USDA Agricultural Research Service
Northern Great Plains Research Laboratory
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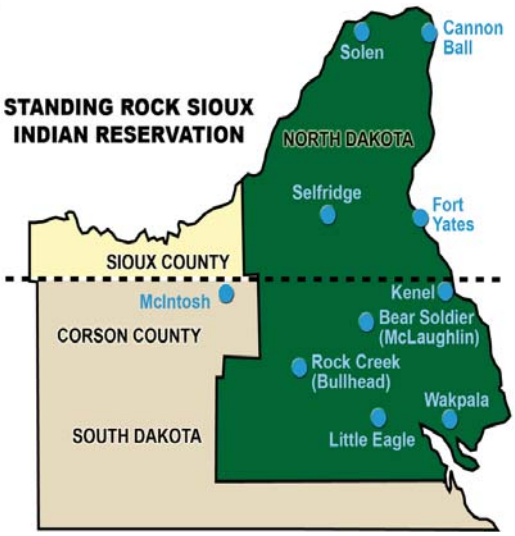
INTEGRATOR

www.ars.usda.gov/pa/ngprl

Renewal on the Standing Rock Sioux Reservation: Land, Cattle, Beef, and People

John Hendrickson, USDA-ARS

Since 2010, the USDA-ARS Northern Great Plains Research Laboratory has been conducting collaborative research with Sitting Bull Tribal College, North Dakota State University and South Dakota State University on the Standing Rock Sioux Reservation.



The long-term goal of this research is to enhance the natural resource base on the Standing Rock Reservation and to develop a natural meat product that could be packaged and marketed by the tribe.

A project team that included soil, range, wildlife and animal scientists, communication specialists, and extension personnel initiated a project entitled "Renewal on the Standing Rock Sioux Reservation: Land, Cattle, Beef, and People".

Initial research focused on natural resource management, community feedback and outreach efforts. The natural resource research was conducted on a 4500 acre leased ranch near McLaughlin, SD.

Findings from the 'Renewal' project were presented during the Native American Range Forum at the 2015 Society for Range Management annual meetings held in Sacramento, CA. At this meeting, the project team presented a symposium titled 'Renewal on the Standing Rock Reservation: Knowledge and Opportunities', moderated by Dr. John Hendrickson from USDA-ARS Northern Great Plains Research Laboratory and Dr. Roger Gates from South Dakota State University.

Tim Faller from NDSU discussed the development of the 'Renewal' project. Linda Black Elk from Sitting Bull College emphasized Native science and the need to respect other ways of thinking. Other topics included the project's communication strategy, ways to incorporate Tribal Colleges into research, examples of development projects from Africa and Asia and federal programs to promote Tribal College Research.

Technical talks included a discussion by Dr. Mark Liebig (USDA-ARS) on the impact that prairie dogs and soils, and talks by other project scientists on how prairie dogs affect vegetation, livestock production, wildlife diversity, and ecological dynamics.

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Renewal on the Standing Rock Sioux Reservation: Land, Cattle, Beef, and People

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Dr. Jim Garrett of Sitting Bull College concluded with a future vision for the project based on a sustainable and healthy food production system. Following the talks, a panel discussion was held, featuring Tim Faller, Chris Schauer (NDSU) and Jim Garrett and moderated by Linda Black Elk, presenting challenges and opportunities for future collaborative research.

Over 70 people attended the symposium. The presenters are planning to publish the talks in a special issue of the journal 'Rangelands'.

Tim Faller, Assistant Director, NDSU Ag Research

Mark Liebig, USDA-ARS Soil Scientist

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Message from Matt

This time of year is the "meeting season" when extension, seed companies, and many others hold informational events to present the latest research results, introduce new varieties, and display new equipment.

Here at the NGPRL we hold our semi-annual Customer Focus Group meeting at this time to present our latest findings and listen to what our customers and stakeholders have to say.

This group and meeting provide an important accountability mechanism for the lab. Scientists discuss their progress on achieving research goals and solving the problems they have been tasked to address. More importantly, our customers question the scientists about what the results mean and how the results will benefit their farming operation, business, or agency. Customers also have the opportunity to inform us of emerging problems that need research attention.

