nebraska Green Scene

An Annual Publication of the University of Nebraska–Lincoln's Department of Agronomy & Horticulture

ON FIRE
Research pyromania?

Green roof and grazing systems
Students pair up with professors for research

Who Dunnit?
The Big Red Green Team investigates a murder

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News from the Department of Agronomy & Horticulture

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On the Cover:

Who Dunnit: (photo by Erin Bauer) In the second episode of "Big Red Green Team: Investigating Scenes of Crime," bitter vandals terrorize the golf course, and the team must analyze the evidence and catch the culprits before they strike again. See page 8 for the full story.

Green roof and grazing systems: Find out what projects are keeping students of Agronomy and Horticulture engaged on pages 10–11.

On Fire: Research is heating up on page 13.

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Find our PDF newsletter on the Web at agronomy.unl.edu/newoutreach/alumni.html

Letter from the Head

Dr. Mark Lagrimini

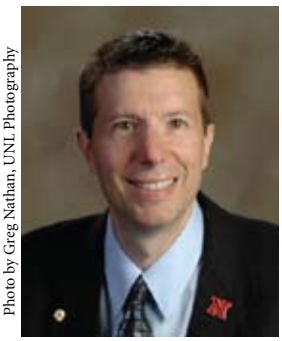


Photo by Greg Nathan, UNL Photography

It has been another outstanding year for the Department of Agronomy and Horticulture. Undergraduate enrollment is up thirty percent over the previous year due, in part, to the extraordinary efforts by our new student recruiter Anne Streich and our "GO GREEN" recruitment campaign initiated last year. It doesn't hurt that commodity prices are at an all-time high. The job market continues to look strong in Nebraska, with 100% of our graduates being placed with private university or governmental employers. Enrollment continues to look strong, with new majors in Plant Biology, Turf and Landscape Management, and Landscape Architecture leading the way. In addition, the College of Agriculture and Natural Resources leads the University in enrollment growth.

> "The job market continues to look strong in Nebraska with 100% of our graduates being placed with private, university or governmental employers."

Student enrollment is not the only thing growing in Nebraska. In this past year, Dr. Jeff Mower has been hired jointly with the Center of Plant Innovation in the area of Comparative Genomics, and Dr. Dipak Santra has been hired as an Alternative Crops Breeder for the Panhandle Research and Extension Center. The Department is currently interviewing to fill six vacant faculty positions including: a horticultural molecular geneticist to study the nutritional quality of fruits and vegetables; a plant stress physiologist to study the mechanisms by which plants compensate for drought and heat stress; a nutrient management specialist to work on improving irrigated and dryland crop productivity in West Central Nebraska; a range management/calf cow specialist to optimize range productivity for cattle production in Western Nebraska; a maize quantitative geneticist to study genes that control quantitative traits of agricultural importance; and a crop variety testing focused educator to coordinate the Nebraska Variety Testing Program. Dr. Lenis Nelson will be retiring at the end of 2008, and Dr. Ken Russell has left the University to pursue other interests.

To accommodate this growth, the University is renovating both Keim and Kiesselbach Halls. Kiesselbach Hall has received a new heating, ventilation and air conditioning (HVAC) system and minor improvements to interior spaces. Keim Hall will receive a $13.5 million renovation from head to toe. It will receive a new HVAC system, windows, office suites, classrooms and laboratories. Keim Hall will be a LEED-certified "GREEN" building, reusing existing materials and incorporating natural and plant-based materials in construction. The much maligned courtyard will be transformed into a one-of-a-kind teaching and recreational garden. Renovation began in August 2008 and is expected to take eighteen months to complete. We hope to see you in 2010 to celebrate the grand reopening of Keim Hall and the Centennial Celebration for the Department.

Make the Difference

Our students are the future of the green industry. We are relying on them to be problem solvers and forward thinkers. You can be part of their growth and development. To meet our educational challenges, we are offering you the opportunity to contribute to the University of Nebraska Foundation in support of the Department of Agronomy and Horticulture and its students. Together we can make a difference in the life of each student. Please make gifts payable to the University of Nebraska Foundation, 1010 Lincoln Mall, Suite 300, P.O. Box 82555, Lincoln, NE 68501-2555.

If you have questions about giving opportunities, please contact Dr. Mark Lagrimini, Professor and Head, Department of Agronomy and Horticulture, at (402)472–1555 or mlagrimini2@unl.edu. You may also contact Ann Bruntz, Director of Development IANR, University of Nebraska Foundation, at (402)458–1176 or abruntz@nufoundation.org.

Hot Peppers

Seminis Vegetable Seeds

By Terry Berke, Ph.D.,
Senior Plant Breeder

Since I received my Ph.D. degree in Plant Breeding under Dr. P. Stephen Baenziger in 1990, I have worked in diverse jobs on three different continents. I started with a post-doc in maize starch genetics at Purdue (1990–91), spent a semester teaching at a university in Les Cayes, Haiti (1992), and then did post-docs in maize molecular genetics at the University of Illinois (1992–93) and the Neve Ya'ar Research Center, Israel (1994–95). Needing a real job to support my wife and two children, I became the hot and sweet pepper breeder at the Asian Vegetable Research and Development Center (AVRDC) in Taiwan for five years (1995–2000) where we had two more children. Returning to the states, I became the hot pepper breeder at Seminis Vegetable Seeds (a wholly-owned subsidiary of Monsanto) in Woodland, California in 2000, where we had our fifth child. Two of my varieties Mariachi and Holy Mole have won the prestigious All-America Selections award for home garden varieties. I recently completed eight years with Seminis, all in Woodland. In April, I was privileged to return to Lincoln to give the Dermot P. Coyne Graduate Student Distinguished Lectureship and enjoyed meeting former teachers, friends, current teachers and graduate students. Please contact me at terry.berke@seminis.com.

