



**NATIONAL LIVESTOCK READINESS PROGRAM:
SUSTAINABILITY**

**PRESENTED BY: WILL ZORRILLA
FEBRUARY 8, 2018**

EARTH'S HARVEST INTRODUCTION

- Food security, 501(c)3 nonprofit
- **Facilitate large-scale, public/private research and infrastructure projects**
 - Create systems to leverage and coordinate resources
- Titles/Roles
 - Managing Director - WGRC I/UCRC (K-State)
 - Grants and Industry/University Partnerships - Kansas Wheat Commission

EARTH'S HARVEST EXPERTISE

- White papers/business plans
- Project management
- Grant writing
- Industry relations
- Contracts and Agreements
- Interdepartmental collaborations
- Technical advisor, appropriations
- State and Federal agency engagement
- Additional funding opportunities and mechanism development

OBJECTIVES OF THE PRESENTATION

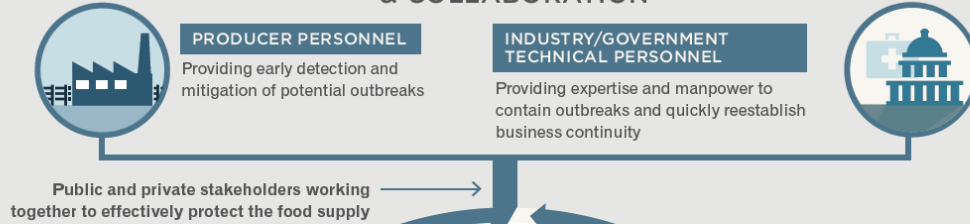
- Draft sustainability framework
- Successful public/private models
- Next steps



NATIONAL LIVESTOCK READINESS PROGRAM

INDUSTRY INVESTMENT & COLLABORATION FOR SUSTAINABLE PROTECTION AGAINST EMERGING DISEASE OUTBREAKS AND AGRO TERRORISM

INDUSTRY/GOVERNMENT INVESTMENT & COLLABORATION



RESPONSE TRAINING

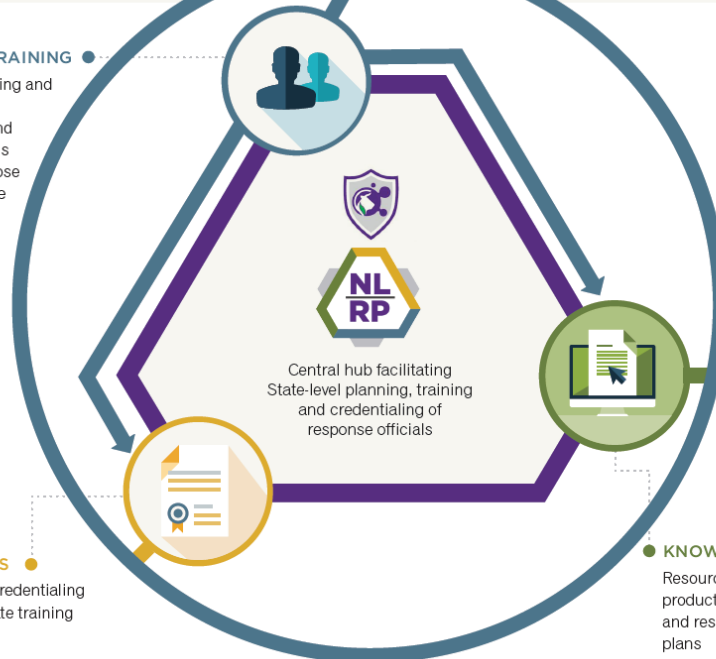
Response planning and training of State preparedness and response officials who will then close gaps in response preparedness

CREDENTIALS

Synchronizing credentialing schemes for State training professionals

KNOWLEDGE PRODUCTS

Resource library of knowledge products for planning, training, and response development plans



SUCCESSFUL MODELS IN WHEAT



WGRC I/UCRC
A PUBLIC-PRIVATE CONSORTIUM



- Wheat germplasm and genetic stocks collected over 35 years: “Wheat Genetic Gold Mine”
- Started with a \$10,000 grant from the Kansas Wheat Commission



- “Black box”
- Funded through earmark



- National Geographic, The Next Green Revolution

**The Future of the Wheat Genetics Resource Center (WGRC):
A Public-Private Partnership for Sustainability and Enhancement of
Wheat Genetic Resources**

A White Paper Submitted to the

Kansas Agricultural Experiment Station

And

Kansas Wheat Commission

February 15, 2011

Prepared By

Earth's Harvest, Inc.