The twice yearly focus group meeting is a formal process we use to hold ourselves accountable, but it is not the only accountability process. We are open to the public and we welcome visitors to drop by to ask questions, view our research, and get to know us. The accountability process is critical to keeping our research relevant and focused.

If you have questions about our research or would like to learn more about us please consider joining our Customer Focus group and feel free to call or visit.

Matt Sanderson
Research Leader

Area 4 SCD Cooperative Research Farm
Bismarck State College Agriculture Program
NDSU Extension Service
North Dakota Agricultural Experiment Station
USDA-ARS Northern Great Plains Research Laboratory
USDA Natural Resources Conservation Service

FARMING FOR THE BOTTOM LINE

Monday, March 2, 2015 10:00 a.m. CST

Bismarck State College, National Energy Center of Excellence, Bavendick State Room

1500 Edwards Ave, Bismarck ND

NEW Online Registration!

Register now at: www.bityurl.com/00f6c2

to join us for this **FREE** 1-Day seminar! CCA CEUs available.

If you are unable to register online, please call the
NDSU Extension Service of Morton County at 701-667-3340.

MUST register *no later than* February 23, 2015

SESSION SCHEDULE

Update from the Area 4 Farm.....Matt Sanderson, NGPRL Research Leader

Managing Costs of Production.....Bret Olke, Innovus Agra Business Consulting

Crop Rotation and the Bottom Line.....Dave Archer, NGPRL Ag Economist

Short-Term Soil Responses to Late Seeded Cover Crops.....Mark Liebig, NGPRL Soil Scientist

LUNCH PROVIDED

North Dakota Climate: Past, Present & Future Conditions....Brian Fuchs, Drought Mitigation Center - University of Nebraska

Crop Diversity, Soil Health and Reducing Inputs.....Shannon Osborne, NC Ag Research Lab, Brookings SD

Production Perspectives Panel .....John Weinand - Ag Producer, Sheila Braaten - Crop Consultant, Ted Alme - NRCS Agronomist; Moderated by Al Gustin

Profit Potential for Alternative Crops.....Dwight Aakre, NDSU Ag Economist

Requests for accommodation related to disability should be made to NDSU Extension/Morton County at 701-667-3340 by February 23, 2015.

Soil change induced by prairie dogs across three ecological sites

Reprinted with permission from CSA News

Prairie dogs (Cynomys spp.) can alter soil properties through their role as foragers of non-woody vegetation and constructors of extensive burrow networks and mound structures. If given enough time, prairie dog-induced changes in soil properties can affect vegetation composition and structure as well as landscape hydrology. Accordingly, prairie dogs are considered a keystone species due to their influential role as bioturbators.

Previous studies evaluating soil responses to prairie dog activity have been conducted on deep, well-drained soils. While such studies have been valuable in understanding prairie dog contributions to soil change, they have fallen short when applying results across rangeland landscapes, which are typically highly variable.

In a new study published in the November-December 2014 issue of Soil Science Society of America Journal, researchers from Sitting Bull College, North Dakota State University, and USDA-ARS investigated prairie dog effects on soil properties within three unique ecological sites differing in soil and landscape attributes. The project was conducted on a 4000 acre ranch on the Standing Rock Sioux Reservation near Mahto, South Dakota.

Soil properties were evaluated across three sites on the ranch, each possessing distinct landscape, soil, and vegetation characteristics. Each site – designated by unique USDA-NRCS Ecological Site Descriptions – possessed paired locations with and without prairie dog activity in close proximity (<0.3 mile). Ecological sites were characterized as thin claypan, loamy, and shallow loamy, and corresponded to footslope, backslope, and summit/shoulder landscape positions, respectively.

Soil responses to prairie dog activity were observed at all three ecological sites, and were generally similar in frequency and magnitude across sites. Within ecological sites, prairie dog activity contributed to soil heterogeneity through alterations in nutrient status, acidification, and physical condition. Consistent with previously published research, mounds exemplified nutrient 'hot spots', with elevated levels of extractable N, available P, and soil organic C. Concentration of feces and urine deposition, accumulation of unconsumed plant biomass, and presence of prairie dog carcasses and bones served to enrich macro-nutrients close to mound centers. Elevated infiltration rates within on-mound areas suggested a potential for movement of soluble nutrients lower in the soil profile for loamy and shallow loamy ecological sites. Nutrient accumulation dissipated with distance from the mound center and was most pronounced in the near-surface depth (0-4 inches), likely reflecting spatial patterns of prairie dog behavior where habitation outside burrow networks occurs most frequently closest to the mound.

