

Breeding Self-Pollinated Crops

Common Wheat

Principles of plant breeding – The four stages of the plant breeding process

- Creation of genetic variability
- Selection to fix desired genes
- Evaluation of the selected lines
- Cultivar release

Aberdeen Breeding Program

Year 1: Initial crosses made → P1 x Q1 400-800

Year 2: Additional crossing → P1/Q1 x P1 or P2

Year 3: F₁ progeny rows

Years 4-5: F₂-F₃ plots, one bulk/plot

Year 6: F₄ plots, 200 heads/plot

Year 7: F₅ head rows, 5-15% selection index

Year 8: Non-replicated, two environments

Year 9: Replicated, two environments

Year 10: Elite yield trials, multiple environments

Year 11: Elite and Western Regional yield trials

Year 12: Repeat Y11, start PNW variety trials

Aberdeen Breeding Program

Stage IV – Cultivar Release

- Year 13: Repeat Y12, Breeder seed production,
- Year 14: Repeat Y13, release and PVP, Foundation seed production
- Year 15: Repeat Y14, Registered seed production
- Year 16: Repeat Y15, Certified seed production

Stage I: Planning & Hybridization – creating genetic variation

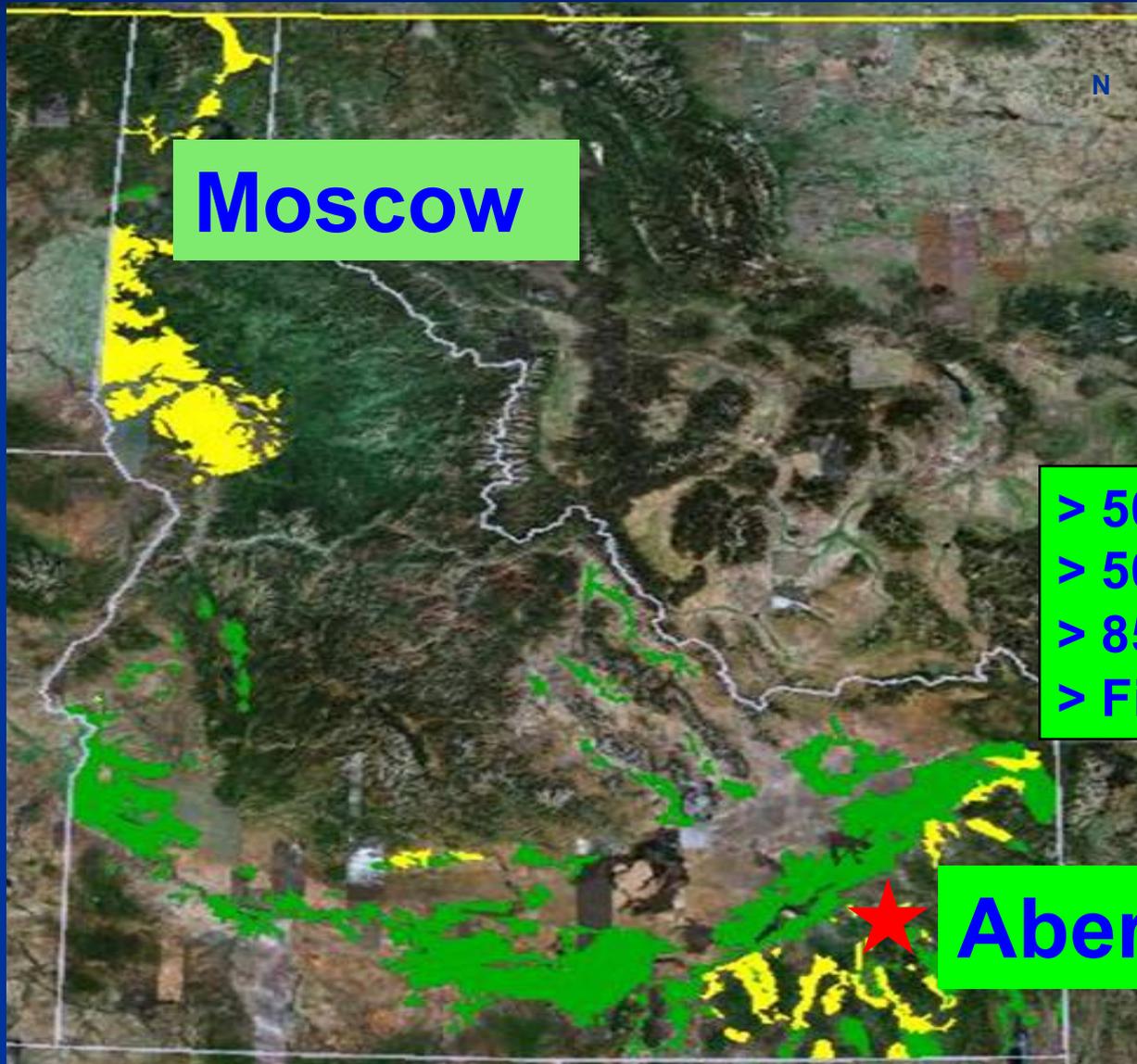
- Define breeding objectives
- Determine mating methods
- Traditional crossing
- Chromosome engineering
- Mutagenesis
- Tissue culture
- Transgenic

Stage I: Planning & Hybridization – creating genetic variation

- Year 1: Initial crosses made \rightarrow PI x Q1 400-800
- Year 2: Additional crossing \rightarrow PI/Q1 x P1 or P2



