.6	1100	58	30	3.4	71	67	.70	.43	1.10
FS	XBMR	5700	11.9	1400	54	26	2.2	82	68	.71	.44	1.12
SXS	Sooner Sweet	5680	11.7	1300	58	29	3.3	74	67	.70	.43	1.10
SXS	SXS 94X63	5660	10.4	1100	58	30	3.5	73	67	.70	.43	1.10
SXS	Nutri + BMR	5640	11.9	1500	54	26	2.6	77	68	.71	.44	1.12
FS	BMRX1	5550	12.7	1700	53	25	2.0	82	68	.72	.45	1.12
FS	Canex BMR208	5330	12.2	1450	55	26	2.0	82	68	.71	.44	1.12
FS	X43024	5210	13.0	1750	57	28	2.9	80	68	.71	.44	1.11
SXS	Super Sweet ST	5050	12.0	1200	58	29	3.4	73	67	.70	.43	1.10
FS	Rox Orange	4770	11.5	1550	54	26	2.2	82	68	.72	.44	1.12
S	Piper	4530	9.4	900	62	33	4.1	67	66	.68	.42	1.08
FS	Early Sumac	4300	11.3	1350	55	27	2.2	81	68	.71	.44	1.11
	Mean	5490	11.5	1650	56	28	2.8	77	68	.71	.44	1.11
	LSD .05	790	1.0	200	1.9	1.3	.4	2.3	.4	.01	.01	.01

[a]Abbreviations are: CP = crude protein, NO_3N = nitrate nitrogen, NDF = neutral detergent fiber, ADF = acid detergent fiber, ADL = acid detergent lignin, IVDMD = in vitro dry matter digestibility, TDN = total digestible nutrients, NE_m = net energy for maintenance, NE_g = net energy for gain, ME = metabolizable energy, LSD = least significant difference.
[b]Crop abbreviations are as follows: SXS = sorghum x sudangrass, FS = forage sorghum, S = sudangrass.
[c]Dry matter yields are averages for two years, but quality is from 1998 only.

2 are an average of trials in 1998 and 1999. Dry matter percentages, plant heights and maturity scores are not shown, but were similar between years. Crude protein levels for 1998 ranged from 13 to 9.4% of dry matter, which was consistent with the maturity stages that ranged from boot to headed. Producers who want summer forage high in crude protein and digestibility should harvest crops more than once a season when the crops have regrowth capability. Other producers may want more dry matter yield with a single cut system when the crude protein and TDN contents are adequate for the animals that will consume the forage.

Dry matter yields for irrigated summer forages are shown in Table 3 as an average of 1998 and 1999 trials. In Tables 2 and 3, cultivars with an X before or after numbers or a name were experimental cultivars in the years of these

Table 3. Production and quality of irrigated summer annual forages at the UNL Panhandle Res. & Ext. Center, Scottsbluff, NE, 1998[a].

Crop[b]	Cultivar	DMYLD[c] lb/acre	CP %	NO_3N ppm	NDF %	ADF %	ADL %	IVDMD %	TDN %	NE_m Mcal/lb	NE_g Mcal/lb	ME Mcal/lb
SXS	Super Sweet ST	13600	8.5	500	61	35	5.7	65	65	.67	.41	1.07
FS	XBMR	13520	8.7	800	58	32	2.5	77	66	.69	.42	1.09
FS	Sweet N Red	13230	9.7	1000	61	34	4.2	69	66	.68	.41	1.08
SXS	Att-A-Graze	13120	8.9	650	61	36	6.5	62	65	.67	.40	1.07
FS	X24442	13040	9.8	800	62	36	4.6	67	65	.67	.40	1.07
SXS	Sooner Sweet	12980	9.0	700	62	36	5.7	65	65	.67	.40	1.07
FS	Canex BM208	12900	8.7	800	53	29	3.7	77	67	.70	.43	1.10
FS	X43024	12760	10.8	1050	63	36	4.0	70	65	.67	.40	1.07
SXS	Nutri + BMR	12100	7.9	700	61	35	5.3	64	65	.67	.41	1.07
SXS	SXS 94X63	12010	8.0	500	61	36	5.6	64	65	.67	.40	1.07
FS	Early Sumac	11930	9.5	750	61	35	4.4	68	65	.67	.41	1.07
FS	FS22	11920	11.1	1100	64	36	4.2	67	65	.67	.40	1.07
PM	Mega Mil	11300	11.8	2000	66	39	4.7	68	64	.66	.39	1.06
FS	Rox Orange	11220	9.2	900	61	35	4.1	70	65	.67	.41	1.07
S	Piper	10910	8.2	500	66	39	5.9	60	64	.66	.39	1.05
PM	P10XIM	10800	10.5	1250	66	38	5.7	61	64	.66	.39	1.06
FS	BMRX1	10780	9.9	1000	60	34	4.0	68	66	.68	.41	1.08
PM	HPM	9990	12.0	2100	65	37	5.3	63	65	.66	.40	1.06
	Mean	12120	9.6	950	62	35	4.8	67	65	.67	.41	1.07
	LSD .05	1240	1.6	650	3.6	2.8	1.0	4.2	2.9	.01	.01	.02

