



2017

# Annual Highlights



North Dakota Agricultural  
Experiment Station

NDSU Extension Service

**NDSU** NORTH DAKOTA  
STATE UNIVERSITY



# Welcome to the 2017 Annual Highlights



Ken Grafton

## Ken Grafton

Vice President for Agricultural Affairs  
Director, North Dakota Agricultural Experiment Station  
Dean, College of Agriculture, Food Systems, and  
Natural Resources

We are pleased to share the valuable accomplishments of the North Dakota Agricultural Experiment Station (NDAES) and NDSU Extension Service in our 2017 Annual Highlights. Our missions contribute directly to the economic success of North Dakota's agriculture and the needs of our residents.

This report provides information on the important research that advances and sustains agriculture as the leading economic sector in North Dakota. The agricultural economy is facing challenging times, and NDAES scientists are applying innovative technologies to improve farm and ranching profitability.

Agricultural research is a long-term investment with excellent returns on that investment. Our crop and livestock research efforts provide direct benefit to our farmers and ranchers in the state by providing improved crop varieties; increased efficiencies in livestock production and management; and better management of one of our greatest resources, the highly productive soils found throughout this state.

Developing improved risk management tools and other financial analyses is critical in this period of low commodity prices. Widespread acceptance and use of precision agriculture is allowing our stakeholders to farm more efficiently and with less risk to the environment.

Other examples of our varied research programs are presented throughout this publication. The NDAES secures partnerships with industry, other universities and federal scientists to ensure that we have access to innovative technology to solve the range of issues facing our crop and livestock producers in the state. Investments in NDAES research will continue to generate positive outcomes for North Dakota farmers, ranchers and industry.



Chris Boerboom

## Chris Boerboom

Director, NDSU Extension Service

I would like to highlight two items before you read this sample of our many positive contributions to North Dakota.

First, the State Board of Agricultural Research and Education (SBARE) conducted a thorough review of Extension in 2017 (p. 26). We welcomed this review as we aspire to be a high quality organization, delivering exceptional public value. While our core educational mission to agriculture, 4-H, families and communities remains, our programs continually change in response to emerging local and state needs.

SBARE carefully reviewed staffing, particularly Extension agents. County residents expressed vocal support for their Extension agents and the incredible value of having local access to programs. We were told that Extension is vital to rural North Dakota and a county-based Extension system is needed. We listened and are modifying the cost share model with counties to sustain Extension agents in partnership with counties.

Second, I highlight the exceptional efforts our specialists and agents provided in response to the 2017 drought (p. 28-29). I'm proud that Extension was able to provide local documentation, testing and economically sound recommendations to assist ranchers and farmers to make the best decisions possible during this difficult time.

Although Extension is operating under a 14 percent state budget reduction, we remain committed to serving North Dakota in keeping with our motto: Extending knowledge, changing lives.

**We sincerely hope you enjoy reading the 2017 Annual Highlights!**

### North Dakota Agricultural Experiment Station mission:

Develop and disseminate technology important to the production and utilization of food, feed, fiber and fuel from crop and livestock enterprises. The research must provide for an enhancement of the quality of life, sustainability of production and protection of the environment.

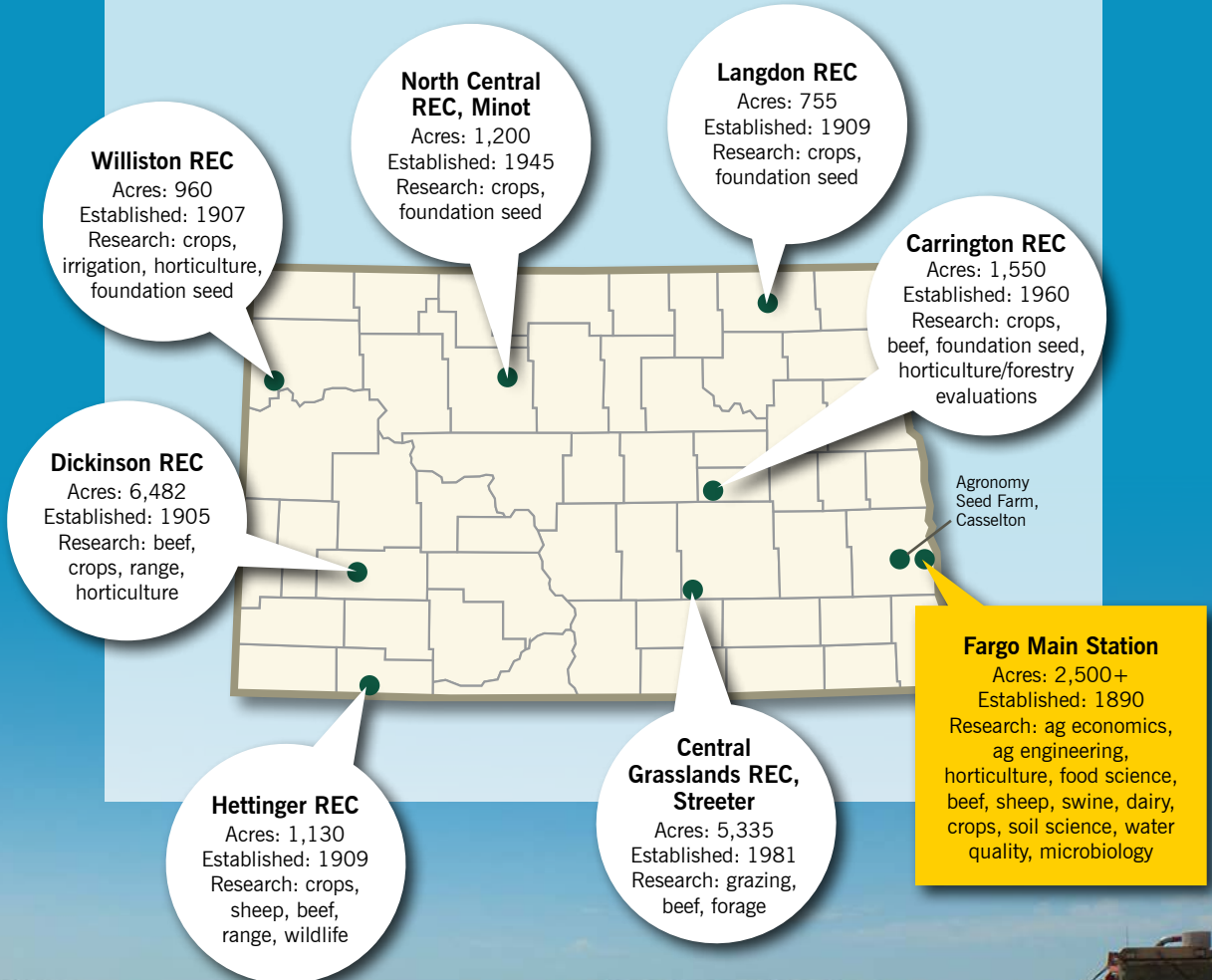
### NDSU Extension Service purpose:

Create learning partnerships that help youth and adults enhance their lives and communities.

# N.D. Agricultural Experiment Station *Generates Results*

The North Dakota Agricultural Experiment Station (NDAES) is finding solutions and discovering opportunities that enhance North Dakotans' quality of life; sustaining the production of food, feed, fuel and fiber; and protecting the state's land and resources.

North Dakota has a diversity of soils and weather conditions that impact crop and livestock production. In addition to the Main Station in Fargo, the NDAES has seven Research Extension Centers (RECs) placed strategically throughout the state to respond to issues and challenges in a particular area.



## Working Together

Scientists at the Main Station and RECs work collaboratively to develop new crop varieties that excel in North Dakota's climate and are resistant to insects and diseases; advance beef reproduction and genetics; explore ways to improve and protect the soil, one of the state's greatest natural resources; evaluate new technology that could benefit producers; and provide farmers and ranchers with marketing and risk management tools they need to remain profitable, even when commodity prices are uncertain.

Narrowleaf hawksbeard, a weed that has reduced dry pea yields significantly, is one example of how the NDAES responds to a particular challenge.

When the weed recently spread from Canada and Montana into western North Dakota, Brian Jenks, weed scientist at the North Central REC near Minot, visited fields to see the extent of the infestation and learn what producers were doing to combat it. In 2016, he began collaborating with Montana State University on research trials in both states to understand the weed's biology and find the best control practices.

"Without a weed scientist in the local region, this weed may have escaped detection and control for much longer," center director Shana Forster says.

The Main Station, established in 1890, is home to more than 2,500 acres of research land in and around Fargo, as well as the Agricultural Experiment Station Research Greenhouse Complex, Beef Systems Center of Excellence, and other laboratories, centers and institutes.

The RECs, which range from 36 to 112 years old, were developed at the grass-roots level, with local producers deciding the original direction of the research based on the concerns in their region. But these concerns have changed, and so have the centers' focuses.

For instance, the Hettinger REC was established in 1909 to evaluate dairy cattle production systems, which were the basis of livestock production during the settlement of southwestern North Dakota. However, by the 1930s, producer attention shifted, and the center started a sheep research program.

While sheep still are a primary part of the center's research efforts, the REC has added research programs in agronomy, weed science, beef cattle, and range and wildlife science because of the importance of the state having a diversified agricultural economy.



“This one example demonstrates the ability of the RECs in North Dakota to continue to adapt to changing agricultural conditions,” says Christopher Schauer, Hettinger center director.

The centers often work together to research an issue, such as production practices for a crop that's new to the state. Data from multiple centers improves the reliability of the information that will be shared with producers.

“To make our research even more relevant to our producers, most RECs have established a series of off-station research sites that are used to further refine their ability to address ag issues due to soils and climatic differences that exist, even within their geographic region of the state,” says Blaine Schatz, Carrington REC director.

In another collaborative effort, the Carrington, Langdon, North Central and Williston RECs work with the NDSU Foundation Seedstocks program and NDAES Agronomy Seed Farm near Casselton in developing and releasing new crop varieties to North Dakota producers. These RECs grow foundation-grade seed to sell to North Dakota seed producers, who then sell certified seed. The RECs have seed-conditioning facilities to process and condition the seed to maintain high quality and purity.

Plant breeding also is a key focus at the North Central REC. While most of NDSU's crop breeding teams are on campus, the pulse breeding program's assistant breeder is at the North Central REC. This allows program personnel to work in the part of the state that grows the majority of the pulse crops such as field peas, lentils and chickpeas, Forster notes.

RECs have other roles as well, including providing support to Extension agents, who share the information gained through the research with producers in every county in the state. In addition, RECs offer opportunities to train graduate students in research while giving them real-life exposure to agricultural production.

“This is becoming increasingly important, as many of our new graduate students do not come from a production agriculture background,” Schauer says.

**FOR MORE INFORMATION:**

Ken Grafton, 701-231-7655, k.grafton@ndsu.edu  
[www.ag.ndsu.edu/research/research-extension-centers](http://www.ag.ndsu.edu/research/research-extension-centers)



# New Veterinary Diagnostic Lab is Operational



Cando veterinarian Judy Gibbens couldn't be happier with the North Dakota Agricultural Experiment Station's new Veterinary Diagnostic Lab.

"I don't think you can underestimate the value of a good veterinary diagnostic lab in North Dakota," she says.

Gibbens, who uses the lab's services fairly regularly and often refers clients there, notes that the former lab in Van Es Hall on campus wasn't easily accessible, especially when bringing in an animal carcass. Plus, with the amount of cases the lab handles and the advances in technology, the old lab, built in the early 1970s, had inadequate space.

The new one-story, \$18 million, fully accredited lab, which became operational in October 2017, is not on campus; it's on 19th Avenue North west of Interstate 29. With 30,000 square feet of space, including 22,000 for labs and offices, it is more than twice the size of the former lab.

The new lab is easily accessible from the interstate, and it's in a much more secure location than the former facility, which was in a high-foot-traffic area near dorms and the Wallman Wellness Center, according to lab director Brett Webb.

Opposed to just a few windows in the old lab, the new lab has abundant natural lighting from multiple windows. It also is designed for better efficiency and better separation for the sensitive testing that occurs. The new facility has individual labs for toxicology, bacteriology, virology, molecular diagnostic, clinical and anatomic pathology, parasitology and serology testing.

The most important part of the new facility might be its

biosecurity **level 3** suite



It allows staff to work safely with diseases that can be passed between animals and humans.



**30,000**  
square feet  
of space

**25%**  
workload increase  
since 2012

Lab staff provide animal health testing and diagnostic services for veterinarians, animal owners and producers, and the public health sector. They also test livestock feed for issues such as nitrates and mold toxins; tissues for trace elements; and vitamins for nutritional value. In addition, they can test for pesticides such as Compound 1080, a chemical used in predator control, and for phytoestrogens (plant-based estrogens).

“We’re the only full-service laboratory in the region,” Webb says.

The lab’s workload has grown 25 percent in just the last five years. Now 19 full-time and two part-time staff handle about 13,000 cases and conduct 75,000 tests a year. That compares with fewer than 10,000 cases in 2012.

For Gibbens, the most important part of the new facility might be its biosecurity level 3 suite, which allows staff to work safely with diseases that can be passed between animals and humans.

“As veterinarians, we’re acutely aware of bioterrorism and foreign animal diseases,” she says. “To have a biosecure facility for veterinarians, producers and anyone interested in animal health and welfare that’s readily available, readily accessible—it means a great deal.”

