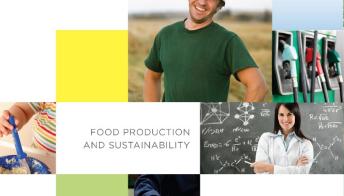
# **USDA FVIAC Committee: Research and Grants Working Group**

Plant Breeding and the **National Institute of Food** and Agriculture's funding priorities

> Ed Kaleikau, NIFA **National Program Leader for Plant Breeding**, Genetics and **Genomics**







YOUTH, FAMILY, AND COMMUNITY





NATIONAL INSTITUTE OF FOOD AND AGRICULTURE



# **NIFA's Mission & Vision**

- USDA's primary <u>extramural</u> agency to advance food & agricultural sciences
- We <u>lead & fund</u> initiatives that ensure the long-term viability of agriculture by:
  - Supporting <u>research</u>, <u>education</u>, <u>& extension activities</u> in partnership with institutions across US (Land-Grant University System, other universities/colleges, government, private, and non-profit organizations)
  - > AGENCY BUDGET:
  - \$1.49 Billion (2016)
  - \$1.88 Billion (2017 Request)





# **NIFA Provides**

## • Competitive grants:

- Basic & applied research, education, & extension activities
- Projects that integrate research, education, & extension functions.

### • Capacity grants:

- Distributed by formula to Land-Grant Universities, Schools of vet medicine, & other partners to maintain "capacity" to conduct research & extension.
- 25% research funds → <u>Multi-state</u> Research Committees focus on critical areas needing regional or national coordination
- Non-competitive grants: Directed by Congress to designated institutions for research, education, or extension on topics of importance to a state or region.



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# **NIFA Covers Many Topics**



### Advanced Technologies

Bioenergy

National Institute

- Biotechnology
- Nanotechnology



### Animals

- Animal Breeding
- Animal Health
- Animal Production
- Aquaculture



### **Business and Economics**

- Markets and Trade
- Natural Resource Economics
- Small Business



### Education

- Minority Serving Institutions
- Teaching and Learning
- Workforce Development



### **Environment**

- Climate Change
- Ecosystems
- Invasive Pests and Diseases



### Farming and Ranching

- Agricultural Safety
- Agriculture Technology
- Farmer Education
- Organic Agriculture
- · Small and Family Farms



United States Department of Agriculture

# NIFA's Many Topics Cont'd



### Food Science

- Food Quality
- Food Safety



### Health

- Nutrition
- Obesity
- Wellness



### International

- Global Engagement
- Global Food Security



### **Natural Resources**

- Air
- Forests
- Grasslands and Rangelands
- Soil
- Water



### People

- Community Vitality
- Family Well-Being
- Youth



### Plants

- Crop Production
- Pest Management
- Plant Breeding
- Plant Health



### **Overview:**

NIFA manages a range of funding programs that can make awards to plant breeding research, education, and extension

NIFA listens to stakeholders in various ways for input on within-program priorities

Success stories from NIFA's plant breeding funding are typically in combination with other funding types.





# NIFA's Plant Breeding, Genetics and Genomics **Portfolio:**

- Addresses regional, national and global needs in alignment with the 2014 Farm Bill, USDA REE action plan and NIFA strategic plan and especially in coordination and alignment with USDA ARS National Programs (i.e. NP301 Plant Genetic Resources, Genomics, and Genetic Improvement Action Plan, 2018-2022).
  - **Investments are responsive to stakeholder critical needs** to increase productivity by providing agricultural plants with higher inherent genetic potential.
  - **Focuses on genetic improvement** through more efficient and effective breeding, and exploits new sources of genes and traits, innovative breeding methods, data-mining, bioinformatics tools, and knowledge of molecular and biological processes.
  - **Goals** are to improve the production efficiency, yield, sustainability, resilience, healthfulness, product quality, and value of U.S. agricultural plants.



