January 2005

Endeavors 2004-05

ENDEAVORS

Highlights of University of Nebraska-Lincoln Agricultural Research Division research

2004-05

Research, discovery for Nebraskans

Whether they're making a breakthrough discovery that expands the frontiers of science or developing innovative solutions to pressing practical problems, University of Nebraska-Lincoln's Agricultural Research Division scientists are committed to serving Nebraska and the nation.

ARD, a division of the university's Institute of Agriculture and Natural Resources, has a unique role as the only public entity in Nebraska responsible for conducting agricultural research. As Nebraska's Agricultural Experiment Station, ARD links the Cornhusker state to a nationwide network of agricultural research at land-grant universities.

ARD was created to serve the people of Nebraska and the nation. We take this responsibility seriously. Our scientists strive to provide the scientific knowledge and technologies critical to keeping Nebraska competitive. While our research enterprise is diverse, it has a common goal of enhancing Nebraska's food and agriculture industry; its families, communities and businesses; and its environment, natural resources and quality of life.

We share our discoveries with Nebraskans from the classroom to the field. We work closely with Nebraska Cooperative Extension to deliver research findings to people statewide. Our scientists are also teachers. In UNL classrooms, they incorporate their research findings into lessons for their students, who have opportunities to work side-by-side on research projects.

This 2004-05 edition of Endeavors features a sampling of ARD research under way to serve Nebraskans through research and discovery.

If you have questions or comments, please contact Darrell Nelson, ARD dean and director, 207 Ag Hall, P.O. Box 830704, University of Nebraska, Lincoln, Neb., 68583-0704; phone, (402) 472-2045; e-mail dnelson1@unl.edu. Or you can read more about ARD research online at our Research Nebraska magazine Web site, http://ard.unl.edu/nebraska.html.

Tallow key to new cholesterol fighter

Beef tallow may seem an unlikely cholesterol-fighter, but it's a key ingredient in a promising new food additive.

An IANR nutrition scientist combined components from soybeans and beef tallow – both abundant Nebraska products – to create the new cholesterol-lowering compound. It packs more cholesterol-lowering power than commercially available plant-based food additives and should be easier to incorporate into a variety of foods.

The new compound outperformed plant-based additives in animal studies, reducing LDL, or bad cholesterol, by around 70 percent, compared with 10 percent for commercially available plant-based additives. Preliminary research also suggests it works at least as well as widely prescribed cholesterol-lowering statin drugs.

This new compound is a blend of sterols from soybeans and stearic acid, a saturated fat, from beef tallow. In earlier studies of fats' roles in heart disease, this scientist found that stearic acid actually lowers cholesterol.

Scientists have long known plant sterols help reduce cholesterol but they don't dissolve in water. Mixing sterols with oil or fat improves their solubility but limits their use to higher fat foods such as margarine or salad dressings. Commercially available plant sterol additives also are gooey and stick to food manufacturing equipment.

Building on his earlier findings about stearic acid as a beneficial saturated fat, the IANR scientist devised a way to blend specific amounts of stearic acid with plant sterols. The combination boosts its cholesterol-lowering power.

It also is easily made into a powder that theoretically could be added to a variety of foods, from breakfast cereals to chocolate.

The College of Education and Human Sciences team is testing the compound's effectiveness in animal studies and exploring how best to commercialize it for consumers' benefit. The university is patenting this technology.

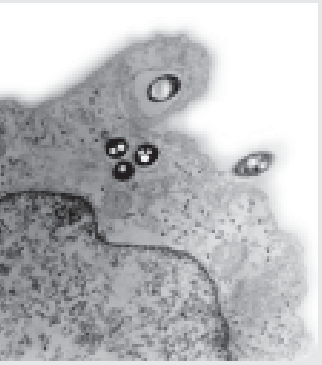
IANR Nutrition Scientist Tim Carr has developed a novel new cholesterol-fighting compound made from components in soybeans and beef tallow. Commercially available plant-based food additives (left) are gooey substances that stick to food processing equipment. Carr's compound is easily made into a powder (right) that should be useable in a variety of food products.

Exploring genetics of potential biological threat

Tularemia, a disease known mainly to hunters as rabbit fever, has taken on new, potentially diabolical dimensions since 9/11. Biosecurity officials fear terrorists might try to turn the naturally occurring bacterium that causes tularemia into a biological weapon.

