THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

134/1 SCIENCE AND PRACTICE OF AGRICULTURE 1

(For school Candidates Only)

Time: 2:30Hours **ANSWERS** **Year: 2018**

Instructions

1. This paper consists of **ten (10)** questions in sections A, B and C
2. Answer **five (5)** questions choosing at least one question from each section.
3. Each question carries twenty marks

1. (a) Identify the following types of oils based on US Society of Automotive Engineers:

(i) Four engine oils:

The Society of Automotive Engineers (SAE) classifies engine oils primarily by their viscosity grades. Common SAE viscosity grades for engine oils include:
SAE 0W-20: A multigrade oil suitable for cold climates, providing good fuel efficiency.
SAE 5W-30: A widely used multigrade oil offering balanced performance in various temperatures.
SAE 10W-40: A multigrade oil suitable for warmer climates, providing protection under higher temperatures.
SAE 15W-50: A multigrade oil designed for high-performance or heavy-duty engines operating in hot conditions.

(ii) Four gear and transmission oils:

SAE also provides classifications for gear and transmission oils, which differ from engine oil classifications. Common viscosity grades include:
SAE 75W: A low-viscosity gear oil suitable for cold temperatures.
SAE 80W-90: A multigrade gear oil commonly used in manual transmissions and differentials.
SAE 85W-140: A heavier multigrade gear oil designed for high-load conditions.
SAE 90: A single-grade gear oil used in moderate temperature ranges.

(iii) Two multigrade oils:

Multigrade oils are formulated to perform effectively across a range of temperatures. Examples include:

SAE 5W-30: Provides good performance in both cold and warm temperatures, ensuring easier starts in cold weather and effective lubrication in warmer conditions.
SAE 10W-40: Suitable for varying temperatures, maintaining stability in both low and high-temperature environments.

(b) Briefly explain five functions of the lubrication system.

A lubrication system performs several critical functions:

- Reducing Friction and Wear: It forms a film between moving parts, minimizing direct contact and thereby reducing friction and wear.
- Cooling: By carrying heat away from components, it helps maintain optimal operating temperatures.
- Cleaning: It transports contaminants and debris to filters, keeping engine parts clean.
- Sealing: It helps seal gaps between components, such as between piston rings and cylinder walls, preventing leakage.
- Corrosion Protection: It provides a protective layer that shields metal surfaces from moisture and corrosive substances.

- (c) Briefly describe three types of lubrication systems.

Lubrication systems can be categorized based on their methods of delivering lubricant:

- Splash Lubrication System: In this system, components are partially submerged in lubricant; their movement causes splashing, distributing the lubricant to necessary areas.
- Pressure Lubrication System: A pump circulates lubricant under pressure to all parts requiring lubrication, ensuring consistent and adequate distribution.
- Mist Lubrication System: Lubricant is atomized into a fine mist and mixed with air; this mist is then directed to the lubrication points, commonly used in two-stroke engines.

(d) Differentiate between detergent oils and grease.

Detergent Oils: These are engine oils containing additives that clean engine components by preventing deposit formation and neutralizing acids.
Grease: A semi-solid lubricant composed of oils thickened with soaps, used where oil would not stay in place, providing lubrication and protection against contaminants.

2. (a) What are the functions of each of the following workshop tools?

(i) Wood Float: Used to smooth and level the surface of plaster or concrete. (ii) Bolster: A chisel-like tool with a wide blade, used for cutting bricks or masonry. (iii) Rasps: Coarse files with raised teeth, used for shaping wood or soft materials. (iv) Bastard File: A file with a medium grade of coarseness, used for general-purpose filing of metal or wood. (v) Hand Drill: A manually operated tool used to drill holes in various materials.

(b) Suggest four measures to be taken in order to increase the lifespan of files.

