

NDSU

PLANT SCIENCES



December 2023

Impact Highlights

- *Agronomic and horticultural crops and nursery, greenhouse, floriculture and sod account for over 81% of the state's total cash farm income.*
- *The outputs from our department impact all four corners of the state. A very visible accomplishment each year is the release of new varieties and plant products from our breeding programs. In the past two years, the durum wheat program released the low cadmium accumulating durum wheat ND Stanley, the soybean program released the varieties ND21008GT20 and ND2108GT72, the hard spring wheat program released the hard red spring (HRS) wheat ND Heron, the barley program released ND Treasure six-rowed barley for the pet food market, the dry bean program released ND Polar navy bean, and the Woody Plant Improvement Program released Hyland Guard™ Mountain Pine and 'EmerDak' (Emeral Flare®) Tianshan Birch.*

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About the Department

The Department of Plant Sciences is an integral component of the College of Agriculture, Food Systems, and Natural Resources, the North Dakota Agricultural Experiment Station (AES), and NDSU Extension. The department provides research and Extension in biotechnology, cereal science, crop physiology, crop production, food science, forestry, genetics, horticulture, plant breeding, sports and urban turfgrass management, and weed science.

Research

Basic and applied research in these programs provides new wealth, economic development, and improved quality of life in the state and region. Not including crops grown as feed and forage for the livestock industry, agronomic and horticultural crops and nursery, greenhouse, floriculture, and sod account for more than 81% of the state's total cash farm income (*USDA-National Agricultural Statistics Service 2017, Census of Agriculture State Profile*).

Extension

Extension faculty in Plant Sciences work closely with research scientists at NDSU Research and Extension Centers to develop multidisciplinary education programs. Programs to introduce new cultivars, effective cultural practices and cropping systems, efficient weed control strategies, integrated pest management, and improved horticultural practices have been successful due to the Extension specialists' close interaction with scientists and clientele groups.

Research and Extension Impacts

Breeding

Dry Edible Bean Breeding (Osorno)

Based on the 2022 annual dry bean grower's survey in the Northharvest region (ND & MN), NDSU dry bean varieties were grown on ~60%, ~40%, and ~15% of the area seeded with black, great northern, and pinto beans, respectively. This represents a ~38% average adoption use of NDSU dry bean varieties across all market classes in the region. Smaller but significant values can be seen for other market classes as well. Total farm gate value of dry bean production for ND & MN in 2021 was ~\$400 million. Therefore, NDSU dry bean varieties contributed to generate ~\$152 million to dry bean growers in the region. This represents a net return of ~\$200 USD per every dollar invested in the NDSU dry bean breeding program.

End-Use Quality

Food Processing (Xu)

Research is being done to transform soybean meal into a viable 3D printing ink. Tapping into the burgeoning food 3D printing sector, projected to hit a billion-dollar valuation by 2025, could yield an additional \$10 per ton of soybean profits. This would translate to an incremental annual income of \$50 million if applied to 5 million tons of soybean meal.

Wheat Quality (Islam)

Since the early 1960s, the NDSU Wheat Quality Program has performed annual quality surveys on HRS and durum wheat, involving sample collection, analysis, and reporting of key quality attributes. Spanning the Northern Great Plains and Pacific Northwest, the survey evaluates the important market-

ing attributes of the \$5 billion HRS and durum wheat crop entering into the commercial market channels around the world annually. The data from these analyses are published in the Regional Crop Quality Report and the U.S. Wheat Associates Annual Crop Quality Report, serving as primary marketing resources for these wheat crops.

Production

Forages and Cover Crops (Berti)

Cover crops and perennial forages are part of the strategy to increase carbon sequestration in regenerative agriculture. Perennial crops, such as alfalfa and perennial forages are carbon sinks due to their deep root systems. Companies contracting carbon credits for regenerative practices are offering 5-10\$/

Research and Extension Impacts (Cont.)

acre for adopting perennial crops, no-tillage, and/or cover crops. Our research is promoting the integration of perennial crops into annual cropping systems. For every one million acres of cropland in ND that adopts regenerative practices and joins a carbon credit program, the impact in revenue to the state will be 5 to \$10 million annually. There is no doubt that forages and cover crops will have a very important role in N₂ fixation, C sequestration, and C markets in the near future.

Extension

Potato Agronomy (Robinson)
The NDAWN Potato Blight App provides growers with information to make critical decisions on managing late blight and early blight. It was estimated

that the *NDAWN Potato Blight App* value to growers was \$5,607,143 annually.

Weed Science Invasive and Noxious Weeds (Law)

Kochia is a troublesome weed, largely due to its ability to develop herbicide resistance. In the literature, kochia has reduced soybean yield by an average of 52%, and most remaining herbicides that control herbicide-resistant kochia in soybean and dry beans are PPO-inhibitors. In 2023, Dr. Law's program confirmed multiple cases of PPO-inhibitor-resistant kochia in North Dakota, the first documented cases of such within the United States. Using 2022

soybean value of production estimates, mitigating the spread of this new herbicide resistance trait in kochia could save North Dakota soybean producers up to \$1.4 billion annually.

Weed Resistance (All)

North Dakota has at least 11 weed species that are resistant to herbicides, and control of herbicide-resistant weeds is estimated to cost \$10 to \$40 more per acre than standard weed control. In comparison, proactive resistance management strategies are estimated to provide long-term annual economic returns of \$20 to \$50 per acre. Our department's weed scientists are developing tools and strategies to

facilitate proactive resistance management through genetic diagnostics and integrated management systems.

Horticulture

Sports Turf Management (Li)

Dr. Li is conducting research to establish management practices for using annual bluegrass on putting greens in the upper Great Plains. Adopting such a strategy rather than treating it as a weed, which can only be effectively controlled by herbicides, would mean a savings of about \$600,000 annually on golf courses in North Dakota.

Challenges

Operating

Rising wages of hourly employees and inflation have severely impacted how far we can stretch the spending of our research appropriated funds. While some grants will provide additional funds to cover higher hourly employee salaries and travel costs as a result of inflation, most grants will not cover the cost of purchasing major equipment or equipment repairs.

Graduate students are the backbone of our research programs. They are the individuals conducting the day-to-day thesis/dissertation research that better North Dakota agriculture and assist our faculty on their research programs. Attracting the brightest and best students is very competitive among universities. In a survey done last winter of North Central university agronomy and soils graduate programs, NDSU Plant Sciences had the lowest PhD stipends at \$19,600.

The remaining universities were paying between \$25,000-\$32,000. If we are going to be competitive with our peers in attracting the best students, we need to be competitive in our graduate stipends.

An operating cost to be aware of in the future will be the cost of utilities for the new Agriculture Field Laboratory Facility. The NDAES pays no utilities for scientists located in Waldron Hall, Wiidakas Laboratory, Potato Research,

and the Lord & Burnham South Greenhouse. All of the scientists working in these buildings will be moving to the new field lab and the NDAES will be required to pay for 100% of the utilities in this complex.

Needs

Operating

Additional operating funds to the NDAES to support:

- 1) Increased operating costs for hourly employees, equipment repair, and purchasing major equipment.
- 2) Increased funding to support our graduate research assistant stipends so our stipends are competitive with our peers in the north central region.



Peltier Complex Under Construction