Francisella tularensis is one of six organisms classified as Class A, or leading, bioterrorism agents, but scientists know little about how it causes disease.

IANR and NU Medical Center scientists are collaborating to better understand this organism and to learn why some subspecies cause disease while others don't. Such differences could lead to development of new control strategies.



In nature, tularemia primarily infects wild animals. People typically get it from skin contact with infected animals or ticks. However, a rare, potentially deadly inhaled form, called Type A, worries homeland security officials because it kills up to 60 percent of people who become infected.

IANR microbiologists have identified some genetic differences among different *F. tularensis* strains and are examining whether these differences are important to the disease process. Their research includes finding a way to manipulate specific genes, which is an essential step in evaluating which ones play roles in causing human illness.

These findings could help national security efforts to prepare the nation for the possibility that terrorists might try to use tularemia as a weapon. Unraveling the genetic links to the disease-causing process is a critical step toward protecting people. These discoveries also could point the way for developing vaccines or antibiotics to prevent or treat tularemia.

Creating wearable corn – husks, that is

Your favorite shirt or sweater someday might be made from Nebraska's leading crop – cornhusks to be exact.

An IANR textiles scientist has found a way to turn cornhusks into textiles. He has developed a process that efficiently, inexpensively converts cellulose in cornhusks into textile fibers that can be made into fabric. The university is patenting his invention.

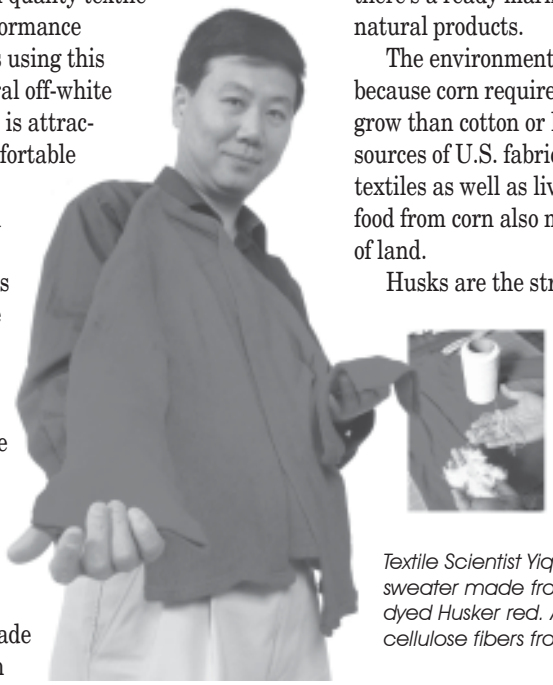
His initial research shows cornhusks produce a high quality textile with good performance characteristics using this process. Natural off-white cornhusk fiber is attractive, more comfortable than many synthetics and easy to dye.

Researchers have lots more work to do before cornhusk textiles become available, but the College of Education and Human Sciences team already has made a sweater from cornhusk yarn – dyed Husker red – to demonstrate the new textile's potential.

The economic impact of turning husks, which now blow out the back of a combine, into textiles could be significant. The United States produces about 20 million tons of cornhusks annually. If all of that were used to produce textiles, it could make at least 2 million tons of fibers worth about $2 billion annually. Textiles are a huge industry so there's a ready market for new, functional natural products.

The environment might benefit, too, because corn requires fewer chemicals to grow than cotton or linen plants, the primary sources of U.S. fabric fibers. Producing textiles as well as livestock feed or human food from corn also makes more efficient use of land.

Husks are the strongest part of the corn plant and researchers think their fibers could have other uses such as packing and wrapping materials, fiber composite materials and industrial fabrics.



Textile Scientist Yiqi Yang displays a sweater made from cornhusks and dyed Husker red. Above right are cellulose fibers from husks and yarn.

Tracking helps predict landslide sites

Landslides aren't unusual in Nebraska and sometimes threaten roads and homes, but most people don't recognize them since they're seldom as dramatic as slides elsewhere.

An IANR research geologist can spot a landslide anywhere in the state. He's studied, photographed and mapped more than 300 Nebraska slides since 1980. His research team has transformed years of carefully gathered and interpreted information on virtually every aspect of Nebraska landslides into computerized maps. They portray where slides have occurred and why, and help predict where slides are most likely.

Research Geologist Duane Eversoll records information at a landslide site near Lincoln. His research helps predict where landslides are likely.