- Clean Regularly: Remove filings from the teeth after use to prevent clogging.
- Proper Storage: Store files in a dry place, separated to prevent them from knocking against each other.
- Avoid Contamination: Keep files away from moisture and corrosive substances to prevent rust.
- Use Correctly: Apply appropriate pressure and use the correct type of file for the material to avoid damaging the teeth.

(c) Write the functions of four types of saws used in a farm workshop.

- Crosscut Saw: Designed for cutting wood across the grain.
- Rip Saw: Used for cutting wood along the grain.
- Hacksaw: Used for cutting metal or plastic pipes and rods.
- Pruning Saw: A curved saw used for trimming trees and shrubs.
- (a) Classify two types of wood.

Wood is primarily classified into two categories:

i. Hardwood: Sourced from angiosperm trees, which are typically broad-leaved and deciduous. Examples include oak, maple, and mahogany. Hardwoods are generally denser and more durable, making them suitable for furniture and flooring.
ii. Softwood: Obtained from gymnosperm trees, usually coniferous and evergreen. Examples are pine, fir, and spruce. Softwoods tend to be lighter and are often used in construction and paper production.

(b) Account for four uses of timber as a building material.
Timber is utilized in construction for various purposes:
i. Structural Framework: Timber serves as the primary material for building frames, trusses, beams, and columns, providing structural support to buildings.
ii. Flooring: Wooden floors are valued for their aesthetic appeal and durability, offering a warm and natural finish to interiors.
iii. Roofing: Timber is used in constructing roof structures due to its strength and ability to support various roofing materials.
iv. Cladding: Timber cladding provides an attractive and protective exterior finish to buildings, enhancing insulation and weather resistance.
(c) Give four merits and four demerits of timber as a building material.

Merits:
i. Aesthetic Appeal: Timber offers a natural and warm appearance, enhancing the visual appeal of structures.
ii. Sustainability: As a renewable resource, timber can be sustainably harvested and replenished.
iii. Insulation Properties: Timber has low thermal conductivity, providing good insulation and energy efficiency.
iv. Ease of Workability: Timber is relatively easy to cut, shape, and join, facilitating various construction methods.

Demerits:
i. Susceptibility to Pests: Timber can be vulnerable to insects like termites and requires treatment to prevent infestations.
ii. Moisture Sensitivity: Without proper treatment, timber can absorb moisture, leading to decay, warping, or swelling.
iii. Flammability: Timber is combustible and poses a fire risk if not adequately treated with fire-retardant materials.
iv. Dimensional Instability: Timber can expand or contract with changes in humidity and temperature, potentially affecting structural integrity.

(d) Identify five advantages of using concrete in farm building.
Concrete offers several benefits in agricultural construction:
i. Durability: Concrete structures withstand harsh environmental conditions, providing longevity and reduced maintenance.
ii. Fire Resistance: Concrete is non-combustible, enhancing the safety of farm buildings against fire hazards.
iii. Pest Resistance: Unlike timber, concrete is impervious to pests, eliminating concerns of insect damage.

iv. Thermal Mass: Concrete can absorb and store heat, helping to regulate indoor temperatures and improve energy efficiency.
v. Low Maintenance: Concrete surfaces require minimal upkeep compared to other materials, reducing long-term maintenance costs.

4. (a) What do you understand by land clearing?

Land clearing refers to the process of removing native vegetation, such as trees, shrubs, and other plant materials, as well as obstacles like rocks and debris, to prepare a specific area for agricultural activities, construction projects, or other developmental purposes. This process is essential for creating a suitable environment for planting crops, building infrastructure, or other land uses.

(b) Elaborate four principles of chaining as a land clearing method.

Chaining is a land clearing technique that involves dragging a heavy chain between two tractors or bulldozers to uproot and remove vegetation. The key principles of chaining include:

i. Equipment Selection: Utilizing a heavy-duty chain, often made from anchor chain links, attached between two powerful tractors or bulldozers to ensure effective removal of vegetation.
ii. Operational Coordination: Synchronizing the movement of the two machines to maintain consistent tension on the chain, allowing for efficient uprooting of trees and shrubs.
iii. Adaptability to Terrain: Implementing chaining on relatively flat or gently sloping terrains where the equipment can operate safely and effectively.
iv. Post-Clearing Management: Following up with additional clearing methods, such as burning or mulching, to manage the debris and prepare the land for its intended use.

