AGRICULTURAL SCIENCE

FOR

Senior Secondary School

1

AKADALEARN

S.S.S 1

AGRICULTURAL SCIENCE

FIRST TERM

Table of content

WEEK 1

Meaning of Agriculture

The term agriculture is derived from two Latin words 'ager' meaning field, and 'cultural' meaning cultivation. By this statement, agriculture means field cultivation. However, this is not a complete definition of agriculture since agriculture also has to do with animal production. Agriculture can be defined as the art and science that deals with cultivation of crops and the rearing of animals for man's use.

Importance of Agriculture to three groups of People

The importance of agriculture can be grouped into three categories:

A. To an individual or farmer

1. Provision of food
2. Provision of materials for shelter
3. Provision of materials for clothing
4. Employment for the working population
5. Generation of income for farmers.

B. To the society or community

1. Development of towns
2. Provision of facilities for recreation and tourism
3. Provision of market for industrial goods

C.To the nation

1. Sources of foreign exchange earnings
2. Generation of revenues
3. Provision of raw materials for industries

Scope or Branches of Agriculture

This simply means areas of specialization in agriculture, which includes the following:

1. Animal science / animal production / animal husbandry / animal nutrition
2. Veterinary medicine / animal health
3. Soil science
4. Crop science / agronomy / crop pathology / entomology
5. Food science / food technology
6. Horticulture
7. Forestry and wild life conservation
8. Wildlife and eco-tourism
9. Wood product
10. Apiculture (bee keeping)
11. Heli-culture (snail farming)
12. Fishery
13. Agricultural engineering and mechanization
14. Agricultural economics and farm management
15. Agricultural extension and education
16. Agric-business education and farm management
17. Agricultural technology

General Importance of Agriculture

For decades, agriculture has been associated with production of essential food crops. At present, agriculture above and beyond farming includes forestry, dairy, fruit cultivation, poultry, bee keeping, mushroom, arbitrary, etc. Today, processing, marketing and distribution of crops and livestock products etc. are all acknowledged as part of current agriculture.Thus, agriculture could be referred to as the production, processing, promotion and distribution agricultural products. Agriculture plays a critical role in the entire life of a given economy. Agriculture is the backbone of economic system of a given country. In addition to providing

food and raw material, agriculture also provides employment opportunities to very large percentage of population. Below are the importances of agriculture:

Source of Livelihood

The main source livelihood of many people is agriculture. Approximately 70 % of the people directly rely on agriculture as a mean of living. This high percentage in agriculture is as a result of none development of non-agricultural activities to absorb the fast growing population. However, most people in developed countries do not engage in agriculture.

Contribution to National revenue

Agriculture is the main source of national income for most developing countries. However, for the developed countries, agriculture contributes a smaller per cent age to their national income.

Supply of Food as well as Fodder

Agricultural sector provides fodder for domestic animals .Cow provides people with milk which is a form of protective food. Moreover, livestock also meets people's food requirements.

Significance to the International Trade

Agricultural products like sugar, tea, rice, spices, tobacco, coffee etc. constitute the major items of exports of countries that rely on agriculture. If there is smooth development practice of agriculture, imports are reduced while export increases considerably. This helps to reduce countries unfavorable balance of payments as well as saving foreign exchange. This amount may be well used to import other essential inputs, machinery, raw-material, and other infrastructure that is helpful for the support of country's economic development.

Marketable Surplus

The growth of agricultural sector contributes to marketable surplus. Many people engage in manufacturing, mining as well as other non- agricultural sector as the nation develops. All these individuals rely on food production that they might meet from the nation's marketable surplus. As agricultural sector development takes place, production increases and this leads to expansion of marketable surplus. This may be exported to other nations.

Source of Raw Material

The main source of raw materials to major industries such as cotton and jute fabric, sugar, tobacco, edible as well as non-edible oils is agriculture. Moreover, many other industries such as processing of fruits as well as vegetables and rice husking get their raw material mainly from agriculture.

Significance in Transport

Bulks of agricultural products are transported by railways and roadways from farm to factories. Mostly, internal trade is in agricultural products. Moreover, the revenue of the government, to a larger extent, relies on the success of agricultural sector.

Foreign Exchange Resources

The nation's export trade depends largely on agricultural sector. For example, agricultural commodities such as jute, tobacco, spices, oilseeds, raw cotton, tea as well as coffee accounts for approximately 18 % of the entire value of exports of a country. This demonstrates that agriculture products also continue to be important source of earning a country foreign exchange.

Great Employment Opportunities

Construction of irrigation schemes, drainage system as well as other such activities in the agricultural sector is important as it provides larger employment opportunities. Agriculture sector provides more employment opportunities to the labor force that reduce the high rate of unemployment in developing countries caused by the fast growing population.

Economic Development

Since agriculture employs many people it contributes to economic development. As a result, the national income level as well as people's standard of living is improved. The fast rate of development in agriculture sector offers progressive outlook as well as increased motivation for development. Hence, it aids to create good atmosphere for overall economic development of a country. Therefore, economic development relies on the agricultural growth rate.

Source of Saving

Development in agriculture may also increase savings. The rich farmers we see today started saving particularly after green revolution. This surplus quantity may be invested further in the agriculture sector to develop the sector.

Food Security

A stable agricultural sector ensures a nation of food security. The main requirement of any country is food security. Food security prevents malnourishment that has traditionally been believed to be one of the major problems faced by the developing countries. Most countries rely on agricultural products as well as associated industries for their main source of income.

Assessment

1. Api culture has to do with _____

2. Heliculture means _____

3. What part of Agriculture deals with enlightening farmers on the use of technology ____

4. _____ is the pratice of garden management and cultivation

5. Explain extensively two importance of Agriculture

6. Define Agriculture?

Answers

1. Bees – rearing of bees
2. Snail farming
3. Agricultural extension and education
4. Horticulture
5. a. Provision of food b. Generation of revenues
6. The term agriculture is derived from two Latin words ‘ager’ meaning field, and ‘cultural’ meaning cultivation.

Week: 2

Topic: Subsistence and Commercial Agriculture

Subsistence Agriculture

This can be defined as a system of farming whereby a farmer cultivates crops and rears animals in order to produce food for consumption of himself and his family only.

Characteristics of Subsistence Agriculture

1. It is practiced by peasant farmers.
2. It involves small plot of land.
3. It involves the use of crude tools.
4. It employs unskilled labour.
5. There is no specialization.
6. Food crops are produced.
7. Does not involve any marketing.

Commercial Agriculture

Commercial agriculture is defined as the type of agriculture which is concerned with the production of food, animals and cash crops in large quantities for sale.

Characteristics of Commercial Agriculture

1. It involves large / huge capital.
2. It employs skilled labour.
3. Cash crops are produced.
4. Requires organized market.
5. Records are kept.
6. Mono cropping is practiced.
7. There is specialization.

Differences between Subsistence and Commercial Agriculture		
S/N	**Subsistence Agricultural**	**Commercial Agriculture**
1.	Yields or returns are low.	Yields or returns are high.
2.	Pests and diseases are not controlled	Pests and diseases are controlled.
3.	Produce is mainly for family consumption.	Produce is mainly for sale or export.
4.	Low environment degradation.	High environment degradation.
5.	No need for storage and processing facilities.	Storage processing facilities are required.

ASSESSMENT

1. What is the difference between Subsistence and Commercial farming?
2. Mention 3 characteristics of commercial Agriculture

ANSWER

1. Subsistence farming can be defined as a system of farming whereby a farmer cultivates crops and rears animals in order to produce food for consumption of himself and his family only while Commercial farming is defined as the type of farming which is concerned with the production of food, animals and cash crops in large quantities for sale.

2.

- It involves large / huge capital.
- It employs skilled labour.
- Cash crops are produced.

Week: 3

Topic: Problems of Agricultural Development in Nigeria and Possible Solutions

Introduction

Nigeria is one of the most highly blessed nations in Africa. That she has not been able to solve, even her own problems of food and agricultural development is a matter of very great concerns. Anyhow, if you would like to be on the full know of the major problems of food production in Nigeria, and then you have come to the right source.

1. **Land Tenure Problem** – Land is needed for agriculture and many lands in Nigeria are owned via land tenure. Many Nigerians who want to go into agriculture gets discouraged as a result of the laws embedded in Land tenure systems in Nigeria.

2. **Unavailability of Basic amenities** – Many of the basic amenities needed for agricultural practices are not available to farmers and these have hindered the development of agriculture to a large extent. These things may seem simple and mundane but they help farmers and other farm workers and also they help prevent the migration of people to cities. Examples of these amenities are: television viewing centres, good roads, electricity, telephone, standard schools. Functional health centres etc. Availability of these amenities will prevent low agricultural production, migration of people to cities and unemployment of able bodied persons.

3. **Poverty** – In today's Nigeria, one of the major problems of Agricultural development is poverty. On the other hand, one of the simplest and a doubtless truth that you can easily know about Nigeria is the fact that over 75% of her rural dwellers are full-time farmers. Another doubtless truth that you can also discover there is that Nigeria's present inability to, even solve her own problems of food and agriculture, is not as a result of her peoples' laziness; or say a matter of the nation being naturally unblessed. Nigerian farmers and Nigerians in general are really hard-working and industrious. A very great variety of delicious species of organic foods, fruits, vegetables and cash-crops abound in the country. In fact, the nation is so highly blessed, and there are very large acres of fertile agricultural lands all around the country.

4. **Ignorance –** Nigeria of today is a country where agriculture is still greatly and relatively undermined; and or even over-looked as a mere "back-yard business ". Some Nigerian youths even regard farming as:" an odd job that is meant only for the illiterate rural people ". In the eyes of some of Nigeria's wealthy class, farming is ignorantly underrated or abhorred as: "poor peoples' job ". The very worst is that the governments in Nigeria are, pretentiously doing very little or nothing in terms of solving the nation's food and agricultural problems.

5. **Use of Manual/Crude Farm Tools and Methods** – Do you know that the average Nigerian farmer is still making use of only the same out-dated manual farm tools – like cutlass and hoe – as their fore-fathers used since many centuries ago? Do you also know that instead of using some affordable modern agricultural techniques or simple machines; the farmers in that part of the world have changelessly, adhered to various archaic agricultural methods and practices that were copied from their ancestors? In short, their use of these kinds of archaic and out-dated tools and techniques constitutes a very great set-back in the country's food and agricultural out-puts.

6. **Poor Financing** – This is another major factor hindering the development of Agriculture in Nigeria. Due to lack of proper financing, many farmers are limited to subsistence farming instead of venturing into commercial farming and thus are not able to achieve the full potential of Agriculture. Lack of finance makes the farmers poor and they are unable to secure collateral they can use to obtain loans. They are not able to access credit facilities and thus cannot grow in this area.

7. **Lack of Food storage facilities** – Many delicious and juicy fruits, vegetables, and cash-crops are largely produced from Nigeria's local farming communities. But, do you know that a very great percentage of these delicious organic farm produce often get damaged and, or wasted before they reach their final consumers? In this kind of a situation, one of the major problems that are facing the helpless local farmers there is lack of adequate food storage or processing facilities.

8. L**ack of modern farm machines /techniques –** Another major problem of Nigeria's food and agriculture is lack of modern farm machines or techniques. As I stated earlier, the farmers in Nigeria are still making use of ancient agricultural tools / techniques; whilst there are low-cost modern farm machines / techniques out there for use as better substitutes.

9. **Lack of scientific & technological know-how** – In Nigeria, scientific and technological know-how is relatively very low. Many schools here in Nigeria do not even have science laboratories. Hence, a great majority of students there rather theorize sciences than practicalize them. In fact, this problem of Nigeria's under-development in science and technology often leave the country to depend largely on importation. And this equally, is part of the major problems and challenges of the country's food and agricultural developments.

10. **Disorganization and Unaccountability** – Organization and accountability is one of the basics of better and successful management. But, till this age of modernization and civilization, Nigeria is still internally disorganized. She lacks, even a valid and a well-organized documentations of her citizens or properties or marriages or births or deaths. In the same vein, a majority of farms there in Nigeria lacks organization or records and accountability. Some farmers there are merely planting without any sort or kind of

a farm records or organization; or measurements or, at least; an account for an easier identification of the possible reasons behind their agricultural gains or losses.

11. **Impact of Imported Foods** – Nigeria is a net importer of food. The country does not produce enough food to meet the demand of its people. This produces a lot of problems with regard to agricultural development. Generally, there is less incentive for local farmers to grow local foods, when cheaper, more palatable foods are imported. This forces local farmers to reduce prices, which reduces the income generated by the farm. The consequence is decreased farm production. To combat the effects of imported food on development, several initiatives are suggested, including providing farmers with micro-credit that is subsidized and increasing tariffs on imported food.

12. **Lack of Investment** – The problems of agriculture in Nigeria are also caused by a lack of investment. The government budget for agriculture is not enough to meet the challenges. International aid groups have supplemented the funding of the government, but most of the funds don't reach the local farmer.

13. **Lack of Leadership and Neo-colonialism** – One of the most serious of all the major problems of food and agriculture in Nigeria is lack of leadership. Mismanagement; corruption and embezzlement of public funds are very common within Nigeria's government officials. And as you know, patriotism; trust, honesty; organization and careful management has often led the
success and prosperity of modern man.

14. **Illiteracy** – The greatest number of dedicated full-time farmers in Nigeria can neither read nor write. The local farmers there are even as uninformed as they lack modern agricultural education. The climax of illiteracy there, is Nigeria's total negligence and, or her non-usage of native languages in the nation's pursuits for modern education. For in this modern world, people that still studies in foreign languages have not really started learning. And this level of illiteracy and unawareness do often constitute some serious set-backs, even in Nigeria's food production efforts.

15. **Soil Infertility** – The problems of agriculture in Nigeria begin with the soil. Most of the farmable land in Nigeria contains soil that is low to medium in productivity. According to the Food and Agriculture Organization of the United Nations (FAO), with proper management, the soil can achieve medium to good productivity. The main problem that affects soil fertility is soil erosion. Wind erosion, in particular, is quite damaging. Overtime, strong winds expose seedlings and crop root systems by blowing away loose, fine grain soil particles. Another effect is the accumulation of soil particles in drifts, which can cover crops. Also, wind erosion changes the texture of the soil. The particles responsible for water retention and fertility, such as clay, silt, and organic matter are generally lost, leaving behind a sandy soil. Wind erosion can be greatly reduced by planting trees near farming areas. The trees will absorb most of the wind, which will prevent the loss of soil particles. Another type of erosion that affects fertility is water erosion. There are two types of water erosion: splash erosion and rill erosion. Splash

erosion occurs when rain drops impact the soil, and rill erosion occurs when channels of water carry soil downstream. Water erosion is reduced when the soil is covered with a canopy. Also, improving the soil structure by adding organic matter greatly reduces water erosion.

Possible Solutions to Agricultural Development Problems

1. **Good Leadership** – One of the ways to solve Nigeria's Food and Agricultural Problems is by having an Honest-Minded, Patriotic and Caring Leadership whose utmost priority is for Nigeria to be able to produce its own food instead of importing always. For the over-all Nucleus of Nigeria's decades in problems is LEADERSHIP. Any real and lasting solution to the problems of Food and Agriculture in Nigeria can only be Possible under an uncorrupt and caring leadership. Situations where public funds meant for other things are embezzled only add to the problems of the nation.

2. **Agricultural Education of Farmers** – Government should introduce a FREE and Affordable Modern Agricultural Education Programs for Farmers in Nigeria's Rural Communities. Farmers should be enlightened on the use of modern equipment and technologies. Using this kind of Agricultural Education Programs can even help to organize the Local Farmers into Reachable Farmers' Co-Operative Union.

3. **Provision of Mechanized Farming Equipment** -Farm machines and simple farm equipment is another powerful solution to her problems of food and agriculture. This is very important because the local farmers there in Nigeria are still using crude equipment such as cutlass and hoe for Agricultural practices. Government can give farmers this equipment at a subsidized rate. Examples of such equipment are – Tractor, Plough, Harrow etc.

4. **Funding** – The Average Nigerian Local Farmers are not just facing the hardships and challenges of poverty, they also have little or no funds to expand their farm potentials. Agricultural funds really need to be made available for these farmers as this is still part of the most effective solutions to the nation's food and agricultural development. Another plus to funding is to provide these farmers with Hybrid seeds and simple agricultural machines at subsidized rates.

ASSESSMENT

1. Discuss in details 4 problems of Agricultural development

2. State 2 possible solutions to Agricultural development problems.

ANSWER

- **Land Tenure Problem** – Land is needed for agriculture and many lands in Nigeria are owned via land tenure. Many Nigerians who want to go into agriculture gets discouraged as a result of the laws embedded in Land tenure systems in Nigeria.

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Week: 4

Topic: Roles of Government and Non-Governmental Organizations in Agricultural Development

The roles of government in agricultural production include;

1. **Formation of and execution of policies**

A key role of the government is the formulation and execution of plans, as well as defining the aims and objectives of the agricultural sectors of the economy.

2. **Provision of physical infrastructure**

The building of roads and bridges which forms a link to markets, provision of electricity, pipe – borne water, crop storage facilities and other physical infrastructure which aid agricultural production, directly or indirectly.

3. **Granting of loans, credits and subsidies**

Loans, credits and subsidies are continually needed for agricultural production. Loans are money lent to farmers with the signed agreement that they will pay back at later dates. Credits refer to seeds, agro chemicals and materials which farmers are allowed to take immediate possession of with the understanding that they will make more repayments at later dates. Subsidies are money granted on behalf of farmers to partly pay the costs of certain agricultural inputs.

4. **Setting-up of schemes, bodies and other official organs which aid agriculture**

Various agricultural Programmes such as farm settlement schemes and agricultural development projects and bodies such as marketing boards, as well as organs such as agro service centers are established to render a wide range of services to agriculture.

Other roles of government are; Provision of social infrastructure, harnessing of natural resources to service agriculture, solving agricultural problems of multidimensional nature etc.

Government Agricultural Programmes

1. **Farm settlement schemes**

Farm settlement schemes are government projects where large tracts of land are exclusively reserved for farming. The fundamental aim of farm settlement schemes is to provide opportunity for settlers to farm without distraction, allow beneficial interaction and permit them to be able to jointly solve mutual problems encountered in farming.

2. **Co- operative Farming**

A farmer's cooperative society is a formal association of farmers existing for the purpose of mutual cooperation among themselves in matters relating to farming.

3. **Farm Insurance Scheme**

The farm insurance scheme is a means of protecting the investment of farmers in the farms.

4. **Operation Feed the Nation**

The federal government of Nigeria which was in power between 1976 and 1979 executed a programme called Operation Feed the Nation (OFN).

Other government agricultural Programmes are; Green Revolution (GR) and River Basin Development Authorities (RBDAS).

Non-Governmental Organization

Organizations which are not created or controlled by governments or business concerns are referred to as non – governmental organization (NGO). Some NGOs whose activities have been quite remarkable in recent years are;

1. **West African Rice Development Agency (WARDA)**

The West Africa Rice Development Agency (WARDA) is an information research organization with headquarters in Bouake, Cote d'Ivoire. The mandate of WARDA is to improve the capability of the West African region in rice production. This organization conducts researches aimed at developing better rice varieties and improving the management of natural resources in rice production.

2. **International Institute of Tropical Agriculture**

The International Institute of Tropical Agriculture (IITA) is based in Ibadan, Nigeria. IITA conducts researches in various aspects of crop husbandry, plant breeding, plant protection, soil science and to some extent, agricultural engineering. Its main crops of focus are maize and cassava.

3. **International Livestock Research Institute (ILRI)**

The International Livestock Research Institute (ILRI) formally known as International Livestock Center for Africa (ILAC) is headquartered in Addis – Ababa, Ethiopia. Overall, ILRI investigates livestock production systems in Africa with emphasis on ruminant livestock. It aims at improving the capability of Africans in the production of meat, milk and other animal products.

4. **International Crop Research Institute for the Semi-arid Tropics (ICRISAT)**

This is based in Patancheru, Andhra Pradesh, in the Asian nation of India. The mandate of ICRISAT is to improve the quantity and reliability of food production in the semi-arid tropics.

ASSESSMENT

1. State 4 roles of Government in Agricultural Development?
2. List 2 Government Agricultural Programs?
3. List 2 Non-Governmental Agricultural Programs?

ANSWER

1.

- Formation of and execution of policies
- Provision of physical infrastructure
- Granting of loans, credits and subsidies
- Setting-up of schemes, bodies and other official organs which aid agriculture

2.

- Co- operative Farming
- Operation Feed the Nation

3.