The staff think another major improvement is having south-facing, heated docks and an overhang protecting the docks when unloading large animal carcasses. The unloading dock at Van Es was on the north side of the building and could be icy in cold weather.

“It was really a challenge in the winter months,” Webb says. “The overhang seems to protect the doors pretty well.”

The new lab also is equipped with a 5,000-pound load capacity incinerator. It can burn up to 1,000 pounds of tissue an hour.

Other lab features include a liquid waste capture system, a geothermal heating and cooling system, a backup generator, unused space that can be used to expand a current lab or create a new test area, and a system that provides the facility with fresh rather than recycled air.

Gibbens feels all of these features add up to a building that’s not only better for the people who use the lab’s services but for the staff as well.

“The people who work there—they give it their all for their jobs,” she says. “We would be lost without them.”

The North Dakota Legislature provided funding for the new lab in 2015. That was a good time to ask for bids on the lab construction because of the downturn in the Bakken oil fields in western North Dakota, Webb says.

Webb is confident the new lab not only will meet the increasing current needs, but be able to handle future animal health challenges and technological advances.

**FOR MORE INFORMATION:**

Brett Webb, 701-231-5271, [brett.webb@ndsu.edu](mailto:brett.webb@ndsu.edu)  
[www.vdl.ndsu.edu](http://www.vdl.ndsu.edu)



about  
**75,000**  
tests conducted  
annually

Kevin Zachman, Zerr-Berg Architects

# Meat Science Research Provides Vital Knowledge

Meat science research at the North Dakota Agricultural Experiment Station's Main Station in Fargo and Research Extension Centers across the state helps ranchers improve the way they produce and market their cattle, provides insight into human health issues and makes beef more palatable for consumers.

Some scientists are studying the correlation between a pregnant cow's nutrient intake and the development of her fetus. They've found that if beef heifers don't receive the proper nutrition early in their pregnancy, fetal development can be reduced. That led them to create supplementation strategies to help producers prevent potentially negative consequences of poor maternal nutrition and increase cattle production.

## Dietary Studies

Several studies evaluate other beef cattle dietary issues, such as supplementing cows with distillers grains and whether corn fed to cattle needs to be processed.

Research at the Central Grasslands Research Extension Center (REC) found that supplementing cows with feed such as corn dried distillers grains with solubles will provide the animals with the extra nutrients they require. The scientists involved in this research also studied the impact of supplementing pregnant cows with alfalfa hay and a liquid supplement.

"Cows supplemented with alfalfa or liquid supplement lost weight and body condition, which might indicate that these supplements did not supply adequate energy to meet animal demands," says Michael Undi, the center's animal scientist.

Research at the Carrington REC found that corn can be fed to beef cattle in the backgrounding and finishing phases without having to process the corn, which is a money-saver for producers.

Typically, when corn is included in cattle rations, particularly in backgrounding and finishing diets, it is processed by dry rolling, grinding or steam flaking, according to scientists at the center. However, not everyone has the ability to process corn on the farm, and it is an added cost.

## Meat Palatability

Scientists in NDSU's Animal Sciences Department found that taking vitamin A out of growing and finishing diets for commercial Angus and purebred Simmental steers improved the meat quality of the Angus steers but not the Simmental steers. The Angus steers were an Angus-Simmental cross, with a minimum of 75 percent Angus genetics.

Marbling is the fat that appears as white flecks in beef. It improves the meat's tenderness, juiciness and flavor.

The Angus-cross steers without vitamin A in their diets had a 16 percent increase in marbling, the research showed. That resulted in 26.6 percent of these steers grading higher for their meat than the steers that were fed vitamin A.

"Increasing marbling has the potential to add significant value to a beef carcass," says Alison Ward, an assistant professor in the Animal Sciences Department and one of the researchers.





## Beef and Human Health

NDSU scientists have found that eating red meat can be good for humans, provided that the meat is part of a balanced diet.

Using pigs as a model for humans, researchers discovered that replacing sugar in the average American diet with nutrient-dense beef may alter body composition and reduce risk factors for obesity-related metabolic disorders.

Scientists found that gilts fed ground beef developed less fat and more muscle mass than gilts receiving a ration suitable for swine based on the average American diet, called the total Western diet or TWD, and the growth of the pigs on the TWD was stunted. The gilts eating the ground beef also had a 1.65 times greater concentration of insulinlike growth factor I, an anabolic hormone that likely is driving the increase in muscle mass in the female swine fed ground beef.

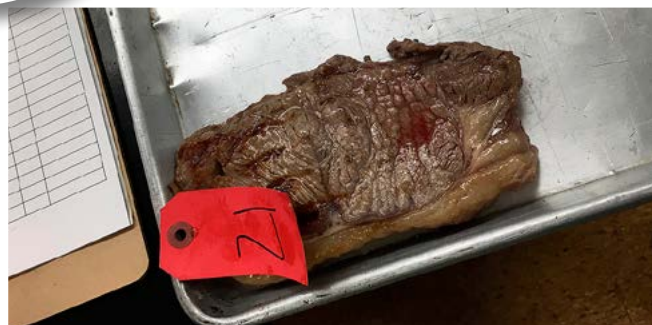
In another NDSU study that has implications for humans, piglets born to sows that didn't get exercise had considerably more fat between the muscle cells than piglets of sows that had regular exercise.

"In livestock species, we refer to this type of fat as marbling, but when observed in human muscle, it is an indication of metabolic syndrome," says Eric Berg, a professor in NDSU's Animal Sciences Department who is leading these research projects. Metabolic syndrome is a group of risk factors such as high blood pressure, high blood sugar, unhealthy cholesterol levels and abdominal fat.

This research provides sound dietary advice that will help medical providers when they give dietary advice and ultimately will result in increased domestic and foreign demand for U.S. beef, Berg adds.

### FOR MORE INFORMATION:

Eric Berg, 701-231-6271, [eric.p.berg@ndsu.edu](mailto:eric.p.berg@ndsu.edu)  
Michael Undi, 701-424-3606, [michael.undi@ndsu.edu](mailto:michael.undi@ndsu.edu)  
Alison Ward, 701-231-5649, [alison.ward@ndsu.edu](mailto:alison.ward@ndsu.edu)  
[www.ag.ndsu.edu/cattledocs/research-reports](http://www.ag.ndsu.edu/cattledocs/research-reports)





## Scientists Improve Soil Reclamation Success

When an oil or brine spill occurs or pipeline installation disturbs cropland, one of the most important resources in the reclamation process is knowledge.

That knowledge is what North Dakota Agricultural Experiment Station scientists are providing through their research at sites such as oil and brine releases near Tioga and a water pipeline installation in a field at NDSU's Williston Research Extension Center (REC).

For the past two growing seasons, NDSU soil science associate professor Tom DeSutter, NDSU School of Natural Resource Sciences director and soil science professor Frank Casey, and assistant professor and Extension soil health specialist Abbey Wick have been planting test plots of spring wheat and field peas at the Tioga spill site using different soil mixtures.

"Mainly, we are looking at whether we can use thermally desorbed subsoil with or without native topsoil," DeSutter says.

Thermal desorption is used to remove the petroleum hydrocarbons from contaminated subsoil by heating the soil material to about 650 F. The resultant product is low in hydrocarbons and has been found to be safe to be used as growing media or fill.

Extra topsoil is not readily available in western North Dakota, so the scientists are hoping to find the mixture of topsoil and thermally desorbed subsoil that will bring the oil spill-damaged land back to its prior productivity. Test results have been promising, DeSutter says.

Andeavor, the pipeline's owner, provided funding for the research.

### **Waterline Installation Leads to Research**

When a 36-inch water pipeline was installed at the Williston REC in 2015, center director Jerry Bergman, research specialist Austin Link and soil scientist James Staricka saw it as an opportunity to do some much-needed research. They collaborated with DeSutter; Kevin Sedivec, NDSU Extension rangeland management specialist and Central Grasslands REC director; and Chris Augustin, NDSU Extension soil health specialist at the North Central REC, to evaluate several cropping sequences and perennial cover crops as long-term reclamation practices in areas disturbed by pipeline installation.

This is valuable research because many producers are having to deal with soil disturbances, whether from gas, oil or waterlines, Link says. Funding for the project came from the North Dakota Industrial Commission's Oil and Gas Research Program.

The scientists chose to evaluate five annual and two perennial cropping sequences using hard red spring wheat, durum, field peas, barley, safflower, alfalfa and native perennial grass to represent the most traditional crops grown in western North Dakota, along with a full-season cover crop mix including turnips and radishes.

"The reason we chose to do so many sequences is because they have unique characteristics," Link notes.



The scientists are studying the impacts of these cropping sequences on soil health and crop performance on three disturbance areas: the pipeline trench, an area that had its topsoil stripped off and then was used as an access road during pipeline construction, and adjacent undisturbed land. In 2015 and 2016, annual crops yielded less in the road and pipeline areas.

However, the alfalfa produced significantly more biomass over the pipeline than in the undisturbed and road areas. The scientists suspect alfalfa grew better over the pipeline because the soil may not be as compacted and water accumulated there, making it the last place to run out of water in drought conditions.

Also, alfalfa's deep rooting may have allowed it to access otherwise unavailable moisture. Moisture-sensing equipment will be installed at the site to help determine how water is contributing to crop performance.

"We have several clues, but we don't yet have a complete picture of what is driving crop performance differences," Link says.

The scientists also are studying other soil health and production improvement options, including one-time, 18-inch-deep tillage, called ripping, alone and with the application of manure to decrease compaction, jump-start beneficial organisms in the soil and increase organic matter.

## Brine Spill Reclamation

In related research, DeSutter, associate professor and NDSU Extension Service livestock environmental stewardship specialist Miranda Meehan, Augustin and assistant soil science professor Aaron Daigh received a U.S. Department of Agriculture grant for brine spill research. Their objective is to develop reclamation strategies to help landowners by returning disturbed land to its prior productivity and assist companies doing the reclamation.

"We want to empower both with improved knowledge so they can make better informed decisions," DeSutter says.

The oil industry is very supportive of the scientists' efforts.

"In cooperation with NDSU on issues related to soil reclamation, industry has benefited from their ideas and desire to educate everyone," says Dustin Anderson, environmental superintendent for Oasis Petroleum, a Texas-based company with an office in Williston.

### FOR MORE INFORMATION:

Tom DeSutter, 701-231-8690, [thomas.desutter@ndsu.edu](mailto:thomas.desutter@ndsu.edu)

Austin Link, 701-774-4315, [austin.t.link@ndsu.edu](mailto:austin.t.link@ndsu.edu)

[www.ag.ndsu.edu/willistonrec/dryland-research-1](http://www.ag.ndsu.edu/willistonrec/dryland-research-1) and [www.ndsu.edu/soilhealth](http://www.ndsu.edu/soilhealth)

# NDSU Research Benefits North Dakota

## Wheat Producers



**#1** North Dakota ranks first in hard red spring wheat production

growing an average of

**235 million bushels**

or almost **half** the nation's crop



North Dakota wheat yields

**\$6.4 billion** in annual economic activity  
(\$2.1 billion direct and \$4.3 billion secondary)

Each acre of wheat generates

**\$750** in total economic activity  
making wheat **20%** of all farm marketing in North Dakota



If you're going to visit the office and laboratories where Senay Simsek conducts her research, you'd better wear some running shoes because this associate professor and cereal scientist in the NDSU Department of Plant Sciences moves very fast.

Simsek is the Bert L. D'Appolonia Cereal Science and Technology of Wheat Endowed Associate Professor at NDSU, where she leads the cereal and food biochemistry research laboratory.

Each year, the wheat quality lab at NDSU receives hundreds of samples from North Dakota, South Dakota, Montana and Minnesota to be analyzed for quality parameters. In 2017, Simsek's lab analyzed 799 samples of hard red spring wheat for the U.S. Wheat Associates' Crop Quality Report.

The samples are tested for their protein content and gluten quality, among other properties. During busy months, the lab runs 24 hours a day to make sure the quality analysis is done in a timely manner.

The information discovered in the laboratory then is disseminated to a multitude of people.

"The wheat breeders, pathologists and geneticists incorporate this information into their breeding programs," Simsek says. "North Dakota farmers then use this information about the quality of their wheat to help market it to end-users, such as millers and bakers."

Because more than 50 percent of the state's hard red spring wheat is exported, much of Simsek's work involves international buyers. Simsek meets with visiting trade teams to relay technical information about North Dakota's hard red spring wheat's chemical makeup so that buyers will understand how to use the wheat to fit their needs.

"Hard red spring wheat from North Dakota and the surrounding region is recognized as the best-quality wheat grown in the world," Simsek says. "My job is to highlight the unique quality aspects to help farmers in our region sell their wheat to overseas customers."



More than  
**50%**  
of North Dakota  
hard red spring wheat  
is exported

**799**  
hard red spring wheat  
samples analyzed  
in 2017

## Research Impacting the Reputation of Wheat

Celiac disease is a serious autoimmune disorder that occurs when the ingestion of gluten leads to damage in the small intestine. It is estimated to affect one in 100 people worldwide. When people with celiac disease eat gluten, a protein found in wheat, rye and barley, their body mounts an immune response that attacks the small intestine.

According to the Celiac Disease Foundation, a genetic predisposition to celiac must exist in individuals before the presence of gluten peptides triggers the immune response.