(c) Propose three methods that can be used to dispose of the vegetation removed from land clearing.
i. Mulching: Utilizing machinery to grind the cleared vegetation into mulch, which can then be spread over the land to improve soil quality, retain moisture, and prevent erosion.
ii. Burning: Conducting controlled burns to dispose of accumulated vegetation debris, a method that requires careful planning and adherence to local regulations to prevent uncontrolled fires.
iii. Composting: Collecting the cleared vegetation and allowing it to decompose naturally, producing compost that can be used to enrich the soil for future agricultural activities.

(d) What are the eight important questions to be considered when selecting machine models to be purchased?

When selecting machine models for land clearing or other purposes, consider the following questions:
i. What is the specific purpose or application of the machine? Understanding the primary tasks the machine will perform ensures it meets operational requirements.

ii. What is the size and type of land to be cleared? Assessing the terrain, soil conditions, and vegetation density helps determine the appropriate machinery specifications.

iii. What is the machine's capacity and efficiency? Evaluating the machine's performance capabilities ensures it can handle the workload effectively.
iv. What are the operational and maintenance costs? Considering fuel consumption, parts availability, and service requirements impacts long-term affordability.
v. Is the machine compatible with existing equipment? Ensuring compatibility can enhance operational efficiency and reduce additional costs.
vi. What is the availability of spare parts and technical support? Access to parts and service technicians is crucial for minimizing downtime.
vii. What are the safety features and compliance standards? Verifying that the machine meets safety regulations protects operators and aligns with legal requirements.
viii. What is the machine's environmental impact? Considering emissions, noise levels, and ecological effects aligns with sustainable practices and may be subject to regulatory standards.

5. (a) Briefly describe the furrow irrigation system.

Furrow irrigation is a surface irrigation method where water is directed into small, parallel channels, or furrows, dug along the field's slope. Crops are typically planted on the ridges between the furrows, and water infiltrates the soil laterally and vertically to reach the root zones. This method is commonly used for row crops and is suitable for soils with moderate to low infiltration rates.

(b) Outline three advantages and four disadvantages of the furrow irrigation system.

Advantages:

i. Cost-Effectiveness: Furrow irrigation requires relatively low initial investment compared to pressurized systems, making it accessible for many farmers.
ii. Simplicity: The system is easy to design, implement, and manage without the need for complex technology.
iii. Reduced Water Contact with Foliage: By delivering water directly to the soil, furrow irrigation minimizes moisture on plant leaves, reducing the risk of certain diseases.

Disadvantages:

i. Water Inefficiency: Furrow irrigation can result in uneven water distribution and runoff, leading to water wastage.
ii. Soil Erosion: The movement of water in furrows can cause soil erosion, especially on steeper slopes.
iii. Labor Intensive: Regular maintenance of furrows and monitoring of water flow require significant labor input.
iv. Limited Suitability: This method is less effective on sandy soils with high infiltration rates or uneven terrains.

(c) Suggest four necessary conditions for a surface irrigation system to take place.

i. Level or Gentle Sloping Terrain: Ensures uniform water distribution across the field.
ii. Appropriate Soil Texture: Soils with moderate infiltration rates, such as loam or clay-loam, are ideal to prevent excessive percolation or runoff.
iii. Adequate Water Supply: Sufficient and reliable water sources are essential to meet crop water requirements throughout the growing season.
iv. Proper Field Layout: Well-designed fields with appropriate slope and furrow dimensions facilitate efficient water movement and coverage.