Idaho Wheat Production



Moscow

- > 50% of Idaho wheat
- > 50% of spring wheat
- > 85% irrigated wheat
- > Five classes of wheat

Aberdeen

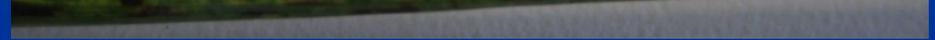
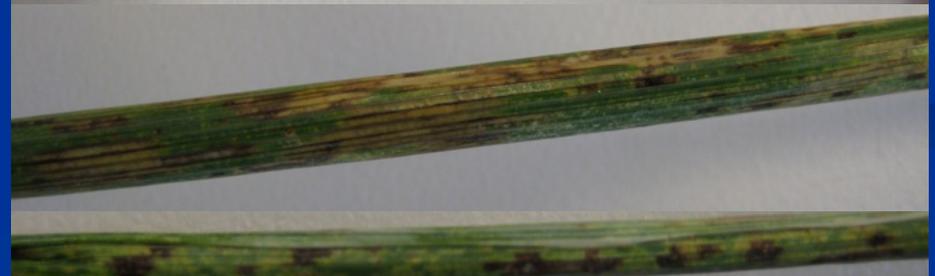


Stripe Rust Infection

Fusarium Head Blight or Scab



Wheat Black Chaff



Barley Yellow Dwarf Virus



Wheat Stem Rust



Wheat Hessian Fly



Fly/eggs



Larvae

Dwarf Bunt





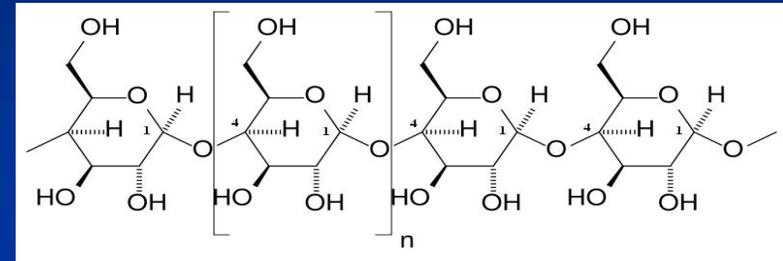
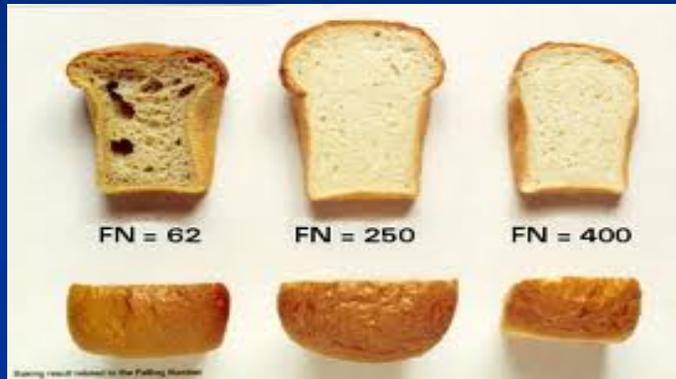
Dryland Foot Rot



Abiotic Stresses



Pre-harvest Sprouting - PHS



Starch

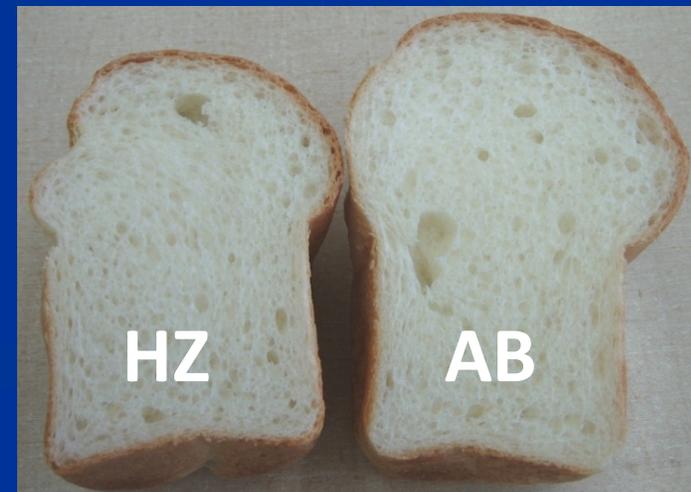
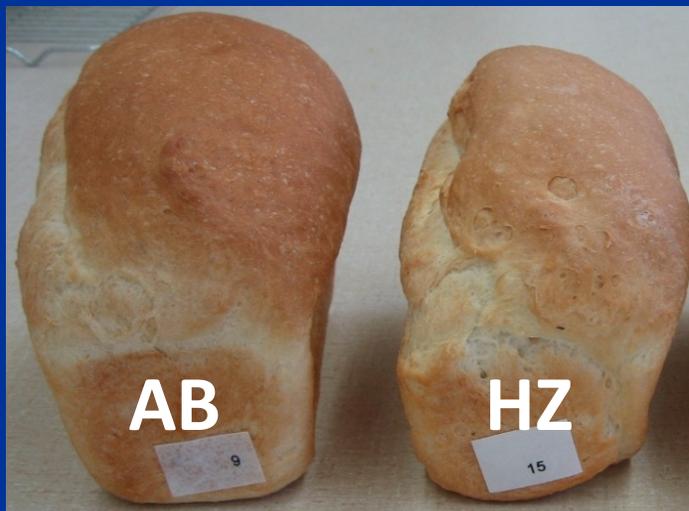