- West African Rice Development Agency (WARDA)
- International Livestock Research Institute (ILRI)

WEEK 5

TOPIC: ROLES OF SCIENCE AND TECHNOLOGY IN AGRICULTURE

Introduction

Science and Technology has played an important role in the development of agriculture in many countries. These roles are:

1. **Implements and Machinery** – Science and technology has aided the development of implements and machineries such as tractor, harrower, milking machines, seed planters, shellers, planters to replace crude tools such as hoe, cutlass, rake and shovel. These implements help farm operations to be easier and faster.

2. **Pests and Disease control** – Through the aid of Science and Technology, chemicals like insecticides, pesticides, avicides, fungicides, nematicides and fumigants have been developed to combat against problems caused by pests and other disease causing pathogens such as bacteria, virus et.c

3. **Animal and Plant Breeding** – Various breeds of animals and varieties of plants have been developed through the application of genetics and cross breeding. As a result of these, plants with exceptional characters are now developed. Plants and animals now exhibit early maturity, high yield resistance to pest and diseases and other traits specifically required by the farmer.

4. **Animal Nutrition** – Feeds have been formulated to meet the nutritional demands of animals in order to enhance rapid growth and maturity.

5. **Transport Network** – The transport network has been developed through the construction of roads, railways, waterways, ship and airways. All these transportation channels have aided the movement of farm produce from rural to urban areas at a great speed including exportation.

6. **Processing Machines** – Science has helped to develop special machines like incubators, milking machines, grinders, millers, shellers which have made the processing of food easier and faster within a short period.

7. **Weather and Climate** – With the help of Science and Technology, Farmers have been able to understand the weather and climatic condition of their area, and by so doing, helps them to understand the type of crop to be grown at a particular season in a particular area.

8. **Development of Fertilizer** – The development and application of fertilizers have helped to increase crop yields. Through the help of science and technology, farmers have been

able to know and determine soil fertility level before planting. They are also able to determine nutrient deficiencies, organic matter content, water holding capacity e.t.c and the type of crop that can do well on a particular soil

9. **Farm Building and Structure** – Technology has helped the farmer in designing and constructing farm houses, farm structures like poultry houses, pig pens and cattle pens for livestock animals. Farm storage structures like barns and silos are equally built.

10. **Development of Irrigation Practices** – Science and Technology has also helped to develop irrigation practices in which water is applied to the soil artificially, especially during the dry season.

11. **Provision of Storage Facilities** – Science and Technology has also develop storage facilities for the preservation of harvested products. e.g. Silos

12. **Development of Farm Management System** – Improved farm management systems have also been developed with the aid of science and technology e.g crop rotation and mixed farming.

ASSESSMENT

1. Explain 5 roles of Science and Technology in Agriculture

ANSWER

1.

- **Implements and Machinery** – Science and technology has aided the development of implements and machineries such as tractor, harrower, milking machines, seed planters, shellers, planters to replace crude tools such as hoe, cutlass, rake and shovel. These implements help farm operations to be easier and faster.

- **Pests and Disease control** – Through the aid of Science and Technology, chemicals like insecticides, pesticides, avicides, fungicides, nematicides and fumigants have been developed to combat against problems caused by pests and other disease causing pathogens such as bacteria, virus etc.

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- **Transport Network** – The transport network has been developed through the construction of roads, railways, waterways, ship and airways. All these transportation channels have aided the movement of farm produce from rural to urban areas at a great speed including exportation.

WEEK 6

TOPIC: Agro Allied Industries and Their Relationship With Agriculture

Introduction

Agro-Allied industries are industries which depends on Agriculture for their raw-materials so as to operate successfully in the production of finished goods that are useful to animals and humans. They are industries whose primary raw materials are agricultural products. Agriculture provides vital resources and raw materials to the industrial sector.

Relationship between Agriculture and Industry

1. Agriculture provides food for industrial workers.
2. Industries produce machinery and equipment for agricultural uses e.g. tractors, ploughs, cutlass, hoes, etc.
3. Agriculture can provide market for industrial products e.g. farm machinery, chemicals, fertilizers, etc.
4. Agriculture and industry compete for labour.
5. Rise in agriculture income due to good management can also bring about good development in the industrial sector.
6. Industries provide a large range of products that the farmer wants to buy.
7. Agriculture provides raw materials for industries.
8. Industries produce agro-chemicals for agriculture uses e.g. pesticide, fertilizers, vaccines, herbicides, etc.
9. Industries provide storage facilities for agricultural produce like milk, fruits, meat stored in silos, cans.
10. Agriculture also allows a shift of factors of production like land to industries.

Agro-based Industries	**Raw Materials Used**
Beverage Industry	Coffee,cocoa and tea
Soap industries	Oil seeds/oil
Feed mill	Cereal and grains
Tyre industries	Rubber latex
Sugar industries	Sugar cane
Paper industries	Pulp wood

Starch industry	Cassava and maize
Breweries	Cereals
Textile and Gunnery	Cotton
Tobacco industry	Tobacco leaves
Fruit canning industry	fruits
Oil milling industry	Oil seed

ASSESSMENT

1. What is the relationship between Agriculture and Industry?
2. Mention 5 agro-industries and their products.

ANSWER

1.

A. Rise in agriculture income due to good management can also bring about good development in the industrial sector.
B. Industries provide a large range of products that the farmer wants to buy.
C. Agriculture provides raw materials for industries.

2.

Agro-based Industries	**Raw Materials Used**
Beverage Industry	Coffee, cocoa and tea
Soap industries	Oil seeds/oil
Feed mill	Cereal and grains
Tyre industries	Rubber latex
Sugar industries	Sugar cane

WEEK 7

TOPIC: AGRICULTURAL LAWS AND REFORMS

Introduction

This area is concerned with the laws guiding the acquisition and utilization of agricultural lands.

LAND TENURE SYSTEMS IN WEST AFRICA

This is the system whereby certain rights are assigned to the use of particular pieces of land. In Nigeria, rights to the use of land can be defined as the systems of land ownership by individual or by status or Act of parliament. Land tenure can also be defined as the systems of land ownership by individual or community either for temporary or permanent use.

It can be broadly classified into
1. Communal ownership
2. Inheritance
3. Individual
4. Leasehold
5. Rent
6. Gift
7. Free hold
8. Tenant at government will.

Communal Land Tenure System: This is the system where land belongs to community. The community may be made up of families, tribe, clans, villages, etc. the head of the community can be a Chief, an Oba, Obi, Emir, Obong or a Baale. The head of the community decides the basis of sharing out land. Every adult (especially male) member of the community is allocated a piece of land. Land is usually shared for farming purpose at the beginning of each planting season.

Advantages
1. Every adult member of the community an acquire land and each person has full right to the land allotted to him.
2. It is cheap to acquire as no cost is involved.
3. It is ideal for large scale farming.
4. Farmers' cooperatives may be easily organized.

Disadvantages

1. Non-indigenes of the community cannot acquire land or have access to it.
2. Permanent crop cultivation is not accepted because land is allotted for only a farming season.
3. Scale of land is not allowed.
4. Mechanized farming cannot be practiced without permission of the whole community.
5. Allotted land can be revoked by a new leader.
6. Land cannot be used as a collateral for loan except when the community approves it.
7. The area of land allotted depends upon the size of the population.
8. Unmarried women may not be allotted land.

Individual Land Tenure: This is a system of ownership where the land can be acquired by an individual either male or female.

Advantages

1. Male or female can acquire any size of land based on the financial resources available
2. Both permanent and arable crops can be cultivated.
3. The owner has authority as to how the land is used.
4. There is no discrimination as to tribe or state of origin in the process of acquiring land.
5. Land can be used as a collateral for loan.

Disadvantages

1. Only the rich may acquire land at certain areas.
2. Land acquired through this process may not be used for agricultural activity.
3. Land may be acquired in fragments

Inheritance Tenure System: This is a system where a piece of land can be acquired at the death of one's parent, hence, land can also mean a system of transferring land from parents to offspring from one generation to another.

Advantages

1. This is the most readily available tenure system open to farmers.
2. Permanent plants can be cultivated e.g. oil palm, cocoa, rubber, kola, etc.
3. Land can be used as collateral in obtaining loan from banks.
4. Children yet unborn are provided for e.g. like in the Benin Empire where Oba's children are

provided for.
5. Legitimate and illegitimate children have access to land.

Disadvantages
1. It leads to land fragmentation i.e. small scattered portions of land.
2. Size of land allotted may not be suitable for commercial agriculture.
3. Sharing of land is not easy as bitterness may be generated among family members.
4. In some families, scale of land is not acceptable because this will deprive future generations of their inheritance.
5. Women are often not listed as the beneficiaries during land allocation except where the deceased has no male child.
6. Ownership is sometimes difficult to determine, especially in polygamous families where every first born male child is a head.

Leasehold Tenure System: This is a contract existing between a person called the leasor and another called the leasee for the lease of a piece of land for a specified period of years, which may be twenty-five years, fifty years or ninety-nine years. The leasee will exercise his right on the use and maintenance of the land for the period of lease.

Advantages
1. An agreed sum of money is paid for the period of lease.
2. It allows the farmer to have maximum use of land.
3. It is available for permanent crop cultivation.

Disadvantages
1. The farmer cannot develop the beyond the lease agreements terms.
2. Land on leases cannot serve as security for loans.
3. A lease agreement of less than fifty years is not ideal for permanent crop cultivation.

Gift Tenure System: This is a system in which a piece of land is given out by a person voluntarily to another for the good work done by that person. Gift land can be between individuals, government and her citizens or communities in an area.

Advantages
1. New owner can make maximum use of the land for production purpose.
2. Land on gift is irredeemable.
3. Permanent crops and keeping of animals are acceptable.
4. It can be used to source for loan from financial institutions.

Disadvantages
1. Land may be given out unwisely and this can cause serious disagreement between the offspring and the beneficiary.
2. Where land is given out by government and is not backed by proper documentation, it can be retrieved.
3. The true ownership can be challenged and revoked by a court order.

Rent Tenure System: This is a system whereby a tenant pays some amount for the period of using the land to a stated landlord. The period of rent is relatively very short compared to leasehold systems.

Advantages
1. It is ideal for food crop production.
2. The farmer can make the best use of land during the rent period.

Disadvantages
1. The landlord can revoke the tenancy when the rent period expires.
2. Since there is so much uncertainty as to the continuous use of land, the farmer cannot plan very well.
3. Land cannot be used as collateral for loan from financial institutions.
4. Development on land is very slow

Purchase or Freehold Tenure System: This is a system whereby a person pays a certain sum of money for the acquisition of a piece of land. The land now becomes the real property of the purchaser.

Advantages
1. It is a personal property and there can be used for both commercial, agricultural and permanent crop cultivation purpose.
2. Land can be used for the sourcing of loan from financial institutions.
3. Both male and female can acquire land provided the price is paid.

4. Animal husbandry is also very ideal.
5. There is a maximum use of land to increase production.

Disadvantages
1. Land may be expensive.
2. Size of fertile land may be too small.
3. Prospective farmers may not have access to the required land.
4. Farmers may fall into the hands of illegal sales agents (fraudsters) because the real owner may not be known.
5. Mechanization is not possible on small land holdings.

Tenants at Government Will: This system is where a piece of land is given out to farmers by the government by paying a stipulated amount of money. Any farmer using such land is at the mercy of the government that allocated the land.

Advantages
1. Poor and rich farmers can have access to land.
2. Women can be given land.
3. It is ideal for aggressive food production programme.
4. The land is cheap to acquire and period of grace is usually given before paying rent.

Disadvantages
1. Too much red tape (long bureaucracy), regulations and control.
2. The land can be revoked if the tenant fails to meet two to three installments.
3. Land cannot be used as a collateral for loan.
4. Permanent crops cannot be cultivated.

Assessment

Give the names of the tenure systems below

1. ____ is a system whereby a person pays a certain sum of money for the acquisition of a piece of land
2. ____ is a contract existing between a person called the leasor and another called the leasee for the lease of a piece of a piece of land for a specified period of years

3. ____ is a system where a piece of land can be acquired at the death of one's parent
4. ____ is a system in which a piece of land is given out by a person voluntarily to another for the good work done by that person
5. ____ is a system whereby a tenant pays some amount for the period of using the land to a stated landlord

Explain the advantages and disadvantages of Inheritance Tenure System

Answers

1. Purchase Tenure System
2. Lease hold Tenure System
3. Inheritance Tenure System
4. Gift Tenure System
5. Rent Tenure System

WEEK 8

TOPIC: LAND AND ITS USES

Introduction

From agricultural stand point, land is defined as the solid part of the earth surface in which agricultural activities can be practiced. Land like air and water is a free gift of nature.

Use of Land for Agricultural and Non-Agricultural Purposes

There are two schools of thoughts. They are the pedeathologists and edaphologists. The pedeathologists are concerned with land used for construction and other non-agricultural activities, while the edaphologists are interested in such lands used for agricultural activities. From the above, land has two major uses.
(a) Agricultural Land (b) Non-agricultural land.

1. Agricultural Land: Land for agriculture must be fertile, flat and free from many problems. Agricultural land can be used for food crop production e.g. rice, yam, potato, beans, sorghum and cash crops like kenaf, cotton, rubber, cocoa, kola, groundnut, etc. Agricultural land requires regular management practice like drainage, irrigation, and fertilizer application.

a. Land for Forestry:

i. Land for forestry must not be too fertile.
ii. Forest is established in area of sparse population.
iii. Land should be where the rate of erosion is high.
iv. Sometimes at state or country boundaries.
v. Disputed land.

Uses of forests include the following

- The wood of trees can be used in making paper, furniture, match sticks, coffins, and canoes.
- The trees help to prevent erosion.
- The leaves of rainfall in an area.
- Herbs of various kinds can be got from the forest for medicinal purposes.
- Dyes, ropes, fibers, wax and latex are essential products from the forest.
- Forest acts as home for wild animals.
- Forest products can generate revenue and employment for people.

Some Forest Reserves in Nigeria
Shasha River Forest Reserve in Ogun State.
Omo Forest Reserve in Ogun State.
Sapoba Forest Reserve in Edo State.
Mamu River Forest Reserve in Anambara State.
Afi River Forest Reserve in Kadnuna State.
Awba Hills Forest Reserve in Oyo State.
Sanga Forest Reserve in Plateau State
Anara Forest Reserve in Kaduna State.
Zamfara Forest Reserve in Sokoto State
Okomu Forest Reserve in Edo State.
Ofosu Forest Reserve in Edo State.

b. Land for Wildlife
i. The land to be utilized for wildlife must not be good for agriculture and forestry.
ii. There should be sparse population where it is to be located.
iii. It may be a plain, hill or valley.

A wildlife reserve is a place where wild animals are conserved to avoid extinction while they are carefully exploited.

Uses of wildlife including the following:
i. Tourist attraction.
ii. Revenue generation.
iii. They provide horns, meat, egg and fish for food.
iv. Hides and skins from wildlife like zebra, giraffe, tiger are also very important.

Poaching or the indiscriminate killing of animals in a game reserve should be prohibited. Forest fires, fishing with chemicals should be avoided.

Examples of game reserves in Nigeria are:
i. Yankari Game Reserve in Bauchi State.
ii. Zugurma Game Reserve in Niger State.
iii. Borgu Game Reserve in Kwara State.
iv. Kainji National Park in Kogi State.

Some animals conserved in the game reserve are:
i. Lions. ii. Monkeys iii. Elephants iv. Tigers
v. Leopards vi. Snakes vii. Turtles viii. Tortoises
ix. Crocodiles x. Birds.

2. Non-Agricultural Land use
a. The lands for non-agricultural use are not good for agriculture, forestry and wildlife.
b. They are smaller in size in terms of land mass.
c. They are also suitable where population is high.

Types of non-agricultural activities:
i. Construction: This includes land for road, bridge, railway lines, airport, etc. Their major problem is the reduction of agricultural land as well as their ability to cause erosion due to inadequate drainage, and again, because agricultural land may be destroyed. Their usefulness lines in the case of transportation of goods and persons.
ii. Social / Recreational Centres: This includes the land for building viz:
(i) Cinema houses (ii) Parks – amusement park (iii) Stadia and gymnasia (iv) Churches and mosques (v) Schools – primary, secondary and tertiary (vi) Markets (vii) Hospital (viii) Cemeteries.
iii. Residential Buildings: This includes lands used for the construction of residential buildings, which we live. It also includes land for building offices, banks , etc.
iv. Industries Buildings: These are located either close to the raw materials or markets in Nigeria. Many industries are located in the industrial estates like Ikeja, Matori, Agbara in Lagos State.
v. Land for Mining: This includes land used for the extraction and mining of petroleum, gold, tin and others. The size of land may be very large therefore reducing agricultural land.

Assessment

1. Give three uses of Forest
2. List four examples of Non-agricultural activities related to land use
3. List 3 animals that can be found in the game reserve

Answers

1. The wood of trees can be used in making paper, furniture, match sticks, coffins, canoes.
   - The trees help to prevent erosion.
   - The leaves of rainfall in an area.

- Herbs of various kinds can be got from the forest for medicinal purposes.
- Dyes, ropes, fibers, wax and latex are essential products from the forest.
- Forest acts as home for wild animals.

2. Construction of roads, bridges,
   Social / Recreational Centres such as cinema, amusement parks, stadia, churches, schools
   Residential Buildings such as offices, banks,
   Industry Buildings

3. Lions, Monkeys, Elephants, Tortoises, Snakes, Leopards, Crocodiles, Turtles

WEEK 9

TOPIC: Environmental Factors Affecting Agricultural Production

Content

Environmental factors are those non-genetic factors which contribute to the characteristics of a plant. In other words, they are the components of all factors which influence plant growth and development to the exclusion of the genetic factors. They are referred to also as external factors to distinguish from the genetic factors which are described as internal.

The environmental factors are divided into two main groups: biotic and abiotic factors. The descriptive word *biotic* means living while *abiotic* means non-living or dead.

Biotic Factors Affecting Agricultural Production.

Biotic factors means all factors or components of the environment that are "biotic" or living. Therefore, these factors comprise of living organisms belonging to any kingdom such as Animalia, Plantae, Fungi, Monera, and Protoctista. The effects of these organisms on crop growth and yield are varied. Any of these factors can be advantageous or disadvantageous to a crop plant. **Biotic factors** refer to the living organisms, both macro- and micro-organisms, including the various ways in which they affect plant growth and development. These are

(1). Soil Organisms

(i) It includes bacteria, fungi, earthworm, rodent, termite, etc.

(ii) Some e.g. bacteria and fungi can cause diseases.

(iii) Some aids aeration of soils, percolation and fertility.

(iv) Some like the root nodule bacteria can fix nutrients directly to plants and soil.

(v) Some open up wounds on plants or animals for other pathogens to enter.

(vi) Some reduces the quality of crops e.g potato, yam etc.

(vii) Some helps in the decomposition of plant materials to form humus.

(2). Pests

(i) These include insects, rodents, birds and some mammals.

(ii) It reduces the yield of crops and animals.

(iii) It also reduces the quality of crops and animals.

(iv) Some are vectors or carriers of diseases.

(v) They reduces the income of the farmers

(vi) The cost of their control increases the cost of production

(3). Parasites

(i) They include ticks, liverflukes, tapeworm, dodder, mistletoe, lice, etc.

(ii) Some transmit diseases.

(iii) They reduce the quantity or yield of produce.

(iv) They also reduce the quality of produce.

(v) They may cause the death of plants and animals.

(vi) They reduce production capacity of livestock or crops.

(vii) Cost of control increases cost of production.

(viii) They may be external or internal (i.e. ecto or endoparasites)

(4). Diseases

(i) They may be viruses, bacteria, fungi, protozoa, etc.

(ii) They causes reduction in yield of crops and animals

(iii) They can cause the loss or death of plants and animals.

(iv) The cost of control increases the cost of production.

(v) Reduction in farmer's income.

(5). Weeds

(i) They compete with crops of space, water, nutrients and sunlight.

(ii) Some weeds can harbour diseases and pests.

(iii) They reduces the yield of crops

(iv) Weed control increases the cost of production.

(v) Weeds causes poor growth of crops

(6). Predators

(i) These are birds, rodents, praying mantis etc.

(ii) Some are beneficial in agricultural production.

(iii) Some are used to control some harmful pests of crops and animals.

(iv) Some feeds on farm animals e.g. hawks feed on chicks.

