MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE

Semester End Theory Examination

B.Sc. (Agri.)

Semester	:	III (New)	**Academic year**	:	Monsoon 2016-17
Title	:	Principles of Plant Breeding	**Credits**	:	3 (2+1)
Course No.	:	BOT-233	**Total marks**	:	80
Day & Date	:		**Time**	:	3 hrs

Note
1. Solve any **Eight** questions from **SECTION "A"**
2. All questions from **SECTION "B"** are compulsory
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

MODEL ANSWER SHEET

SECTION "A"

Q.1 Define plant breeding. Describe various objectives of plant breeding with suitable examples.

Ans. Plant breeding is the art and the science of improving the heredity of plants for the benefit of human kind. **(2 marks)**

General objectives of plant breeding. **(6 marks)**

1. High yield
2. Improvement in quality
3. Resistance to biotic stress
4. Resistance to abiotic stress
5. Wider adaptability
6. Early maturity
7. Insensitivity to temperature and light
8. Synchronous maturity
9. Desirable agronomic characters
10. Development of Toxin free varieties
11. Insects and disease resistant varieties
12. Lodging resistant varieties

(explanation of each in short with examples)

Q.2 Enlist different breeding methods for self and cross pollinated crops. Explain mass selection method with merit and demerits.

Ans. Breeding methods used in self pollinated crops. **(4 marks)**

1. Plant Introduction
2. Pure line Selection
3. Mass selection
4. Pedigree method
5. Bulk method
6. Backcross method
7. Single seed descent method

Breeding methods used in cross pollinated crops

1. Plant Introduction.
2. Mass and Progeny selection.
3. Backcross method
4. Heterosis breeding
5. Synthetic breeding
6. Composite breeding
7. Polyploid breeding
8. Distant hybridization
9. Transgenic breeding

Explanation of mass selection method with merits and demerits. **(4 marks)**

Q.3 What is recurrent selection? Enlist different types of recurrent selection. Expl recurrent selection.

Ans. Idea of recurrent selection was independently given by Hays and Garber (1919). But t recurrent selection was first coined by Hull (1945).

Definition It is defined as selection generation after generation with intermitting of selected pla to produce the population for the next selection cycle. **(2 marks)**

Types of recurrent selection : . **(2 marks)**

Simple recurrent selection (SRS).

1. Recurrent selection for general combining ability (RSGA).
2. Recurrent selection for general specific ability (RSSA).
3. Reciprocal recurrent selection.

(Explanation of simple recurrent selection) **(4 marks)**

Q.4 Define male sterility. Enlist the different types of male sterility and explain cytoplasmic genetic male sterility with its merits and demerits.

Ans. **Definition** A condition in which either pollen is absent or non-functional in flowering plants. **(2 marks)**

Types of male sterility: **(2 marks)**

1. Genetic male sterility
2. Cytoplasmic male sterility
3. Cytoplasmic genetic male sterility
4. Chemical induced male sterility
5. Transgenic male sterility

Cytoplasmic genetic male sterility **(4 marks)**

- Definition of cytoplasmic genetic male sterility
- Main feature of cytoplasmic genetic male sterility
- Limitations of cytoplasmic genetic male sterility
- Merits and demerits of cytoplasmic genetic male sterility

Q.5 What is polyploidy? Give the classification of polyploidy and explain autopolyploidy.

Ans. This is the mechanism in which organism content more than two sets of chromosome or one or two additional or less chromosome number in diploid. **(2 marks)**

Classification **(2 marks)**

A. Euploidy

1. Monoploidy 2. Haploidy 3. Polyploidy

B. Autoployploidy

a) Autotriploidy b) Autotetraploidy c) Autopenuploidy d) Autohexaploidy
e) Allotetraploidy f) Allohexaploidy

a. Aneuplody

1. Hapoploidy
   a. Monosomic
   b. Nullisomic
2. Hyperploidy
   a. Trisomic
   b. Tetrasomic

(Explanation of Autopolyploidy) **(4 marks)**

Define mutation. State different types of mutation and explain procedure of mutation breeding.