Alpha-amylase



Falling number test

Bread Baking Quality



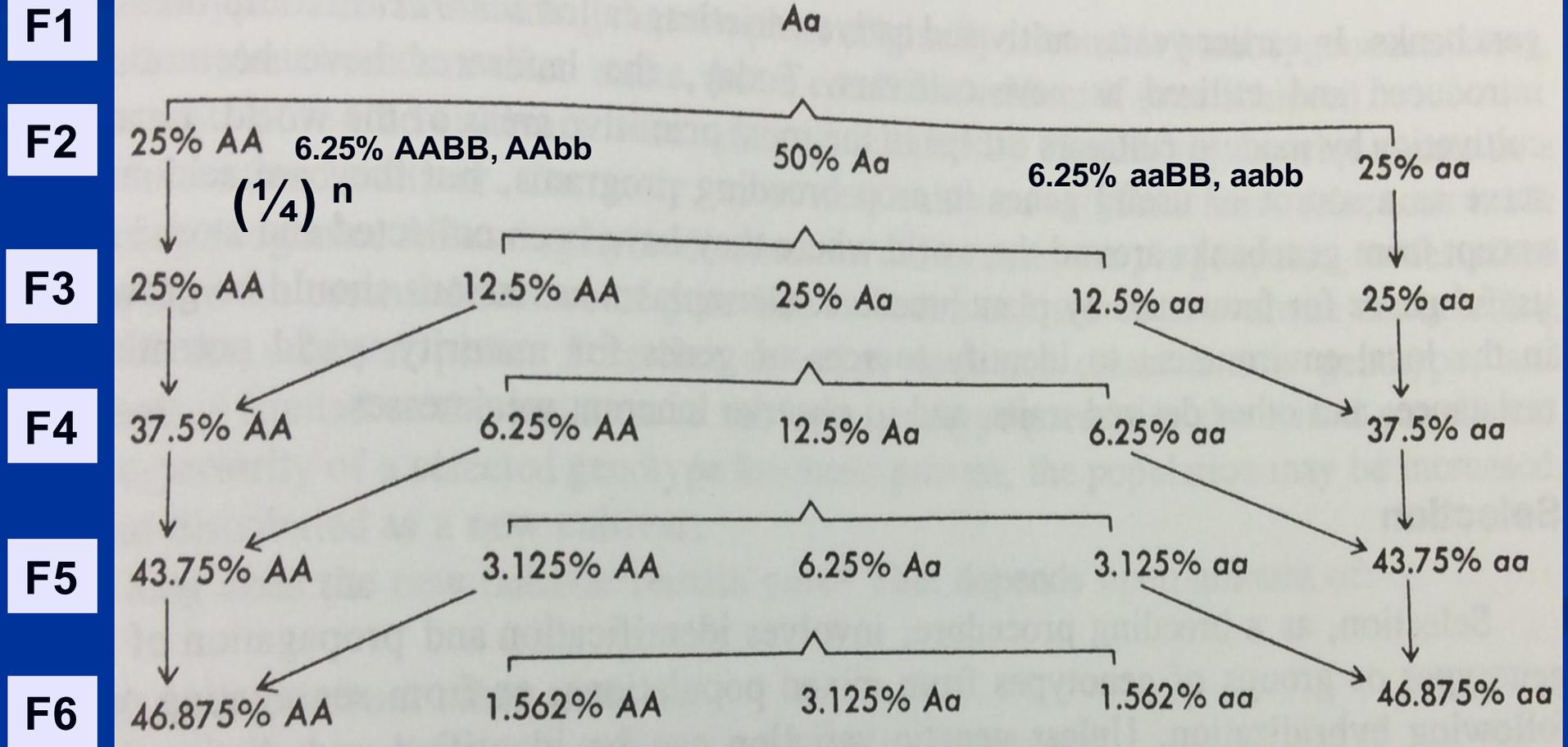
Stage II: Early Generation Advancement

- Year 3: F_1 progeny rows
- Years 4-5: F_2 - F_3 plots, one bulk/plot
- Years 6: F_4 plots, 200 heads/plot
- Year 7: F_5 head rows, 5-15% selection index