Abiotic Factors

The exact opposite to biotic factor is the abiotic factor, referring to the non-living components of the environment. It comprises of the topographic, soil (edaphic), and climatic factors. Further, the specific environmental factors under climatic factors include light, temperature, water or rainfall, relative humidity, air, gravity, and wind. The abiotic factors that affect plant growth and development include topography, soil, and climatic factors. They are the nonliving components of the **environment** which, along with the **biotic** or living factors, determine the extent in which the **genetic factor** is expressed in the plant. Examples of Abiotic factors are

1. **Soil** – Soil is the outermost layer of the surface of the earth in which plants grow. It is composed of eroded rock, mineral nutrients, decaying plant and animal matter, water and air. There are two properties of the soil having pronounced direct effects on plant growth and crop
   production: **physical** and **chemical** properties. The *physical* and *chemical* properties of the soil are referred to as edaphic factors of the plant environment. The **physical properties** include the soil texture, soil structure, and bulk density which affect the capacity of the soil to retain and supply water while the **chemical properties** consist of the soil pH and cation exchange capacity which determine its capacity to supply nutrients.

2. **Topography** – Topography is a nonliving factor that refers to the "lay of the land." It includes the physical features of the earth such as the land elevation, slope, terrain

(flat, rolling, hilly, etc.), mountain ranges and bodies of water. The steepness of a slope affects plant growth through differential incidence of solar radiation, wind velocity and soil type. A steep slope is susceptible of rapid surface runoff and soil erosion which cause soil degradation.

3. **Climatic Factors** – Climatic factors are also categorized under abiotic factors. These are *rainfall* and *water*, *light*, *temperature*, *relative humidity*, *air*, and *wind*.
   i. **Light** – Light is essential in the production of chlorophyll and also during photosynthesis reaction, the process by which plants manufacture food in the form of sugar (carbohydrate). Two ways in which light can affect productivity is through Intensity and Quality of Light.
   ii. **Air** – This is a mixture of gases. Plants breathe in Carbon dioxide and breathe out Oxygen.
   iii. **Rainfall/Water** – This is the falling of water in droplets on the surface of the Earth from clouds. Plants need water regularly for healthy growth.
   iv. **Temperature** – The degree of hotness or coldness of a substance is called temperature . This climatic factor influences all plant growth processes such as photosynthesis, respiration, transpiration, breaking of seed dormancy, seed germination, protein synthesis, and translocation. At high temperatures the translocation of photosynthate is faster so that plants tend to mature earlier.
   v. **Relative Humidity**– This is the amount of water vapor in the air. It controls the opening and closing of Plant Stomata.

Assessment

1. ____ are to the living organisms, both macro- and micro-organisms, including the various ways in which they affect plant growth and development.
2. Soil, topography and climatic factors are _____
3. Give three examples of parasites that can affect plant growth
4. How do weeds affect plant growth and production?
5. Light is essential in the production of ____

Answers

1. Biotic Factors
2. Abiotic Factors
3. Ticks, liverflukes, tapeworm, dodder, mistletoe,
4. Weeds compete with crops of space, water, nutrients and sunlight.
   Some weeds can harbour diseases and pests.
   Weed control increases the cost of production

5. Chlorophyll

Week 10

Topic: CLASSIFICATION OF CROPS BASED ON LIFE CYCLE

Classification of Crops based on Life cycle and Uses

Crops plants are classified based on three criteria which are;

1. Botanical classification – Based on generic and specific names
2. Agricultural classification – Based on the uses or important of crops to man and animals
3. Classification based on life cycle – Based on numbers of year or season from germination to harvesting or death.

General Classification of Plants

1. By Growth habit:

Succulent plants – herbaceous or herbs (succulent seed plants possessing self-supporting stems)
Vine – a climbing or trailing herbaceous plant (**Liana** – a climbing or trailing woody plant)
Trees – having a single central axis
Shrub – having several more or less upright stems

2. By Leaf drops:

Deciduous – no living leaves during dormant (winter) season (apple)
Evergreen – retaining functional leaves throughout the year (spruce)

3. By Life span:

Annuals – plants that normally complete their life cycle during a single growing season (lettuce, spinach, marigold)
Biennials – plant that normally completes its life cycle during a period of two growing seasons (celery, carrot)

Perennials – plants that grow year after year, often taking many years to mature.

4. By Temperature tolerance:

Tender plant – damaged or killed by low temperature
Hardy plant – withstands winter low temperatures
Wood hardy – a whole plant is winter hardy
Flower-bud hardiness – ability of flower buds to survive low winter temperatures (peach, ginkgo tree)

5. By Temperature requirements:

Cool-season crop – prefers cool temperatures (peas, lettuce)
Warm-season crop – prefers warm temperatures (tomato, pepper)

6. By Habitat or Site preference:

Xerophyte – prefers dry sites
Shade plants – prefers low light intensity
Acid loving – prefers low pH soils
Halophyte – prefers salty soils

Plant crops are grouped into three categories according to their life cycles such as;

I) Annual Crops

From the name it is clear that the plants live for one season or less. They complete their life cycle once in a year or a growing season; during which the vegetative and reproductive stages are completed e.g. maize, rice, cowpea, millet, vegetables, cotton, groundnut, etc. Annual plant is one which completes its life cycle from germination to seed formation within one season and then dies usually as a result of complete exhaustion of its food reserve in the process of reproduction. They comprise of several of most beautiful and easily grown plants, widely varying in from habit of growth and colour. Annuals are very effective, grown neither in pots nor in ground. Particular annuals thrive best in particular period of the year. The annuals are conveniently grouped according to season as follows.

1. Rainy Season Annuals: They can stand more in rain than others and therefore grown to flower during rainy season. The time of sowing then would be from April to May in most places e.g. Mary gold, Aster, and Zinnia etc.

2. Winter or Cold Season Annuals: The thrive and bloom best during winter. These are sown in September, October e.g. phlox, Antirrithium.

3. Hot weather or summer season Annuals: They are sown in January – February and blooming period is April, May e.g. Sunflower and Zinnia.

II) Biennial Crops

They complete their life cycle once in two years or two group seasons. In the first year, they undergo the vegetative stages where leaves and roots are produced in abundance, the plant also elongates. But during the second year, the plants undergo reproductive stages where flowers, fruits and seeds are produced e.g carrot, lettuce, cabbage, ginger, cassava, etc. These plants usually requires two years or at least two growing seasons with more or less of a dominant season or lasting season between two completed life cycle. Seed sown in spring or summer, and vegetative growth is completed in first year and in the following spring, flowering and fruiting takes place. Generally the period of growth is 6 to 9 months e.g. Gladioli, Dahlia. No hard and fast line can be drawn between annuals and biennials crops like turnip, carrot, cabbage and onion are classified as biennials.

III) Perennial Crops

Any plant that lives more than two years is a perennial e.g. Mango, Citrus. They complete their life cycle once in three years. In the first two cycles once in three years, they undergo vegetative stages while in the last years, the reproductive stages are completed e.g. rhizome, sugarcane, banana, plantain. A perennial plant that can survive for thirty years and above is called permanent crop e.g. cocoa, kola, mango, oil palm, rubber, coconut, etc.

These crops are classified in to two groups.

i) Herbaceous:

Herbaceous perennials are those with more or less soft succulent stems. In Temperate climates the tips die off after seasons growth but root remains alive and produce new stem and tops on favorable conditions. In other words their tips are annual while ground parts are perennials lie many years and are classified as: a) Trees b) Shrubs c) Vines according to their habit of growth.

a) Trees: Trees are upright in habit and stems take the form of central axis e.g. Mango, guava, Mandarins etc.

b) Shrubs: Shrubs have no main trunk but a number of erect or semi erect stems are seen but do not forms the main frame work e.g. Hibiscus, Rose etc.

c) Vine: Both woody and herbaceous have stems which are flexible and not in position to keep their branches and leaves erect. They either spread on the ground or require some support whether alive or man-made e.g. Grape vines, Passion fruit etc.

Agricultural Classification or classification based on the uses of crops:- In this category crops are classified into the following groups, legumes, cereals, spice, latex, beverages, fibre.

IV) Ephemerals: They are crops that complete their life cycle once in three or four months and can undergo two or three life cycles in a year e.g. tomato

ASSESSMENT

1. Give an examples each of annual, biennial, perennial crops
2. Give 2 examples of classifications of plant crops.
3. Name the three criteria inwhich plants are classified?

ANSWER

1. Annual- Rice Biennial- Carrot Perennial- Mango
2. By Growth and by Life Span
3.

- Botanical classification – Based on generic and specific names
- Agricultural classification – Based on the uses or important of crops to man and animals
- Classification based on life cycle – Based on numbers of year or season from germination to harvesting or death.

S.S.S 1

AGRICULTURAL SCIENCE

SECOND TERM

TABLE OF CONTENT

WEEK 1 & 2

TOPIC: Cultural Practices Associated with Crop Production

Introduction

There are different terminologies used in agricultural science to explain cultural practices. Cultural practices involves all the activities carried out on the
farm before, during and after planting of crops. They are grouped into: pre-planting, planting and post-planting operation.

1. PRE-PLANTING OPERATION: These are the operations done before
planting. They are:
a. Choice of site
b. Clearing of land or Bush Clearing
c. Stumping
d. Ploughing
e. Harrowing
f. Ridging

2. PLANTING OPERATION: These are activities done during planting. They are:
a. Planting
b. Transplanting
c. Nursary practices

3. POST-PLANTING OPERATION: These are the activities that are done
after planting. They are:
a. Thining
b. Supplying
c. Mulching
d. Manure or application
e. Watering
f. Weeding
g. Pest and disease control
h. Harvesting

i. Processing
j. Storage

A. **Bush Clearing** – This is the removal of bushes through Mechanical or Chemical means. Mechanically through manual cutting of bushes with crude implements eg Hoes and Cutlasses or through the use of machines. Chemically through the use of Herbicides (chemicals used to kill weeds) e.g Paraquat.

Advantages:

- It prevents the habitation and breeding of harmful organisms
- It encourages development (Urbanization)
- It helps in security as there will be no hidden places
- It reduces environmental pollution
- It helps maintain healthy living
- It keeps the environment clean

Disadvantages:

- Destruction of different organisms natural Habitat
- Causes disruption in the eco-system
- Causes Extinction of wild animals
- Encourages Erosion (soil erosion)
- Reduction of Oxygen in such an area (As green plants produce oxygen)
- Discourages Afforestation and Reafforestation

B. **Stumping** – The removal of perennial roots and tree stumps present in the soil.

C. **Ploughing** – The primary purpose of ploughing is to turn over the upper layer of the soil, bringing fresh nutrients to the surface, while burying weeds, the remains of previous crops, and both crop and weed seeds, allowing them to break down. It also aerates the soil, allows it to hold moisture better and provides a seed-free medium for planting an alternate crop. It can be carried out using manually with a hoe or a plough. A plough is an implement used in **farming** for initial cultivation of soil in preparation for sowing seed or planting to loosen or turn the soil. As the **plough** is drawn through the soil it creates long trenches of fertile soil called furrows.

D. **Harrowing** – This is the breaking up and smoothing out the surface of the soil. This is a method for shallow cultivation of soil and care of *agricultural* crops. It is accomplished by toothed or disk harrows and revolving hoes. It is often carried out on fields to follow the rough finish left by ploughing operations. The purpose of this harrowing is generally to break up clods (lumps of soil) and to provide a finer finish, a good tilth or soil structure that is suitable for seedbed use.

E. **Ridging** – This involves making ridges for planting. This is a strip of ground thrown up by a plow or left between furrows where seeds can be planted.

F. **Nursery and Transplanting** – A **nursery** is a place where plants are propagated and grown to usable size. Transplanting is the transfer or movement of ready seedlings from the nursery bed, seedling trays or pots to the main field. Transplanting is used in vegetable raising, fruit growing, forestry, tobacco *farming*, and flower raising. Seedlings are transferred from seedbeds,
hotbeds, hothouses, and nurseries topermanent sites, where they continue to grow and to pro duce a crop. For potatoes, tubers are planted; for onions, smallbulbs raised from seeds; for min t, rootstock cuttings; and for sugarcane, stemcuttings. To obtain the seeds of root crops, the root is planted.

G. **Planting and Sowing** – Planting is the act of sowing the desired seeds on a prepared field. There are different fabricated machinery that could be used to achieve this, depending on the type of crop (planter). Sowing is the process of planting seeds. An area or object that has had seeds planted will be described as being sowed. Planting is the act or an instance of putting seeds or young plants into the soil**.** There are different methods of sowing and the crop to be sowed determines the method to be used. There are 6 sowing methods which differ in their merits, demerits and adoption. These are:
1. Broad casting
2. Broad or Line sowing

3. Dibbling
4. Transplanting
5. Planting
6. Putting seeds behind the plough.

H. **Thinning and supplying** – **Thinning** is a term used in agricultural sciences to mean the removal of some plants, or parts of plants, to make room for the growth of others. Selective removal of parts of a plant such as branches, buds, or roots is typically known as pruning. Supplying can be defined as the process of planting so many crops for the nursey stage of pre-planting process in other to make available crops for planting.

I. **Weeding** – This is the systematic removal of weeds. A **weed** is a plant considered undesirable in a particular situation, "a plant in the wrong place".

J. **Rouging** – This refers to the act of identifying and removing plants with undesirable characteristics from **agricultural** fields. Rogues are removed from the fields to preserve the quality of the crop being grown.

K. **Fertilizer Application** – A **fertilizer** is any material of natural or synthetic origin (other than liming materials) that is applied to soils or to plant tissues (usually leaves) to supply one or more plant nutrients essential to the growth of plants. It is the adding of nutrients to the soil. The placing of organic or chemical manure to the soil helps to improve nutrients. Application of this susbtance is called Fertilizer Application.

L. **Mulching** – Mulching is the placing of dry grass, cardboard or plastic to keep soil moist and prevent soil erosion. This involves the use of either plant residue or mulching material, to cover the soil in a bid to prevent excessive moisture loss; or to reduce the effect of high temperature on germinating seedlings, plant root etc.

M. **Harvesting** – **Harvesting** is the process of gathering a ripe crop from the fields. Reaping is the cutting of grain or pulse for **harvest**, typically using a scythe, sickle, or reaper. On smaller farms with minimal mechanization, **harvesting** is the most labor-intensive activity of the growing season. It is also is the act of removing a crop from where it was growing and moving it to a more secure location for processing, consumption, or storage.

N. **Processing** – This is the transformation of raw ingredients, by physical or chemical means into food, or of food into other forms. Food **processing** combines raw food ingredients to produce marketable food products that can be easily prepared and served by the consumer.

O. **Storage** – **Storage** is an important marketing function, which involves holding and preserving farm products from the time they are produced until they are needed for consumption. The **storage** of products, therefore, from the time of production to the time of consumption, ensures a continuous flow of goods in the market.

P. **Grafting** – **Grafting** is a way to produce plants from pieces of existing plants instead of seeds. Branches or buds are cut from one plant and placed on a related kind of plant. It is an artificial, vegetative method of plant propagation. The branch or bud that is **grafted** is called the scion. The plant that accepts the **graft** is called the rootstock. Plant *grafting* is a technique in which tissue from one plant, the scion, is attached onto another, the rootstock.

Q. **Budding** – This is a form of asexual reproduction in which a new organism develops from an outgrowth or bud due to cell division at one particular site. The new organism remains attached as it grows, separating from the parent organism only when it is mature, leaving behind scar tissue. Since the reproduction is asexual, the newly created organism is a clone and is genetically identical to the parent organism. Budding is the vegetative method of plant propagation and can be defined as " an art of insertion of a single mature bud in to the stem of the rootstock in such way that the union takes place and the combination continues to grow. It is grafting of a single individual bud instead of whole bud stick on scion as in done in case of grafting.

R. **Scion and Root Stock** – In grafting, the upper part of the combined plant is called the scion (the branch to be grafted) while the lower part is called the rootstock (the part that accepts the graft). The scion contains the desired genes to be duplicated in future production by the stock/scion plant.

S. **Staking:** It is a situation whereby a stick is placed besides a plant to prevent it from bending or fruit from touching the ground. This help the efficient growth of the crop. Staking provides physical support so that plants don't break under the strain of fruit or inclement weather. Staking enables better air flow through plants, which results in less internal moisture that can result in disease. Crops like tomato, yam requires staking.

T. **Irrigation –** Irrigation is the method in which a controlled amount of water is supplied to plants at regular intervals for agriculture. It is used to assist in the growing of agricultural crops, maintenance of landscapes, and revegetation of disturbed soils in dry areas and during periods of inadequate rainfall. This is the watering of the plant for growth and development.

U. **Pruning** – It is the removal of branches of the center and end of plant to allow sunlight. The sunlight miss very important in the growth of crops.

V. **Mounding** – This is the gathering of soil around the plant to avoid soil erosion, and for proper aeration.

W. **Pest Management** – Pests are organisms that attack crops at different stages of growth, which often have adverse consequence on the productivity of the crop, and reduced output realizable from the farm. There are different approach to pest management which include: Pesticide based approach such as fungicide, insecticide, fungicide etc. Biological pest control approach: such as the use of trap crops, cover crops. Biotechnology-based approach: such as plant breeding and genetic modification.

X. **Disease management**: is the practice of minimizing disease in crops to increase quality or quantity of harvest yield. It involves making conscious decisions related to numerous agronomic factors over which control can be exercised. Plant diseases are caused by microorganisms such as fungi, bacteria, viruses, nematodes. Various methods used to control pest includes: Developing new crop variety, Crop rotation, rouging etc.

Assessment

Use the following options to answer questions 1 – 10 below.
Thining, Supplying, Mulching, Watering, Weeding, Harvesting, Processing, Storage, Bush Clearing, Stumping, Ploughing, Harrowing, Ridging

1. _____ is the removal of bushes through Mechanical or Chemical means
2. _____ is a situation whereby a stick is placed besides a plant to prevent it from bending or fruit from touching the ground
3. _____ is the removal of branches of the center and end of plant to allow sunlight

4. _____ is the transformation of raw ingredients, by physical or chemical means into food, or of food into other forms
5. _____ is the breaking up and smoothing out the surface of the soil
6. _____ is the placing of dry grass, cardboard or plastic to keep soil moist and prevent soil erosion
7. _____ refers to the act of identifying and removing plants with undesirable characteristics from **agricultural** fields.
8. _____ removal of perennial roots and tree stumps present in the soil
9. _____ is the gathering of soil around the plant to avoid soil erosion, and for proper aeration
10. _____ can be defined as the process of planting so many crops for the nursey stage of pre-planting process in other to make available crops for planting.

Answers

1. Bush Clearing
2. Staking
3. Pruning
4. Processing
5. Harrowing
6. Mulching
7. Rouging
8. Stumping
9. Mounding
10. Supplying

Week 3

Topic: Husbandry of Selected Crop (Maize)

Contents

1. Meaning of Crop Husbandry
2. Selected crops (maize)

Crop Husbandry simply means careful management of the establishment, growth and harvesting of crops.

According to the International Institute of Tropical Agriculture, Maize is a cereal crop that serves as a staple food source for more than 1.2 billion people in Africa and Latin America alone. It's also an important livestock feed. Ochef notes the term "corn" is rarely used throughout most of the world except to refer to corn-based products, such as syrup and oil. The Spanish, French, Italian and Germans refer to corn using some variation of the word "maize."

Cereals – Common name – Maize
Botanical Name: *Zea mays*

Land Preparation

1. Clearing of land
2. Stumping should be done
3. Land should be harrowed
4. Ridges can also be prepared

Propagation

1. It is propagated by seed
2. May be planted manually
3. May be planted mechanically

Climatic requirement: It requires a temperature of about 20Oc – 30Oc. Rainfall should be between 75cm – 150cm annually

Soil requirement: Well drained loam and silt loam with fine tilth.

Planting date: Early planting type is planted between March and April. Late maize can be planted anytime depending on the rate of rainfall in the north and south.

Seed Rate

1. 25 – 20kg maize seed per hectare.
2. 2 -3 seeds per hole

Spacing

1. 25cm along the row and 75cm between rows
2. 30cm x 60cm along and between the rows respectively.
3. 90cm x 60cm at two seeds per hole

Cultural Practices

Supplying: This is the process of filling the in-germinated spaces

Thinning: Removal of weak or excess plants per hole in a farmland e.g. thin maize one or two per hole.

Fertilizer application

1. Apply N.P.K 15:15:15 at about 200kg or 4 bags per hectare.
2. Apply farmyard /poultry dropping/organic manure by side dressing or by broadcast method.