> "I was privileged to return to Lincoln... and enjoyed meeting former teachers, friends, current teachers and graduate students."

Life Decisions Conservation & Cattle

By Eric M. Mousel

It was mid-July in Kansas, and I was trailing steers out of a creek-bottom pasture when it occurred to me: there has to be a better way to make a living from livestock and the land. The thought was a revelation, of sorts. I had never thought seriously about my educational future beyond just learning enough to get the next job done.

In an agricultural community south of Hastings, I grew up surrounded by an extended family of farmers and ranchers. My grandfather John Elder worked for the University of Nebraska–Lincoln's Conservation and Survey Division for nearly forty years. In the years following his retirement from UNL's CSD in 1983, we spent many hours talking about his experiences in land conservation and its evolution since the days of the Dust Bowl. I found his experience in Dodge City, Kansas, during the 1930s simply fascinating. My community and family laid the foundation for my interest in livestock and the land, which is why it was no accident that I chose to return to Nebraska to finish my education and plan my future.

I wanted a career that combined managing land and livestock; but, at the time, I did not know what that would be. These two vastly different interests, seemingly at opposite ends of the agricultural spectrum, became a crossroads for me at UNL's Department of Agronomy and Horticulture when I met Dr. Walter Schacht. It was his influence that cemented my future in the field of range livestock management.

At UNL, I completed my M.S. and Ph.D. programs under the guidance of Dr. Schacht. Along the way, the faculty members in Range Science enhanced my development as a researcher, teacher and professional. Dr. Lowell Moser was instrumental in developing both my interest in teaching and my teaching style. As his teaching assistant in Agronomy 240 for four semesters, I learned that his no-nonsense, practical approach to teaching really struck a chord with undergraduate students. I will never forget how refreshing it was to have faculty that took an interest in individual students.

Today, I am an assistant professor and range livestock specialist with South Dakota State University, living the dream of combining my interests in livestock and land conservation management through undergraduate teaching, research and extension education.

Reflecting on my experience at UNL, I strive to mirror the dedication and interest shown to me as I prepare the next generation of ranchers and land managers, in addition to working with ranchers all over the United States, Canada, Mexico, South America and Europe. There is a great deal of personal satisfaction in helping students become successful and aiding ranchers in making sound decisions that positively impact their bottom line.

The ranching industry has changed dramatically in the last thirty years, and changes in the next thirty may be more dramatic. The education and training I received from UNL have prepared me to meet the challenges of the 21st century and to help others address new challenges in the future of their ranching businesses.

a word from **Charlene Wendt**

By Charlene Wendt

I began my employment in the Department of Agronomy in 1985, serving as staff secretary to Professor August "Gus" Drier and Dr. James Stubbendieck. The summer of 1987 brought a change to my duties when I accepted the position of administrative secretary to the head of the department, Dr. Darrell Nelson. The next year, 1988, Dr. Nelson was appointed agricultural research dean for the Institute of Agriculture and Natural Resources, and since that time, I have served four department heads and one interim head. Two-time interim head Dr. Lowell Moser and department heads Dr. Robert Sherman, Dr. P. Stephen Baenziger, Dr. Kenneth Cassman, and, currently, Dr. Mark Lagrimini.

I've been able to view the world through the travels of our faculty, have had the opportunity to meet many national and international leaders in the agricultural arena and have become acquainted with graduate students from all over the world.

When I am not at work, I enjoy spending time with my husband, Rick, and our grandchildren. We spend time traveling the United States, and since my husband is a postmaster, some of our travels involve attending conventions of the National League of Postmasters of the United States. I am involved in the National League of Postmasters Auxiliary, and currently serve as its national president.

This is my twenty-fourth year with the department. I have had so many interesting experiences, some very funny and some very serious. My greatest joy and reward have come from serving and working with our faculty, staff and students. What an awesome experience it is!

a word from **Mitch Montgomery**

By Mitch Montgomery

The sight of a greenhouse in winter doesn't mean much to most people, but to Mitch Montgomery, agricultural research technologist in Steve Baenziger's small grains breeding program, it is the high point of the greenhouse season because it is plant 'crossing' time. Mitch came to the University of Nebraska–Lincoln in 1998 from North Dakota State University's oil seed breeding program.

Mitch and his crew are responsible for the propagation and care of 800 to 1,000 crosses each year—most of which eventually make it to the test plots. Preparatory work includes mixing soil for 8,000 pots, filling the pots and planting seeds, followed by months of constant watering and care. During the year, Mitch also helps with the field crops.