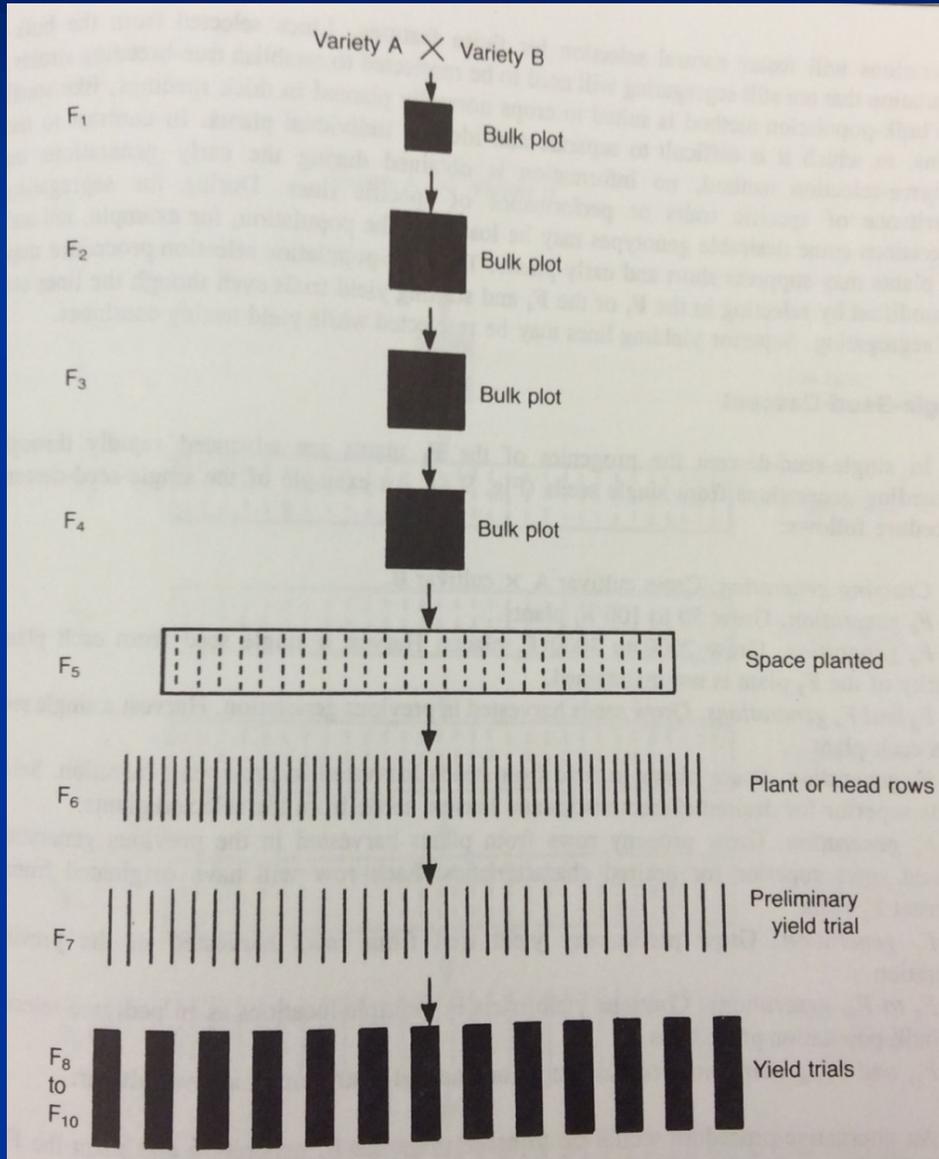


Proportion of Homozygous and Heterozygous Genotypes in a Population

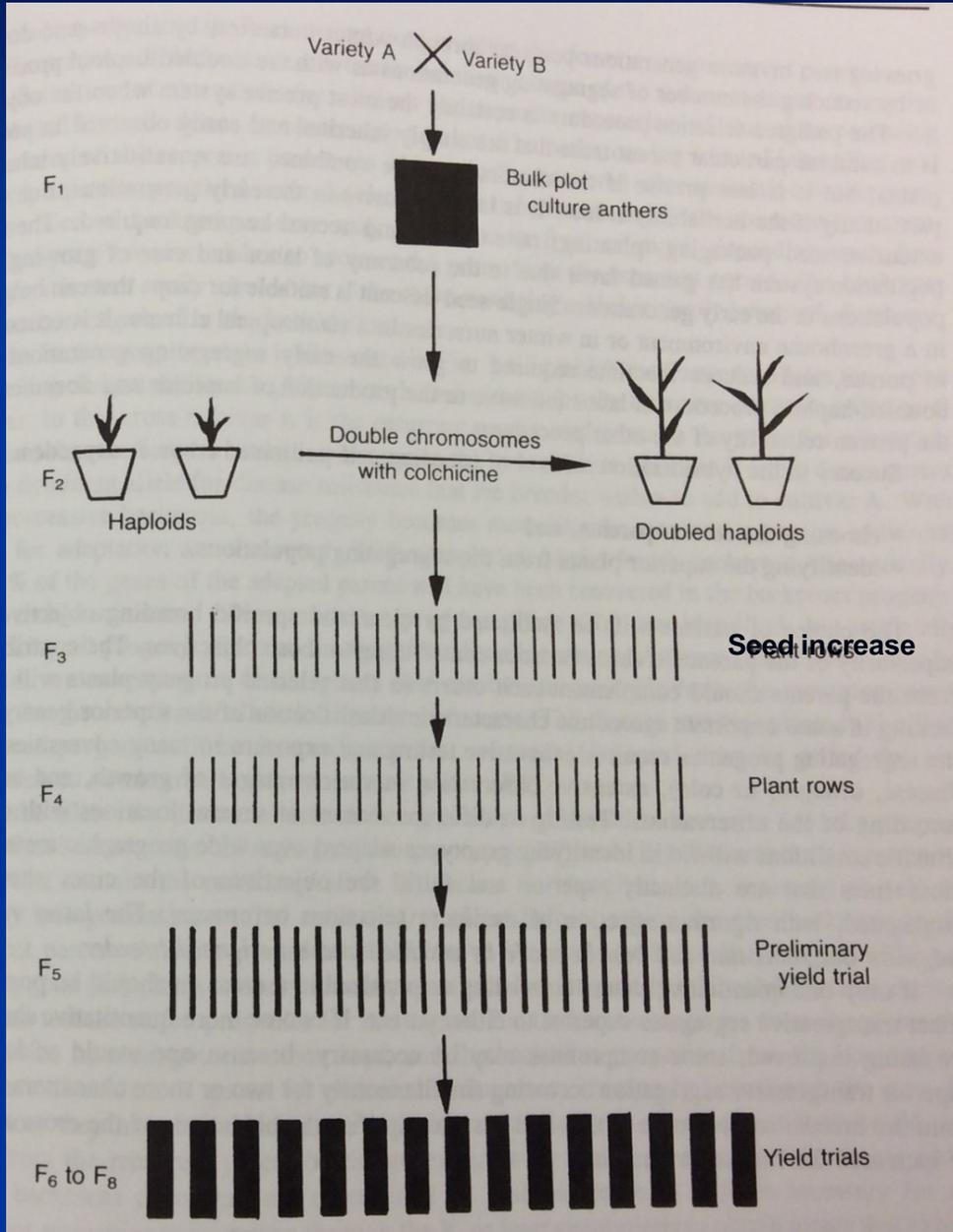
AA x aa



