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+256 778 633 682, 753 802709
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UACE P515/2 Principles and practices of agriculture 2011

Instructions

- This paper consists of sections: **A, B, C, D and E**
- Answer **question 1** in section A and four other questions, selecting **one** from each of the sections **C, D and E**.
- Write your answers in the answer booklets provided
- Any additional question(s) answered will not be marked

SECTION A (20MARKS)

Question 1 is compulsory

1. Figure 1 shows the concentration of DDT in parts per million, at different trophic levels in a food chain. Study the figure and answer the questions that follow

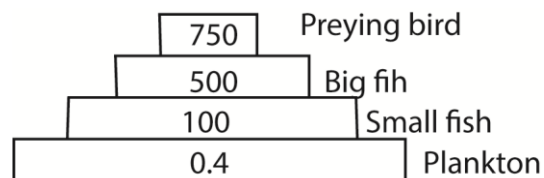


Fig.1

- (a) What conclusion can be drawn from the information? (03marks)

There is progressive increase in the pesticide concentration in organisms at higher trophic levels due to accumulation.

An organism at a higher trophic level consumes very organisms at lower trophic level thereby accumulating the non-biodegradable pesticide.

- (b) At what trophic level is DDT likely to have the most effective and why? (02marks)

At 4th trophic level (preying birds) due to high concentration of pesticide

- (c) Explain how the preying bird might have come to contain DDT. (04marks)

Organisms feed on large number of others on the lower trophic levels accumulating the pesticides from them leading to progressive increase in pesticide concentration up to that of preying birds.

(d) Outline precautions farmers would take to avoid DDT hazards. (05marks)

- Use DDT sparingly
- Wear protective clothes such as overalls, gloves, rubber boots, head masks and eye shields.
- Chemical should be stored in safe places away from children.
- Do not eat or drink while working with pesticides
- Wash any spillage from your body as soon as possible
- Clean the equipment after use
- Dispose of empty containers safely as instructed by the manufacturer.
- Do not use empty containers for edible substances.
- Wear protective clothes such as overalls, gloves, rubber boots, head masks and eye shields.
- Chemical should be stored in safe places away from children.
- Do not eat or drink while working with pesticides
- Wash any spillage from your body as soon as possible
- Clean the equipment after use
- Dispose of empty containers safely as instructed by the manufacturer.
- Do not use empty containers for edible substances.

(e) Describe the qualities of a good pesticide. (06marks)

- toxic to the target organism
- specific to the target organism
- biodegradable not to accumulate in the environment
- harmless to the plants and animals
- cheap and readily available
- easy to store and transport
- readily soluble in water
- not accumulate in ecosystem

SECTION B (20MARKS)

CROP PRODUCTION

Answer **one** question from this section

2. (a) Outline characteristics of weeds that contribute to their success in environment. (06marks)

- Rapid rate of growth and maturation
- Drought resistant
- Resistant to pest and disease
- Some are parasitic
- Produce large volume of seed to increase their chance of survival
- Vegetative reproduction allows weeds to develop from any part of the plant

- Weeds employ various mechanisms of dispersal using wind, water, animals and self-dispersal mechanisms.
- Produce poisonous substances to crops
- Can obtain nitrogen from carnivorous behavior
- Are protected by structures such thorns and itching hairs that protect them herbivores.
- Some are resistant to herbicides

(b) How do weeds affect crop growth? (05marks)

- Compete with plants for water, light, space, and nutrients and therefore reducing crop yields
- Are host for vectors and pests
- Some weeds produce poisonous substance that kill crops

(c) Explain ways in which weeds are spread from one place to another. (09marks)

- Weed seeds and fruits are dispersed by wind; these have light seeds and wing extensions to be blown by wind
- Weed seeds and fruits dispersed by animals; these may have adhesive/sticky coats, edible indigestible seed,
- Weed seeds and fruits are dispersed by water; these are hollow seed and fruits with hard coat to float on water for long distances
- Use of contaminated planting materials
- By self-explosion fruits and scattering of seed
- Through use farm equipment such as wheelbarrow contaminated with seeds
- By birds through fecal materials
- Through tilling land and rhizomes moved through soil.
- Through infected farm containers

3. (a) Explain the factors to consider when deciding which fertilizer to apply. (10marks)

- Economic return: fertilizers are usually applied to high value crops.
- Type of crops required varied nutrients from the soil
- Rate of nutrient removal from the soil
- Cost of the fertilizer
- Availability of fertilizer
- Soil pH
- Crop growth stage: plants require different nutrients at different stage
- Soil properties such as texture, pH, temperature, moisture, and organic matter.
- Type of fertilizer whether it contains minerals deficient in the soil.
- Method of application whether broadcasting, banding, foliar etc.
- Environmental conditions: temperature and precipitation can impact nutrient availability.