[a]Abbreviations are: DMYLD = dry matter yield, CP = crude protein, NO_3N = nitrate nitrogen, NDF = neutral detergent fiber, ADF = acid detergent fiber, ADL = acid detergent lignin, IVDMD = in vitro dry matter digestibility, TDN = total digestible nutrients, NE_m = net energy for maintenance, NE_g = net energy for gain, ME = metabolizable energy, LSD = least significant difference.
[b]Crop abbreviations are as follows: SXS = sorghum x sudangrass, FS = forage sorghum, S = sudangrass, PM = pearl millet.
[c]Dry matter yields are averages for two years, but quality is from 1998 only.

trials. High-yielding cultivars included both forage sorghum and sorghum x sudangrass hybrids. Some brown midrib hybrids had good yields but showed some lodging in the single harvest system that allowed them to grow 6 to 7 ft tall, but this was also true for some non-BMR hybrids.

Forage quality results shown for 1998 indicate variation in CP and IVDMD, which is often due to maturity differences when harvested. However, the emergence of summer forages with increased digestibility, such as the brown midrib cultivars in forage sorghum, sorghum x sudangrass, pearl millet and corn hybrids, brings new opportunities for improved animal performance through grazing or feeding of these forages. Reduced lignin fiber content of these forages allows for greater digestibility, but multiple harvest or grazing systems may be needed to minimize lodging problems that can occur if they get too tall. In both the irrigated and dryland trials in 1998, the highest IVDMD values were associated with the lowest acid detergent lignin percentages which are typical for many BMR hybrids.

Nitrate nitrogen levels in Tables 2 and 3 were generally below the 2000 ppm level often listed for initial toxicity concern for ruminants. However, previous research with similar forages in western Nebraska showed some potentially toxic nitrate levels in irrigated forage in the first of two harvests during the summer, especially with high nitrogen fertility in the soil. Thus, nitrogen application rates will need to be managed carefully along with maturity stage at harvest to achieve satisfactory levels of CP without increasing nitrates to toxic levels.

The choice of an annual forage crop and cultivar may depend more on the time forage is needed in the grazing or harvested forage system rather than on differences in yield potential. Fitting a forage crop into a cropping system would be an important consideration. Also, equipment requirements for the shorter annuals, like small grain or foxtail millet forages, may already be in an operation for other hay crops, whereas equipment needed to easily harvest and feed the taller forages may be unique. Getting the thicker stemmed forages to dry down in a reasonable time period for making hay will usually require a crimping action of the forage during cutting. The emergence of hybrids with higher digestibility may enhance grazing of standing or windrowed summer annual forages during the winter.

CGS Associates

In September **Martin Massengale**, CGS Director, received the 2000 Exemplary Service to Agriculture Award from the Nebraska Ag Relations Council.

Steven Rothenberger is co-editor of a new book titled *A Prairie Mosaic: An Atlas of Central Nebraska's Land, Culture, and Nature* (see Resources).

