NDSU PLANT SCIENCES

Plant Sciences

November 2019

Highlights

- *Agronomic and horticultural crops and nursery, greenhouse, floriculture and sod account for over 81% of the state's total cash farm income.*
- *Over 90% of total durum wheat acreage in the state was seeded with NDSU cultivars, resulting in an annual value of $263 million to North Dakota growers.*
- *NDSU Extension weed scientists alerted and educated over 8,000 stakeholders on the weed Palmer amaranth in 2018.*
- *The Pulse Crop Improvement program is researching methods to incorporate more pulses into foods through ingredient technologies and developing new varieties with increased protein levels.*

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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; and Extension at North Dakota State University. 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 work closely with researchers at NDSU and the Research Extension Centers to develop multi-disciplinary educational 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 Extension specialists' close interaction with scientists and clientele groups.

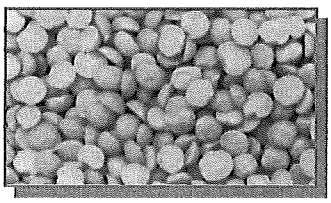
Research and Extension Impacts

Breeding

Durum Wheat (Elias) On average the last three years, North Dakota annually produced 55% (43.2 million bushels) of the durum in the U.S., with a $268 million direct economic value to producers in the state. Over 90% of North Dakota durum acreage is sown with varieties developed at NDSU. In 2018, Divide, Carpio and Joppa, collectively, were grown on 54% of the acreage in North Dakota. Two low Cadmium varieties, ND Grano and ND Riveland, with high yield potential were released in 2017. If the new varieties replace 50% of the acreage and give a 2% increase in yield, it will add approximately $2.7 million annually to North Dakota producers.

End-Use Quality

Pulse Quality (Rao & Bandillo) The food industry is undergoing transformational change to natural ingredient solutions, in part because consumers are demanding non-GMO protein sources as ingredients. The Pulse Quality research project is researching methods to incorporate more pulses into foods through ingredient technologies and developing new varieties with increased protein content. The potential economic impact of pulse fortification in foods is significant. If 5% of bakery and pasta products in the U.S. were fortified with pulse flour, an equivalent of 1.3 billion pounds of pulses, or approximately 1 million acres, would be needed to meet the needs of the bakery and pasta markets. The 1.3 to 2.8 billion pounds of pulses at an average price of $0.23 per pound would result in a $303 to $634 million economic impact for pulse growers.



Extension

Crop Production (Kandel) The annual NDSU Extension educational series *Getting It Right in Soybean Production* focuses on providing research-based soybean education. In 2018, participants estimated the value of the knowledge they gained, if implemented on their farm, at $7.95 per acre. The 192 attending growers collectively farmed over 189,500 acres of soybean. The total estimated perceived value of this meeting series was about $1.5 million. Efficient utilization of farming inputs into soybean production will benefit growers, society, and the environment.

Tom Peters holds a Palmer amaranth plant.

Weed Control (Ikley & Peters) NDSU Extension has created awareness to the weed Palmer amaranth similar to what was done for leafy spurge. If Palmer amaranth was to infest southeast North Dakota, where soybean is grown on nearly 2.2 million acres, it is estimated that the cost of weed control would increase by a factor of 3.2 and failure to control the weed could reduce soybean yields by up to 79%.

Challenges

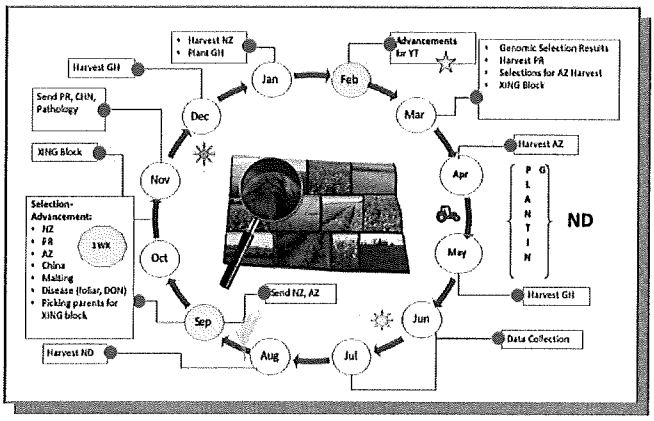
Facilities

Our department's scientists are challenged by aged and inadequate field laboratories; facilities for drying and cleaning seed, short- and mid-term seed storage, and safely storing field plot equipment; and plot land suitable for use in overly wet years.

