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ENDEAVORS

Highlights of University of Nebraska–Lincoln Agricultural Research Division research
2005-06

Sharing discoveries, innovations statewide

Through their ongoing research and discovery, University of Nebraska–Lincoln Agricultural Research Division scientists provide scientific leadership, new knowledge, technological advancements and innovative solutions for Nebraska and the nation.

The Agricultural Research Division (ARD) is part of the university's Institute of Agriculture and Natural Resources. It has a unique role as Nebraska's only public entity responsible for conducting agricultural research. As Nebraska's Agricultural Experiment Station, ARD ties Nebraska to a network of agricultural research at land-grant universities nationwide.

IANR scientists concentrate their efforts on high priority research with the best potential long-term payoffs for Nebraskans. They work on both applied research, directed at solving immediate problems, and basic research, which pushes the frontiers of knowledge and provides answers for the future.

With roughly 370 research projects, our work is diverse. Yet every project shares a common goal: enhancing Nebraska's food and agriculture industry; its families, communities and businesses; and its environment, natural resources and quality of life.

We share our research with Nebraskans from the classroom to the field. As IANR faculty, our scientists also teach students or educate Nebraskans through UNL Extension. In the classroom, researchers incorporate their findings into lessons for their students, who have opportunities to work side-by-side on research.

This 2005-06 edition of Endeavors features a sampling of progress on some of our ongoing research projects that address the needs of Nebraskans. For more information, visit the ARD Web site at <http://ard.unl.edu>.

If you have questions or comments, please contact the ARD office, 207 Ag Hall, P.O. Box 830704, University of Nebraska, Lincoln, Neb., 68583-0704; phone, (402) 472-2045.

New tool aids crop decisions when water restricted

Nebraska irrigators facing limited water supplies have a new tool to help them make better-informed cropping decisions.

The Water Optimizer, a decision-support computer program developed by IANR researchers, became available to farmers in 2005. A biological systems engineer and an agricultural economist designed the tool in response to continued drought, water limits and policies that restrict water use in parts of Nebraska.

Water Optimizer helps farmers maximize their profits by helping them sort out how best to use their limited irrigation water. They can evaluate whether it would be most profitable to grow different crops, irrigate fewer acres, apply less water to existing crops or go to dryland farming.

The tool evaluates single fields for several crop options. Irrigated crops include: corn, soybeans, sorghum, wheat, alfalfa, edible beans and sunflowers. Dryland crops include: corn, soybeans, sorghum, sunflowers, alfalfa and wheat in continuous summer fallow and eco-fallow rotations.

Growers load information such as the amount of water available, soil type, irrigation system type and fuel type for



The Water Optimizer, a decision-support computer program, developed by IANR researchers, helps farmers sort out how best to use their irrigation water.

irrigation into a spreadsheet. They also enter their production costs, irrigation costs, crop prices and crop type.

The program uses this individualized information to calculate the crops that will be most profitable with the given costs and available water.

The program lets growers weigh and compare different options on a computer screen. By running "what if" scenarios, they can see the relative payoffs of different choices.

Other potential uses of the program include comparing management strategies such as profit-maximizing deficit irrigation, fixed crop rotations, single- and multi-year full irrigation strategies, or Environmental Quality Incentives Program or Conservation Reserve Enhancement Program leasing.

The Water Optimizer tool is available on the Web at <http://extension-water.unl.edu/> or on a DVD/CD set.

Quantifying impact of attack on nation's grain marketing system

A terrorist attack on the nation's grain marketing infrastructure could mean major losses in U.S. grain exports.

That's the conclusion of a UNL agricultural economist who analyzed the impact of grain handling disruptions at the Port of New Orleans, which handles up to three-quarters of U.S. corn exports. This work is part of ongoing multi-state research quantifying economic ramifications of a terrorist attack on the nation's grain marketing system.

The IANR study found that a moderate to medium disruption at this critical port would result in a \$600 million to \$900 million annual loss in export value.

Researchers developed a database to project economic impacts of terrorist attack scenarios that reduced the Port of New Orleans' corn export volume by 10 percent, 15 percent and 25 percent for a year. Analysis was based on three-year average cash corn prices and grain movements from 1997 through 1999.