UNL Research Towards Biological Control of Turfgrass Diseases — Part I *(continued from page 1)*

composts that suppress diseases by enriching microbe numbers and diversity in the turf. Another biocontrol strategy–one that is particularly attractive for commercialization–relies on the isolated microorganisms. The advantage of this strategy is that products involving isolated microorganisms are defined, and thus, their performance is more predictable. Currently, there is a commercial biocontrol product for fungal diseases of turfgrass that contains the fungus *Trichoderma harzianum*.

Successes at UNL

Research in my laboratory has focused on isolated bacteria as biocontrol agents. We chose bacteria as subjects because most bacterial species found on plants and in soil can be easily propagated in culture to high cell numbers. Furthermore, bacteria would be compatible with existing liquid pesticide and fungicide application procedures. We targeted two fungal pathogens: (1) *Rhizoctonia solani*, which causes brown patch disease in all cool- and warm-season turfgrass, and (2) *Bipolaris sorokiniana*, a cause of leaf spot and "blight" in several cool-season grasses. Although it is less destructive and has a smaller host range than *R. solani*, *B. sorokiniana* is representative of a large group of fungal pathogens formerly known as the "Helminthosporium" fungi.

Through the efforts of former graduate students Loren Giesler and Zhongge Zhang, a bacterium we coined C3 was found to be effective in controlling both target fungi. C3, which belongs in the species *Stenotrophomonas maltophilia*, was discovered on Kentucky bluegrass leaves. It first attracted our attention because of its aggressive suppression of fungal growth when applied to grass leaves in the laboratory. When sprayed onto tall fescue turf in a greenhouse, control of the fungal diseases was dramatic (Fig. 1). The ultimate proof of any control measure, however, is its effectiveness in the field; most biocontrol organisms, unfortunately, cannot meet this test. To our joy, C3 was effective in repeated field trials against brown patch and leaf spot. In order to obtain maximum effectiveness, C3 has to be cultured in a broth medium containing chitin, a polymer that makes up the bulk of fungal cell walls, and then the entire contents of a culture is applied in diluted form. The broth fluid is thought to provide nutrients for the growth of the bacterium on grass leaves. It also contains enzymes and other anti-fungal compounds produced by C3 while in culture. In 1999, we found this treatment to reduce damage from brown patch disease in tall fescue and perennial ryegrass and to provide a visible increase in the quality of the turf (Table 1). Disease control provided by C3, however, is not at levels provided by fungicides. Thus, considerable research on C3 is required before it can be a commercially practical system.

Table 1. Biocontrol of brown patch disease using bacterium C3 – ARDC, 1999.

Treatment	*Tall fescue*		*Perennial ryegrass*	
	Disease severity (1 low - 5 high)	*Quality (1 low - 10 high)*	*Disease severity (1 low - 5 high)*	*Quality (1 low - 10 high)*
C3 chitin broth culture	1.5	8.2	1.5	7.8
Fluid from C3 chitin broth culture	2.2	7.0	2.8	6.2
C3 cells in phosphate buffer	2.8	6.0	2.5	6.5
Nontreated control	3.8	5.0	3.8	4.0
LSD(0.05)	1.0	1.3	0.8	1.4

Author's Note: I wish to thank the Turfgrass Interdisciplinary Research Group and Lanny Wit, in particular, for providing infrastructure and assistance for my field research. For further information about biological control of plant diseases, please contact me at gyuen@unl.edu, 402-472-3125.

Barker and Collins to Give Leu Distinguished Lectures in November

As part of the 2000 Center for Grassland Studies Fall Seminar Series, Dr. Dave Barker from The Ohio State University will present "Biodiversity in New Zealand Grasslands" on November 13, 3:30-4:30 pm in the East Campus Union. While he is here, Barker will present an additional seminar titled "More Grass, More Beef, More $$?" on November 14, 9:00-10:00 am in A211 Animal Science Building.

Dr. Scott Collins with the Division of Environmental Biology at the National Science Foundation will present "Spatial and Temporal Dynamics in Tallgrass Prairie" on November 29, 3:30-4:30 in the East Campus Union. He will also meet with faculty to discuss trends in ecological research. Collins' visit is co-arranged by the Center for Grassland Studies and the Initiative in Ecological and Evolutionary Analysis.

