

MAHARASHITRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Sc. (Hort.)

Semester	: II (New)	Academic Year	: 2013-14 - 2015-16
Course No.	: H/BOT-122	Title	: Principle of Plant Breeding
Credits	: 2(1+1)		
Day & Date	:	Time : 2 hrs	Total Marks : 40

- Note :
1. Solve ANY EIGHT questions from SECTION 'A'
 2. All questions from SECTION 'B' are compulsory
 3. All question carry equal marks
 4. Draw neat diagrams wherever necessary.

MODEL ANSWER
SECTION 'A'

Q.1 Define hybridization. Explain in detail the steps involved in hybridization.

Ans. Hybridization: The mating of two plants or lines of dissimilar genotype is known as hybridization. 1

Step involved in hybridization 2

- 1) Choice of parents
- 2) Evaluation of parents
- 3) Emasculation
- 4) Bagging
- 5) Tagging
- 6) Pollination
- 7) Harvesting and storing of F1 seeds.

Q.2 Define male sterility. List out various types of male sterility. Explain cytoplasmic male sterility.

Ans. **Male sterility** : refers to condition in which pollen is either absent or nonfunctional in flowering plants. 1

Types of male sterility

1. Genetic male sterility 1
2. Cytoplasmic male sterility
3. Cytoplasmic genetic male sterility
4. Chemically induced male sterility

Cytoplasmic Male Sterility:

This type of male sterility is due to cytoplasm genes. It is governed by dominant genes. It is not influenced by environmental factor. Commonly used in asexually propagated crops like sugarcane, potato, and horticulture crops where seed is not important. 2

Q.3 What is self incompatibility? Differentiate between sporophytic and gametophytic incompatibility.

Ans. **Self Incompatibility:**

It refers to failure of pollen to fertilize the same flower or other flower of the same plant.

Sporophytic incompatibility

1. Self incompatibility is controlled by the genetic constitution of pollen
2. Crosses may be sterile, partially fertile or fully fertile
3. Reciprocal differences are not observed
4. Recovery of only male parent is possible
5. The pollen tube growth is usually inhibited in the style or ovary

Gametophytic incompatibility

1. Self incompatibility is controlled by the genotype of pollen producing plant
2. Crosses would be either fully sterile or fully fertile
3. Reciprocal differences are observed
4. Recovery of male and female parents is possible from crosses
5. Pollen germination or pollen tube growth is inhibited on the stigma

Q.4 Define Plant Breeding. Describe briefly the various objectives of plant breeding.

Ans: Plant breeding is a science as well as art of improving the genetic make up of plants in relation to their economic use.

Objectives of Plant Breeding:

- 1) Higher yield
- 2) Improved quality
- 3) Biotic and abiotic resistance
- 4) Hardiness
- 5) Photo and thermo insensitivity
- 6) Synchronous maturity
- 7) Removal of toxic compounds
- 8) Wider adaptability

Q.5 Define Pollination. Enlist the various mechanisms that promotes self and cross pollination.

Ans. Pollination: The transfer of pollen grains from the anther to the stigma of flower.

Mechanisms that promote self pollination.

- 1) Bisexuality
- 2) Cleistogamy
- 3) Homogamy
- 4) Sticky stigma
- 5) Staminal column
- 6) Chasmogamy

Mechanisms that promotes cross pollination

1. Dicliny
2. Dichogamy
3. Heterostyly
4. Herkogamy
5. Self incompatibility
6. Male sterility.

Q.6 What is apomixis? Write in brief different types of apomixis.

Ans: Apomixis: Development of seed without sexual fusion.

Types of apomixis:

- 1) Parthenogenesis: development of embryo from egg cell without fertilization.
- 2) Apogamy: embryo develops directly from either synergids or antipodals.
- 3) Apospory: The embryo develops directly from the diploid egg cell from another embryo sac.
- 4) Adventive embryony: The development of embryo directly from the diploid cells of ovule lying outside the embryo sac.

Q.7 Define Plant Introduction. Give brief account of merits & demerits of plant introduction.

Ans: Introduction : Plant introduction consists of taking a genotype or a group of genotype of plants into new area or region where they were not being grown before.

Any individual or institution can introduce germplasm in India. But all the introductions must be routed through the NBPGR, New Delhi. The imported material is examined by quarantine department.

Merits:

1. It provide entirely new crop plants
2. It provides superior varieties either directly, after selection or through hybridization.
3. Introduction and exploration are the only feasible means of collecting germplasm and to protect variability from genetic erosion.
4. It is very quick and economical method of crop improvement.

Demerits:

- 1 Plant introduction are associated with the entry into the country of weeds, diseases and pests along with the introduced materials.

Q.8 Define clone. Explain the procedure for clonal selection after hybridization.

Ans: Clone: Clone is group of plants obtained from single plants through asexual reproduction.

Procedure for clonal selection after hybridization.

Selection among F_1 families.

2nd year-space planting 5000-20000 seedlings. Select 500-2000 superior plants.

3rd year- individual clones from selected F_1 plants are grown.

4th -PYT, selection outstanding clone.

5th year- MLT selecting outstanding clones and released as new varieties.

Q.9 Write short notes on (Any two)

② 1) Pureline: Homogenous progeny of a self pollinated homozygous plant. Johannsen (1903, 1926), a Danish biologist, developed the concept of pureline theory working with the Princess variety of common bean. He isolated 19 different lines on the basis of seed weight from the original seed of the princess variety concluded that 1) continuous inbreeding leads to homozygosity 2) variation within a pureline results from environment factor only 3) Selection within pureline is not effective 4) selection in the original population is effective because the plants have genetic variation

2) Apomixis: Development of seed without sexual fusion.

Types of apomixis:

Parthenogenesis: development of embryo from egg cell without fertilization.

Apogamy: embryo develops directly from either synergids or antipodals.

② Apospory: The embryo develops directly from the diploid egg cell from another embryo sac.

Adventive embryony: The development of embryo directly from the diploid cells of ovule lying outside the embryo sac.

3) Heterosis: Superiority of F_1 hybrids in one or more characters over its parents

Theories of Heterosis:

② 1) Dominance Hypothesis 2) Over Dominance Hypothesis 3) Epistasis Hypothesis

Estimation of heterosis:

a) Average heterosis: when heterosis is estimated over the mid parent.

b) Heterobeltiosis: When heterosis is estimated over the superior or better parent.

c) Useful heterosis: when heterosis is estimated over the standard commercial check

Q.10 Define mutation breeding. Explain merits and demerits of mutation breeding.

① Ans. Mutation Breeding: The genetic improvement of crop plants for various economic characters through mutation.

Merits:

② Induced mutagenesis is used for induction of cytoplasmic male sterility.
It is a cheap and rapid method of developing new variety.

More effective for improvement of oligeneic characters such as disease resistant.
Simple, quick and best in vegetatively propagated crops

Demerits:

- Most mutations are deleterious and undesirable.
- Micro mutation identification is difficult.
- Useful mutation frequency is very low.
- Limited scope for quantitative characters.

SECTION 'B'

Q.11 Match the pair

'A'

- 1 Heterosis
- 2 SSD Method
- 3 Mutation
- 4 Centre of origin

'B'

- a. Shull G. H.
- a. Goulden
- a. Stadler L. J.
- b. Vavilov N. I

Q.12 Fill in the blanks

1. Domestication is the process of bringing wild species of plants under cultivation.
2. The line which restores male fertility of the male sterile line is known as restorer line
3. Introduction is the quickest method of plant breeding.
4. The transfer of pollen grain from the anther of one flower to the stigma of other flower by wind is called anemophily.


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