Plant Propagation PLS 3223/5222

Dr. Sandra Wilson
Dr. Mack Thetford

UF UNIVERSITY of FLORIDA

Principles and Practices of Seed Selection

Chapter 5

Chapter 5 Objectives are to Understand:

- Self and cross pollination
- Sexual incompatibility
- Procedures used to control genetic variability during seed production
- Seed production systems
- Legalities of genetic purity

Types of Genetic Variability

homo = same genous = phenotype

hetero = different zygous = genotypes

Heterozygous	• dissimilar genotype
Homozygous	• similar genotype
Heterogenous	• dissimilar phenotype
Homogenous	• similar phenotype

Line

-A population of seedling plants whose genotype is maintained to a specific standard in consecutive generations.

- Self pollinated
- Cross-pollinated
- Hybrid

Self Pollination

- When the pollen germinates on the stigma and the pollen tube grows down the style to fertilize the same flower or a flower of the same plant

Wheat	Rice	Oats	Barley	Peaches
Beans	Tomatoes	Peppers	Citrus	Apricots

Fixing Parental Genotypes

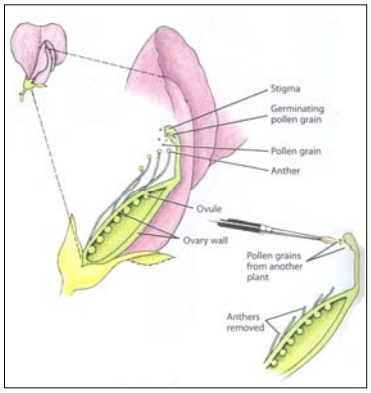
	DD	Dd	dd
P1	1		1
F1		1	
F2	1	2	1
F3	3	2	3
F4	7	2	7
F5	15	2	15
F6	31	2	31
F7	126	2	126

Table 5-1 Hartmann et al., 2002

Cross Pollination

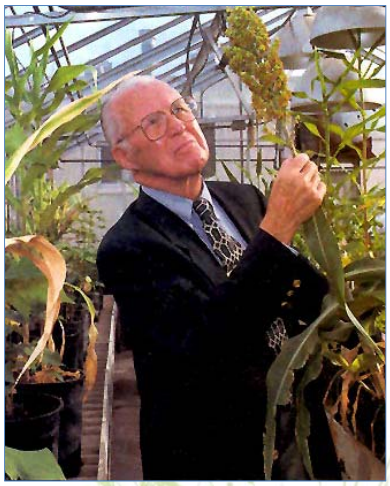
- The transfer of pollen from the anther of one plant to the stigma of a flower of another plant

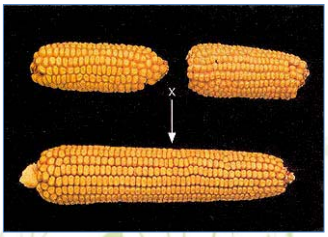
- Beans
- Tomatoes
- Peppers
- Citrus
- Apricots



Raven et al., 1999

Hybrids





Stern, 2003

Hybrid Seed Corn Production

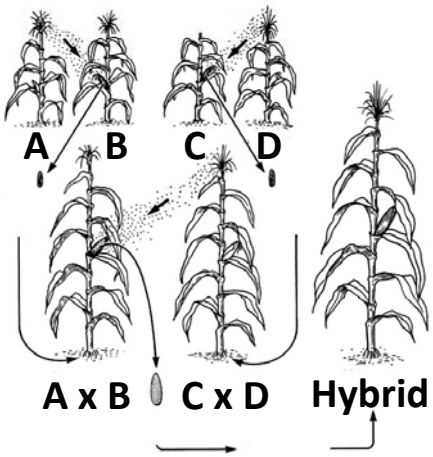


Fig. 5-14 Hartmann et al., 2011

To Pollinate or Not to Pollinate:

- Stamen and stigma maturation times- dichogamy
- Stigma and pollen incompatibility
- Monoecious and dioecious species
- Animal/insect pollinated flowers
- Wind pollinated flowers
- Ovary position

Flower Structure Types

Dioecious	• plant trait in which male and female flowers are produced on different plants
Monoecious	• plant trait in which the male and female parts are in different flowers but on the same plant
Perfect	• male and female parts are present in the same flower

Sexual Incompatibility (Sporophytic or gametophytic)

- Genetic trait in which the pollen either fails to grow down the style or does not germinate on the stigma of a plant with the same incompatibility alleles.

