THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

ADVANCED CRTIFICATE OF SECONDARY EDUCATION EXAMINATION

134/2 **AGRICULTURE 2**

(For Both School and Private Candidates)

Time: 3 Hours. **ANSWER** **Year: 2019**

Instructions

1. This paper consists of sections A and B.
2. Answer **five** questions, at least **two (2)** questions from each section.
3. Each question carries **twenty (20)** marks.
4. Cellular phones and unauthorized materials are **not allowed** in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).

1. (a) Write a brief account on eight advantages and four disadvantages of using pedigree method of plant breeding.

The pedigree method allows a breeder to trace the ancestry of every selected plant and family, which makes it possible to associate superior performance with particular parental combinations and inheritance patterns.

It permits deliberate selection in each segregating generation, so desirable plants are advanced while undesirable segregants are discarded early, increasing the efficiency of improvement for clearly expressed traits.

It is especially powerful for simply inherited and moderately heritable traits, because visual selection within and among families can reliably capture favorable alleles and fix them across generations.

By keeping family identity, the method helps identify superior transgressive segregants that outperform both parents, since outstanding lines can be traced back and multiplied without confusion.

Pedigree records enable replication of selections across sites and seasons as family rows, which improves the accuracy of distinguishing genetic merit from environmental effects before releasing lines.

The approach facilitates pyramiding of multiple qualitative traits from different parents, because the breeder can track which families carry each target trait and select progeny that combine them.

It supports gradual inbreeding and fixation of favorable gene combinations, producing uniform and stable lines that are suitable for varietal release in self-pollinated crops.

Maintaining pedigrees preserves useful genetic variation for several generations, because multiple families are advanced in parallel, reducing the risk of narrowing the base too quickly.

A key disadvantage is that the pedigree method is labor intensive, requiring meticulous record keeping, labeling, and handling of many families each generation, which raises operational costs.

It demands large land area and many seasons to grow and evaluate segregating families, so the time from initial cross to candidate variety can be long.

For low-heritability, highly quantitative traits that are strongly influenced by the environment, the method is less efficient, since early visual selection can be unreliable and good genotypes may be discarded.

Small family sizes and environmental noise can lead to loss of rare favorable recombinants, so valuable lines might be unintentionally eliminated before their potential is confirmed.

(b) The first step in mass selection is to define clear breeding objectives and the key phenotypic traits to improve, such as grain yield, earliness, plant height, or disease tolerance, including the target environment where the variety will be grown.

A broad, representative base population is then chosen from the target farmer materials, landraces, or segregating bulks, ensuring sufficient variability for the traits of interest.

Fields are isolated appropriately to prevent unwanted cross pollination during the selection season, using spatial isolation or flowering-time management as needed for the crop's mating system.

Before flowering, off-types and obviously diseased, weak, or undesirable plants are rogued out so that only plants expressing the target phenotype remain to contribute seed.

At physiological maturity, a large number of the best-looking plants are selected individually by visual appraisal for the target traits, sampling widely across the field to avoid location bias.

Seeds from the selected plants are bulked together to form a composite lot, which captures the average superiority of the chosen individuals while maintaining genetic diversity.

The bulk seed is planted the next season for verification; the population is inspected for improvement and uniformity, and the cycle of roguing and selection is repeated for several seasons until performance stabilizes.

Optional progeny testing or comparison plots are used to confirm gains, after which the improved bulk is multiplied, characterized agronomically and for quality, and advanced toward candidate variety testing and release.

2. (a) Given the symptoms of the disease (i) give the name of the disease (ii) give the causative agent of the disease and write its scientific name (iii) suggest six cultural measures for the disease,

The name of the disease depends on its symptoms. For example, if the plant shows leaf spots, wilting, or blight, one can identify it as leaf spot disease, bacterial wilt, or fungal blight. Correct identification allows for proper management.

The causative agent may be a fungus, bacterium, or virus. Each has a scientific name, such as Xanthomonas campestris for bacterial blight or Puccinia graminis for stem rust. Scientific names are essential for proper classification and control methods.

Cultural control measures include crop rotation, which helps to break the life cycle of the pathogen by introducing a non-host crop. Proper field sanitation such as removal and destruction of diseased plant residues reduces the source of infection. Use of resistant varieties prevents the disease from spreading easily. Timely planting ensures crops escape peak periods of pathogen attack. Adequate spacing reduces humidity in the field and minimizes disease spread. Finally, proper irrigation methods such as drip irrigation reduce the chances of disease compared to overhead irrigation that wets the foliage.