(d) Briefly explain six importance of drainage in the irrigated farm.

i. Prevents Waterlogging: Effective drainage removes excess water, preventing root suffocation and promoting healthy plant growth.

ii. Controls Salinity: Draining excess water helps leach salts from the root zone, maintaining soil salinity at levels conducive to crop production.
iii. Improves Soil Structure.

6. (a) Give five ways employed in soil air management.

Effective soil air management is crucial for maintaining soil health and promoting optimal plant growth. Here are five methods commonly employed:

i. Tillage Practices: Implementing appropriate tillage loosens the soil, enhancing pore space and facilitating better air exchange between the soil and atmosphere.

ii. Organic Matter Addition: Incorporating organic materials, such as compost or manure, improves soil structure, increases porosity, and promotes aeration.

iii. Cover Cropping: Growing cover crops protects the soil surface, reduces compaction, and enhances soil structure, leading to improved aeration.

iv. Subsoiling: Deep tillage techniques break up compacted soil layers, improving deep soil aeration and root penetration.

v. Drainage Management: Installing proper drainage systems prevents waterlogging, ensuring that pore spaces remain filled with air rather than excess water.

(b) Briefly explain four factors affecting the composition of soil air.

The composition of soil air is influenced by several factors:

i. Soil Moisture Content: Higher moisture levels reduce the air-filled pore space, decreasing oxygen availability and increasing carbon dioxide concentration.

ii. Soil Texture: Sandy soils, with larger pore spaces, facilitate better aeration, while clayey soils, with smaller pores, may restrict air movement.

iii. Biological Activity: Respiration by plant roots and soil microorganisms consumes oxygen and produces carbon dioxide, altering soil air composition.

iv. Soil Depth: Oxygen levels typically decrease with soil depth due to reduced air exchange and increased biological activity consuming oxygen.

(c) Analyze the effects of the following physical properties of soil on soil temperature:

i. Soil Color: Dark-colored soils absorb more solar radiation, leading to higher temperatures, while light-colored soils reflect more sunlight, remaining cooler.

ii. Soil Moisture: Moist soils have higher thermal conductivity but also higher heat capacity, causing them to warm up and cool down more slowly compared to dry soils.

(d) Describe the following terminologies as used in soil science:

i. Infiltration: The process by which water on the soil surface enters the soil, influenced by factors such as soil texture, structure, and moisture content.

ii. Percolation: The downward movement of water through soil layers, driven by gravity, affecting groundwater recharge and soil moisture distribution.

iii. Permeability: The ability of soil to transmit water and air, determined by the size and connectivity of its pore spaces, influencing drainage and aeration.

7. (a) (i) "Presence of high aluminium ions (Al^{3+}) in soils is known to contribute to soil acidity". By using well-balanced equations, justify this statement.

In acidic soils, aluminium ions (Al^{3+}) contribute to soil acidity through hydrolysis reactions. When Al^{3+} is present in the soil solution, it reacts with water, leading to the release of hydrogen ions (H^+), which increase soil acidity. The hydrolysis of aluminium can be represented by the following equations:

- First hydrolysis step:

$Al^{3+} + H_2O \text{----------} \rightarrow AlOH^{2+} + H^+$

- Second hydrolysis step:

$AlOH^{2+} + H_2O$ ----------→ $Al(OH)^{+} + H^{+}$

- Third hydrolysis step:

$Al(OH)^{+} + H_2O$ ----------→ $Al(OH)_3 + H^{+}$

Through these sequential hydrolysis reactions, each aluminium ion can release up to three hydrogen ions into the soil solution, thereby increasing the soil's acidity.

(ii) Differentiate between active and potential acidity.

Active Acidity: This refers to the concentration of hydrogen ions (H^{+}) present in the soil solution at a given time. It is measured by the soil's pH and represents the immediate acidity affecting plant roots and soil microorganisms.

Potential Acidity: Also known as reserve acidity, this encompasses the hydrogen and aluminium ions adsorbed onto soil colloids, which can be released into the soil solution over time. Potential acidity indicates the soil's capacity to become more acidic under certain conditions and is not directly measured by soil pH.