# NIFA's Plant Breeding, Genetics and Genomics Portfolio Align with:

The 2014 Farm Bill:	
PRIORITY SI AREA	UBPRIORITIES
A. Plant Health and Production and Plant Products iii. br qu qu bi  iv. sy v. vi	plant genome structure and function molecular and cellular genetics and plant otechnology . conventional breeding, including cultivar and reed development, selection theory, applied ualitative genetics, breeding for improved food uality, breeding for improved local adaptation to otic stress and abiotic stress . Plant pest interactions and biocontrol ystems crop plant response to environmental stresses . [improved] nutrient qualities of plant products i. new food and industrial uses of plant roducts

### The USDA REE Action plan goals 1&2:

 Goal 1. Sustainable Intensification of Agricultural Production

Subgoal 1A. Crop and Animal Production
Subgoal 1B. Crop and Animal Health
Subgoal 1C. Crop and Animal Genetics, Genomics,
Genetic Resources, and Biotechnology
Subgoal 1D: Consumer and Industry Outreach,
Policy Markets, and Trade

Goal 2. Responding to Climate and Energy Needs Subgoal 2A. Responding to Climate Variability Subgoal 2B. Bioenergy/Biofuels and Biobased Products

# The USDA NIFA Strategic plan Goal 1 (Science):

 Goal 1: Catalyze exemplary and relevant research, education and extension programs

Subgoal 1.1: Advance our Nation's ability to achieve global food security and fight hunger.



# Plant Breeding, Genetics and Genomics Programs:

## **Agricultural Food Research Initiative (AFRI):**

- Plant Breeding for Agricultural Production
  - Priorities: Pre-breeding and germplasm enhancement, cultivar development, selection theory, applied quantitative genetics, and participatory breeding. In 2016 included new opportunities for two commodity board topics: (i) Kansas Wheat Commission - Breeding for genetic resistance to wheat viruses and; (ii) Iowa Corn Promotion Board - Environmental influence on phenomics in crop improvement and production.

## Breeding and Phenomics of Food Crops and Food Animals

 Priorities: development and use of high-throughput genomic technologies, phenomics, and advanced computational informatics to (i) produce varieties and breeds with improved resilience to climate change, drought, and extreme weather; (ii) increase protection of agricultural crops and food animals from disease and pests; and (iii) enhance nutritional composition for improved human health.

### Interagency: International Wheat Yield Partnership

 Priorities focus on breakthroughs for wheat breeding using new technologies and also discoveries that lead to significantly greater yield e.g. gene editing and Unmanned Aerial Vehicles, hybrid wheat.



# Example: Agricultural Food Research Initiative (AFRI)

National
 Cereal
 Germplasm
 Phenotyping
 Coordinated
 Agricultural
 Project



United States Department of National Institute of Food and Agriculture

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# NIFA Funding Accelerates Wheat & Barley Plant Breeding

The Triticeae\* Coordinated Agricultural Project (T-CAP) is a USDA National Institute of Food and Agriculture (NIFA) Agriculture and Food Research Initiative grant that develops new wheat and barley varieties for changing environments. T-CAP addresses food security and nutrition demands of a growing population and helps ensure the prosperity of American growers.

T-CAP VARIETIES represent about 15% of the wheat and 4% of the barley harvested in the United States, with a production value of \$1.8 B and \$61 M, respectively.



### WHEAT IN AMERICA



2014 production: > \$12 B
2014 harvested acres: > 46.4 M

2012 consumption per person: > 132 POUNDS

is grown in 42 STATES with more than 63 VARIETIES developed by T-CAP

USED TO MAKE MANY POPULAR FOODS AND BEVERAGES

### **BARLEY IN AMERICA**

2014 production: \$870 M

2014 harvested acres 2.5 M

2.5 M



### • INTEGRATING breeding efforts to avoid duplication

 FUNDING 56 participants at 28 institutions in 21 states across the country

collaboration

T-CAP SUPPORTS PARTNERSHIPS BY:

- EMPOWERING the wheat and barley breeders and growers through federal funding
- · ADVANCING science to maximize productivity

#### T-CAP TRAINED STUDENTS HAVE BEEN HIRED BY:

100
TRAINED STUDENTS

- 57 U.S. companies/foundations
- 40 U.S. academic institutions and/or the government
- 18 international venues

UNITING the breeding and

genetic research communities

ENCOURAGING public-private

\*Triticeae: A taxonomic group of grasses that include many domesticated grains such as wheat, barley, and rye.















FUNDS RELEA

DESIRABLE TRAITS

FIELD TESTING

FOR GROWERS

GRAIN CROPS

GRAIN PRODUCTS SOLD AT MARKET

The numbers presented reflect results from the T-CAP and previous wheat and barley CAPs. | SOURCES: FAOSTAT. Retrieved December 2015 from faostat fao.org. | Wheat's Role in the U.S. Diet. Retrieved December 2015 from essusdagor. | NIFA invests in and advances agricultural research, education, and extension and seeks to make transformative discoveries that solve societal challenges.