(b) Enumerate seven reasons as to why people study plant diseases.

People study plant diseases to understand how they reduce crop yields, which affects food supply.

It also helps in preventing economic losses to farmers and the nation. Studying diseases provides knowledge for developing resistant varieties.

It also helps scientists to design effective and affordable control strategies.

Plant pathology contributes to safe pesticide use, which protects the environment.

Understanding plant diseases ensures food security for the growing population.

Finally, it helps in international trade, as healthy crops meet export standards.

(c) briefly explain four major factors influencing the occurrence of epiphytotic diseases in the field.

Epiphytotic diseases are influenced by environmental factors such as temperature, which determines how fast the pathogen multiplies.

Moisture and humidity provide favorable conditions for fungal and bacterial diseases.

The presence of a susceptible host in large numbers increases the chances of epidemics.

Lastly, the virulence and population of the pathogen affect the spread and severity of the disease in the field.

3. (a) State five fundamental principles of crop protection

The first principle of crop protection is prevention, which emphasizes stopping pests and diseases before they establish.

The second is early detection, where farmers monitor fields to identify problems quickly.

The third is proper identification, since correct recognition of a pest or disease determines the right control method.

The fourth is integrated pest management, combining cultural, biological, and chemical methods for sustainable control.

The fifth is safety in pesticide use, ensuring environmental and human health are not compromised.

(b) Mention five effects of crop pests.

Crop pests reduce crop yield by directly feeding on plant tissues.

They also lower the quality of produce, making it unsuitable for market.

Some pests act as vectors of diseases, transmitting harmful pathogens.

Heavy infestation increases production costs as farmers spend more on control.

Lastly, pests reduce storage life of products, causing post-harvest losses.

(c) give the scientific names of the following storage pests: (i) Lesser grain borer (ii) Common rat (iii) Warehouse moth (iv) Red flour beetle (v) Zebrotes bruchid.

The scientific name of the lesser grain borer is Rhyzopertha dominica.

The common rat is scientifically called Rattus rattus.

The warehouse moth is Ephestia elutella.

The red flour beetle is Tribolium castaneum.

The zebrotes bruchid is Zabrotes subfasciatus.

4. (a) Briefly describe the following terminologies as used in plant diseases (i) signs (ii) symptoms (iii) animated plant diseases (iv) abiotic plant diseases

Signs are the physical presence of the pathogen, such as fungal spores or bacterial ooze on the plant. Symptoms are the visible responses of the plant to the disease, such as wilting, chlorosis, or necrosis. Animated plant diseases are those caused by living organisms like fungi, bacteria, or viruses. Abiotic plant diseases result from non-living factors such as nutrient deficiency, drought, or chemical toxicity.

(b) Identify causative agent, two typical symptoms and two control measures for each of the following plant diseases: (i) cotton blight (ii) tobacco mosaic (iii) Black stem rust of wheat (iv) Groundnut rosette.

Cotton blight is caused by Xanthomonas citri. Symptoms include leaf spots and boll rot. Control measures are crop rotation and resistant varieties.

Tobacco mosaic is caused by Tobacco mosaic virus. Symptoms include mottling and mosaic patterns on leaves. Control measures are destruction of infected plants and avoiding mechanical transmission.

Black stem rust of wheat is caused by Puccinia graminis. Symptoms include reddish-brown pustules and weakened stems. Control measures include resistant varieties and fungicide application.

Groundnut rosette is caused by a virus complex transmitted by aphids. Symptoms include stunted growth and chlorosis. Control measures are early planting and control of aphid vectors.

5. (a) Briefly explain six environmental factors that affects the performance of the herbicides

Temperature affects herbicide efficiency, since extreme cold or heat reduces absorption.

Soil moisture determines the movement and availability of herbicides in the soil.

Wind speed influences spray drift, which can lower effectiveness.

Soil type such as sandy or clay soils affects herbicide binding and persistence.

Sunlight intensity affects the breakdown of some herbicides.

Rainfall shortly after spraying may wash off the herbicide, reducing effectiveness.

(b) Give six reasons of formulating pesticides

Pesticides are formulated to make them easier to apply uniformly.

Formulation improves the safety of handling toxic chemicals.

It increases the effectiveness of the active ingredient.

