"Investing in Africa's future"

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

NACP 405: PLANT BREEDING AND BIOTECHNOLOGY

END OF FIRST SEMESTER EXAMINATIONS

DECEMBER 2023

LECTURER: MR. TABARIRA J.

DURATION: 3 HRS.

INSTRUCTIONS

1. Answer Four questions
2. Read and fully understand the question before answering
3. DO NOT repeat material
4. Credit will be awarded for logical and systematic presentations

Question One

a. Briefly outline the justification that can convince African governments to spend large sums of money in research and development of cultivars suitable for the smallholder farmers. **[10]**

b. Give an appropriate explanation for each of the following statements:

i) Plant breeding is both an art and a science **[2]**

ii) Selection acts on existing variability, **[2]**

iii) Meiosis is the source of variability in breeding populations, **[2]**

iv) Broad sense heritability is always higher than narrow sense heritability, **[2]**

v) Introductions are not always beneficial in crop production systems. **[2]**

Question Two

a. State **four** different sources of germplasm and explain the strength of each in a breeding program **[8]**

b. Discuss possible challenges being faced in your country in adopting emerging plant breeding technologies **[12]**

Question Three

a. Discuss in detail possible reasons why GMO technology may not ensure food security in developing economies. **[12]**

a. Given a population size of **400 diploid** individuals with alleles **[A_1 or A_2]** at a gene locus and a mixed population of the following genotypes 200 A_1A_1 plants, 120 A_1 A_2 plants and 80 A_2 A_2 plants, calculate:

i. Total number of A_1 and A_2 alleles **[3]**

ii. Gene frequency of A_1 and A_2 alleles in the population. **[2]**

iii. Genotypic frequency of A_1A_1, A_1A_2 and A_2A_2 genotypes in the population. **[3]**

Question Four

a. Discuss in detail Johannsen's classical studies with *Princess beans*. State the major findings and their application in plant breeding **[10]**

b. With the aid of sketch diagrams, explain the following inbreeding methods:

i. Half-sib mating **[3]**

ii. Self-pollination **[2]**

iii. Full-sib mating **[3]**

iv. Back crossing **[2]**

Question Five

a. With the aid of a flow diagram, explain how you would develop a new soya bean cultivar using a breeding procedure of your choice. **[12]**

b. State and explain four features that promote self-pollination in self-pollinated crop species **[8]**

Question six

a. Plant breeding can be summarized using the following verbs:
   i. Variate; **[2]**
   ii. Isolate; **[2]**
   iii. Intermate; **[2]**
   iv. Evaluate; **[2]**
   v. Multiplicate; and **[2]**
   vi. Disseminate **[2]**

   Briefly explain each of the activities stated above

b. Suppose you are appointed a breeder in a new breeding program, explain guiding principles when deciding on a breeding method to use in your program. **[8]**

END OF EXAMINATION