William Zorrilla, Program Manager

Forrest Chumley, Chairman

Heartland Plant Innovations, Inc.

Forrest Chumley, President and CEO

Rob Berard, Chief Financial Officer

WGRC WHITE PAPER

- Historical overview
- Value proposition
- Market analysis
- Budgets
- Funding models and grant opportunities
- Sustainability targets



WGRC WHITE PAPER SUSTAINABILITY TARGET SUCCESSES

- Endowment (BCS)
- Industry consortium with annual membership fees (WGRC I/UCRC)
- Proprietary project funding from industry partners (HPI, BCS, Gen Mills...)
- Revenue from licensing and entrepreneurial spinoffs (not yet)
- Grants from foundations and government agencies (EDA equipment and greenhouse awards, NSF: GPF-PG: Genome Structure and Diversity of Wheat and Its Wild Relatives, KDA: drought and heat tolerance)
- Self-generated income from services such as distributing seed stocks (Collection's yearly budget is covered by I/UCRC membership fees)
- Base funding from Kansas State University. (WGRC salaries, infrastructure)





WGRC I/UCRC
A PUBLIC-PRIVATE CONSORTIUM



**Industry/University
Cooperative Research
Center (I/UCRCs)**

Funded by the National Science Foundation

- Industry members pay yearly membership fee
- Member rights
 - Voting on funding research projects
 - Bayh-Dole
 - Nonexclusive royalty-free license, multiple members
 - Exclusive, one member
 - Review of publications
 - 10% indirects



WGRC I/UCRC METRICS




HARNESSING OUR WILD SIDE

Mobilizing genetic diversity to enhance wheat yields and meet food security needs

August 2013 →



1 GERMLASM RELEASE



1 PATENTABLE TECHNOLOGY



\$1.5MM
RESEARCH COST AVOIDANCE/YR



4 WHEAT BREEDERS/FACULTY



2 GRADUATE STUDENTS/POSTDOCS

~\$4MM WHEAT RESEARCH

\$1 INDUSTRY MEMBER INVESTMENT = **\$19** ADDITIONAL RESEARCH INVESTMENTS

Since 1984, 15 masters level students, 24 PhD students, and 20 postdocs have trained with the WGRC.

CYTOGENETICS + MOLECULAR BIOLOGY + GENOMICS + BIOINFORMATICS + HIGH-THROUGHPUT GENOTYPING + MAPPING AND PHENOTYPING

To improve wheat, we need new genetic diversity. Without it, breeders will be unable to make the progress necessary to feed future generations. It is the key to delivering varieties to farmers with the "genetic grill" to fight devastating disease, destructive pests, and severe climates. The WGRC I/UCRC mines and harnesses the valuable attributes of wheat's ancient ancestors to help breeders, and then farmers, produce higher yielding, better quality bread wheat.





WGRC I/UCRC
A PUBLIC-PRIVATE CONSORTIUM









www.k-state.edu/wheat-ucrc



CURRENT PROJECTS

Our research program

COLLECTION AND PRESERVATION

PI, Jon Raupp, Plant Pathology
Kansas State University

Diversity is often thought of in terms of culture and society, but what about the diversity that lies within one tiny seed? The Wheat Genetics Resource Center (WGRC) collects and preserves genetic diversity in wheat germplasm that provides the ability to grow better wheat and in turn produce better and more nutritious wheat food products.

Raupp and the WGRC's germplasm preservation system ensure that future generations of public and private wheat scientists will be able to tap into the novel genetics in the collection. As technology advances so does the ability of scientists and breeders to take wheat to the next level and, in the end, return a better product to the consumer.