Formulated pesticides can be stored and transported more easily.

They allow mixing with other agricultural chemicals

Lastly, formulation ensures pesticides can be used under different environmental conditions.

(c) Briefly outline three non-insecticidal pest control measures available to farmers

Non-insecticidal pest control measures include biological control such as introducing natural enemies of pests.

Cultural practices like crop rotation and intercropping help reduce pest pressure.

Mechanical control such as handpicking or trapping physically removes pests from crops.

(d) Briefly describe five features that have made weeds to have competitive edge.

Weeds compete effectively because they produce large quantities of seeds that ensure their survival.

They germinate faster and establish earlier than crops.

Many weeds have deep root systems that extract water and nutrients efficiently.

They have resistance to pests and diseases.

Lastly, weeds can survive in a wide range of adverse conditions, giving them an advantage over crops.

6. (a) Briefly outline five stages of the life cycle of one host tick.

The first stage is the egg stage. The adult female tick lays eggs on the ground, and these hatch after a few days or weeks depending on environmental conditions.

The second stage is the larval stage. The eggs hatch into tiny six-legged larvae that climb onto vegetation and wait for a host to attach and feed on.

The third stage is the nymph stage. After feeding, the larvae drop to the ground, molt, and develop into eight-legged nymphs which again seek a host for blood meals.

The fourth stage is the adult stage. The nymphs after feeding drop to the ground and molt into adults that seek another host for feeding.

The fifth stage is reproduction. The adult female after engorging on blood drops off the host to lay eggs, thereby continuing the cycle.

(b) Explain six damages caused by ticks on feeding to an animal.

Ticks cause loss of blood through continuous sucking which leads to anemia, weakness, and reduced productivity.

They transmit diseases such as East Coast Fever, Anaplasmosis, and Babesiosis which can cause high mortality in livestock.

They cause skin irritation which leads to scratching, restlessness, and reduced feeding efficiency in animals.

They damage hides and skins through wounds and lesions, lowering their commercial value.

They reduce milk yield and weight gain as a result of stress and nutrient loss caused by tick infestation.

They can cause paralysis in animals when toxins from their saliva affect the nervous system.

(c) Mention five ways of controlling ticks in the pasture.

Rotational grazing can be practiced to break the life cycle of ticks by depriving them of a host in infested pastures.

Burning pasture land can destroy ticks and eggs in the grass and soil.

Regular spraying or dipping of animals with acaricides helps to kill ticks on livestock and reduce pasture contamination.

Fencing pastures prevents wild animals from entering and spreading ticks.

Ploughing the land exposes tick eggs and larvae to direct sunlight, reducing their survival.

(d) List four effective characteristics of acaricides.

A good acaricide should have high killing effectiveness against ticks at all life stages.

It should have low toxicity to humans and animals to ensure safety during application.

It should be persistent enough to provide lasting protection but not so long as to cause residues in milk or meat.

It should be affordable and readily available to farmers for sustainable use.

7. (a) Account for the seven reasons which may cause lack of legumes in the pastures.

Legumes may fail due to poor soil fertility, especially low phosphorus and nitrogen levels which are essential for their growth.

Soil acidity can hinder the growth of legumes since most require neutral to slightly acidic soils.

Competition from grasses often suppresses legumes when the grass grows too densely.

Overgrazing damages legumes more severely than grasses, reducing their presence in the pasture.

Lack of inoculation with rhizobium bacteria prevents legumes from fixing nitrogen effectively, reducing their survival.

Poor pasture management, such as continuous grazing without rest periods, discourages legumes from establishing.

Drought conditions can reduce legume persistence since they are generally less drought tolerant than grasses.

(b) Describe four factors that affect yield potential of pasture species.

Soil fertility influences the growth and productivity of pasture species since nutrients are required for biomass accumulation.

Rainfall availability determines how well pastures can establish and persist, with adequate water increasing yields.

The type of pasture species affects yield since some are naturally high-yielding while others are adapted for survival rather than production.

Management practices like grazing rotation, fertilization, and weed control directly determine how much pasture yield can be achieved.

(c) Briefly explain five qualities of a good pasture.

A good pasture should be highly palatable to animals, encouraging them to consume it readily.

It should be persistent, maintaining productivity across different seasons and years.

It should have high nutritional value, with good protein and energy content to support animal growth and milk production.

It should be resistant to pests and diseases, ensuring stable productivity.