Mauseth, 1998

Prevention of Self Pollination

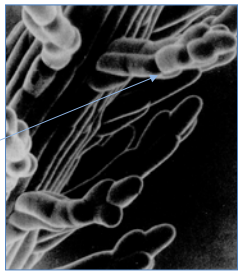
Pollen sterility

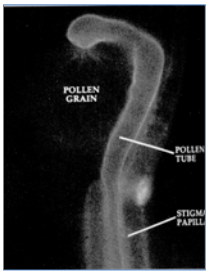
- pollen doesn't form.

Incompatibility

- pollen is viable but pollen tube cannot grow down style of plant of the same genotype.

Papillae on stigma to capture pollen





Hybrids

- The F1 progeny of two or more parental lines

Hybrid Vigor

- when two lines are crossed and the resulting population has more size and vigor than either parent. The individual plants may be heterozygous but the population is likely to be homogeneous and uniform.

Genetically Pure Seed

- Trueness-to-name
- Trueness-to-type
- Free from contaminants

Photo credit: http://growwildflowers.com

Pedigreed Stock System

- A controlled seed-production system of consecutive generations with standards to maintain genetic purity leading to commercial distribution

Photo credit: Jeff Norcini

Control of Genetic Variability During Seed Production

Isolation

- achieved by isolating plants or flowers to prevent mechanical mixing of seed during harvest or prevent unwanted pollination.

Roguing

- removing off-type plants to eliminate the small population that is not true to type.

Seedling progeny tests

- used in developing cultivars to test its adaptability to various environments.

3 Phases of Pedigreed Stock System

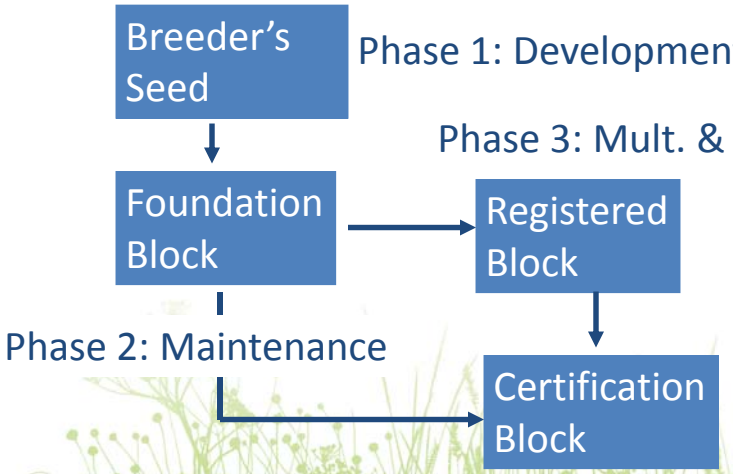


Figure 5-13: Hartmann et al., 2011

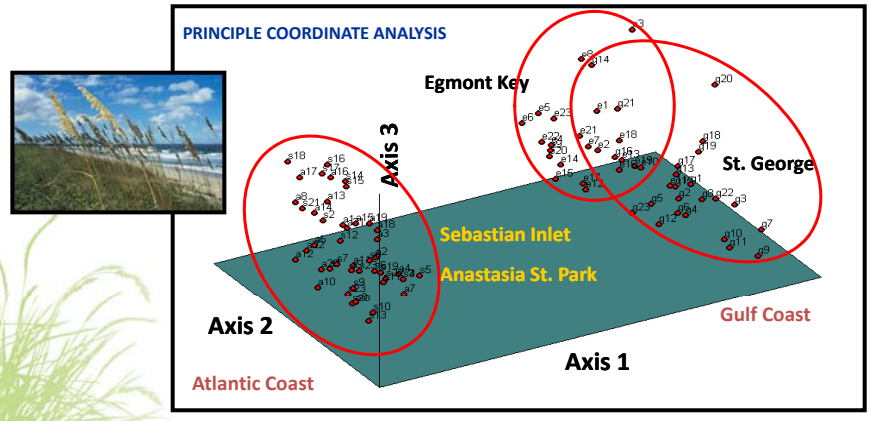
Provenance

- A forestry term used to indicate the climatic and geographical locality where the seed originated