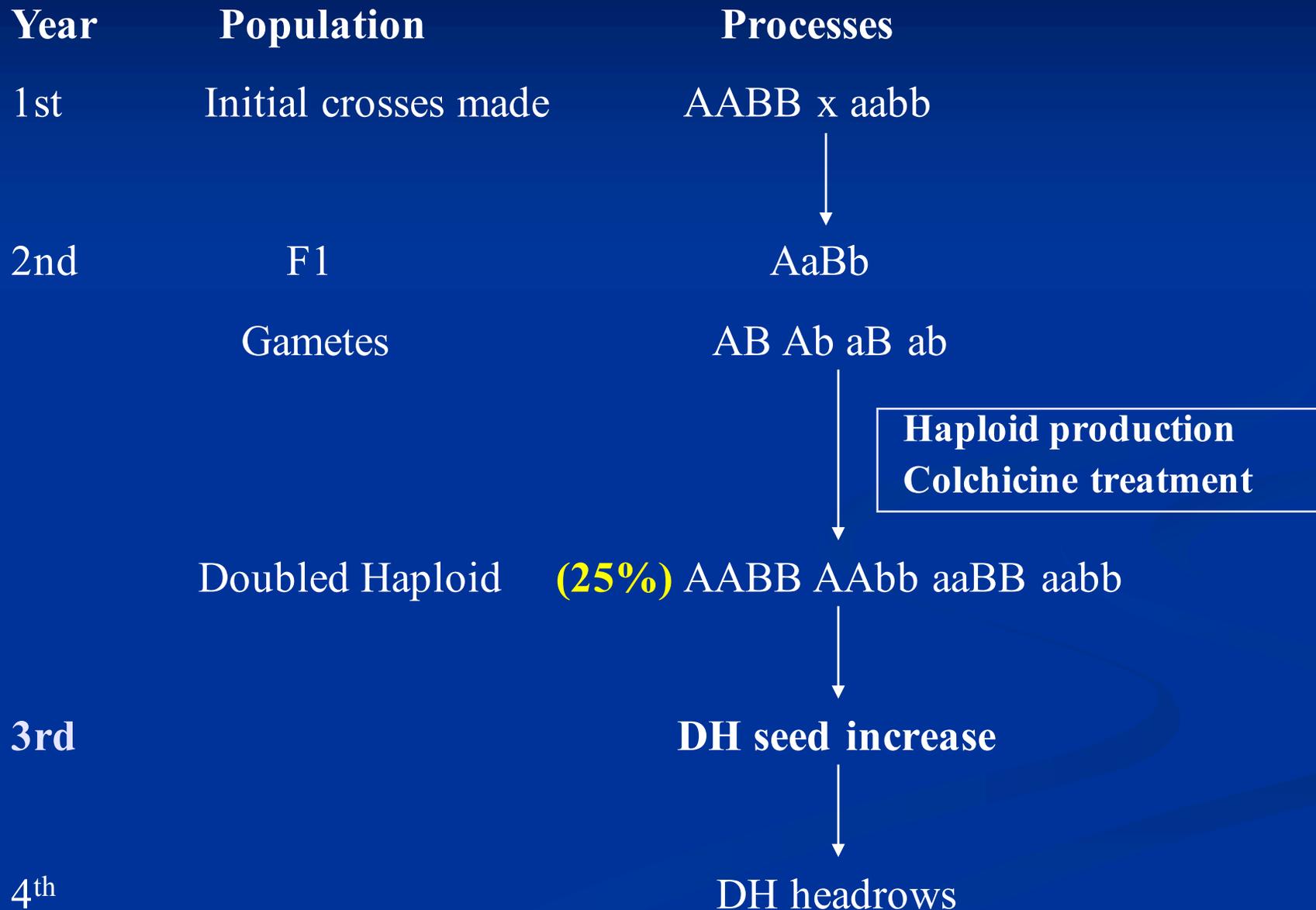
Bulk- Population of Selection



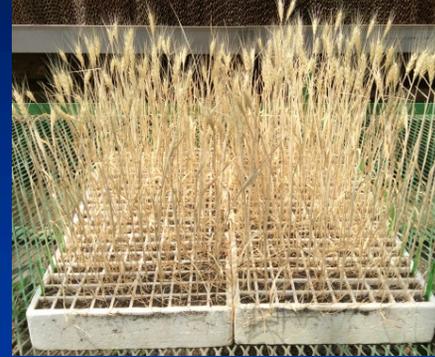
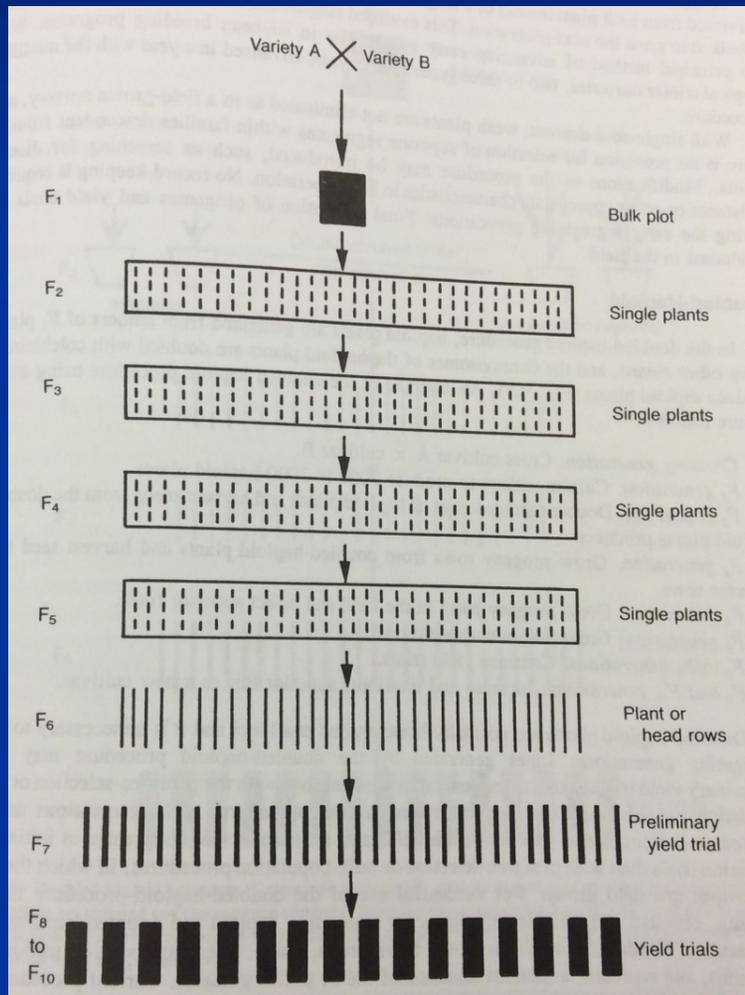
Doubled – Haploid Procedure