- Amount/dosage of fertilizer used
- Rate of application

(b) Why would a farmer prefer to use inorganic fertilizers rather than organic fertilizers? (05marks)

- They are not bulky hence easy to store and transport
- Easy to apply
- Provide nutrients readily to the soil and plant
- Easily applied with machines
- They can be applied at any stage of growth
- They contain known nutrient composition

(c) What are the advantages of using organic fertilizers? (05marks)

- They supply organic matter and increase the cation exchange capacity of soil
- They supply a variety of plant nutrients
- They improve soil structure by binding soil particles together.
- They act as food for microorganism in the soil
- They are cheap to purchase
- Readily available
- They buffer pH of the soil
- They add humus to the soil that add a dark color to the soil making good heat absorber
- They conserve soil moisture

SECTION C (20MARKS)

ANIMAL PRODUCTION

Answer **one** question from this section

4. (a) Explain the factors to consider when selecting dairy cattle for improvement. (14 marks)

- Adaptability of the animal to environmental conditions;
- Availability of the breed within the environment
- Availability of market for animal products for the animal being bred
- Animal temperament should be low for easy handling
- Animal resistance to pests and diseases should be high
- Animal body conformity should confirm the breed and type
- History of success of the breed in the environment
- Feed conversion ratio of the breed i.e. should have a high ability of converting feeds into products like milk , meat and eggs
- Growth rate of the breed
- Availability of quality feeds for the animals
- Fertility of the animal being considered

- Productivity of the animal in terms of milk, meat and eggs
- (b) Outline the methods of maintaining breeding efficiency in cattle. (06marks)
- Proper feed of the animal
 - Giving a resting period after calving to restore the uterus
 - Breeding animals at the right time
 - Proper observation of heat
 - Control diseases
 - Use of proven bull or semen
 - Proper record keeping
5. (a) Suggest possible causes of pasture deterioration. (09marks)
- Presence of poor unproductive pasture plant
 - Presence of large and undecayed plant residues that prevent water entry
 - Wet areas containing marshy plants e.g. nut grasses
 - Over growth of pasture hence becoming fibrous
 - The pasture become stunted
 - Development of bare patches in pasture
 - Accumulation of parasites in pastures.
 - Accumulation of vector in the pasture
 - Presence of weeds
 - Overgrazing
 - Adverse climate
 - Overstocking
 - Pollution e.g. with oil residue
- (b) Explain the factors that influence food conversion ratio in animals. (06marks)
- Type of animal
 - Age of animal: young animals have high conversion ratio
 - Health status of an animal: health animals have higher food conversion ratio than sick animals
 - Nature of feed and its nutrient composition.
 - Level of production for instance milk cattle and layer have high food conversion ratio.
 - Inheritance
 - Temperature
- (c) What consideration should be made when formulating rations for animals? (05marks)
- The nutrient requirement of for the animals whose ration is being formulated
 - The palatability or acceptability of the final mixture of the feed
 - Availability of ingredients and their cost
 - Health status of the animal
 - Nutrient composition of the final mixture
 - Physical nature of feed
 - The wholesomeness of the food stuff. The final mixture should not harmful to the animals
 - Age of animal i.e. young animal requires high proportion of proteins

- Level of production for instance milk cattle and layer require high proportion of calcium.
- Type of animal for instance ruminant can digest cellulose

SECTION D (20MARKS)