GENETIC CURATION OF THE GERmplasm COLLECTIONS

PI, Narinder Singh, PhD Candidate,
Plant Pathology, Kansas State
University

Wild wheat seeds, or germplasm, have been collected from their natural habitats and placed in genebanks all over the world to be used for research. The exact identity of accessions in a collection are not always reliable as systems for keeping inventory are not globally standardized. Furthermore, germplasm is often exchanged between genebanks and researchers and has passed through many hands over time. Over decades of different field collections and sharing among wheat scientists, the identity of accessions in the collection can be lost leading to the potential for redundancies and lack of important information on these valuable seeds. A researcher could be using germplasm they think are unique from one another, but in reality, they are duplicating other's efforts or even their own.

Singh created a pipeline to identify duplicate accessions by DNA sequencing. Using this technology, Singh was able to identify those accessions that were 99% genetically similar. His findings found 27% identical accessions in the WGRC collection of tauschii, and 50-55% duplication in the International Maize and Wheat Improvement Center (CIMMYT) and Punjab Agricultural University (PAU) collections. This powerful technology does not only reduce costs attributable to redundancy, but can also be used to inventory the world's genebanks. Plugging this pipeline into ongoing operations of the WGRC I/UCRC reduces research redundancies that cost time and money.

GENE MINING OF WILD TETRAPLOID WHEAT AND AEGILOPS TAUSCHII CORE SETS

PI, Dr. Vijay Tiwari,
University of Maryland

Contained in the WGRC collections and other genebanks are thousands of accessions of wild wheats. Research has shown that within these wild relatives of wheat is the genetic potential to combat diseases, pests, and adverse environmental conditions facing wheat growers. However, the cost to mine all of these wild accessions for valuable genes and bring these genes into cultivated wheat would be much too costly.

After leveraging the germplasm redundancy pipeline developed by Narinder Singh, Vijay Tiwari applied genomic tools to shed light on which accessions have the most important alleles and valuable qualities. Dr. Tiwari's work serves to create guides for breeders to find sought after genetics within the wild species. Think of it as a genetic shopping cart where breeders can trace accessions with valuable genes for wheat improvement to exploit in their breeding programs.



SYSTEM FOR EFFICIENT GENE TRANSFER FROM WILD INTO CULTIVATED WHEAT (PATENT PENDING)

PI, Dr. Dal-Hoe Koo, Plant Pathology
Kansas State University

Taking a gene from a wild wheat into a cultivated wheat can create a better plant, but the actual process is quite challenging. Wheat is made up of 3 progenitors, or descendants. The combination of the 3 genomes (A, B and D), in part, is what gives wheat its amazing properties that consumers love for their breads and cookies. However, built-in to the biology of wheat are mechanisms inhibiting the shuffling of genes from one genome to another. This shuffling, also known as recombination, is limited from A to A, B to B, and D to D. In the context of bringing useful genes from wild into cultivated wheat, this means researchers are obstructed from bringing in genes from distant wheat relatives.

Research Associate, Dr. Dal Hoe Koo at the WGRC I/UCRC has developed a system to greatly increase the efficiency with which valuable genes from wild wheat relatives can be transferred into elite bread wheat lines. This improved system can reduce the time needed to capture genes for improving wheat from decades to years.

W_{3M3} (GERMPLASM RELEASE)

PI, Dr. Bernd Friebe, Plant
Pathology, Kansas State University

Reflecting the benefit of center membership, the WGRC released to members only a new germplasm with resistance to wheat streak mosaic virus (WSMV) and Triticum mosaic virus (TriMV). WGRC I/UCRC members have a two-year exclusive access to this material before it is openly available through a public WGRC release. WSMV is transmitted by the wheat curl mite, leading to destructive disease epidemics in both Kansas and wheat fields worldwide. WGRC scientists have mined the wheat gene pool and found the W_{3M3} gene in a distant relative of wheat, *Thinopyrum intermedium* and used directed chromosome engineering to transfer it to wheat. After years of dedicated work, this unique resistant gene is ready to mobilize in breeding programs.