Weeding

1. Weed farmland regularly
2. Use manual Methods e.g. hoe and cutlass
3. Use chemical or mechanical method

Maturity period: 3 – 4 months or 90 – 120 days after planting

Harvesting

1. Maize can be harvested either green or dry
2. Mostly harvested when dry
3. Harvested on a small scale by plucking the cobs and on a large scale by machines such as corn-picker
4. We can also use sickle to harvest maize

Storage

1. Store above fire-place.
2. Store in air-tight container
3. It can also be stored in flour form

Yield

1. About 3,500kg/hectare for improved varieties
2. About 600 to 1,200kg/hectare for local varieties
3. Processing: The husks can be removed from the cobs
4. Shelling should be done to remove grains from the Cobs
5. Winnowing is done to remove dirt from the grain.

Pest of Maize

1. Stem Borer: It is a field pest which larva destroys young stems
2. Maize Weevil: It is both filed and store pest. The adult and larva destroy the grains
3. Grasshopper: It destroys the vegetative parts of the plant

Control of Pests

1. Plant resistant variety
2. Early planting
3. Fumigate the store with BHC Powder or phostorin tablets
4. Early harvesting

Types and Uses of Maize

- **Field corn** in the U.S. is used mainly to feed livestock, but in other countries is used for human consumption as well.
- **Sweet corn**, the type most commonly eaten in the U.S., is a genetic variation that accumulates more sugar and less starch in the kernels; it is usually shorter than field corn.
- **Baby corn**, popularly used in Asian cuisine, is a variety of maize developed to produce many small ears, rather than a few larger ones. The ears are harvested very young while they are still immature, and are tender enough for the whole ear to be eaten.
- **Waxy corn** , This corn comprises of a soft, wax-like substance resembling tapioca starch
- **Popcorn**, the ability of maize kernels to "pop" and expand upon heating, was also discovered by the Native Americans. Maize is able to pop because, unlike other grains, its kernels have a hard moisture-sealing hull and a dense starchy filling. When heated, pressure builds inside the kernel until an explosive "pop" results, and the starch expands and then hardens in the cooler air. Many maize varieties will pop, but some varieties have been specifically cultivated for this purpose.
- **Flint Corn** – This is a hard corn that ripens rapidly.
- **Indian corn** was originally the term applied to what we now know as maize or corn, to differentiate it from the generic term of "corn" Europeans used for all grains at that time. Now, it usually refers to any corn that has different colored kernels. Usually it is dried and used for ornamental purposes.

Maize can also be used in a number of other ways: 3 main uses are

Animal feed

Human food

Industrial products.

- **Maize flour, or meal**, is made into a thick porridge in many cultures (polenta, Italy; angu, Brazil; mămăligă, Romania; sadza, nshima, ugali, and mealie pap, Africa). Maize meal is also used as a replacement for wheat flour, to make cornbread and other baked products.
- **Masa** (cornmeal treated with lime water) is the main ingredient for tortillas, atole, and many other dishes of Mexican food.
- **Cornstarch** is made from maize kernels, which are high in starch, and used as a thickening agent in soups.
- **Corn syrup** is used as a sweetener instead of sugar in thousands of products, including soda, candy, cookies and bread.
- **Kitty litter** made from maize is environmentally-friendly.
- **Corn for cows, hogs, catfish and chickens**: the largest market for maize in the U.S. is actually as food for livestock (sometimes called fodder, or silage). Cows eat field corn, not the sweet corn that people in the U.S. usually eat. Maize is also a large component of commercial chicken feed, as well as food for catfish, especially in farmed catfish.
- **Maize mazes**: mazes are a fun use of maize. Rows of maize are planted in the shape of a maze. The locations of some "amazing maize mazes" can be found

Assessment

1. List two pests of maize
2. Mention four types of corn
3. List three uses of maize

Answers

1. Stem borer, Maize Weevil, Grasshopper
2. Waxy corn, Field corn, Sweet corn, Baby corn, Flint corn, Indian corn, Pop corn
3. Maize mazes, Kitty litter, Corn syrup, Corn starch, Masa, Maize Flour

Week 4

Topic: Agricultural Ecology

Introduction

Agricultural Ecology is the study of crop planted and farm animals in relation to their environment. Agricultural ecology can be defined as a field of study which deals with the relationship of living organisms with one another and with the environment which they live in. Two main branches of Agricultural Ecology are

1. **Autecology** – This is the study of individual organisms or a single species of organisms and its environment e.g the study of a single cattle and its environment
2. **Synecology** – This is the study concerned the inter-relationship between groups of organisms or species of organisms living together in an area e.g the study of different species of fish in a pond in relation to their aquatic environment.

Ecosystem

An ecosystem refers to a community of crop plants and farm animals functioning together with their non-living environment. In other words, ecosystem consists of living factors (plants and animals) interacting with the non-living factors in a farm environment. It should be noted that a farm ecosystem is a natural unit in which there is an interaction between all living organisms (called biotic factors) and non-living organisms (called abiotic factors) within a farm environment or habitat.

Components of Farm Ecosystem

The farm ecosystem is made up of two main components. These are the biotic (living) components and the abiotic (non – living) components.

1. **Biotic Components** – The biotic components include the living things (crop plants and farm animals). The biotic components can be grouped into two classes. These are heterotrophism and autotrophism.
   Heterotrophism – This is a group of organisms mainly farm animals which can not manufacture their own food but depend directly or indirectly on plants for their food, hence they are called consumers. An organism that cannot manufacture its own food and instead obtains its food and energy by taking in organic substances, usually plant or animal matter is an heterotroph. Farm animals that feed directly on green plant s (producers) are called herbivores or primary consumers e.g cattle, sheep, goat and

rabbit while animals or organisms that feed on the primary consumers are called carnivores or secondary consumers. Animals that feed on the secondary consumers are called tertiary consumers. Heterotrophs includes all farm animals, fungi and some bacteria.

2. **Autotrophism** – This is a group of organisms which can use sunlight or chemicals to manufacture their food from inorganic substance during the process of photosynthesis. An autotroph or producer, is an organism that produces complex organic compounds from simple substances present in its surroundings, generally using energy from light or inorganic chemical reactions. In other words, autotrophs are organisms mainly crop plants which are capable of synthesizing their own food hence they are called producers. Producers are green plants or autotrophs which traps the energy of sunlight, radiant energy or solar energy and converts it to chemical energy in order to form organic compounds during photosynthesis using carbon dioxide and water or simple inorganic substance as raw materials. Producers or autotrophs provide food for the other organisms in the farm.
3. **Abiotic Components** – The abiotic components of an ecosystem include the non-living things which are
   i. Climatic factors like temperature, win, humidity, sunlight and rainfall
   ii. Inorganic materials and nutrients such as carbon dioxide, oxygen, nitrogen, calcium and phosphorus.
   iii. Edaphic factors like soils, rocks, topography.
   iv. Other factors like dust, storm, fire and water.

General Interaction among the Components of Ecosystem

There is a unique interaction among the various components of an ecosystem. Green crop plants use carbondioxide, water and chlorophyll in the presence of sunlight to produce carbohydrate or starch. Farm animals feed on these carbohydrates or plants and release carbon dioxide for crop plant to take in. Micro-organisms and other decomposers breakdown dead plants and animal dungs to release nutrients to the soil. These nutrients are absorbed by plants for use in food production. Crop plants gives out oxygen during photosynthesis which is used by animals for their normal respiration.

Interactions among the Components of Agro-ecosystem in some Farm Settings

Mono or Sole Cropping System – Mono cropping is a system of cropping where one type of crop is grown or a farm or the same piece of land at the same time. Monocropping is usually practiced on large scale farms where crops such as oil palm, cocoa, kolanut, rubber, rice, maize are grown. The interaction between the biotic and abiotic factors in the environment are as follows:

1. Crop plants absorb nutrients from the soil grown
2. Crop plants also absorbs water to grow and produce fruits
3. Crop plants also absorbs carbon dioxide from air to carry out photosynthesis
4. Crop residues decay and with the aid of soil micro organisms release nutrients to the soil.
5. Some organisms in the soil like earthworms, rodents and also aid water percolation.
6. Crop plants also release oxygen to the atmosphere during respiration.

In Mixed Cropping System – Mixed cropping system is a system of cropping which involves the growing of two or more crops on the same piece of land at the same time during the same growing season. The crops are mixed together on the same piece of land. Crops like maize, cassava, cowpea etc can be cultivated at the same time on the same piece of land. The interaction between the biotic and the abiotic factors in the environment are as follows:

1. Crops like cowpea can add nutrients to the soil
2. Cassava obtains nutrients from the soil to grow and produce fruits
3. Carbon dioxide from the air is absorbed by the crop plants to manufacture its food through photosynthesis
4. Oxygen is also released to the atmosphere by the crop plants
5. The leaves of all crops fall on the ground, they decay and add nutrients to the soil.
6. Farm animals can feed on these cops and then release their faeces or dung on the ground which serves as manure to the soil
7. Crop plants also release carbon dioxide into the atmosphere during respiration.

In Mixed farming – This involves the cultivation of crops and rearing of animals on the same piece of land simultaneously. The farm is divided into two parts. Interaction between the biotic and the abiotic components are

1. The grasses or remains of crops serves as food to animals
2. The animal dungs or droppings are used as inorganic manure to improve soil fertility
3. Both animals and plants release carbon dioxide to the atmosphere during respiration
4. Crops like cowpea and other crop residue decay and add nutrients to the soil
5. Crop plants absorb soil nutrients and water from soil for growth
6. Crop plants release oxygen to the air during photosynthesis
7. Crop plants make use of sunlight in the environment to make their food

In Fish Pond – Fish pond is an aquatic environment where fishes live and grow, produce and are harvested for food purposes. Interaction between biotic and abiotic components are

1. Fishes feed on planktons in the water
2. Death of some fishes serves as manure for the microscopic plants (planktons) in water
3. Both planktons and fishes release carbon dioxide
4. Planktons in water make use of carbondioxide and water to make their food with the aid of respiration in water
5. Planktons make use of sunlight
6. Fish dungs provide nutrients to planktons in water

In Forest or Savanna – Savanna is a large expanse of land containing varieties of plants and animals living together and interacting with one another in a terrestrial environment. The interaction between biotic and abiotic components are

1. Animals feed on plants and fruits to get their food
2. Animal dungs and droppings can serve as nutrients to the soil
3. Plants obtain the nutrients and water from the soil to enable them prepare their food
4. Plants and animals also respire to release carbon dioxide to the environment which is used by plants to manufacture their food.
5. Sunlight from the atmosphere is also used by green plants to manufacture their food during photosynthesis

6. Plants generally releases oxygen into the environment during photosynthesis.

Assessment

1. ____ involves the cultivation of crops and rearing of animals on the same piece of land simultaneously
2. ____ is a system of cropping which involves the growing of two or more crops on the same piece of land at the same time during the same growing season.
3. ____ are a group of organisms mainly farm animals which can not manufacture their own food but depend directly or indirectly on plants for their food
4. ____ is a system of cropping where one type of crop is grown or a farm or the same piece of land at the same time.
5. ____ are a group of organisms which can use sunlight or chemicals to manufacture their food from inorganic substance during the process of photosynthesis

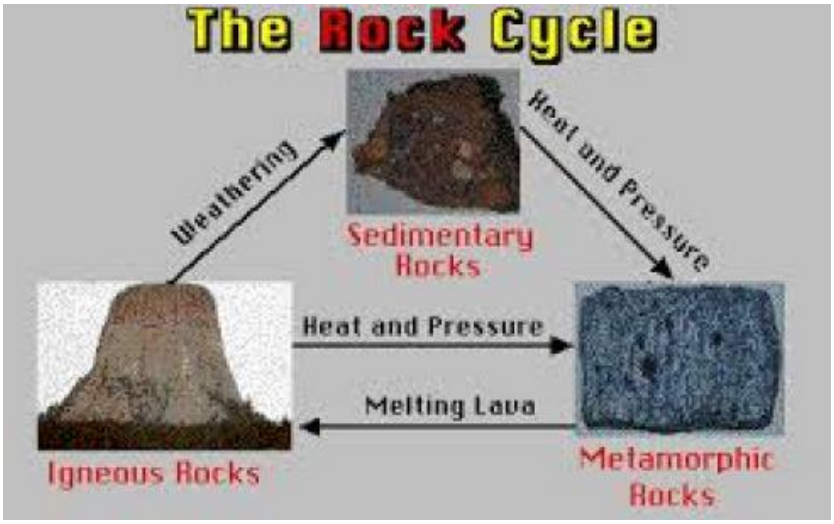
Answers

1. Mixed Farming
2. Mixed cropping system
3. Heterotrophs
4. Mono or Sole cropping
5. Autotrophs

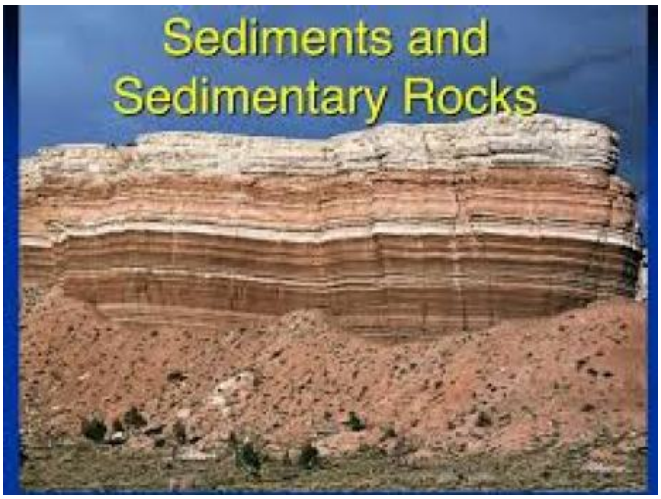
WEEK 5

TOPIC: Rock Formation

The three main ways **rocks are formed**:



- **Sedimentary rocks** are formed through the gradual accumulation of sediments: for example, sand on a beach or mud on a river bed. As the sediments are buried they get compacted as more and more material is deposited on top. Eventually the sediments will become so dense that they would essentially form a rock. This process is known as lithification. Tiny debris from the rock masses and mountains are eroded together with soils, sand, and other granite pieces are normally washed from highlands to low areas. After many years, these materials finally settle down through the process of sedimentation. Some may accumulate under water and others on the lower areas of the land. Sedimentary rocks are formed from sediment deposits through the process of weathering, erosion, deposition and finally compaction and cementation. Examples of sedimentary rocks include mudstone, limestone, sandstone, and conglomerate.



Types of Sedimentary Rock

1. **Clastic Sedimentary Rocks**

Clastic sedimentary rocks are formed from the buildup of clatics: small pieces of fragmented rocks deposited as a result of mechanical weathering then lithified by compaction and cementation. Examples of Clastic sedimentary rocks include sandstone, shale, siltstone, and breccias.

2. **Chemical Sedimentary Rocks**

Chemical sedimentary rocks are formed when the water components evaporate, leaving dissolved minerals behind. Sedimentary rocks of these kinds are very common in arid lands such as the deposits of salts and gypsum. Examples include rock salt, dolomites, flint, iron ore, chert, and some limestone.

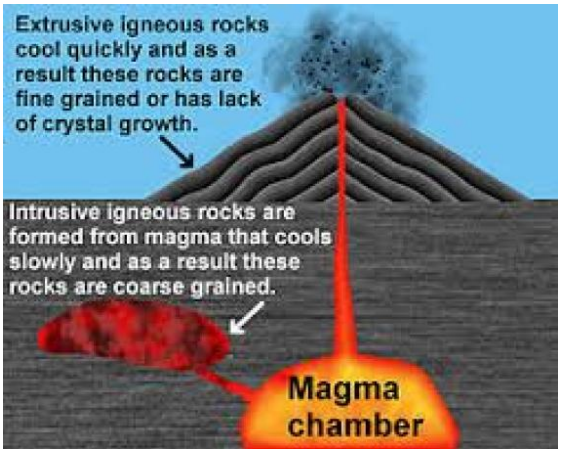
3. **Organic Sedimentary Rocks**

Organic sedimentary rocks are formed from the accumulation of any animal or plant debris such as shells and bones. These plant and animal debris have calcium minerals in them that pile on the sea floor over time to form organic sedimentary rocks. Examples include rocks such as coal, some limestone, and some dolomites.

- **Igneous rocks** are rocks which have crystallized from a melt or magma. The melt is made up of various components of pre-existing rocks which have been subjected to melting either at subduction zones or within the Earth's mantle. They are formed from the cooling of magma – molten materials in the earth's crust. The terminology Igneous means fire or heat. In this sense, igneous rocks are formed when molten rock (magma) solidifies either underneath the earth crust to form plutonic (intrusive) igneous rocks or on the surface of the earth to form volcanic (extrusive) igneous rocks. They are simply the rocks formed through heating then followed by cooling. The heated material is the molten rock which is made up of partial or complete melting of previously existent rocks in the earth's crust that are consistently subjected to intense heat, high pressure changes, and alterations in composition.
  The melt is hot and so passes upward through cooler country rock. As it moves, it cools and various rock types will form through a process known as fractional crystallization. Igneous

rocks can be seen at mid ocean ridges, areas of island arc volcanism or in intra-plate hotspots.

Igneous Rock



Types of Igneous Rocks
Igneous rocks are of two types, intrusive (plutonic rocks) and extrusive (volcanic rocks).

1. **Intrusive Igneous Rocks**

Intrusive igneous rocks are formed when the magma cools off slowly under the earth's crust and hardens into rocks. Gabbro and granite are examples of intrusive igneous rocks. Intrusive rocks are very hard in nature and are often coarse-grained.

2. **Extrusive Igneous Rocks**

Extrusive igneous rocks are formed when molten magma spill over to the surface as a result of volcanic eruption. The magma on the surface (lava) cools faster on the surface to form igneous rocks that are fine grained. Examples of such kind of rocks include pumice, basalt.

- **Metamorphic rocks** are rocks which once existed as igneous or sedimentary rocks but have been subjected to varying degrees of pressure and heat within the Earth's crust. The processes involved will change the composition and fabric of the rock and their original nature is often hard to distinguish. Metamorphic rocks are typically found in areas of mountain building. Metamorphic rocks are the rocks formed from other rocks. They are sedimentary or igneous rocks that have undergone changes as a result of extreme pressure and heat. The name defines their formation whereby 'meta' means change and 'morph' means 'form.' Hence, metamorphic rocks are those whose forms have been changed through geological process such as large tectonic movements and magma intrusions.

Metamorphic Rock

Types of Metamorphic rocks

1. **Foliated Metamorphic Rocks**

Foliated metamorphic rocks are formed from direct exposure to pressure and heat. They are the most vital and largest groupings of metamorphic rocks. Foliated metamorphic rocks have four distinguishable types of aligned textures and they normally have a banded or layered appearance. Examples include slate, gneiss, phyllite, and schist. Non-foliated are formed as a result of tectonic movements or direct pressure which makes their formation highly dependent on their pre-existing conditions.

2. **Non-foliated Metamorphic Rocks**

Non-foliated metamorphic rocks do not have a banded or layered appearance. The extensively known example of non-foliated metamorphic rock is marble. Other examples include quartzite, hornfels, and novaculite.

Assessment

Describe the Process of Formation of Sedimentary Rock

WEEK 6

TOPIC: ROCK WEATHERING

Contents:

Weathering

Weathering is the process by which rocks are broken down into smaller fragments called soil.

Weathering is the process where rocks or soils are dissolved or worn away into smaller and smaller pieces due to particular environmental factors such as the examples given above. In geological terms, weathering is defined as the disintegration of rocks influenced by animal and plant life, water, and the atmospheric forces in general.

Weathering is different from erosion. While erosion is the process by which soil and rock particles are worn away and moved elsewhere by wind, water or ice, weathering involves no moving agent of transport. It is the process of breakdown of rocks at the Earth's surface, either by extreme temperatures or rainwater or biological activity. It simply does not involve any movement of rock material.

Weathering is caused by the following process;

- Physical or mechanical process: Mechanical weathering takes place when the rocks are broken down without any change in the chemical nature of the rocks. The rocks are essentially torn apart by physical force, rather than chemical breakdown. Mechanical weathering is the physical breakdown of rocks into smaller and smaller pieces. One of the most common mechanical actions is frost shattering. It happens when water enters the pores and cracks of rocks, then freezes. Frost weathering, frost wedging, ice wedging or cry fracturing is the collective name for several processes where ice is present. These processes include frost shattering, frost-wedging and freeze-thaw weathering.
- Biological process: This process of weathering is very common and we see it around us.A good example is an animal that can burrow into a crack in a rock. It is the disintegration of rocks as a result of the action by living organisms. Trees and other plants can wear away rocks since as they penetrate into the soil and as their roots get bigger, they exert pressure on rocks and makes the cracks wider and deeper.