AGRICULTURAL ENGINEERING

Answer **one** question from this section

6. (a) Outline the safety rules for tractor operations. (08marks)
- Do not get on or off a tractor when it is moving
 - Do not clean or grease when a tractor is in motion
 - Do not allow other persons to ride on the tractor during operation
 - Do not remove or fit the belt to the pulley when the pulley is in operation
 - Avoid removing the radiator cap when water is still very hot
 - Do not run the engine when the oil gauge does not show any reading
 - Never use a clutch pedal as a foot rest
 - Do not refuel a tractor when the engine is running
 - Do not operate a tractor with faulty tyres, brakes and clutch.
 - Do not check level of oil when the engine is running
 - Employ skilled drivers
 - Do not drive the tractors when drunk with alcohol
 - Ensure that the bolts and nuts are tight
 - Never drive a tractor near a ditch
 - Keep the tractor in well maintained conditions.
- (b) Explain factors that influence the choice of tool or implements used for cultivation. (12marks)
- **Adaptability:** farmers prefer implement that can work under the local conditions.
 - **Availability of implement:** farmers select an implement from those available and those with available spare parts.
 - **Cost of purchase and maintenance:** farm equipment should be cheap to buy and maintain.
 - **Durability:** farmers prefer durable equipment
 - **Number of uses:** farmers prefer a versatile machine that performs a number of tasks.
 - **Size of the farm:** big farms require big machines
 - **Presence of source of power:** some farm machines such as milking machines require electricity.
 - **Presence and level of skilled manpower:** some machines require skilled manpower for example use of a tractor.
 - **Topography:** for instance ragged terrain does not favor use of a tractor.
 - **Level of production:** high level production requires large machines
 - **Availability of capital** to purchase the equipment.
 - **Efficiency of the machine.**

7. (a) Describe the vacuum pressure method of treating wood. (15marks)
- Fresh poles/posts are peeled to remove the bark.
 - Poles/posts are parked in large cylinder containing a chemical preservative.
 - The cylinder is sealed up and pressure increased inside it forcing the chemical into the posts.
 - Posts are removed from the cylinder and allowed to dry.
- (b) Why is wood popularly used in construction of farm structure? (05marks)
- It is readily available
 - It is light to lift and transport
 - Cheap to buy
 - Easy to cut and mould into shape
 - Durable
 - Good insulator
 -

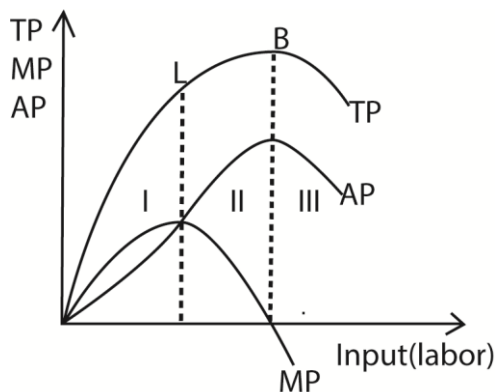
SECTION D (20MARKS)

AGRICULTURAL ECONOMICS

Answer **one** question from this section

8. (a) Using an illustration, describe the relationship between total product, average product and marginal product of a production function. (09marks)

Graphical illustration of the relationship between Average product, Marginal product and Total product



From the graph the following is observed.

- T.P(total product) begins by increasing, reaches maximum point B and then falls

- Marginal product (MP) begins by increasing reaches a maximum at L and then decreases up to the negatives.
- Average product begins by increasing, reaches a maximum and then falls.
- When total product (TP) is increasing at an increasing rate (up to point L), Marginal product (M.P) is also increasing. When TP is at maximum M.P is zero, when T.P is falling M.P is negative. Therefore M.P is the measure of the rate of change of total product.
- When average product (A.P) is increasing; M.P is higher than AP and when average product (A.P) is falling M.P is lower than A.P and when A.P is at maximum when MP = A.P.
- **L is called a point of inflexion.** It refers to the point below which MP is increasing and beyond which M.P is declining. OR. It is a point below which total product is increasing at an increasing rate and beyond which total product is increasing at a declining rate.

(b) Describe the characteristics of stage one of production function. (05marks)

- Production is not yet maximum.
- TP is increasing at increasing rate.
- Increase in variable input increase output.
- Marginal product increases more than average product.
- When marginal product is maximum, it is equal to average product
- The fixed factor is under utilized

(c) Suggest with reasons the region of the production function, farmers would be advised to operate in. (06marks)

The second stage because resources are optimally utilized. Beyond this stage increase in variable input lead to negative marginal product

9. (a) Describe the activities carried out to facilitate marketing of agricultural products. (12marks)

- Processing thereby adding value for instance turning into tomato sauce
- Preserving to increase self-life e.g. refrigeration
- Improving transport network for easy access to the market
- Producing perishable products near the market
- Advertisement of the products
- attractive packaging
- Quality standardization
- Early harvesting
- Attractive packaging