However, the simplified explanation that gluten causes celiac disease has hurt the reputation of wheat and foods containing wheat. Claims also have been made that modern wheat breeding practices have changed wheat protein chemistry, resulting in a higher concentration of immunogenic peptides in modern wheat, compared with historical wheat varieties, which contributes to increased incidences of celiac disease.

Funded by the North Dakota Wheat Commission, a 2017 study conducted by NDSU scientists aimed to test the protein chemistry of 30 hard red spring wheat cultivars released in North Dakota in the last century to determine the presence of celiac disease-initiating peptides.

The research found that 15 immunogenic peptides were present, but the presence of these peptides was not related to the release year of cultivars and the peptides appeared randomly.

"We were able to conclude that modern hard red spring wheat varieties are not higher in terms of celiac disease immunogenicity, compared with historical varieties," Simsek said.

In addition to Simsek, the NDSU research team included Steven Meinhardt, NDSU plant pathologist, and graduate student Maneka Malagoda.

"The work of the wheat-quality research program at NDSU is relevant to real people, farmers and consumers," Simsek says. "Although you might not see our research directly on a farm, my program's influence behind the scenes is helping to keep hard red spring wheat profitable for North Dakota farmers."

"So, if I hear a baker from a country thousands of miles away talking about North Dakota wheat quality being No. 1 in the world, that makes me happy."

### FOR MORE INFORMATION:

Senay Simsek, 701-231-7737, [senay.simsek@ndsu.edu](mailto:senay.simsek@ndsu.edu)

# Precision Ag Research Helps Producers Make



Concept picture, Aker Technologies

## Here are some specific precision ag research projects:

- **Invasive and noxious weeds** – Researchers use UAS imagery to monitor leafy spurge and purple loosestrife in ditches and on rangeland and other public and private land. This information is important to county weed control boards.
- **Weed identification** – UAS imagery detects troublesome weeds such as kochia, waterhemp and ragweed while they still are small (3 inches or less) so they can be treated before they get out of control.
- **Herbicide injury** – UAS imagery shows where damage occurred if herbicide isn't applied at the proper rates or it drifted outside the application area.
- **Plant stand** – Sensors provide data on a variety of issues, including when seeds germinate and the number of plants growing per acre, which helps producers decide whether they need to replant, or how much fertilizer to apply and where in the field to apply it.
- **Herbicide resistance** – Sensors on UAS flying over a field hours after a herbicide application can detect whether weeds are resistant to the chemical. Herbicide-sensitive weeds are about 5 degrees warmer than resistant weeds after a herbicide application because healthy plants have enough water in their cells to keep them cooler.

"There wouldn't be a farmer who wouldn't be interested in knowing that," Nowatzki says.

Josh Albers, who raises wheat, corn and soybeans with his father and brother near Center, sees the advantages of precision agriculture.

Technology that allows producers to apply more fertilizer where it's needed in a field and less where it's not saves money, he says. Automatic steering, automatic spray-rate controllers and high-tech row crop planting also have been very helpful in reducing equipment operator fatigue and improving accuracy.

"It's come a long way," he says of agricultural technology.

But the Albers were leery at first about adopting it because they weren't sure what it could do for them.

"I don't think we jumped in with both feet," he says.

The Albers aren't alone. Today's high-tech agricultural equipment can provide producers with massive amounts of data, but many don't use the information to make farming decisions.

"Most farmers aren't interested in looking at another spreadsheet of data," says Sreekala Bajwa, chair of NDSU's Agricultural and Biosystems Engineering Department. "They want to know what's going on in their field and what they are going to do about it."

That's why Bajwa, whose areas of expertise include precision agriculture, remote sensing and unmanned aerial systems (UAS), and John Nowatzki, the department's Extension agricultural machine systems specialist, lead research to evaluate agricultural technology and demonstrate how producers can use it to make better decisions about their farming operation and increase their profit.

For the past few years, the scientists, with assistance from colleagues in other departments and graduate students, have tested a variety of UAS-mounted sensors. The sensors can locate waterlogged parts of fields, for instance, or determine the extent of hail damage in an area.

The researchers also are evaluating the usefulness of precision agriculture technology to detect volunteer soybeans coming up in dry edible bean fields early in the growing season so the soybeans can be eliminated, help producers determine how much nitrogen to apply in a field and identify the particular disease affecting a field.

"You can see there is a problem, but it's not easy to say what it is," Bajwa notes.

# Profitable Decisions

Nowatzki says that in addition, they've continued to evaluate the huge amount of data collected in 2016 and 2017 during a collaboration with Elbit Systems of America. Elbit, an Israeli-based company, provided a UAS with a 35-foot wingspan for a project to study the usefulness of large-scale UAS in crop and livestock production. The goal is to make the data available to producers and others interested in using the information.

In 2018, the researchers would like to establish a 160-acre Discovery Farm at the North Dakota Agricultural Experiment Station's Agronomy Seed Farm near Casselton. A lot of the precision agriculture research being conducted is in the greenhouse and field plots, so a Discovery Farm would allow scientists to evaluate technology on a commercial scale, Bajwa says.

"What we want to do is demonstrate how all the technology is used and the economics of it," Nowatzki adds.

This effort would involve Agribusiness and Applied Economics Department faculty and local equipment manufacturers.

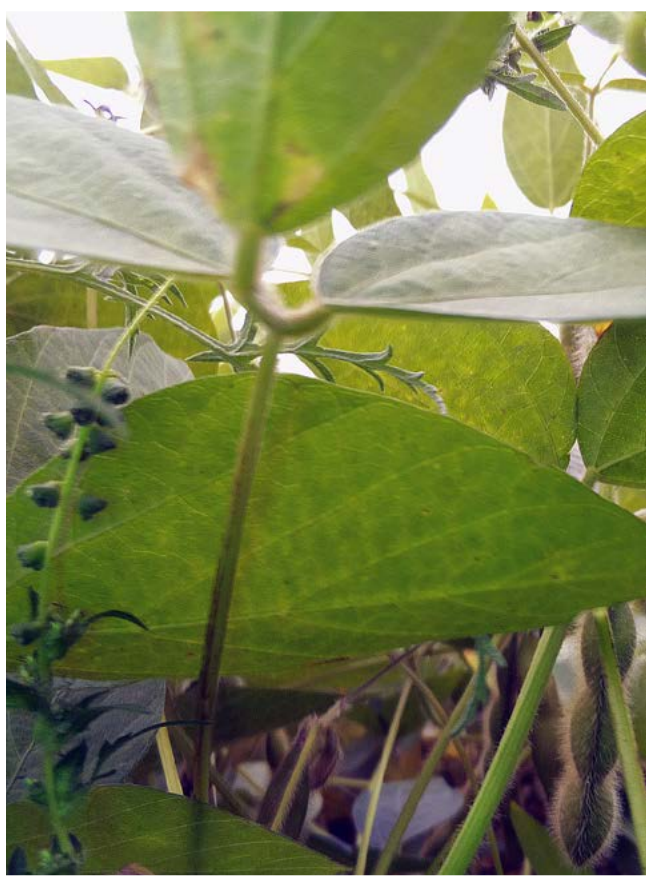
Another project the researchers hope to launch is a robotic probe that can drop down from a UAS into a crop canopy. The probe would take high-resolution photos to help detect diseases or count insects such as aphids to help producers determine whether they need to take action to control a problem.

Although most of the precision agriculture research has been in crop production, Nowatzki hopes to expand to livestock. He wants to test a battery-powered radio-frequency identification (RFID) tag that can be read from 100 feet away. Theoretically, a producer could fly a UAS over a herd and capture data from these tags. The RFID tags ranchers typically use do not have batteries, and you need to be 5 feet or less away to read them.

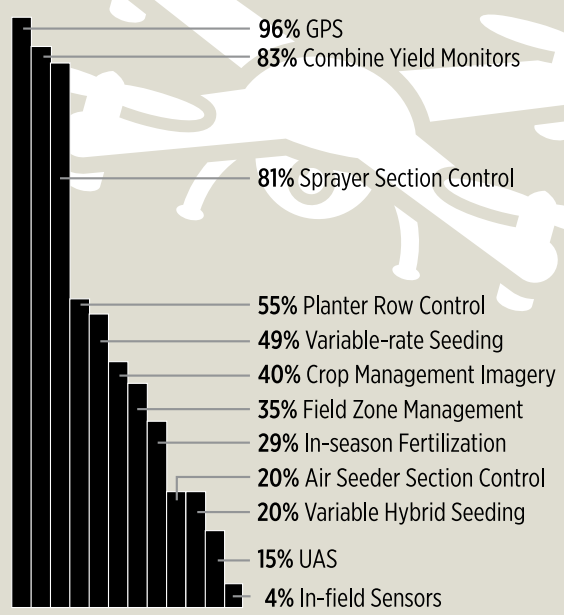
Because of the amounts of data that technology has created and will continue to develop, Bajwa sees a great need for this kind of research to continue.

"We will see a lot of new technology in the next 10 years or so," she says.

**FOR MORE INFORMATION:**  
 Sreekala Bajwa, 701-231-7265, sreekala.bajwa@ndsu.edu  
 John Nowatzki, 701-231-8213, john.nowatzki@ndsu.edu  
[www.ag.ndsu.edu/agmachinery/precisionagriculture](http://www.ag.ndsu.edu/agmachinery/precisionagriculture)



## Precision agriculture usage in North Dakota



Source: NDSU



# Cover Crop Study

Two years into a four-year research project, NDSU agricultural researchers and producers already have a better understanding of interseeding cover crops into fields of corn and soybeans.

“We were able to gain insights on what cover crops survive better under the crops’ shade, and when to plant them and how to manage them,” says NDSU Plant Sciences Department professor Marisol Berti, who leads the project.

This project, funded with a nearly \$3.74 million grant from the U.S. Department of Agriculture, is a collaborative effort of 13 researchers, including eight from NDSU. The rest are from the University of Minnesota, Iowa State University and the U.S. Department of Agriculture’s Agricultural Research Service laboratory in Morris, Minn. Ten graduate students and two post-doctoral scholars from NDSU also are involved.

One of their objectives is using cover crops and innovative seeding to improve the resilience and productivity of crops such as corn and soybeans. Cover crops are grasses, legumes and forbs planted to provide soil cover on cropland when it is bare, such as before crops emerge or after harvest in the fall.

“The use of cover crops, common in the eastern and central Corn Belt, is uncommon in corn-soybean systems in the Upper Midwest and northern Great Plains due to the short growing season and extreme fluctuations in temperature and precipitation within and across growing seasons,” Berti says.

“Lack of winter soil cover increases soil and nutrient losses, resulting in decreased crop productivity and resiliency,” she adds. “For these reasons, larger amounts of agricultural inputs are required to maintain or increase yields. Therefore, there is a critical need to alter current cropping systems in our region by incorporating technologies to improve long-term productivity while enhancing ecosystem services.”



Joe Breker, Rutland





# Reaping Benefits

As part of the project, the researchers are:

- Modifying seeding equipment to work with cover crops
- Developing tools to help producers make cover crop decisions
- Estimating the amount of soil nutrients cover crops provide and subsequent crops' nutrient use
- Conducting an economic analysis of seeding equipment modifications
- Introducing relay cropping (growing two or more crops on the same field by planting the second crop after the first one has completed its development) and intercropping (growing two or more crops simultaneously in the same field) to existing cropping systems

In 2016 and 2017, the researchers conducted field experiments at six locations in North Dakota, Minnesota and Iowa. They found that establishing winter annual cover crops was a greater challenge in corn than soybeans. They say that's likely because the corn plants limited the amount of sunlight reaching the cover crops and the soil lacked suitable moisture.

To make cover crop planting more efficient, NDSU researchers worked with personnel at Amity Technology of Fargo to develop an interseeder. It's a high-clearance planter adapted to plant cover crops at corn's V6 stage (about three to four weeks after plant emergence) at the same time a side dressing of fertilizer is applied. It also can interseed into soybeans at different growth stages. This planter has interseeded more than 500 acres of cover crops for the project.

Extension Service members of NDSU's research team set up on-farm field trials at two locations. One of them is Joe Breker's farm near Rutland. He provides land, seeding, chemical spraying and harvesting for the trials.

"I like to watch what's going on in the plots throughout the year," Breker says. "That helps me relate to the results as I see them."

He adds that he has worked with NDSU on various research projects for 40 years, and he always feels he has benefited.

The Extension team members also have held numerous workshops, training sessions, field days, tours, lunch seminars and informal gatherings called Café Talks led by Abbey Wick, an assistant professor in NDSU's School of Natural Resource Sciences and an Extension soil health specialist. They've shared research results and recommendations with more than 1,000 North Dakota producers, Extension agents, crop consultants, agricultural product sales representatives and commodity groups.

"Although we do not have figures yet, by word of mouth, we know the adoption of interseeding cover crops into standing corn and soybean is spreading rapidly," Berti says. "More and more producers participate in our Extension activities, eager to learn more about cover crops and how to insert them into current cropping systems."

Research team scientists also have given several presentations on this project. In addition, they've developed fact sheets, two publications and a book chapter to help increase producers' knowledge of how to select and grow cover crops as a way to improve productivity, profitability and soil health.

"It will be interesting to watch this research unfold in future years," Breker says.