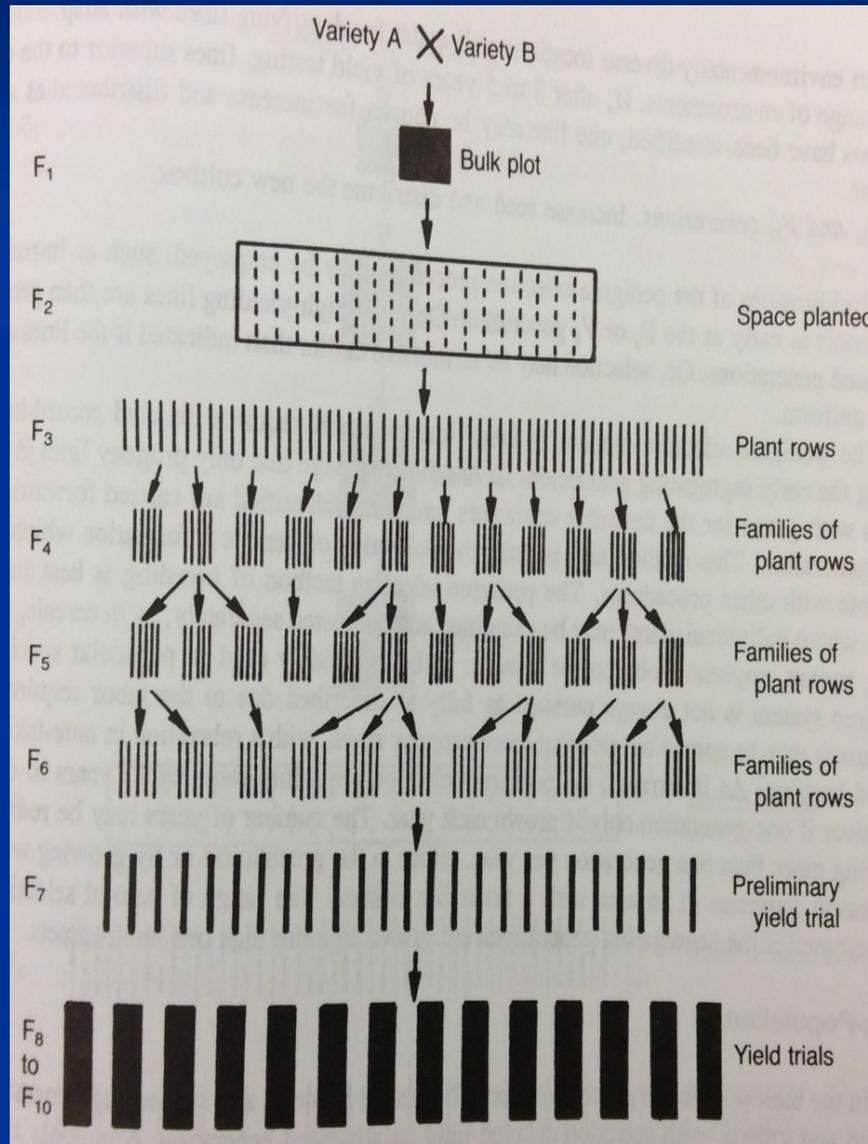
Di-haploid (doubled) System



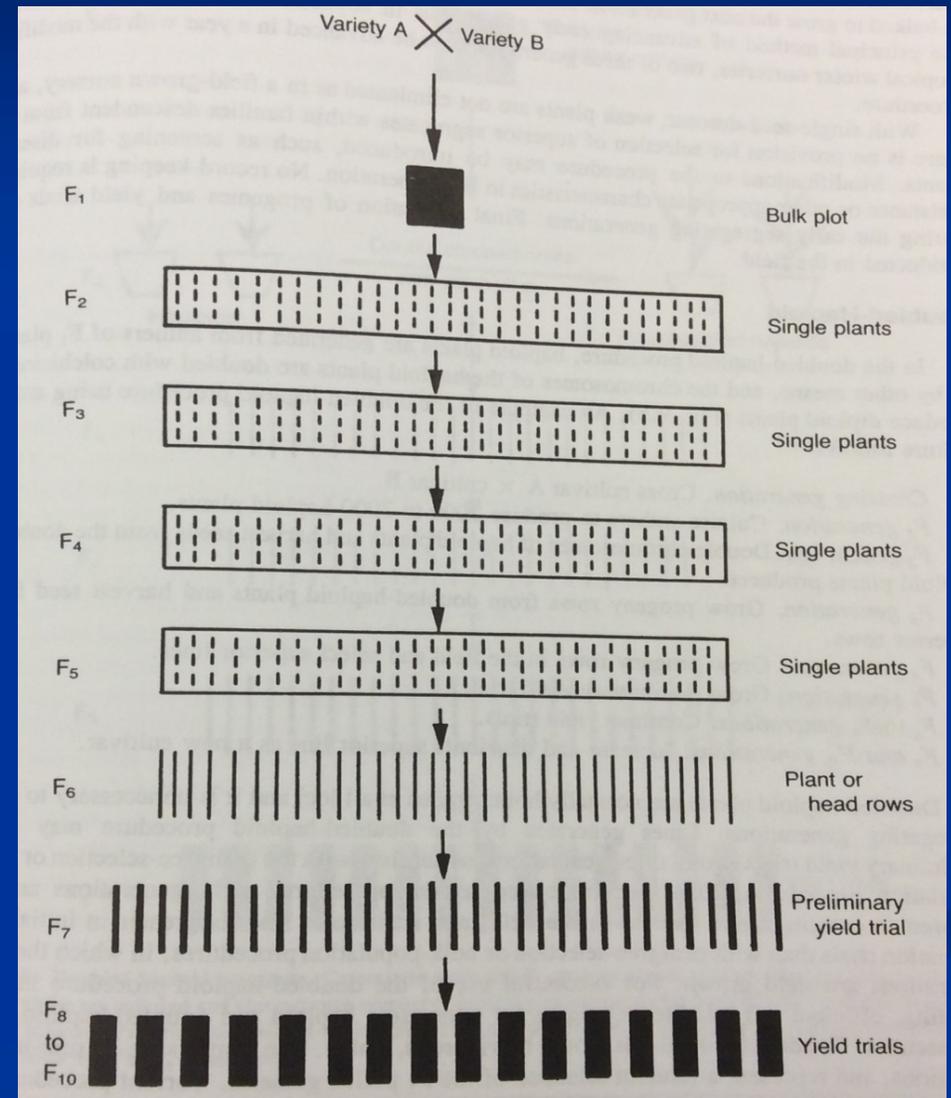