Ecotype

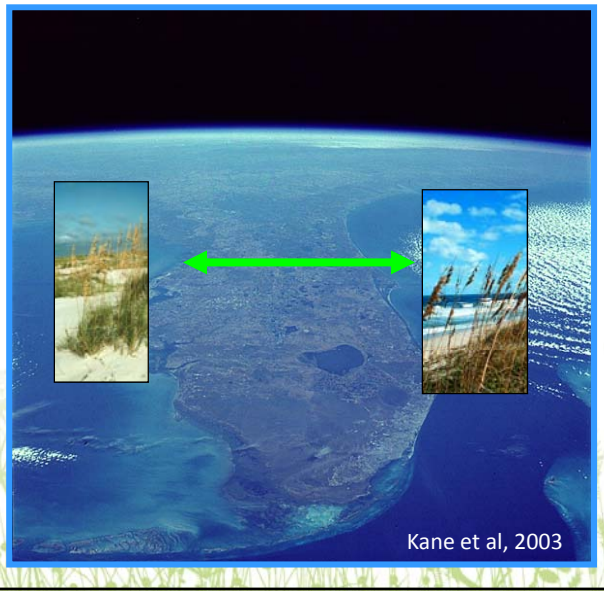
- A genetically distinct group of plants within a species that is adapted to a specific ecological location

Sea Oats Population Genetic Diversity



Data used with permission from M. Kane, 2002

Sea Oats Ecotypes



Sea Oats Acclimatization

EK 16-3 EK 11-1

Wildflower Ecotypes

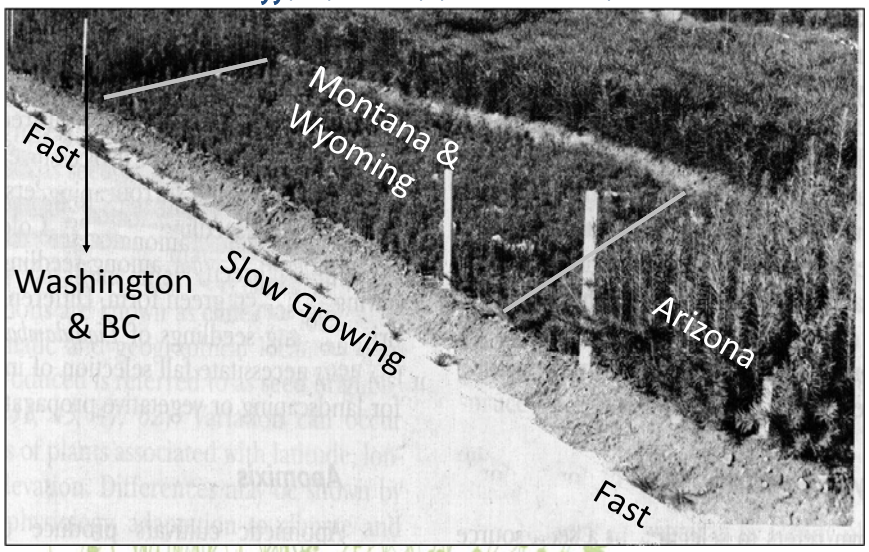
Photo credit: Jeff Norcini

Seed Collection Zones

-Naturally occurring zones (forest plants) designated by elevation, latitude, and longitude that identifies a specific seed source

California has 85 seed collection zones

Variation in Progeny Performance Among Different Seed Sources



Hartmann et al., 2002