#### FOR MORE INFORMATION:

Marisol Berti, 701-231-6110, [marisol.beriti@ndsu.edu](mailto:marisol.beriti@ndsu.edu)  
[www.ag.ndsu.edu/plantsciences/research/forages/cover-crops](http://www.ag.ndsu.edu/plantsciences/research/forages/cover-crops)

Photo: Joe Breker, Rutland



## Research Supports

# Organic Agriculture



The majority of the research conducted has been to provide organic crop and variety trial data for:

- |                   |                    |
|-------------------|--------------------|
| <b>wheat</b>      | <b>soybeans</b>    |
| <b>oats</b>       | <b>cowpeas</b>     |
| <b>barley</b>     | <b>emmer</b>       |
| <b>durum</b>      | <b>einkorn</b>     |
| <b>flax</b>       | <b>spelt</b>       |
| <b>field peas</b> | <b>potatoes</b>    |
| <b>faba beans</b> | <b>buckwheat</b>   |
| <b>dry beans</b>  | <b>cover crops</b> |
|                   | <b>rye</b>         |

**114**

certified organic farms  
in North Dakota

**116,305**

acres of land in  
North Dakota are  
certified organic

U.S. residents are buying more organic food and household products than ever before, says the Organic Trade Association, the nation's leading organic industry group.

In 2016, sales of organic food and goods topped \$47 billion, an increase of more than 8 percent from the previous year.

According to an article in Food Business News, General Mills Inc., one of the nation's top five organic ingredient purchasers in North America, is aiming to double the organic acreage from which it sources ingredients. The company expects to have 250,000 acres by 2019.

In North Dakota, 114 certified organic farms utilize 116,305 acres of certified organic land.

Steve Zwinger, an organic research scientist at the Carrington Research Extension Center (CREC), has been studying the development of the organic agriculture industry for many years.

"The CREC's mission includes addressing the needs of many types of farms and farming systems," Zwinger says. "Research trials conducted in certified organic environments are just another method of delivering information to serve the needs of organic farmers, along with building a long-term database of information related to this farming method."

In response to the growing demand for organic production information, the CREC has been conducting research in certified organic environments for more than 17 growing seasons at the center and in the fields of participating farmers.

Off-farm research sites have been near the North Dakota communities of Cathay, Robinson, Tappen, Dawson, Fessenden, Rugby and LaMoure.



CREC's certified organic land has been approved by the USDA for

**10**  
years

## Organic Certification

To become a certified organic producer, farmers must follow a stringent accreditation process through the U.S. Department of Agriculture (USDA). This process may involve transitioning any conventional cropland to organic cropland by not applying any prohibited substances to it for three to four years.

The CREC's certified organic land has been approved by the USDA for 10 years, with the last restricted product applied in the summer of 2004. In 2014, the center began converting an additional 12 acres to meet the needs of its expanded organic research program.

The majority of the research conducted has been to provide organic crop and variety trial data for wheat, oats, barley, durum, flax, field peas, faba beans, dry beans, soybeans, cowpeas, emmer, einkorn, spelt, potatoes, buckwheat, cover crops and rye.

Other areas of research have included trials related to various production practices or management, such as seeding rate and date, cover crop management, compost tea, no-till practices, and rotation trials using animal manures and cover crops.

"One of the challenges of organic agriculture is the limited selection of different seed varieties and the availability of certified organic seed," Zwinger says.

The USDA's national organic policy requires the use of organic seed when commercially available. However, very few public and private breeding programs are focusing on the development of organic seed, Zwinger notes.

## Organic Field Pea Development

In 2014, the CREC joined a collaborative effort to develop an organic field pea variety.

Pulse USA, a member-owned seed company specializing in pulse crops, and Blaine's Best Seeds, a certified organic seed grower, entered multiple experimental cultivars into the CREC organic field pea variety trials.

Two other organizations also were involved in the project: the Northern Plains Sustainable Agriculture's Farm Breeding Club, whose members assist in the development of organic seed through research and education, and the Foundation for Agricultural and Rural Resources Management and Sustainability (FARRMS), a nonprofit educational organization that provided the funds for the variety testing.

The ultimate goal of the project, once the evaluation of experimental cultivars is complete, will be to select the best lines adapted to an organic environment, then secure seed rights to grow and sell the seed exclusively to organic seed markets.

## Organic Ag Field Day

To support North Dakota farmers with an interest in organic production, the CREC hosts an annual organic agriculture field day. The 2017 field day included topics such as insight on consumer wants and needs related to oats and cereal grains, marketing organic oats for local markets, organic oat breeding and the future of organic agriculture.

"The demand for certified organic cereal grains is far outpacing the supply," Zwinger says. "U.S. farmers are simply not able to keep up with consumer demand for organic food products.

"The CREC has limited land, but we will continue to provide cutting-edge research and information so that North Dakota farmers can help to shrink the gap," he adds.

### FOR MORE INFORMATION:

Steve Zwinger, 701-652-2951, [steve.zwinger@ndsu.edu](mailto:steve.zwinger@ndsu.edu)  
[www.ag.ndsu.edu/CarringtonREC/center-points/organic-research-at-the-crec](http://www.ag.ndsu.edu/CarringtonREC/center-points/organic-research-at-the-crec)

# Scientists Expand Safe Use of Chemicals in Minor Crops

Weeds are considered one of the greatest problems in crop production, according to Brian Jenks, weed scientist at the North Central Research Extension Center (NCREC) in Minot.

“Changes in weed species, weed densities and weed resistance to herbicides have made weed control more and more challenging for North Dakota farmers,” he says.

Conducting weed research to expand the safe use of herbicides is one of the main research goals at the NCREC. Weed control studies are being conducted in small grains, canola, sunflowers, safflower, faba beans, flax, dry beans, dry peas, lentils, chickpeas, mustard, corn and soybeans.

The scientists at the NCREC also evaluate new herbicides and different uses of existing herbicide products in various crops. Other experiments involve evaluating the impact of different cultural practices such as crop rotation and conventional tillage versus no-till on crop yield, seed quality, weed control and economic feasibility.

While weed control is critical for the success of all farmers, it’s especially tough for producers of minor crops, such as sunflowers, dry beans, dry peas, lentils, chickpeas, mustard and safflower, says Jenks.

He explains, “The major herbicide manufacturers focus most of their resources on major crops such as corn, soybeans and wheat. Minor crops in North Dakota receive much less attention and thus have few registered herbicides.”

## NCREC Conducts IR-4 Research

One of the ways the NCREC helps farmers is by testing herbicides for registration on minor-use crops through the Inter-Regional Research Project Number 4 (IR-4 Project).

The IR-4 Project was created by the U.S. Department of Agriculture in 1963 to provide specialty crop farmers with legal access to essential pest management products that protect their crops from destructive pests and weeds.

“At the present time, flax, mustard and safflower producers don’t have a desiccant (or dry-down) herbicide available for their use,” says Jenks.

“Based on the feedback of these producers, the NCREC submitted a petition to the IR-4 Project and the makers of Diquat, a desiccant herbicide, to study its residue effects,” he adds. “We completed the study during the 2017 growing season and then submitted our data to the Environmental Protection Agency (EPA).”

He continues, “Within three years, the EPA most likely will allow Diquat to be registered as a desiccant herbicide for all oilseed crops.”

The NCREC conducted nine IR-4 Projects in 2017 and plans to conduct six projects in 2018.



## Real-world Recommendations

Although IR-4 Project research is an important part of weed control research at the NCREC, it is just one way the center is supporting area farmers.

“The research and education we provide is all directed by the needs and questions of producers,” Jenks says. “We identify the needs and try to find solutions that will help farmers control weeds more effectively or reduce costs.”

As an example, the center completed a study in 2017 on the use of Tough 5 EC, an experimental herbicide for postemergence broadleaf weed control in chickpeas.

Jenks continues, “Tough 5 EC is expected to be registered in 2019, and we need to be familiar with its strengths and weaknesses so that we can make proper recommendations about its use.

“We wanted to know when the right time to apply it is,” he says. “What spray volume is it most effective at and what adjuvants (or additives) would help it work better.”

Helping growers identify weeds and making research-based suggestions about ways to control them is also a part of the job.

“This summer many farmers were concerned about a new yellow-flowered weed in their fields,” Jenks says. “We visited several farms and identified the weed as narrowleaf hawksbeard (*Crepis tectorum* L.). Now we are conducting research to help identify methods to control this new weed.”

This invasive weed is spreading in North Dakota because of its tolerance to several herbicides and because it thrives in no-till or low-till systems. Because of its prevalence, the team of weed scientists at NDSU has named narrowleaf hawksbeard its 2018 weed of the year.

“Our goal is to help North Dakota farmers be more profitable by providing cutting-edge weed science research and then passing on those findings,” Jenks says.

Weed control research and recommendations are available on the NCREC’s website, through its field days and producer meetings, and in the annual “North Dakota Weed Control Guide.”

### FOR MORE INFORMATION:

Brian Jenks, 701-857-7677, [brian.jenks@ndsu.edu](mailto:brian.jenks@ndsu.edu)  
[www.ag.ndsu.edu/NorthCentralREC/weed-science-research](http://www.ag.ndsu.edu/NorthCentralREC/weed-science-research)  
[www.ag.ndsu.edu/weeds](http://www.ag.ndsu.edu/weeds)



## Narrowleaf hawksbeard

named 2018 weed of the year by team of NDSU weed scientists



## Nanotechnology Has Plant Disease Control Potential

Imagining just how small a nanometer is isn't easy.

It's 1 billionth of a meter. More than 25 million nanometers are in an inch, and one sheet of newspaper is about 100,000 nanometers thick.

Nanoscience and nanotechnology involve the ability to see and control individual atoms and molecules.

Robert Brueggeman, an associate professor in NDSU's Department of Plant Pathology, and Achintya Bezbaruah, an associate professor in the Department of Civil and Environmental Engineering, along with a multidisciplinary group of undergraduate and graduate students, are using nanoparticle research to determine how barley responds to these particles and pathogens at a molecular level.

"Nanotechnology has the potential to significantly address issues related to agricultural production and, in turn, help mitigate global food security issues," Brueggeman says. "This new technology has the potential to change how we manage disease in crops, including the development of novel pesticides that reduce the negative effects they have on the environment."

Net form net blotch (NFNB) is a destructive foliar disease of barley in major growing regions worldwide. Thus, identifying and understanding the resistance/susceptibility genes is important for breeding and understanding host-pathogen interactions.

Brueggeman and his team were awarded a grant, in part by the National Science Foundation, to study plant-engineered nanomaterial interactions in barley. The study's long-term goal is to understand how nanoparticles applied to the outer surface of a barley plant can enter the plant's cells and induce the plant to have enhanced genetic resistance to diseases.

Prior research has shown that reprogramming a plant's genes via engineered nanomaterial interactions can have beneficial and detrimental effects.

The study's initial results suggest that applying zinc oxide-engineered nanoparticles to barley produces immunity-response genes, and those genes may enhance barley's resistance to some pathogens but reduces resistance to NFNB.

"When you start introducing nanoparticles to a plant, the small particles have the ability to mimic biological molecules, as well as things that plants recognize from the environment," says Brueggeman. "Those types of molecules can elicit strong physiological changes in the plant, which can be very advantageous for disease immunity and plant growth.

"But the problem is that when you start altering the immunity of the plant to one disease, you change how the plant might respond to issues later in its growth cycle, such as microbes in the soil, other diseases, nematodes or aerial spores," he adds.

Other study objectives are to better understand why some nanoparticles elicit a positive plant response versus a negative response.

"We've had ideas about how we could combine nanoparticles and fertilizer, and not only have the fertilizer slow-release into the plant, delivering micronutrients, but also inducing physiological changes that allow the plant to grow faster and more prolifically," Brueggeman says. "The impact of this research on precision agriculture technology could be monumental."

**FOR MORE INFORMATION:**

Robert Brueggeman, 701-231-7078, [robert.brueggeman@ndsu.edu](mailto:robert.brueggeman@ndsu.edu)



## New Crop Varieties Offer Excellent Properties

Plant breeding is the art and science of combining favorable genes for disease resistance, agronomic performance and end-use quality into a single plant to produce improved varieties.

North Dakota Agricultural Experiment Station breeding programs developed several varieties that were released in 2017.

### ■ ND17009GT Glyphosate-tolerant Soybean

ND17009GT is early maturing and well-suited for northern North Dakota. It performed very well in trials across North Dakota and in the multistate uniform regional test. ND17009GT is resistant to race 4 of phytophthora root rot and has moderate tolerance to iron-deficiency chlorosis (IDC).

### ■ ND Benson Soybean

ND Benson, a conventional variety, is intended to replace Ashtabula. ND Benson is not resistant to glyphosate, has high yield potential and 0.4 relative maturity. It has excellent resistance to soybean cyst nematode and is resistant to races 3 and 4 of phytophthora root rot. It also has tolerance to IDC and is not prone to lodging.

### ■ ND Stutsman Soybean

ND Stutsman, a conventional variety, is not resistant to glyphosate. It has high yield potential and its relative maturity is 0.7, maturing one day later than Sheyenne.

ND Stutsman performed well in trials across North Dakota and in the multistate regional uniform test. In North Dakota tests performed from 2012 to 2016, ND Stutsman produced 4 bushels per acre more than ND Bison and 2 bushels per acre more than Sheyenne.

ND Stutsman is resistant to race 3 of phytophthora root rot and has tolerance to IDC. It is not prone to lodging.

The North Dakota Soybean Council provided funding for the development of these varieties.

### ■ ND VitPro Hard Red Spring Wheat

ND VitPro is widely adapted to the North Dakota spring wheat region. It has improved straw strength, compared with recent NDSU varieties, and its plant height is similar to Faller and Prosper.

