Modes of reproduction

Types of cultivar
What is a Cultivar?

✓ Distinctness: “….. Shall be clearly distinguishable, by one or more important characteristic, from any other plant variety”

✓ Uniformity: “….. Similar or genetically identical as regards the characteristics, taken as a whole”

✓ Stability: “….. Exhibit its essential characteristics after successive reproductions …”
What is a Cultivar?

Value for Cultivation and Use (VCU):
“ ….. constitute either genetically or as far as production in a specific area is concerned, a clear improvement either as regards crop farming or the use made of harvested crops or of products from these crops”
Value for Cultivation and Use

✓ No statutory VCU trials
  • Reputation of seed companies.

✓ Regulatory VCU trials
  • Mistakes are made, and potentially useful cultivars are wrongfully discarded.
  • Only limited numbers of new lines can be tested annually.
  • Tests do not mimic actual agricultural situations.
  • Delays the period of new cultivars being commercialized.
Modes of reproduction

Types of cultivar

“I don’t have any hard evidence, Connie — but my intuition tells me that Ed’s been cross-pollinating.”
Sexual Reproduction

✓ Self-pollinating:
  • Tolerant to inbreeding
  • Few deleterious recessive alleles
  • “Closed” flowers
  • Little heterosis

✓ Out-pollinating:
  • Intolerant to inbreeding
  • Many deleterious recessive alleles
  • Flower morphology that promotes cross pollination.
  • High heterosis
Breeding System and Life Cycle

<table>
<thead>
<tr>
<th>Breeding System</th>
<th>Annual</th>
<th>Perennial</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbreeding</td>
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<td>1</td>
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<tr>
<td>In/Out breeding</td>
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<td>47</td>
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<tr>
<td>Out breeding</td>
<td>23</td>
<td>47</td>
<td>70</td>
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<tr>
<td>Total</td>
<td>70</td>
<td>53</td>
<td>123</td>
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</table>
A-sexual Reproduction

Reproduction through plant parts

Reproduction through apomixis
Reproduction through plant parts

✓ Bulb.
  • Large bud with stem at its lower end (e.g. onion).

✓ Corm.
  • Like a bulb in size and form, but has a different internal structure (e.g. crocus).

✓ Rhizome.
  • Horizontal stem that grows at, or below the soil, bearing buds in axils (e.g. mint, couch grass).
Reproduction through plant parts

✔ Stolon.
  • Horizontal stem that roots at nodes (e.g. strawberry).

✔ Tuber.
  • Swollen stem with buds (e.g. potato).
Apomixis

✓ Advantageous embryony
  • No embryo sac is formed during seed development (citrus).

✓ Androgenesis
  • Seed develops from sperm nucleus of the pollen grain in the embryo sac.

✓ Apospory
  • Somatic cells of ovary divide mitotically to form $2n$ embryo sac. Most common form (e.g. Kentucky bluegrass).
Apomixis

✓ Diplospory
  • Origin of embryo and endosperm is the $2n$ megaspore mother cell.

➢ Parthenogenesis
  ❖ Development of haploid from egg cell without fertilization.

➢ Pseudogamy
  ❖ Requires pollination, and stimulates embryo development.

➢ Semigamy
  ❖ Pollen grain enter embryo sac, penetrates egg, no fusion. Sperm and egg cells develop independently.
Pure-line Inbred

- In breeding mating system.
- Annual seed propagation.
- Homozygous and homogeneous.

- Selection and move towards homozygosity.
- Includes multilines.
Open-pollinated Population

✓ Out breeding mating system.
✓ Annual, biennial, or perennial.
✓ Heterozygous and heterogeneous.

✓ Selection to change gene frequency (population improvement).
✓ Also synthetic cultivars.
Hybrids

- Out breeding mating system.
- Annual or biennial.
- Homogeneous and highly heterozygous.

- Selection and inbreed parents.
- Select for combining ability.
Clones

 ✓ Out breeding mating system.
 ✓ Perennial or Quasi-annual propagation.
 ✓ Highly homogeneous and heterozygous.

 ✓ Selection of genetically fixed genotypes.
Factors to be considered

- Annuals and Perennials
  - Perennials pose greater time difficulties.
  - Many perennials are not reproductive for several years after growth.
  - Perennials (often clones) can become infected with virus diseases.

- Reproductive sterility
  - Limited parent choice
  - Ploidy manipulation
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Breeding Objectives

Blue print plans of a breeding program