UNIVERSITY OF FORT HARE

PLANT BREEDING
AGC 422

DEGREE EXAMINATIONS
NOVEMBER 2018

TIME : 3 HOURS
SUBJECT : AGC 422
MARKS : 100

This paper consists of four printed pages including this cover page

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INSTRUCTIONS
Answer any ANY FIVE questions
Question 1 [20 marks]

(a) State the nature of control of any three types of male sterility found in plants. [6]

b) Bulk population selection can be accomplished using short-term or long-term bulks. Explain how these two types of methods can be distinguished. [4]

c) What is the application of male sterility in plant breeding? [4]

d) Why are hybrid varieties not popular for self-pollinated crops, when compared with cross-pollinated crops? [2]

e) Write short notes on half-sib family selection. [4]

Question 2 [20 marks]

a) Write short notes on pre-fertilisation barriers that are encountered in distant hybridisations. [5]

b) Indicate how the following types of aneuploids are produced.
   (i) monosomic; [2]
   (ii) trisomic. [2]

c) Elaborate on how you can improve a maize population using the simple ear-to-row method. [8]

d) Define self-incompatibility and elaborate on its applications in plant breeding. [3]

Question 3 [20 marks]

a) Explain the origins of genetic variation in crop evolution under the following subheadings, and give examples where possible:
   i) Mendelian variation; [4]
   ii) Interspecific hybridization. [4]

b) Briefly describe procedures involved in pedigree breeding. [8]

c) Elaborate on the significance of Johannsen’s pureline experiment in the breeding of self-pollinated crops. [4]
Question 4  [20 marks]

a) Elaborate on the importance of creating disease epiphytotics when breeding crops for disease resistance.  [4]

b) Elaborate on any two mechanisms of disease resistance in crop plants.  [6]

c) What are the genetic consequences of cross-pollination? Explain how this influences the type of varieties that should be developed for cross-pollinated crops.  [5]

d) Define the following terms:

i) Amphidiploid;  [1]

ii) Pureline.  [1]

e) Write short notes on choice of parents for purposes of hybridization in a crop improvement programme.  [3]

Question 5  [20 marks]

a) Explain the origins of the following:

(i) an autotriploid, such as the banana plant, and  [3]
(ii) an allotetraploid, such as tobacco.  [5]

b) Briefly explain the applications of allopolyploidy in crop improvement under the following subheadings:

(i) Utilisation as bridging species;  [4]

(ii) Widening the genetic base of existing allopolyploids.  [2]

c) Briefly discuss the potential role of open pollinated varieties (OPVs) of maize in the smallholder sector of South Africa.  [6]

Question 6  [20 marks]

a) Define the following terms:

i) Allogamy;  [2]

ii) Race-specific resistance;  [2]

iii) Horizontal resistance.  [2]
(b) Explain why a cross between a cytoplasmic male sterile female and a male fertile male will produce all male sterile progeny. [2]

c) What is a primary centre of origin in relation to crops? Furthermore, explain why centres of origin are important for plant breeders. [2]

d) Write short notes on combination breeding. [4]

e) Inbred lines are very useful in the production of hybrid varieties. Inbred parents have to be evaluated in order to determine their usefulness. Elaborate on the following ways of evaluating them:

i) Top crossing; [3]
ii) Single cross evaluation. [3]