Its medium early maturity is similar to Barlow. ND VitPro has high grain protein and test weight, and outstanding kernel and milling traits.

ND VitPro is moderately resistant to all prevailing races of stem rust, has moderate scab resistance and shows good adult plant resistance to leaf rust and stripe rust.

### ■ ND Grano Durum

ND Grano has high yield potential, good quality and low cadmium uptake. It performed well in the uniform regional durum nursery and has good yield potential across North Dakota. It has similar yield to Carpio.

ND Grano also has good test weight, large kernels, medium maturity, medium resistance to leaf disease and good straw strength. Compared with Carpio and Joppa, ND Grano has higher test weight, smaller kernel size and similar height. Fusarium head blight disease severity in ND Grano is similar to that of Joppa.

### ■ ND Riveland Durum

ND Riveland has good quality and low cadmium uptake. It had higher yield than all the cultivars tested in variety trials across North Dakota.

ND Riveland also has good test weight, large kernels, medium maturity, medium resistance to leaf disease and good straw strength. Compared with Carpio and Joppa, ND Riveland is taller, and has higher test weight and larger kernel size. Fusarium head blight disease severity in ND Riveland was the lowest among all cultivars tested.

#### FOR MORE INFORMATION:

Richard Horsley, 701-231-8142, richard.horsley@ndsu.edu



# Extension Committed to Extending Knowledge, Changing Lives

One hundred three years after the NDSU Extension Service was established to develop practical ways to apply research knowledge, it continues to respond to North Dakotans' needs with timely, science-based education that helps them improve their lives and livelihoods.

**Purpose:** Create learning partnerships that help youth and adults enhance their lives and communities.

Citizen input plays a huge role in shaping Extension's programming. Extension listens to citizens, whether through community forums such as the 11 held across North Dakota in 2015 or discussions with individuals and groups concerned about a particular topic.

Extension specialists, many who are housed on the NDSU campus, then use their expertise in a particular

field to develop recommendations and programs to respond to those concerns and needs, and find solutions to problems. However, Extension's reach is statewide. Specialists and agents extend these recommendations and programs to all 53 counties and the four Native American reservations.

Key Extension program areas are:

- 4-H youth development
- Family and community wellness
- Crop and livestock production
- Environmental and natural resources
- Farm economics
- Food and nutrition
- Horticulture

"An important part of Extension's success is partnering with federal and state agencies, state commodity groups and associations, and local entities to use Extension's educational capacity to deliver programs efficiently and effectively," says NDSU Extension Director Chris Boerboom. "Extension educates and collaborates but does not duplicate."

Extension understands that people learn in different ways. As a result, Extension makes educational information available so youth and adults can access the information when and how they want it. That includes workshops, websites, apps, webinars, publications and fact sheets, lessons, news articles and columns, social media, phone calls, field tours, demonstrations and one-on-one discussions.

Because North Dakotans will face increasingly complex issues, Extension also is committed to being innovative, adaptable and willing to listen to citizens' needs and concerns to create new ways of thinking, learning and addressing issues for the future.

**FOR MORE INFORMATION:**

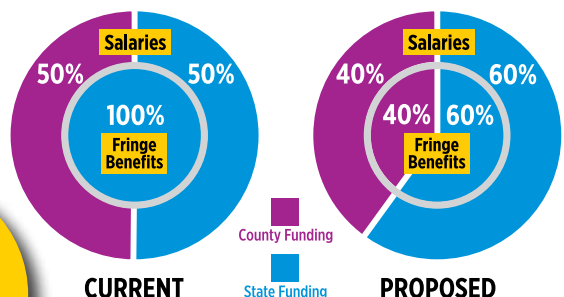
Chris Boerboom, 701-231-8944, [chris.boerboom@ndsu.edu](mailto:chris.boerboom@ndsu.edu)  
[www.ag.ndsu.edu/extension](http://www.ag.ndsu.edu/extension)

**Extension Employee Distribution**



\*Does not include 66 county office support staff who are on county, rather than Extension, payroll

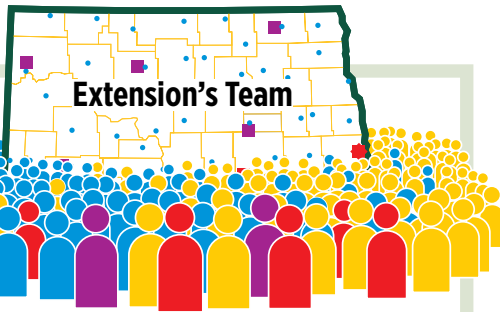
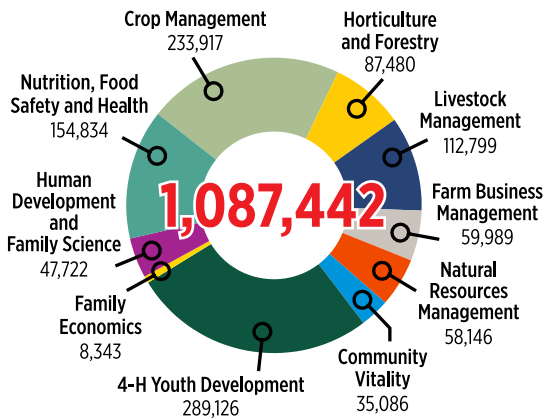
**Funding for county-based Extension agent positions (current and proposed)**



**EFNEP and FNP**  
**100%**  
Federally Funded



## 2017 Total Direct Contacts by Program Area (as reported by staff)



**Extension agents, parent educators and nutrition education assistants** deliver educational programming and work with citizens to meet needs in the counties they serve.

**Off-campus specialists** typically are based at Research Extension Centers across the state. They develop and lead programs in specific areas, such as livestock or crop production, soil health or leadership.

**Campus specialists** develop and support programs on issues of statewide concern. They usually hold faculty positions in NDSU's College of Agriculture, Food Systems, and Natural Resources or the College of Human Development and Education. Many also have partial research or teaching appointments.

**Support staff** usually are citizens' first point of contact with Extension in county offices. At NDSU, support staff increase the efficiency of specialists by managing office operations and assisting in developing educational resources.

## Extension Successes

Here are some ways Extension impacts North Dakotans:

■ **Livestock** – When east-central North Dakota beef producers began losing cows because the animals couldn't digest the plastic net wrapping on hay bales, Angie Johnson, agriculture and natural resources agent in Steele County, educated them on other options. She emphasized the importance of removing the plastic wrapping before grinding the hay and feeding it to cattle or wrapping the bales with sisal (fiber-based) twine.

"By using sisal twine, it degrades away by the time I need to feed the hay, so all I have to do is remove the plastic twine, which is just enough to keep the bale held together and there's not very much I have to pull off in the winter," producer Mike Johnson says.

■ **Leadership** – Extension's Rural Leadership North Dakota (RLND) program helps participants think critically and creatively, communicate effectively, do strategic planning and manage conflict. They also learn about agricultural and rural policy, economic trends that could affect North Dakota and civic engagement.

For RLND alumna Vawnitia Best, that knowledge has been valuable on her family's Watford City ranch; it helped her family develop effective marketing plans and gain a better understanding of how to have a voice in policy decisions that affect rural America. RLND also shaped her decision to run for public office and her approach to her role as a McKenzie County commissioner.

"It is important to develop policy from a place of objectivity," she says. "RLND has helped with the awareness to better gauge and feel that place of responsibility where empathy and objectivity intersect."

■ **Farm operation** – Annie's Project enabled 106 farm women in 2017 to be better business partners through educational sessions on the business of farming and ranching. More than 90 percent of the participants said the program was a very empowering experience that gave them the courage and knowledge to become more actively involved in the business side of their agricultural operation.

■ **Youth development** – 4-H communication arts contests help youth become effective communicators. Good communication may be the most important skill for a strong leader. Of the preteen program participants surveyed, 38 percent strongly agree and another 38 percent agree the program gave them the confidence to speak in front of groups.



# SBARE Review and Response

The 2017 North Dakota Legislature instructed the State Board of Agricultural Research and Education (SBARE) to review the NDSU Extension Service to increase Extension's effectiveness and efficiency. During the first phase of this review, a committee looked at Extension's mission, organization, programs, delivery methods, marketing and funding, and recommended changes.

In the second phase, a committee reviewed three specific areas:

- Administrative structure
- State, area and county staffing and program structure
- Sustainability of the current funding model

The committee made several recommendations and supported several recommendations and ideas NDSU Extension Service Director Chris Boerboom made.

Here is a brief look at findings and preliminary recommendations, and how Extension is responding.

## MISSION

### Extension Mission

- Provide science-based transformational education
- Collaborate with counties to fulfill local needs
- Collaborate, not duplicate, with federal and state agencies to fulfill educational objectives

## DELIVERY

### Recommendation: Improve Delivery Methods

#### Extension response

- Increase use of issue-based teams
- Increase efforts to target younger adults
- Increase use of technology

## VISIBILITY

### Recommendation: Improve Extension's Visibility

#### Extension response

- Provide more opportunities for citizen input by:
  - Increasing county advisory councils
  - Establishing a state advisory council
  - Conducting a statewide needs assessment every five years
- Increase efforts to educate the public about Extension's mission, programs and impacts

## EFFICIENCY

### Recommendation: Improve Administrative/personnel Efficiency

#### Extension response

- Restructure district leadership from four to three districts
- Restructure the Extension Leadership Team
- Restructure roles and responsibilities of area specialists
- Restructure Extension agent funding model with county partners
- Combine family and consumer sciences and community vitality into one program: family and community wellness
- Adopt the Program Evaluation and Reporting System to enhance Extension's ability to plan and develop programs, and report impacts
- Supplement funding through cost recovery for specific programs

#### FOR MORE INFORMATION:

Chris Boerboom, 701-231-8944, [chris.boerboom@ndsu.edu](mailto:chris.boerboom@ndsu.edu)  
[www.ag.ndsu.edu/extension](http://www.ag.ndsu.edu/extension)

# Transforming Lives Through Education

Judith Larson of Adams County is all too aware that retirement can be frightening for farmers and ranchers. She and her husband come from multigenerational farm families, and both have parents near retirement age.

Then she attended an NDSU Extension Design Your Succession Plan (DYSP) program. One DYSP goal is to help families start their succession planning by determining their vision for the farm or ranch, whether that's transferring a viable business to the next generation or dividing the farm or ranch assets among heirs.

"I guess my expectation was to find out what Extension had to offer to bring back to my dad and my in-laws and my husband," Larson says. "I got so much more out of it. It gave me some talking points, as far as family is concerned."

DYSP is one of many examples of how Extension's educational approach, called transformational education, empowers North Dakotans to improve their life and community.

"In transformational education, Extension staff make a conscious and continued effort to provide information in a way that will serve as a catalyst for individual

and community change," says Lynette Flage, assistant director, Extension Family and Community Wellness. "It's really getting people to make that step to transform themselves."

Transformational education also sets Extension apart from other information sources, such as Google.

"We're local," Flage says. "We have the expertise. We're also neutral."

Transformational education is a combination of four educational strategies in which Extension personnel provide:

- Information or a service, such as insect identification or soil testing
- Facilitation by serving as nonpartisan facilitators and organizing an event or meeting about a particular topic of concern
- Content transmission by providing answers to people's problems in person, on the phone or through newsletters, radio programs, media interviews, publications and social media
- High-impact programs that help people solve identified, multifaceted problems

#### FOR MORE INFORMATION:

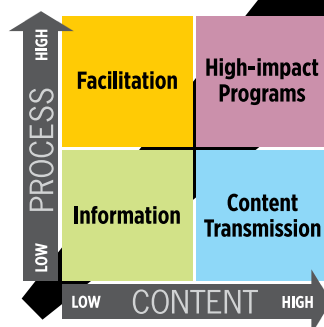
Lynette Flage, 701-231-7782, lynette.flage@ndsu.edu

## Test Your Knowledge

Each of these scenarios matches one of the educational processes in the graphic. Match the scenario to the educational process (answers below).