Definition: mutation refers to sudden heritable change in the phenotype of an individual, in the molecular term, mutation is defined as the permanent and relatively rere change in the number or sequence of nucleotides. **(2 marks)**

Types of mutation : (definition of each) **(3 marks)**

1. Spontaneous mutations
2. Induced mutations
3. Micro mutations
4. Macro mutations
5. Lethal mutations
6. Sub vital mutations

Procedure of mutation breeding in seed propagated species : **(3 marks)**

Year	Breeding activities
1	1. Seed treatment with selected mutagen [X-rays, gamma rays, UV rays or chemical mutagen] using recommended dose and duration of treatment. 2. Raising M_1 generation using wider spacing. 3. Recording observations on morphological variants and fertility 4. Selfing of all M_1 plants to avoid contamination. 5. Harvesting of each M_1 plant separately
2	1. Raising M_2 generation from self seeds obtained from M_1 using wider speacing. 2. Identification and selection of disease resistant mutants 3. Harvesting seed of such mutants separately.
3	1. Raising M_3 generation separately for each M_2 selected plants. 2. Evaluation of homozygosity for disease resistance. 3. Bulking of homozygous disease resistant M_3 progeny.
4.	Planting of M_4 disease resistant progeny in replicated trial using local check for comparison.
5-9	1. Multi-location evaluation in coordinated trials for disease resistance. 2. The disease resistant line is released as a variety.

Q.7 **What is emasculation and pollination? Explain different methods of emasculation with suitable examples.**

Ans. **(2 marks)**

Definition: Emasculation refers to removal of anthers before dehiscence from a hermaphrodite (bisexual) flower. In other words removal of immature anthers forma a bisexual flower is called emasculation.

Pollination : transfer of pollen grains from anther to stigma of same flower stigma another flower is non as pollination.

Methods of emasculation. (6 marks)

1. Hand emasculation. 2. Emasculation with hot water. 3. Emasculation with cold water. 4. Emasculation with alcohol. 5. Suction method 6. Chemical emasculation. 7. Male sterility method.

(Explanation of each in short)

Q.8 What is self incompatibility? Give the different types of self incompatib... heteromorphic self incompatibility.

Ans. Definition :

The inability of plant with functional pollen to set seeds when self pollinated. **(2 marks)**

Type of self incompatibility : **(2 marks)**

1. Heteromorphic self incompatibility
   a. Distyly b. Tristyly
2. Homomorphic system :

1. Gametophytic system. 2. Saprophytic system.

(Explanation of heteromorphic self incompatibility with example) **(4 marks)**

1. Dristyly 2. Tristyly (pin x pin) (Pin x Thrum) (Thrum x Pin) (Thrum x Thrum)

Q.9 Define pure line selection? Describe in brief Johannsen pureline theory.

Ans. Pureline selection : Development of new variety through identification and isolation of single plant progeny **(2 marks)**

Theory: Johannsen developed the concept of pure line theory working with princess varie common bean (*Phaseouls vulgaris*). The common bean is a self pollinated species. Johar isolated 19 different lines on the basis of seed weight form the original seed of princess va Each of the 19 isolated lines had characteristic mean weight of seed. The line No. 1 with larges had a mean weight of 640 mg and the line No. 19 with smallest seed showed mean seed wei 350 gm. The variability within the line was much lesser than the original seed lot. When the in each line were separated into various classes of 100 mg difference and grown separatel seeds of different classes within pureline produced progeny with the same mean weight. Conc of the study : 1. Continuous inbreeding (selfing) leads to homozygosity 2. Variation w pureline results from environmental factors only. 3.Selection within a pure line is not ef because all the plants in a pureline have exactly the same genotype and 4. Selection in the c population is effective because the plants have genetic variations. **(6 marks)**

(8 marks)

Q.10 Write short notes (Any Four)

1. Synthetic variety

Ans. Definition: synthetic variety is developed by crossing selected genotypes in all combinations and mixing the seeds of all F_1 crosses in equal quantity.

