MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION
B.Sc. (Agri.)

Semester:- IV (New)	**Academic year :** 2018 - 19	
Course No.:- ELEGPB - 244	**Course Title: -** Commercial Plant Breeding	
Credits : 3(1+2)		
Day & Date :-	**Time:**	**Total Marks:** 40

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 diagrams wherever necessary

SECTION 'A'

Q.1 **Define male sterility. List the various types of male sterility and explain in detail the genetic male sterility.**

Ans. Male sterility is defined as an absence or non-function of pollen grain in plant or incapability of plants to produce or release functional pollen grains.

Types of Male Sterility:

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

1) Genetic Male Sterility:

The pollen sterility, which is caused by nuclear genes, is termed as genic or genetic male sterility. It is usually governed by a single recessive gene ms or 's' with monogenic inheritance, but dominant gene governing male sterility are also known E.g Safflower. The male sterility alleles may rise spontaneously or it can be induced artificially and is found in several crops viz. Pigeon pea, castor, tomato, limabean, barley, cotton, etc. A male sterile line may be maintained by crossing it with heterozygous male fertile plant, such a mating produces 1:1 male sterile and male fertile plants.

Utilization in Plant Breeding:

Genetic male sterility is usually recessive and monogenic hence can be used in hybrid seed production. It is used in both seed propagated crops and vegetatively propagated species. In this progeny from crosses (msms X Msms) are used as a female and are inter planted with homozygous male fertile (MsMs) pollinator. The genotypes of msms and Msms lines are identical except for the 'ms' locus i.e. they are isogenic and are known as male sterile A) Maintainer B) Line respectively. The female line would

Therefore contain both male sterile and male fertile and male fertile plants, the later must be identified and removed before pollen shedding. This is done by identifying the male fertile plants in seeding stage either due to the pleiotropic effect of ms gene or due to phenotypic effect of closely lined genes.

In this rogueing of male fertile plant from the female is costly operation and due to this cost of hybrid seed is higher. Therefore, GMS has been exploited commercially only in few crops by few countries. E.g. In USA used in castor while in India used for hybrid seed production of Arhar (cajanus cajan).

Q. 2 **Briefly describe the various modes of reproduction in crop plants.**

Ans. **Modes of Reproduction:** The modes of reproduction in crop plants are broadly grouped into asexual and sexual.

Asexual reproduction:
It does not involve the fusion of male and female gametes. In this new plants may develop from vegetative part of the plant (vegetative reproduction or may develop from embryos without fertilization (apomixis).

Write in short on following points:

A) Vegetative Reproduction:
B) Apomixis:
i) Adventive Embryony: ii) Apospory: iii) Displospory:
a) Parthenogenesis:
1) Natural Selection:
2) Artificial Selection:
b) Apogamy:

Sexual Reproduction:
It involves fusion of male and female gametes to form a zygote, which develops into an embryo.
a) Isogamy: b) Heterogamy:

Q.3 **Enlist types of crops. Write in detail classification of crops.**

Ans.
1. Food Crops (Wheat, Maize, Rice, Millets and Pulses etc.)
2. Cash Crops (Sugarcane, Tobacco, Cotton, Jute and Oilseeds etc.)
3. Plantation Crops (Coffee, Coconut, Tea, and Rubber etc.)
4. Horticulture crops (Fruits and Vegetables)

Classification of Crops:

I. Classification based on climate:
1. Tropical
2. Temperate

III. Use/Agronomic classification:
1. Grain crops
2. Pulse/legume crops
3. Oil seeds crops
4. Forage Crop
5. Fiber crops
6. Roots crops
7. Tuber crop
8. Sugar crops
9. Starch crops
10. Dreg crop.
11. Spices & condiments/spices crops
12. Vegetables crops
13. Green manure crop
14. Medicinal & aromatic crops

VIII. Based on No. of cotyledons:
1. Monocots or monocotyledons
2. Dicots or dicotyledonous

X. Based on length of photoperiod:
1. Short-day plants
2. Long day's plants
3. Day neutral plants

II. Based on growing season:
1. Kharif/Rainy/Monsoon crops
2. Rabi/winter/cold seasons crops
3. Summer/Zaid crops

IV. Based on life of crops/duration of crops:
1. Seasonal crops
2. Two seasonal crops
3. Annual crops
4. Biennial crops
5. Perennial crops

