This is what we’re up against.

More than one billion people are hungry and malnourished. Climate change threatens coastal population centers and irrigation capacity. Extreme weather events are more common and prolonged. Competition for land and water is fierce. Tropical pests are migrating north into the grain belt.

Through both basic and applied research, the University’s Institute of Agriculture and Natural Resources has been at the forefront of helping the state’s agriculture industry add value to its commodities. The longer you can keep an agricultural product in the state for processing and development, the greater the impact on the labor force and economy of the state. This is an exciting time for Nebraska agriculture.

Martin Massengale
President Emeritus, University of Nebraska
Chair, National Advisory Board to the Secretary of Agriculture for Research, Extension, Education and Economics
Today’s crop solutions were yesterday’s challenges.

In order to sustain Nebraska’s leadership in crop production, the Institute of Agriculture & Natural Resources (IANR) at the University of Nebraska–Lincoln will employ research-based discovery and engineering, imaginative “what if” thinking, and unmatched in-the-field extension education.

Crop production in the future is not just about what we grow or how much. It’s also about:

- Producing plants that can sense threats and respond swiftly
- Creating germplasm that produces more food on less land and less water with less environmental impact
- Monitoring plant and soil health in real time
- Developing sophisticated crop models to assure maximum productivity with minimal inputs
- Producing more nutritious “smart foods” that meet dietary needs while reducing our risk from disease

We’ve come far. Imagine what awaits. Whatever it is, IANR will be at the vanguard—developing Crops for the Future. And helping Nebraska reap the benefits.

Now we’re working on tomorrow.
Managing through MARKER-ASSISTED BREEDING

Mapping the genome was just the beginning.

Markers are like genetic fingerprints of desired plant traits. Markers allow researchers to match molecular patterns to specific characteristics of the plant. ● Markers are used with both traditional plant breeding and GMO development of new varieties. ● Plants with desirable trait combinations can be identified before maturity.

FUTURE IMPLICATIONS
- Reduces some breeding time and steps in new variety development.
- Identifies individual transgenic events where the transgene went into a good location of a crop’s chromosome.
- Aids in stacking traits.

Plant breeders use gene maps to help identify which crosses are most likely to produce ideal varieties with enhanced traits.

The protein-producing parts of a soybean flower are removed and applied to the flower of another soybean, creating a controlled cross.

UNL’s wheat breeder, Dr. Steven Baenziger, makes crosses between two wheat plants.
Over the last 75 years we’ve seen tremendous increases in crop productivity through mechanization and at the expense of non-renewable fossil fuels (petroleum, fertilizers, pesticides). Now we’re focusing on improving crop genetics and developing a better understanding of plant growth and the factors affecting yield. With more precise field monitoring technologies and improved genetics, we’ll be able to take yields to the next level.

Mark Lagrimini
Head, UNL Department of Agronomy and Horticulture
The research of today drives the innovation of tomorrow. Most of the developments in production agriculture that we enjoy today are deeply embedded in the research and work of land grant universities. Lots of private companies do their own research, but there’s an important place for research by public universities. They will lead the direction and innovation of future agriculture.

Rod Gangwish
Nebraska Grain Producer
Managing through BIOTECHNOLOGY

Sustainability through technology.

IANR researchers enhance crop genetics for improved agronomics and end use value. Dicamba tolerance developed by IANR researchers—a powerful weed management tool. 
- Dicamba tolerance/RoundUp Ready stack in soybeans (2013 release)
- Dicamba tolerance/Liberty Link stack in cotton (2014 release)

WE'RE WORKING ON: Improved oxidative stability of soybean oil for food & industry. 
- Enhanced omega-3 fatty acid content of soybean oil for aquaculture feed
- Improved end-use quality and drought tolerance in wheat
- Improved digestibility, nutrition and dough quality of sorghum
- Induced male sterility for hybrid seed production and biomass accumulation
All too often we look outside the state for business development opportunities. I think our best source for growth lies right here in our vast agricultural lands and water resources. As the world population continues to grow, Nebraska is in a position to help feed the world while enriching the lives of our state’s residents.