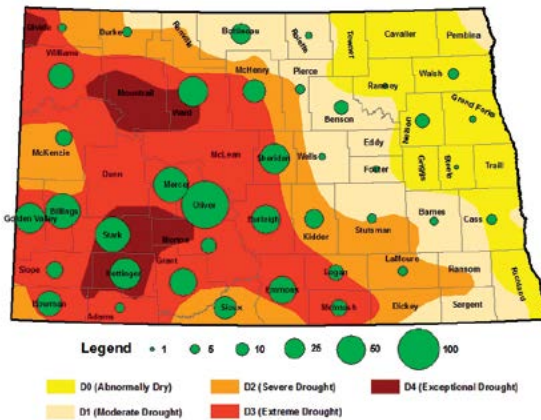
1. Extension specialists and agents provide information at workshops on the state's agricultural economy, short- and long-term outlooks, and trend analysis. \_\_\_\_\_
2. An agent creates a task force to address a significant increase in suicides in the county. The agent helps the group identify steps to take and educational approaches, and provides a roadmap for the county to follow. \_\_\_\_\_
3. A team of Extension agents and specialists uses multiple methods, such as social media, webinars, videos, field demonstrations, workshops and informal community gatherings called café talks, to provide producers with information about soil health. As a result, participating producers form soil health groups to exchange ideas and share experiences on improving soil health on their operations. \_\_\_\_\_
4. Extension specialists provide an online guide on the warning signs to watch for when dealing with distressed clientele and how to respond. \_\_\_\_\_

### Educational Process



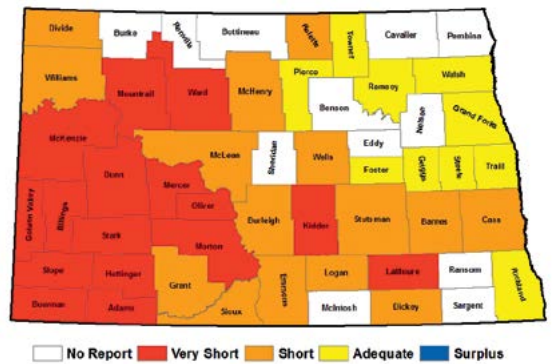


**Drought 2017**  
Number of NDSU Extension Office Calls  
June 19 – October 9, 2017



Source: NDSU

**Drought 2017**  
Available Surface Water August 7, 2017



Source: NDSU

Extension specialists:

**CREATED**  
**6** Handouts  
Fact Sheets  
and Other  
Educational  
Material

Developed  
or updated  
more than

**50**  
PUBLICATIONS

Gave  
presentations  
at

**12**  
MEETINGS

Sent out

**27**  
drought-related  
news releases

CONDUCTED  
more than

**40!**  
news media  
interviews

# Drought Information Helps Producers

Once drought became a real possibility in late spring 2017, NDSU Extension specialists, agents and administrators strategized how they could help farmers and ranchers.

They held weekly conference calls that included representatives from the Farm Service Agency (FSA), North Dakota Agriculture and Health departments, livestock organizations, state veterinarian's office and Natural Resources Conservation Service, and the state climatologist. Participants shared drought impacts and discussed gaps in resources. As a result, specialists:

- Updated Extension publications and NDSU's drought website, and created fact sheets, including a comprehensive list of livestock drought resources
- Drafted news releases and gave numerous media interviews on issues such as testing for nitrates before feeding drought-stressed feed to livestock, water quality concerns, managing forage and feed resources, early weaning, weed control, small-grain diseases, herbicide application and haying drought-damaged crops
- Developed a water testing guide in collaboration with the Health Department and NDSU's Veterinary Diagnostic Laboratory, and provided Extension's county offices with water sampling kits

Agents held informational meetings and worked one-on-one with producers on drought management strategies. Many also conducted water quality and nitrate testing.

"With drought, many producers are in stress mode and looking at how they can find enough hay for winter, but they forget about the hidden dangers sometimes, so nitrate testing tells them where to put their resources (labor)," says Craig Askim, agriculture and natural resources agent in Extension's Mercer County office. "They don't need to spend time haying a field that is high in nitrate, or at least they know how to manage it and feed it in the future if the nitrates are present."

Agents also:

- Reported their county's drought conditions weekly through an Extension-created online form. The state climatologist provided the data to the U.S. Drought Monitor author. Making sure drought maps accurately reflected conditions in North Dakota was important because the FSA uses the official drought designations as a basis for disaster payments. This resulted in North Dakota farmers and ranchers receiving more than \$50 million for livestock-related losses in 2017.
- Collected livestock feed samples from producers. The samples were tested on campus and producers received information on nutrient content and nitrate levels.
- Provided input that a specialist used to create maps of range and pasture moisture, range use and available surface water

"Extension played a critical role in providing producers with drought resources in a manner that enabled them to be proactive instead of reactive in planning their drought response," says Miranda Meehan, NDSU Extension livestock environmental stewardship specialist.

#### FOR MORE INFORMATION:

Miranda Meehan, 701-231-7683, [miranda.meehan@ndsu.edu](mailto:miranda.meehan@ndsu.edu)  
[www.ag.ndsu.edu/drought](http://www.ag.ndsu.edu/drought)

Drought  
condition reports  
resulted in

**\$50 million**

for N.D. livestock-  
related losses in  
2017

**6,800**

people

VIEWED



**17,356**

NDSU EXTENSION SERVICE  
drought

web pages

# Extension Helps Producers in Stressful Times

Farming and ranching is stressful. Adverse weather, disease, regulations, low or volatile commodity prices, family dynamics and financial issues can be constant sources of worry for North Dakota farmers and their families.

In the summer of 2017, with much of North Dakota facing drought conditions and dropping commodity prices, NDSU Extension Service agents and specialists recognized a need to help farmers and ranchers who were experiencing persistent stress levels that were negatively impacting their lives.

“One of the characteristics of people working in agriculture is that they tend to be self-reliant, but the tendency to go it alone is not helpful when dealing with stress,” says Sean Brotherson, NDSU Extension family life specialist.

Brotherson and an NDSU Extension team of experts in farm financial management, family relationships, and health and wellness came together to develop a variety of educational resources for stressed farm and ranch individuals, couples and families, and those involved in working with and supporting them.

A resource website, [www.ag.ndsu.edu/farmranchstress](http://www.ag.ndsu.edu/farmranchstress), was created to provide a central location for all farm stress-related resources, including educational materials on farm stress, a farm stress management plan and other resources on farming, finances and stress. Available publications include:

- Farming and Ranching in Tough Times
- Responding to Distressed People
- Working with Distressed Clientele
- Farming/Ranching: Stressful Occupations
- Stress Symptoms
- Stress Management for Farmers/Ranchers
- Stress Management for Couples
- When Generations Farm/Ranch Together

Other efforts have included training seminars across the state and region with agriculture professionals on stress issues in farming, displays on farming and wellness at trade shows and meetings, and surveys to assess needs in the state related to farm stress concerns.

“When there is stress in agriculture, it doesn’t just stop in the field,” Brotherson says. “It is likely to travel with a person into their homes and into their personal relationships.

“Our hope is to provide healthful, real-world resources to help farmers and their families cope with the sometimes stressful industry that agriculture can be,” he adds.

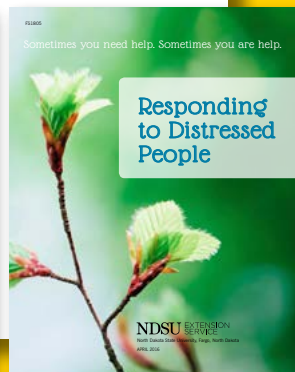
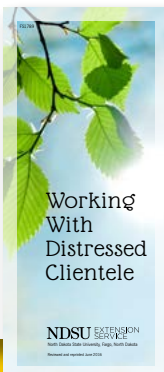
## FOR MORE INFORMATION:

Sean Brotherson, 701-231-6434, [sean.brotherson@ndsu.edu](mailto:sean.brotherson@ndsu.edu)  
 David Ripplinger, 701-231-5264, [david.ripplinger@ndsu.edu](mailto:david.ripplinger@ndsu.edu)  
[www.ag.ndsu.edu/farmranchstress](http://www.ag.ndsu.edu/farmranchstress)



## Stress

in agriculture doesn't just stop in the field.





## Bale Grazing Shows Promise

Progressive cattle ranchers always are looking for ways to make their operations more profitable. What once was seen as a lazy way to feed cattle now is offering producers a way to reduce labor and fuel costs, boost soil health and improve manure distribution.

Bale grazing is the practice of allowing livestock to graze hay bales in a hayfield or improved pasture. Ranchers space individual round bales of hay across a field in strategic lines looking much like a checkerboard from the sky.

Animals are given access to a portion of bales at one time and then are rotated to different sets of bales or different pastures with bales already positioned based on the animal's nutrient needs.

The entire supply of hay to be fed through the winter is set out at one time in the fall, and a tractor may not be needed to feed the cow herd for the rest of the winter.

"We know from research done in Canada that bale grazing had an effect on forage production and soil health and we wanted to see if it would have the same effects for our North Dakota producers," says Mary Berg, NDSU Extension livestock environmental management specialist.

Including Berg, an NDSU Extension team of rangeland and soil health specialists and NDSU Extension agents conducted a two-year bale grazing study at four participating North Dakota ranches.

Ranchers distributed their bales based on their normal routine and fed between January and April in 2016. Four control sites with no bales were placed directly outside the bale-grazed area.

Soils data were collected during the fall of 2015 prior to the start of the project and again in the fall of 2016 and 2017 to measure changes in soil quality. Data were collected during the grazing period to make sure animal performance was not compromised.

Forage data were collected in June 2016 and again in 2017 to look at forage quality and production. The same data were collected in the area outside the bale-grazed area.

"Preliminary data suggests that herbage production was greater on the bale-grazed treatment 15 feet from the bale center; however, it was not different within the zone 0 to 10 feet from the bale center six months after treatment," says Berg. "Bale grazing enhanced grass crude protein and phosphorus content six months after treatment from the bale center out to 10 feet.

"On the soil quality side, soil nitrates, phosphorus and potassium at the 0- to 6-inch soil depth increased on the bale-grazed treatment side, and the percent of organic matter at that depth increased up to 1.4-fold at the bale-grazed sites, compared with the control sites," she says.

Data collected during the 2017 growing season is being analyzed to determine if improvements may be seen 18 to 20 months after treatment on any areas that were impacted negatively and if the positive benefits are retained for two growing seasons on the other sites.

### FOR MORE INFORMATION:

Mary Berg, 701-652-2951, [mary.berg@ndsu.edu](mailto:mary.berg@ndsu.edu)



# Corn Silage Sampling Project Benefits Beef Producers

Corn silage is one of the most important forages used for livestock worldwide. Silage provides high yields of high-energy feed per acre, is palatable, is harvested rapidly and can be stored at a low cost in a variety of ways.

In response to questions from North Dakota beef producers about ways to optimize their silage quality, the NDSU Extension Service launched a corn silage research project in early 2017.

“Over the years, when livestock producers would send us feed samples for nutrient testing, we began to notice a wide variation in nutrient values,” said Carl Dahlen, an associate professor in NDSU’s Department of Animal Sciences.

Aimed at understanding the factors contributing to variation in the quality of corn silage throughout North Dakota, the project also was designed to strengthen the relationship between county Extension agents and local beef producers.

Dahlen, along with Miranda Meehan, NDSU Extension livestock environmental stewardship specialist, worked with 29 Extension agents to collect 171 corn silage samples from 27 North Dakota counties.

Each sample was analyzed for dry matter, ash, crude protein, neutral detergent fiber, acid detergent fiber, in-vitro dry matter digestibility (IVDMD), calcium and phosphorus.

Producers were surveyed about factors that could affect silage quality, including planting date, maturity, irrigation, inoculation and storage methods.

“Agents concluded the survey by asking producers what was the biggest concern facing their operation and how NDSU Extension could help,” said Meehan. “Not only do we want to provide recommendations to producers about ways to enhance their silage quality, we also want to better understand their continuing education needs.”

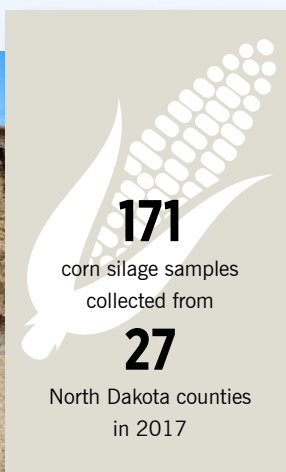
Once all samples and accompanying data were collected, producers were provided a detailed analysis of their individual sample.

In the spring of 2018, NDSU Extension agents will be conducting meetings to discuss the results of the surveys with local beef producers.

#### FOR MORE INFORMATION:

Carl Dahlen, 701-231-5588, [carl.dahlen@ndsu.edu](mailto:carl.dahlen@ndsu.edu)

Miranda Meehan, 701- 231-7683, [miranda.meehan@ndsu.edu](mailto:miranda.meehan@ndsu.edu)





## Extension Proactive on *Animal Health*

The veterinary feed directive (VFD) changes the way livestock producers buy certain antibiotics.

So three years before it went into effect on Jan. 1, 2017, NDSU Extension specialists and agents began educating producers, veterinarians and livestock feed distributors about the federal regulation. It requires producers to obtain a written order from their veterinarian before buying antibiotics intended for use in or on animal feed.

Agents and specialists spoke about the VFD at numerous meetings; created YouTube videos, a publication, brochure and handout; and provided information in news releases, columns and media interviews, and through social media.

Nicole Wardner, Extension agent in Sheridan County, discovered just how far ahead NDSU Extension was on VFD training when she attended the 2017 National Cattlemen's Beef Association meeting in Nashville, Tenn. Beef quality assurance program directors told her that in many states, producers didn't receive any education until after the directive went into effect.

"It was very evident that NDSU Extension was very proactive on this," she says.

As part of the VFD effort, Extension also educates producers and veterinary professionals on the proper use of antibiotics, including why they're needed, when and how they should be used, what antibiotics to use, the correct dose and how they're administered.

"We are also communicating with our state public health leaders to help address concerns over the use of antibiotics in both humans and animals," says Gerald Stokka, NDSU Extension veterinarian and livestock stewardship specialist.

Proper vaccine storage is another focus of Extension's animal health work. Temperature fluctuations and exposure to sunlight can reduce vaccines' effectiveness.

After seeing a vaccine storage cooler Extension beef quality assurance specialist Lisa Pederson made, Fort Rice ranchers Aaron and Sheyna Strommen created one of their own by drilling holes in the sides of a small plastic foam cooler. They insert vaccine-filled syringes into the cooler through the holes to keep the vaccine at the proper temperature until it's needed.

