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: 2022**

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) Account for the six significant achievements that have been made by plant breeding in the crop production.

Plant breeding has led to the development of high-yielding crop varieties. These improved varieties provide farmers with higher harvests per unit area, helping to increase food production and reduce food insecurity.

It has contributed to the improvement of crop resistance to diseases and pests. Resistant varieties reduce crop losses and minimize the dependence on chemical pesticides, which in turn lowers production costs and environmental pollution.

Plant breeding has helped in improving crop tolerance to adverse environmental conditions such as drought, salinity, and extreme temperatures. This allows farmers to grow crops in areas that were previously unsuitable for cultivation.

It has also led to the improvement of nutritional quality in crops. For example, breeding programs have produced bio-fortified varieties of maize, rice, and sweet potatoes that are rich in vitamins and minerals essential for human health.

Through breeding, crops with improved storage qualities and longer shelf life have been developed. This reduces post-harvest losses and ensures a steady supply of food for both local consumption and international trade.

Plant breeding has also enhanced the adaptation of crops to modern farming systems such as mechanized agriculture. Uniform and improved varieties are easier to harvest and manage, saving labor and increasing efficiency.

(b) Briefly explain four ways in which the application of plant breeding brings about the undesirable effects in crop plants.

One undesirable effect is the loss of genetic diversity. Continuous use of a few improved varieties may lead to the extinction of traditional varieties, reducing the genetic pool needed for future breeding programs.

Plant breeding can sometimes produce varieties that are highly dependent on chemical inputs such as fertilizers and pesticides. This increases production costs for farmers and may harm the environment if used excessively.

Some improved varieties may have reduced resistance to certain minor pests or diseases. While they perform well against major threats, they may become more vulnerable to secondary problems.

Over-reliance on high-yielding varieties may lead to soil exhaustion since they often require high nutrient uptake. This can cause soil degradation if sustainable soil management practices are not followed.

2. (a) Outline six measures that farmer should take to overcome the problem of scours in calves in their farmstead.

Farmers should ensure calves receive adequate colostrum immediately after birth. Colostrum provides antibodies that boost the calf's immunity and reduce susceptibility to infections that cause scours.

They should maintain high standards of hygiene in calf pens, feeding utensils, and water troughs. A clean environment reduces the spread of pathogens responsible for scours.

Proper feeding practices should be observed, including giving calves the right quality and quantity of milk at the correct temperature. Poor feeding practices often upset the digestive system and cause diarrhea.

Farmers should provide clean and safe drinking water. Contaminated water sources often harbor pathogens that lead to calf scours.

They should ensure calves are not overcrowded in their housing. Overcrowding encourages the rapid spread of infections and increases stress, making calves more prone to scours.

Regular veterinary check-ups and vaccinations should be conducted to prevent diseases that cause scours. Early treatment of sick calves prevents further spread of the disease.

(b) Outline four points on how to control Newcastle disease.

Vaccination is the most effective way of controlling Newcastle disease. Farmers should follow the recommended vaccination schedules for poultry.

Farmers should practice strict biosecurity measures by limiting access to poultry houses and ensuring visitors disinfect before entry.

Isolation of infected birds is essential to prevent the spread of the virus to healthy birds in the flock.

Proper disposal of dead birds through incineration or deep burial helps reduce the risk of spreading the disease further.

3. Explain five points on how the animal breeding can overcome the problem of poor yield and low quality livestock products from local breeds.

Animal breeding can help by crossbreeding local breeds with exotic breeds that have high milk, meat, or egg yields. This introduces desirable traits that improve productivity.

Selective breeding within local breeds can improve specific traits such as disease resistance or faster growth rates. Over time, this results in better performing livestock.

Breeding programs can introduce improved reproductive efficiency, allowing animals to produce more offspring within shorter intervals, which increases overall herd productivity.

Genetic improvement through breeding enhances product quality, for example, producing milk with higher butterfat content or meat with better tenderness and flavor.

Animal breeding also helps adapt livestock to different environments, ensuring that farmers have animals that perform well under local climatic and feeding conditions while still giving high yields.

4. (a) Use five points to illustrate disagreement with farmers' belief that, using different proper methods to control weeds will one day have their crop farms completely free from weeds.

Weeds have a high reproductive capacity, producing large numbers of seeds that remain viable in the soil for many years, making complete eradication impossible.

Weed seeds can be introduced from external sources such as wind, animals, and farm machinery. This means new weeds can always appear even after control measures.

Some weeds have underground structures like rhizomes and tubers that allow them to regenerate even after the above-ground part has been destroyed.

Weed species are highly adaptable and may develop resistance to herbicides, making them difficult to eliminate completely.

The ecological balance of farming systems ensures that some weeds will always exist, as they are part of the natural ecosystem and may not be entirely eliminated.

(b) Briefly describe five ways on how weeds cause the decline in the agricultural production.

