THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATION COUNCIL OF TANZANIA

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

134/2 **AGRICULTURE 2**

(For Both School and Private Candidates)

Time: 3 Hours. **ANSWER** **Year: 2002**

Instructions

1. This paper consists of **ten (10)** questions in sections A and B.
2. Answer **five (5)** questions choosing at least **two (2)** questions from each section.
3. Each question carries **twenty (20)** questions.
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. Process of developing a new crop variety through hybridization

The development of a new crop variety through hybridization involves several key steps.

The first step is **selection of parent plants**. Breeders choose plants with desirable traits such as high yield, disease resistance, drought tolerance, or better nutritional value.

Next is **controlled pollination**. The chosen parent plants are cross-pollinated, either by manual transfer of pollen or using insects as pollinators, to combine the desirable traits.

The **collection of seeds** from the cross-pollinated plants follows. These seeds carry genetic material from both parent plants.

The seeds are then **grown in a nursery or field**, and the resulting offspring are evaluated for the desired traits.

The next step is **selection of superior offspring**. Only the plants that exhibit the best combination of traits are selected for further propagation.

Finally, the **stabilization of the new variety** is done through repeated selection and breeding over several generations until the traits are consistently expressed. After testing for performance, the variety can be released for commercial cultivation.

2. Importance of terms in plant pathology

(a) Pathogen: A pathogen is an organism (fungus, bacterium, virus, or nematode) that causes disease in plants. Understanding the pathogen is essential for developing effective control methods and breeding resistant crop varieties.

(b) Inoculum: Inoculum refers to the material (spores, bacteria, or infected tissue) that carries the pathogen and initiates infection. Identifying and managing inoculum sources helps prevent disease outbreaks.

(c) Vector: A vector is an organism, often an insect, that transmits a pathogen from one plant to another. Controlling vectors is crucial in preventing the spread of diseases like mosaic viruses.

(d) Epiphytotic: An epiphytotic is a sudden and widespread outbreak of a plant disease affecting a large number of plants. Recognizing epiphytotics helps in timely intervention and management strategies.

(e) Symptom: A symptom is a visible sign of disease on a plant, such as wilting, leaf spots, or discoloration. Observing symptoms is important for diagnosing diseases and applying appropriate treatments.

3. Economic importance of three common fungal diseases in cereals

a) Rust (Puccinia spp.)

Symptoms: Reddish-brown or yellow pustules appear on leaves and stems, causing premature leaf drop.

Economic importance: Reduces photosynthetic area, leading to lower grain yield and quality.

Control measures: Use resistant varieties, apply fungicides, and practice crop rotation.

b) Smut (Ustilago spp.)

Symptoms: Black, powdery spores replace grains or kernels, deforming the ears.

Economic importance: Reduces marketable grain yield and can contaminate harvested grain.

Control measures: Use certified disease-free seeds, treat seeds with fungicides, and destroy infected crop residues.

c) Head blight or Fusarium ear blight (Fusarium spp.)

Symptoms: Bleached spikelets and pinkish fungal growth on ears; contaminated grains may produce toxins.

Economic importance: Reduces yield, lowers grain quality, and poses health risks due to mycotoxins.

Control measures: Grow resistant varieties, rotate with non-host crops, and apply fungicides at flowering stage.

4. Purpose of additives in pesticide formulations

(a) Surfactants: Surfactants reduce the surface tension of pesticide solutions, allowing better spread and wetting of plant surfaces for more effective coverage.

(b) Emulsifiers: Emulsifiers help mix oil-based pesticides with water to form a stable emulsion, ensuring uniform application.

(c) Diluents: Diluents are inert substances added to pesticides to increase volume, reduce toxicity, or adjust concentration.

(d) Adjuvants: Adjuvants improve the performance of pesticides by enhancing adhesion, penetration, or stability of the active ingredient.

(e) Stickers: Stickers help pesticides adhere to plant surfaces, reducing loss by rain or wind and prolonging effectiveness.

5. Difference between complete and incomplete metamorphosis in insect pests

Complete metamorphosis involves four distinct life stages: **egg, larva, pupa, and adult**. The larval stage often looks entirely different from the adult.

Examples: Maize stem borer (Busseola fusca), cotton bollworm (Helicoverpa armigera).