The database showed no change in the U.S. export market from the 10 percent reduction; a 15 percent disruption would cut U.S. corn export sales by 1 percent.

The real change came with a 25 percent loss export volume at New Orleans. That conservatively would cost the United States \$600 million per year in lost exports.

Researchers found reductions beyond 25 percent would require a major change in world corn markets. The United States is the world's leading corn exporter. Ultimately, global demand for corn probably couldn't be met if U.S. exports dropped more than 25 percent.

This research provides information for national security officials who must plan for possible terrorist events. Findings also offered insights into the potential economic losses caused by Hurricane Katrina's disruption of grain exports at the port.

Soy oil finding's help shape food allergen labeling laws

UNL soybean oil research is influencing food allergen labeling laws here and abroad.

An international study by IANR food scientists confirmed that highly refined soybean oil does not cause reactions in people who are allergic to soybeans. Soy-allergic people don't react because refined oil contains only minuscule amounts of protein, the culprit in allergic reactions. Findings do not apply to cold- or expeller-pressed soy oil, which contains more protein and may cause reactions.

The study has drawn interest internationally from allergic consumers, food manufacturers and farmers as well as regulators because soybeans are a common allergen and soy oil is used extensively in foods worldwide.

Scientists in the university's Food Allergy Research and Resource Program shared their findings with policy-makers, congressional staffers, industry and the leading consumer group for allergic consumers.

The Nebraska findings played a role in

European Union food allergen labeling decisions in 2005 as well as the U.S. Food Allergen Labeling and Consumer Protection Act of 2004, which Congress passed to protect allergic consumers.

Highly refined soybean oil was among the soy components that the European Union temporarily exempted from food allergen labeling regulations. Industry included UNL's findings in a successful request for a three-year temporary exemption.

Earlier, U.S. regulators exempted highly refined vegetable oils derived from known allergens, such as soybeans or peanuts, from the new federal food allergen labeling law that takes effect in 2006. Nebraska's research contributed to the scientific evidence for that decision.

As a result, ingredient labels on foods containing soy oil need not explicitly list soy oil. Instead, labels can read "soybean, canola or safflower oil."

These decisions help preserve soybean growers' widest possible access to the world's markets.

Feedlot heat stress research saves millions

Widespread adoption of IANR-developed strategies for reducing heat stress in feedlot cattle is saving the region's cattle industry millions annually in cattle deaths and performance losses.

In the past decade, at least five summer heat waves killed feedlot cattle and reduced feedlot cattle performance in Nebraska. During this time, extensive research by animal scientists at the university's Northeast Research and Extension Center/Haskell Agricultural Laboratory at Concord expanded understanding of the nature of heat waves' impact on cattle. Scientists developed management strategies that reduce heat stress in cattle and an extensive UNL Extension education effort helped producers adopt these preventive measures.



In the 2005 heat wave alone, this effort saved the region's cattle industry between \$10 million and \$27 million, thanks to widespread adoption of these IANR-developed strategies. This estimate of economic impact is based on information collected about the heat waves' severity and the number of cattle on feed at the time.

This analysis showed a steady decline in the percentage of feedlot cattle that died during the most severe heat waves of 1995, 1999 and 2005. Cattle deaths as a percent of those on feed dropped from 2.32 percent in 1995 to 1.25 percent in 1999 and to 0.61 percent in 2005. The 1995 heat wave was slightly more severe and occurred before research results were available. Death and performance losses declined as more producers adopted prevention strategies during the decade.

The 1.71 percent decline in death loss between the 1995 and 2005 heat waves represents a savings of more than \$27 million. The 0.64 percent decline in death loss between 1999 and 2005 heat waves of similar magnitude represents more than \$10 million in savings.

Field trials providing info to combat soybean rust

Soybean rust is a major new disease worry for growers nationwide. UNL plant pathologists are studying this threat to ensure Nebraska farmers have information and resources to combat rust if it strikes the state.

Thirteen field trials across Nebraska during the 2005 growing season examined various aspects of fungicide application and efficacy. Researchers also are studying how planting and maturity dates and soybean varieties influence the disease. IANR plant pathologists will use these preliminary results and future field trials to devise an integrated soybean rust management program for Nebraska growers.