Both landscape-associated and mound-specific soil heterogeneity induced by prairie dogs may complicate rangeland restoration efforts, which are generally applied at large spatial scales. In instances where prairie dogs are extirpated (e.g., epizootic plague), findings from this study suggest restoration efforts explicitly consider soil heterogeneity within and across ecological sites.

This study was partially funded by the Tribal College Research Grants Program within USDA-NIFA Agriculture and Food Research Initiative, and was a precursor to a larger NIFA-funded effort that aims to increase food security of people on the Standing Rock Sioux Reservation through the development of sustainable rangeland management practices that support culturally-acceptable natural meat production.

Adapted from Barth, C.J., M.A. Liebig, J.R. Hendrickson, K. Sedivec, and G. Halvorson. 2014. Soil change induced by prairie dogs across three distinct ecological sites. Soil Sci. Soc. Am. J. 78:2054-2060. View the full article online at doi:10.2136/sssaj2014.06.0263.

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Internship gives students hands-on lab research experience

Condensed from the Bismarck Tribune 8-10-2014

A former pre-med student spent a summer as a soil scientist and found a new way to test soil samples.

It's an example of how summer internships at Mandan's U.S. Department of Agriculture Northern Great Plains Research Laboratory are opening students' minds to careers in research, particularly agricultural research.

"The goal is to get young people in agricultural work," said USDA soil scientist Jonathan Halvorson. "One of the challenges is to draw people into agricultural research. It's still not something that jumps up right away when you think about research."

Jeremy Houser, a 2014 summer intern at the USDA NGPRL south of Mandan, explains to agriculture scientists his research project using existing instruments for a new way to measure carbon in the soil. The visual data shows the overall health of the soil and should help farmers better manage their cropland.

Jeremy Houser, a Bismarck resident attending Concordia College in Moorhead, Minn., knew he wanted to do something research-related. He said after looking for some time for a summer internship near his hometown, he heard about the research lab from a friend.

The internship Houser participated in was funded by the USDA Agricultural Research Service and Mandan research lab.

Houser said the internship gave him the hands-on lab experience he was looking for. During his eight weeks there, he stumbled across a new way to view differences in soil samples using a spectrofluorophotometer (spec), a machine typically used to show differences in water samples.

"Jeremy doesn't have a fear of instruments. I just told him to turn it on and see if it works," Halvorson said.

Houser's idea to use the spec gave a snapshot of carbon in the soil from different areas of the farm, Halvorson said. Soil from different fields had different amounts and types of carbon.

"The difference in carbon levels was expected based on other research," Halvorson said. The spec gave reassurance about past methods of research and the results add to the body of data from which soil scientists will be able to draw.

"We're not close to being done. I think we're encouraged to take the next step," Halvorson said. "Houser was able to accomplish quite a bit in a short amount of time because he already had a strong interest in doing research," Halvorson said.

"I think it (the internship) is just as valuable for those that don't know what they want to do," he added. "It can get people fired up about research or allow them to get useful experience."

Halvorson said it opens their eyes to what it is like to do research for a government agency. He said agriculture is one industry that has a great demand for research.

"I really did find something I love doing," Houser said. He had been a certified nurse assistant at Sanford Health but decided medicine wasn't what he was passionate about, he said. He is not sure what type of research he eventually wants in his career but he is considering microbiology, maybe even soil microbiology.

"I learned there is more to soil and agriculture than I ever thought about," Houser said. "This has shown me there are a lot of opportunities in agriculture and gave me valuable experience to get in a lab and do professional level research."

Jessica Holdman, Bismarck Tribune

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Kentucky bluegrass effects on rangeland hydrology

David Toledo, USDA-ARS

Across the Northern Great Plains there is increasing concern regarding the spread of Kentucky bluegrass. Plant foliar cover and biodiversity data collected at the USDA-ARS Northern Great Plains Research Laboratory in 2012 suggest that Kentucky bluegrass now covers between 3 and 54% of the pastures sampled and as cover of Kentucky bluegrass increases, plant species richness decreases.