USDA is an equal opportunity provider and employed Inauray 2016

National Institute of Food and Agriculture

# Plant Breeding, Genetics and Genomics Programs examples Cont'd

# **Special Research Grants Program:**

- Potato Breeding Research
  - The program seeks to enhance the effectiveness of limited state, federal, and industry resources and accelerate the development of superior performing varieties that produce greater benefits to the potato industry.

**Multi-state Research Projects** involve a team of investigators associated with several State Agricultural Experiment Stations working together to solve complex scientific problems of regional or national interest.

- Corn Breeding Research
  - Facilitates multi-location testing of breeding techniques, training of students, and coordination between public and private breeders.
- Database Resources for Crop Genomics, Genetics and Breeding Research
  - Provide database resources for target crops and further develops a standardized database platform for use by other communities.



#### National Institute Department of of Food and Agriculture

# **Speciality Crops Research Initiative**

- Addresses the critical needs of the specialty crop industry by awarding grants to support research and extension that address key challenges of national, regional and multi-state importance.
- First authorized in the 2008 farm bill. Since inception, there have been five legislatively mandated focus areas. Focus area 1 deals with plant breeding, genetics and genomics.
  - "(1) research in plant breeding, genetics, and genomics to improve crop characteristics, such as—
    - "(A) product, taste, quality, and appearance;
    - "(B) environmental responses and tolerances;
    - "(C) nutrient management, including plant nutrient uptake efficiency;
    - "(D) pest and disease management, including resistance to pests and diseases resulting in reduced application management strategies; and
    - "(E) enhanced phytonutrient content
- Since 2012, SCRI has funded 31 projects with some component of genomics, genetics and breeding.



# Speciality Crops Research Initiative

- Example: ROSBREED: COMBINING DISEASE RESISTANCE WITH HORTICULTURAL QUALITY IN NEW ROSACEOUS CULTIVARS -Includes work on apple, blackberry, peach, pear, rose, strawberry, sweet cherry, and tart cherry. Provides modern genomic and genetics tools, in a nationally coordinated effort, to augment the efforts of traditional breeders in the efforts to efficiently and effectively deliver cultivars with producer-required disease resistances and marketessential horticultural quality.
- The RosBreed network of over 25 collaborators across North America, Europe, and Australia, are sharing both new genetic and historical breeding information to facilitate more efficient experimentation with varieties in new regions. They are increasing routine use of genetic information through the design and implementation of new DNA tests, online portals for testing DNA and through direct outreach to industry leaders. The project produces a quarterly newsletter, industry briefs, brochures, and DNA test cards.



National Institute

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# Potential Future areas of research

- Breakthrough enabling technologies such as genome editing to create defined genetic changes to breed for more nutritive foods for human health benefit and crops more tolerant to adverse environmental conditions;
- Remote sensing of yield and other traits in field plots to rapidly generate more germplasm testing and accelerate breeding cycle improvement;
- Development of data mining tools for analyzing genotypic, phenotypic, and environmental data to improve predictive breeding as part of NIFA's Food and Agriculture Cyberinformatics and Tools (FACT) initiative in data-driven advances.

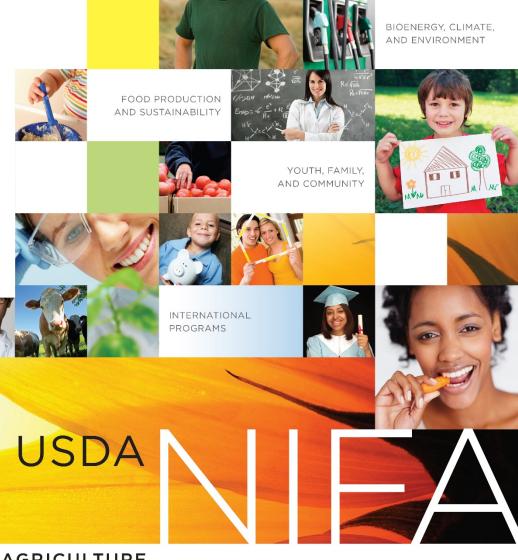


# **Thank YOU!**

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