"It's expensive if you don't vaccinate; it's expensive if you do vaccinate," Sheyna Strommen says. "It makes sense that if you're going to invest in herd health, then do it right."

### **FOR MORE INFORMATION:**

Gerald Stokka, 701-231-5088, [gerald.stokka@ndsu.edu](mailto:gerald.stokka@ndsu.edu)  
Lisa Pederson, 701-328-9718, [lisa.pederson@ndsu.edu](mailto:lisa.pederson@ndsu.edu)  
[www.ag.ndsu.edu/publications/livestock/animal-health](http://www.ag.ndsu.edu/publications/livestock/animal-health)



## Education Helps *Soybean Farmers Get It Right*

From 2000 to 2017, the soybean acres harvested in North Dakota increased from 1.85 million to 7.1 million, with a record yield of 41.5 bushels per acre in 2016.

Due to the increased interest in soybean production in North Dakota, especially in the western part of the state, the need to educate producers about all management aspects of growing soybeans is continuous, says Hans Kandel, NDSU Extension agronomist and professor.

To meet this need, the NDSU Extension Service, in partnership with the North Dakota Soybean Council, created a series of meetings called "Getting it Right in Soybean Production." In 2017, five meetings were conducted at locations throughout the state.

Extension specialists and agents presented research-based educational material to soybean growers on variety selection, diseases, insect control, intensive crop management and soybean economics.

Participants at the 2017 meetings estimated the value of the knowledge they gained, if implemented on their farm, at \$11.58 per acre. The 153 attending growers, collectively farming 116,000 soybean acres, estimated the total perceived value of the meeting series at \$1.3 million.

In addition to the soybean production meetings, Kandel and a team of NDSU Extension agents and agronomists embarked on a three-year study, starting

in 2015, aimed at generating baseline producer data on current soybean practices in North Dakota. Some additional data from 2014 also was included in the survey.

"Information gathered from large numbers of soybean producers will help us determine what production factors might be the most important among producers relative to limiting yields of soybeans," says Kandel.

Although the survey is ongoing, preliminary data has determined:

- Growing soybeans after corn or wheat in eastern North Dakota resulted in up to 2.8 bushel per acre higher yields, compared with growing soybeans after soybeans.
- Chemical seed treatments resulted in higher yields from 2014 to 2016.
- Planting soybeans before mid-May, if conditions are favorable, may provide higher soybean yields.
- Seeding at 165,000 to 170,000 seeds per acre provided the highest yields from 2014 to 2016.

"My goal has always been to help soybean producers in North Dakota be the most profitable they can be," Kandel adds. "By providing relevant and timely information about the management and economics of soybeans, I believe Extension can make a difference."

**FOR MORE INFORMATION:**

Hans Kandel, 701-231-8135, [hans.kandel@ndsu.edu](mailto:hans.kandel@ndsu.edu)

**7.1 million**

North Dakota soybean  
acres harvested  
in 2017



## Ag Producers Adopt New Technologies

Managing thousands of data points, understanding imagery and remote sensing with unmanned aerial systems (UAS), and developing a plan for precision application of pesticides are just a few of the challenges facing today's agricultural producers.

"I believe Extension agents can help producers better manage this technological change," says Jacob Maurer, former Extension agent in Cass County. "Because Extension provides unbiased, research-based education, we have the unique opportunity to become a trusted source for precision agriculture information.

"During my time in Cass County, I tried to incorporate agriculture technology information into every workshop, training and one-on-one conversation I had," he adds.

Maurer also worked with the NDSU Precision Agriculture team to conduct a statewide survey asking producers what type of precision agriculture tools and resources they find most beneficial to their operations.

Extension agents Alyssa Scheve from Traill County and Angie Johnson from Steele County also know firsthand the importance of understanding precision agriculture technology and being able to talk to local producers about its adoption.

In 2016, when a large-scale UAS research project was conducted over producers' farms in Traill and Steele counties, Scheve and Johnson helped producers understand the value of the project.

"How we integrate technology into the operation and enhance our agronomic and economic farm management decisions using digital data will define the future of agriculture," Maurer says.

Johnson agrees, "Right now, as Extension agents, we are turning our focus to how to use the imagery to help producers make management decisions in their fields and/or livestock operations to ultimately save them time and money."

**FOR MORE INFORMATION:**

Angie Johnson, 701-524-2253, [angela.b.johnson@ndsu.edu](mailto:angela.b.johnson@ndsu.edu)  
[www.ag.ndsu.edu/agmachinery/uas](http://www.ag.ndsu.edu/agmachinery/uas)



Our focus is how to use the imagery to help producers make management decisions to

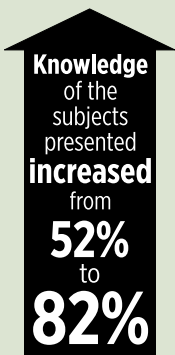
**save  
time and money**



**2,447**  
WEBINAR VIEWS



SURVEYED  
**55%**  
Will Change  
Practices



Knowledge  
of the  
subjects  
presented  
**increased**  
from  
**52%**  
to  
**82%**



**8,485**  
VIEWS  
**484**  
Likes/Comments



**4,969**  
VIEWS  
**64**  
Likes/Retweets



**66**  
Likes

Source: NDSU

## Growers Learn Safe Food-handling Practices

More and more people are interested in growing and preserving their own food, and even selling it, but they may not be aware of safe food-handling practices.

An estimated 48 million people get sick, 128,000 are hospitalized and 3,000 die from a foodborne illness each year, according to the Centers for Disease Control and Prevention.

“The fact is that foodborne illness is preventable,” says Shaundra Ziemann-Bolinske, an agent with NDSU Extension’s Burleigh County office who is working to keep North Dakotans safe through Extension’s Field to Fork program.

It’s a collaborative effort of Extension agents and specialists, NDSU research faculty, growers and regulators to improve people’s knowledge of growing, transporting, processing and preserving produce, particularly those specialty fruits and vegetables grown in North Dakota. The U.S. Department of Agriculture’s Agricultural Marketing Service provided funding for this project.

Here are some resources the Field to Fork team developed:

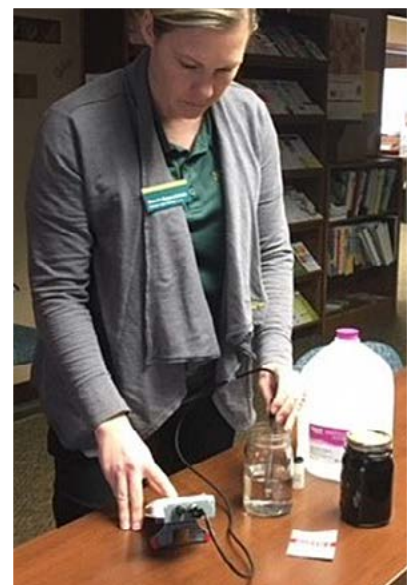
- A webinar series on topics such as canning, which vegetable varieties grow best in North Dakota and safe food handling while processing and selling local foods (webinars are archived)
- A workbook showing when to harvest fruits and vegetables, and a weed guide with common yield-reducing weeds
- Food safety demonstration training kits (pH meter, dehydrator and canning equipment) that were distributed to 25 Extension county offices for workshops

- Face-to-face and webinar- and module-based food safety training for growers and small food businesses
- Educational materials (news releases, online modules, fact sheets, Facebook posts and PowerPoint presentations) about North Dakota-grown specialty crops, including apples, chickpeas, dry beans, grapes, leafy greens, onions, pumpkins and raspberries

“Next, we’re going to assist the North Dakota Health Department in providing information about the new North Dakota Cottage Foods Act and create a food safety checklist to help cottage food industry entrepreneurs working with North Dakota specialty crops,” says Extension food and nutrition specialist and professor Julie Garden-Robinson, who leads the Field to Fork program.

### FOR MORE INFORMATION:

Julie Garden-Robinson, 701-231-7187,  
[julie.garden-robinson@ndsu.edu](mailto:julie.garden-robinson@ndsu.edu)  
[www.ag.ndsu.edu/fieldtofork](http://www.ag.ndsu.edu/fieldtofork)





## Leadership Development Benefits Rural N.D.

Finding enough people to serve on governmental and nonprofit organization boards can be challenging.

North Dakota has more than 8,000 boards, councils and committees, which means one of every 24 residents 18-plus years old would need to serve in a leadership role. NDSU Extension developed Lead Local, a one-day program that teaches participants about ethics, parliamentary procedure and conflict resolution, to help people develop the skills and confidence to serve effectively.

Board service especially can be an issue in rural areas.

“We all know if you are on one board, you’re probably on a few others as well,” says Carie Moore, a Soil Conservation District technician with the Natural Resources Conservation Service in Cando who attended Lead Local. “So this training impacts many boards just through a single person.”

Nearly 240 people from 528 North Dakota organizations, 39 of them agriculture-related, have attended Lead Local. Many report that their boards save an hour of meeting time because their meetings run more efficiently now. If all 528 organizations saved an hour a month, that would be a yearly savings of \$160,934 (based on Independent Sector’s value of volunteer time).

Rural Leadership North Dakota (RLND), Extension’s 18-month leadership development program, also impacts rural North Dakota substantially: 32 percent of the participants have been from the agriculture sector, and 19 have run for office. Three were elected to positions, including county commissioner. In addition, RLND participants have used their leadership skills to initiate projects such as:

- Events, activities and blogs to educate youth and adults about North Dakota agriculture
- Heifer exchange program for Dickinson State University’s agriculture program and Ag Club students
- Farm and ranch agritourism operations
- Calf feed-out program for Angus producers

“RLND was a real-world experience that I learned from and utilize every day,” says Dickinson-area rancher and RLND Class VI alumnus Will Meyer.

### FOR MORE INFORMATION:

Lynette Flage, 701-231-7782, [lynette.flage@ndsu.edu](mailto:lynette.flage@ndsu.edu)  
Marie Hvidsten, 701-231-5640, [marie.hvidsten@ndsu.edu](mailto:marie.hvidsten@ndsu.edu)  
[www.ag.ndsu.edu/ccv](http://www.ag.ndsu.edu/ccv)



workshops  
meetings  
websites  
mobile apps  
videoconferences  
publications  
lessons  
news releases  
email  
social media  
field tours  
one-on-one conversations



# Extension Delivers Programs in *Innovative Ways*

One of the goals of the NDSU Extension Service is to enable lifelong learning. Determining the most appropriate way to deliver its programs can be as important as developing them.

Extension makes educational information available so people can access it when they want it and in the way that best meets their needs.

Some of the ways Extension reaches people are through workshops, meetings, websites, mobile apps, video-conferences, publications, lessons, news releases, email, social media, field tours and one-on-one conversations.

Here are a few examples of NDSU Extension's innovative program delivery in 2017:

## ➤ More Than Beans Meetings

More Than Beans is a monthly meeting hosted by Golden Valley County Extension agent Ashley Ueckert on a topic of importance in the county.

Most of the meetings are held about 7 a.m. to encourage participation before work. Coffee and a light breakfast are provided.

"I really try to identify topics that are of interest to people in Golden Valley County and then invite interesting speakers to present on those topics," says Ueckert. "These meetings are for everyone, as the topics range from understanding Medicare and Part D supplement plans to budgeting for the holidays."

Other meeting topics included indoor winter gardening, drought management, tree issues, food preservation, crop marketing, vegetable varieties, backyard poultry flocks and creating your own compost.

### FOR MORE INFORMATION:

Ashley Ueckert, 701-872-4332, ashley.ueckert@ndsu.edu

## ➤ Spring Fever Garden Forums

Organized by NDSU Extension horticulturist Tom Kalb, the Spring Fever Garden Forums use the internet to connect gardeners in North Dakota with horticulture experts from NDSU Extension.

Throughout March and April 2017, about 450 gardeners at 30 NDSU Extension county offices learned how to care for their yards and gardens by watching a live, interactive video broadcast of experts presenting on gardening topics.

Each week during the forums, Extension specialists in trees, entomology, turf, vegetables, fruits, flowers, soils and shrubs were on hand to deliver information and answer questions.

Since 2014, all Spring Fever Garden Forums have been archived at [www.ag.ndsu.edu/springfever](http://www.ag.ndsu.edu/springfever).

### FOR MORE INFORMATION:

Tom Kalb, 701-328-9722, tom.kalb@ndsu.edu

## ➤ Soil Health Café Talks

With settings such as the local grain elevator, seed store or small-town coffee shop, NDSU Extension soil health specialists and local agents are changing the way they disseminate information to North Dakota's farmers.

Started in 2014, the Soil Health Café Talks are informal, discussion-based sessions with no set agenda, and farmers' questions determine the direction of the meetings.

Small-group session time also is included to discuss such issues as soil salinity, sodicity, cropping systems, cover crops and compaction.

"It also helps NDSU Extension better understand some of the management challenges farmers are facing and the innovative approaches farmers are taking to overcome those challenges," says NDSU Extension soil health specialist Abbey Wick. "We can then use this information to guide our research efforts and develop meaningful programs."

### FOR MORE INFORMATION:

Abbey Wick, 701-850-6458, abbey.wick@ndsu.edu

## ➤ Nourishing Boomers and Beyond

Started in 2014 as a monthly class aimed at helping North Dakotans age 50 and older eat more nutritiously and reduce their risk of developing chronic diseases, Nourishing Boomers and Beyond has since evolved into a robust online program.

