

SBARE Priorities for the North Dakota Agricultural Experiment Station

May 3, 2018

NDSU NORTH DAKOTA AGRICULTURAL EXPERIMENT STATION

Agribiome Initiative

Knowledge of the human microbiome has revolutionized medicine and nutrition and fueled the \$45 billion probiotics industry. A similar revolution is happening in agriculture, where the microbiomes of crops, soils, and livestock (the Agribiome) are being harnessed to increase productivity, efficiency, safety, and quality. Food production must double to meet the global population demand by 2050, despite depleting water resources, shrinking farmland, and rising input costs. The inputs that drove intensive crop production in the 20th century have diminishing returns and may lead to unintended environmental consequences, so the next agricultural revolution must be based on a more sustainable approach that harnesses microbiomes to increase water- and nutrient-use efficiency, stress tolerance, disease resistance, and production of high quality food and agricultural products.

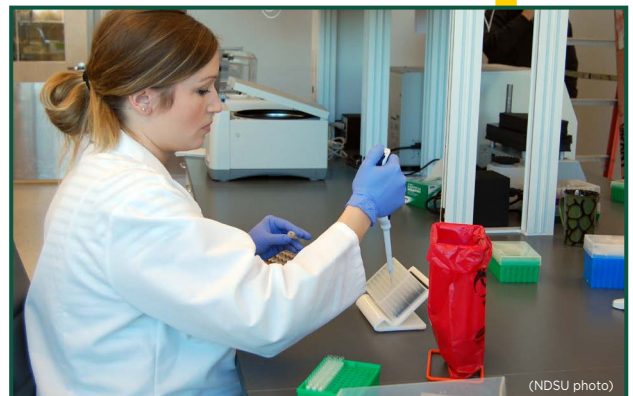
Microbes were an untapped resource until recently, with just a tiny fraction of the microbial world accessible by traditional research methods. Major scientific breakthroughs now allow all microbes to be readily identified, creating a platform for innovation through the discovery of microbes with desirable traits in agriculture (*agricultural probiotics*). While all sectors of agriculture can benefit from the development of probiotics, the potential gains in crop and livestock production are as exciting as they are highly relevant to North Dakota. The North Dakota Agricultural Experiment Station (NDAES) has several areas of strength that can support an Agribiome initiative focused on crop and livestock production. These include:

- Strong programs in plant breeding, genetics, and genomics; plant nutrition; plant pathology; soil health; and water quality.
- Strong programs in animal nutrition, physiology, husbandry, genetics, and health as well as range sciences and forages.
- Facilities to study microbiomes from lab to field or herd scale.
- Infrastructures to connect researchers with producers across the state to understand problems, identify solutions, and translate discoveries into practical applications.

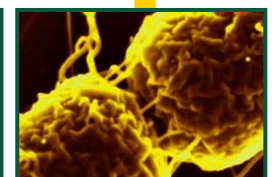
REQUEST: 2.0 FTE scientist and technician (\$355,000 salary and fringe — focusing on microbe-livestock interactions) and 2.0 FTE scientist and technician (\$355,000 salary and fringe — focusing on organismal-plant interactions); \$450,000 operating.

Total — \$1,160,000

Addressing important areas of the Agribiome related to crop and livestock production will require a multi-faceted approach. While several scientists are already engaged in researching some aspects of the Agribiome, additional scientists will reduce gaps in our existing expertise and move North Dakota to the forefront in this critical area.