Although Mitch's first loves are his pots in the greenhouse, you can also find him riding on the planter or driving the combine during summer harvest. When Mitch is not in the field or greenhouse, you will find him camping with his family, fishing or showing off his talents as an Irish dancer.

a word from **Ruth Miller**

By Ruth Miller

Ruth Miller is a greenhouse manager for the Department of Agronomy and Horticulture and oversees the operations of fourteen different research greenhouses on East Campus. As part of her job, Ruth assists faculty, technicians and graduate students with research projects housed in the greenhouses. Ruth's duties require her to be knowledgeable about the sophisticated computer controls that are critical for monitoring and regulating conditions in the facilities. Ruth excels at her position and finds it to be the perfect job for her because she enjoys working with both plants and people so much.

Special Greetings from **Uruguay**

By Andrés Quincke

Editor's Note: Andrés Quincke and Verónica Ciganda came to UNL from Uruguay in 2000. During their six years in Lincoln, they both attained master's and doctoral degrees and started a family. They returned to Uruguay in the summer of 2006 with their three children. The following is an update from Andrés.

The first semester was a busy one for us, and so were all of the following ones. Yes, the six years of master's and doctoral programs were intense, but fun, too! Both Verónica and I are grateful to students, staff members, friends and neighbors who enriched our daily lives throughout our adventure. We are also thankful to the department's faculty members, especially those who advised us so thoroughly in our projects.

So, what are we up to now? We are both with the Instituto Nacional de Investigacion Agropecuaria, or INIA, at La Estanzuela's experimental station, near Colonia, Uruguay. I am working in soil management and fertility and especially enjoy managing two long-term experiments on mixed crop rotations, while also addressing soil fertility issues in continuous cropping systems. My wife, Verónica, is studying how intensified animal agriculture is impacting the environment through runoff and greenhouse gas emissions. She is also participating in an on-farm precision agriculture project. And our kids? Well, to tell you the truth, they are growing up climbing trees, watching birds and watering the garden here in La Estanzuela. At dinnertime, we often remember and talk about our old neighborhood, the zoo and the parks in Lincoln and, of course, East Campus.

Promotions & Tenure July 2008

Rhae Drijber

Promoted to full professor: Agronomy and Horticulture. Hired: 1994. Ph.D., University of Alberta, 1993; M.S., University of British Columbia, 1986; B.S., University of British Columbia, 1982. Area of focus: Research to describe, quantify and understand the functional roles of soil microbial communities as they exist in situ in natural and managed ecosystems. Teaching centers on principles and applications of soil microbial ecology.

Clyde L. Ogg

Promoted to associate Extension Educator: Agronomy and Horticulture. Hired: 1986. M.S., University of Nebraska–Lincoln, 1989; B.S., University of Nebraska–Lincoln, 1986. Area of focus: Develop a comprehensive statewide educational program of excellence in Pesticide Safety Education Programs including Integrated Pest Management.

Richard K. Sutton

Promoted to full professor: Agronomy and Horticulture. Hired: 1975. Ph.D., University of Wisconsin-Madison, 1997; M.L.A., Utah State University, 1974; B.S., Colorado State University, 1970. Area of focus: Landscape design and landscape architecture teaching; native plants and green roofs.

Kim Todd

Promoted to associate professor and awarded tenure: Agronomy and Horticulture. Hired: 2002. M.A., University of Nebraska–Lincoln, 1983; B.S.L.A., Iowa State University, 1975. Area of focus: Landscape design and management, focusing on woody and herbaceous landscape plants.

Jerry D. Volesky

Promoted to full professor: Agronomy and Horticulture, West Central Research and Extension Center. Hired: 1995. Ph.D., South Dakota State University, 1986; M.S., North Dakota State University, 1982; B.S., Dickinson State University, 1980. Area of focus: Programs focus on rangeland and forage management systems affecting grazing livestock productivity.

Twenty Years and **Growing**

By Luann and Rich Finke

Finke Gardens grew out of the experiences and relationships we developed at the University of Nebraska–Lincoln while students in the horticulture department. Rich and I worked on our bachelor's and master's degrees between 1975 and 1985 and had the good fortune of working with many legendary professors—Joe Young, Walt Bagley, Dermot Coyne and Dave McGill, to name a few, who set high standards of innovative excellence that inspired us. Working in the formative years of the Nebraska Statewide Arboretum (NSA) planted the seeds of what has now become a specialty nursery and landscape design company just a short distance from East Campus.

Our company sprouted and grew from the founding principle that it is good business to offer good plants. Exposure to native plants through ecology and botany classes and work with NSA members were great supplements to our horticulture and agronomy coursework. The innovative UNL campus landscape brought about by Bud Dasenbrock and Kim Todd set the example for how residential and commercial landscapes could evolve in Lincoln, and Finke Gardens has capitalized on that energy and inspiration. We learned from the best to seek out the new and unusual from "plant nuts" throughout the state.

Finke Gardens is located at 500 North 66th Street, just east of Westfield Gateway Mall. The narrow sliver of property that runs between the Mopac Bike Trail and Deadman's Run between 66th and 70th Streets produces a large portion of our trees and shrubs and also is home to our greenhouses, in which all of our own annual and perennial flowers are grown, as well as to our retail store, in which we offer garden furnishings, such as pottery, benches, statuary and fountains. While I work primarily as a landscape designer, Rich enjoys the growing side of the company. He can always be found in the retail greenhouse in busy spring and fall seasons, helping customers choose the best plants for their gardens.

As a landscape design and installation company, we mark our success with projects that range from SouthPointe Pavilions to long-term relationships with residential clients. We strive to develop landscape projects that use native and durable plants that are both low-maintenance and attractive.