Despite its accelerated expansion, the consequences of Kentucky bluegrass on ecosystem services remain largely unknown. We synthesized the available data related to Kentucky bluegrass and how it affects native plant diversity and ecosystem services. We found that invasion may bring negative consequences to ecosystem services, such as pollination, habitat for wildlife species, and alteration of nutrient and hydrologic cycles, among others.

In the paper, we identified knowledge gaps regarding Kentucky bluegrass and its expansion across the Northern Great Plains region. One such knowledge gap is determining how Kentucky bluegrass cover alters root and thatch layers and its effects on hydrologic function.

Rainfall simulator setup at a heavily grazed loamy ecological site at the NGPRL.

Kentucky bluegreass litter samples being tested for hydrophobicity using the molarity of ethanol droplet test.

Late August 2014, a crew from the USDA-ARS Great Basin Rangelands Research Unit traveled from Reno, NV to NGPRL to run a rainfall simulator to measure rate of runoff. Data collected will help fill in the research gaps regarding hydrology of Kentucky bluegrass dominated areas.

Follow-up work with soil cores collected in the plots where the rainfall simulations took place provided insight regarding water repellency of Kentucky bluegrass litter, thatch and root mat layers. Preliminary results suggest that dry litter, thatch and root mats were more water repellent than when wet, potentially increasing runoff and compounding soil dryness during short-lived rainfall events. This last work is being presented at the 2015 Society for Range Management annual meetings.

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Toledo, D., Prosser, C., Printz, J., Hendrickson, J., and Shaver, P. 2015. Developing the 18th indicator for Interpreting Indicators of Rangeland Health on Northern Great Plains Rangelands. Poster presented at the 2015 Annual meeting of the Society for Range Management.

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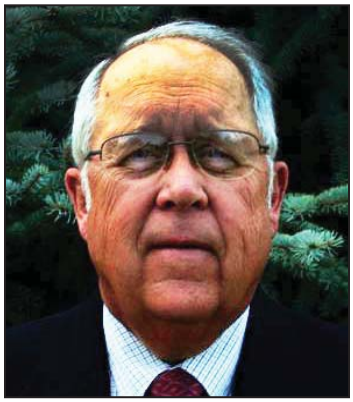
Former NGPRL Lab Director receives prestigious award

IPNI Press Release

The International Plant Nutrition Institute (IPNI) has named Dr. Ardell D. Halvorson as the winner of the 2014 IPNI Science Award. Halvorson was NGPRL Lab Director from 1994-1997.



"We are honored to be able to announce Dr. Halvorson as the recipient of the 2014 IPNI Science Award," said Dr. Terry Roberts, President of IPNI. "Ardell's goal throughout his 42 year career with USDA-ARS has been to increase the efficiency, productivity, profitability, and sustainability of Great Plains agricultural production systems. Amongst many achievements, Ardell has been internationally recognized for his work in identifying yield-limiting factors related to efficient nutrient management and water use efficiency."

Ardell Halvorson received his B.Sc. degree in Soil Science from North Dakota State in 1967; his M.Sc. degree in Agronomy (Soil Chemistry) from Colorado State University in 1969; and his Ph.D. degree in Agronomy (Soil Chemistry), from Colorado State University in 1971. Dr. Halvorson's most recent position was with the USDA-ARS as Research Soil Scientist/Lead Scientist, located in Fort Collins, Colorado.

Early in his career Ardell recognized that working directly with farmers and their advisers was the best pathway to having an impact on the overall system. His creative and innovative research has provided solutions to problems ranging from dryland saline seeps, to efficient nutrient management in dryland and irrigated farming systems, to improving water use efficiency in dryland cropping, and to reduce greenhouse gas emissions. Efficient and environmentally safe management of fertilizer nitrogen has been one of Dr. Halvorson's key concerns throughout his career. His research in reducing nitrate-leaching losses contributed to the successful development of the NLEAP model, which is widely used across North America.

Ardell was instrumental in developing a major long-term alternative cropping systems project at the USDA-ARS aimed at identifying alternate crop rotations to wheat-fallow. This work has resulted in a large increase in dryland summer crop production and a decrease in the inefficient crop-fallow. His latest research with irrigated no-till crop production systems has reduced soil erosion, improved soil carbon sequestration, and reduced greenhouse gas emissions.