Much of this landslide research is done for the Nebraska Department of Roads, which has spent hundreds of thousands of dollars controlling and stabilizing landslides, and fixing their damage. But the findings help developers, planners and engineers make more informed decisions about where, and where not, to build.

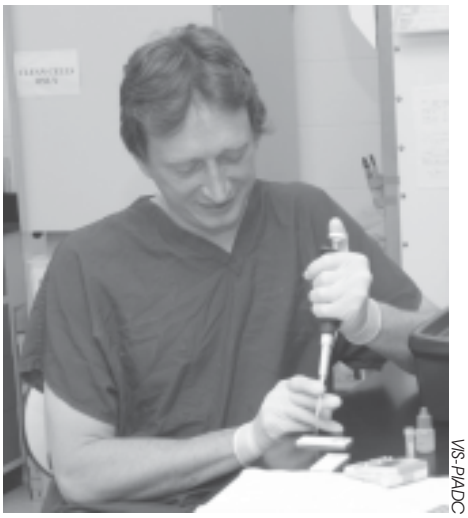
Most Nebraska landslides or slumps involve soil and rocks that break away from a slope or hillside over time, sometimes moving inches over years.

Assessing foot-and-mouth test kits

The United States has been free of foot-and-mouth disease since 1921. Animal health officials are doing everything possible to keep it that way because an outbreak could cost the U.S. economy billions of dollars.

But amid heightened national security, officials also must prepare for an outbreak they hope never materializes – by accident or terrorism. Foot-and-mouth, or FMD, doesn't affect people, but it's highly contagious and is the world's most economically devastating livestock disease.

International research by IANR veterinary scientists is helping federal animal health officials assess the effectiveness of FMD-testing tools. For this project, one of the IANR scientists is working at the Plum Island Animal Disease Center, USDA's high security lab, so he can collaborate with scientists there.



VS-PADC

Gustavo Delhon, an IANR veterinary scientist, tests a foot-and-mouth disease kit at USDA's Plum Island Animal Disease Center, off the Long Island coast.

Researchers evaluated the effectiveness of commercial test kits used internationally to distinguish cattle vaccinated against FMD from those infected with the disease. Kits detect antibodies that only infected animals carry in their blood.

Such tests could be used after emergency vaccinations following an outbreak to see if cattle were exposed to the virus after vaccination. U.S. animal health officials need to know how the tests perform in the field.

To find out, an IANR veterinary scientist tested the kits in Argentina in collaboration with that nation's animal health laboratory in a real-life foot-and-mouth epidemic. Back in Nebraska, colleagues analyzed the field data on each kit's performance.

This was the first comprehensive field evaluation of the tests by U.S. scientists. Results revealed differences among the tests. Information about each test's performance under different conditions will aid biosecurity preparedness.

Remote images could predict crop health

Farmers soon should be able to see how crops are faring, spot stressed and healthy plants or predict yields months before harvest, all by viewing satellite or aerial images.

IANR scientists with the Center for Advanced Land Management Information Technologies are developing tools to translate remotely gathered data and images into practical crop information. This research should lead to new sensors for detecting key crop information and new ways of transforming sensor data and remote images into useful tools, including maps.

Scientists are working on how best to remotely assess chlorophyll content, photosynthesis, leaf area, plant biomass and other indicators of plant vigor and productivity in crop fields.

They hope to make the technology and tools publicly available soon in a user-friendly format. Eventually, this technology should give farmers a snapshot of potential yield early in the growing season as well as overall plant condition without field scouting or testing.

The image maps, derived from aircraft sensors, are detailed enough to show where fields, or parts of a field, need fertilizer, additional water or other attention. The images reveal problems before they can be seen with the naked eye so farmers can target problem areas before they become severe.

Treating only the areas that need attention uses resources more efficiently.

If funding becomes available, researchers plan to transfer this new technology into a useable public format. Eventually, products or data might be offered either as a free or subscriber Web service, maps or photographic images.

New mapping system tracks livestock diseases

Whether natural or the result of bioterrorism, an animal disease outbreak could quickly threaten the state's or nation's livestock industry. Some diseases also might endanger human health.

IANR researchers developed a livestock disease mapping system that is helping state and national animal health officials better track potential disease threats. It's among the latest tools devised by remote sensing and geographic information experts at the University of Nebraska-Lincoln's Center for Advanced Land Management Information Technologies to help state and federal agencies anticipate, manage and respond to diseases, natural disasters and homeland security.