> "Finke Gardens has capitalized on that energy and inspiration. We learned from the best to seek out the new and unusual from 'plant nuts' throughout the state."

We've also had the good fortune to employ many UNL students and graduates over the years. It's easy for us to forget how many years have past since we were in their shoes. We try to provide work experiences that will help prepare them to be the best horticulturists. Growing, selling, and designing plants are the easy parts; understanding clients, the environment and their confounding interactions are challenges for any professional.

We're sending our oldest off to college this fall, not to become a second generation of "Finke Gardens" but to follow the career example we have established by working hard to do what is right, being committed to care for the earth and by loving what you do. Rich and I have worked hard to build our business and set that example for our children, and it all began with our experiences at UNL.

Luann and Rich Finke
Finke Gardens and Nursery
500 North 66th Street, Lincoln, NE 68505
(402) 466–1995, www.finkegardens.com.

Green Scene Investigation

The Big Red Green Team is on the Case

By Erin Bauer

With the popularity of the television crime show "CSI," Agronomy and Horticulture department head Mark Lagrimini saw the opportunity for using the well-known franchise to attract new college students to agronomy and horticulture programs. After talking with extension educator Clyde Ogg and extension assistant Erin Bauer from the Pesticide Education Office, and electronic media producer Brad Mills from Communications and Information Technology about the project, the "Big Red Green Team: Investigating Scenes of Crime" series was born.

In early 2007, Ogg and Bauer created outlines for the CSI spoof and met with Lagrimini and Mills to discuss them. The goal was to film and produce the episodes and promote them on Web sites frequented by young audiences, especially future college students.

Lagrimini explained, "We are not just about solving crimes. Go Green! and the Big Red Green Team are about reintroducing Agronomy & Horticulture to the youth of Nebraska. We are all about feeding the world, protecting the environment, conserving energy, and training the next generation's farmers, scientists, designers, managers, and entrepreneurs. We are about developing landscapes that conserve water, producing food for less energy, and turning sunlight into fuel for our vehicles."

The Big Red Green Team project has provided a unique outreach opportunity. Unlike traditional recruitment strategies, this CSI spoof hopes to use popular culture to encourage students to enter careers in agronomy and horticulture. Already CSI has created an interest in the forensic sciences, and the Big Red Green Team hopes to do the same for future weed scientists, plant pathologists, agronomists, and soil scientists of the world. Go Green!

In the first episode of "Big Red Green Team: Investigating Scenes of Crime" titled "Batter Luck Next Time," the Big Red Green team must solve the murder of a star Husker baseball player.

BIG RED GREEN TEAM

Big Red Goes Green.

THIS MESSAGE OF "GREEN" HAS BEEN APPROVED BY THE BIG RED.
UNIVERSITY OF NEBRASKA–LINCOLN

How can you learn to inspire, grow and impact your career, your economy and your future?

Opportunity is not just a word your parents use; it is the ability to find the most drought-resistant crop; it is the chance to watch your own greenhouse flourish; it is the freedom to make your ranch succeed.

The Big Red Green Team of the Department of Agronomy and Horticulture offers you this chance with eight new program areas from Biotechnology to Sustainable Landscapes to help you reach your goals.

If you want something more than average, join the Big Red Green team and GROW.

meet Kelsey Latshaw

By Kelsey Latshaw

As a part of the Undergraduate Creative Activities and Research Experiences Program (UCARE), I am paired with faculty member Richard Sutton of the Department of Agronomy and Horticulture researching prairie plant establishment on green roofs. If the prairie plants continue to grow successfully, a whole new genre of plants could enhance green roof technology. Prairie plants have a history of surviving drought,

wind and other stressful situations. Their ability to withstand harsh conditions makes them perfect candidates for the green roof environment. Native plants have already adapted to our climate and are disease resistant; therefore, they will survive with less care than other species of plants. Low-maintenance plants are essential for a project like this because plants on the roof will not be extensively maintained.

A green roof consists of structure, building materials and growing media with plants. Of these three components, the media is by far the most vital to plant life. There are several important chemical and physical factors within growing media that regulate the ability of a plant to grow and develop. Growing media must provide water, supply macronutrients, permit gas exchange, support plant roots and act as a reservoir for micronutrients. The growing media, therefore, must be comprised of a delicate balance of macro- and micropores in the space between particles. This is to ensure that there are enough large pores, or macropores, to exchange oxygen with carbon dioxide and to drain excess water from the plant, while also having enough small pores, or micropores, to hold and store water for the plant. Because the growing media controls all these variables, to begin the research, I started testing Rooflite™, a certified green roof growing media. With the help of Jay Fitzgerald, I conducted tests finding the water-holding capacity and drainage qualities of the media. This was done by pouring water into small receptacles containing Rooflite™. Twenty-four hours later, the water was drained by removing a small plug in the bottom of the container.

> "The site stands as a historical representation of the prairie that once covered the whole state. To preserve the priceless environment, I designed a plan to make the location more publicly accessible, visible and enjoyable."

After testing, the media was applied to Nebraska's first commercial green roof on the new Nature Center at Pioneers Park. Prairie plants were planted randomly in twelve treatment blocks. Some plots were left as controls, while others were inoculated with prairie soil microbes, Horta-Sorb™, an absorbent, or a combination of both. I am currently incorporating my recorded testing of Rooflite™ into a research paper to be published next year. This research will heighten public awareness of green roofs and also promote their many benefits: reducing storm runoff, insulating roofs, filtering pollutants and mitigating excess heat from buildings.