Throughout his career Ardell has invested heavily in communication with farmers; strongly participating in producer and agribusiness sponsored informational meetings to transfer his research results to the end user. This is most characterized by his receiving of the "U.S.A. Zero Till Non-Farmer of the Year Award" from the Manitoba-North Dakota Zero Tillage Farmers' Association in 1998.

Kentucky bluegrass poses issues for producers

Condensed from Farm & Ranch Guide

John Hendrickson, a rangeland scientist at the USDA-ARS, Northern Great Plains Research Laboratory, Mandan, is involved in a pair of research projects that are focused on using early grazing to suppress Kentucky bluegrass and evaluating its impact on other plants that share the same area.

Hendrickson's "Early Grazing to Suppress Kentucky Bluegrass" study focuses on the impact of earlier than traditionally recommended grazing on Kentucky bluegrass infestations.

"We've seen an increase in Kentucky bluegrass," said Hendrickson. "What we do know is that Kentucky bluegrass is growing earlier in the spring than most of our native grasses. We wanted to see if there was an opportunity there with early spring grazing to reduce Kentucky bluegrass and help out our native grasses."

Kentucky bluegrass is a cool-season, less desirable grass that has experienced a rapid increase in abundance in the Northern Great Plains region over the past 20 years. This increase has not only suppressed native grasses and forb diversity, but it has also had a negative impact on the forage cycle, hydrology, and nutrient cycle of grasslands in the region.

"With Kentucky bluegrass, it seems like it's increased productivity, but it's decreased diversity and that's a concern that we're seeing a lot less diversity in areas dominated by Kentucky bluegrass when compared to areas that are not dominated by it," said Hendrickson.

As part of his study, Hendrickson said they have designated a group of small pastures, about 7 1/2 acres, and split them in half, randomly assigning half to be grazed early and half to being grazed light. Once assigned, they placed 10 cow/calf pairs on the pastures and began grazing them as soon as possible once spring arrived.

"We looked to see if there was enough grass there to carry them for a week," said Hendrickson. "The thought being that we could get cold periods, but usually it keeps warming up in May, so we felt that if we had enough in there for a week that production would catch up and we could keep them there longer."

During the late grazing portion of the study, Hendrickson would place the cattle on the pasture around June 1, with only 5 cow/calf pairs this time, but they would keep them on twice as long as the early grazing to give them the same stocking rate for the study.

"We looked at the data, and the early grazing seems to increase the amount of native species," he said. "So if we increase our natives, the effect of Kentucky bluegrass is a lot less there."

Hendrickson's other study evaluates Kentucky bluegrass's impact on other plants in its region.

"We looked at some soil parameters and we also looked at some of the above ground aspects, meaning we basically looked to see if Kentucky bluegrass impacted species diversity," he said. "We found that it didn't impact the species richness, but it did have an impact when we looked at evenness, which is a measure of how well distributed those species are within that frame."

"If I was a rancher, I'd be a little bit concerned," he said. "One of our pluses that we have here is a pretty diverse grassland that allows us to graze for basically the entire summer season, but if Kentucky bluegrass is dominating, our forage production is a lot more compressed and moves to earlier in the season. That presents some issues if you're a producer to decide how you're going to handle that later on in the season, especially if it's dry," Hendrickson concluded.

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New wheatgrass seed available for purchase

NRCS Press Release

After years of tests and research, Manifest intermediate wheatgrass, developed at the Northern Great Plains Research Laboratory, is now available. Foundation seed for increase is available from the NRCS Plant Materials Center in Bismarck, ND, and commercial seed for establishing pasture and hayland can be purchased from vendors. According to the Agricultural Research Service (ARS) and the Natural Resources Conservation Service (NRCS), Manifest is easy to establish and more productive than many other grasses.

"Manifest intermediate wheatgrass is a better grass variety choice for grazing or haying on many sites," said Wayne Duckwitz, manager of the Plant Materials Center in Bismarck. "Like other intermediate wheatgrasses, it is a moderately long-lived, fast growing, sod-forming grass."