This system monitors livestock by species, location, numbers, disease outbreaks and susceptibility as well as other factors. The database helps pinpoint when, where and what type of disease may be occurring and tracks disease patterns over time.

This system essentially bundles complex information from diverse sources with geographic data, which makes the information more accessible, powerful and useful.

The IANR team devised the animal health tracking system after the Nebraska Department of Agriculture and USDA sought help in 2003. System information is confidential. Authorized personnel in these agencies use the system to better track and prepare for livestock disease outbreaks in Nebraska, prepare for potential bioterrorism threats involving animal diseases and protect the state's people and livestock.

This system could be adapted to track diseases nationwide or for homeland security tracking needs.

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Exploring genetics behind obesity

America has a weighty problem. More than 60 percent of U.S. adults are overweight or obese, according to the Centers for Disease Control.

Basic research by IANR animal scientists could lead to a better understanding of how and which genes predispose some people to obesity.

Obesity is a complex genetic trait. Each person or animal inherits hundreds of genes that interact with each other and with the environment to create a unique predisposition for obesity. Scientists know little about them, but advances in molecular biology are changing that.

IANR animal scientists are studying the genes that predispose people and animals to obesity. As part of this research, Jackie Potts, an animal science lab manager, works with a mouse that was specially bred to be obese.

A molecular geneticist and colleagues are using these powerful new technologies in their search for obesity-predisposition genes.

Researchers are comparing genes from several mice strains specially bred for obesity studies, including two types developed by an IANR animal scientist. These mice are similar except they were bred to burn either fewer or more calories, causing obesity or leanness.

They're studying the difference in gene expression between the fat and normal mice to isolate obesity predisposition genes. They're still seeking that first piece of this complex trait puzzle but have found clues. They know, for example, that the genes they're chasing are involved in energy regulation – the balance between calories consumed and calories burned.

After genes are located in mice, medical researchers can use the information to see if they play similar roles in humans. Better understanding of the genetics of obesity predisposition someday could help scientists develop new tools to diagnose and manage obesity. Those could include drugs that block or alter the products of obesity-related genes.

Genetic technologies also could enhance livestock producers' efforts to breed leaner animals.

Team seeks lower cost ways to reduce arsenic

Complying with new lower federal limits for arsenic in drinking water will be a big financial burden for some small Nebraska towns because traditional cleanup methods are expensive.

IANR water scientists are working with several small towns across the state to evaluate the occurrence of arsenic in water supplies. They're researching ways to reduce arsenic in groundwater that cost less than drilling new wells or traditional approaches to removing the contaminant. Arsenic occurs naturally and is linked to some types of cancer and other health problems.

Public water systems have until 2006 to comply with new U.S. Environmental Protection Agency regulations that reduce the amount of arsenic allowed in drinking water from 50 to 10 parts per billion.

It's estimated that complying with this new EPA standard could easily total more than $120 million for small community water systems statewide. More than 75 small public water systems across Nebraska could have trouble complying because of costs.

One method IANR scientists are studying is removing arsenic within the aquifer before pumping the water. This approach uses iron oxides, similar to rust, to attract and bond with the arsenic to remove it from the water. Researchers also are helping communities improve their well water sampling procedures to better assess arsenic levels.

The goal is to develop recommendations to help public water supplies meet the 2006 deadline. This research should provide practical information that could save small water systems thousands of dollars on arsenic cleanup costs.

IANR water scientists are working with small towns on lower cost ways to reduce arsenic levels in public water supplies. Here, Lynn Klawer, project coordinator, collects a sample from a small community's water main.

Larger, softer kernels boost feed value

When it comes to corn and beef cattle feed efficiency, it really is what's inside that counts, IANR animal scientists have found.

Research on the nutritional value of different corn hybrids has showed that selecting hybrids with favorable chemical and physical traits could dramatically increase feed efficiency.

This study involved seven commercially available corn hybrids with different chemical and physical properties. In feedlot trials, two hybrids provided better than average feed-to-gain ratios, while four others showed promise.

The difference in feed efficiency — how effectively an animal converts feed into gain — between the lowest and highest performer in this study was more than 9 percent.

A key finding was that larger, softer kernels with a greater proportion of soft starch content produced the best feeding performance for cattle.

Feeders historically have preferred harder corn because of its higher test weight, but this research demonstrates that test weight is not a good indicator for animal performance.

