"Investing in Africa's future"

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

NACP 405: PLANT BREEDING METHODS AND BIOTECHNOLOGY

END OF FIRST SEMESTER FINAL EXAMINATIONS

NOVEMBER/ DECEMBER 2020

LECTURER: MR. TABARIRA J.

DURATION: 24 HRS.

INSTRUCTIONS

Download the Question paper from the Moodle platform and work offline

Choose and Answer **One** question

DO NOT repeat material

Credit will be awarded for logical and systematic presentations

Question One

a. Discuss in support of the notion that plant breeding is the answer to global food security challenges. **[20]**

b. Discuss the low adoption rate of GMO technology in developing countries under the following subheadings:

   i.   The possible reasons for the low adoption rate. **[10]**

   ii.   The perceived effects to household incomes and food security. **[10]**

   iii. The strategies you may employ to improve the adoption rate. **[10]**

c. Outline challenges encountered in maintaining genetic equilibrium in breeding populations. **[10]**

d. Demonstrate your understanding of the following statements:

   i.   Heterosis is higher in single cross hybrids than in three-way hybrids; **[4]**

   ii.   Mass selection involves selection and sampling; **[4]**

   iii. Marker assisted selection is an indirect selection procedure; **[4]**

   iv.   Effectiveness of selection depends on degree to which phenotype reflects genotype; and **[4]**

   v.   Understanding additive gene action is key in plant breeding. **[4]**

e. Explain key aspects you will take into consideration when including introductions in your breeding materials **[20]**

Question Two

a. Explain key aspects that differentiate between the following:

   i.   Pureline selection and pedigree selection. **[4]**

   ii. Random mating in breeding populations of self-pollinated and cross-pollinated crop species. **[4]**

   iii. Landraces and improved cultivars as sources of germplasm. **[4]**

iv. Phenotypic recurrent selection and mass selection in cross-pollinated crop species. **[4]**

v. Qualitative and quantitative traits. **[2]**

vi. Specific combining ability and general combining ability. **[4]**

vii. Conventional breeding and marker assisted selection. **[4]**

b. Suppose you have been appointed Wheat breeder at CIMMYT and the following are available for use in your program.

- One hectare piece of land,
- A greenhouse,
- Irrigation facilities,
- Pest and disease screening facilities,
- Hand emasculation equipment, and
- Seed storage and drying facilities.

i. State the breeding procedure that you are going to use. **[1]**

ii. Explain how you are going the use the facilities clearly showing the stage in the selection procedure when each of the above facilities will be used. **[20]**

c. Inbreeding has negative effects in breeding populations.

i. Outline the effects of inbreeding. **[8]**

ii. Discuss in detail circumstances where inbreeding is desirable in breeding populations. **[20]**

d. Discuss the notion that, GMO technology has more to offer in developing countries than developed countries. **[25]**

Question Three

a. Assume upon completion of your studies, you get employed as a breeder to initiate a participatory wheat breeding program. In the development of your program demonstrate your understanding of the following:

    i.   Participatory plant breeding, **[2]**

    ii.   The role of farmers in the wheat breeding program, and **[12]**

    iii. Source(s) of germplasm. **[4]**

b. Provide a detailed explanation as to why farmers recycling open-pollinated maize cultivars are advised to buy new certified seed after every three seasons. **[12]**

c. As a Plant Breeder, how do you apply the key findings of Johansson's pureline theory in your work? **[10]**

d. Discuss the cultivar evaluation procedures that you will follow until a new commercial cultivar is released on the market. **[25]**

e. What justification can you put forward to convince environmental lobby groups that adoption of GMO technology is beneficial to the environment? **[10]**

f. Outline tissue culture techniques commonly used by plant breeders and clearly explain how they achieve plant breeding objectives. **[25]**

END OF EXAMINATION PAPER