IANR's product performance trials examined fungicide application timing, techniques and rates as well as chemigation, the application of fungicide through center pivot irrigation systems. Since soybean rust hadn't made its way to Nebraska, researchers evaluated and treated another common



foliar disease of soybean, brown spot, to collect data.

Findings will provide practical, science-based information growers and companies can use to decide whether chemigation is a good way to apply foliar fungicides to treat soybean rust. They're also looking at the economic feasibility of different treatments.

If soybean rust develops in Nebraska, scientists don't think it will require treatment every year. That's why it's important to understand the role planting and maturity dates and different varieties play in disease control. This information will help researchers devise an integrated management program to control the disease and reduce the need for fungicides.

Much of Nebraska's research is conducted in collaboration with the North Central Soybean Research Program. Results of trials and research findings are posted on the university's soybean rust Web site, soybean-rust.unl.edu, as soon as possible so growers can access the latest information.

Cattle grazing influences bird nesting in Sandhills

When it comes to bird-nesting success in Nebraska's Sandhills, the number of cattle grazing a pasture can be more important than the type of grazing system being used, UNL School of Natural Resources research found.

In the three-year study of cattle's impact on bird nesting, wildlife ecologists compared different grazing schemes – season-long and short- and medium-length rotations – to determine which provide the bird habitat. Findings are providing insights about how best to manage grazing to optimize benefits for cattle and birds.

Scientists initially thought rotational grazing would give birds the best chance at nesting success because cattle would be in a given area for a short time before being moved elsewhere. Rotations would allow vegetation to regrow to varying heights, creating more habitat diversity.

However, this IANR study found stocking rates – the number of cattle introduced into any grazing system –

most strongly influence grazing intensity and nesting success.

Stocking rates can vary widely within the same type of grazing system as ranchers make decisions within their own ranch. Scientists say that may explain why they didn't see big differences in nesting success among different systems.

Nesting was most productive regardless of the grazing regime when land had a chance to rest. Management-intensive pastures didn't always have more bird species. While it might seem that pastures grazed season-long would have fewer species and less nesting success, this IANR study found that no one system favored high species diversity.

Findings indicate a mix of grazing approaches within a region would provide the greatest habitat diversity. Scientists now are focusing on small-scale changes within pastures to determine how grazing pressures within different systems affect birds.

Initiative increases UNL expertise, collaboration for water research

Water is one of Nebraska's leading resources. A new initiative is strengthening UNL scientists' ability to explore and understand this vital resource and positioning UNL as a water research and education leader.

The Water Resources Research Initiative aims to enhance and expand UNL's water research by promoting greater collaboration between scientists with diverse water expertise and bolstering the university's water research capacity. Launched in late 2003, the initiative already is beginning to pay off. This effort includes numerous departments and colleges. IANR researchers play key roles in this effort.

UNL has formed collaborative teams of scientists with diverse expertise, hired additional researchers in key areas, developed comprehensive research proposals and is increasing cooperation with water-focused federal and state agencies. In 2005, the initiative was named one of 11 Programs of Excellence at UNL.

Seven new researchers were hired in 2005 to strengthen UNL's hand in water law, water quality, water chemistry, water economics, surface and river ecology and climate modeling. They complement the university's traditional strengths in groundwater hydrology, water quality, drought mitigation, climate change, irrigation, remote sensing and geographic information systems.

The initiative is helping scientists better compete for federal funds to address issues such as contaminated soil, groundwater and surface water as well as launch an economic study of drought-depressed Lake McConaughy and participate in the Platte River Cooperative Hydrology Study. Graduate and undergraduate water, policy and law programs also are expanding to help train tomorrow's water scientists and policy-makers.

This multi-disciplinary focus is enabling UNL scientists to tackle complex water-related issues facing Nebraskans and provide information needed for wise water management. In an era of increasing concern about and competition for water, their findings also will benefit the Great Plains and the nation.

Demand growing for IANR's improved, water-thrifty buffalograsses

Demand for UNL's water-thrifty turf-type buffalograsses is increasing nationwide as people look for more sustainable turf options.

IANR-developed turf buffalograsses are showing up in lawns, golf courses, roadways and parks coast to coast. Demand is greatest in water-short areas such as the West; interest is increasing in eastern states and even abroad.

These improved buffalograsses are the result of long-running IANR research to provide environmentally friendlier turf. Buffalograss requires up to 50 percent less water than Kentucky bluegrass, far less mowing and fertilization, and grows in poor soils.