Manifest can also be used as a single-species forage or in mixes with other species. Mixed with legumes, it produces high quality forage. Manifest has erect stems with a heavy growth of bluish-colored basal leaves, and by mid-summer, its height reaches three to four feet. Manifest is a cool-season grass, so most of its growth is produced in the spring and fall. This allows it to be managed as spring or fall pasture when moisture is favorable.

In a replicated trial by the Agricultural Research Service (ARS) in Mandan, North Dakota, Manifest produced 4,614 pounds of forage per acre, compared to 4,474 pounds per acre for other intermediate wheatgrass varieties. "Because of its high shoot replacement ratio, Manifest is able to withstand heavy grazing," Duckwitz said. "Manifest 'stands tall' when compared with many other species and/or varieties of intermediate wheatgrass."

In addition to its growth, Manifest resists drought better than smooth bromegrass, but less than crested wheatgrass. Well-drained soils in areas with at least 14 inches of annual rainfall produce the greatest plant growth.

Manifest is a cooperative release by two USDA agencies, the Agricultural Research Service and the Natural Resources Conservation Service. For more information on Manifest intermediate wheatgrass, contact the USDA-NRCS Plant Materials Center at (701) 250-4330 or visit the Plant Materials program website.

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Can cattle be trained to graze leafy spurge?

Scott Kronberg, USDA-ARS

We have known for many years that sheep and goats can suppress leafy spurge with repeated grazing over several years. However, on the northern Great Plains where leafy spurge has been a major invasive weed, there are not enough sheep and goats to graze all the patches of spurge and there is little evidence that cattle will graze it, although a few ranchers in various places on the Great Plains observed small amounts of leafy spurge apparently grazed by their cattle.

From our research in the 1990s and 2000s, we concluded that cattle either avoided eating spurge completely because they had not learned to graze it when with their mothers, and/or they developed strong aversions after initially grazing small amounts of spurge. Their aversion probably develops because leafy spurge contains toxic diterpene compounds called ingenol esters. Some ingenol esters are more toxic than others and results from some of our research indicated that ruminal microbes in cattle may convert the ingenol esters in spurge to more toxic versions of these compounds.

We tried ensiling leafy spurge in an attempt to make it less toxic and aversive to cattle with little success. However, in the process of trying to better understand interactions of cattle, sheep and goats with leafy spurge, we learned that sheep were more likely to develop learned aversions to spurge if they were physiologically stressed when they consumed spurge as a new forage a first and second time. We assumed this relationship was true for cattle and this led to the idea that if this stress could be greatly reduced or prevented, then cattle might graze leafy spurge.

Possible (but untested) interventions include altering microbial fermentation in the rumen to detoxify the toxic compounds in spurge, providing cattle and their ruminal microbes extra energy (supplemental feed) and/or other secondary compounds (e.g., tannins) to help them detoxify and/or neutralize the effect of the toxins, and also perhaps by preventing the linkage in the brains of cattle for spurge as a novel plant and physiological stress after eating a little of it (dose them with some dry ground spurge in gelatin capsules along with the regular feed they eat a week before they eat any spurge). This simple training procedure would be done to make cattle less cautious with novel but potential foods in their environment including leafy spurge.

My answer to the original question on the potential of training cattle to graze leafy spurge is a qualified 'yes', there likely is potential to reduce the stress cattle incur when initially grazing small amounts of leafy spurge, and if one is grazing a lot of cattle together using 'mob grazing' with very high stock density per acre, then relatively small amounts of spurge intake per animal times many animals can result in significant amounts of spurge grazed.

However, I doubt that a simple training procedure will enable individual animals to graze large amounts of spurge because cattle are less able, for reasons we don't fully understand, to cope with the toxins in leafy spurge compared to sheep and goats.

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Ag economist evaluating possibility of using oilseeds as feedstock for jet fuel

The Prairie Star

A study spanning eight locations across the Western U.S. from Iowa to California is examining the possibility of using oilseeds as a feedstock for jet fuel for both military and commercial aviation usage.

"In this study we're looking at different oilseed varieties and how they grow in different parts of the western U.S.," said Dave Archer, agriculture economist, USDA-ARS Northern Great Plains Research Laboratory in Mandan.

Archer said they are primarily looking at wheat producing areas, which are best suited for oilseed production.

"We're trying to look at a broader range of crops and monitor the crop growth throughout the season in detail so we can use that information in crop simulations and crop growth models to help identify where these crops would be best suited," said Archer. "From an economic standpoint, we're looking at where they'll be most profitable to grow in with wheat in different rotations."