GENOMIC BASED TRAIT ANALYSIS

PI, Dr. Sanzhen Liu, Plant Pathology,
Kansas State University

The *Aegilops tauschii* core set accessions contain contrasting observable characteristics for many resistance traits such as leaf rust, stem rust, Hessian fly, greenbug and others. This provides an opportunity to create populations that have both resistant and susceptible individuals from core accessions where many resistance genes can be simultaneously mapped in the same cross. At the same time, *Ae. tauschii* offers a simpler system, relative to bread wheat, for mapping of novel resistant genes. WGRC has identified 40 genetically diverse accessions, which represent more than 90% of the genetic diversity of the species. We therefore propose to create mapping populations from intercrosses among accessions of the core set and will use an efficient genetic mapping approach to rapidly examine the genetic basis of useful traits in each accession. Our study will provide solid genetic information for the utilization of these tauschii accessions in wheat breeding and germplasm improvement.



MATCHING GRANTS: EDA

- Kansas Wheat Innovation Center
 - Economic Development Administration/Kansas Wheat Commission/K-State
 - Equipment - \$860,000
 - Greenhouse Expansion - \$3.2 million



KansasWheat @KansasWheat · 2/23/17
We were honored to host @SenPatRoberts and @RogerMarshallMD on a tour of the Kansas Wheat Innovation Center today.

MATCHING GRANTS: NIFA/COMMODITY BOARD PROGRAM

- Kansas Wheat Commission commits \$750,000 matched by NIFA
 - FY16 AFRI Food Security Challenge Area (Quality) pg. 12, \$1 million total (AWARDED)
 - FY16 AFRI Foundational Program (Viruses) pg. 12, \$500k total
- Two more research topics this spring



ADDITIONAL GRANT FUNDING

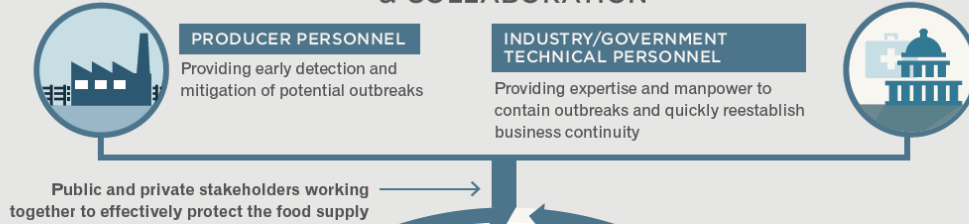
- **Established Program to Stimulate Competitive Research (EPSCoR)**
- PFI: AIR-RA
- PFI: AIR-TT
- Clusters for Grand Challenges
- GOALI
- REU/RET/REV/VRS



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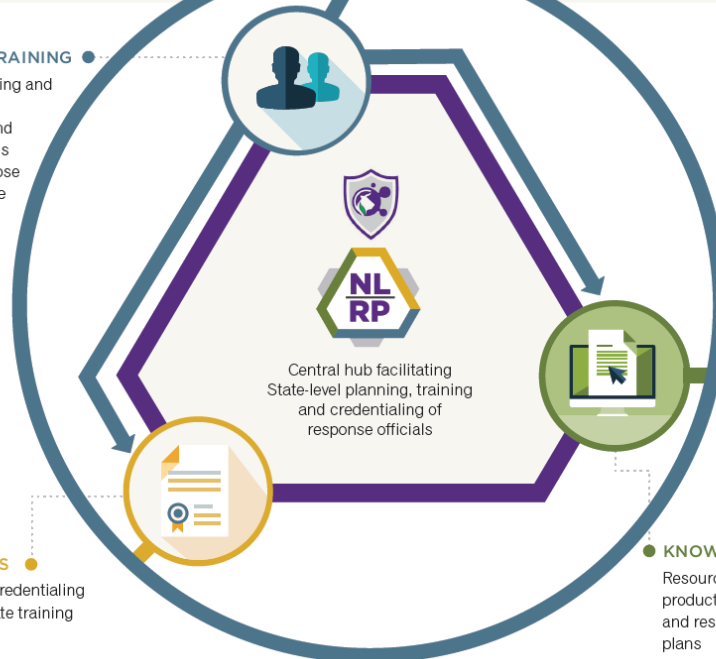
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NEXT STEPS



- Gather stakeholder feedback
 - Industry/Government
 - USDA and NSF Feb. 28 - March 1
- Develop white paper outlining sustainability plan
 - Market analysis
 - Budgets
 - Funding models and grant opportunities
 - Sustainability targets
- Goal: To develop strong stakeholder engagement and multiple funding mechanisms to provide long-term sustainability for NLRP

QUESTIONS??

Contact

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