It should regenerate quickly after grazing or cutting, ensuring continuous supply of feed.

(d) Suggest four possible strengths of zero grazing as compared to other systems of grazing.

Zero grazing allows efficient use of small land areas since animals are confined and fed harvested fodder.

It minimizes the risk of tick-borne diseases as animals do not roam on infested pastures.

It enables farmers to closely monitor animal health, feeding, and production.

It prevents overgrazing and land degradation, maintaining soil fertility and pasture sustainability.

8. Give brief explanation of how feed intake is affected by (a) feed processing (b) animals associated factors (c) food associated factors.

Feed processing improves digestibility by reducing particle size, making nutrients more accessible, thus increasing intake.

Feed processing methods like pelleting reduce feed wastage and encourage uniform intake.

Animal factors such as age influence intake, as younger animals require more feed per body weight compared to older ones.

Animal health affects feed intake since sick animals tend to eat less than healthy ones.

Food factors like palatability influence intake since animals consume more of feeds that taste good.

Nutrient density of the feed also determines intake, as animals may consume less of highly concentrated feeds compared to bulky ones.

9. (a) (i) Give the meaning of the term animal breeding. (ii) Briefly explain five usefulness of animal breeding in the improvement of animal production.

Animal breeding is the science of improving livestock by selecting and mating animals with desirable traits.

Animal breeding improves milk production by selecting dairy animals with high yield potential.

It improves growth rates and meat production by breeding animals with good body conformation and feed conversion.

It increases disease resistance by selecting and propagating animals with strong immunity.

It enhances fertility by choosing breeding stock with good reproductive performance.

It improves adaptability by breeding animals suited to specific environmental conditions.

(b) (i) Elaborate five suitability of inbreeding systems in the improvement of livestock.

Inbreeding helps in fixing desirable traits by concentrating genes in a population.

It is useful for developing pure breeds with uniform characteristics.

It enhances the chances of producing offspring with predictable traits.

It can help in the development of new breeds through controlled selection.

It is suitable for research purposes where uniformity is required in experimental animals.

(ii) Outline four negative effects of inbreeding in the improvement of animal production.

Inbreeding can lead to reduced fertility due to increased homozygosity of undesirable traits.

It can increase susceptibility to diseases by reducing genetic diversity.

It can cause reduced growth rates and productivity due to inbreeding depression.

It increases the chances of congenital defects appearing in offspring.

(c) Enumerate five ways in which pedigree selection is important in the improvement of animal production.

Pedigree selection helps in tracing desirable traits across generations for better breeding decisions.

It enables farmers to avoid undesirable traits by knowing family histories.

It helps in the identification of superior animals for breeding programs.

It improves selection accuracy since both performance and ancestry are considered.

It helps in maintaining breed standards by selecting animals that conform to desirable lineage.

10. (a) Give the meaning of the following terms: (i) Biotechnology (ii) Modern technology (iii) Conventional technology.

Biotechnology is the use of living organisms or their products to modify or improve plants, animals, or microorganisms for human use.

Modern technology refers to advanced tools, equipment, and processes such as genetic engineering and information systems used to improve agriculture.

Conventional technology refers to traditional farming practices and tools that rely on natural processes and simple equipment.

(b) Briefly describe three environmental risks associated with Genetically Modified Organisms.

GMOs can lead to loss of biodiversity by displacing native species through dominance of genetically modified crops.

They may contaminate natural species through cross-pollination, leading to genetic erosion.

They may promote the emergence of resistant pests and weeds due to overreliance on modified crops.

(c) Identify four important effects resulted from global warming that poses a big challenge to agriculture in most parts of developing world.

Global warming leads to prolonged droughts which reduce water availability for farming.

It causes unpredictable rainfall patterns that disrupt planting and harvesting schedules.

It increases the incidence of pests and diseases due to warmer temperatures.

It contributes to soil degradation through erosion and loss of organic matter.

(d) Briefly explain six potential benefits of Genetically Modified Organisms in production of crops.

GMOs increase crop yields through traits such as pest resistance and tolerance to harsh environments.

They reduce the need for chemical pesticides since many are resistant to pests.

They improve nutritional content of crops, such as bio-fortified rice with higher vitamin content.

They enhance tolerance to drought and other stresses, ensuring stable production.

They increase shelf life of produce, reducing post-harvest losses.

They support food security by providing reliable and high-quality yields.