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:	F_1 progeny rows
Years 4-5:	F_2-F_3 plots, one bulk/plot
Year 6:	F_4 plots, 200 heads/plot
Year 7:	F_5 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

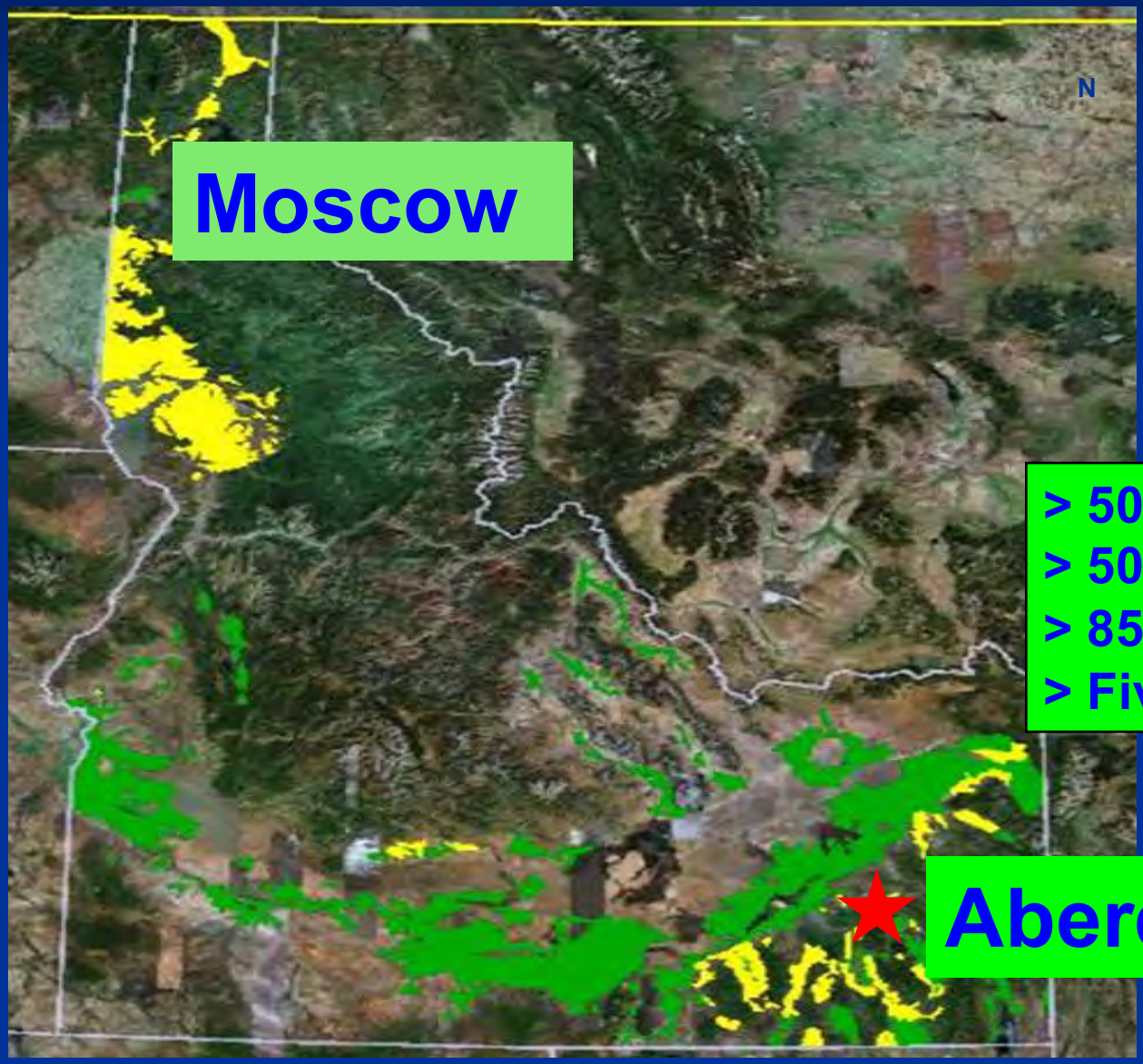
- Define breeding objectives
- Determine mating methods
- Traditional crossing
- Chromosome engineering
- Mutagenesis
- Tissue culture
- Transgenic