As a part of UCARE, I also am currently designing the entrance to Lincoln's Nine Mile Prairie with Richard and David Wedin, of the School of Natural Resources. The site stands as a historical representation of the prairie that once covered the whole state. To preserve this priceless environment, I designed a plan to make the location more publicly accessible, visible and enjoyable. The highlights of the plan include a sod roof prairie shelter to serve as a place to sit and picnic, a series of plots that will feature native prairie plants and identify them for educational purposes and separate paths for pedestrian and vehicular access.

Reflecting Back

By Dale Lindgren

It has been almost forty years since I graduated from what was then known as the University of Nebraska–Lincoln's Department of Horticulture and Forestry. I was fortunate to earn a bachelor of science degree with majors in both horticulture and agronomy. That combination of majors has been invaluable throughout my career.

I also experienced the department as a faculty member, which has provided me with a unique opportunity to view departmental changes. The most significant change has been the evolution of technology in all phases of education, including research. However, one vital area has remained the same—the special contacts and relationships forged between students and teachers.

I have special memories of my undergraduate horticulture instructors, especially Drs. Coyne, O'Keefe and Kinbacher. In fact, when I returned to the University of Nebraska as an assistant professor at the West Central Research and Extension Center, all three of these horticulture members became my colleagues.

I had the chance to attend graduate school in Wisconsin, travel to special places and make acquaintances. I feel I can make a difference in the industry in which I work.

I genuinely appreciate those special years as an undergraduate at UNL. My degree prepared me well for a very satisfying career, and I know our current and future students will experience similar rewards, because the fields of agronomy and horticulture have so much to offer.

meet Jessica Milby

By Jessica Milby

This is the third summer I have spent working at the Barta Brothers Ranch south of Long Pine, Nebraska. The first two summers, I helped graduate students with their projects, as well as doing general ranch work. This summer is a little bit different, though, because I received a Undergraduate Creative Activities and Research Experiences (UCARE) grant to work on my own project—Plant Community Response to Grazing Systems in the Nebraska Sandhills.

This is the 10th year of a grazing study on the ranch that compares the differences between eight pasture short-duration grazing systems and four pasture-deferred rotation systems. Before the study began, permanent transects were established at 87 sites throughout the ranch. These transects run parallel to the contour of the land on the top of dunes, at the midpoint between dune tops and valleys on both north- and south-facing slopes, and through the center of valleys between dunes. The transects on the dune tops and slopes are 100 meters long, while the valley transects are 50 meters long. Plant species' frequency was estimated along each transect by placing a 0.1 m^2 quadrat at four-meter intervals, for a total of 25 quadrats on the slopes and dune tops, and 13 quadrats in the valleys. At every quadrat placement, all the plants rooted inside the quadrat are identified by species and then recorded. These measurements were taken in 1998, the year the transects were established then five years later in 2003, and again this summer. The goals of the project are to determine if the different grazing systems have affected the plant communities since their implementation and to look at how plant communities change based on the topographical position of the transect.

Mitch Stephenson, a range and forage graduate student, and I began reading the transects in the middle of June. Before starting, we had to be sure that all the warm season plants had emerged and were actively growing so we could get an accurate count of all the species present. At the same time, we wanted to be able to finish reading the transects before the cool season grasses became dormant or unidentifiable.

I am fortunate to have the opportunity to be involved in research that interests me while I am an undergraduate student. One of my favorite classes at the University has been Dr. Jim Stubbendieck's Wildland Plants class, where students learn how to identify 200 of the most important range plants in North America, as well as using a key to identify grasses. Returning to the ranch for a third summer to work on this project has been a great learning experience, and I have been able to spend the summer enjoying the beauty of the Sandhills.

Own Time, Any Time Tour

Living Horticulture Matters

By Emily Levine and Elizabeth Killinger

Visitors to the University of Nebraska–Lincoln's East Campus can take advantage of two new Department of Agronomy and Horticulture projects designed to help them enjoy, understand and learn from the campus's unique horticultural resources.

The "Own Time, Any Time" cell phone tour of the Earl G. Maxwell Arboretum is the result of the master's project of horticulture student Elizabeth Killinger. A native of Cotesfield, Nebraska, Killinger received her undergraduate degree in horticulture from UNL. Working under associate professor Kim Todd, Killinger used voice mail technology to create the tour, which guides visitors to points of interest in the arboretum. Users dial a general access number and, from there, are guided through a series of options. Currently, there are five stops and two information numbers on the tour, but there are plans for expansion, as the possibilities with this technology are virtually limitless. Tour brochures with maps are available at the East Campus Visitor's Center, located in the Dairy Store.

Killinger writes, "Visitors coming to East Campus for an ice cream cone or to enjoy the fall colors may not be aware of the international links between a particular plant and history or the diversity of learning opportunities available. These little-known bits of information provide a layer of interest and intrigue, personalizing and connecting what is often perceived as a vast institution to real people and real events."

The tour emphasizes history by including information on giants in the field of plant sciences at the university, such as Charles Bessey, John E. Weaver, George Beadle and Earl Maxwell, himself. There are tour stops about specific plants, gardens and collections, including Fleming Slope and the three plant breeding brothers for which it is named, the design principals used in creating Yeutter Garden and the history and lore of lilacs. The tour's information numbers lead you to the ReTree Nebraska Program and the Big Red Green Team. There are also numbers at which you can leave feedback and find out what is new and different. The number to access the tour is (402) 472–5555.