In 2009, the U.S. Navy set a 2020 target date to have half of its energy needs served by non-oil sources, and since 2011, North Dakota is among a number of states working to make that a reality.

Archer said the variety trial includes both fall-seeded and spring-seeded varieties to try and measure the growth and productivity of different oilseeds in the canola and mustard family.

Motivation to find a source for a renewable jet fuel increased as oil and fuel prices continued to sky rocket, causing budgetary issues for the U.S. military, as well as commercial aviation in the U.S.

"In the military, they were stuck with a budget and had to take from other parts of their budget to keep flying," said Archer. "Then, with commercial aviation, we were seeing fuel surcharges added onto plane tickets, so at that point they were interested to finding another source that could hopefully reduce the price increases."

Another interest that has contributed to these studies is having the ability to domestically produce a renewable fuel, according to Archer.

"We're producing a lot of oil domestically right now, but having an additional source is always a benefit," he said. "From a military standpoint, they don't want to rely on a foreign source. Having renewable fuel that has some environmental benefits is marketable as well."

About one million acres of canola are grown in North Dakota annually, and the military's capability to sign large contracts could provide assurance that growers would be able to market their crop. An increased market would also correlate to an increase in prices as well.

Archer said they are in their second year of the trial, and the first round has provided some promising results to date and that he expects the trial to continue through next growing season.

Ryan Crossingham, The Prairie Star

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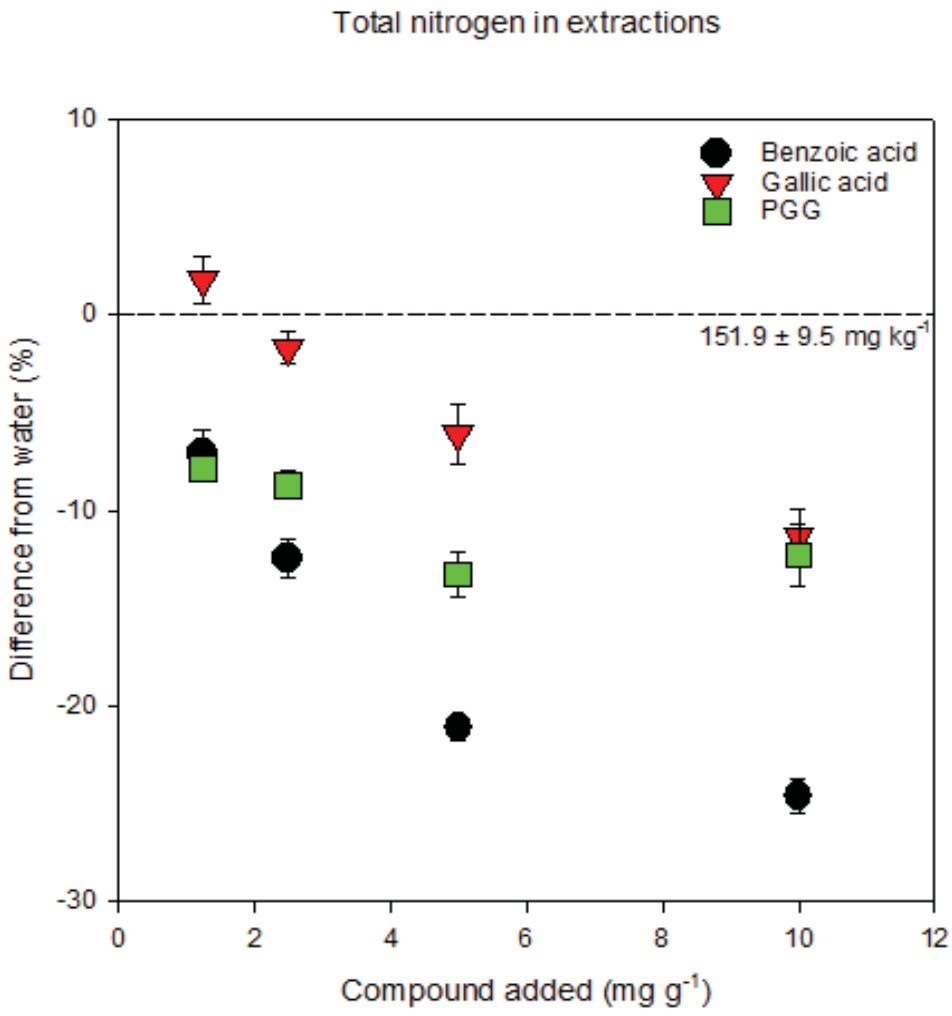
Phenolic compounds: a tool to improve nutrient use efficiency?