(b) What is the role of advertising in marketing? (08marks)

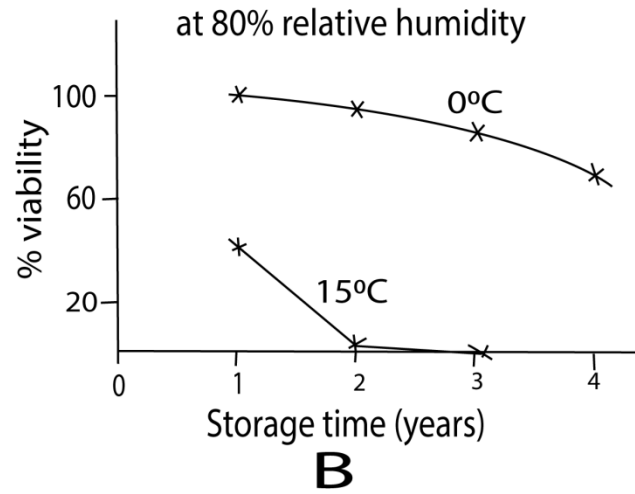
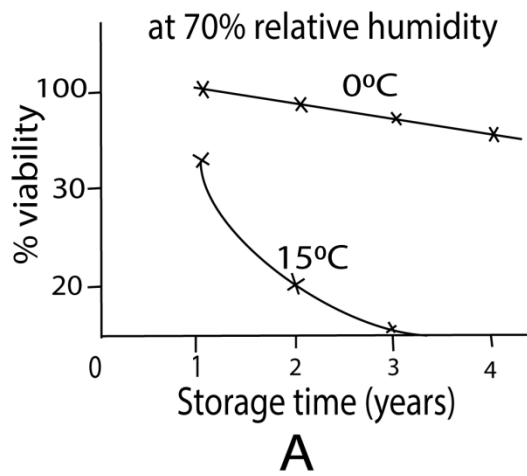
- Inform customers providing product information
- Reinforces customers' positive attitude towards the product.
- Persuades the customer to buy products

- Educates the customers about the product
- Adds value to the products
- Builds brand equity
- Reinforces brand image
- Creates demand
- Counter competitor's claims
- Creates awareness about the product brand and/or price
- Reminds the target customers about the product

END

Suggested answers

1. Figure A and B below show the variation of viability of fescue grass seed at different conditions.



- (a) From the figured state the factor that affect viability of fescue grass seed (03 marks)
humidity

Temperature

Storage time

- (b) Explain the shape of the curves in figure A (05marks)

At zero degrees, viability of seed decreases slowly as the years of storage time increases because of respiration and exhaustion of food reserves, and damage due to pests and moulds

At 15°C, viability of seeds decrease more rapidly as the years of storage time increases because the rate of respiration and exhaustion of food reserves is higher. Also pests and moulds are more active at destroying the seeds.

- (c) Compare curves A and B (04 marks)

The rates of loss of viability of seed in B are higher for both at 0°C and 15°C

- (d) Explain the difference in curves of figure A and B (02marks)

Increase in humidity from 70% in A to 80% in B promoted the rate of respiration and damage to the seed by pests and mould leading to faster loss of seed viability.

- (e) Describe two ways how viability of a seed lot can be established (06marks)

- Germination test: Place a known number of seeds in a moist cloth or paper and calculate the percentage of seeds that germinate.
- Floating test: place the given number of seeds in a container of water for 15 minute; viable seeds will sink while non-viable seeds will float.
- Embryo test: Embryos are removed from the seed and placed in a nutrient solution and then observed to see how many develop further.
- Tetrazolium Test: seeds are soaked in water and then placed in a tetrazolium solution; viable seeds will stain red, indicating active respiration

SECTION B (20MARKS)

CROP PRODUCTION

Answer **one** question from this section

2. (a) Describe field practice that would promote the higher crop yields. (12marks)
- motoring and regulation of soil pH
 - crop rotation to maintain soil fertility
 - weeding to remove plant competitor
 - tillage to improve soil texture, water filtration and aeration
 - pest control
 - disease control
 - Planting high quality seeds and planting materials
 - Irrigation when necessary
 - Proper spacing of plants to ensure adequate sunlight per plant
 - Provide fertilizers as required
 - Mulch to maintain soil moisture
 - Control soil erosion to protect soil fertility
 - Research into high yielding varieties
 - Timely planting
- (b) Outline the effect of diseases on crop production. (08marks)
- Lower crop yield
 - Lower the quality of produce
 - Make it difficult to harvest crops due to uneven ripening
 - Reduce market value of crop yield
 - Cause death of crops
 - Stunted growth
 - Increase cost of production