Eventually, the plants break the rocks apart. There are many insect,rodents and bigger animals that lives in the holes in the ground or rocks.

- Chemical process: Chemical weathering is caused by rain water reacting with minerals(clays)and soluble salts.These reactions occur particularly when the water is slightly acidic. The natural chemical reactions within the rocks change the composition of the rocks over time. Because the chemical processes are gradual and ongoing, the mineralogy of rocks changes over time thus making them wear away, dissolve, and disintegrate. The degree of chemical weathering depends on the type of rock for example limestone is more readily chemically weathered than granite. Other factors such as temperature also play a role as the chemical reactions occur more quickly in areas of high temperatures.

Types of Weathering

- Physical Weathering

• **Freezing and Thawing** – The expansive force of water pushes the soil structures apart. Water expands considerably when frozen and this expansion literally pushes the soil apart, breaking it down. When the ice thaws the soil can slump back again. The overall process is rather like a very slow 'churning'. Freeze-thawing can literally grind mountains down over time!

• **Heating and Cooling** – Soils subjected to extremes of temperature are affected as they expand and contract. The effect is less pronounced to that of freezing and thawing but over time this can become significant.

• **Wetting and Drying** – Soils that are wet are prone to swelling. Clay minerals in particular exhibit this property. The soils that have thus expanded then shrink when the soils dry out. These seasonal effects are termed shrinkage and swelling. Many household claims for subsidence are based upon such shrinkage and swelling of clays under foundations.

• **Grinding or Rubbing** – Most obvious on the beach, grinding of particles against each other leads to particle disintegration. This is why beach pebbles become smooth. Abrasion similarly breaks down the soil particles.

• **Organisms** – The effect of organisms, plants and animals, living in the soil cannot be overstated. Soil is home for a wide range of organisms. If plants can push through concrete – soil presents little obstacle! Worms churn their way through soil, mixing and aerating it all through their lives and there can be thousands of worms in a field.

• **Unloading** – When pressure is placed upon soil it becomes compressed. Never mind tractors, imagine the weight of a glacier! When ice melts a huge weight is lifted and the soils may react accordingly by uplifting and expanding.

Chemical Weathering

• **Solution** – Certain solid components in the soil can be dissolved in soil water. In this way underground caverns can form in limestone karst landscapes. The name Karst comes from the Krass plateau in Slovenia where there are some of the most magnificent cave systems anywhere in the world – valley sized caves!

• **Hydrolysis** – Some compounds in the soil can react to elements in the water.

• **Carbonation** – Soil compounds can react with carbonic acid.

• **Hydration** – Water in the soil can react to change the chemical structure of the soil components.

• **Oxidation** – Oxygen in the soil can react to change the chemical structure of the soil components.

• **Reduction** – A lack of oxygen in the soil can react to change the chemical structure of the soil component.

Assessment

1. Define Weathering
2. Explain 3 processes under chemical weathering.
3. Mention 3 Physical weathering processes

Answers

1. It is the process of breakdown of rocks at the Earth's surface, either by extreme temperatures or rainwater or biological activity. Weathering is the process where rocks or soils are dissolved or worn away into smaller and smaller pieces due to particular environmental factors such as the examples given above.
2. **Hydration** – Water in the soil can react to change the chemical structure of the soil components.
   Oxidation – Oxygen in the soil can react to change the chemical structure of the soil components.
   Reduction – A lack of oxygen in the soil can react to change the chemical structure of the soil component.
   Hydrolysis – Some compounds in the soil can react to elements in the water.
   Carbonation – Soil compounds can react with carbonic acid.
3. Wetting and Grinding
   Unloading
   Organisms
   Heating and Cooling
   Grinding and Rubbing

WEEK 7

Topic: SOIL FORMATION

Contents:

A. Processes of Soil Formation

Soil is formed from parent materials by the process of weathering.

The formation of a new soil depends on the presence of new soil material –]obtained either by **denudation** – the scraping clean of a surface by action of wind, water or ice – or **deposition** of new materials from erosion elsewhere – for example river gravels, rock-falls or blowing sand – or the formation of new rocks by uplift of the ocean bed or volcanic action. Thus there is a huge variety of possible parent materials, all with uniquely different characteristics which will be incorporated into the soils which form on them.

Here are some examples:

- Rocks – Sandstone, siltstone, mudstone, limestone, volcanic lavas or dusts
- Gravels – river and sea deposits
- Scree – fallen rocks
- Alluvium – sands, silts, clays from marine, estuarine or freshwater rivers and lakes
- Boulder clay – can be very variable deposits laid down by scraping ice
- Loess – blown silts and clays are common inland on the continents
- Blown sand – forming dunes or plains
- Man-made materials – e.g. quarry or mining waste

Soils form from these parent materials by processes of **weathering** – i.e. the breakdown of the material under the influence of gravity, wind and water, accelerated by the chemical and physical effects of plant roots and animal action. Soils are also formed by the formation and decay of organic matter and by **pedogenic processes** – the leaching and evaporating effects of water and the biochemical actions of bacteria and other living things. In the illustration above, soils form as the silty estuarine sediments are colonized by hardy plants which trap more sediment, and eventually raise the surface level beyond the reach of normal tides.

Four Soil Forming Processes

- Additions: Materials added to the soil, such as decomposing vegetation and organisms (organic matter), or new mineral materials deposited by wind or water.
- Losses: Through the movement of wind or water, or uptake by plants, soil particles (sand, silt, clay, and organic matter) or chemical compounds can be eroded, leached, or harvested from the soil, altering the chemical and physical makeup of the soil.
- Transformations: The chemical weathering of sand and formation of clay minerals, transformation of coarse organic matter into decay resistant organic compounds (humus).
- Translocations: Movement of soil constituents (organic or mineral) within the profile and/or between horizons. Over time, this process is one of the more visibly noticeable as alterations in color, texture, and structure become apparent.

Leaching – leaching is the removal of soluble components of the soil column. As water washes down through the soil it can carry away bases such as calcium, held as exchangeable ions in clay-humus complexes, as well as acidification through the substitution of hydrogen ions.

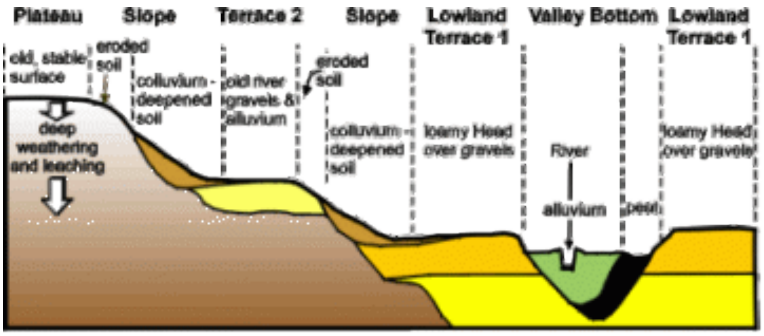
Eluviation – Soil particles held in suspension, such as clay, are removed (eg. washed away).

Illuviation -Soil particles held in suspension, such as clay, are accumulated (eg. deposited).

Podsolization – Podsolization occurs when strongly acidic soil solutions cause the breakdown of clay minerals. As a result silica, aluminium and iron form complexes with organic substances in the soil. These minerals are removed from the surface zone of the soil and can accumulate in distinct dark sub-surface layers – very evident on inspection. Upland heaths and moors often contain podsols.

Gleying – Gleying occurs in waterlogged, anaerobic conditions when iron compounds are reduced and either removed from the soil, or segregated out as mottles or concretions in the soil. Marshy wetlands often contain gleyed soils.

It is important to realize also that soil types are closely related to the shape of the landscape – or its 'topography'. Soil scientists use this to help them create soil maps. An experienced eye can determine changes in underlying soil types when walking through a landscape and observing changes in topography (and often vegetation too).



2. Factors affecting Soil Formation

1. **Time** – Soil formation takes several hundreds to thousands of years to undergo significant changes and their eventual formation. Most of the soils of the world have taken more than 10,000 years to form the current state of soils. What's more, is that the soils within this age bracket are apparently still young as they present weak soil horizon development and slight alteration of parent material.

2. **Parental Material** – Parental materials are the unconsolidated organic deposits and minerals in which soils are developing. For this reason, parental material determines the mineralogical composition and widely contributes to the chemical and physical characteristics of the soil. The type of parental material also determines the rate at which soil forming processes occurs. Accordingly, the complexity of soil patterns, texture, composition, and color in different areas highly depends on the physical and chemical compositions of the parent materials. Majority of loamy soil, for instance, forms as a result of thin deposits of fine grained materials that have been mixed with organic materials and other underlying materials through natural process.

3. **Climate –** Climate especially precipitation, temperature and frost action have a fundamental influence on the soil formation process that takes place within any given location. The prevailing climatic conditions highly determine the nature of weathering process that will take place and the rates of physical and chemical processes. Climate directly has an effect on the kind of vegetation in an area which in turn will affect the soil formation processes related to root penetration and vegetation cover. The accumulation and decay of organic matter also depends on humidity and temperature. Rainfall leaches away soluble materials and iron-rich minerals from the upper soil horizons into the lower ones and evaporation brings about the accumulation of salt compounds in the surface horizons. Cold winter temperatures give room for frost action which physically disintegrates the rocks into fragments.

4. **Topography and relief –** Topography is the configuration of a land surface and the relations among its man-made and natural features. Typically, it is the shape of the land surface and its position as well as slope on the landscape. So, these characteristics all together highly determine the types of soils formed within a region.

5. **Organisms** (living things including man, plants and animals) – All living organisms play an active role in the soil formation processes. Organisms including fungi, bacteria, animals, humans, and vegetations are the major determinants and they impact on the physical and chemical environments of the soils. Some types of micro-organisms encourage acidic conditions which change the soils chemistry and eventually determine the kind of soil formation process that occur. Microbial activities also decompose organic matter and recycle them in the soil. Larger animals including burrowing animals and earthworms mix the soil and alter its physical characteristics. This makes the soils more permeable to water and air thus enhancing the soil structure. Man's activates have as well made tremendous changes to the natural soils. Through cultivation, construction, and addition of fertilizer and lime has altered the physical and chemical properties of the soil. Filling, mining, and artificial drainage have altered the natural soil environments thereby negatively and positively affecting the process of soil formation.

Assessment

Explain the soil formation processes

Mention 3 factors affecting soil formation

S.S.S 1

AGRICULTURAL SCIENCE

THIRD TERM

TABLE OF CONTENT

Week 1

Topic: Farm tools and Their Uses

Farm tools are implements and equipment used for farming purposes.

See below the list of farm tools and their functions.

1. **Spade** – This is a basic farm tool used for digging, planting, hoeing, shoveling, and cutting lawn edges. Long-handled spades have more leverage when digging, but the short-handled spade encourages the user to grip the handle lower down – more under the load, and to use the leg muscles more. The T-piece, or D-piece on the short-handle type, gives some twisting leverage – a help when turning over spadesful of soil during digging.

Spade

2. **Tractor** – The farm **tractor** is **used** for pulling or pushing agricultural machinery or trailers, for plowing, tilling, disking, harrowing, planting, and similar tasks. It can also be called an engineering vehicle specifically designed to deliver a high tractive effort (or torque) at slow speeds, for the purposes of hauling a trailer or machinery used in agriculture or construction. Most commonly, the term is used to describe a farm vehicle that provides the power and traction to mechanize agricultural tasks, especially (and originally) tillage, but nowadays a great variety of tasks. A variety of specialty farm **tractors** have been developed for particular **uses**.

3. **Hoe** – A **hoe** is an ancient and versatile agricultural and horticultural hand tool used to shape soil, remove weeds, clear soil, and harvest root crops. Shaping the soil includes piling soil around the base of plants (hilling), digging narrow furrows (drills) and shallow trenches for planting seeds or bulbs. There are basically two types of hoe: push hoe and draw hoe. With a push hoe, the user moves backwards on to the un-hoed ground, and thus avoids walking on the newly-hoed weeds. With a draw hoe, the user moves forward towards the un-hoed ground and walks on the newly-hoed area.

Hoe

4. **Rake** – A rake is a farm implement consisting of a row of straight or curved teeth of metal or wood attached to a bar or frame. It is used for gathering hay or grain into piles; for clearing fields, lawns, and yards; and for stirring and spreading soil. A rake can be used to make a fine seedbed, to open and close seed-drills, to remove lawn clippings and leaves, to tear out moss and dead grass, and to freshen up gravelled areas and flower beds. Long, even strokes of a rake are best, so a long handle is essential. The head should not be very wide, or too narrow. The teeth should be straight, or only slightly curved, and set not too far apart.

Rake

5. **Trowel** – Garden **trowel**, a tool with a pointed, scoop-shaped metal blade and wooden, metal, or plastic handle. It is **used** for breaking up earth, digging small holes, especially for planting and weeding, mixing in fertilizer or other additives, and transferring plants to pots. It is also essential for planting bedding and vegetable

plants.

Graden Trowel

6. **Watering Can** – This is a portable container, usually with a handle and a spout with perforated nozzle, used to water plants by hand. A watering can has a vital role in ensuring the establishment of young plants of all kinds. It can also be used to apply weed-killers on paths and lawns. It can be used as a substitute for a sprayer to apply insecticides too.

Watering can

7. **Garden Fork** – This is an implement, with a handle and several (usually four) short, sturdy tines. It is used for loosening, lifting and turning over soil in **gardening** and farming. A garden fork can be used for digging; it is an essential piece of equipment on stony ground. It is useful for picking up debris such as prunings. For compost-making, it is a tool without which it is difficult to keep the heap tidy. Though not suitable for digging, a dung fork is more useful for the other tasks mentioned.

Garden Fork

8. **Hand Cultivator** – a three pronged fork with a short wooden handle. The sharp prongs make digging easier. The tool is helpful to dislodge weeds and to cultivate in

narrow spaces between plants. Hand cultivators with longer handles and four pronged forks are useful for compost management and cultivating flower-beds without stooping.

9. **Shellers** – Shellers are used mainly to separate the seeds from the husk or cob. It is also used for detaching the seed from the pod. Shellers used for rice, wheat, oats are sometimes called thrashers.

10. **Dryer** – A dryer is used for removing water from crops and by so doing, lower the moisture content of the crop to a desired level. For most crops the drier the crop, the longer their storage life.

11. **Grinder** – A grinder is used for crushing crops into the powder (when dry) or slurry (when wet). Grinder of large capacity is called mills.

12. **Conveyors** – These are machines used to move bulk masses of crops from one point to the other on the farms.

13. **Seeds Planting Machines Broadcaster** – This is a machine designed to plant seeds by random scattering to seeds about the field.

14. **Seed Drill** – This also designed to plant seed along the rows on the field. A **seed drill** is a sowing device that precisely positions seeds in the soil and then covers them. Before the introduction of the seed drill, the common practice was to plant seeds by hand.

15. **Planter:** A planter is an agricultural farm implement towed behind a tractor, used for sowing crops through a field. It is connected to the tractor with a draw-bar, or a three-point hitch. It is used for planting seeds. Planters lay the seed down in precise manner along rows. Seeds are distributed through devices called row units. The row units are spaced evenly along the planter.

Planter with Tractor

16. **Harvesters** – These are machines designed primarily to facilitate the removal of matured crops. E.g. mover, forage harvester etc.

17. **Sprayer:** A sprayer is a piece of equipment that is used to apply herbicides, pesticides, fertilizers, agro-chemicals and water in irrigation farming on agricultural crops. These are machines for the application of liquid chemicals in droplets spraying form for various farm operations. Examples of sprayers are knapsack, hand gun, motorized sprayer, boom etc. Sprayers range in sizes from man-portable units (typically backpacks with spray guns) to trailed sprayers that are connected to a tractor, to self-propelled units similar to tractors, with boom mounts of 60 –151 feet in length.

18. **Incubators** – These are machines used for hatching fertilized eggs artificially. It takes 21 days for fertilized eggs of domestic fowl to develop and hatch in incubators.

19. **Milk Machines** – These are used for expelling milk from the udder of diary animals. In use, the machine is connected to the teats at the base of the udder. Through sucking action, milk flows through the teats into the machine. These are machines designed to deliver feed at a rate that ensures best growth and development of livestock. Milking machines are used to harvest milk from cows when manual milking becomes inefficient or labour-intensive. Milking machines work in a way that is different from hand milking or calf suckling. Continuous vacuum is applied inside the soft liner to massage milk from the teat by creating a pressure difference across the teat canal (or opening at the end of the teat). Vacuum also helps keep the machine attached to the cow.

20. **Plough**: Tillage is the basic operation in farming. It is done to create favourable conditions for seed placement and plant growth. This is done mainly with a plough. To breakup or loosen the soil,kill insects and uprooting weeds. The basic components of the plough are a shoe, a share, a body, a handle and a beam.

21. **Flail mower**: A **flail mower** is a type of powered garden/agricultural equipment, which is used to deal with heavier grass/scrub which a normal lawn mower could not cope with.

Flail mower

Rice Huller

Sowing machine with seed drill concept

22. **Rice Huller**: A **Rice huller** or **Rice husker** is an agricultural machine used to automate the process of removing the chaff (the outer husks) of grains of rice.

Assessment

Spade, Tractor, Hoe, Grinder, Sheller, Milking machine, Incubator, Dryer, Grinder, Seed drill, Rake, Garden Trowel, Rice Huller, Flail mower, Conveyor, Plough, Planter, Hnd cultivator, Garden Fork.

Use the options above to answer questions 1 to 10

1. A ____ is a piece of equipment that is used to apply herbicides, pesticides, fertilizers, agro-chemicals and water in irrigation farming on agricultural crops
2. A ____ is a type of powered garden/agricultural equipment, which is used to deal with heavier grass/scrub which a normal lawn mower could not cope with.
3. A ____ is a machine used to move bulk masses of crops from one point to the other on the farms.
4. A ____ is a farm implement consisting of a row of straight or curved teeth of metal or wood attached to a bar or frame.
5. A ____ is a sowing device that precisely positions seeds in the soil and then covers them
6. An ___ is a machine used for hatching fertilized eggs artificially
7. A ____ is used mainly to separate the seeds from the husk or cob
8. A ____ is used for crushing crops into the powder (when dry) or slurry (when wet).
9. A ____ is a basic farm tool used for digging, planting, hoeing, shovelling, and cutting lawn edges
10. A ____ is a tool with a pointed, scoop-shaped metal blade and wooden, metal, or plastic handle and it is **used** for breaking up earth, digging small holes, especially for planting and weeding, mixing in fertilizer or other additives, and transferring plants to pots.

Answers

1. Sprayer
2. Flail mower
3. Conveyor
4. Rake
5. Seed drill
6. Incubator

7. Sheller
8. Grinder
9. Spade
10. Garden Trowel

WEEK 2

TOPIC: Farm Power

Content

- What is Power?
- Sources of Farm Power

Introduction

Power is defined as the rate of doing work or the rate of expenditure of energy. **Farm power** is one of the most expensive and critical inputs when growing a rice crop. Humans, animals and machines are all used as sources of **power in agriculture** production. When undertaking different operations on a **farm**, a certain amount of work is required to complete the task.

Farm power can be obtained from the following sources

1. Human Power
2. Mechanical Power
3. Animal Power
4. Electrical Power
5. Solar Power
6. Wind Power
7. Water Power
8. Biogas

Human Power

This kind of power is provided by human beings. It is the most common kind of power in farm operations. With the aid of his intelligence, man uses his hand to perform certain farm operations. Human labour is used with traditional tools. It involves more people than all other forms of power. Human labour can be hired, it may be skilled and unskilled. Human beings are the main source of power for operating small tools and implements. They are also employed for doing stationary work like threshing, winnowing, chaff cutting and lifting irrigation Water.

Farm Operations which require Human power

Crop Production –

i. Clearing of Land

ii. Land Preparation

iii. Stumping

iv. Planting

v. Weeding

vi. Harvesting

vii. Storage

viii. Food Processing

Advantages of Human Power

1. The intelligence of Man is at play and its an asset to farm operations
2. Readily available in all farm operations
3. It controls all other forms of farm power
4. For jobs with precision, Human power is used
5. Easy to control and readily available
6. Used with traditional tools

Disadvantages of Human Power

1. Cannot perform tedious operations like land clearing without getting fatigued
2. Poor state of health may affect his performance
3. It may be expensive
4. Human power is not stable and efficiency decreases with age
5. It consumes time and its less efficient
6. Human power can not be used on commercial basis

Animal Power

This is the most important source of power which is derived from animals. They are used to perform certain kinds of farm operations. Animals like bull are used for pulling ploughs, harrows, planters, ridgers while donkeys and camels are used for transportation of farm produce. Oxen and bullocks (drought animals) are yoked while man controls the direction of the implement for soil tillage.

