Summary & PowerPoint

The New Age of Wheat Research

Summary to follow.

Learning Objectives

Presenter
Aaron W. Harries

Presentation Time
Monday, February 25, 2019
1:30 pm - 2:05 pm

Session
Breakout 3
The New Age of Wheat Research

Aaron Harries
V.P. of Research and Operations
Kansas Wheat

Topics

• The Complexity of Wheat
• Factors that Affect Wheat Quality
• The Birds and Bees of Wheat
• New Wheat Research Tools
• Imagine the Possibilities
• Questions
Kansas Wheat

- Established in 1957 when the Kansas Legislature approved the Kansas Wheat Act.
- KWC is a farmer funded entity. Funding comes from a 2 cents per bushel assessment at the first point of sale for all wheat sold in Kansas.
- Statutory mission of education, research and promotion.
- Promotes Kansas wheat through direct producer investment in:
  - Plant breeding: to improve wheat varietals yield, milling and baking quality
  - Increasing domestic consumption of wheat-based foods through educating consumers about the health benefits of eating more grain-based foods
  - Improving international utilization of Kansas produced wheat through farmer-funded market development offices worldwide.

Wheat Complexity

- Wheat
- Cultivars

![Image showing genetic relationships between different wheat species](image)
Wheat Complexity

- Size matters!
- The bread wheat genome is 5X larger than the human genome.
- The human genome has 3 billion DNA letter. Bread wheat has 16 billion!
- Hexaploid = 6 sets of 7 chromosomes
- One chromosome is larger than the entire soybean genome.

Factors Affecting Wheat Quality

- Kansas Winter Wheat Yield & Protein 1996-2018

[Graph showing the relationship between yield and protein over the years from 1996 to 2018]
The New Frontier

• We have the map!
**The New Frontier**

- Many crops share the same set of genes.
- Information gained from other crops can be used to select targets for editing.
- Gene editing technologies now can be used to change gene sequences that affect agronomic traits.
- Non-transgenic

**Gene Editing**

- CRISPR/CAS9 knock-out of all three copies of the wheat TaGW2 gene resulted in substantial increase in seed size.
  - Grain length (6.3% increase)
  - Grain width (11.5% increase)
- Gene editing of all three copies of the TaGW2 gene results in 27.7% increase of Thousand Grain Weight (TGW)
**Predictive Genomics**

**Fertilizer = Quality**

**Five Key Research Questions**

1. How does S affect wheat growth and grain yield in environments with low/moderate/high available N?
2. How does S affect wheat grain quality, including asparagine concentration, in environments with low/moderate/high available N?
3. Can producers use N:S ratios in plant biomass and wheat grain to determine if the wheat is (or was) S deficient, and if S applications will (or would have) improve yield or quality?
4. Does late-season S application improve winter wheat grain yield and/or quality?
5. What is the occurrence of high asparagine wheat grain in typical varieties grown in Kansas field environments?
Higher yield + better quality
Enhanced flavor profiles = sweeter wheat
Low glycemic index/high resistant starch
Celiac-safe wheat??
Drought tolerance
Disease tolerance
Higher photosynthesis efficiency
Research Challenges

• Research funding has plateaued as crop acres and size continue to decline.
• Decrease in public funding from federal and state sources causes more reliance on private investment.
• Kansas wheat farmers stepped forward in a big way with the construction of the $15 million Kansas Wheat Innovation Center in Manhattan.
Thank You!
Questions?

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