WINNERS ONLINE SCHOOL

2022 AGRICULTURE PRACTICAL TRAINING

BY

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ROUND 2

QUESTION 3 AND 4

AGRICULTURE PAPER II CONFIDENTIAL INSTRUCTIONS

QUESTION 3

- Provide the student with the following specimen each
  - Elephant grass marked **A**
  - Maize bran marked **B**

QUESTION 4

- Provide each student with the following
  - A piece of sugarcane labelled **P**
  - A piece of sweet potato vine labelled **Q**
  - Cassava tuber labelled **R**
  - Bean seed marked **S**
  - Two soil samples marked **Y and Z**

QUESTION 1

You are provided with soil samples labelled, **P, Q, R and S.**

(i) Name the specimens

P a sugarcane vine
Q is a sweet potato vine

R is a cassava tuber

S is bean seed

ii. Which plant materials are propagated by asexual

iii. Give any two advantages and disadvantages of asexual propagation?

iii. What is importance of including sample **S** in crop rotation

iv Mention one product that can be obtained from sample **R**.

v Mention one agro-based industry that process sample **S**

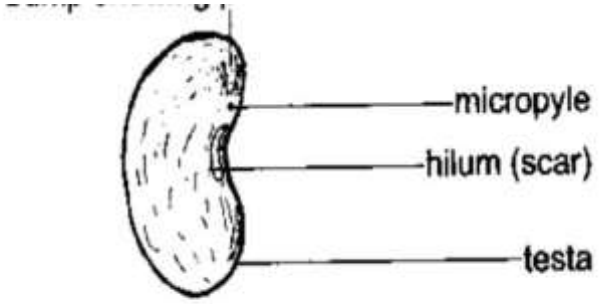
vi. State one marketing functions that can be performed in marketing of product **R**

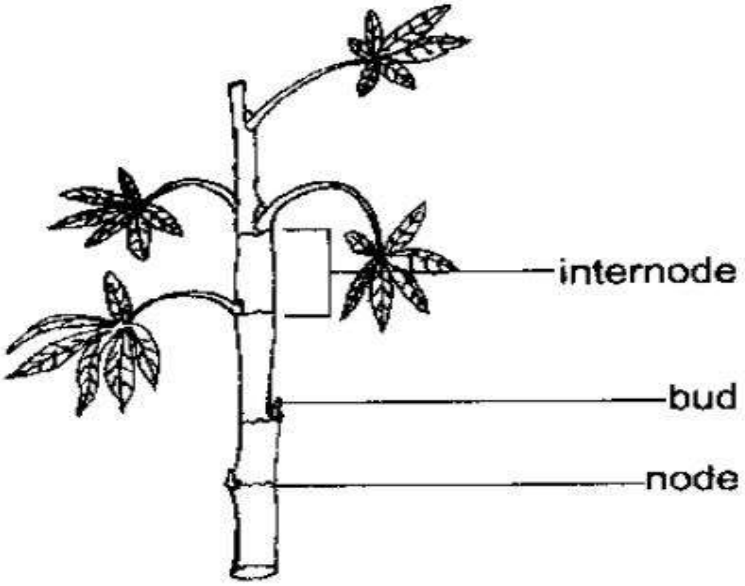
vii How do you understand by the word marketing margin

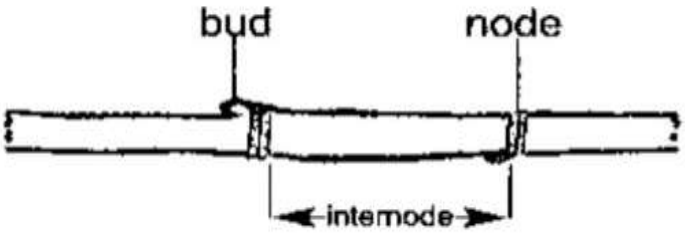
vii List two ways in which a farmer can reduce marketing margins of product **S**

viii Name type of vitamin found in sample **Q**

ix Prepare a planting materials from the specimens. Draw the prepared planting materials. On the diagram, label two parts that will show that the specimens have been prepared as a planting materials.