Qualities of Drought Animal

- Good body size or deep barrel
- Strong hind limbs and sloping rump
- Strong hooves and good stride
- Should be male or castrated
- Must be docile
- Should be healthy
- Must be energetic and powerful

Farm Operations that require Animal Power

- Drawing ploughs, harrows and ridgers and planters.
- Carrying People
- Transportation of loads e.g fertilizers, farm produce, chemicals.

Factors affecting efficiency of Drought Animals

- Health of animal and diseases
- Food intake
- Breed and Genetic Make-up
- Poor management of animal
- Age of the animal
- weight of the animal
- Sex of the animal

- Climatic and environmental factors
- Training of the animal

Advantages of Animal power

1. They can work for longer period of time than humans
2. They are more efficient than humans
3. Animal wastes acts as fertilizer to the soil
4. No technical knowledge to use animals
5. Animals provide source of meat after exceeding useful life span
6. They are easier to maintain when compared to machines
7. Animals carry heavier loads than farmers or humans
8. They give higher output when compared to humans

Disadvantages of Animal Power

1. Animals are prone to diseases
2. Animals can sometimes be difficult to control or show aggression
3. They are not as efficient as machines
4. Animals suffer fatigue like humans
5. Animals die
6. A level of training is needed to handle animals
7. They require continuous supervision and attention
8. They can destroy or eat up crops

Mechanical Power

This is the use of machineries to optimize farm operations. Example of machineries are – harvesters, ploughs, harrows, planters, ridgers, tractors, food processors, grinders etc. They facilitate the cultivation of a large hectare of land and are useful for commercial purposes.

Advantages of Mechanical Power

1. It can cover more land area per unit time
2. Not prone to diseases
3. Higher efficiency, works faster
4. Reduces labour cost and overall cost of production
5. Makes farm operations timely
6. Makes farm work less tedious
7. Can perform a wider range of farm operations

Disadvantages of Mechanical Power

1. High cost of maintenance
2. Displacement of Labour (unemployment of able bodied persons)
3. Capital intensive
4. Causes pollution e.g air pollution through the release of toxic waste
5. Requires technical skills for operation
6. Not easily available
7. Cannot be used by small scale farmers
8. Can destroy soil structure

Electrical Power

This type of power is derived from electricity or generator. Electricity is needed for many purposes on the farm land. It is very efficient, reliable but expensive.

Farm Operations that require electrical power

- Refrigeration
- Incubation
- Shelling of fruits and seeds

- Brooding of chicks
- Egg grading
- candling
- Milking Machines
- Debeaking.

Most farm operations require electrical power

Advantages of Electrical Power

1. Cannot contaminate products thus makes them safe for human consumption
2. Cheap source of power
3. Aids operations and increases productivity
4. Very dependable and neat
5. Easy to operate
6. Efficient and saves labour
7. Very versatile

Disadvantages of Electrical Power

1. Irregular Supply
2. Dangerous or fatal if handled carelessly
3. Very expensive
4. Can cause fire hazards
5. Must be strictly regulated or controlled
6. Cannot be used for field operations

Solar Power

This type of power is derived from the radiation, light and heat reaching the earth surface from the sun. Energy from the sun is the ultimate source of energy. It can be converted to electrical energy through the use of solar panels.

Farm Operations that require solar energy

- Generation of Electricity
- For photosynthesis by crops
- Processing of farm produce e.g. cocoa, meat, fish maize e.t.c.
- Heating of farmstead

Advantages of Solar Energy

1. It is cheap
2. Can be stored for later use
3. Solar panels have long life span
4. Economically viable
5. Running cost is low because no fuel is consumed
6. Solar energy is environment friendly

Disadvantages of Solar Energy

1. Performance is dependent on weather condition
2. Technology requires sophisticated processes
3. Initial capital is high
4. Special trained personnels and special infrastructures are needed

Wind Power

Generated by wind movement. It can be converted to mechanical power.

Farm Operations that require solar energy

1. Windmills
2. Winnowing – separation of chaffs from grain
3. Drying of Produce
4. Pumping water from borehole
5. To generate electrical power

Advantages

1. Cheap
2. Available everywhere
3. Serves as alternative to electrical power

Disadvantages

1. Supply is sporadic and uncertain
2. Operation is expensive compared with the energy it generates
3. Efficiency varies
4. Cannot be stored or controlled
5. Limited to some farm operations

Water Power

Derived from water flowing in rivers, streams and dams. It is used in Hydro-electric stations to drive turbines

Farm Operations that require Water

1. Hydro-electric power stations
2. Transportation of logs and farm produce
3. To operate steam engines
4. To generate electricity
5. For crop production

Advantages

1. Very Cheap
2. Easy to harness
3. can be converted to another form of energy

Disadvantages

1. Low level of water can cause low generation of electricity
2. Supply is affected by weather
3. Doesn't supply electricity directly
4. Destructive if carelessly handled
5. Not available in all areas

Biogas

Generation of power through the use of farm wastes. E.g. Animal dung is carefully collected and accumulated in an airtight container to digest. As it decays anaerobically, microbes and hydrocarbons are formed. This hydrocarbon is used for heating and lighting.

Advantages

1. Cheap source of power
2. Can be converted to another form of energy

3. Can be controlled easily
4. Power derived can be used as source of heat for brooding chicks

Disadvantages

1. Not common
2. Requires expertise
3. Expensive to set up and maintain
4. Limited to areas where animals are reared

Assessment

Mention and explain 4 sources of Farm power

Mention 5 advantages Animal power and 3 disadvantages of Animal power

WEEK 3

TOPIC: Farm Mechanization

Introduction

Farm mechanization refers to the development and use of machines that can take the place of human and animal power in agricultural processes. The mechanization of agriculture that took place during the 20th century led to major changes in how farmers plant, irrigate and harvest crops. Combines, tractors, harvesters and other machinery have enabled farmers to increase their production while relying less upon an extended labor force.

The term “mechanization” is used to describe tools, implements and machinery applied to improving the productivity of farm labour and of land; it may use either human, animal or motorized power, or a combination of these. In practice, therefore, it involves the provision and use of all forms of power sources and mechanical assistance to agriculture, from simple hand tools, to draught animal power and to mechanical power technologies.

Mechanised agriculture is the process of using agricultural machinery to mechanise the work of agriculture, greatly increasing farm worker productivity. In modern times, powered machinery has replaced many farm jobs formerly carried out by manual labour or by working animals such as oxen, horses and mules. G. D. Aggarwal – “Farm mechanization is a term used in a very broad’ sense. It not only includes the use of machines, whether mobile or immobile, small or large, run by power and used for tillage operations, harvesting and thrashing but also includes power lifts for irrigation, trucks for haulage of farm produce, processing machines, dairy appliances for cream separating, butter making, oil pressing, cotton ginning, rice hulling, and even various electrical home appliances like radios, irons, washing machines, vacuum cleaners and hot plates.”

The entire history of agriculture contains many examples of the use of tools, such as the hoe and the plough. But the ongoing integration of machines since the Industrial Revolution has allowed farming to become much less labor-intensive. Mechanization was one of the large factors responsible for urbanization and industrial economies. Besides improving production efficiency, mechanization encourages large scale production and sometimes can improve the quality of farm produce. On the other hand, it can displace unskilled farm labour and can cause environmental degradation (such as pollution, deforestation, and soil erosion), especially if it is applied shortsightedly rather than holistically.

Advantages of Farm Mechanization

1. **Increase in Volume of Production**: Farm mechanization has helped in increasing the volume of agricultural production. Mechanization increases the rapidity and speed of work with which farming operations can be performed.

2. **Multiple Cropping**: Farm Mechanization encourages multiple cropping which was not possible under traditional farming.

3. **Larger Land Area for cultivation**: Farm mechanization saves labor,makes the job for leveling and preparation of land easy and helps in bringing more land under cultivation.

4. **Increase in Labour Productivity**: Farm mechanization increases efficiency of farmers and raises the output per worker. Mechanization raises the efficiency of labour and enhances the farm production per worker. By its nature it reduces the quantum of labour needed to produce a unit of output.

5. **Reduction of dependence on Animal Power**: It reduces dependence upon animal power which is costly and also slow in-operation. Machines work better and faster.

6. **Increase in Income**: Mechanization helps in increasing the income of farmers by minimizing pre and post-harvest losses. More productivity, more income.

7. **Self-sufficiency in Food Production**: Mechanization of agriculture helps in achieving self-sufficiency and surpluses in food and other crops.

8. **Lower cost of Production**: It has been accepted by all that one of the methods of reducing unit costs is to enlarge the size of the farms and go in for more intensive farming. It is found that the cost of production and the yields can be adjusted properly if mechanization is resorted to.

9. **It leads to commercial agriculture**: Mechanisation results in a shift from 'subsistence farming' to 'commercial agriculture. This shift occurs mainly due to the need for more land and capital to be associated with farmer in order to reap the full technological benefits.

10**. It Releases Manpower for Non-Agricultural Purposes:** Since the mechanisation of agriculture results in the employment of lesser number of persons on farms, surplus manpower may be available for other economic activities.

Disadvantages of Farm Mechanization

1. The initial cost of a machine is high. An idle machine is a waste. This wastage is greater, if the machine is costly.

2. Adoption of certain machines will lead to unemployment.

3. If the operator, who works on the machine, is not an expert, then its result will be useless. In the same way, if he has been trained to operate it and if he is absent, the machine will lie idle and any substitution of hand will cause additional expenses. Thus there is an increase in cost.

4. Clerks can more easily be trained in new methods and systems. In case of machines for specialized jobs, if the systems are changed, it is difficult to make use of them in the new system.

5. Machines are subject to break-down and lie idle when electricity fails (if it is electrically operated).

6. Depreciation charges are high; this will reduce the profit.

7. Certain types of machines may become obsolete within a short span of time.

8. High cost or maintenance and servicing

9. Often needs highly skilled operator, increased wages.

10. Health and safety

11. The basic defect of mechanisation is that it will result in too many agricultural workers becoming surplus and there is a large case of unemployment.

Assessment

1. Explain Farm Mechanization?
2. Why is Farm Important?

Answers

1. **Farm mechanization** refers to the development and use of machines that can take the place of human and animal power in agricultural processes. The term “mechanization” is used to describe tools, implements and machinery applied to improving the productivity of farm labour and of land; it may use either human, animal or motorized power, or a combination of these. In practice, therefore, it involves the provision and use of all forms of power sources and mechanical assistance to agriculture, from simple hand tools, to drought animal power and to mechanical power technologies.

2. You are expected to list the advantages of Farm mechanization to answer Question 2.

Week 4 & 5

TOPIC: Anatomy and Physiology of Farm Animals/The Gut and Digestion

Anatomy and Physiology
Anatomy refers to the form and structure of the body while physiology refers to the functions of the forms and parts of the body. Some of the systems which maintain the body include, circulatory system, reproductive, respiratory, nervous and digestive system.

Circulatory System

This system involves all the organs and tissues which are concurred with the movement of materials from one part of the body to another where they are either used or removed. These organs and tissues include the heart, the blood and the blood vessels.

- **The Heart**

The heart is one of the most powerful organs in the circulatory system. It helps to pump blood round the body. Each pumping action of the heart is known as heartbeat.

- **The Blood**

Blood is a fluid tissue. It is made up of two parts. The fluid plasma and the blood cells are corpuscles. There are three blood cells. These are erythrocytes (RBC), Leucocytes (WBC) and Thrombocytes (The blood platelets).

- **The Blood Vessels**

The blood vessels are the network of spaces in the body through which materials are moved from one part of the body to the other with the aid of blood. There are three types of blood vessels. These are the artery, the vein and capillaries.

B. Reproductive System

Reproduction is the ability of animals to give birth to young ones. The reproductive system includes all the organs and tissues concerned with reproduction in animals.

Male reproductive system

The male reproductive system include the testes, somniferous tubules, scrotal SAC (Scrotum), Epididymis, uterus masculinus, Spermatic cord, uretha, cowper's gland, seminal vesicle, prostate glands and penis.

Female reproductive system

The female reproductive systems include the ovaries, oviduct, uterus, vagina, vestibule, cowper's gland, perineal gland and vulva.

Respiratory System

The respiratory system includes all the organs and tissues associated with the exchange of gases between the animal and its environment leading to the release of energy. The purpose of respiration is to supply oxygen to the cells which oxidize, or burn down the food to release energy. The most important oxygen of respiration in all land animals is the lungs while aquatic animals like; fish use the gills to respire.

Types of Respiration

1. Aerobic respiration
2. Anaerobic

Process of Breathing

- Inspiration (inhalation): This involves the breathing in of air into the lungs.
- Expiration (Exhalation): This involves the breathing but of air from the lungs

Nervous System

The nervous system includes all the organs and tissues which enable animals to respond to changes in their environment. A change in the environment is called a response. The nervous system of mammals is composed of two parts namely;

1. The central nervous system: This is made up of the brain and the spinal cord.
2. The peripheral nervous system: This consists of the cranial and spinal nerves and the autonomic nervous.
3. Reflex actions: These are actions carried out by animals in response to certain stimuli without first thinking or planning for them e.g. sneezing etc.

Digestive System

The digestive system of a farm animal includes all the organs and tissues associated with the breaking down or digestion of food in the body. Farm animals are grouped into two main classes based on the nature of their alimentary canal or digestive tract.

They are;

1. Mono-gastric or non-ruminant animal e.g. Pig, Rabbit etc.
2. Poly-gastric or Ruminant animals e.g. Cattle, Sheep etc.

Differences between Mono-gastric Animal and Ruminant Animal

S/N	Mono-gastric Animal	Poly-gastric Animal
1.	Possesses only one stomach.	Possesses four stomach compartments.
2.	They cannot chew cud.	They can chew cud.
3.	They do not regurgitate.	They regurgitate.
4.	Digestion is not aided by bacteria.	Digestion is aided by bacteria.
5.	They cannot digest cellulose and fibres properly.	They can digest cellulose and fibres properly.

The Gut And Digestion

Plant cells are made of organic molecules using energy from the sun. This process is called photosynthesis. Animals rely on these ready-made organic molecules to supply them with their food. Some animals (herbivores) eat plants; some (carnivores) eat the herbivores.

1. **Herbivores**

Herbivores eat plant material. While no animal produces the digestive enzymes to break down the large cellulose molecules in the plant cell walls, micro-organisms' like bacteria, on the other hand, can break them down. Therefore herbivores employ micro-organisms to do the job for them.

There are three types of herbivore:

The first, ruminants like cattle, sheep and goats, house these bacteria in a special compartment in the enlarged stomach called the rumen.

The second group has an enlarged large intestine and caecum, called a functional caecum, occupied

by cellulose digesting micro-organisms. These non-ruminant herbivores include the horse, rabbit and rat.

Humans also have a cecum and can be classified as the third type of herbivorous class, along with orangutans and gorillas.

Plants are a primary pure and good source of nutrients, however they are digested very easily and therefore herbivores have to eat large quantities of food to obtain all they require. Herbivores like cows, horses and rabbits typically spend much of their day feeding. To give the micro- organism's access to the cellulose molecules, the plant cell walls need to be broken down. This is why herbivores have teeth that are adapted to crush and grind. Their guts also tend to be lengthy and the food takes a long time to pass through it.

Eating plants have other advantages. Plants are immobile so herbivores normally have to spend little energy collecting them. This contrasts with another main group of animals – the carnivores that often have to chase their prey.

2. Carnivores

Carnivorous animals like those in the cat and dog families, polar bears, seals, crocodiles and birds of prey catch and eat other animals. They often have to use large amounts of energy finding, stalking, catching and killing their prey. However, they are rewarded by the fact that meat provides a very concentrated source of nutrients. Carnivores in the wild therefore tend to eat distinct meals often with long and irregular intervals between them. Time after feeding is spent digesting and absorbing the food.

The guts of carnivores are usually shorter and less complex than those of herbivores because meat is easier to digest than plant material. Carnivores usually have teeth that are specialised for dealing with flesh, gristle and bone. They have sleek bodies, strong, sharp claws and keen senses of smell, hearing and sight. They are also often cunning, alert and have an aggressive nature.

3. Omnivores

Many animals feed on both animal and vegetable material – they are omnivorous. Most primates, including humans, are herbivorous but a few, such as chimpanzees belong to this category as do pigs and rats. Their food is diverse, ranging from plant material to animals they have either killed themselves or scavenged from other carnivores. Omnivores lack the specialised teeth and guts of carnivores and herbivores but are often highly intelligent and adaptable reflecting their varied diet.

Treatment Of Food

Whether an animal eats plants or flesh, the carbohydrates, fats and proteins in the food it eats are generally giant molecules (see chapter 1). These need to be split up into smaller

ones before they can pass into the blood and enter the cells to be used for energy or to make new cell constituents.

For example:

Carbohydrates like cellulose, starch, and glycogen need to be split into glucose and other monosaccharides;

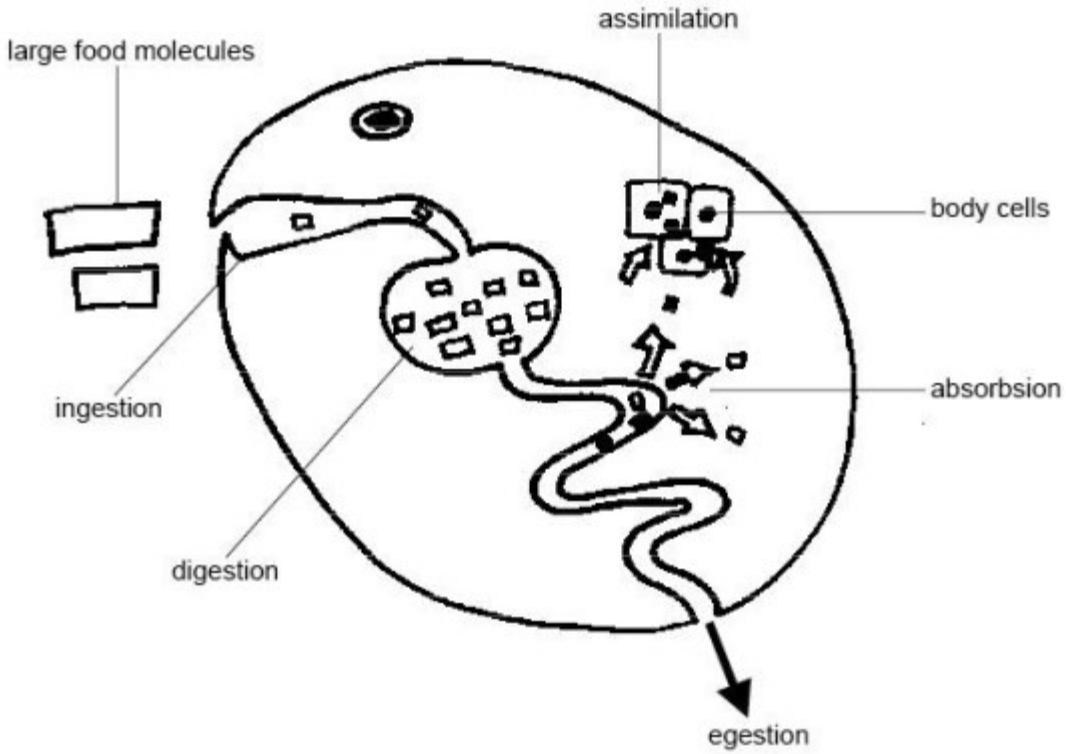
Proteins need to be split into amino acids;

Fats or lipids need to be split into fatty acids and glycerol.

The Gut

The digestive tract, alimentary canal or gut is a hollow tube stretching from the mouth to the anus. It is the organ system concerned with the treatment of foods.