Michael Jacobson
Chairman, Nebraska Bankers Association
President, Agricultural Builders of Nebraska

**Crops for Specific VAT**

**Energy for our engines**

Can energy crops fuel Nebraska agriculture? Switchgrass, forage sorghum and corn stover are being studied. Research focused on higher biomass yields, conversion efficiency and best practices. Must be carefully balanced with soil nutrient levels and net energy return.

**FUTURE IMPLICATIONS**

Sustainable biofuels industry. Reducing U.S. dependence on foreign oil. Additional cropping options and profit potential for ag producers.

Cooperative Research of the Agricultural Research Service, USDA (USDA-ARS) and the University of Nebraska

With its high level of biomass, switchgrass could be a major feedstock for biofuel after management and storage challenges are addressed.
Energy for our bodies

Unlocking the secrets of sorghum: Rich source of phytochemicals in current varieties appear to address cholesterol, diabetes, cancer, and inflammation. Sorghum is a non-GMO crop, so compounds can be incorporated into human food products worldwide.

Future Implications: Reduced healthcare costs, improved human nutrition globally as sorghum is widely adaptable in dry climates, added value for sorghum producers, more food with less water.
Managing through SEED GENETICS

How one idea becomes millions of seeds.

From amaranth to wheat, Husker Genetics is how UNL licenses its seed technology. Serves as interface between the University and industry, but does not compete with paying entities. Varieties are grown on 1,000 acres at various UNL sites. It takes time to develop a seed line for commercialization: six years for soybeans—up to two decades for native grasses. Largest crop type produced is cereal grains, primarily hard red winter wheat.

FUTURE IMPLICATIONS Rapid lab-to-market transfer puts new traits in the field sooner. Consistent, reliable supply of new varieties is critical to producers.
I’m just amazed at the progress agriculture has made in the last 10 years and where we’re going. Advances with genetics, biotechnology, new seed and farming practices are leading to tremendous growth and continued profitability. I’m looking forward to raising crops that will produce more ethanol per acre, healthier food for humans, and improved feed for livestock.

Keith Olsen, Dryland Grain Farmer
President of the Nebraska Farm Bureau
Managing through MEASUREMENT

Gaining knowledge at every level.

Making giant leaps by managing the smallest increments. The spectrum of light reflection from the leaves is measured to determine plant health and performance. Images from 10,000 feet are overlaid with field-level leaf scans and microscopic cellular structure analysis. Information is combined and extrapolated to create pixel-by-pixel data on the entire field.

FUTURE IMPLICATIONS
Enables prescription response to fertility, disease and management challenges. Greater biomass and yield from existing acres. Improved water and input efficiencies.

Leaf stomata (pores) open and close to regulate photosynthesis and respiration. Understanding this process better can help us improve plant performance.
We need to keep finding more efficient ways to meet our food and fiber needs. By necessity, industry focuses on short-term benefits, but it is the university’s responsibility to conduct research and extension programs that protect and develop the state’s resources for future generations.

Tom Hoegemeyer
UNL Professor of Practice and former CEO of Hoegemeyer Hybrids
The ripple effect of agriculture is enormous across Nebraska. Anything that makes for more efficient crop production, food processing, or energy production has an economic effect statewide. With cutting edge research, Nebraska can continue to be at the center of these efforts.

Roger Wehrbein
Farmer and Livestock Producer
Managing through BIOLOGY

Helping plants defend themselves.

Why do insects and pathogens survive on some plants, but not others?

Research on mechanisms and genes that allow plants to resist attack

Genes enhancing defense against specific pest threats can be stacked for broader protection

New traits will better balance crop production and yield with environmental stewardship and reduced pesticide use

FUTURE IMPLICATIONS

Pest and disease stress will increase with climate change

Remote sensing of plant stress will allow more precise and accurate responses

Healthy crops are needed to meet global demand for food, feed and fuel