RAMA UNIVERSITY

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FACULTY OF AGRICULTURE SCIENCES AND ALLIED INDUSTRIES

(Crop Improvement I (Kharif))

For

B.Sc. Ag (Third Year)

Course Instructor

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Concepts of breeding Self pollinated, Cross pollinated and asexually propagated crops

The mode of pollination and reproduction play an important role in plant breeding. Based on this, crop plants are divided into three groups *viz.*

1. Self Pollinated
2. Cross pollinated
3. Vegetatively propagated

Self Pollinated Species:

These are all self fertilizing species. In these species development of seed take place by self pollination (autogamy). Hence self pollinated species are also known as autogamous species or inbreeders. Various plant characters such as homogamy, cleistogamy, chasmogamy, bisexuality etc. favour self fertilization. Some important features of autogamous species are

1. They have regular self pollination
2. They are homozygous and have advantage of homozygosity, means they are true breeding.
3. Inbreeders do not have recessive deleterious genes, because deleterious genes are eliminated due to inbreeding by way of gene fixation.
4. Inbreeding does not have any adverse effects on inbreeders.
5. In autogamous species, new gene combinations are not possible due to regular self pollination.
6. Inbreeders are composed of several component (homozygous) lines. Hence variability is mostly among component lines.
7. Inbreeders have generally narrow adaptation and are less flexible.

Methods of Breeding in Autogamous Species

1. Plant introduction
2. Pureline selection
3. Mass selection
4. Pedigree method
5. Bulk method
6. Single seed descent method
7. Backcross method
8. Heterosis breeding
9. Mutation breeding
10. Polyploidy breeding
11. Distant hybridization
12. Transgenic breeding

Four breeding approaches viz., recurrent selection, disruptive selection, diallel selective mating and biparental mating are used for population improvement.

Cross pollinated species

This group refers to cross fertilizing species these species produce seed by cross pollination (allogamy) hence, referred to as allogamous species or out breeders. Various plant characters which promote cross pollination which include dichogamy, monoecy, dioecy, heterostylely, herkogamy, self incompatibility and male sterility. Some important features of out breeders are

1. They have random mating. In such population, each genotype has equal chance of mating with all other genotypes
2. Individuals are heterozygous and have advantage of heterozygosity
3. Individuals have deleterious recessive gene which are concealed by masking effect of dominant genes.
4. Out breeders are intolerant to inbreeding. They exhibit high degree of inbreeding depression on selfing.
5. Cross pollination permits new gene combinations from different sources.
6. In these species, variability is distributed over entire population.
7. They have wide adaptability and more flexibility to environmental changes due to heterozygosity and heterogenety.

Methods of Breeding Allogamous species

1. Plant introduction
2. Mass and progeny selection
3. Back cross method.
4. Heterosis breeding
5. Synthetic breeding
6. Composite breeding
7. Polyploidy breeding
8. Distant hybridization
9. Transgenic breeding
10. Mutation breeding (rarely)

Three breeding approaches viz., recurrent selection, disruptive mating and biparental mating are used for population improvement.

Asexually propagated species

Some crop plants propagate by asexual means i.e. by stem or root cuttings or by other means. Such species are known as asexually propagated species or vegetatively propagated species. Such species are found in both self and cross pollinated groups. Generally asexually propagated species are highly heterozygous and have broad genetic base, wide adaptability and more flexibility.

Methods of breeding Asexually propagated species

1. Plant introduction
2. Clonal selection

3. Mass selection (rarely used)
4. Heterosis breeding
5. Mutation breeding
6. Polyploidy breeding
7. Distant hybridization
8. Transgenic breeding

BREEDING POPULATIONS

The genetic constitution of plants is determined by mode of pollination. Self pollination leads to homozysity and cross pollination results in heterozygosity to exploit homozygosity in self pollinated crops and heterozygosity in cross pollinated species, because inbreeders have advantage of homozygosity and outbreeders have advantage of heterozygosity. Based on genetic constitution, breeding populations are of four types *viz.,*

1. Homogenous
2. Heterogenous
3. Homozygous
4. Heterozygous

1. Homogenous population

Genetically similar plants constitute homogenous populations. Examples of homogeneous populations are pure lines, inbred lines, F1 hybrid between two pure line or inbred lines and progeny of a clone. Pure lines and inbred lines generally have narrow adoption.

2. Heterogenous populations

Genetically dissimilar plants constitute heterogenous populations. Examples are land races, mass selected populations, composites, synthetics and multilines. Heterogenous populations have wide adaptability and stable performance under different environments.

3. Homozygous populations

Individuals with like alleles at the corresponding loci are know as homozygous. Such individuals do not segregate on selfing. Thus non-segregating genotypes constitute homozygous populations. Examples are pure lines, inbred lines and mass selected populations in self pollinated plants. Thus pure lines and inbred lines are homozygous and homogeneous and mass selected varieties of self pollinated crops and multi lines are homozygous and heterogenous, because they are mixtures of several pure lines.

4. Heterozygous populations

Individuals with unlike alleles at the corresponding loci are referred to as heterozygous. Such individuals segregate into various types on selfing. This includes F1 hybrids, composites and synthetics. Thus F1 hybrids are heterozygous but homogeneous and composites and synthetics are heterozygous and heterogenous population. Such populations have greater buffering capacity to environmental fluctuations.