At the mouth the large food molecules are taken into the gut – this is called ingestion. They must then be broken down into smaller ones by digestive enzymes – digestion, before they can be taken from the gut into the blood stream – absorption. The cells of the body can then use these small molecules – assimilation. The indigestible waste products are eliminated from the body by the act of egestion



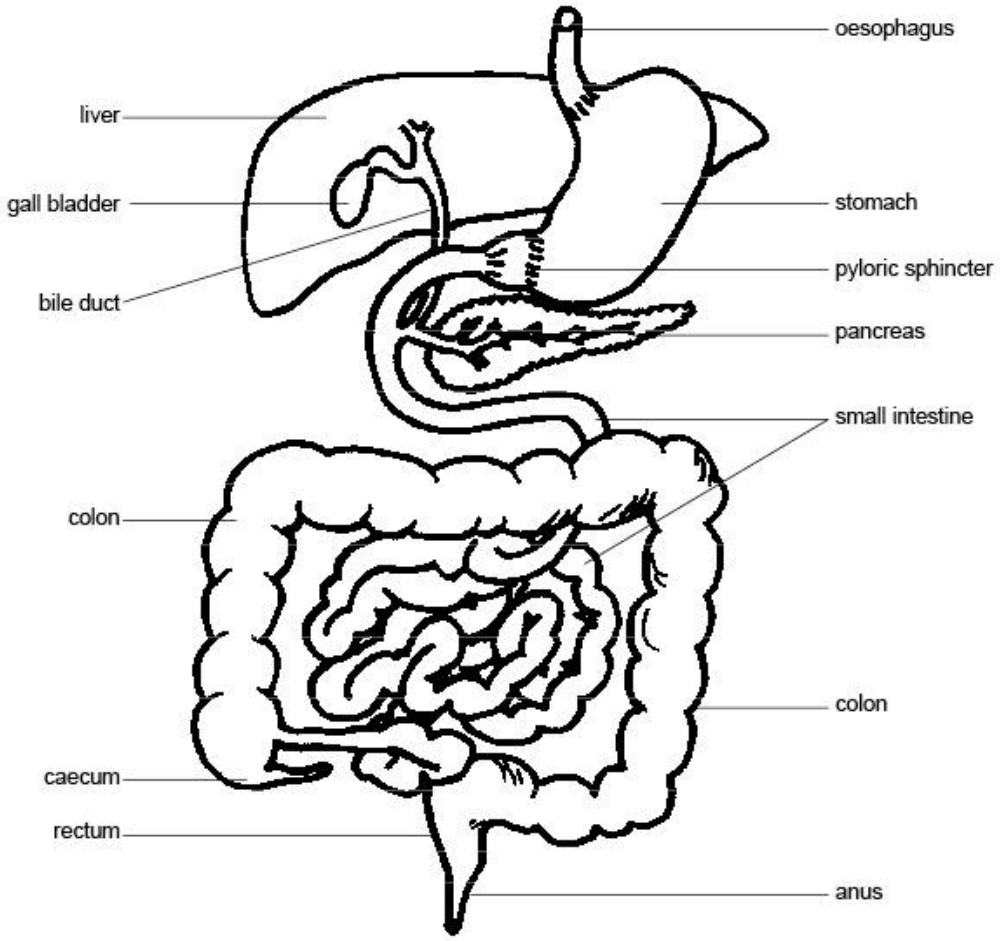
Ingestion to Egestion

From ingestion to egestion

The 4 major functions of the gut are:

1. Transporting the food;
2. Processing the food physically by breaking it up (chewing), mixing, adding fluid etc.
3. Processing the food chemically by adding digestive enzymes to split large food molecules into smaller ones.
4. Absorbing these small molecules into the blood stream so the body can use them.

The regions of a typical mammals gut (for example a cat or dog) are shown below



A typical mammalian gut

The food that enters the mouth passes to the oesophagus, then to the stomach, small intestine, cecum, large intestine, rectum and finally undigested material exits at the anus. The liver and pancreas produce secretions that aid digestion and the gall bladder stores bile. Herbivores have an appendix which they use for the digestion of cellulose. Carnivores have an appendix but is not of any function anymore due to the fact that their diet is not based on cellulose anymore.

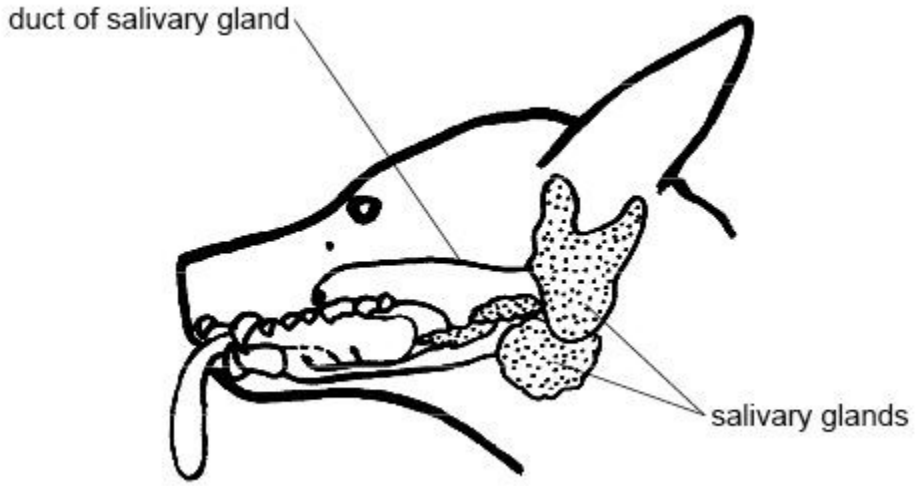
Mouth

The mouth takes food into the body. The lips hold the food inside the mouth during chewing and allow the baby animal to suck on its mother's teat. In elephants the lips (and nose) have developed into the trunk which is the main food collecting tool. Some mammals, e.g. hamsters, have stretchy cheek pouches that they use to carry food or material to make their nests.

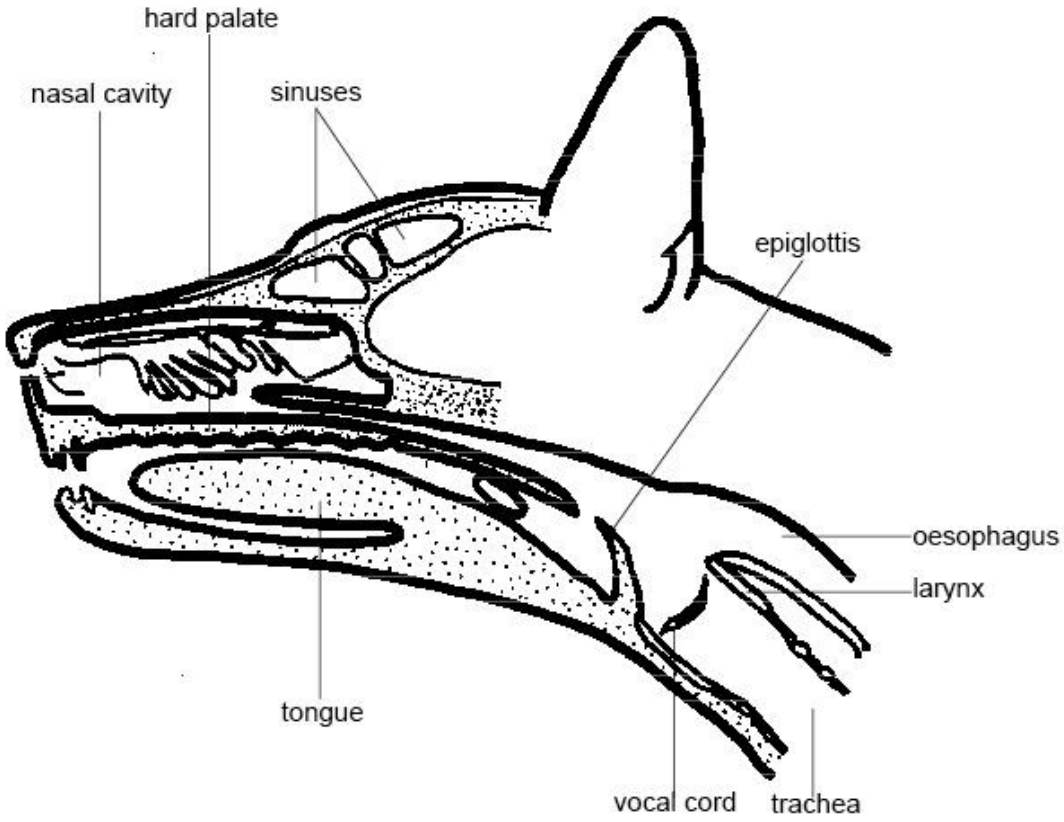
The sight or smell of food and its presence in the mouth stimulates the salivary glands to secrete saliva. There are four pairs of these glands in cats and dogs. The fluid they produce moistens and softens the food making it easier to swallow. It also contains the enzyme, salivary amylase, which starts the digestion of starch.

The tongue moves food around the mouth and rolls it into a ball for swallowing. Taste buds are located on the tongue and in dogs and cats it is covered with spiny projections used for grooming and lapping. The cow's tongue is prehensile and wraps around grass to graze it.

Swallowing is a complex reflex involving 25 different muscles. It pushes food into the oesophagus and at the same time a small flap of tissue called the epiglottis closes off the windpipe so food doesn't go 'down the wrong way' and choke the animal



Salivary glands

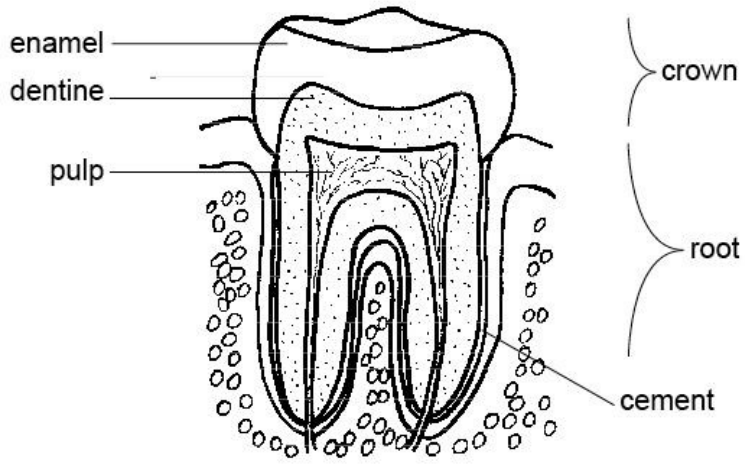


Section through the head of a dog

Teeth

Teeth seize, tear and grind food. They are inserted into sockets in the bone and consist of a crown above the gum and root below. The crown is covered with a layer of enamel, the hardest substance in the body. Below this is the dentine, a softer but tough and shock resistant material. At the centre of the tooth is a space filled with pulp which contains blood vessels and nerves. The tooth is cemented into the socket and in most teeth the tip of the root is quite narrow with a small opening for the blood vessels and nerves

In teeth that grow continuously, like the incisors of rodents, the opening remains large and these teeth are called open rooted teeth. Mammals have 2 distinct sets of teeth. The first the milk teeth are replaced by the permanent teeth.



Structure of a tooth

Types of Teeth

All the teeth of fish and reptiles are similar but mammals usually have four different types of teeth.

The incisors are the chisel-shaped 'biting off' teeth at the front of the mouth. In rodents and rabbits the incisors never stop growing (open-rooted teeth). They must be worn or ground down continuously by gnawing. They have hard enamel on one surface only so they wear unevenly and maintain their sharp cutting edge.

The largest incisors in the animal kingdom are found in elephants, for tusks are actually giant incisors. Sloths have no incisors at all, and sheep have no incisors in the upper jaw (see diagram 11.6). Instead there is a horny pad against which the bottom incisors cut.

The canines or 'wolf-teeth' are long, cone-shaped teeth situated just behind the incisors. They are particularly well developed in the dog and cat families where they are used to hold, stab and kill the prey (see diagram 11.7).

The tusks of boars and walruses are large canines while rodents and herbivores like sheep have no (or reduced) canines. In these animals the space where the canines would normally be is called the diastema. In rodents like the rat and beaver it allows the debris from gnawing to be expelled easily.

The cheek teeth or premolars and molars crush and grind the food. They are particularly well developed in herbivores where they have complex ridges that form broad grinding surfaces (see diagram 11.6). These are created from alternating bands of hard enamel and softer dentine that wear at different rates.

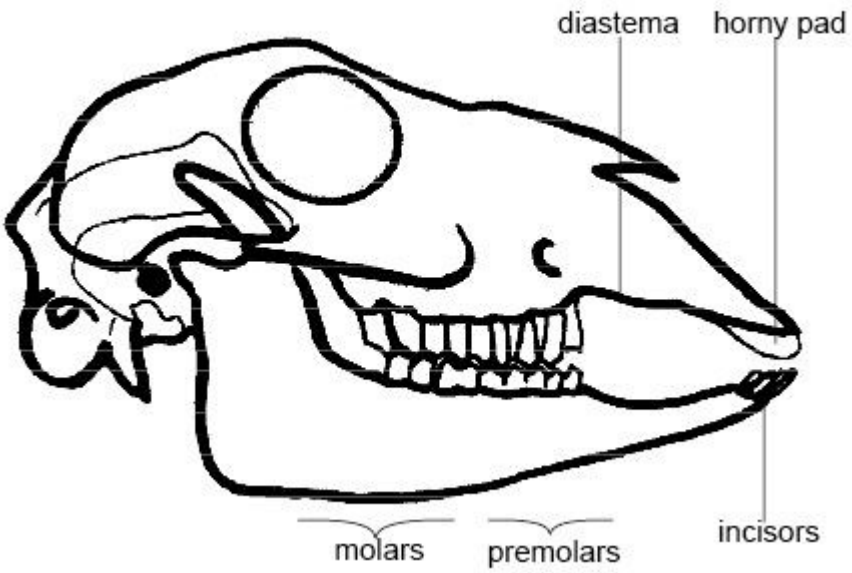
In carnivores the premolars and molars slice against each other like scissors and are called carnassial teeth see.They are used for shearing flesh and bone.

Dental Formula

The numbers of the different kinds of teeth can be expressed in a dental formula. This gives the numbers of incisors, canines, premolars and molars in one half of the mouth. The numbers of these four types of teeth in the left or right half of the upper jaw are written above a horizontal line and the four types of teeth in the right or left half of the lower jaw are written below it.

Thus the dental formula for the sheep is:

It indicates that in the upper right (or left) half of the jaw there are no incisors or canines (i.e. there is a diastema), three premolars and three molars. In the lower right (or left) half of the jaw are three incisors, one canine, three premolars and three molars.



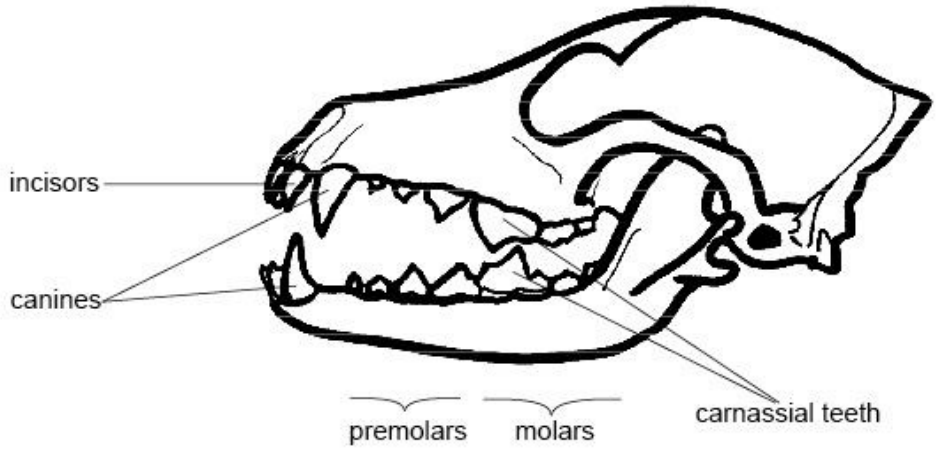
A sheep's skull

The dental formula for a dog is:

3.1.4.2

3.1.4.3

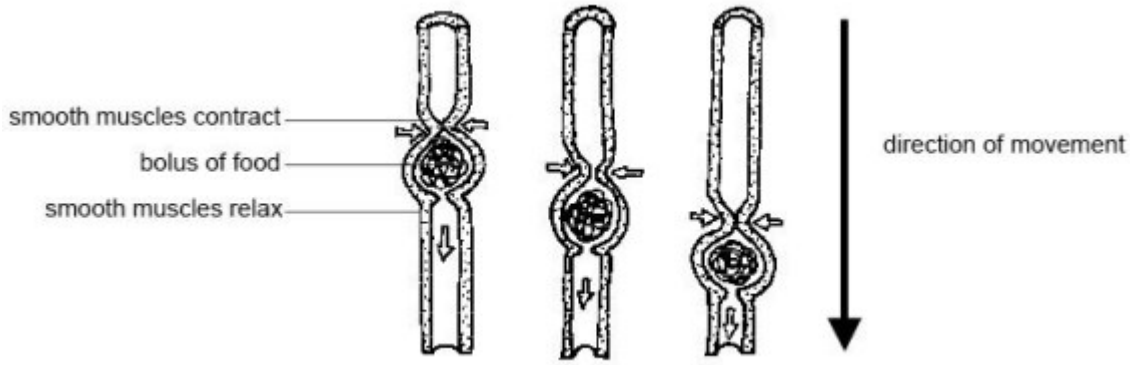
The formula indicates that in the right (or left) half of the upper jaw there are three incisors, one canine, four premolars and two molars. In the right (or left) half of the lower jaw there are three incisors, one canine, four premolars and three molars.



A dog's skull

Oesophagus

The oesophagus transports food to the stomach. Food is moved along the oesophagus, as it is along the small and large intestines, by contraction of the smooth muscles in the walls that push the food along rather like toothpaste along a tube. This movement is called peristalsis (see diagram 11.8).

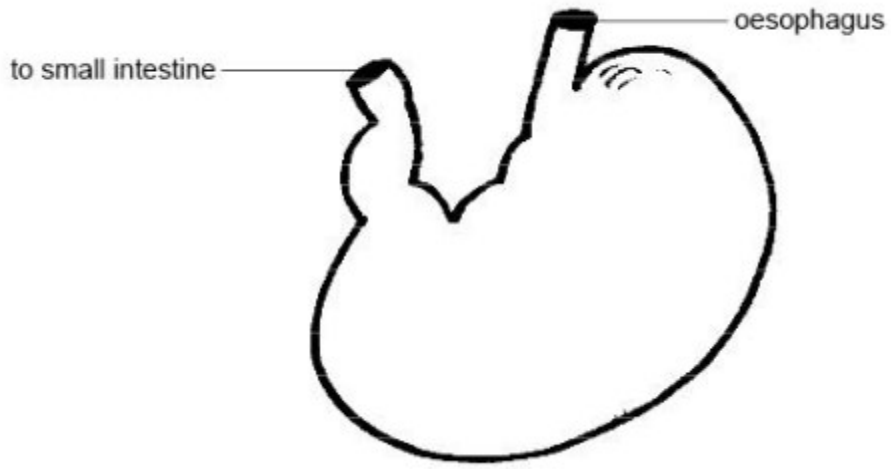


Peristalsis

Stomach

The stomach stores and mixes the food. Glands in the wall secrete gastric juice that contains enzymes to digest protein and fats as well as hydrochloric acid to make the contents very acidic. The walls of the stomach are very muscular and churn and mix the food with the

gastric juice to form a watery mixture called chime (pronounced kime). Rings of muscle called sphincters at the entrance and exit to the stomach control the movement of food into and out of it (see diagram 11.9).



The stomach

Small Intestine

Most of the breakdown of the large food molecules and absorption of the smaller molecules take place in the long and narrow small intestine. The total length varies but it is about 6.5 metres in humans, 21 metres in the horse, 40 metres in the ox and over 150 metres in the blue whale.