Stage I: Planning & Hybridization – creating genetic variation

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

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

Idaho Wheat Production

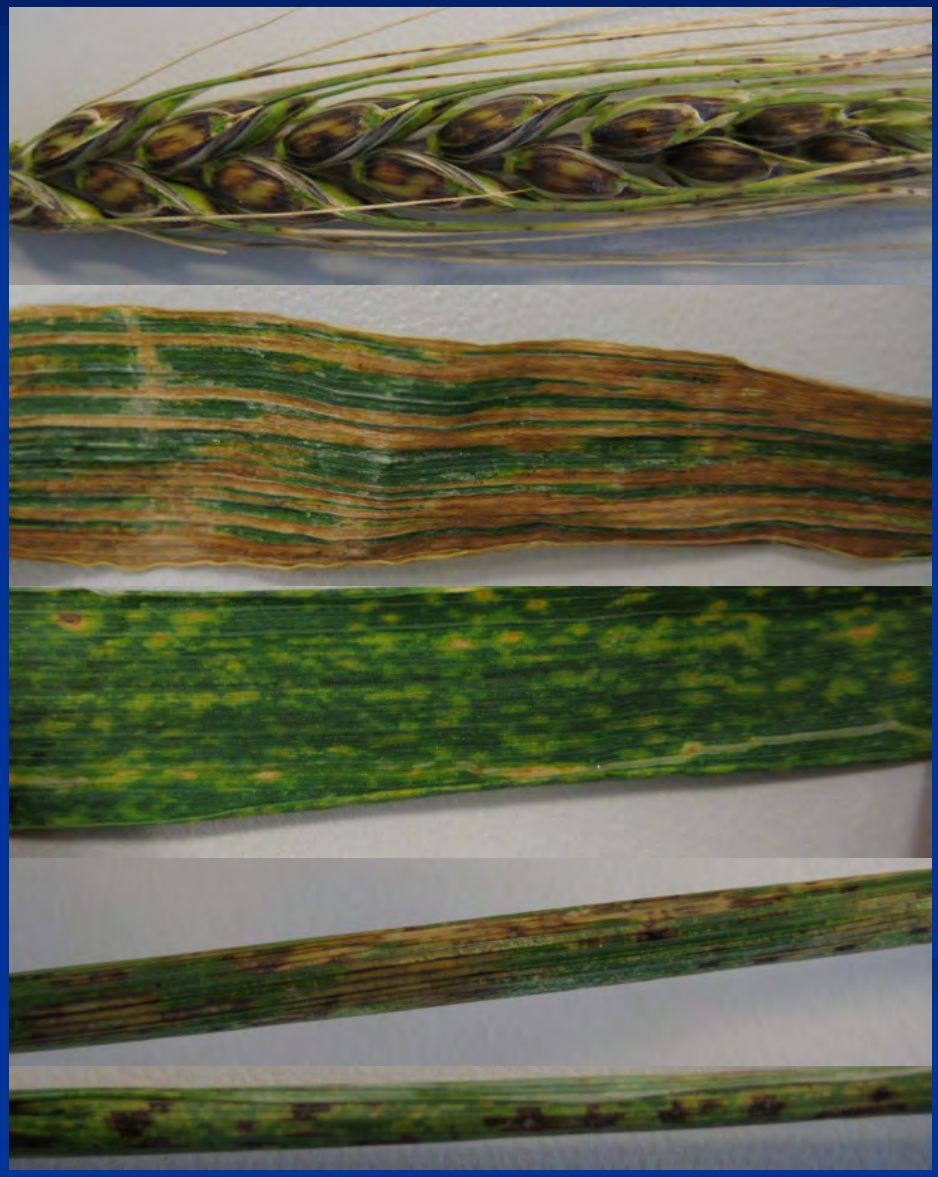


> 50% of Idaho wheat
> 50% of spring wheat
> 85% irrigated wheat
> Five classes of wheat