3. (a) Outline the benefits of processing farm produce. (06marks)
- Increased shelf life
 - Higher market value
 - Create a variety of products from the same raw material
 - Creates jobs
 - Enhances nutritional value
 - Eases storage
 - Eases marketability
 - Lessens transport costs
- (b) Explain the factors that affect shelf life of farm produce. (14marks)
- Genetic composition
 - Proper handling that minimize damage
 - Temperature: very high temperature enhance decay
 - Humidity: high humidity promote growth of pests and moulds
 - Ethylene gas accelerates ripening and spoilage
 - Poor hygiene promotes contamination and spoilage
 - Antimicrobial treatment lengthen shelf life
 - Pasteurization prolong shelf-life of milk
 - Processing prolong shelf life of produce
 - Refrigeration prolong shelf life
 - Drying promotes shelf life
 - Salting promotes shelf life

SECTION C (20MARKS)

ANIMAL PRODUCTION

Answer **one** question from this section

4. (a) Explain the mutualistic relationship between microorganisms in the digestive tract of animals and their hosts. (12marks)

In mutualistic relationship of herbivores and microorganisms; herbivores and hind gut fermenter benefit in the following ways:

- Microorganisms produce enzymes that break down cellulose to simple carbohydrates such as acetic acids which provide energy to herbivores.
- Microorganisms synthesize useful proteins from non-protein sources for the animals
- Microorganisms synthesize useful vitamins such as K, C and B complexes that are utilized by host animals
- Microorganisms protect ruminant against pathogens
- Microorganisms recycle ammonia gas into proteins

While herbivores provide the following favorable conditions for microorganisms

- Favorable pH (6.2 – 6.8) which maintained by saliva and continuous removal of volatile fatty acid.
- Low level of oxygen since most of these microbes are anaerobic.
- Enough moisture
- Macro minerals and some trace minerals in the rumen needed by microbe.
- Supply of readily fermentable carbohydrates such as sugar and starch
- Adequate supply of energy and nitrogen which enhances microbial activity
- Shelter

(b) Outline ways in which digestion in ruminants differs from that in non-ruminants. (08 marks)

The difference between ruminant and non-ruminant

Ruminants	Non-ruminants
Saliva contains lipase	Saliva lacks lipase
Have four stomach compartments	Have one stomach compartment
Saliva lacks amylase	Saliva contains amylase
Chew cud	Do not chew cud
Fermentation is possible due to the presence of rumen	Fermentation not possible
Contain bacteria that digest cellulose	Contain no bacteria for digestion of cellulose
Depend on volatile fatty acids for energy	Depend on glucose for energy
Most digestion and absorption occurs in the rumen	Most absorptions occur in the small intestines
Do not produce enzymes for protein digestion	Produce enzymes for protein digestion
Take long to digest to digest plant materials.	Take relatively short time to digest their food
Premolars and molars move lateral directions	Premolar and molars move in vertical direction
Have two blunt canines	Have four sharp canines
Long digestive canals	Short digestive canals
Have larger liver	Have smaller liver
Regurgitate.	Do not regurgitate.
Produce a lot of fecal material	Produce little fecal material
Examples: Herbivores (e.g., cattle, sheep, goats).	Examples Omnivores and carnivores (e.g., humans, dogs, swine).

5. (a) Explain the factors that influence the choice of pasture species to be planted in an area. (12marks)

- Type of soil (pH, drainage, fertility) – different pasture species survive on different soil type
- Topography – different pasture species prefer different topography
- Climate – drought resistant pasture are preferred
- Pest and disease resistance
- Presence of planting materials and/or seeds
- Cost of production – The farmer should make sure that the expense involved in pasture establishment can be met from the income of the animals.
- Grazing tolerance: it is important to select a species that can withstand the grazing habits of livestock
- Ability of species to survive winter conditions
- The type of livestock and their nutritional needs influence the choice of pasture
- Legume percentage in mix: including legumes in the pasture mix can improve soil nitrogen levels and provide a more balanced diet for livestock.
- Digestibility of pasture
- Palatability of the pasture species to intended livestock
- Ability to produce enough herbage

(b) Outline the signs that indicate the need to improve pasture. (08marks)

- Presence of poor unproductive pasture plant
- Poor conditions of the livestock (emaciated) grazing on the pasture
- Presence of large and undecayed plant residues that prevent water entry
- Livestock hunting for palatable pasture
- Wet areas containing marshy plants e.g. nut grasses
- Over growth of pasture hence becoming fibrous
- The pasture become stunted
- Development of bare patches in pasture
- Accumulation of parasites in pastures.