(b) (i) What is meant by liming as used in management of acid soils?

Liming refers to the application of alkaline materials, commonly known as lime, to acidic soils to raise the pH level towards neutrality. This process neutralizes excess hydrogen ions in the soil solution, thereby reducing acidity and creating a more favorable environment for plant growth and microbial activity.

(ii) By using at least one chemical equation in each case, examine four liming materials commonly used in agriculture.

- Calcium Carbonate ($CaCO_3$): Also known as agricultural lime or calcitic lime, it neutralizes soil acidity through the following reaction:
  $CaCO_3 + 2H^{+}$ ----------→ $Ca^{2+} + H_2O + CO_2$

- Dolomitic Lime ($CaMg(CO_3)_2$): Contains both calcium and magnesium carbonates, providing magnesium in addition to neutralizing acidity:
  $CaMg(CO_3)_2$ + 4 **H^{+} ----------→ $Ca^{2+} + Mg^{2+} + H_2O + 2CO_2$**

- Calcium Hydroxide ($Ca(OH)_2$): Known as hydrated lime or slaked lime, it reacts with soil acidity as follows:
  $Ca(OH)_2 + 2H^{+}$ ----------→ $Ca^{2+} + 2H_2O$
- Calcium Oxide (CaO): Also called quicklime or burnt lime, it reacts with water to form calcium hydroxide, which then neutralizes acidity:
  CaO + **H_2O ----------→ $Ca(OH)_2$**

Each of these liming materials increases soil pH by neutralizing hydrogen ions, thereby reducing soil acidity and improving conditions for plant growth.

(c) Make a clear distinction between the following pairs:

(i) Organic fertilizers and inorganic fertilizers.
Organic Fertilizers: Derived from natural sources such as plant residues, animal manure, or compost, these fertilizers release nutrients slowly as they decompose, improving soil structure and promoting microbial activity.
Inorganic Fertilizers: Also known as synthetic or chemical fertilizers, these are manufactured through industrial processes and provide nutrients in readily available forms, allowing for precise nutrient management but not contributing to soil organic matter.

(ii) Complex/compound fertilizers and straight fertilizers.
Complex/Compound Fertilizers: These fertilizers contain two or more essential nutrients combined chemically or physically, such as NPK fertilizers that provide nitrogen, phosphorus, and potassium in a single product.
Straight Fertilizers: These provide a single nutrient, such as urea supplying only nitrogen or superphosphate providing only phosphorus, allowing for targeted nutrient application based on specific soil or crop needs.

8. (a) What is international trade?

International trade refers to the exchange of goods, services, and capital across international borders or territories. It allows countries to expand their markets, access goods and services not available domestically, and specialize in the production of goods where they have a comparative advantage.

(b) Briefly explain the significance of international trade. Give five points.

International trade is significant for several reasons:

i. Economic Growth: By accessing larger markets, countries can increase production and achieve economies of scale, leading to higher GDP growth.
ii. Resource Allocation Efficiency: Trade enables countries to specialize in producing goods where they have a comparative advantage, optimizing global resource utilization.
iii. Consumer Benefits: It provides consumers with a wider variety of goods and services, often at lower prices due to increased competition.
iv. Employment Opportunities: Export-oriented industries can create jobs, reducing unemployment and improving living standards.
v. Technological Transfer: Exposure to international markets facilitates the exchange of technology and innovation, enhancing productivity.

(c) The following table shows production of two crops by two countries, A and B. Study it carefully and then answer the questions that follow:

country	Maize (bags/Ha)	Paddy (bags/Ha)
A	8	60
B	30	12

(i) Use the law of comparative advantage to describe the production of crops in both countries.