The Barker and Collins seminars are free and open to the public. The Leu Distinguished Lectureship is made possible by an endowment from the Frank and Margaret Leu Foundation.

CGS Seminars Available on Video

Since 1996, selected presentations in the CGS Seminar Series have been videotaped by CGS staff and are available for check-out from the CGS reference center, 221 Keim Hall on the East Campus. To see a listing of all seminars and which are on video, see www.ianr.unl.edu/ianr/cgs/seminars.htm. This site also shows seminars remaining this year.

Prairie Restoration Cooperative

by Gerry Steinauer, Nebraska Game and Parks Commission

Hand collecting seeds from native prairies and wetlands on hot, muggy summer days in Nebraska is hard work. But the weather could not stop employees of the Prairie Plains Resource Institute (PPRI), Nebraska Game and Parks Commission (NGPC), and The Nature Conservancy (TNC) from collecting seeds from over 250 species of native grasses, sedges, and forbs this past summer. The seeds will be used to restore over 100 acres of wet meadows in the Platte and Loup River valleys and 50 acres of tallgrass prairie in Lancaster County. These restorations are being conducted as part of the Prairie Restoration Cooperative.

The Cooperative is a three-year, multi-agency project designed to restore threatened prairie and wetland plant communities in eastern and central Nebraska. Prairie Plains Resource Institute, located in Aurora, is the lead agency in the Cooperative and administrator of a grant from the Nebraska Environmental Trust that provides the majority of the funding for the project. Other project partners include the NGPC, U.S. Fish and Wildlife Service (USFWS), Natural Resources Conservation Service (NRCS), TNC, Pheasants Forever, and the Volunteer Conservation Corp.

During the project's duration, over 450 acres of prairie and wetlands will be restored and monitored. Native plant communities to be restored in years 2 and 3 of the project include Missouri River wet meadows (100 ac), tallgrass prairie (50 ac), loess mixedgrass prairie (100 ac), and Lancaster County saline wetland. Most of the land being restored is owned by the NGPC, but land owned by the USFWS, TNC, and private individuals whose properties are protected by Wetland Reserve Program easements will also be restored.

Since European settlement, a large majority of eastern and central Nebraska's prairie and wetlands has been destroyed or degraded through agricultural and urban development. Attempts to restore these plant communities have been few, and the staffs of conservation agencies have little, if any, experience conducting such restorations. Compounding the problem, locally-adapted seeds for most of Nebraska's native plants are commercially unavailable, or if available, extremely expensive.

The restorations conducted through the Cooperative will include up to 150 species per planting. Only seeds from local ecotypes will be used in the restorations, with most of the seed sources being within a 50-mile radius of the restorations. The seeds of wildlflowers and less abundant grasses and sedges will be hand collected. Seeds of the dominant grasses, such as big bluestem and Indiangrass, will be machine harvested using a pull-behind brush stripper and a combine.

Prairie Plains Resource Institute has been conducting tallgrass prairie restorations in the central Platte River valley for over 20 years. The knowledge and experience of PPRI will be relied upon heavily by the Cooperative while conducting the restorations. However, we hope to build upon this knowledge base as we conduct the restorations, in some cases, in previously unrestored plant community types such as salt marshes, Missouri River wet meadows, and loess mixedgrass prairie. At project's end we will produce restoration manuals for each restored plant community type detailing: species suitable for planting; seed collecting, storage and processing methods; planting methods; and post-planting management.

An additional goal of the Prairie Restoration Cooperative is to increase the availability of seeds of locally-adapted native plants for restorations, wildlife plantings, and landscaping in Nebraska. The Game and Parks Commission intends to harvest seeds off its restorations for future restorations and wildlife plantings on other NGPC lands and privately-owned lands enrolled in its wildlife programs. The private landowners with restorations under Wetland Reserve Program easements will be encouraged to harvest and sell native seeds as an alternative source of farming income. Finally, samples of seeds collected for the restorations will be provided to the Nebraska Statewide Arboretum. The Arboretum's long-term goal is to make these locally-adapted native plants available to nurseries and seed farms for use in landscaping and other plantings in Nebraska.