The second project is called UNL Gardens, and it is dedicated to the proposition that East Campus's living horticultural resources are not only places to enjoy aesthetically but are also invaluable educational tools and places to reflect on life. They are often overlooked jewels in the crown of Lincoln's green spaces. UNL Gardens is a joint project of the Department of Agronomy and Horticulture and the support group of the University of Nebraska–Lincoln's Botanical Garden and Arboretum—the UNL Garden Friends. As such, the project is concerned with the academic department's gardens, as well as those of the UNL Botanical Garden and Arboretum. Additional operating expenses are provided by the Friends of Maxwell Arboretum.

The main focus of the project is the Web site at unlgardens.unl.edu. The site contains inventories, maps and information on the plants and gardens of East Campus. You can access information on each of the cultivars in the Flack Lilac Collection, read about the history of the Perin Porch or learn how the department's demonstration and teaching garden gives students hands-on experience. You will find lots of horticultural "read more about it" here with special emphasis on historical resources. We aim to link the horticultural world to the greater world of ideas—to literature, philosophy, history, politics and poetry. If gardening were just about the plants, it would be a great thing; the fact that it connects us to the wider world is what imbues it with meaning and makes it a sustaining force in our lives.

In addition to presenting material on the gardens of East Campus, the Web site will present information on the horticultural history of the campus, published resources on horticulture of the Great Plains from the past 140 years and links to other great Web sites to enrich your gardening experiences and love of plants.

Both of the above-mentioned projects will serve the university community—students, faculty and staff—as innovative teaching tools to enhance education, as well as welcoming the greater Lincoln community to East Campus. They will also benefit the many visitors to campus who come from all across the state and around the world. Because of the telephonic and Web technology utilized by the projects, they are accessible even to those who cannot make the trip to our beautiful campus.

Flaming

A Potential New Tool for Weed Control

By Stevan Knezevic

There is an increased interest in organic production among farmers and industries with current organic food sales totaling $15 billion, or 2.5 percent of the food market. Demand for organics is expected to continue with sales of organic foods projected to reach $25 billion by 2010.

Growth in organic food sales has brought additional farmland into organic production, totaling about four million acres nationwide. Nebraska was ranked ninth nationally in 2006 in certified organic crop acres with 80,000 acres and 10th in certified organic pasture acres with 20,000 acres. Of the most common organic agronomic crops, Nebraska has 20,000 acres of organic wheat, 15,000 acres of organic corn, and 10,000 acres each of organic soybeans and alfalfa.

Organic producers rank weeds as their number-one problem. Hand weeding and cultivation are the most popular physical methods for weed control utilized by organic growers. However, hand weeding is becoming cost prohibitive, while repeated cultivation increases the chance for soil erosion and promotes emergence of new weed flushes. In addition, there are only a few organic herbicides approved for use in organic production, and they are very expensive, some costing in excess of $1000/acre. Therefore, there is a need to evaluate various alternative and integrated methods of weed control. The use of propane for weed flaming is one of the alternative methods for weed control in organically grown agronomic crops.

During the flaming process, heat from the flame is transferred to plant tissues increasing the thermal energy of plant cells and resulting in coagulation of cell proteins if the temperature exceeds 50 degrees Centigrade. Furthermore, exposing plant tissue to a temperature of about 100 degrees Centigrade for a split second, e.g., 0.1 second, can cause cell membrane rupture, resulting in water loss and plant death.

We are currently conducting a series of experiments to obtain baseline information on crop and weed tolerance to broadcast flaming in Nebraska. As part of Santiago Ulloa's doctoral thesis, the dose response curves of propane will be described for control of 12 major weed species and tolerance of six major agronomic crops. We believe that depending on the desired level of weed control or tolerable crop injury level, a propane dose can be selected to either control the weed or reduce its growth, offsetting its competitive ability against the crop.

Flaming in our project is conducted using a custom-built flamer mounted on an all-terrain vehicle, which produces open flames utilizing propane as the source of combustion. There are four burners on the LT 2x8 liquid torch, placed 30 centimeters apart.

Based on the first year of data, broadleaf weeds and broadleaf crops are more susceptible to flaming than are grassy species. About 80 percent control was achieved with a propane rate of four gallons per acre for velvetleaf and pigweed, compared to eight gallons per acre for barnyard grass and seven gallons per acre for green foxtail. There was no complete kill of barnyard grass or green foxtail, as the plants regrew in three to four weeks. Despite the regrowth, flaming provided early season control of both grassy species by severely reducing their growth, thereby offsetting their competitive ability against the crop. Similarly, corn and sorghum were less susceptible to flaming than were soybean and sunflower. Such differences are likely a result of the physical positioning of the species' growing points at the time of flaming. Growing points in broadleaf species were above ground, thus exposed to the flame; in contrast, growing points in grassy species during early growth stages were below the soil surface, thereby protecting them from the flame.

Flaming has the potential to be utilized as a very effective tool for managing broadleaf weeds and suppressing an early season growth of grasses. Based on our testing to date, we feel that broadcast flaming has the most potential for use in field corn. These studies are continuing into the 2009–2010 seasons. For additional information, please contact me at (402) 584–2808, e-mail knezevic2@unl.edu.

