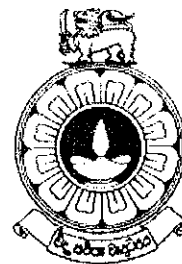


The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme



020

Department	: Botany
Level	: Level 5
Name of the Examination	: Final Examination
Course Title and - Code	: Plant Breeding (BYU5306/BYE5306)
Academic Year	: 2023/2024
Date	: 31.03.2024
Time	: 1.30 – 3.30 pm
Duration	: 02 hours

General Instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of 06 questions in 04 pages.
3. Answer any 04 questions only. All questions carry equal marks.
4. Answer for each question should commence from a new page.
5. Draw fully labelled diagrams where necessary
6. Involvement in any activity that is considered as an exam offense will lead to punishment.
7. Use blue or black ink to answer the questions.
8. Clearly state your index number in your answer script.

1.

Asexually propagated plants have a varied nature of propagation.

- a) What are asexually propagated plants?
- b) How are they classified?
- c) What are the different breeding methods identified for asexually propagated plants?
- d) Explain the procedure of clonal selection in asexually propagated plants using a flow chart.
- e) Compare the advantages and drawbacks of the clonal selection procedure.

2.

- a) Heritability of a trait is a measure of its genetic variation. Explain the advantage of estimating the heritability value of a trait of interest when breeding a new crop variety.
- b) Two homozygous Okra varieties (O-1 and O-2) were crossed to produce F_1 hybrids. The average phenotypic variance in yield of the three populations P_1 , P_2 and F_1 , was 12.20. The variance of F_2 was 22.20.
 - i) Calculate the heritability of yield in the F_2 population and comment on the validity of using these two Okra varieties (O-1 and O-2) in a breeding programme based on the heritability value obtained for yield.
- c) In rice, the inbred lines, L1, L2, L3, L4 and L5 were crossed in all possible combinations in a diallel cross. The progeny produced the following data for the yield.

	L1	L2	L3	L4	L5
L1	30	32	41	31	30
L2	40	39	41	34	32
L3	41	38	41	35	35
L4	31	40	38	34	29
L5	31	33	30	26	19

- i) Calculate the General Combining Ability (GCA) of each line.
- ii) Identify the line with the highest GCA.

3.

- What are the four (04) main factors which contribute to the change in gene frequencies of a population?
- Explain briefly how each factor causes change in the gene frequency.
- Give a brief account of the Average effect (α), Breeding value (A) and Dominance deviation (D).
- Find out the Breeding values and Dominance deviations of the following genotypes.

(Assume that the frequency of allele X_1 (q) is 0.4)

GENOTYPE	X_1X_1	X_1X_2	X_2X_2
GENOTYPIC VALUE	120	160	100

4.

- A) Mutations can contribute to a change in gene frequency of a population. At a particular locus which controls the Pod shape, there are two alleles, S and s . The mutation rate of S to s is 3.0×10^{-5} , whereas the mutation rate of s to S is 6.0×10^{-7} . Allele frequency (p) of S is 0.6.

Assumption: No other factor is operating in the population to disturb the equilibrium.

What is the equilibrium frequency of s allele?

- B) Frequencies of three genotypes in three sample populations are as follows. What are the Breeding Values (A) of these genotypes in the population? (Hint: take the average)
(Frequency of allele A (p) is 0.4).

Genotype	Frequencies		
	Population 1	Population 2	Population 3
AA	0.03	0.27	0.60
AB	0.33	0.55	0.34
BB	0.54	0.20	0.08

5.

- a) Several factors determine whether a plant is predominantly selfed or predominantly outcrossed.
 - i) What are these factors?
 - ii) Give a brief account of each factor.
 - iii) Give five (05) examples for predominantly selfed and five (05) examples for predominantly outcrossed crop plants.
- b) Plant reproduction can be controlled either by manipulating incompatibility or by inducing male sterility.
 - i) What is self-incompatibility?
 - ii) Briefly explain the terms 'Gametophytic self-incompatibility' and 'Sporophytic self-incompatibility'.
 - iii) What is male sterility?
 - iv) Explain how male sterility is important in a breeding programme.
- c) There are strategic perspectives to be taken into account when planning a breeding programme. What are they?

6.

- A) Using biotechnological knowledge, plant breeders made considerable progress in improving a few crop species.
 - a) Identify three (03) plant features that could be improved using plant biotechnology to increase global food production.
 - b) What is Recombinant DNA Technology?
 - c) Name four (04) types of uses of applying recombinant DNA technology in plant breeding.
- B) Using genetic engineering, transgenic plants have had their DNA modified to introduce a new trait that does not occur naturally in the species.
 - a) Giving four (04) examples of transgenic crops which are cultivated on a commercial scale, explain why/how they have been genetically modified.

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