Stripe Rust Infection

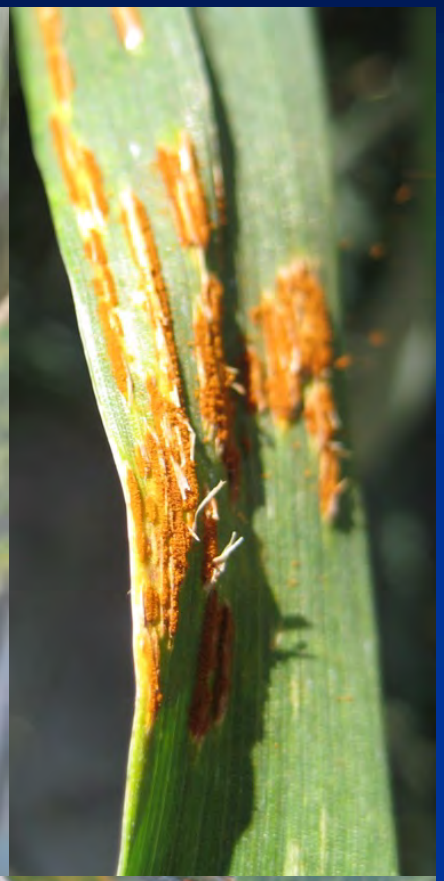
Fusarium Head Blight or Scab

Wheat Black Chaff



Barley Yellow Dwarf Virus

Wheat Stem Rust



Wheat Hessian Fly

Fly/eggs

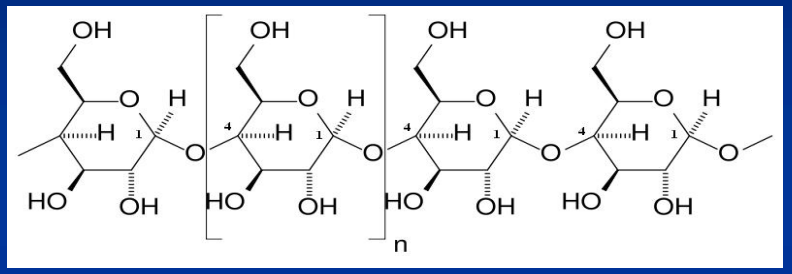
Larvae

Dwarf Bunt

Dryland Foot Rot