Thanks to careful breeding and selection, Nebraska's turf buffalograsses retain their prairie ancestors' toughness, but with looks suited for lawns. Improved buffalograsses generally are denser, darker green and keep their color longer than traditional buffalograss.

Since 1990, nine turf buffalograsses developed by IANR turf scientists have been commercialized for sale to the public or the turf industry. Private companies in Nebraska and elsewhere grow and sell these improved buffalograsses as seed, sod or plugs under licensing agreements with the university. Royalties from buffalograss sales have earned the university about \$1.1 million since 1990. Royalties help fund ongoing research.

IANR turf scientists were among the first to examine buffalograsses' turf potential. Before Nebraska's research began in 1984, turf nationwide research focused on non-native grasses; buffalograss was primarily considered pasture grass. Today, UNL is the nation's leader in turf buffalograss research.



Buffalograss test plots at the Agricultural Research and Development Center near Mead.

Lighter weight replacement heifers cut feed costs without hurting reproductive performance

Feed is the single biggest cost in cow-calf operations. New UNL research indicates producers can save on feed by developing replacement heifers to lighter than traditional weights.

Typically, ranchers equate lighter weight replacement heifers with poor pregnancy rates and calving difficulty. However, IANR animal science research shows replacement heifers can be developed to a lighter-than-traditional weight without hurting reproductive performance.

The study found no problems in developing spring-born heifers to 53 percent of mature breeding weight compared with 58 percent. Tradition-

ally, ranchers develop replacement heifers to 60 percent or 65 percent of mature weight. This lighter approach significantly reduces costs for developing heifers from fall weaning until the following summer's breeding season.

Feeding heifers to 53 percent of mature weight costs about \$22 per head less during the development period than feeding to traditional replacement weights. In a 500-cow operation with 15 percent of heifers replaced annually, that represents a \$1,650 annual savings.

In this three-year study at the university's Gudmundsen Sandhills Laboratory near Whitman, heifers reached 53 percent or 58 percent of the weight of a mature 1,200-pound cow at the beginning of the breeding season. The two weight groups had similar average calf birth dates, weights and calving difficulties.

There also was no difference between the two weight groups in the percentage of cows that successfully rebred for their critical second pregnancy. Researchers tracked lighter heifers through their fourth pregnancy and found no problems. The heifers remained at lighter than traditional weights as mature cows.



Beef reproductive physiologist, Rick Funston, studied lighter weight replacement heifers.

Undergrads and scientists team on research efforts

Some undergraduates get hands-on research experience working with IANR scientists on studies that tackle issues important to Nebraskans.

UNL's Agricultural Research Division's Honors Student Research program funds selected research by undergraduates who work closely with IANR researchers. The students' studies let them apply their classroom learning to real-world scientific problems and experience discovery firsthand. Scientists say students' findings contribute to ongoing research programs. For example:

Beef producers and the environment should benefit from an animal science student's study of phosphorus levels in cattle bones. She worked with IANR animal scientists who are examining cattle's need for this essential nutrient. Results indicate cattle have plenty of phosphorus and don't need supplemental phosphorus. Findings should

help producers reduce supplement costs and excess phosphorus in manure.

Cattle feeders are already using results of an agribusiness student's research. Working with an IANR agricultural economist, he surveyed Nebraska feedyards, compared employee variables such as wages, education and benefit packages, and calculated industry averages that feedlot managers can use in hiring decisions. His findings are detailed in a UNL Extension publication the pair authored.

A veterinary science undergrad's research on West Nile Virus in horses should lead to better diagnoses for the state's horse industry. Her findings suggest some horses with West Nile symptoms may have had prior exposure to the virus from an earlier infection or a vaccination to prevent the disease. The IANR veterinary scientist who advised her said this work will improve the accuracy of diagnoses.

Studies provide insights about antibiotics' fate in soil

Applying manure to cropland enriches soil and puts waste to good use. Today's manure may contain traces of antibiotics used in livestock production and there's growing interest in knowing what happens to antibiotics in the environment.

Scientists know relatively little about the fate of antibiotics in soil. To find out, IANR agricultural scientists teamed with a USDA Agricultural Research Service researcher at UNL and others on field studies at the West Central Research and Extension Center at North Platte.