IANR researchers hope feed hybrids someday will be labeled for hard or soft endosperm content. Feeders could use this information to buy corn that is best for cattle, while corn growers could target the feed market niche with specialized hybrids.

Feed is a cattle producer's biggest expense, so this is a critical finding for an industry that accounts for 56 percent of Nebraska's agricultural production.

Alternative crops could aid Panhandle

Expanding cropping options in Nebraska's Panhandle should help the region's economy as well as its farmers.

That's why IANR agricultural scientists continue to identify, study and introduce potential alternative crops for the region's semi-arid, high plains climate.

There's no guarantee a crop that grows well elsewhere will thrive in the Panhandle. To find out, researchers look at everything from how different varieties perform to their market potential. Findings help growers learn to plant, manage, harvest and sell the new crops.

IANR research over the years has helped turn sunflowers, sugarbeets and proso millet into regional mainstays. It also provides key information for growing emerging crops such as chicory.

Sunflowers, now a Panhandle mainstay, were once an alternative crop. IANR researchers are exploring other potential new crops for the region.

Today scientists hope to bolster the list of crop options by studying other potential newcomers. For example, they are evaluating brown mustard and canola, which can be used to make biodiesel, an environmentally friendly fuel alternative that blends well with petroleum-based diesel and one day may even replace it.

Other non-food crops, such as turfgrass, actually grow better in the Panhandle than in other areas because the region's low humidity restricts growth of diseases. Turfgrass seed production is a growing part of the Panhandle's agricultural economy.

Bird seed, including proso and foxtail millet, sunflower, sorghum and safflower, is the region's third largest acreage crop behind wheat and corn.

The food industry remains an important market for new crops. Researchers are testing growing conditions and marketability of canola, sunflower and safflower for cooking or salad oils. Salad bar favorites such as chickpeas, also called garbanzo beans, show promise.

Research also continues on chicory, which now is processed for a pet food additive but one day may be used in human foods.

Better understanding servant-leadership

IANR researchers are advancing the understanding of leadership trends that favor teamwork over traditional management approaches.

IANR leadership education experts identified five key factors that can be used to differentiate an emerging organizational philosophy known as servant-leadership.

Servant-leadership de-emphasizes rank in favor of teamwork, personal growth and an ethical, caring environment.

Researchers surveyed 80 elected leaders and their staffs, and identified five factors related to servant-leadership: altruistic calling, emotional healing, mental astuteness, persuasive mapping and organizational stewardship.

Aspects of these five factors include a desire to make a positive difference in the lives of others; a commitment to helping others recover from hardship; the ability to pick up cues from the environment and understand their implications; skill at framing issues and dreaming up new ideas; and legacy building.

Findings suggest servant-leadership creates a higher quality relationship between leaders and employees than more traditional leadership forms.

This research provides an assessment tool to aid leadership research and help businesses, agencies and other organizations create more effective leadership opportunities.

Analysis examines impact of GM crops

Ultimately, consumers will decide the fate of agricultural biotechnology in the marketplace.

That's among the findings of an IANR agricultural economist who has extensively studied the market and welfare ramifications of introducing genetically modified, or GM, products into the food system.

Overall, this research found that consumer attitudes toward GM food and consumers' influence on public policy will significantly affect demand for GM products throughout the system. Consumer acceptance and demand depend mostly on whether people think this technology benefits them and whether they believe GM foods differ from traditional products.

Mandatory labeling could increase costs and, ultimately, boost consumer food prices, according to this analysis.

It also indicated that introduction and regulation of GM foods are likely to continue to create conflicts of interest and disagreements among growers, companies and consumers. For example, this study found that consumers, ag producers and biotech companies seldom agree on the regulation and labeling of GM products.

While GM crops are being used in foods, consumers so far haven't enjoyed cost savings or other benefits from the first generation of products of ag biotechnology. However, this research showed the potential for significant benefits from the introduction of consumer-oriented GM products for consumer welfare as well as market acceptance and growth of agricultural biotechnology.

This economic analysis provides a clearer picture of what's likely to happen to GM products in the marketplace under different regulatory and labeling scenarios. Decision-makers, regulators and others can use these findings to make agricultural biotechnology policy choices.

Simulation tool aids corn growers

A user-friendly computer program that simulates corn growth and yields is designed to help farmers make more informed management decisions.

IANR agricultural scientists developed the Hybrid-Maize software, which became available to farmers in 2004. It's the result of ongoing interdisciplinary research to better understand corn and soybean yield potential.