Steps in development of synthetic variety: development of synthetic varieties consists of fo steps viz. (i) isolation of inbred lines (ii) evaluation of inbred lines for general combining ab intermating of good general combining in breads in all possible combinations and (iv) m seed of all F1 crosses in equal quantity. (explanation of each point in short)

2 marks)

Transgressive breeding

Transgressive breeding aims at improving yield or its contributing characters through transgressive segregation. Transgressive segregation is the production of plants in an F_2 generation that are superior to both the parents for one or more characters. Such plants are produced by an accumulation of plus or favourable genes from both the parents as a must combine well with each other and should preferably be genetically diverse, i.e., quite different, This way, each parent is expected to contribute different plus genes which when brought together by recombination give rise transgressive segregants. As a result, the intensity of character in the transgressive segregants, i.e., the new variety, is greater than that in either of the parents. The pedigree method of breeding and its modifications, particularly the population approach, are designed for the production of transgressive segregants.

3. Apomixis

Ans. Apomixis refers to the development of seed without sexual fusion (Fertilization).

There are four types of apomixis viz.

1. Parthenogenesis 2.Apogamy 3. Apospory 4. Adventives embryony

(Explanation of each point in short.)

4. Plant Introduction

Ans. Plant introduction refers to transposition of crop plants from the place of their cultivation to such areas where they were never grown earlier.

Types of Plant Introductions : Plant introductions are generally classified on the basis of adaptation and utilization. Based on adaptation, introductions are of two types, viz. (1) primany introductions, and (2) secondary introductions. Based on utilization, again introduction are of two types, viz., (i) direct introduction, and (ii) Indirect Introduction.

Primary Introduction : Introduction that can be used for commercial cultivation as a variety without any change in the original genotype is referred to as primary introduction.

Secondary Introduction : Introduction that can be used as a variety after selection from the original genotype or used for transfer of some desirable gene to the cultivated variety is known as secondary introduction.

Purpose of Plant Introduction : Plant material is introduced for five main purposes, viz. (1) economic use, (2) study of origin and evolution of crop plant, (3) conservation of diversity, (4) genetic improvement of crop plants, and (5) aesthetic interest.

5. Role of wide hybridization in crop improvement

Ans. Role of wide hybridization in crop improvement

1. Improvement in yield	5. Improvement in adaptation
2. Disease resistance.	6. Alteration in mode of reproduction
3. Insect resistance	7. Dwarf stature, earliness, etc.
4. Improvement in quality	

SECTION "B"

Q.11 Define the following terms. **(8 marks)**

1 **Cleistogamy :** Completion of pollination and fertilization in unopened flower bud.

2 **Hermaphrodite :** When male and female reproductive organs are present in same flower.

3 **Allogamy :** It is also called cross pollination i.e. transfer of pollen grain from anther of one flower from stigma other flower.

4 **Hybridization :** Crossing of two different plant deferring in their genetic constitution.

5 **Clone:** Progeny of single plant obtained by asexual reproduction.

6 **Composite variety:** A variety developed by mixing the seed of various genotypes which are similar in maturity, height, seed size, seed colour.

7 **Heterobeltoisis:** Superiority of F_1 over the better parent variety.

8 **Euploidy:** Numerical change in the entire genome.

Q.12 Give the contribution of following scientist.

1 **G. H. Shull :** Coined the term heterosis for first time.

2 **N.I. Vavilov :** Identified 8 main centres and 3

3 **Thomas Fairchild :** He Developed first

4 **Goulden C. H.:** First suggested the use of
generations of self pollinated crops.

5 **K. Ramiah :** Renowned Rice breeder

6 **C. T. Patel :** He developed the world first cotton hy

7 **Rimpu :** First made intergeneric cross between bread

8 **M. S. Swaminathan :** Father of green revoluation.