Manure from confined cattle fed the recommended dose of oxytetracycline, an antibiotic commonly used in rations, was applied to irrigated corn plots at UNL recommended or twice the recommended rates. Scientists sampled soil at different depths and tested water from the bottom of 8-foot sealed columns of soil, called lysimeters.

Traces of oxytetracycline were detected in topsoil for 17 months after manure application. Levels decreased over time and the antibiotic was undetectable after 18 months. Two years of testing found no oxytetracycline in water collected 8 feet under test plots.

Manured plots contained significantly more tetracycline-resistant bacteria in topsoil than commercially fertilized plots



To learn more about what happens to antibiotic residues after livestock manure is applied to fertilize cropland, IANR scientists conducted field studies at the university's West Central Research and Extension Center at North Platte. Agronomist David Tarkalson draws a water sample from an irrigated corn test plot.

for five months after application. Levels declined over time with no difference than commercially fertilized plots after five months. Further study is needed to determine whether the increase in resistant bacteria originates in the manure or develops in natural soil bacteria.

This research provided one of the first overviews of what happens when manure is applied to irrigated cropland. There's much more to learn but these findings lay the scientific foundation for further studies to better understand potential health and environmental implications.

Ozone cleans soil contaminated with explosives

Soil around former bomb-making plants often is contaminated with toxic compounds that can pollute groundwater and public drinking water. Conventional soil clean up methods are expensive.

An IANR soil environmental chemist and graduate student found ozone effectively cleans carbon-based explosives residues, such as RDX and TNT, from soil. Injecting ozone into soil as a fumigant turns the contaminants into

harmless carbon dioxide. Lab tests on soil from a Texas bomb plant site show ozone can be 100 percent effective at eliminating carbon-based residues.

Scientists are perfecting their technique for use with existing technology and equipment to pump ozone through the soil on a large scale.

Ozone injection should be simpler and less expensive than conventional soil cleanup methods that involve digging up, removing and incinerating soil.

Nutrition research finds many pre-school children short on key vitamins

Getting enough key vitamins is important to good health, especially for young children whose bodies are growing. Low-fat diets that many adults favor may leave children short on key fat-soluble vitamins, IANR research indicates.

A UNL nutrition scientist reached that conclusion after studying pre-school-age children in four Lincoln, Neb., day care centers. She launched her study to evaluate the National Academy of Sciences' dietary recommendation for vitamin E in children. She found these recommendations are appropriate.

Her study also revealed that two-thirds of these 2- to 5-year-olds don't consume enough vitamin E and one-third don't get enough vitamin C. Interviews with parents about their children's dietary intake indicated that young children who share their parents' low-fat diet may get inadequate vitamin E. Children deficient in either vitamin came equally from all ethnicities, genders and ages.

Based on this research, she recommends children regularly consume whole milk, nuts and seeds, regular salad dressings and whole-grain cereals fortified with vitamins plus plenty of citrus fruits and juices for vitamin C. Parents may also want to talk with their physician about whether their young children should take a multi-vitamin/multi-mineral supplement.

This College of Education and Human Sciences study highlights the importance of preparing healthy snacks and meals that provide adequate vitamins to meet children's needs. Parents and day care providers can use this information to ensure children are consuming enough vitamins.

The researcher is expanding her study to include more children, especially in rural areas.

Visit ARD's
Web site at

<http://ard.unl.edu>

New Sandhills facilities will aid research

Buildings completed in 2005 at UNL research facilities in the Sandhills significantly expand IANR research and educational capabilities.

The 9,100-square-foot Wagonhammer Education Center, dedicated in August at the Gudmundsen Sandhills Laboratory near Whitman, accommodates 300 people plus research and teaching space for faculty and graduate students. The main auditorium, named the Ray Bohy Conference Room, commemorates Bohy's 30 years' service to the university and IANR.

Two gifts – the first in 2001 from Elaine Wolf of Albion and her husband, James, who died in 2002, the other from Bohy – made the center possible. The Wolf family owns Wagonhammer Cattle Co.

Gudmundsen is the site of a variety of range, beef, soils, entomology, ecology, geology, hydrology and wildlife research. The center will enhance research and extension efforts.