Agronomy & Horticulture **2007 Photo Contest Winners**

"Dismal in the Fall" by Garald Horst

"Dragonfly" by Courtney Schuler

"Biodynamic Vineyard" by Jessica Kelling

Crop Plant Water Use and Drought Tolerance

A Lay Person's Primer

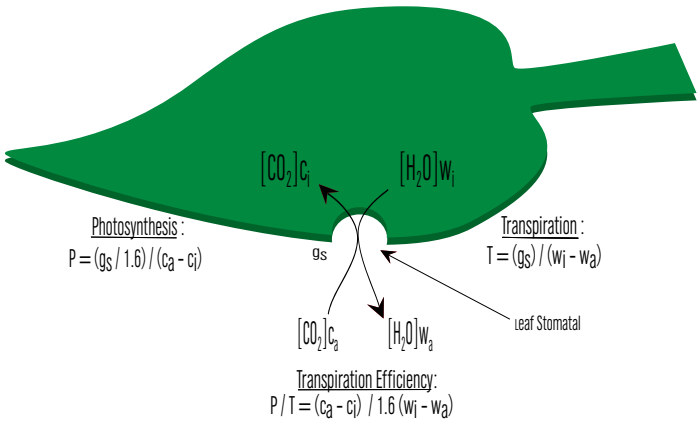
By Jim Specht

Consider these numbers: one inch of rain covering an acre of land, i.e., 43,560 square feet, constitutes 27,154 gallons of water. A gallon of water weighs 8.35 pounds, so one acre-inch of water from rain or irrigation weighs 213,613 pounds, or about 115 tons. An early-May to late-September Nebraska soybean crop producing 70 bushels per acre will require about 20 acre-inches of water, which translates into 543,080 gallons or 2,300 tons! Each plant, if there were 110,000 plants per acre, would require about a five-gallon bucket of water during that season.

Why do plants require so much water? Plant leaves gather light energy to convert a carbon dioxide (CO_2) molecule into carbohydrate , e.g., CH_2O, via a process known as "photosynthesis," during which two water (H_2O) molecules are also fractured to obtain the hydrogen protons and electrons needed to reduce the carbon, which thereby releases oxygen (O_2) and a water molecule: $CO_2 + 2H_2O$ + light energy → $CH_2O + H_2O$. The photosynthetic reaction shows that plants "consume" one net H_2O molecule for every CO_2 molecule fixed and reduced. However, plants use much more H_2O than that. When a leaf pore, known as a stomatal aperture, opens to let CO_2 enter the leaf, H_2O simultaneously escapes from the very humid leaf interior to the less humid, often quite dry, atmosphere. This process is called "transpiration." During the time it takes for just one CO_2 molecule to pass through a soybean leaf pore on a typical summer day, 400 H_2O molecules will pass by and exit that same leaf pore as water vapor! To avoid dehydration, a plant's root system must continuously explore the soil to scavenge the water needed to replenish this substantive transpiratory daily water loss.

> "Each plant, if there were 110,000 plants per acre, would require about a five-gallon bucket of water during that season."

Because the plant has no choice but to exchange many molecules of H_2O for every CO_2 molecule it acquires, photosynthesis and transpiration are highly coupled processes. Indeed, I and others have shown that cumulative seasonal crop biomass is linearly related to seasonal crop transpiration amount, i.e., BM = P/T x T, where BM is the seasonal biomass amount, P/T is the CO_2/H_2O exchange ratio, and Ts is the seasonal transpiration amount. The linear relationship also holds for seed yield, i.e., SY = P/T x T x HI, where SY is the final seed yield, and HI or harvest index, denotes the fraction of biomass that is seed. These simple equations make clear that if one reduces the seasonal transpiration amount, one will inevitably reduce seasonal biomass and seed yield. Reducing total seasonal transpiration is not the route to better drought tolerance. Actually, the key to better drought tolerance is the CO_2/H_2O exchange ratio, which is also known as water-use efficiency or transpiration efficiency.



In the above diagram, **g_s** is stomatal conductance (a reflection of leaf stomatal aperature width), which plants can adjust to regulate the *simultaneous* entry of CO_2 (**c**) and exit of H_2O. The concentrations of CO_2 (**c**) and H_2O (**w**) in the atmosphere (**a**) and leaf interior (**i**) are denoted by the respective terms **c_a** and **c_i** and **w_a** and **w_i**. Plants have no control over **c_a** or **w_a**, and plant adjustment of leaf **w_i** is limited. However, **c_i** is regulated by the plant's carboxylation mechanism. Note: CO_2 is heavier than H_2O and thus diffuses 1.6 times slower.

Some scientists have focused on reducing the amount of transpiratory water loss per photosynthetic unit of CO_2. However, this approach, often used by molecular biologists, will almost invariably result in a lessened stomatal aperture during parts of the day or growing season. A lessened stomatal aperture does reduce transpiratory H_2O loss more than it reduces photosynthetic CO_2 acquisition—in fact, partially closing stomatal aperture is how plants naturally regulate their leaf water content. However, a reduction in stomatal aperture typically reduces total seasonal transpiration, as well. The resultant trade-off in crop productivity, i.e., yield, that occurs with this kind of drought tolerance focus is not acceptable to most producers in the United States.