Interest in high-diversity prairie and wetland restorations in Nebraska grows each year among conservation agencies and private individuals; the days of the five-species, warm-season grass restorations appear to be nearing an end. The Prairie Restoration Cooperative hopes to provide a stimulus for more restorations, increase our working knowledge of prairie restoration in Nebraska, and increase the seed avail-

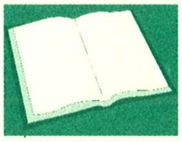
Info Tufts

Scientists at the U.S. Meat Animal Research Center (MARC), Clay Center, Nebraska, have developed methods that detect even a few E. coli O157:H7 in manure. The method was used in research that showed that feeding hay rather than a finishing ration to market-ready cattle for 7 days reduced the bacteria's prevalence from 52 to 18%. To see the complete article published by USDA-ARS, see www.ars.usda.gov/is/AR/archive/oct00/ecoli1000.htm.

On October 11 President Clinton signed a major conservation bill that will double spending next year for federal land acquisition and preservation. The bill earmarks $12 billion over six years for purchasing fragile lands, maintaining parks, preserving wildlife and other initiatives.

The Nature Conservancy has bought the 27,000-acre Camp Creek Ranch, which represents 20% of the Zumwalt prairie in the Northwest. The bunchgrass prairie covers 146,000 acres overall and is home to one of the nation's densest concentrations of nesting birds of prey.

Resources



The *2000 Nebraska Beef Report* is in press and should be available shortly. This annual report contains many research articles on a variety of topics related to beef production, including several on forage and grazing. Summaries of all the reports may be obtained from Nebraska Extension Educators. Summaries as well as the full reports are at ianrwww.unl.edu/ianr/anisci/beef/beef.htm. For a printed copy of the report, contact the Center for Grasslands Studies.

Developed in accordance with Executive Order 13112 on Invasive Species issued by President Clinton in February 1999, the Invasive Species Information System site (www.invasive species.gov) facilitates access to and exchange of invasive species data and resources by researchers, scientists, land and resource managers, public and private sector agencies, and concerned citizens. The site is guided by the Invasive Species Council, a federal, interagency, executive committee that is coordinating efforts to minimize the economic, ecological, and human impacts of invasive plant and animal species in the U.S. As a side note, the only production agriculture representative on a 32-member advisory committee to the Invasive Species Council is Nebraska rancher Barb Cooksley from Anselmo. If you wish to have input in this process, you can contact Barb through the CGS office.

World Resources 2000-2001: People and Ecosystems, The Fray*ing Web of Life*. Examines grassland, coastal, forest, freshwater, and agricultural ecosystems. Grades their health on the basis of their ability to produce the goods and services that the world currently relies on. These include production of food, provision of pure and sufficient water, storage of atmospheric carbon, maintenance of biodiversity, and provision of recreation and tourism opportunities. To access the online version or to order hard copy, see www.wri.org/wr2000.

Growing Carbon: A New Crop that Helps Agricultural Producers and the Climate Too. Free. New brochure sponsored by USDA (NRCS and National Agroforestry Center), Environmental Defense, and Soil and Water Conservation Society. Discusses opportunities producers have to help efforts to slow climate change, to build a cushion against its harmful effects, and perhaps to grow a new crop–carbon. Available online at www.swcs.org (Publications-Educational Resources), or call 1-888-526-3227, or e-mail landcare@swcs.org.

NatureServe is the name of a Web site (www.natureserve.org) that states it is a source for authoritative conservation information on more than 50,000 plants, animals, and ecological communities of the U.S. and Canada. It provides in-depth information on rare and endangered species, but includes common plants and animals, too. NatureServe is a product of the Association for Biodiversity Information in collaboration with the Natural Heritage Network.

Calendar

Contact CGS for more information on these upcoming events:

2000

Dec. 5-8: National Conference on Grazing Lands, Las Vegas, NV, http://www.glci.org/Call.htm

2001

Jan. 8-10: Turfgrass Conference and Equipment Show, Omaha, NE

If you have articles, events, resources, CGS Associate News, or other items you would like to submit for inclusion in future issues of this newsletter, please contact the editor, Pam Murray, at the CGS office.

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