The new Barta Brothers Ranch Research Facility near Long Pine is a two-story, 4,800-square-foot building. It will aid research by providing a meeting room for up to 30 people and dormitory space for researchers working at the ranch.

The building, including a full kitchen and living room, makes research at the ranch easier for scientists who previously had to travel 30 miles to the nearest hotel. It has four bedrooms upstairs to accommodate 12 people with room for an additional bedroom downstairs that could accommodate four others.

The ranch is named after brothers Clifford and James Barta who gave their 6,000-acre ranch to the University of Nebraska Foundation in 1996. The brothers also provided an estate gift to establish the Barta Brothers Fund, a permanent endowment for ongoing support of agriculture research.

Long-term research is the focus at Barta Brothers, including grazing systems, integrated resource management and Sandhills biodiversity. The ranch is also the site for demonstrating best management practices.

Research provides info to help turn crops into fuel

Producing ethanol and biodiesel from Nebraska corn and soybeans provides renewable fuel for Nebraskans and expands markets for the state's corn and soybeans.

UNL agricultural research is providing scientific, technical and economic information to help turn Nebraska's crops into biofuels. For example:

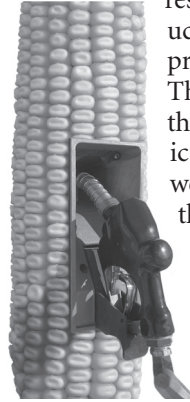
IANR researchers analyzed diverse aspects of Nebraska's ethanol production – from feedlot and corn price economics to the impact of ethanol expansion on the state's agriculture and Nebraska's comparative advantage in ethanol production. They reported their findings at a legislative briefing. Their analysis shows Nebraska's ethanol production costs are about the same as in Iowa but are 5 percent to 6 percent lower than in Illinois and Indiana. Nebraska's cattle feeding industry contributes to this advantage by providing a ready market for ethanol byproducts.

A study by the university's Industrial Agricultural Products Center helped

pinpoint the best soy biodiesel and ethanol blends for combining with petroleum diesel to create biodiesel when using both renewable fuels. This research showed the optimal combination is 20 percent soy biodiesel, 4 percent ethanol and 76 percent petroleum diesel.

IANR animal scientists' ongoing research on feeding ethanol byproducts to cattle is paying off for cattle producers and ethanol plants alike. Their earlier work demonstrated the feasibility, benefits and economic advantages of feeding byproducts wet instead of dry. It's estimated that feeding wet byproducts saves cattle feeders \$10 to \$20 per head. Selling byproducts wet instead of dry also reduces ethanol production costs about 5 percent.

Other IANR biofuels-related research includes quantifying modern ethanol's positive energy balance, evaluating the economic benefits of ethanol production, genetically engineering soybeans to enhance their biofuels use and exploring the feasibility of producing biodiesel in Nebraska.



Soybeans packed with beneficial omega-3 in the works

Wild salmon, tuna and sardines are among the foods rich in omega-3 fatty acid, which is touted for its role in preventing heart disease, cancer and other ailments. However, many Americans don't get enough of this beneficial fat in their diets.

IANR plant scientists are working to create soybeans rich in omega-3. It's part of broader research to modify soybean DNA and produce beans with enhanced nutritional or other characteristics.

They aim to develop soybeans high in omega-3 that could be fed to farm-raised fish or poultry to boost the amount of this important fatty acid in their meat. Consumers who eat the meat from fish or animals fed these enriched soybeans could improve their nutrition without changing their eating habits.

Researchers have already identified genes from other plants, inserted these genes in soybean cells and produced plants high in gamma-linolenic acid and stearidonic acid, the building

blocks for omega-3. Next they hope to transfer genes from a harmless plant fungus into cells from these soybeans to induce production of omega-3.

They also are field testing the new genetically modified soybeans to ensure they yield well before proceeding to that next, more difficult step. It's likely to take about a decade to develop soybeans high in omega-3 for commercial use. These specialty beans also could bring a premium for growers.



Plant Scientist Tom Clemente inspects a transgenic soybean plant in the greenhouse. Clemente's team uses biotechnology to develop soybeans rich in omega-3 fatty acid.

Probing genetic clues to reproductive development

There's mounting scientific evidence that what happens during fetal development affects fertility in adult humans and animals. Genetic, environmental, nutritional and other factors influence reproductive potential.