Operating

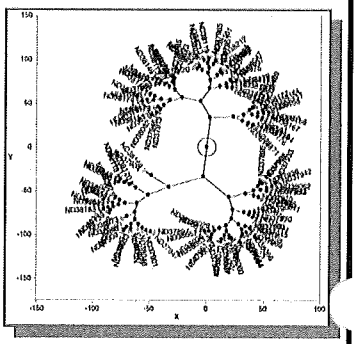
Crop production has been forever changed by the use of digital or predictive agriculture. By 2030, North Dakota producers will make on-farm decisions by querying weather, soil, topography, seed, equipment, labor costs, and other available data to make real-time decisions. NDSU will provide much of the data. Digital information and tools enable agricultural researchers to predict with increasing accuracy everything from commodity performance in a production field to flavor variation among different varieties of a crop plant.

To be competitive, modern plant breeding programs must utilize both DNA and performance data to develop new varieties. The bioinformatics team in Plant Sciences assists our variety improvement teams by helping them utilize the tens of millions of datapoints they generate each year to calculate the expected progeny differences (EPDs) of parents in their crosses and to predict which lines to advance in their breeding programs before they are ever tested in the field. Our work includes development of varieties for traditional and non-traditional uses. This will broaden the use of crops grown in North Dakota and, in some cases, bring significant premiums to growers of commodity crops that are now thought of as ingredients. There are opportunities to expand this concept of breeding ingredients to our other crop improvement programs, especially pulses. There is a rapidly growing demand for non-GMO high-quality protein sources from crops such as pea. Work in the area of developing crop varieties as ingredients will bring new participants and revenue into agriculture in North Dakota.



Typical annual breeding cycle

The department will be hiring a new faculty member to conduct research on the chemical and biological control of noxious and invasive weeds in field crops. Invasive plants currently gaining acres in the state include narrowleaf hawksbeard and Palmer amaranth. A challenge our weed science faculty face is inadequate support staff and operating support. In the first round of VSIPs the university offered, the weed science group lost three state-funded technician positions. With the consolidations of companies in the plant protection areas, there is less funding from private companies available to support weed science research.



Cluster analysis of breeding lines

Needs

Capital Projects

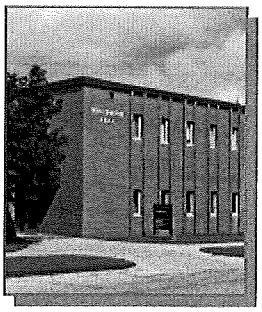
A new Field Crops Research Facility to house research projects now housed in Waldron Hall and elsewhere on campus. Waldron Hall was built in the 1950s to house the field laboratories for the wheat breeding programs in the Department of Agronomy. An addition was built in the mid-1960s to house approximately 16 additional scientists from the Departments of Agronomy, Plant Pathology, and Soils. The total gross area of Waldron Hall is approximately 68,000 sq. ft. The building now houses field laboratories and wet laboratories for nearly 45 scientists at the Main Station involving multiple disciplines. Many of these laboratories are shared and some scientists do not have assigned space, but rather "borrow" as possible. The seed drying, cleaning, and storage facilities are grossly insufficient and pose a health hazard to those working in the facility. We anticipate the new Field Crops Research Facility will house field and wet laboratories, grain cleaning and milling equipment, dryers, a central quality lab to conduct chemical analyses of samples and phenotype seed/grain quality traits for a variety of crops, and long-term seed storage space.

Additional storage buildings for field plot equipment are needed to meet the present and future needs for all AES scientists that conduct field research. The storage building spaces located on campus, NW22, and Prosper are grossly inadequate to store the equipment we currently have. In Plant Sciences alone, we have 57 tractors, 29 drills or planters, and 32 combines. We also require space to park 75 trailers that we use to transport equipment.

Operating

Operating funds are requested to expand the work of our bioinformatics team to other scientists in the AES. Additional operating funds would be used for 1) data input from all of our crop research programs into our database; 2) genotype breeding lines to obtain their DNA data so we can provide predictions; 3) update our harvest equipment so we have the capabilities to measure yield, moisture, and test weight on-the-go; and 4) purchase software or hire consultants to help our bioinformatics team in developing automated computer analyses of breeding data and to help our agronomists and weed scientists to build prediction models based on their remote sensing platforms.

One FTE is requested for an AES research specialist at the Main Station to assist the pulse breeder in developing improved pulse varieties with high quality protein. This individual would assist the breeder in entering and organizing the field and greenhouse performance data and DNA data, and conducting field, greenhouse, and laboratory research.



Waldron Hall

One FTE is requested for an AES research specialist at the Main Station to assist the new weed scientist working on weed control of invasive weed species. The activities of this individual would include assisting the new weed scientist in laboratory, greenhouse, and field research.