Weeds compete with crops for essential resources such as nutrients, water, and sunlight, reducing crop growth and yield.

Some weeds release toxic substances (allelopathy) into the soil that inhibit the germination and growth of crop plants.

Weeds can act as alternative hosts for pests and diseases, increasing the risk of infections that harm crops.

Heavy weed infestations increase the cost of production since farmers must spend more on labor or chemicals for weed management.

Weeds interfere with harvesting operations, making the process slower and less efficient, sometimes even reducing the quality of harvested crops.

5. (a) Examine five benefits of applying the rotational grazing in the pastures.

Rotational grazing allows pastures time to recover between grazing periods, which helps maintain soil fertility and improves pasture growth.

It helps control internal and external parasites in animals since moving animals between paddocks breaks the life cycle of parasites.

This system ensures efficient utilization of forage because animals graze evenly, preventing overgrazing in one area and underutilization in others.

Rotational grazing increases the carrying capacity of pastures since properly managed land supports more livestock over time.

It also helps in maintaining environmental sustainability by reducing soil erosion, promoting biodiversity, and improving water retention in the soil.

(b) Briefly explain five principles underlying the pasture improvement.

Farmers should ensure proper selection of pasture species that are adapted to local soil and climatic conditions.

Application of fertilizers, especially nitrogen and phosphorus, improves the growth and nutritional quality of pastures.

Weed control is an important principle since weeds compete with pasture plants for resources and reduce productivity.

Proper grazing management, including rotational grazing, ensures sustainable use and avoids overgrazing.

Pasture improvement also requires regular reseeding to maintain high pasture density and introduce improved species.

6. (a) Briefly explain four cultural methods to be employed by the farmer to suppress insect pests in the new growing season in the cabbage garden.

Crop rotation is a useful method since planting different crops disrupts the life cycle of insect pests that depend on cabbage.

Field sanitation, such as removing plant debris, reduces breeding grounds for insect pests and minimizes infestation in the next season.

Proper spacing of cabbage plants improves air circulation and reduces favorable conditions for pest development.

Intercropping cabbage with repellent plants such as onions helps deter pests and lowers infestation levels.

(b) Suggest five agronomic measures for controlling the maize stalk borer.

Early planting allows maize plants to establish before the peak of stalk borer infestation, reducing damage.

Timely weeding eliminates alternative hosts for the pest and reduces its population.

Application of recommended insecticides at the right growth stage of the crop helps control stalk borer effectively.

Use of resistant maize varieties reduces the vulnerability of crops to stalk borer infestation.

Proper field hygiene, such as destroying infested maize stalks after harvest, prevents carryover of the pest to the next season.

7. (a) Suggest a disease which is characterised by the mass of dark brown/black spores like soot in the flowering parts of sorghum and maize which have intercropped.

The disease is Head Smut, which affects cereal crops like sorghum and maize, producing black powdery spores in flowering parts.

(b) Mention six possible cereal crops that can be attacked by the disease suggested in (a).

Cereal crops that can be attacked include sorghum, maize, wheat, barley, millet, and oats.

(c) Identify four measures that would be used to control the disease in the next crop growing season.

Farmers should use resistant crop varieties that are less vulnerable to Head Smut.

Crop rotation with non-cereal crops helps break the disease cycle and lowers infection rates.

Seed treatment with fungicides before planting reduces the chances of infection.

Practicing field sanitation by removing and destroying infected plants reduces the spread of the spores.

8. (a) Justify the benefits of practicing sustainable agriculture to both environment and consumers' welfare in Tanzania by giving six points.

Sustainable agriculture conserves soil, which protects the long-term productive base of farming. Practices like mulching, cover crops, and contour planting reduce erosion, build organic matter, and improve soil structure, so fields remain fertile and resilient instead of degrading over time.

It protects water resources, which benefits both ecosystems and people. Efficient irrigation, rainwater harvesting, and buffer strips reduce runoff, limit sedimentation in rivers, and curb agrochemical contamination, so communities have cleaner water for domestic use and fisheries.

It enhances biodiversity on farms, which stabilizes production and ecosystems. Mixed cropping, hedgerows, and agroforestry provide habitat for pollinators and natural enemies of pests, lowering pest outbreaks and reducing dependence on pesticides that can harm wildlife and people.

It cuts greenhouse gas emissions and builds climate resilience, which matters in Tanzania's variable rainfall. Reduced tillage, better manure management, and trees on farms increase carbon storage in soils and biomass, while diverse rotations help yields withstand droughts and floods.

It improves food safety and nutrition for consumers. Lower pesticide residues, fresher produce from local supply chains, and nutrient-dense crops from healthy soils support consumer health and reduce risks linked to chemical exposure.

It strengthens rural livelihoods and market trust. Efficient input use, lower waste, and premium opportunities for sustainably produced goods can improve farmer incomes, while traceable production practices build consumer confidence in the quality and safety of food.