While scientists know how some of the genes function, they don't have a good overall picture of everything involved. A UNL animal scientist is working on a piece of this complex puzzle.

She's examining how vascular, or blood vessel, development influences overall development of the testicles and ovaries. This is basic research but understanding the genetic underpinnings of gonadal development eventually could lead to therapies for infertility.

Findings so far indicate blood vessel development plays a significant role in overall gonadal development. IANR researchers are focusing on a gene that produces a hormone, vascular endothelial growth factor, or VEGF.

When IANR researchers inhibited the hormone's ability to communicate with cells, they blocked formation of blood vessels in what would become testicles. This also blocked development of the structures necessary to make sperm.

This research showed that cells that make up the blood vessels migrate from adjacent tissue to the developing testes to form blood cells. Researchers also found VEGF in precursor and mature sperm cells, which indicates the hormone has a role in sperm development beyond blood vessel formation.

Reproductive problems are a growing concern. For example, 40 percent of adult men in industrialized countries have below normal sperm counts and the incidence of testicular cancer in men under age 20 is increasing at an alarming rate.

This work should aid a broader scientific effort to understand and someday treat the underlying causes of fertility problems.

Researchers exploring subsurface irrigation's potential

Going underground with irrigation could help farmers in water-short areas make the most of every drop.

Subsurface drip irrigation, or SDI, is the most water-thrifty system available but little is known about whether it's practical or feasible for Nebraska growers. New IANR research should answer these and other questions in the coming years. Preliminary results point to major water savings without sacrificing yields.

IANR researchers installed subsurface drip systems at the South Central Agricultural Laboratory near Clay Center in 2004, the Panhandle Research and Extension Center at Scottsbluff in 2003, and at the West Central Research and Extension Center at North Platte in 2003 and 2005. Findings will provide information on SDI's potential with central and western Nebraska soils, crops and farming practices.

SDI delivers water to the crop root zone drop by drop through plastic



Subsurface drip irrigation being installed at the West Central Research and Extension Center.

tubing buried 12-15 inches below the soil surface, virtually eliminating water loss on the soil surface. It also should boost nitrogen efficiency by spoon-feeding

fertilizer to crops as needed.

IANR researchers are studying crop water use, performance and yields response, water savings and nitrogen use efficiency. They also want to examine weed-crop competition for water, insect management, economic implications and how different crops and varieties respond.

First-year results from 2004 at Clay Center found similar yields for corn that received 10.3 inches, 7.7 inches and 5 inches of water through SDI. Yields were 225, 225 and 210 bushels per acre, respectively. This indicates using SDI could reduce water needs without hurting yields.

Future research also needs to address rodent damage to the plastic pipes, system maintenance and the economic feasibility of switching to SDI.



Entomologists' findings could cut aphid damage

Aphid is the most damaging crop pest worldwide but exactly how they harm plants has remained a puzzle. IANR entomologists are piecing together answers that could lead to better control.

Aphid damage causes plants to yellow. Scientists long thought aphids produced a toxin that damaged plant chloroplasts, where photosynthesis happens. But no toxin had been found.

IANR entomologists closely studied aphid-infested plants over time and before the tell-tale yellowing that signals aphid damage. This early inspection revealed abnormalities before visible signs of injury emerged and provided unseen other clues.

They also used fluorometry, which measures plants' energy status. The combination of early inspection and fluorometry revealed that aphids block energy from leaving the chloroplasts. It is a build up of molecules excited by this energy – not a toxin – that eventually chews up the cells and causes visible damage.

The discovery seems to hold true for most types of aphids. It points to the potential for a single solution to reduce losses across a variety of crops and aphid species.

While most plants are damaged by aphids, some are resistant. IANR entomologists now are exploring genes they believe have key roles in protecting resistant plants from aphid damage. If they pinpoint these protective genes and show they are more active in resistant plants during aphid infestations, the genes could be used to develop crops that survive aphid damage.