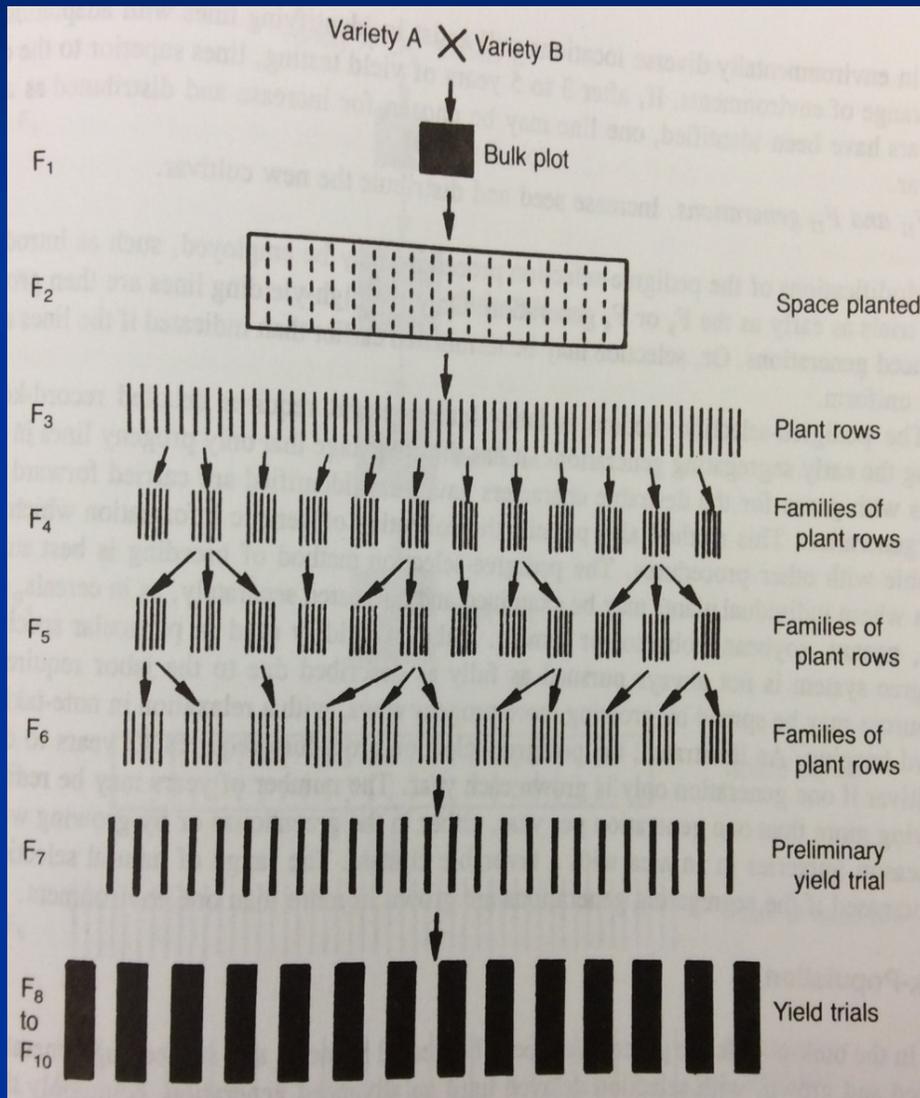
Single Seed Descent of Selection