Xi Classify the specimens that can be propagated vegetativly into runners and cuttings

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Runners	Cuttings

QUESTION 2

You are provided with soil samples labelled**, Y and Z**.

(a) Name the specimens

= Y is sand soil and Z is clay soil

- Wet each of the soil samples with equal amount of water;
- Press a small amount of each soil samples between the thumb and forefinger;
- Open the fingers slowly;

(b) Complete the table below to indicate observation of each soil sample.

Soil sample	**How it feels**
X	
Y	

(c) Roll each of the wet soil samples between the palms of your hands to form a ribbon and complete the table below to indicate observation of each soil sample

Soil sample	**When rolls**
Y	
Z	

(d) Explain **two** ways in which the experiment is important in crop production

(e) **From question 1**. Which specimen can be grown in sample Y. Give the reasons for your answer

(f) Which soil sample would show very low Ph values after analyzed. Give a reason for the answer

(g) Outline **five** steps for determining soil pH using universal indicator

QUESTION 3

You are provided with two specimen of animal feeds labelled A and B

(a) Name the specimens

= A is Elephant grass and B is maize bran

(b) Classify the specimen into classes of livestock feeds.

(c) Give a reason why specimen A is **not** suitable feed for pigs.

(d) Mention the main nutrient that can be found in found in sample B

(e) Describe how a farmer can make hay from specimen A

(f) Describe any importance of specimen A in regards to soil conservation

QUESTION 4

A farmer growing 4 hectares of beans kept the following records

- Cost of 10 hoes at K300
- Cost of bean seeds at K5,000
- Cost of hiring a lorry to carry seeds at k2,000
- Cost of spraying Marathion at K1,500
- Cost of buying CP sprayer at K5,000
- Permanent labour, 8 people at K2,000 each per month worked for four months
- Casual labour K6,000
- The yield of shelled beans at 2,200 kg/hectare - The price of shelled beans at K60 per kg.
- Sale of bean haulms to compost manure making farmer K3,000

a. Calculate the gross margin

b. Find the profit

c. Why is gross margin important to a farmer?

INFLUENCE OF SOIL TEXTURE ON SOIL CHARACTERISTICS

Soil texture has an influence on some of the following characteristics:
infiltration (drainage), water holding capacity (water retention), aeration,
nutrient holding capacity, easy of cultivation, root penetration and capillarity.

(i) **SANDY SOILS**

(a) Well aerated since it has large particles which create large pore spaces between them.

(b) Well drained since percolation/infiltration is easy.

(c) Low nutrient holding capacity due to high rate of leaching.

(d) Low capillarity due to large individual pores.

(e) It is acidic in reaction due to high rate of leaching.

(f) Easy of cultivation and root penetration.

Sand soils have poor chemical properties but good physical properties.

(ii) **CLAY SOILS**

(a) Low aeration due to very narrow (tiny) pore spaces which also reduce drainage.

(b) Difficult to cultivate because it sticks to implements when wet or too hard to break when dry, hence described as heavy soils.

(c) High nutrient holding capacity due to low leaching levels.

(d) High capillarity due to small pore spaces.

Clay soils have good chemical properties but poor physical properties.

(iii) **LOAMY SOILS**

It has good combinations of sand and clay fractions and therefore the best or crop production because it combines the good physical properties of sand and good chemical properties of clay. Are best soils for crop production because they have moderate drainage, moderate fertility and slightly acidic.

EFFECTS OF SOIL TEXTURE ON CROP PRODUCTION

Soil texture determines soil type and soil type influences physical, chemical and biological properties of the soil, essential for crop production.

A soil with good texture (e.g. loam) has all the necessary requirements for crop production because:

(a) Plant roots and shoots are able to penetrate and grow with ease

(b) The soil is easy to cultivate at different moisture contents (consistencies).

(c) Soil is not easily eroded and this helps the nutrients to be retained. (d) It is able to supply nutrients to growing plants

(e) It is well drained and aerated.

(f) It retains water for plant growth.

Different crops grow well in different soil textures e.g.

- Tobacco grows well in well-drained sandy-clay loam soils.
- Maize thrives well in well drained loams.
- Vegetables do well in loam soils.
- Cotton grows well in rich sandy loams.
- G/nuts require sandy or light loams.
- Rice grows well in heavy clays which retains a lot of water.