Incomplete metamorphosis involves three stages: **egg, nymph, and adult**. Nymphs resemble smaller versions of adults and gradually develop wings and reproductive organs.

Examples: Grasshoppers (Locusta migratoria), aphids (Aphis spp.).

6. Balanced ration and factors to consider for high-yielding dairy cows

A **balanced ration** is a diet that provides all the essential nutrients—carbohydrates, proteins, fats, vitamins, minerals, and water—in the right proportions and quantities to meet the nutritional requirements of livestock for maintenance, growth, reproduction, and milk production.

One factor to consider is **age and body weight of the cow**. Younger or growing cows require more protein and energy for growth, while mature high-yielding cows need more energy for milk production.

Another factor is **milk production level**. High-yielding cows require higher energy, protein, and mineral content in their ration to sustain milk output without losing body condition.

Stage of lactation is also important. Cows in early lactation need more energy and protein compared to late lactation cows, to prevent metabolic disorders like ketosis.

Health status should be considered, as sick or stressed animals may need special nutrients or supplements to support recovery and immunity.

Finally, **feed availability and quality** affect ration formulation. The nutrient composition of available forage and concentrates must be analyzed to ensure the cow receives a complete and balanced diet.

7. Roles of four macro-minerals in an animal's body

Calcium (Ca) is essential for strong bones and teeth, blood clotting, muscle contraction, and nerve function. Deficiency can lead to weak bones, milk fever, and poor reproduction.

Phosphorus (P) works with calcium to form bones and teeth and is vital for energy metabolism, as it is part of ATP molecules. Deficiency can cause poor growth, rickets, and reduced milk production.

Sodium (Na) is crucial for maintaining osmotic balance, nerve transmission, and muscle contraction. Deficiency can lead to reduced feed intake, poor growth, and decreased milk yield.

Magnesium (Mg) is important for enzyme activation, nerve function, and proper bone formation. Deficiency may result in grass tetany, convulsions, and poor appetite.

8. Three nutritional disorders in livestock

a) Milk fever (hypocalcemia)

Cause: Low blood calcium levels, often in high-producing dairy cows around parturition.

Symptoms: Weakness, muscle tremors, lying down unable to rise, and reduced milk production.

Prevention: Provide calcium-rich supplements before and after calving, and maintain a balanced diet during late gestation.

b) Bloat

Cause: Accumulation of gas in the rumen, often from eating lush legumes or rapid feeding.

Symptoms: Distended left flank, discomfort, difficulty breathing, and in severe cases, death.

Prevention: Introduce legume pastures gradually, provide anti-foaming agents, and ensure access to dry roughage.

c) White muscle disease

Cause: Deficiency of selenium and/or vitamin E in the diet.

Symptoms: Muscle weakness, stiff gait, inability to stand, and sudden death in severe cases.

Prevention: Supplement feed or pasture with selenium and vitamin E, and use fortified mineral blocks.

9. Importance of forage preservation and methods of making hay

Importance: Preserving forage ensures a reliable feed supply during periods of scarcity, such as dry seasons or winter. It helps maintain animal productivity, reduces feed costs, and prevents wastage of surplus forage.

Method 1 – Traditional haymaking: Cut green forage when it is at optimal maturity, allow it to wilt in the field to reduce moisture content, turn it frequently to ensure even drying, and store it in stacks or barns under dry conditions.

Method 2 – Mechanical haymaking (using balers): Cut and dry forage in the field, use a baler to compress it into compact bales, and wrap or store under cover to protect from rain and moisture.

10. Rotational grazing vs continuous grazing

Rotational grazing involves dividing pasture into paddocks and moving livestock between them periodically to allow forage recovery.

Advantages of rotational grazing:

- Improves pasture productivity and regrowth.
- Reduces overgrazing and soil erosion.
- Helps control parasites and pests.

Disadvantages of rotational grazing:

- Requires more fencing and infrastructure.
- Needs careful planning and labor for movement of animals.
- May require supplemental feed if pasture growth is slow.

Continuous grazing allows animals to graze freely over the same pasture area for extended periods.

Advantages of continuous grazing:

- Simple to manage with minimal fencing.

- Low labor requirements.
- Animals have constant access to forage.

Disadvantages of continuous grazing:

- Higher risk of overgrazing and pasture degradation.
- Uneven grazing, with some areas overused and others underutilized.
- Increased risk of parasite infestation and soil erosion.