(b) Briefly describe four methods of the sustainable agriculture to be practised by farmers in their farms.

Conservation agriculture reduces soil disturbance, maintains permanent soil cover, and uses crop rotations. Minimum tillage with residues left on the surface protects soil structure, conserves moisture, and suppresses weeds, which stabilizes yields and cuts fuel costs.

Integrated pest management combines cultural, biological, mechanical, and precise chemical tactics. Field sanitation, resistant varieties, natural enemies, and threshold-based spraying keep pests below damaging levels while protecting beneficial organisms and human health.

Agroforestry integrates trees with crops and livestock. Multipurpose trees provide shade, fodder, fuelwood, fruit, and soil improvement through leaf litter and nitrogen fixation, while roots reduce erosion on slopes and diversify farm income.

Organic soil fertility management relies on compost, manure, green manures, and legume rotations. These inputs feed soil microbes, increase cation exchange capacity, and release nutrients steadily, which improves crop vigor and reduces reliance on costly synthetic fertilizers.

9. (a) Give four factors that make fungi to be the most important plant pathogen.

Fungi produce enormous numbers of spores that spread efficiently by wind, rain splash, insects, and tools, so they colonize fields rapidly and can trigger epidemics across large areas.

They form durable survival structures such as chlamydospores and sclerotia, which persist in soil and residues for seasons, making eradication difficult and causing recurring infections.

They penetrate plants through many routes, including natural openings, wounds, and direct cuticle entry with enzymes, which allows infection under diverse field conditions.

They evolve quickly and adapt to control measures, including fungicide resistance and overcoming host resistance genes, which challenges long-term disease management and raises production risks.

(b) Explain how the following practices help in eradicating diseases:

(i) Planting clean seeds.
Certified, pathogen-free seed prevents the primary introduction of seed-borne fungi, bacteria, and viruses into new fields. Starting clean breaks the disease cycle at establishment, lowering latent infections that would otherwise spread during the season.

(ii) Crop rotation.
Rotating with non-host crops deprives pathogens of suitable hosts, causing their populations in soil and residues to decline between seasons. After one to three years, many host-specific fungi fall to levels that no longer cause economic damage.

(iii) Burning of crop residues.

Where permitted and used judiciously, burning destroys infected residues that harbor spores and survival structures. This sharply reduces initial inoculum for the next crop, though it should be balanced with soil conservation alternatives like deep incorporation or composting.

10. (a) (i) Describe stepwise procedures on how to compute feed ration using the Pearson Square Method.

State the target nutrient percentage for the final mix and select two ingredients, one with a nutrient level above the target and one below it, for the same nutrient basis, for example digestible crude protein.

Draw a simple square, write the target value in the center, put the high-nutrient ingredient value at the top left and the low-nutrient ingredient value at the bottom left, then compute the absolute differences diagonally across the square.

Assign the diagonal differences as “parts” of the opposite ingredient. The difference between the high ingredient and the target becomes the parts of the low ingredient, and the difference between the low ingredient and the target becomes the parts of the high ingredient.

Add the two parts to get total parts, then convert each ingredient’s parts to proportions by dividing by total parts. Multiply by the desired batch size to obtain the mass of each ingredient.

Verify the result by calculating the weighted average nutrient percentage of the mix. If it equals the target, the formulation is correct; if not, recheck arithmetic and ingredient values.

(ii) Give the necessary circumstances which necessitate farmers to use the Pearson’s Square Method.

Use the method when balancing for a single nutrient using exactly two ingredients, one above and one below the target level, such as blending a high-protein and a low-protein feed.

Use it when a quick, on-farm calculation is needed without computers or linear programming, for example during feed shortages when substitutions must be made rapidly.

Use it when the target nutrient percentage falls between the nutrient concentrations of the two available ingredients, since the method cannot work if the target lies outside that range.

Use it when cost optimization and multiple nutrient constraints are not being solved simultaneously, because Pearson's is a simple blending tool, not a least-cost or multi-constraint optimizer.

(b) Calculate the amount of each feedstuff in kilograms to prepare 100 kg of chick mash containing 30% Digestible Crude Protein using the following data: 20% Digestible Crude Protein of maize meal and 50% Digestible Crude Protein of fish meal.

Target DCP = 30%. High ingredient = fish meal 50%. Low ingredient = maize meal 20%.

Parts of maize meal = $|50 - 30| = 20$. Parts of fish meal = $|30 - 20| = 10$. Total parts = $20 + 10 = 30$.

Proportion of maize meal = $20 \div 30 = 0.6667$. Proportion of fish meal = $10 \div 30 = 0.3333$.

For a 100 kg batch: maize meal = $0.6667 \times 100 = 66.67$ kg. Fish meal = $0.3333 \times 100 = 33.33$ kg.

Check of target DCP: $(66.67 \times 0.20) + (33.33 \times 0.50) = 13.33 + 16.67 = 30.00$ kg DCP per 100 kg, which equals 30%.