Abiotic Stresses

Pre-harvest Sprouting - PHS

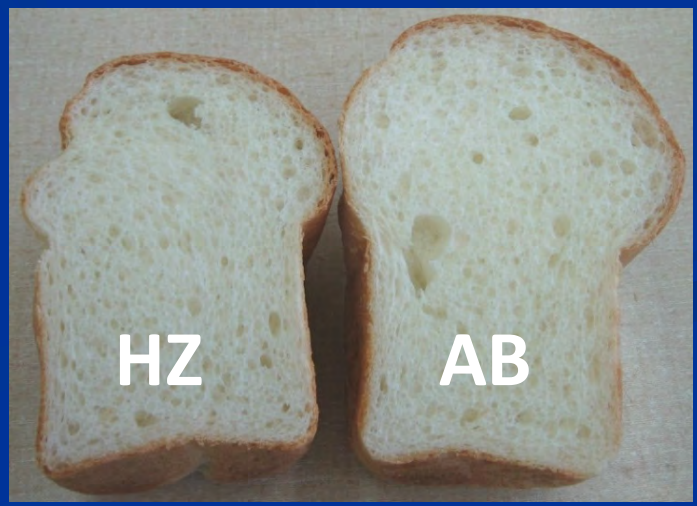


Starch

Alpha-amylase

Falling number test

Bread Baking Quality



Stage II: Early Generation Advancement

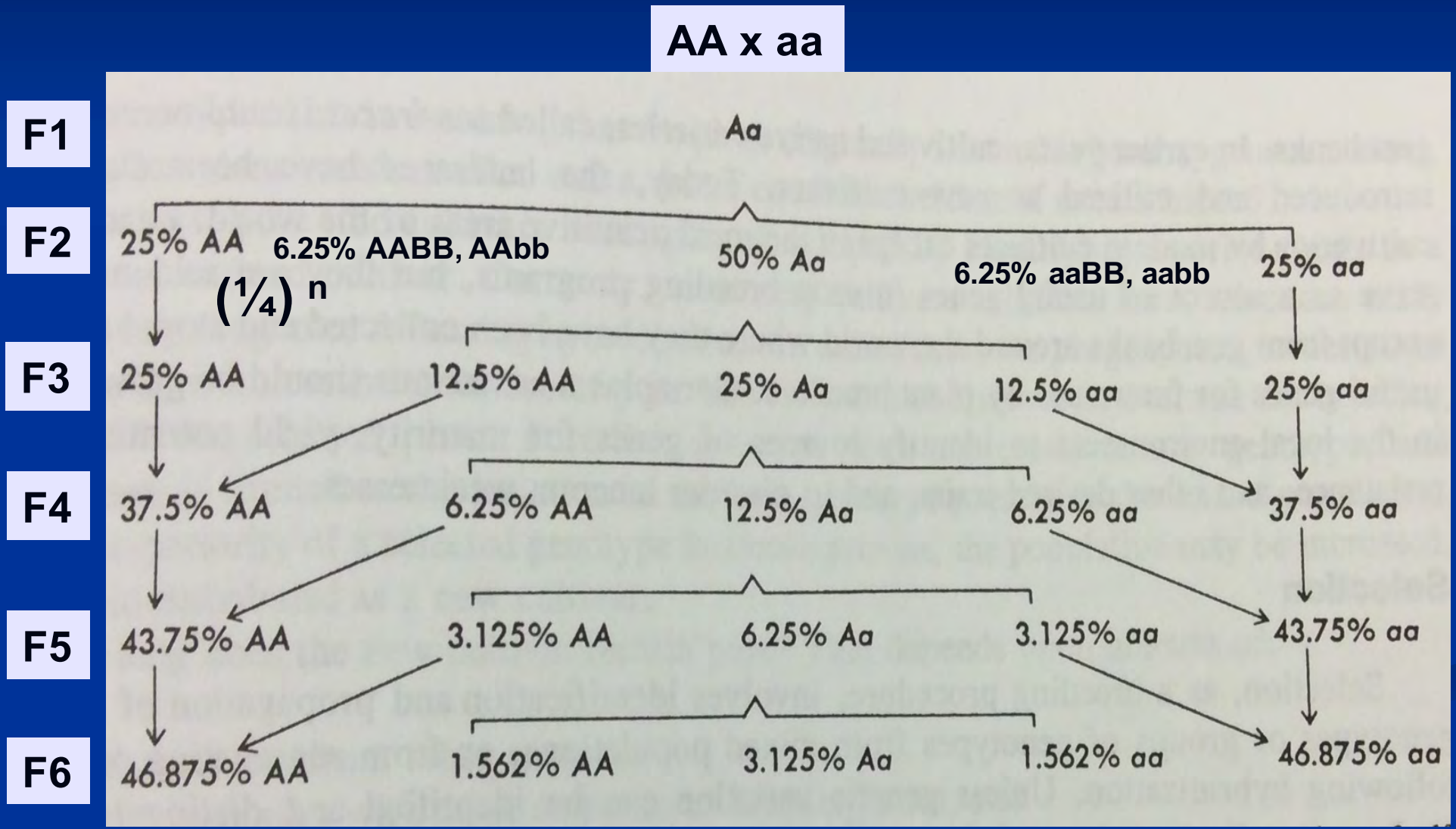
Year 3: F_1 progeny rows