Cassava can tolerate poor soils but grows well in well drained, rich and sandy loams

CHEMICAL PROPERTIES OF SOILS

Chemical properties of soils are soil pH or reaction, cation exchange capacity and salinity.

I. SOIL PH (soil reaction)

It is the term used to describe (express) the degree of acidity or alkalinity. The ions that determine the pH are the hydrogen (H^+) and the hydroxyl (OH^-) ions.

(a) **PH 7 means neutral** – the number of hydrogen ions (H^+) is equal to the number of hydroxyl ions (OH^-) ions in the soil.

(b) **PH > 7 indicates alkalinity** – the number of hydroxyl ions (OH^-) is greater than the number of hydrogen ions (H^+) ions. It also indicates high concentration of Ca^{2+} and K^+.

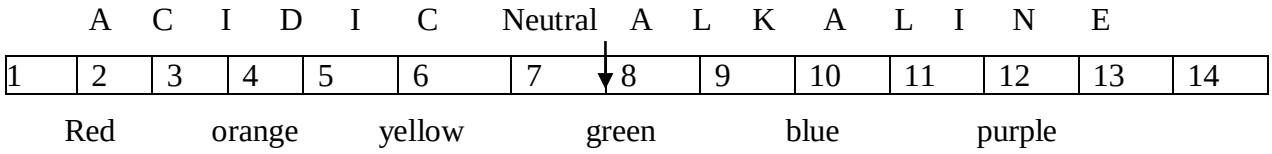
(c) **PH < 7 indicates acidity** – the number of hydrogen ions (H^+) is greater than the number of hydroxyl ions (OH^-).

MEASUREMENT OF SOIL PH

Soil pH can be measured by using

(a) **PH METER** - fastest and most accurate method of measuring soil pH.

(b) **UNIVERSAL INDICATOR** - which changes colour when mixed with a solution of soil in distilled water. The soil pH is determined by comparing the colour change with that on the colour chart. If the soil is acidic the indicator will turn red and will turn blue if the soil is alkaline or basic.



PROCEDURE

- Collect 5 to 10g of soil and grind it.
- Place finely ground soil in a test tube.
- Add barium Sulphate ($BaSO_4$) to break soil particles further.
- Add distilled water followed by few drops of universal indicator.
- Close the test tube and shake the contents vigorously.
- Allow contents to settle for an hour and observe color changes.
- Hold test tube against a colour chart and read off the pH.

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CAUSES OF LOW PH (ACIDITY)

Soil acidity is caused by the preponderance of hydrogen ions in the soil. The following are the factors that contribute to the soil becoming acidic:

(a) **Leaching** – heavy rainfall drains away some dissolved cations e.g. Ca^{2+}, Mg^{2+} and K^{+}. These elements are then replaced by hydrogen ions which increases soil acidity (lowers soil pH).

(b) **Use of acid-forming fertilizers** – continuous and heavy application of Sulphate of Ammonia makes the soil acidic. This is because when the

ammonium radical (NH_4^+) is taken up by the plant, hydrogen ions (H^+) from the soil combines with SO_4^- to form sulphuric acid (H_2SO_4).

(c) **Microbial activities** – microbial activity increases soil acidity as hydrogen ions are released during decomposition of organic matter. Also carbon dioxide produced by microbes dissolves in water and form carbonic acid which increases soil acidity (lowers soil pH).

(d) **Weathering of parent material** –soil acidity increases if the parent material contains sulphur through the formation of sulphuric acid. Soils formed from limestone have high pH (alkaline).

(e) **Nutrient uptake by plants** – plants absorb bases like K^+, Ca^{2+} and Mg^{2+}. These nutrients taken by the plants are replaced by hydrogen ions (H^+) causing the soil acidic unless they are replaced by fertilizers or let the plant residues decay in the garden

(f) **Poor drainage** – in waterlogged areas (e.g. marshy areas) there is high sulphur content (H_2S). If these soils are cultivated or drained oxidation occurs to form sulphuric acid. i.e.

H2S + O2 H2SO4. .