SECTION D (20MARKS)

AGRICULTURAL ECONOMICS

Answer **one** question from this section

6. (a) Giving an example in each case, explain the following product-relationships
(i) Joint products (02marks)

Joint products are the products that are produced as a result of a single production process. E.g. In oil industry **kerosene, gasoline, fuel oil, lubricants** etc. are all produced from the same product, crude petroleum.

(ii) Competitive products (02marks)

Are products that serve same consumer needs e.g. sodas

(iii) Complementary products (02marks)

They are products that are used together or add value to one another; e.g. a DVD and a DVD player, computer and a mouse.

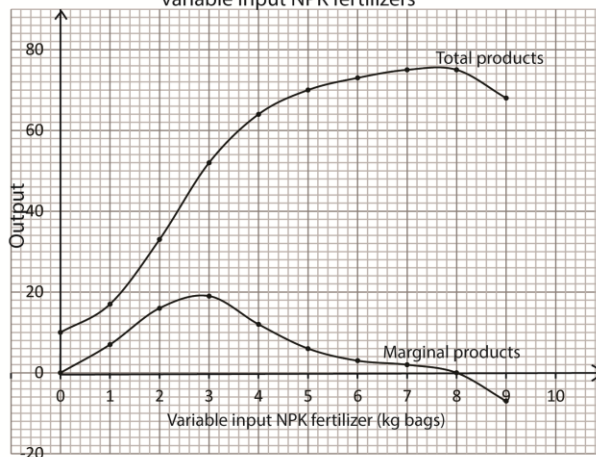
(b) The following table shows production of maize at various levels of nitrogen fertilizer application.

Fixed factor	Variable input NPK fertilizer (kg bags)	Total maize production (No. of bags, 90kg each)	Marginal product
1	0	10	0
1	1	17	7
1	2	33	16
1	3	52	19
1	4	64	12
1	5	70	6
1	6	73	3
1	7	75	2
1	8	75	0
1	9	68	-7

(i) Using the data calculate the marginal product. (05marks)

(ii) Plot a graph of Total and Marginal Product against the variable input. (05marks)

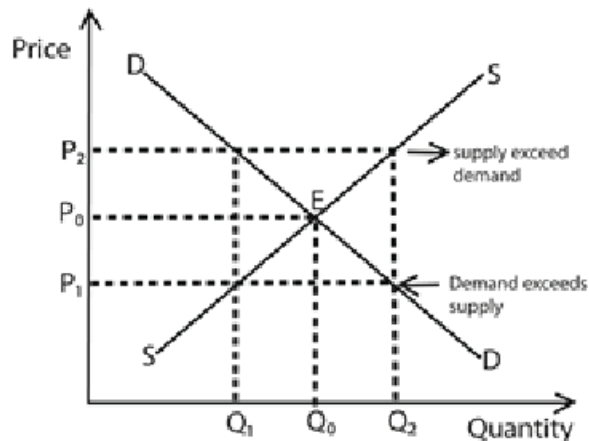
A graph of total and marginal products against variable input NPK fertilizers



- (iii) Explain the relationship between the Total and Marginal product curves. (02marks)
- From 0 to 3 bags both total and marginal product increase;
 - Beyond 3 bags marginal product decrease
 - Between 3 and 8 bags total product increase
 - Beyond 8 bags total product decreases.
- (iv) Using your graph, state when the law of diminishing returns begins to operate. (01mark)
At the 8th bag of NPK fertilizer
- (v) What is the importance of the knowledge of diminishing return in agricultural production? (01mak)
- To maximize labour and other factors of production to optimum level
 - To increase production efficiency by minimizing cost
 - To find out the most economical dose of nay variable resource to be applied