V. Based on cultural method/water:
1. Rain fed:
2. Irrigated crops:

VI. Based on root system:
1. Tap root system
2. Adventitious/Fiber rooted

VII. Based on economic importance:
1. Cash crop
2. Food crops

IX. Based on photosynthesis:
1. C3 Plants
2. C4 plants
3. Cam plants

Q. 4	**Describe the various steps of hybrid seed production.**	
Ans.	**The four main steps of hybrid seed production.** 1. Choice and Development of Seed Parent (A-Line) 2. Choice and Development of Restorer or Male Parent (R-Line) 3. Maintenance and Multiplication of Parental Seeds 4. Production and Improvement of F_1 Hybrids. This can be done in two ways: 1. Single phase repeated back-crossing: 2. Two phase limited back-crossing: The desirable attributes which should be considered for a male sterile line or A-line development are: 1. Plant Height: 2. Duration and Span of Flowering: 3. Tillering Ability: 4. Productivity Potential: 5. Stable Male Sterility: 6. Free from Diseases: 7. Combining Ability:	
Q. 5	**Write short notes on the following.**	
Ans.	**1. National seeds Corporation** The National seeds corporation was initiated in 1961 under the ICAR. In 1963 it was registered as a limited company in the public sector. The NSC was established to serve two main objectives: i. To promote the development of a seed industry ii. To produce and supply the foundation seeds Functions of NSC: i. Production and supply of foundation seed ii. To maintain improved seed stocks of improved varieties. iii. Interstate marketing of all classes of seed. iv. Export and import of seed v. Production of certified seed where required vi. Planning the production of breeder seed vii. Providing technical assistance to seeds corporations etc.	
	2. Anther culture Anther culture is technique by which the developing anthers at a precise and critical stage are excised aseptically from unopened flower bud and are cultured on a nutrient medium where the microspore within the cultured anther develop into callus tissue or embryoids that give rise to haploid plantlets either through organogenesis or embryogenesis.	
Q. 6	**What are the characteristics of quality seed? Explain the genetic and agronomic principles of quality seed.**	
Ans.	**Characteristics of quality seed** i. Higher genetically purity: ii. Higher physical purity for certification. iii. Possession of good shape, size, colour, etc., according to specifications of variety. iv. Higher physical soundness and weight.	

	v. Higher germination (90 to 35 % depending on the crop) vi. Higher physiological vigour and stamina. **Explain in short on following points.** **Genetic Principles:** 1. Deterioration of varieties: a. Developmental variation: b. Mechanical mixtures: c. Mutations: d. Natural crossing: a. The various steps suggested), to maintain varietal purity, are as follows. a. Use of approved seed only in seed multiplication. b. Inspection and approval of fields prior to planting. c. Field inspection and approval of growing crops at critical stages for verification of genetic purity, detection of mixtures, weeds, and for freedom from noxious weeds and seed borne diseases etc. d. Sampling and sealing of cleaned lots e. Growing of samples of potentially approved stocks for comparison with authentic stocks. **The various steps suggested for maintaining genetic purity are as follows:** a. Isolation b. Rouging c. Periodic testing. d. Avoiding genetic shifts by growing crops in areas in their adaptation only. e. Certification of seed f. Adopting the generation system. g. Grow out tests. **Agronomic principles** 1. Selection of a Agro-climatic Region 2. Selection of seed plot 3. Isolation of Seed crops 4. Preparation of Land 5. Selection of variety 6. Seed treatment:	
Q. 7	**Describe the practices of cultivation of hybrid maize for certified seed production.**	
Ans.	Explanation on following may be given in short: i. Isolation ii. Cultural Practices iii. Planting iv. Plant Protection v. Detasselling vi. Roguing vii. Harvesting Viii. Drying	
Q. 8	**Define genetic purity. Explain the various factors affecting genetic purity.**	
Ans.	**Genetic purity** refers to the percentage of contamination by seeds or **genetic** material of other varieties or species. The **genetic purity** of any commercial	