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IMPORTANCE OF SOIL PH IN

CROP PRODUCTION Some of the main effects of soil pH on plant growth include:

(a) Soil pH affects the availability of various nutrients from the soil to plants e.g. low pH lowers availability of phosphorus and molybdenum because they become fixed or immobilized through formation of less soluble iron or aluminium phosphates. At high pH, manganese, potassium, iron, boron and zinc become less available.

- At very low pH concentration of available iron and aluminum increase to toxic (injurious/poisonous) levels to crop.

(b) Soil pH affects the balance of different micro-organisms in the soil.

- Very low pH inhibits activities of nitrogen fixing bacteria hence soils contain low levels of nitrates.

- Low pH favors fungi hence fungal diseases e.g. club rot is common. Nematodes are also common under acidic conditions.
- High pH encourages bacteria hence bacterial diseases e.g. potato scab is common.

(c) Low pH causes disintegration of clay minerals which have high concentration of nutrients and this encourage leaching of nutrients e.g. calcium.

SEEDS AND PLANTING MATERIALS

Plant propagation is the way how species are perpetuated to future generations through use of their parts or seeds or fruits. The objective of propagation is to increase the number of plants and preserve the useful characteristics of the plants. Propagation can occur sexually through seed or asexually through the use of vegetative planting materials.

A. SEXUAL PROPAGATION

SEEDS

A seed is a mature ovule produced sexually. Sexual propagation is a type of reproduction in which male and female gametes unite to produce an offspring. Different seeds have different characteristics such as: color, shape and size. These characteristics help to tell the variety or type of seeds. Seed propagation is the commonest way of propagating self and cross-pollinated crops. **IMPORTANCE OF SEEDS** Food – seeds are food to man and other living organisms.

Protector of species – seeds are very means of survival. They carry germ-plasm protected against heat, drought and water. Dormancy mechanism plays a part in protection.

Propagator of species – multiplies particular species e.g. one plant produces over million seeds.

STRUCTURE OF LEGUME SEEDS

When a bean seed is soaked in water and broken into natural halves it shows the following parts:

(a) Funicle – a short stalk which attaches the bean seed to the inside of the pod. Food for developing seed passes through the funicle from the plant.

(b) Hilum – a black scar where the funicle was attached (appears when the seed is separated from the pod, after ripening.

(c) Testa – a seed coat (it forms protective covering for the embryo against mechanical injury and entry of pathogens).

(d) Micropyle - a tiny hole which allows air to pass through for respiration of the embryo.

(e) Cotyledon – a pair of seed leaves which contain the food for the developing embryo. Seeds with two cotyledons are called dicotyledonous (dicot) seeds e.g. beans, peas, cotton, tobacco and groundnuts.

(f) Radicle – A part of the embryo which forms the primary root (lies between the two cotyledons)

(g) Coleorhizae – is for covering radicle for protection.

(h) Plumule – the other end of the embryo which grows into young shoot i.e. the first leaves and the terminal or apical bud.

STRUCTURE OF CEREAL SEEDS

A maize seed is not a true seed. It is a fruit as the seed is fused with the inside wall of the grain:

(a) Fused pericarp and testa – is united fruit wall (pericarp) and seed coat (testa). Protects the delicate internal parts of the grain and is the bran left over after milling.

(b) Silk scar – a crease or depression showing the point of attachment to the silk. As an ovary (fruit) each grain is attached to a silk (pistil) which dries off when the grains ripen.

(c) Point of attachment to cob – seen as a remnant stalk at the base of the grain. It loosely or firmly attaches the grain to the cob.

(d) Endosperm – the floury part of the grain. It occupies most of the inside of the grain surrounding the embryo. It supplies food for energy for germination and development of the embryo. All seeds containing this part are called endospermic seeds e.g. all cereals and grasses.