Jonathan Halvorson, USDA-ARS

Phenolic compounds are a large class of plant secondary metabolites, ranging in complexity from simple structures such as organic acids, through complex polyphenolics such as tannins. These compounds are of interest because they actively participate in a broad range of important reactions that affect livestock, plants and soil.

In soil, phenolic compounds play a role in important chemical reactions such as protein binding, metal complexation, and antioxidant activity. Furthermore, the compounds are thought to influence the activity of microorganisms responsible for nutrient cycling and diseases, soil organic matter formation, plant nutrient availability, and metal toxicity.



The role of phenolic compounds in northern Plains agroecosystems is largely unknown. To help efficiently direct future research directions on this emerging topic, a preliminary investigation was conducted to evaluate effects of three phenolic compounds on nutrient retention in soil.

Samples of surface (0-2 inch) soil, collected from historical grazing treatments at NGPRL, were treated with water (control) or aqueous solutions of increasingly complex compounds; benzoic acid (BA), gallic acid (GA), or β-1,2,3,4,6-penta-O-galloyl-D-glucose (PGG) at four concentrations (1.25, 2.5, 5 or 10 mg compound per gram soil). We measured soluble N, P, K, Ca, Mg and Mn in treatment supernatants and after a subsequent incubation in hot water (16 h, 80 °C).

Significant quantities of nitrogen were extracted from the samples with water. Each compound reduced the amount of N extracted in a concentration dependent manner with greatest response to BA (about 25%). However, PGG, a tannin, reduced the solubility of N only during hot water incubation, suggesting its effects are mostly on organic forms of N.

Unlike N, solutions of the compounds increased extraction of P. Extraction of K, Ca and Mg were strongly increased by BA and GA but comparatively unaffected by PGG. Extraction of Mn was increased mainly by GA.

These preliminary findings suggest some plant secondary compounds affect nutrient retention in soil, and thus may be part of future management strategies to improve nutrient-use efficiency. Whether they operate mainly at the root-soil interface of the individual crop plant or affect soil quality at the field scale as crop residues or manure, more research is needed to evaluate potential sources of such compounds and interactions with environment.

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New faces

Zeeshan Ahmed

Zeeshan Ahmed is a PhD student in Agronomy at the University of Agriculture, Faisalabad, Pakistan. Zeeshan has been conducting research in Pakistan on Camelina sativa as a potential oilseed crop for water limited environments. His research in Pakistan is primarily focused on developing Camelina sativa as an oilseed crop for edible uses. He is visiting the NGPRL for six months to collaborate with Dr. David Archer on oilseed production, simulation modeling, and economic analysis.

Md Abdul Momin

Dr. Md Abdul Momin, (Momin for short) joined the NDSU Department of Agricultural and Biosystems Engineering in November as a Research Specialist in the "Affected Wood Utilization 2" project funded by the North Dakota Forest Service. He is conducting research, developing educational materials, and helping arrange technical workshops. Dr. Momin was previously an Associate Professor in the Department of Farm Power and Machinery at Bangladesh Agricultural University (BAU). He received his doctorate in Bio-Sensing Engineering at the Graduate School of Agriculture at Kyoto University in Japan. Dr. Momin brings expertise in farm machinery and image-processing of horticultural products.

Krystal Leidholm

Krystal Leidholm has joined the "Renewal of the Standing Rock Sioux Reservation: Land, Cattle, Beef, and People" project. She is a native of Washburn, ND and an NDSU graduate. She was previously at the North Dakota Department of Parks and Recreation.

Retirement

Becky Wald

Becky Wald, USDA-ARS Biological Science Lab Technician, has retired after 32 years of service. Wald also served as co-Collateral Duty Safety Officer for the lab for which she was recognized for excellence by USDA-ARS in 2012.