The software combines field-specific information with current and historical weather data to predict crop yields. Users can manipulate variables to see how weather or management changes influence crop performance.

Using Hybrid-Maize, producers, crop consultants and researchers can experiment with various corn production factors, including planting dates, rainfall or irrigation, fertilizer rates, soil types, hybrid selection and plant density.

The software is paired with an expanded weather database created by IANR scientists at High Plains Regional Climate Center, based at the University of Nebraska-Lincoln. Current and historical weather data for a particular site can be downloaded from the center's Automated Weather Data Network, and Hybrid-Maize users can customize weather data with their own moisture totals.

Predictions derived from the Hybrid-Maize software can help corn growers adjust irrigation and nitrogen applications to boost profits and are particularly useful in allocating water in drought conditions.

In the longer term, the software should help users better understand a field's yield potential, year-to-year yield variations and how different management schemes might affect crop performance.

Researchers say Hybrid-Maize represents a breakthrough in applied research because its user-friendly format enables producers to assess various risk factors and evaluate for themselves a wide range of crop management options.

Devising ways to predict livestock odors

Concerns about livestock odor and emissions are growing in Nebraska's rural communities. Finding science-based information about how best to minimize odor and conflicts is important to Nebraska's livestock industry and rural communities.

IANR biological systems engineers and animal scientists are collaborating on research-based information about livestock odor control and movement. By teaming up, they're gaining a much better overall understanding of what influences odors and ammonia emissions.

Researchers are developing a computing model that will predict odor movement based on Nebraska conditions. This tool will help livestock producers, communities, regulators and policy-makers determine appropriate distances between livestock facilities and neighbors to reduce conflicts and improve environmental quality.

Animal scientists have found that feedlot management and diet can reduce odor and ammonia emissions. In addition, research showed minimizing protein reduces nitrogen, and therefore ammonia, in manure.

Engineers are incorporating these findings with Nebraska livestock operation characteristics, weather, winds, terrain and other data into a computer model called the Nebraska Odor Footprint Tool. The tool will predict odor movement and calculate how far livestock operations need to be from neighbors to avoid conflicts based on site-specific information.

Research by IANR biological systems engineers and animal scientists is yielding information and tools to help minimize livestock odors and predict odor movement.

Gathering emissions data is a painstaking process. Engineers use small wind tunnels to measure gases coming off the surface of feedlots and anaerobic lagoons under different conditions.

Engineers already determined how far in each direction odors travel. Next, they'll nail down approximate distances.

Researchers also hope to test the model in a Nebraska community within the near future.

Local produce could help growers, chefs

Buying local produce can boost profits for both chefs and growers, according to a University of Nebraska survey.

Market researchers at the university's Food Processing Center surveyed members of the Chefs Collaborative, a national network of food service professionals that promotes sustainable cuisine by using local, seasonal and specialty ingredients.

Nearly three-fourths of the respondents agreed that buying locally grown food products can be profitable for food establishments. When it comes to purchasing, 57 percent would prefer to buy direct from a farmer.

Results from the national survey offer specific information that producers can tap to better market their products to restaurants and institutions.

This was one of numerous market-related surveys conducted as part of the USDA-funded North Central Initiative for Small Farm Profitability, a four-state effort headed by an IANR team. The initiative aims to improve the profitability and competitiveness of the region's small- and mid-sized farms and ranches.

The survey's findings, which offer guidance and insights for growers about how best to approach independent food service operations, also found 90 percent of the food service establishments surveyed promote the use of locally grown food on their menu or in promotional material at some time and 49 percent of those who promote it consider the promotion to be very effective.

The initiative also helps groups of producers explore alternative crops and marketing approaches that might be successful in the region. The market research provides information for cooperating grower groups and also for others interested in exploring alternative or niche products.

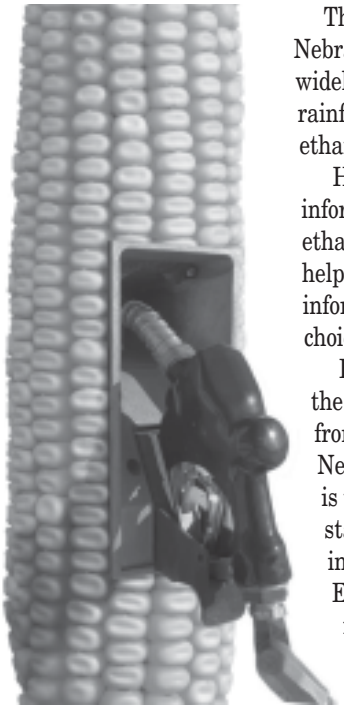
Using corn for ethanol makes energy sense

Ethanol made from corn has a positive energy balance – it yields more energy than needed to produce it.