Years 4-5: F_2-F_3 plots, one bulk/plot

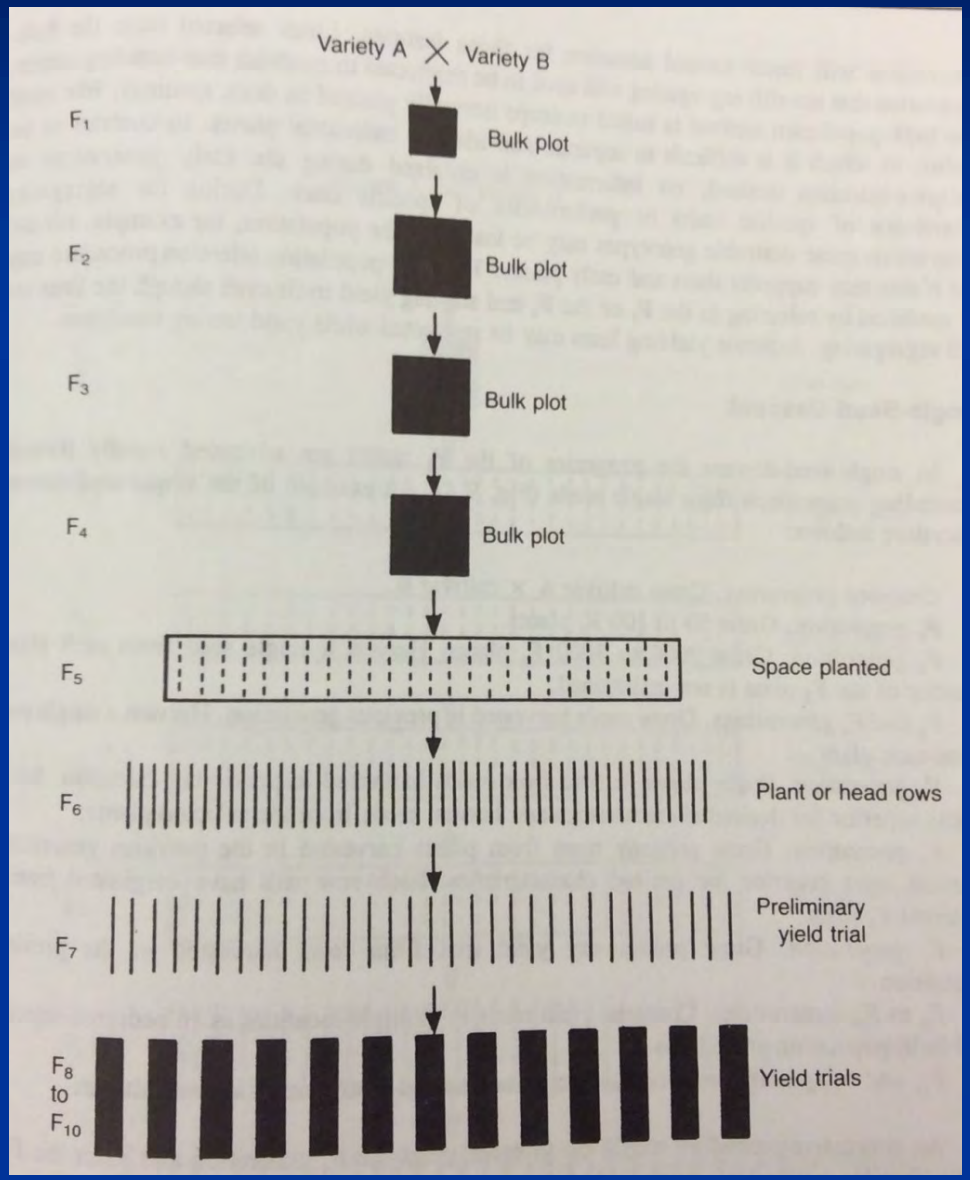
Years 6: F_4 plots, 200 heads/plot

Year 7: F_5 head rows, 5-15% selection index

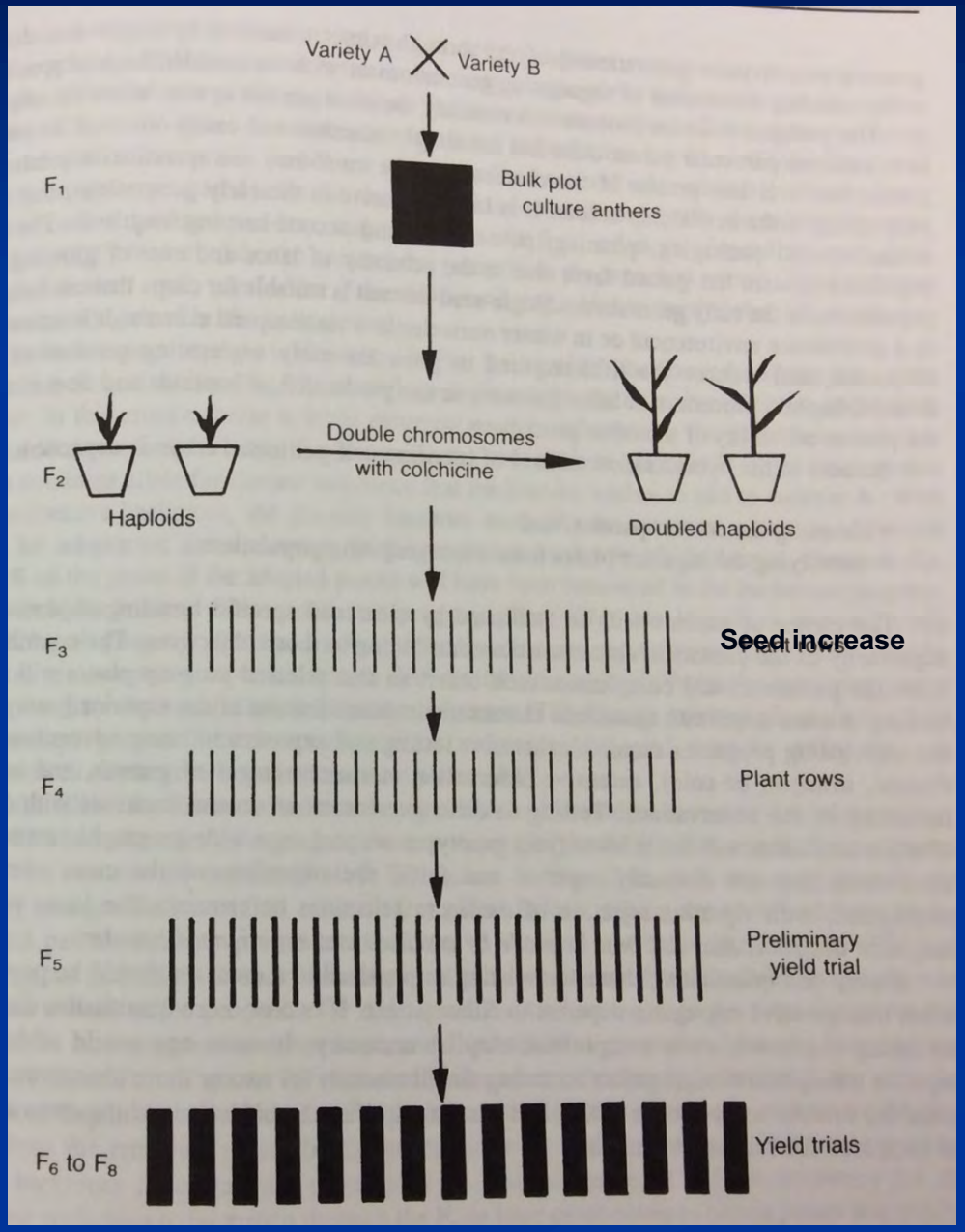
Proportion of Homozygous and Heterozygous Genotypes in a Population



