What is Plant Breeding?

• Genetically manipulating plants to suit our needs

• **Objective:** Recover the best combination of genes for all important characteristics into one individual
Plant Breeding

• Must define objectives

• Must create genetic variation

• Must select upon that variation

• Must take advantage of ‘opportunities’
Plant breeding: same objective, new technology
Breeding Goals

Provide growers with new cultivars that maintain profitability, reduce risk, and lead to sustainable systems:

- High yields, agronomically adapted (farmers)
- Excellent end-use quality (millers, bakers)
- Genetic resistance to major pests (farmers, consumers)
- Consumer demand (you!)
WSU Wheat Breeding and Genetics

Challenges:
- Diverse production region
- Variable environments and stresses
- Crop management issues
- Increasing and evolving disease and insect pressures
- Increasing demands on end-use quality
It all starts with a cross!
Early generation plots of segregating lines

80-100 head rows per family for selection
Crossing selected on quality characteristics of parents

No quality screening done in F2 and F3 stage. Markers are run for known genes (grain protein content, gluten, gluten strength)
Gel Analysis
Individuals rows selected and harvested
Year 4
F₄

45,000 Headrows
Rigorous end-use quality selection

Selection of 4,500 head rows, screened for kernel hardness, micromill flour yield, SRC-water, PPO, and SDS Sedimentation
Doubled Haploids
Preliminary Yield Trials
Year 5
F5

1,500 Lines

Lines initially milled, only excellent milling lines advanced for cookie bake

Test weight
Softness
Protein
Flour Protein

Milling (yield, break yield, ash)
Cookie Diameter
Solvent Retention Capacities
Falling Number
Advanced yield testing at 15 locations statewide and regionally
Traits for Selection

- Snow Mold
- Stripe Rust
- SBWMV
- Foot Rot Resistance
- Cephalosporium Stripe
- Nematode Resistance
- Aluminum Tolerance
- Wireworm Resistance
- Cold Tolerance
- Emergence
- Herbicide Tolerance
- Cropping system
- Many Others!
<table>
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<th>Trials</th>
<th>Year 6</th>
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Full mill and bake on all lines from Year 6 to Year 9.
PNW-wide Variety Trials

4 Lines

Year 10
F_{10}

1-2 Lines

Year 11
F_{11}

Entry into Pacific Northwest Quality Council Testing

**Variety release ~ end of Year 11**
Opportunity: Expect the Unexpected...and take advantage!
Areas of Research

• Germination/Emergence
• Dwarfing Genes
• End-use Quality
• Grain Protein Content
• Foot Rot Resistance
• Nematode Resistance
• Agronomic Adaptability
• Low pH Soil Tolerance
• Snow Mold
• Cold Tolerance
• Cephalosporium Stripe
• Stripe Rust
• Drought
• Heat
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Case et al. 2014

Naruoka et al. 2015
• Otto (SWW)—dryland replacement of Eltan
• Sprinter (HRW)—niche marketed for late planting
• Puma (SWW)—intermediate to high rainfall
• Jasper (SWW)—broadly adapted
Wheat Breeding in the 21st Century

• Release competitive wheat cultivars—utilization of multiple technologies
• Co-evolution of Research and Breeding
• Farmer/Breeder relationships
• Dissemination of information
• Training of new plant breeders
• Collaboration within and outside of University
From Greenhouse to Reality

Crossing

Trait Selection

New Cultivars

Consumers

Domestic and Export Markets

Pacific Northwest Farmers
It takes a team...
Questions