That's the conclusion of IANR research that analyzed the energy balance of modern ethanol production.

Farming practices and corn ethanol conversion technologies have become significantly more efficient over the past two decades. Yet corn ethanol's energy efficiency sometimes gets a bad rap, mainly because energy assessments are based on outdated data from the 1980s and early 1990s.

To calculate a more up-to-date energy balance for corn ethanol, a team of Nebraska agricultural scientists examined on-farm energy consumption and ethanol yield for today's progressive corn management systems and modern, more efficient ethanol plants. They assessed how much fossil fuel is needed to grow and harvest corn, transport and process it into ethanol, blend it with gas and get it to the pump.



This analysis shows today's ethanol has a positive energy balance. Modern ethanol is about 30 percent ahead energy-wise. Converting irrigated corn to ethanol has an energy output to energy input ratio of 1.3-to-1; for dryland corn it's 1.4-to-1.

These findings show that Nebraska, where irrigation is widely used, can compete with rainfed corn-producing states for ethanol production.

Having accurate, current information about modern ethanol's energy balance should help decision-makers make better informed national energy policy choices.

Farmers, rural economies and the environment should benefit from ethanol production. In Nebraska 23 percent of all corn is used for ethanol, and the state's growing ethanol industry is creating rural jobs. Ethanol also provides a renewable, cleaner burning alternative to fossil fuels.

IDing safe levels of manure for growing crops

Applying manure to crops through center pivots could save time and labor, and fertilize crops when they need it. But salt in manure can damage plants so farmers need to know how much is too much.

While the effects of salt accumulations in soil are well-studied, recent IANR research at the Haskell Agricultural Laboratory near Concord focused on salt's effects on growing crops.

Since many producers apply manure to fields through a center pivot, applications during the growing season would save time and money.

Researchers applied manure through a custom spray system in which salt content was measured using simple electrical conductivity, or EC, meters.

Liquid manure from a pit was applied in early or late July at three concentrations: the highest being undiluted manure with an EC of 20, a 50-50 water-manure mix with an EC of 12 and a mix of 75 percent water-25 percent manure with an EC of 6.

In the earlier soybean applications, plants were severely damaged at the high concentration rate. However, in later stages plants were stunted and defoliated but there was regrowth and survival and better yields than with early or heavier applications.

Researchers concluded that manure with EC values of 6 or less should be safe for corn and soybeans at all growth stages; EC values of 12 should be safe for soybeans and corn by late July.

Applying manure through a pivot also has several advantages over hauling it to field in fall or spring. Researchers say it's better for crops to use the nutrients in manure right away. It greatly reduces the chance of leaching into the groundwater, it is less expensive, and application is more uniform.

Sensors should reveal soil differences

The more farmers know about their soil, the better for their profits and the environment.

An IANR biological systems engineer is working on precision agriculture tools that reveal soil differences within fields using sensors that detect and map soil properties as they are pulled across fields.

Biological Systems Engineer Viacheslav Adamchuk (left) and graduate student Philip Christenson adjust the alignment of sensors during a field test of new soil sensors. Adamchuk is developing these sensors to help farmers better understand and manage differences in their soil across fields.

Ultimately, the tools will help farmers more precisely match crop needs to varying soil conditions for optimized crop production. Site-specific adjustments often mean fewer chemicals overall, which benefits farmers and the environment.

One such commercially available system combines a traditional electrical conductivity sensor that maps soil texture with a pH sensor that this researcher invented.

A vehicle pulls the unit across fields as the pH device scoops up soil and its sensors read the pH level. Each time the system takes a sample, it uses Global Positioning System technology to record the locations that are later processed off-site using geographic information system software. The software generates a map of electrical conductivity and pH differences across the field.

In the future, nitrogen, potassium and sodium sensing capabilities will be added.

This type of sampling provides a higher resolution map than traditional grid sampling.