Creating plants that withstand aphids is a better solution than killing the insects. Over time, insects can develop resistance to chemical controls. Allowing aphids to feed on but not kill the plant maintains a natural balance.

glimpses at ARD research

- ◆ IANR scientists were among the most-cited worldwide in agricultural research over the last decade, according to a report that tracks the research that captures the interest of scientists globally. The ISI Essential Science Indicators Report, 1994-2004, indexed nearly 9,000 journals, tracking how often articles are cited by other authors. The report reviewed agricultural sciences articles published by 298 government institutions and large universities worldwide. UNL ranked eighth among U.S. universities, 10th among universities worldwide and 16th among all institutions. This report is an indication of the high quality of IANR research and its value to expanding scientific knowledge worldwide.
- ◆ A new test that quickly detects traces of soy flour is helping food processors better protect consumers with food allergies. It's the latest of several food allergen rapid detection tests developed by IANR food scientists. All are commercially available to the food industry through a university licensing agreement with Neogen, a Michigan company. The UNL team earlier devised tests for peanuts, milk, eggs, almonds and wheat gluten. A test for hazelnuts could be commercialized in the next year. Tests give processors a quick, reliable way to detect traces of an allergenic food on equipment or in foods processed on shared equipment. People with food allergies are safer thanks to these tests, which give processors the tools to check for allergen contamination so it doesn't reach consumers.
- ◆ Inaccurate seed placement takes a big bite out of yields at harvest. UNL biological systems engineers are working to improve planter accuracy by identifying the most important factors in putting seeds in just the right spot. They found that seed tubes play a key role and that wear on sugar beet planter seed tubes can significantly change seed placement. This research also indicates seed coatings can affect seed placement. Some coatings make the seed smoother while others don't affect the texture. This work is helping sugar beet growers fine-tune planters' accuracy.
- ◆ Rural immigrants furthering their education while working face many challenges. College of Education and Human Sciences researchers hope to improve the chances of success by identifying what helps or hinders rural immigrants' educational pursuits. This study of bilingual Latinos in Northeast Nebraska pursuing online classes at UNL showed significant family or community support and access to child care are keys to success. Participants with more support and those who were more integrated into their communities reported less stress and depression. These results and further research should help provide better services for rural immigrants and women seeking an education.
- ◆ The latest generation of decorative millets from UNL plant breeding efforts will debut in garden centers in 2006. The two newcomers – showy hybrids of pearl millet – are named Jester and Purple Baron. Ball Horticultural, a plant and seed wholesaler, will sell seed and young plants to the commercial greenhouse industry under a university licensing agreement. Both come from similar breeding lines as Purple Majesty, UNL's popular decorative millet that now grows in gardens worldwide.
- ◆ Government policies designed to encourage soil conservation also contain components that sometimes may lead to noncompliance, IANR agricultural economics research shows. While most producers comply, costs associated with soil conservation programs have led some producers to collect payments without complying. Under current policy, penalties for noncompliance equal the government payment, creating economic incentives for producers to falsely claim government payments. This research showed the extent of noncompliance and the level of conservation practice adoption depend on the size of the government payment, costs associated with adoption of practices, and level of government oversight and enforcement. Noncompliance can be completely deterred if the expected penalty exceeds costs of program adoption.
- ◆ Combining trees for harvest with grass for grazing could help producers make the most of the land and resources. An IANR range scientist and a plant stress physiologist are examining how different forage grasses perform under different amounts of shade from green ash and scotch pines. Their findings should help producers interested in silvopasturing, which combines trees, grasses or crops with livestock grazing.
- ◆ Hot, humid weather during the breeding season hurts beef cow reproduction, IANR research shows. In general, scientists found that conception rates drop 1 percent for each 1 degree Fahrenheit that breeding season temperatures are above normal. In Nebraska, a major beef producing state with roughly 2 million cows, a 1 percent drop in conception amounts to \$12 million in lost income for cow-calf producers if weaned calves bring \$600. Findings point to potentially significant consequences for producers if global warming increases average temperatures. This study, the first to quantify the relationship between environmental conditions and beef cow reproduction under typical pasture breeding conditions, shed light on this largely hidden production cost.
- ◆ Child care, transportation and health care are just a few things rural women worry about regardless of income. As part of a national study on welfare reform and rural women, IANR family scientists studied 42 rural Nebraska women of all incomes. They found that while 80 percent of the women reported being employed, many go in and out of the work force because of transportation and child care issues. This College of Education and Human Sciences research will provide information to help policy-makers better understand rural needs.

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