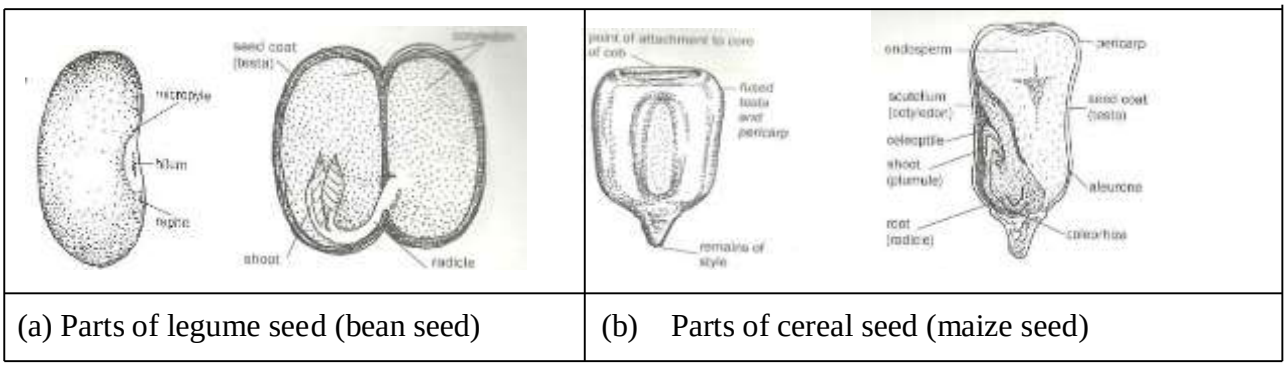
(e) Scutellum (Cotyledon) - a flattened, fleshy, shield-shape which forms the outer rim of the embryo, separating the embryo from endosperm. It is the only cotyledon of the grain hence such seeds are called monocotyledonous seeds (monocots).

(f) Radicle – develops into primary root.

(g) Coleorhiza – a protective sheath surrounding the radicle.

(h) Plumule – develops into shoots (first leaves).

(i) Coleoptile – a protective sheath surrounding the plumule. It protects the shoot as it pushes through the soil during germination and seedling emergence.



(a) Parts of legume seed (bean seed) (b) Parts of cereal seed (maize seed)

Fig. 3 : External and internal parts of seeds

ADVANTAGES OF SEXUAL PROPAGATION (PROPAGATION USING SEEDS)

(a) Seed is easy to carry about (i.e. not too bulky or heavy).

(b) Easy to store for long periods (subsequent seasons) and remain viable for long periods (without significant loss in quality and quantity).

(c) Possible to improve quality by cross-pollination. It provides a natural mechanism by which the characteristics of two different parents can be combined.

(d) The only way of propagating some crops that cannot be propagated vegetatively e.g. maize.

(e) Minimizes risk of transmitting disease or pests from parents to offspring.

(f) Can easily be sown mechanically using seed drills or hoppers.

(g) Easy to sow, handle and prepare for planting (h) It is cheap

DISADVANTAGES OF SEXUAL PROPAGATION

(a) Produce serious variations and off-types among the offspring (new plants). Do not produce plants that resemble parents.

(b) It requires long juvenile period before bearing fruits or seeds especially in tree (fruit) crops.

(c) It requires elaborate seedbed (land) preparation for sowing the seed.

(d) Some seeds do not produce high yield in the first season (e.g. in root /tuber crops).

B. ASEXUAL PROPAGATION

It is the production of new plants vegetatively without use of seeds (i.e. vegetative propagation). Main methods of vegetative propagation used in practice are: cuttings, grafting, budding, layering and use of storage structures (specialized plant parts).

I. GRAFTING

It involves joining a part of the plant (scion) to another plant (root stock) so that one can have good qualities of the different parents. The two parts must be from the same species and must have the same thickness so that the cambium layers are matched. The cut can be a slant or Vshape and union must be neatly fitted and taped. It suits cotyledonous plants because they undergo secondary thickening as opposed to monocotyledonous plants.

REASONS FOR GRAFTING

(a) Makes the growing of more than one type of fruit on one tree/plant.

(b) Facilitates the changing of the top of the tree from being undesirable to being desirable.

(c) Stocks with desirable root characteristics such as tolerant to water-logging are utilized.

(d) Helps to propagate clones that cannot be propagated by other means.

(e) Makes it possible to change variety that is no longer in demand.

(f) Used to repair damaged young/old plants.

Grafting success is influenced by: inherent compatibility of the plant, skill of the worker and environmental factors.