Other scientists focus on enhancing the amount of photosynthetic CO_2 acquisition achieved per unit of transpiratory water loss. One way to achieve greater water-use efficiency without a yield trade-off is to enable a faster diffusion of CO_2 into the leaf, which can be accomplished by steepening the gradient between the atmospheric CO_2 concentration, which is currently 384 ppm, but rising, and the steady-state concentration of CO_2 at the site of its fixation in the leaf, which is typically about 50 to 60 ppm for soybean, though numbers as low as 40 ppm have been reported. To search for genotypes and genes with greater WUE in my soybean drought tolerance research, I am using a technique called "genomic gene" mapping. I do not have sufficient space here to describe that technique, but I can report that I have identified soybean genomic locations that likely harbor genes that have either major or minor effects on soybean WUE.

Skip–Row Corn

Alternative in Conventional Planting

By Dr. Robert Klein, Cropping Systems Specialist

Corn yield is very sensitive to drought in the silking to blister stages. In trying to solve the problem of low yields in limited-water situations, the skip-row corn team, consisting of Robert Klein, Drew Lyon, David Baltensperger, Mark Bernards, Roger Elmore, Stevan Knezevic, Steve Mason, Steve Melvin, Len Nelson, Alex Pavlista and Charles Shapiro, applied principles from a 2002 study of experimental grain sorghum hybrids to corn. The theory derived from the grain sorghum study is that skipping rows i.e., not planting seeds in every row, will prevent developing corn plants from depleting soil moisture too early in the season; and, with Roundup Ready™ corn, weeds can be managed economically. In the sorghum study's initial trial with the lowest moisture level in 95 years, the only rows that produced grain were those next to missing rows, where the hybrids did not produce viable stands.

The corn study began on July 2, 2003, after a wet spring. Rows of corn were removed from conventionally planted plots for a skip-row configuration. Plots with two rows removed between two remaining rows yielded 32 percent more corn than did conventionally planted plots and 22 percent more than plots where every other plant was removed to equal the conventional population.

Based on these results, the skip-row team, as well as participating producers in Nebraska, Kansas and Colorado, expanded the trials. In 2004 and 2005, Charles Shapiro and Stevan Knezevic conducted trials in Concord; Steve Mason and Len Nelson tested skip-row in Lincoln; Mark Bernards and Roger Elmore planted skip-row plots at Clay Center; and Drew Lyon, Alex Pavlista and David Baltensperger tried it in the Panhandle. Steve Melvin also planted skip-row corn at Curtis and other locations. Bob Klein had plots at North Platte, Hayes Center, Trenton and Ogallala, as did participating producers at Tribune and Scott City, Kansas, and Akron, Colorado.

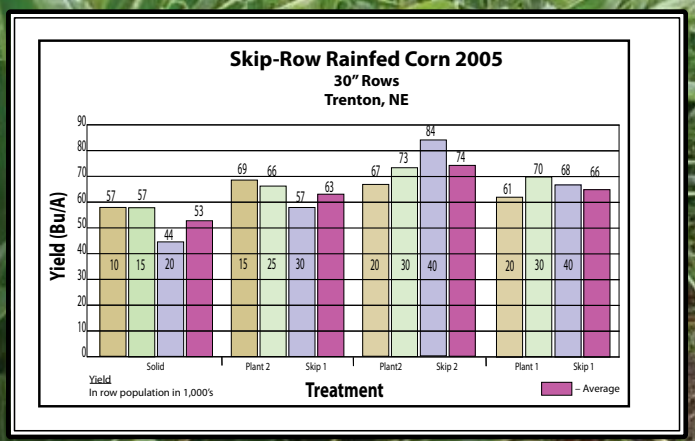
Planting configurations included: no skipped rows, control; one skipped row for every two planted rows; one skipped row alternating with a planted row; and two skipped rows alternating with two planted rows each, at three populations.

The research indicates that, for yields under 100 bushels, the plant two/skip two will increase corn yields, while the plant two/skip one will result in higher yields than conventional, up to 170 bushels, under limited irrigation with good crop residue. At the South Central Agricultural Lab, plant two/skip one averaged 174 bushels versus 155 bushels conventional.

Many UNL Extension educational events conveyed these results to growers and others involved in agribusiness. One of the first informational programs concerning the skip-row research results was on Market Journal. The information was disseminated at other events, including plot tours, skip-row meetings, corn/soybean workshops and water conferences.

Results achieved by selected producers include the following: Doug Lee of Madrid had 100 bushels per acre of skip-row, versus 60 bushels per acre planted conventionally. Marty Schurr of Maywood had skip-row corn yielding 30 and 60 bushels per acre more than his conventionally planted corn. Ray and Tammy Wooten of Potter planted skip-row in 2005 and harvested corn for the first time in four years. Doug and Don Criswell of Chappell harvested 57 bushels of skip-row corn planted at 10,000 seeds per acre in a plant two/skip two, compared to 37 bushels planted conventionally at 14,000 seeds per acre.

Insurance companies are reluctant to insure a skip-row crop at the same rate as a conventionally planted one, which is a primary obstacle limiting farm adoption of the skip-row technique. Specifically, in a plant two/skip two configuration, insurance companies insure it as if only half the field were planted. Skip-row team members have been working to educate insurance company representatives, and, as a result, it appears that companies may fully insure skip-row corn in the very near future.



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