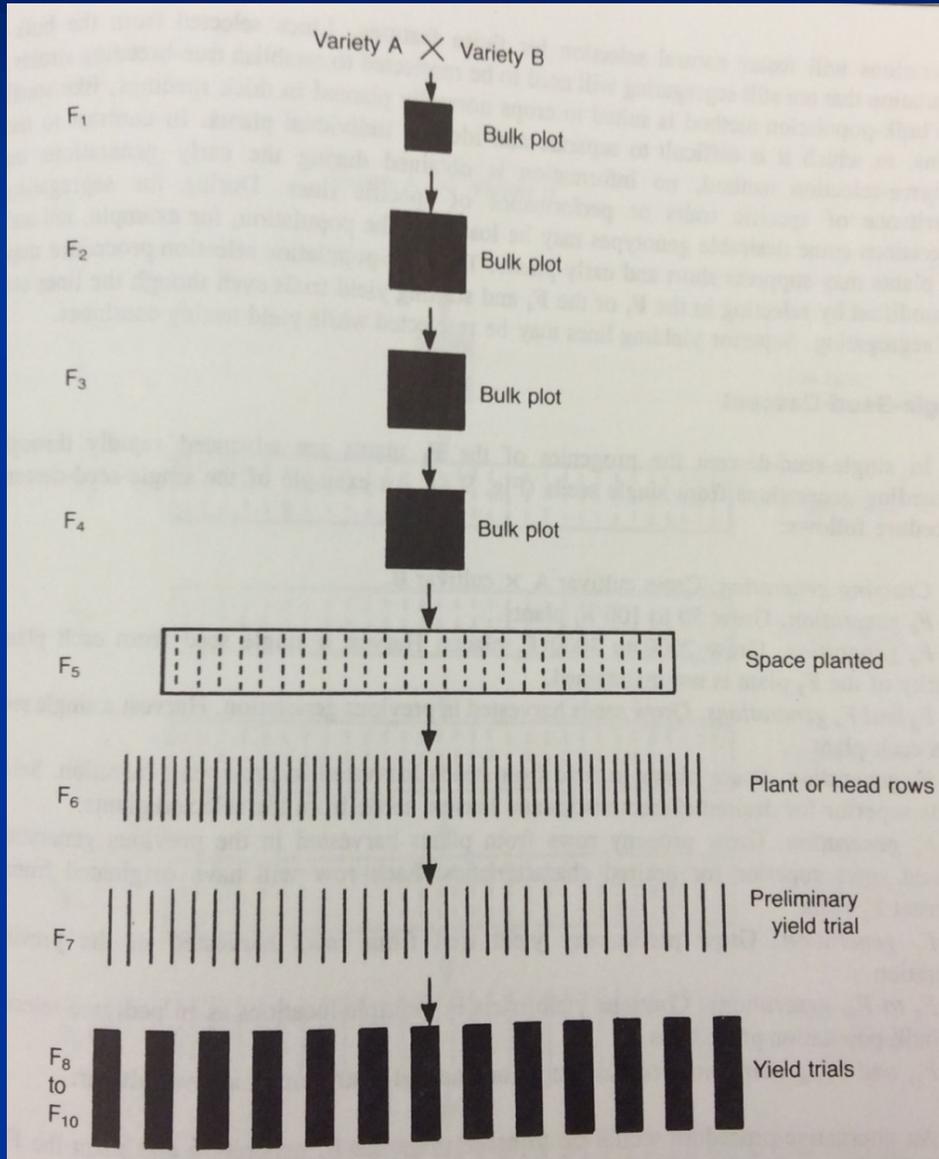
Pedigree of Selection



Pedigree vs. Single Seed Descent



Modified Bulk- Population of Selection



Stage III: Line Evaluation

Year 8: Non-replicated, two environments
(groups 31, 32, 33; groups 301, 302, 303)

Year 9: Replicated, two environments (groups 21, 22, 23;
groups 201, 202, 203)

Year 10: Elite yield trials, multiple environments (groups
11, 12, 13; groups 101, 102, 103)



Early Stress



Height



Lodging

Stage III – Line Evaluation

Year 11 - 12: Western regional trials, PNW (5-10 lines)

Year 13: State variety trials, PNW (2-5 lines)



Stage IV – Cultivar Release

Year 13 - 16

- Justification and decision to release cultivar
- Development and maintenance of breeder seed
- Cultivar Registration and Plant Variety Protection