The law of comparative advantage suggests that each country should specialize in producing the good for which it has the lowest opportunity cost.
Country A:
Opportunity cost of producing 1 bag of maize = 60 bags of paddy / 8 bags of maize = 7.5 bags of paddy.
Opportunity cost of producing 1 bag of paddy = 8 bags of maize / 60 bags of paddy = 0.133 bags of maize.
Comparative Advantage: Lower opportunity cost in producing paddy.

Country B:
Opportunity cost of producing 1 bag of maize = 12 bags of paddy / 30 bags of maize = 0.4 bags of paddy.
Opportunity cost of producing 1 bag of paddy = 30 bags of maize / 12 bags of paddy = 2.5 bags of maize.
Comparative Advantage: Lower opportunity cost in producing maize.

Therefore, Country A should specialize in producing paddy, and Country B should specialize in producing maize.

(ii) Justify how the principle of opportunity cost works in both countries.
Opportunity cost represents the value of the next best alternative foregone when making a choice. In this context:
Country A: By choosing to produce one additional bag of maize, it forgoes the production of 7.5 bags of paddy.
Country B: By choosing to produce one additional bag of paddy, it forgoes the production of 2.5 bags of maize.

Each country minimizes its opportunity cost by specializing in the crop where it has a comparative advantage, leading to more efficient production and potential gains from trade.

(iii) Use the law of comparative advantage and principle of opportunity cost to briefly explain the possible trade between the two countries.

By specializing according to their comparative advantages:
Country A focuses on producing paddy, where it has a lower opportunity cost.
Country B focuses on producing maize, where it has a lower opportunity cost.

They can then trade, with Country A exporting paddy to Country B and importing maize in return. This trade allows both countries to consume more of both goods than they could produce independently, leading to mutual economic benefits.

9. (a) Why is it necessary to plan the farming activities?

Planning farming activities is essential for several reasons:

i. Resource Optimization: Effective planning ensures that resources such as land, labor, and capital are utilized efficiently, minimizing waste and maximizing productivity.

ii. Risk Management: By anticipating potential challenges and market fluctuations, farmers can develop strategies to mitigate risks, ensuring more stable operations.

iii. Financial Performance: Planning helps in forecasting revenues and expenses, enabling better financial management and profitability assessment.

iv. Decision-Making: A well-structured plan provides a framework for making informed decisions regarding crop selection, investment in technology, and expansion opportunities.

v. Sustainability: Planning promotes the adoption of sustainable practices, ensuring long-term soil health, water conservation, and environmental protection.

(b) Differentiate between gross margin and partial budget as used in farm planning.

Gross Margin: This is the difference between the total revenue generated from a specific enterprise (e.g., a particular crop or livestock) and its associated variable costs. It helps in assessing the profitability of individual enterprises by focusing on income and costs that vary directly with the level of production.

Partial Budget: This analytical tool evaluates the financial impact of proposed changes within the farm business. It considers only the costs and revenues that will change as a result of a specific decision, making it useful for assessing the economic feasibility of modifications such as adopting new technologies or altering production practices.

(c) Cite two situations where partial budget can be applied in a farm.

i. Enterprise Substitution: When considering replacing one crop or livestock enterprise with another, a partial budget can analyze the financial implications of the change.

ii. Adoption of New Technology: Evaluating the economic benefits and costs associated with implementing new machinery or production techniques can be effectively conducted using a partial budget.

(d) Suggest four main ways in which profit on the farm can be raised using Gross Margin planning.

i. Cost Reduction: Identifying and minimizing variable costs without compromising productivity can enhance gross margins.

ii. Yield Improvement: Implementing practices that increase crop or livestock yields boosts total revenue, thereby improving gross margins.

iii. Price Optimization: Timing sales to take advantage of favorable market prices or adding value to products can increase income.

iv. Enterprise Selection: Focusing on more profitable enterprises by comparing their gross margins allows for better allocation of resources to high-return activities.