Grafting union is formed from intermingling and interlocking of callus tissues produced by the scion and stock cambium in response to wound. Callus

tissues differentiates to form new cambium which differentiates to form xylem and phloem hence provide connection between scion and stock

II BUDDING (BUD GRAFTING)

It is the transfer of a bud from one plant on to the other plant, where it develops into new shoots. A bud is carefully sliced off the branch of one tree. A patch or a T-shaped cut is made on the stem of another tree (root stock). The bud is carefully inserted into this cut and bound (tied) with twine (string) or tape.

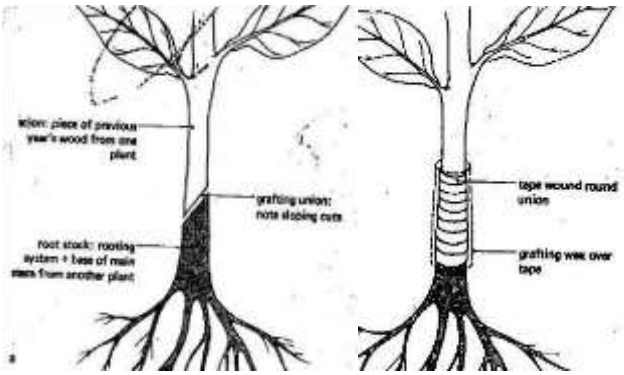


Fig. 5a : Grafting process

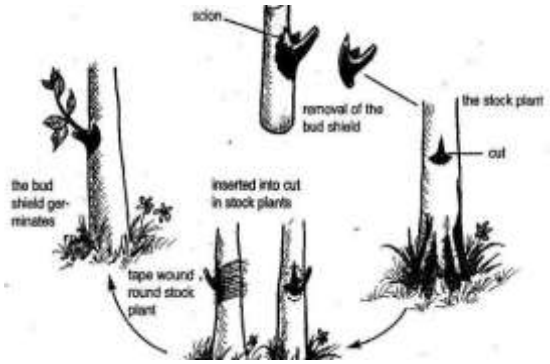


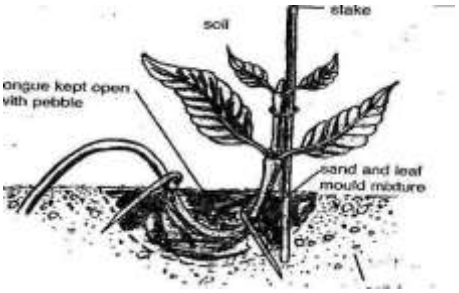
Fig. 5b Budding (Bud-grafting)

III. LAYERING

A branch of fruit tree or shrub is pegged down to the ground so that it develops roots for a new shoot while it is still attached to the plant. It is done when cuttings do not root easily. Method is common in cocoa, coffee and other tree crops. Where stems will not bend to the ground aerial layering is used. (fig. 6)

IV. CUTTINGS

Stem cuttings (setts) of sugarcane, cassava and Napier grass are used for propagating these crops. Cuttings are portions of plants (that have buds at each node) which are cut and used for multiplying the plant. The ability of stem cutting to root depends on the age of the plant, type and location of the stem and the time of the time of the year. (fig. 7)



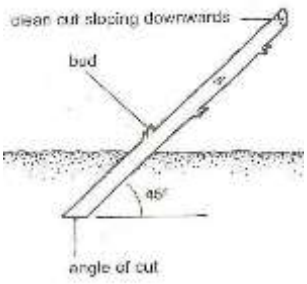


Fig. 6 : Layering

Fig. 7 : Cuttings

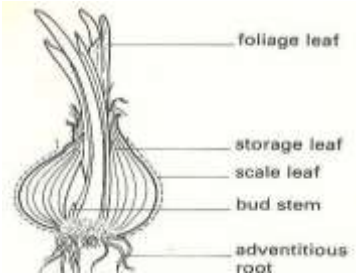
USE OF SPECIALISED PLANT PARTS

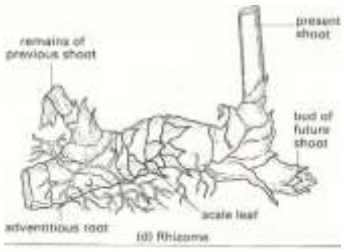
These include storage structures of crop e.g. bulbs, corms, suckers, rhizomes, tubers and runners.