Bulk- Population of Selection



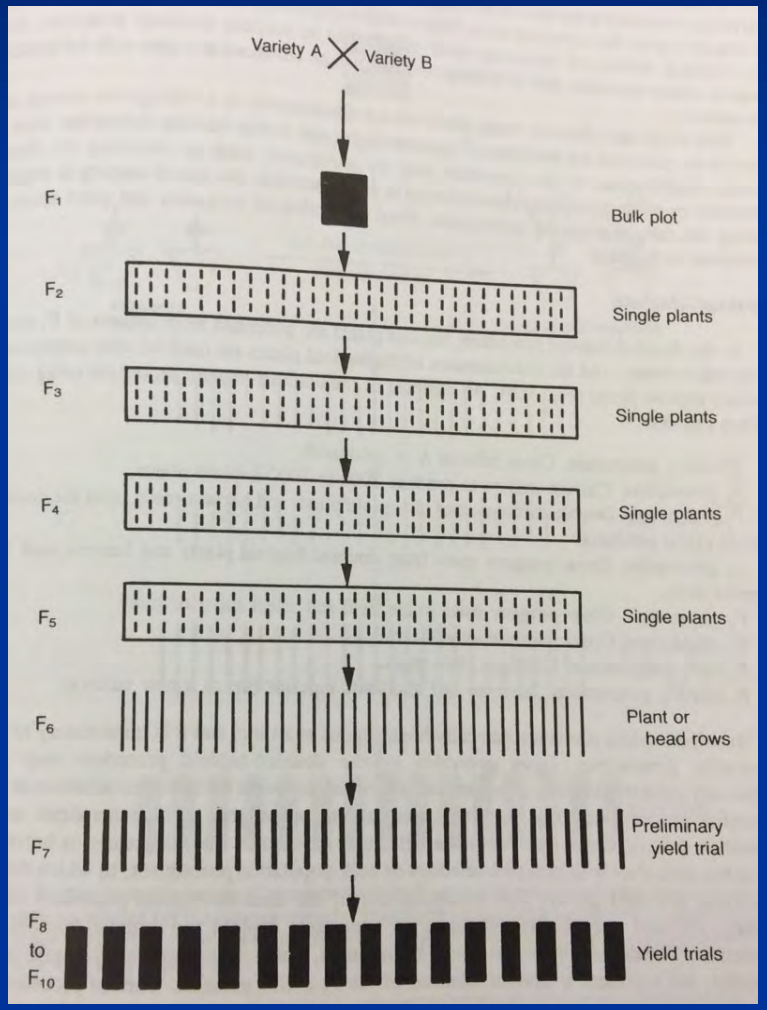
Doubled – Haploid Procedure

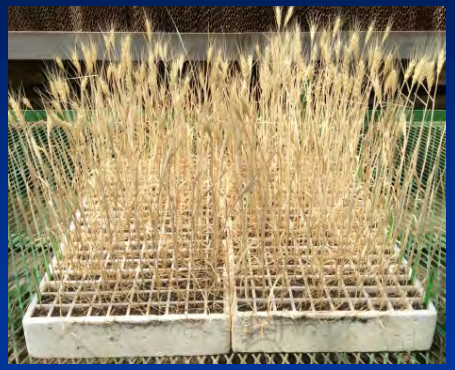


Di-haploid (doubled) System

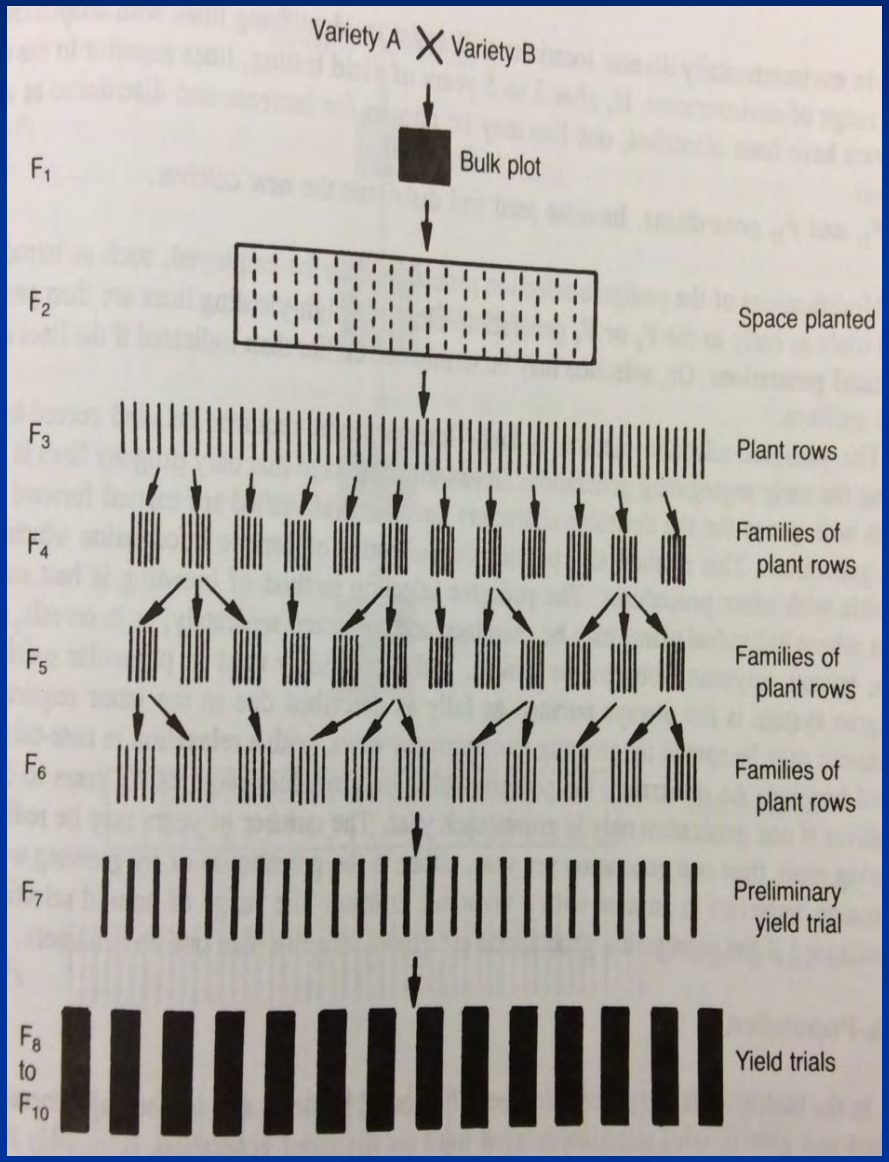
Year	Population	Processes
1st	Initial crosses made	AABB x aabb
		↓
2nd	F1	AaBb
	Gametes	AB Ab aB ab
		↓ **Haploid production Colchicine treatment**
	Doubled Haploid	**(25%)** AABB AAbb aaBB aabb
		↓
3rd		**DH seed increase**
		↓
4th		DH headrows