On its website, participants can find information on topics, such as fitness, stress, sleep habits, the digestive and immune systems, medications and prediabetes.

In addition to the website, information is provided via a free, monthly e-newsletter, a Nourishing Boomers and Beyond Facebook page, a Pinterest site, links to food and fitness trackers, and mobile apps.

### FOR MORE INFORMATION:

Julie Garden-Robinson, 701-231-7187, julie.garden-robinson@ndsu.edu



## 4-H Enrollment Efforts Pay Off

4-H enrollment more than doubled in some North Dakota counties in the past five years.

"I credit our great leaders for the increased enrollment," says Macine Lukach, an Extension agent in Cavalier County, where membership jumped from 39 in 2011-12 to 92 in 2016-17. 4-H is an NDSU Extension program.

Lukach thinks the 4-H archery program and a new Cloverbuds club also sparked interest in 4-H.

Agent Samantha Lahman attributes some of Pembina County's enrollment increase (70 in 2011-12 to 163 in 2016-17) to residents' commitment to 4-H. Many younger members are fourth-generation 4-H'ers.

Also, Lahman and agent Kari Helgoe work to build strong 4-H programs, and identify and train leaders. In addition, the agents ensure youth have opportunities to get involved in activities they enjoy and assist the youth any way possible. That includes helping youth do chores for livestock they're exhibiting at the State Fair and getting 4-H'ers to statewide events such as Citizenship in Action in Bismarck.

"We really strive to put forth the perception that 4-H is for you, and we can find something to interest you," Lahman says.

In Hettinger County, where enrollment rose from 41 in 2011-12 to 88 in 2016-17, agent Duaine Marxen points to the Extension staff's strong commitment.

"Our staff make themselves available to 4-H families, not just during office hours, but also on evenings and weekends," he says.

Such efforts have led to a 19 percent increase in 4-H enrollment statewide in five years. Brad Cogdill, chair of NDSU Extension's Center for 4-H Youth Development, says that's a result of several factors:

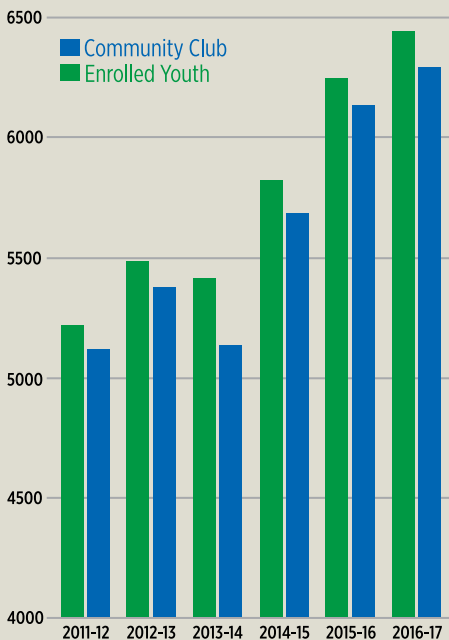
- An intentional effort to promote 4-H as a modern, relevant youth development program and enrollment goal setting
- An updated Cloverbuds (youth ages 5 to 7) curriculum
- The highly popular shooting sports program
- An online enrollment system that makes signing up and enrollment tracking easier

**FOR MORE INFORMATION:**

Brad Cogdill, 701-231-7259, [brad.cogdill@ndsu.edu](mailto:brad.cogdill@ndsu.edu)  
[www.ndsu.edu/4h](http://www.ndsu.edu/4h)



**North Dakota 4-H Enrollments**  
6 year progression



Source: NDSU





Billie Lentz, Rolla



## 4-H Leadership Opportunities Teach Lifelong Skills

For Cavalier 4-H'er Wesley Kemp, attending the 2015 National 4-H Conference in Chevy Chase, Md., was life-changing.

During the civic engagement conference, Kemp participated in a roundtable discussion on how to inspire youth to explore careers in science, technology, engineering and math, and presented suggestions to NASA and the National Science Foundation.

"I learned that everyone's voice is important and that I can succeed in presenting to any audience," he says. "Who could be more intimidating than NASA!"

The conference is one of several national and statewide leadership development opportunities available to North Dakota youth through 4-H, an NDSU Extension program. Here are a few others:

**National 4-H Congress** – Youth gather in Atlanta, Ga., to improve their leadership skills, hear nationally and internationally recognized speakers, and participate in a service learning project.

"I learned how big of an impact 4-H has on my generation and all of the positive opportunities it presents youth around the world, no matter what your interests and talents are," says Marit Wang, Devils Lake.

**4-H Ambassadors** – Youth ages 16 to 22 plan and facilitate statewide and regional 4-H activities and events.

"The 4-H program has helped me to grow so much as a person and has helped me to achieve a lot of my goals, so having the opportunity to give back to 4-H was something that really drew me to the Ambassador program," says Anne Brien, Rolla.

**Extension Youth Conference** – Youth from across North Dakota listen to speakers, participate in a service learning project and attend educational workshops.

"I am now more confident in myself and my abilities," says four-time EYC attendee Dalyce Leslie, Deering.

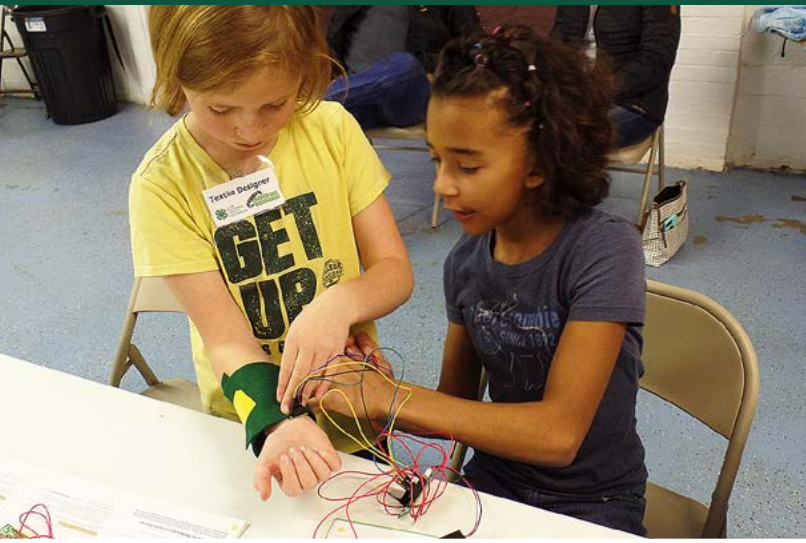
**Civic U** – Sixth- to eighth-graders learn parliamentary procedure.

**Citizenship in Action** – Youth learn about the executive, legislative and judicial branches of North Dakota government.

**Citizenship Washington Focus** – Youth ages 15 to 19 get a behind-the-scenes look at the nation's capital.

**FOR MORE INFORMATION:**

Rachelle Vetter, 701-231-7541, rachelle.vetter@ndsu.edu  
 Sue Quamme, 701-231-5923, susan.quamme@ndsu.edu  
 Dean Aakre, 701-231-8595, dean.aakre@ndsu.edu  
[www.ndsu.edu/4h/programs\\_events](http://www.ndsu.edu/4h/programs_events)



## STEM Projects *Challenge Youth*

Supplied with a small computer, sensor, batteries, wires and guide book, McLean County fifth- and sixth-graders spent about an hour working in groups to create wearable, functioning health monitors.

They were among thousands of U.S. youth who receive hands-on experience in science, technology, engineering and math (STEM) through the 4-H National Youth Science Day experiment every October.

The students tackle a different experiment each year. In 2017, it was Incredible Wearables.

“The Incredible Wearable involved many wires being placed in correct slots on the device, so that was a challenge,” says Michelle Effertz, the agent in Extension’s McLean County office who brought the experiment to the students. 4-H is an NDSU Extension program.

Drone Discovery was the 2016 experiment. Students made a drone replica and learned about flight dynamics, aircraft types, flight control, remote sensing, and flight safety and regulations.

For Jacqueline Schaible, a sixth-grade teacher at Bob Callies Elementary School in Garrison, the drone project couldn’t have come at a better time.

“It actually matched up very well with our variables unit,” she says. “In fact, our next unit focused on flight, and you were able to provide us with a lot of the necessary background information.”

About 2,000 North Dakota students participate in the 4-H National Youth Science Day experiment annually in the classroom or through 4-H clubs.

### FOR MORE INFORMATION:

Lindsey Leker, 701-231-7039, [lindsey.leker@ndsu.edu](mailto:lindsey.leker@ndsu.edu)  
[www.ndsu.edu/4h](http://www.ndsu.edu/4h)

## Other STEM Opportunities Available Through 4-H



**Aerospace Camp** – During this one-day program, 10- to 15-year-olds learn the basics of aircraft structure, navigation and aerodynamics, and about aerospace careers.

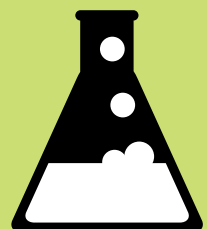
**Rube Goldberg** – This new science contest will be offered at the 2018 State Fair. Youth will organize teams to create a Rube Goldberg machine, a complex machine that does a simple task.

**Computer science** – Ten Cass County youth leaders will lead computer science activities with New Americans in partnership with Lutheran Social Services and the Fargo Microsoft headquarters through a grant from Microsoft and the National 4-H Council.

**Educational trunks** – A grant from Google and the National 4-H Council funded two trunks with 10 virtual reality devices in each trunk and 30 Chromebook computers for pilot computer science activities in North Dakota counties.

**Girls in STEM** – Webinars and other programming will engage girls in STEM in a co-ed environment through a National 4-H Council grant. The webinars will focus on being aware of biases, gender differences, and mentoring youth in a STEM environment.

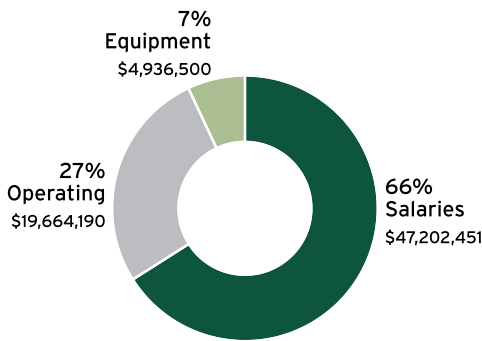
About  
**2,000**  
N.D. students  
participate in the  
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Youth Science Day  
experiment annually



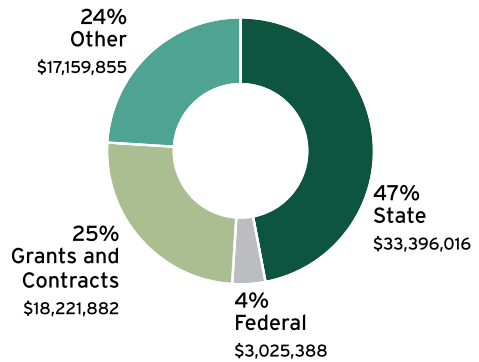
Year 1 Summary of 2017-2019 Biennium  
 2017-2018 Annual Budget Book – Authorization  
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North Dakota Agricultural Experiment Station

Budgeted Expenses

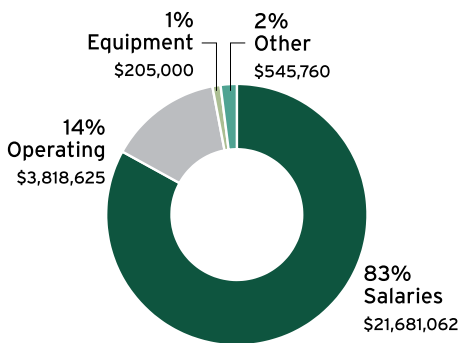


Funding Source

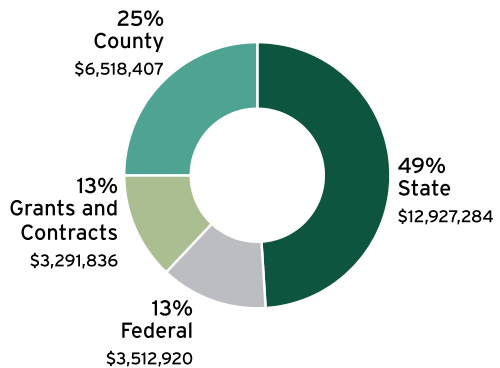


NDSU Extension Service

Budgeted Expenses



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## Agriculture and Extension at North Dakota State University

The North Dakota Agricultural Experiment Station consists of seven Research Extension Centers placed strategically throughout the state and the Main Station in Fargo. We work to develop techniques and technologies to enhance the production and use of food, feed, fiber and fuel from crop and livestock enterprises.

The NDSU Extension Service provides the people of North Dakota with the research-based information they need to succeed in today's increasingly complex world and be prepared for the future. We have offices serving all of North Dakota's 53 counties and Fort Berthold.

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### Ken Grafton

Vice President for Agricultural Affairs  
Director, N.D. Agricultural Experiment Station  
Dean, College of Agriculture, Food Systems,  
and Natural Resources

NDSU Dept. 7520  
314 Morrill Hall, Box 6050  
Fargo, ND 58108-6050

701-231-7655  
k.grafton@ndsu.edu

### Chris Boerboom

Director, NDSU Extension Service  
NDSU Dept. 7000  
311 Morrill Hall, Box 6050  
Fargo, ND 58108-6050  
701-231-8944  
chris.boerboom@ndsu.edu

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