(a) ***BULBS*** - Are storage organs of onions, tulips and garlic and is made up of closely packed, modified, fleshy leaves. Buds develop in the axils of the leaves that make up the bulb. New shoots develop from the buds, feeding on fleshy leaves of the bulb. The new shoots then separate from the parent plant, developing new roots from the base. It has very short stem to which attached fibrous adventitious roots (fig. 8a).

(b) **CORMS** - Are thickened (enlarged) base of vertical underground stems which stores food. A new shoot develops from the bud on the side of the parent corm. The stored food in the parent corm provides nutrients to the new shoot, e.g. coco-yams. Corms usually grow vertically (fig. 8b).

(c) **RHIZOMES** - Is a thick, horizontal underground stem. New shoots and roots develop (grow) from buds on the rhizome e.g. in bamboos (fig. 8c).





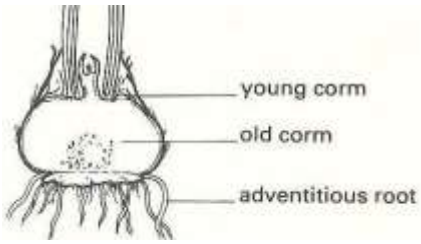


Fig. 8a : Bulb

Fig. 8b : Corm

Fig. 8c : Rhizome

(d) **SUCKERS** - A sucker is a shoot (tiller) arising from auxiliary bud at the based of the parent plant, e.g. bananas. Suckers are cut off or uprooted and planted elsewhere (fig. 8d)

(e) **RUNNERS** - Are stems which grow along the ground (above the soil surface). They have nodes from which roots and shoots develop e.g. in sweet potatoes, straw berries and stargrass (fig. 8e).

(f) **TUBERS** - Can be stem tubers (underground swollen portion of the plant which acts as storage organs e.g. Irish potatoes which has buds from which roots and shoots develop when planted or root tubers e.g. sweet potatoes. (fig. 8f).

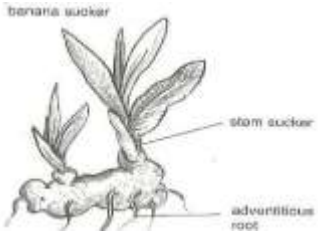


Fig. 8d : Sucker

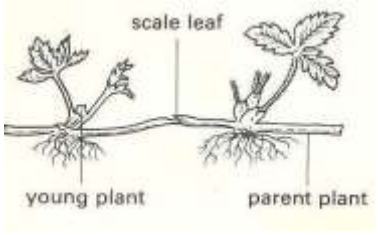


Fig. 8e : Runner

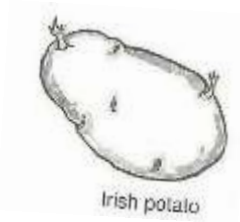


Fig. 8f : Stem tuber

ADVANTAGES OF ASEXUAL PROPAGATION

(a) Reduces juvenile period of the plant because vegetatively propagated materials assume the age of their parents plants. They mature earlier or start bearing or producing crop yield faster than in sexual propagation.

(b) Eliminates the problems of dormancy (common in some seeds) which needs seed treatments in order to germinate.

(c) Ensures genetic uniformity in crops i.e. all offspring resemble their parents.

(d) Makes propagation of crops whose seeds are not viable possible

(e) Vegetative organs are more hardy than seedlings from seeds (are able to withstand environmental hazards e.g. drought).

(f) Vegetative organs have sufficient food resources to help the young shoots to become established.

(g) Vegetative planting materials are readily available to the farmers from previous crop, eliminating the need to buy expensive seed each season.

DISADVANTAGES OF ASEXUAL PROPAGATION

(a) Risks of transferring pests/diseases to new plants are high.

(b) It is more difficult to introduce variation into the crop, making crop improvement difficult.

(c) Vegetative planting materials are bulky (heavy) compared to seeds hence high labor demanding.

(d) Difficult to store planting materials for future time.

Some of procedures in vegetative propagations (e.g. grafting, layering or budding requires skill/knowledge and are slow and tedious.

END OF ROUND 1 2022 CHEMISTRY PRACTICAL TRAINING QUESTIONS.