	agricultural product propagated by seed begins with the **purity** of the seed planted. **Factors affecting genetic purity.** 1) Developmental Variation: When varieties are multiplied outside area of normal cultivation. There is danger of developmental variation and genetic change or shift may appear in the varieties. Sometimes it becomes necessary it raise the seed crop outside their area of adaptation to maintain steady supply of good quality seed. E.g Seed production of flowers there should not be rains during harvesting period; hence seed production needs to be taken outside the normal area of cultivation, where there are no rains in post flowering period. **Similarly seed production of rainfed cotton varieties can be taken under irrigated conditions which reduces land requirement significantly as productivity of material** as irrigated crop is high. Disease free potato seed production is always taken at hilly region of simala though potato is extensively cultivated in plain regions. The extent of developmental variation increases with 1) Number of generation out the area of adaptation. 2) Condition of adaptation – The varieties bred for extreme condition i.e disease resistance, drought resistance against cold, show greater deterioration. 3) Mode of pollination –the cross pollinated crops varieties deteriorate faster than self pollinated. 4) Stability of genotype-Unstable genotype deteriorates fastly. **2) Mechanical Mixture:** This is dangerous source of variety deterioration. It occurs commonly when 1) More than one variety is sown in same piece of land. 2) When same drill used for sowing number of varieties. 3) It occurs when numbers of varieties are threshed on same yard. 4) It also occurs when same threshing machine is used for threshing number of varieties. 5) It also occur when gunny bags and storage bins are reused for storage of seed. It happens when proper care is not taken during different operations. To avoid mechanical mixture to keep sufficient isolation is always desirable. **3) Mutation:** This is not serious factor for varietal deterioration. Minor mutations are difficult to identity. To avoid deterioration due to mutation minute observations and timely roughing is essential. **4) Natural Crossing:** It depends upon natural cross fertilization it may be due to 1) Natural cross with undesirable types 2) Natural crossing with diseased plants. 3) Natural crossing with off types.	
Q. 9	**Explain the various classes of seed. Describe in brief the procedure of seed production of hybrid rice.**	
Ans.	The various stages or classes or seed are: a. Nucleus seed b. Breeders seed c. Foundation seed d. registered seed e. certified seed **Procedure of Hybrid- Rice Seed Production**	

	Explanation on following may be given in short 1) Choice of Areas and Growing Season for Seed Production 2) Selection of Seed Fields 3) Isolation 4) Cultural Practices for hybrid (AXR) Nursery 5) Sowing Time 6) Transplanting 7) Planting Ratio 8) Row Difference 9) Fertilization 10) Water Management 11) Synchronization of Flowering i) Staggered Sowing of Male Parents ii) By Fertilizer Application iii) By Water Management Methods of Improving Seed Setting i) Supplementary Pollination (Rope Pulling) ii) Leaf Clipping iii) Roguing iv) Harvesting of Seed Crop v) Seed Yields	
Q. 10	**Describe the various steps involved in the release of a new variety.**	
Ans.	Describe the following points in short: 1.Evaluation 2. Station trials 3. Multilocation trials i. Initial Evaluation trial ii. Uniform regional trial iii. Agronomic trials iv. National trials v. Adoptive trials 3. Disease and insect tests 4. Quality tests	
Q. 11	**Define following terms.**	
	1. Dioecious: Plant species in which unisexual (male and female) flowers occur on different plants.	
	2. Anthesis: The first opening of a flower.	
	3. Perennial: Crops which live for several years.	
	4. Isolation: Separation of two or more plants, strainsor populations to prevent mating among them. Usually achieved by distance or border rows.	
Q. 12	**Fill in the blanks**	
1.	**Patent** is the right granted by a government to an inventor to exclude others from using or selling the invention.	
2.	Maturation of stigma of a flower before the dehiscence of its anthers is called as **Protogyny**	
3.	**Breeder seed** is the source of foundation seed.	
4.	The progeny obtained by crossing two different genotypes is called as F_1	