E. Coli (NDSU photo)



E. Coli biofilm (NDSU photo)

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Precision Agriculture

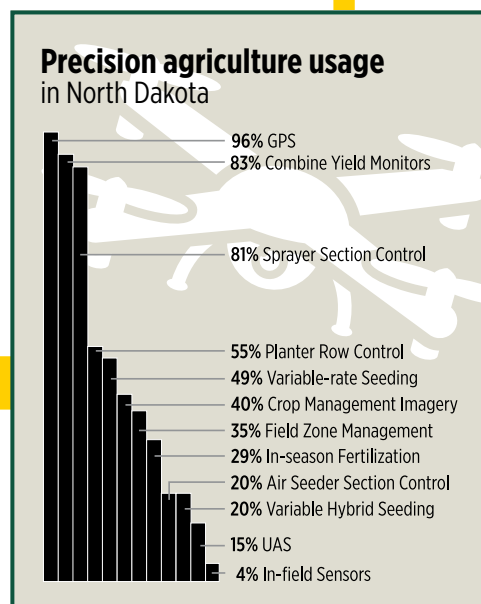
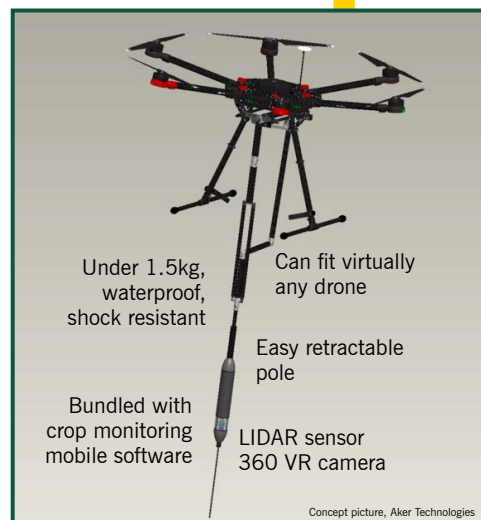
The future of farming will be 'smart farming' that incorporates computer systems to make real-time decisions based on digital data (artificial intelligence) of the conditions in the field. The smart farm is expected to have increased production efficiency, reduced labor costs, and better net return, while providing more protection to the environment. These technological innovations in precision Ag are taking place at a fast pace, with new technologies coming to market every year. A 2018 survey by Glacier Farm Media (www.farmmedia.com) indicates that 89–90% of farmers surveyed felt that using sensors, digital data, and autonomous systems can decrease production cost, increase yield, and/or save time. Unmanned Aerial Systems (UAS), for example, used in precision agriculture are expected to contribute up to 80% of the \$80 billion UAS market by 2025.

North Dakota has a large concentration of companies involved in precision Agriculture that seek partnerships with NDSU to expand and field validate their technologies. Agricultural producers need research-based information on profitable precision Ag technologies to adopt, best utilize, or optimize these technologies on individual farms, and learn how to convert the huge amount of data collected in the field to appropriate decisions.

Precision Ag research at NDSU will benefit the North Dakota agricultural industries by increasing crop yield and efficiency of food production, and reducing inputs. Adopting precision Ag can result in economic benefit of as much as \$165/A in North Dakota (Schimmelpfennig, USDA, 2016).

Precision Ag can improve both soil health and water quality by minimizing runoff of inputs. It also can improve grain quality through the timely and precise application of inputs to the developing crops, resulting in additional benefits to the producers and environment.

REQUEST: The 2015-17 Legislative session provided \$600,000/biennium in operating funds for Precision Ag research. These funds are distributed through an internal competitive grants process. In each biennium, funds requested greatly exceeded the amount that was distributed. An increase in **Operating (\$800,000)** is requested to establish a smart crop farm at Casselton and a smart livestock farm at Fargo that utilizes sensors, autonomous systems, and data to make crop management decisions, and to evaluate these decisions in partnership with industries.



An example of a greenhouse using LED lighting technology that can help boost food production. (photo Shutterstock.com)

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Enhancing Research Capacity

Support for Operations to Offset Inflationary Costs

Agricultural research is a labor-intensive effort spanning a number of disciplines to improve the profitability of farming, ranching, and agribusiness enterprises. A strong focus of the research effort at the NDAES is to work on providing solutions to problems that affect crop and livestock production, improve production efficiency, product quality, and environmental sustainability.

Operating costs for research activities continue to increase. Scientists at the RECs and the Main Station receive high levels of grant funding from a variety of agencies. However, inflationary pressures on operating costs, such as state

motor pool leasing, equipment repairs, and supplies, reduce our ability to respond to current and future production-related issues affecting crop and livestock producers. In addition, it is critically important that our scientists remain relevant by incorporating new technologies into our research programs, which allows the NDAES to emulate the rapidly changing technology environment that exists in 21st Century Agricultural systems.

REQUEST: Operating support for REC's — \$280,000; Operating support for Main Station — \$210,000; Operating support for Oakes site — \$200,000. **Total — \$690,000**



(NDSU photo)