(e) A farmer wants to change over from growing his normal 20 hectares of maize to growing 20 hectares of haricot beans. Both crops are grown in the same season in that particular area.
Maize yield was 400kg per ha selling price Tshs.400 per kg and costs stood at 10kg seed per ha at 4,000/= a kg, 4 tonnes of fertilizer at Tshs.1,000,000 per ton, harvesting and picking costs are Tshs. 10,000 per hectare. 5 tractor hours at Tshs.5,000/= per hour. Expected yield for haricot beans is 1800kg per ha at Tshs. 200/= per kg, using 4kg seeds per ha at Tshs.2,000/= per kg, 3 tonnes of fertilizer at Tshs.1,000,000/= per ton, harvesting costs at Tshs.9,000 per hectare, 4 tractor hours at Tshs.5,000/= per hour. Use this information to prepare a partial budget and advice the farmer whether the change is worthwhile or not.
Solution:
To answer this question, we need to calculate the partial budget by comparing the costs and returns of growing maize and haricot beans. The following steps will help in the evaluation:

- Partial Budget Structure:

- Additional Costs: Costs incurred by switching from maize to haricot beans.
- Reduced Returns: Income lost from stopping maize production.
- Additional Returns: Income gained from growing haricot beans.
- Reduced Costs: Costs saved by stopping maize production.

- Data given;

Maize:
- Yield: 400 kg/ha
- Selling price: Tshs. 400/kg
- Seed cost: 10 kg/ha × Tshs. 4,000 = Tshs. 40,000/ha
- Fertilizer cost: 4 tonnes × Tshs. 1,000,000 = Tshs. 4,000,000/ha

- Harvesting cost: Tshs. 10,000/ha
- Tractor cost: 5 hours × Tshs. 5,000 = Tshs. 25,000/ha
- Total production: 20 ha

- Haricot Beans:
- Yield: 1800 kg/ha
- Selling price: Tshs. 200/kg
- Seed cost: 4 kg/ha × Tshs. 2,000 = Tshs. 8,000/ha
- Fertilizer cost: 3 tonnes × Tshs. 1,000,000 = Tshs. 3,000,000/ha
- Harvesting cost: Tshs. 9,000/ha
- Tractor cost: 4 hours × Tshs. 5,000 = Tshs. 20,000/ha
- Total production: 20 ha

- Calculations:

Maize Production Costs per Hectare:
- Seed: Tshs. 40,000
- Fertilizer: Tshs. 4,000,000
- Harvesting: Tshs. 10,000
- Tractor: Tshs. 25,000
- Total cost/ha: Tshs. 4,075,000

Maize Income per Hectare:
- Yield × Price: 400 kg × Tshs. 400 = Tshs. 160,000

Net Return per Hectare (Maize):
- Income − Costs: Tshs. 160,000 − Tshs. 4,075,000 = −Tshs. 3,915,000 (loss)

Haricot Beans Production Costs per Hectare:
- Seed: Tshs. 8,000
- Fertilizer: Tshs. 3,000,000
- Harvesting: Tshs. 9,000
- Tractor: Tshs. 20,000
- Total cost/ha: Tshs. 3,037,000

Haricot Beans Income per Hectare:
- Yield × Price: 1800 kg × Tshs. 200 = Tshs. 360,000

Net Return per Hectare (Haricot Beans):
- Income − Costs: Tshs. 360,000 − Tshs. 3,037,000 = −Tshs. 2,677,000 (loss)

- Total Comparison for 20 Hectares:

Maize:
- Net Return: 20 × −Tshs. 3,915,000 = −Tshs. 78,300,000

Haricot Beans:
- Net Return: 20 × −Tshs. 2,677,000 = −Tshs. 53,540,000

Difference (Net Advantage):
- Tshs. −53,540,000 − Tshs. −78,300,000 = Tshs. 24,760,000

- Conclusion:

Switching to haricot beans results in a lower loss of Tshs. 24,760,000. Thus, the change is financially advisable as it reduces the farmer's total loss compared to maize production.