Single Seed Descent of Selection

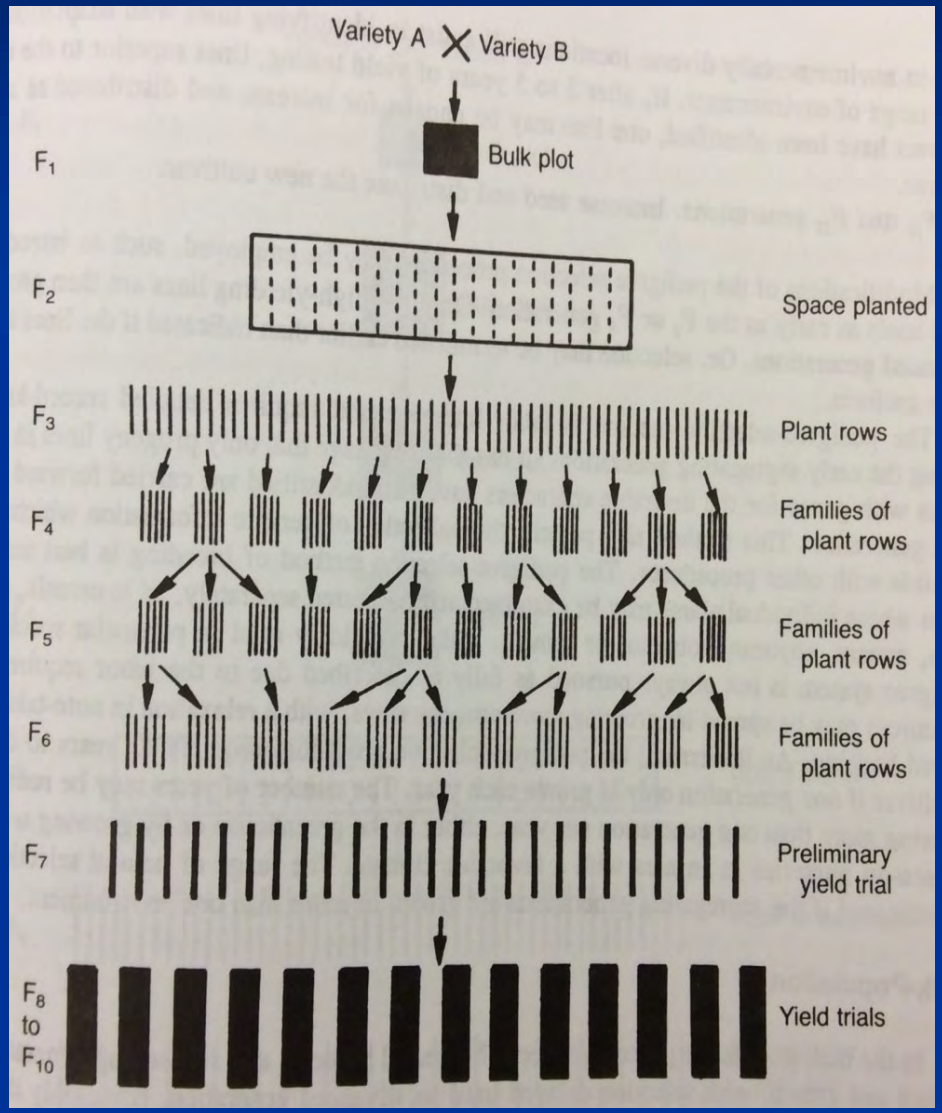


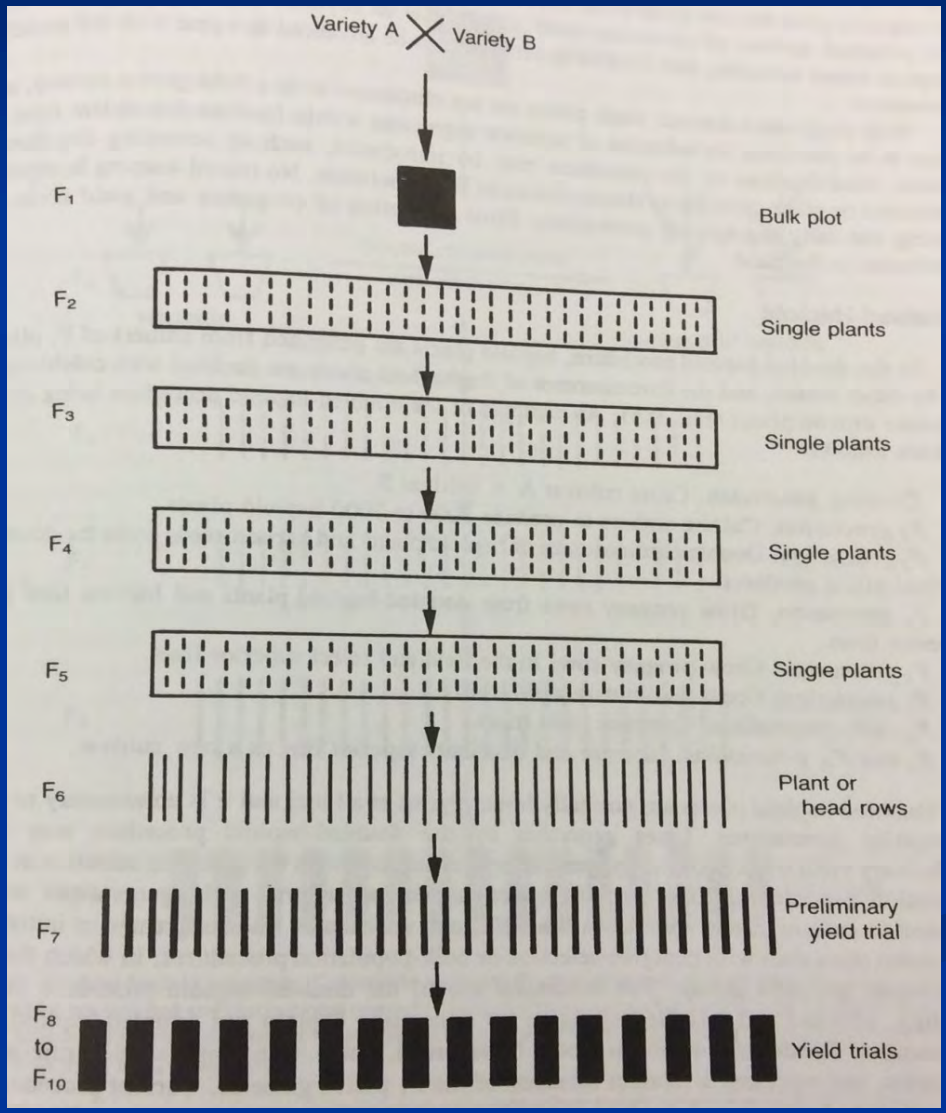


Pedigree of Selection

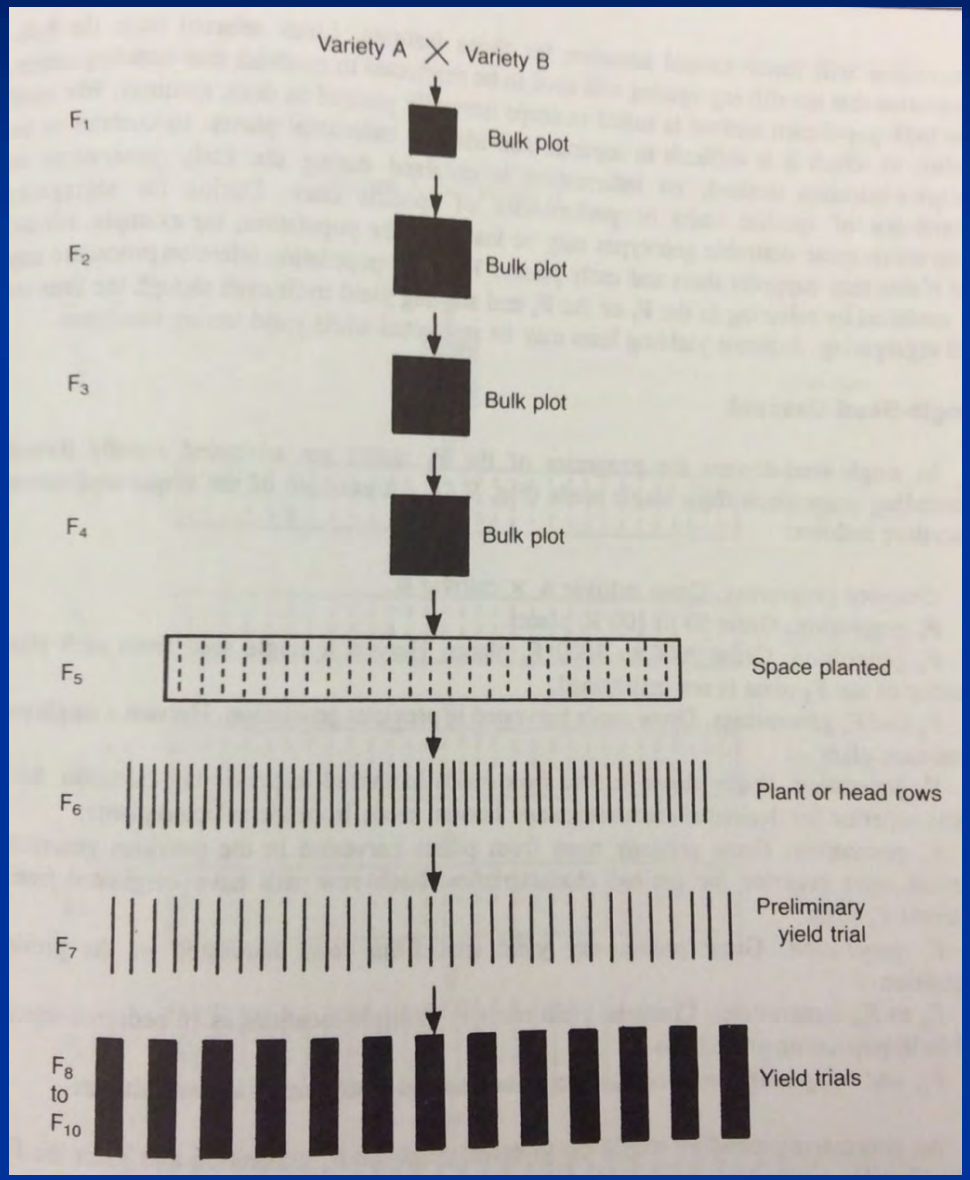