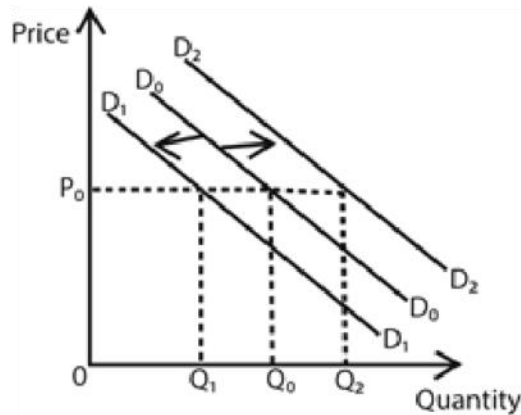
7. (a) With the aid of a labeled diagram, describe how prices of agricultural commodities are determined in a free and competitive market. (10marks)

Market price refers to the prevailing (ruling) price in the market at a given time. Market price is any price determined by the buyers and sellers in the market irrespective of whether quantity demanded is equal to quantity supplied at a given.



- .
- **Equilibrium price** (P_0) refers to the market price where quantity demanded is equal to quantity supplied.
- **Normal (natural) price** refers to the long run equilibrium price established in the market after a long period of price fluctuations.
- **Reserve price** refers to the minimum price set by the seller below which he is not willing to sell his commodity.

- (b) Illustrate how income of the consumer affects the amount of a commodity demanded other factors remaining constant. (10marks)



Provided the price remain unchanged, increase in consumer income increases the quantity demanded, i.e. the demand curve shifts to the right (from D_0D_0 to D_2D_2) and a decrease in customers' income lowers demand of commodity, i.e. the demand curve shifts to the left (from D_0D_0 to D_1D_1).

SECTION D (20MARKS)

AGRICULTURAL ENGINEERING

Answer **one** question from this section

8. (a) (i) Explain the meaning of seasoning in timber processing. (02marks)

Seasoning of timber is the process by which **moisture content in the timber is reduced to required level**

- (ii) Discuss the various methods of seasoning timber. (08marks)

- Air seasoning, which involves stacking the timber logs in layers in a shed and exposing them to air circulation.
- Kiln-drying, which uses a controlled temperature and humidity in a chamber to dry the timber quickly.
- Chemical treatment, which involves immersing the timber in water mixed with salt (urea, ammonium carbonate or other chemicals) to prevent decay and insect attack. And then dry them
- Heat treatment, which uses high temperature and low oxygen to modify the properties of the timber.

- Hot-air seasoning, which blows hot air over the timber to accelerate the drying process.
- Electrical seasoning that involves passing high-frequency alternating current through the logs of wood generating heat that dry timber.

(iii) State the advantages of seasoning wood. (06marks)

- Make timber easily workable and facilitate operations during conversion.
- Maintain the shape and size of the component of the timber article which is expected to remain unchanged in shape.
- Reduced weight, making it easier to carry
- Increased resistance to fungi and insects' damage
- Easy to polish and paint
- Increased strength and durability
- Easy to burn

(b) Outline the qualities of a good wood preservative. (04marks)

- Should be highly effective against fungi, insects and other damaging organisms
- Should have long lasting effects
- It should be compatible with other applications such as paint and vanishes
- Readily available
- Cheap
- Non-poisonous to people
- High penetrating power into wood to provide thorough protection

9. (a) Describe the characteristics of a good livestock house (12marks)

- Should have strong walls to reduce accidents to animals
- Should have concrete rough floor to reduce accidents of farmers from falling
- Should have a gently sloping floor for easy cleaning and draining.
- Should have a roof that is leak free to keep it dry
- Should have enough feed and water trough
- Should be well ventilated
- Should have walls high enough to accommodate animals
- Should be spacious to accommodate animals
- Should have a lockable door for security
- Should have enough litter to absorb moisture

(b) Outline the factors considered when designing a building for housing processing equipment. (08marks)

- It should be water proof to keep it dry and prevent damaging machines
- Should be well ventilated to facilitate aeration for easy cooling of machine
- Should have noise and temperature regulator
- It should be fitted with a fire extinguisher to safeguard it in case of fire outbreak.

- It should be spacious to accommodate the machinery and operator
- Should be strong enough to resist vibrations caused by the machine
- Should have stable power supply to run the machines
- Should have emergency exist in case of accident
- It should be easily accessible for transportation of produce

END

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Thanks

Dr. Bbosa Science