IANR researchers also are working on sensors to help farmers better assess soil organic matter, texture, compaction and other properties that influence productivity.

glimpses at ARD research

- IANR research confirms that feeding or grazing genetically modified corn has no effect on cattle performance. In a series of studies, animal scientists grazed cattle on cornstalks or fed them Bt corn for rootworms, Roundup Ready corn or conventional corn. They found no difference in performance. Results reinforce earlier findings on the feed value of genetically modified crops by scientists at Nebraska and at other land-grant universities. The bottom line for livestock producers is they can expect the same livestock performance when feeding or grazing either currently available genetically modified corn or conventional corn, this research shows.

- An eight-year IANR study is changing golf course managers' views about what causes greens to absorb water more slowly as they age. Managers have long blamed decreased water infiltration on sand and silt particles in top dressing materials. IANR turf scientists' research on aging greens shows that organic matter buildup in the root zone is the real culprit. These findings show that managers need to shift from concentrating on what materials they use to top-dress greens and focus on managing the organic layer. These long-term studies are the first of their kind and are providing insights to improve greens management and protect the environment.

- Variable weather is a Great Plains' trademark. Weather and moisture conditions vary significantly year to year, complicating grassland productivity and management. IANR range and natural resources scientists are in the midst of interdisciplinary research to develop risk assessment tools that help livestock and forage producers better manage their grasslands. Their Grasslands Ecological Monitoring System will integrate current and historic climate, soil moisture, weather, remote sensing and other information with plant growth models to generate site-specific information and forecasts. It should help more accurately predict how to optimize grazing and harvesting based on expected conditions for the year. The goal is to develop it as a free Web-based tool.

- New egg pasteurization guidelines that reflect today's technology and industry practices are based on five years of research by IANR food scientists. Researchers developed a new international egg pasteurization manual that offers guidelines for processors. Guidelines are available to industry and USDA rule-makers. This information should help processors keep *Salmonella*, a foodborne illness-causing bacteria, out of liquid egg products.

- Fumonisin, a fungal poison sometimes found in grains, is helping an IANR biochemist's research. She's using it as a tool in basic research to better understand programmed cell death in plants, a normal but poorly understood process vital to plant development and health. This is basic research, but findings someday might lead to better crop yields and resistance to pathogens.

- When it comes to priorities for water use, indoor residential and agriculture uses are tops for rural residents. That's among the findings of the 2004 Nebraska Rural Poll. The annual poll tracks rural views on key issues. Water for home swimming pools or golf courses and water transfers to other states rated lowest. The poll also highlights some water quality concerns. Nearly a third of respondents said they believe their domestic water quality has deteriorated in the past decade, 56 percent said it has not and 13 percent didn't know.

- Hazelnuts are a promising alternative crop in Nebraska because they are hardy and grow well on marginal land. But hand-husking hazelnuts is time-consuming and labor-intensive. A University of Nebraska-Lincoln graduate student designed and built a mechanical hazelnut husker that husks in 10 minutes the same number of nuts that would take eight hours by hand. IANR researchers have successfully used this machine to husk about 20 types of nuts. By reducing time and labor, the machine could make hazelnut production more practical and possibly open up an alternative market for Nebraskans.

- The international significance of IANR beef muscle profiling research was recognized in 2004 with the 2004 International Meat Secretariat Prize for Meat Science and Technology. Two IANR meat scientists shared the prize with colleagues from the University of Florida and the National Cattlemen's Beef Association. This research had identified several muscles in the chuck and round with potential for higher value uses. Scientists have worked closely with industry and NCBA to provide comprehensive information on muscles and training to help industry turn findings into new products.

- Herbicide-tolerant crops have changed the way many farmers control weeds. But farmers need to know how best to use these tools to ensure that glyphosate, the popular non-selective herbicide, remains effective. Some farmers tend to cut back on the amount of glyphosate they apply to reduce costs. IANR weed scientists' research shows that is a bad idea. Research showed weeds already hard to control with Roundup tend to survive and their numbers increase if treated with less than the recommended concentration of the herbicide. That contributes to a shift to harder-to-control weeds.

- Eastern red cedars can take over rangeland, reducing forage production and creating livestock handling problems. IANR research showed applying herbicides or cutting may be the best controls for the weedy trees. Research revealed that a tree's height is the most important factor for herbicide efficacy and protecting producers' bottom lines. It also identified the best herbicides for individual and broadcast treatments for shorter trees. Findings should help producers control red cedars, which may be increasing because fewer prescribed burns are being allowed to eliminate them.

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