Pedigree vs. Single Seed Descent





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

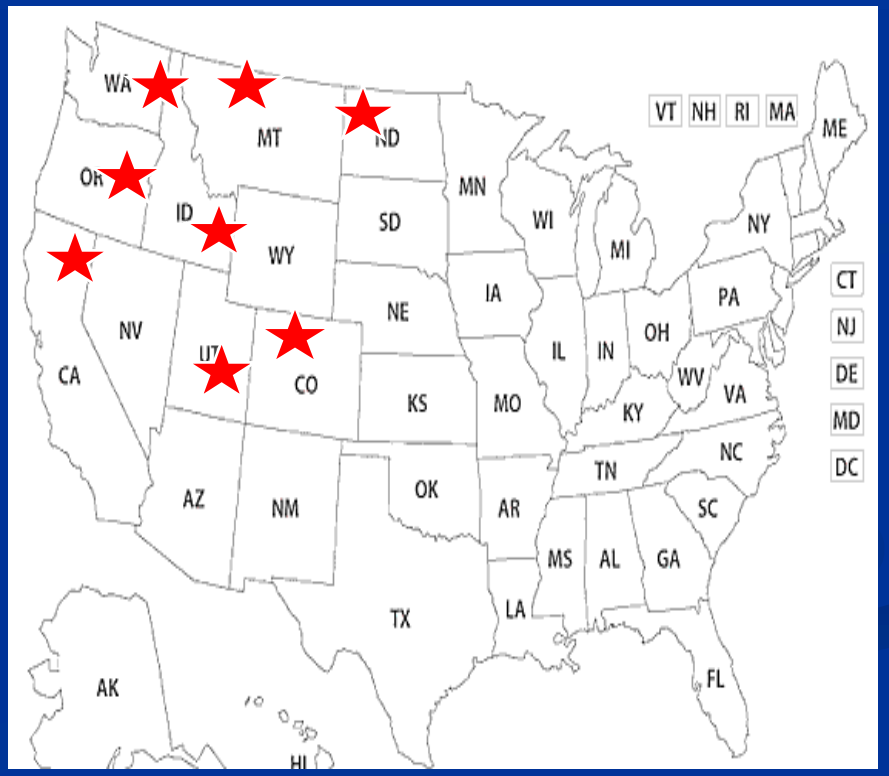
Height

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