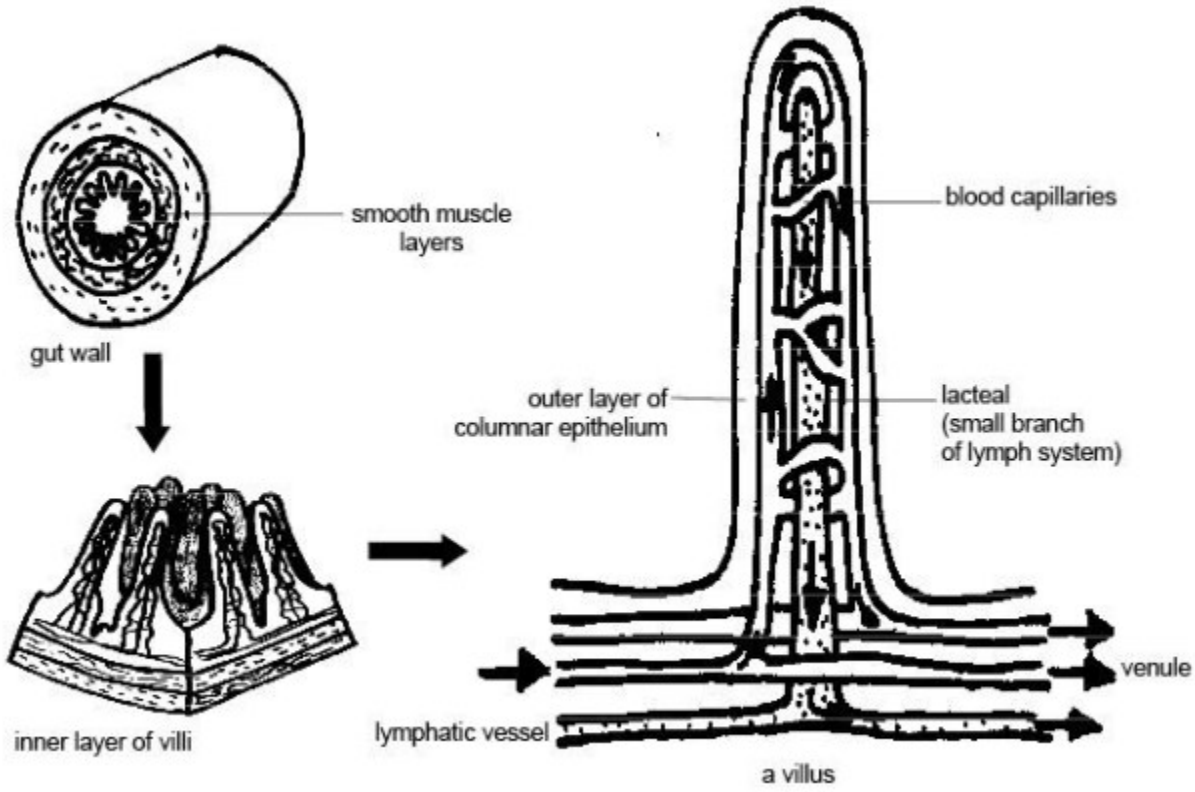
It is divided into 3 sections: the duodenum (after the stomach), jejunum and ileum. The duodenum receives 3 different secretions:

1) Bile from the liver;

2) Pancreatic juice from the pancreas and

3) Intestinal juice from glands in the intestinal wall.

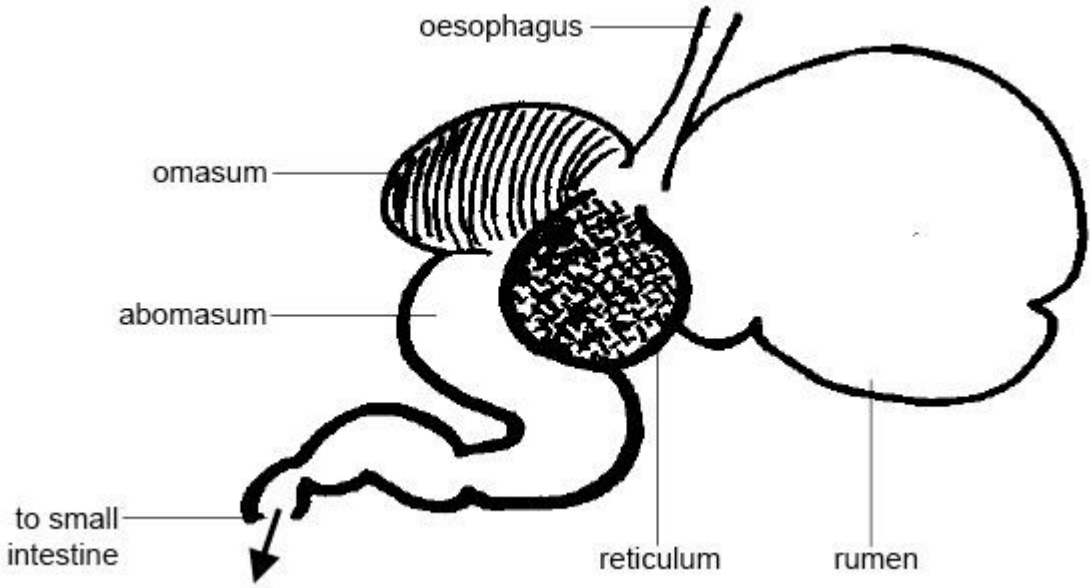
These complete the digestion of starch, fats and protein. The products of digestion are absorbed into the blood and lymphatic system through the wall of the intestine, which is lined with tiny finger-like projections called villi that increase the surface area for more efficient absorption (see diagram 11.10).



The wall of the small intestine showing villi

The Rumen

In ruminant herbivores like cows, sheep and antelopes the stomach is highly modified to act as a “fermentation vat”. It is divided into four parts. The largest part is called the rumen. In the cow it occupies the entire left half of the abdominal cavity and can hold up to 270 litres. The reticulum is much smaller and has a honeycomb of raised folds on its inner surface. In the camel the reticulum is further modified to store water. The next part is called the omasum with a folded inner surface. Camels have no omasum. The final compartment is called the abomasum. This is the ‘true’ stomach where muscular walls churn the food and gastric juice is secreted (see diagram 11.11).



The rumen

Ruminants swallow the grass they graze almost without chewing and it passes down the oesophagus to the rumen and reticulum. Here liquid is added and the muscular walls churn the food. These chambers provide the main fermentation vat of the ruminant stomach. Here bacteria and single-celled animals start to act on the cellulose plant cell walls. These organisms break down the cellulose to smaller molecules that are absorbed to provide the cow or sheep with energy. In the process, the gases methane and carbon dioxide are produced. These cause the “burps” you may hear cows and sheep making.

Not only do the micro-organisms break down the cellulose but they also produce the vitamins E, B and K for use by the animal. Their digested bodies provide the ruminant with the majority of its protein requirements.

In the wild grazing is a dangerous activity as it exposes the herbivore to predators. They crop the grass as quickly as possible and then when the animal is in a safer place the food in the rumen can be regurgitated to be chewed at the animal’s leisure. This is ‘chewing the cud’ or rumination. The finely ground food may be returned to the rumen for further work by the microorganisms or, if the particles are small enough, it will pass down a special groove in the wall of the oesophagus straight into the omasum. Here the contents are kneaded and water is absorbed before they pass to the abomasum. The abomasum acts as a “proper” stomach and gastric juice is secreted to digest the protein.

Large Intestine

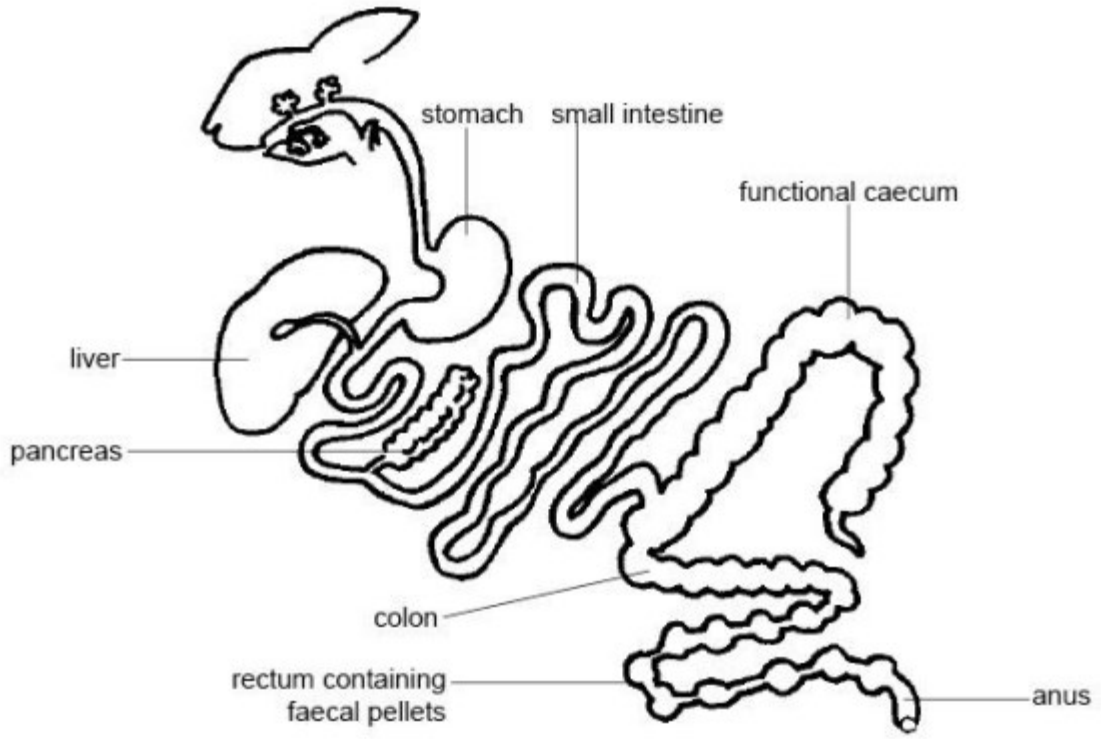
The large intestine consists of the caecum, colon and rectum. The chyme from the small intestine that enters the colon consists mainly of water and undigested material such as cellulose (fibre or roughage). In omnivores like the pig and humans the main function of the

colon is absorption of water to give solid faeces. Bacteria in this part of the gut produce vitamins B and K.

The caecum, which forms a dead-end pouch where the small intestine joins the large intestine, is small in pigs and humans and helps water absorption. However, in rabbits, rodents and horses, the caecum is very large and called the functional caecum. It is here that cellulose is digested by micro-organisms. The appendix, a narrow dead end tube at the end of the caecum, is particularly large in primates but seems to have no digestive function.

Functional Caecum

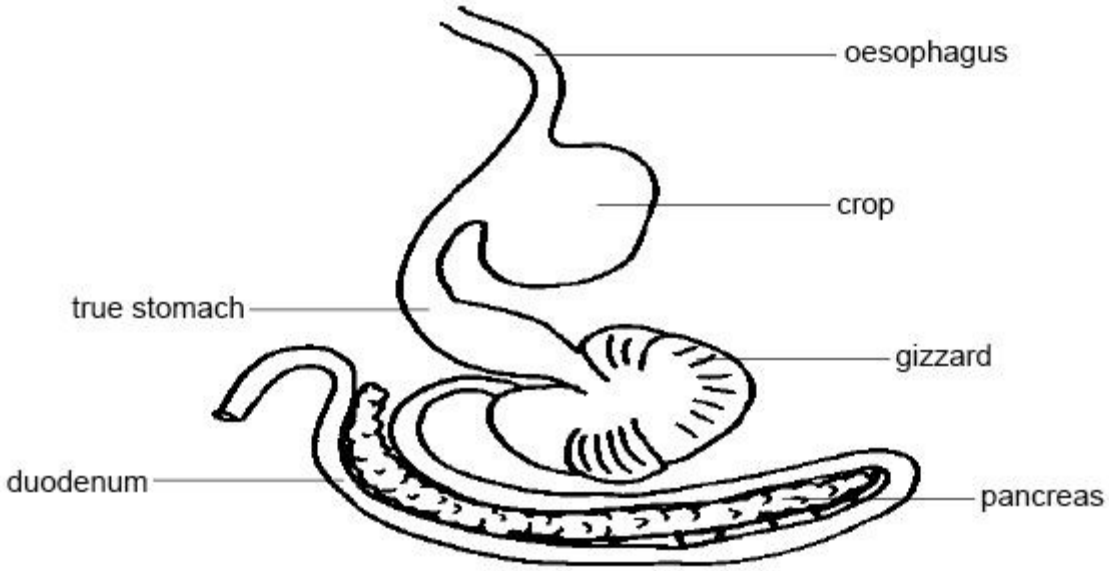
The caecum in the rabbit, rat and guinea pig is greatly enlarged to provide a “fermentation vat” for micro-organisms to break down the cellulose plant cell walls. This is called a functional caecum (see diagram 11.12). In the horse both the caecum and the colon are enlarged. As in the rumen, the large cellulose molecules are broken down to smaller molecules that can be absorbed. However, the position of the functional caecum after the main areas of digestion and absorption, means it is potentially less effective than the rumen. This means that the small molecules that are produced there can not be absorbed by the gut but pass out in the faeces. The rabbit and rodents (and foals) solve this problem by eating their own faeces so that they pass through the gut a second time and the products of cellulose digestion can be absorbed in the small intestine. Rabbits produce two kinds of faeces. Softer night-time faeces are eaten directly from the anus and the harder pellets you are probably familiar with, that have passed through the gut twice.



The gut of a rabbit

The Gut Of Birds

Birds' guts have important differences from mammals' guts. Most obviously, birds have a beak instead of teeth. Beaks are much lighter than teeth and are an adaptation for flight. Imagine a bird trying to take off and fly with a whole set of teeth in its head! At the base of the oesophagus birds have a bag-like structure called a crop. In many birds the crop stores food before it enters the stomach, while in pigeons and doves glands in the crop secretes a special fluid called crop-milk which parent birds regurgitate to feed their young. The stomach is also modified and consists of two compartments. The first is the true stomach with muscular walls and enzyme secreting glands. The second compartment is the gizzard. In seed eating birds this has very muscular walls and contains pebbles swallowed by the bird to help grind the food. This is the reason why you must always supply a caged bird with grit. In birds of prey like the falcon the walls of the gizzard are much thinner and expand to accommodate large meals (see diagram 11.13).



The stomach and small intestine of a hen

Digestion

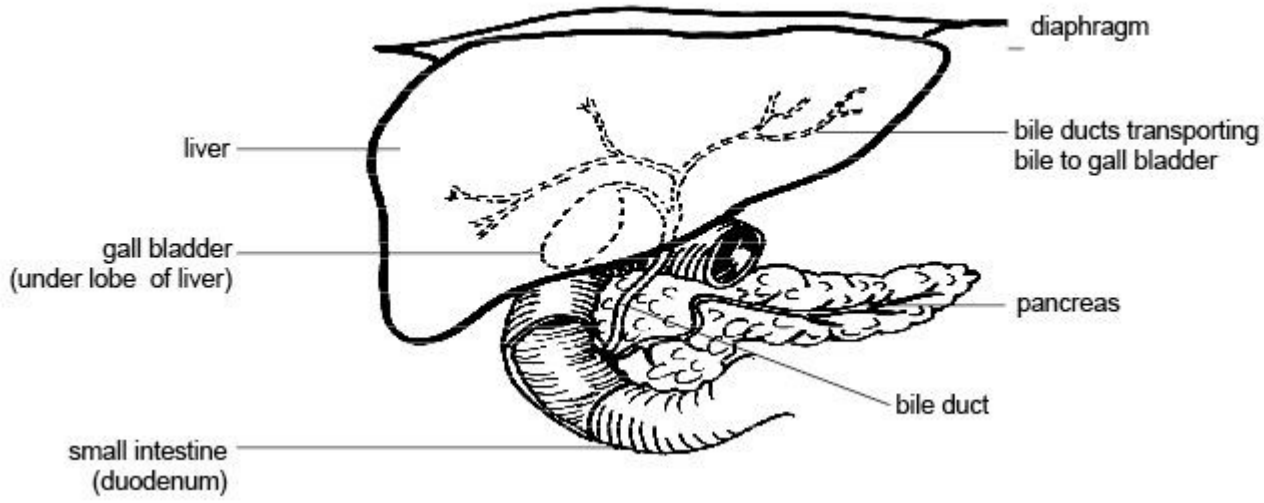
During digestion the large food molecules are broken down into smaller molecules by enzymes. The three most important groups of enzymes secreted into the gut are:

1. Amylases that split carbohydrates like starch and glycogen into monosaccharides like glucose.
2. Proteases that split proteins into amino acids.
3. Lipases that split lipids or fats into fatty acids and glycerol.

Glands produce various secretions which mix with the food as it passes along the gut.

These secretions include:

1. Saliva secreted into the mouth from several pairs of salivary glands (see diagram 11.3). Saliva consists mainly of water but contains salts, mucous and salivary amylase. The function of saliva is to lubricate food as it is chewed and swallowed and salivary amylase begins the digestion of starch.
2. Gastric juice secreted into the stomach from glands in its walls. Gastric juice contains pepsin that breaks down protein and hydrochloric acid to produce the acidic conditions under which this enzyme works best. In baby animals rennin to digest milk is also produced in the stomach.
3. Bile produced by the liver. It is stored in the gall bladder and secreted into the duodenum via the bile duct (see diagram 11.14). (Note that the horse, deer, parrot and rat have no gall bladder). Bile is not a digestive enzyme. Its function is to break up large globules of fat into smaller ones so the fat splitting enzymes can gain access the fat molecules.



The liver, gall bladder and pancreas

Pancreatic juice

The pancreas is a gland located near the beginning of the duodenum (see diagram 11.14). In most animals it is large and easily seen but in rodents and rabbits it lies within the membrane linking the loops of the intestine (the mesentery) and is quite difficult to find. Pancreatic juice is produced in the pancreas. It flows into the duodenum and contains amylase for digesting starch, lipase for digesting fats and protease for digesting proteins.

Intestinal juice

Intestinal juice is produced by glands in the lining of the small intestine. It contains enzymes for digesting disaccharides and proteins as well as mucus and salts to make the contents of the small intestine more alkaline so the enzymes can work.

Absorption

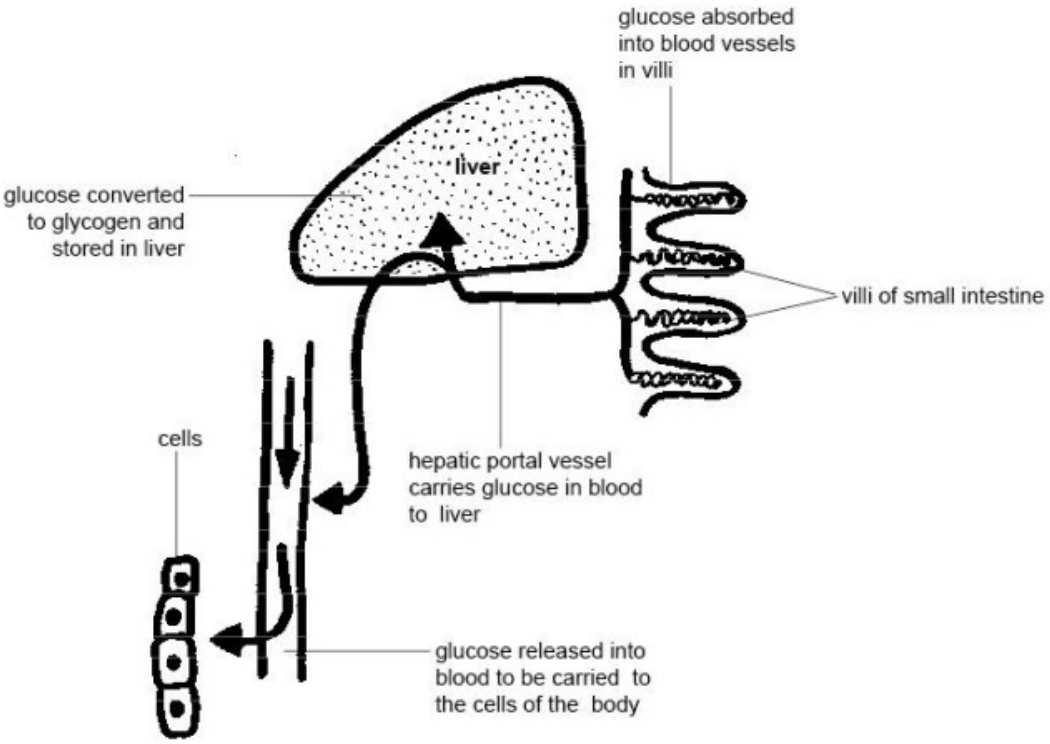
The small molecules produced by digestion are absorbed into the villi of the wall of the small intestine. The tiny finger-like projections of the villi increase the surface area for absorption. Glucose and amino acids pass directly through the wall into the blood stream by diffusion or active transport. Fatty acids and glycerol enter vessels of the lymphatic system (lacteals) that run up the centre of each villus.

The Liver

The liver is situated in the abdominal cavity adjacent to the diaphragm (see diagrams 2 and 14). It is the largest single organ of the body and has over 100 known functions. Its most important digestive functions are:

1. the production of bile to help the digestion of fats (described above) and
2. the control of blood sugar levels

Glucose is absorbed into the capillaries of the villi of the intestine. The blood stream takes it directly to the liver via a blood vessel known as the hepatic portal vessel or vein (see diagram 11.15).



The liver converts this glucose into glycogen which it stores. When glucose levels are low the liver can convert the glycogen back into glucose. It releases this back into the blood to keep the level of glucose constant. The hormone insulin, produced by special cells in the pancreas, controls this process.

The control of blood glucose by the liver

Other functions of the liver include:

1. making vitamin A,
2. making the proteins that are found in the blood plasma (albumin, globulin and fibrinogen),
3. storing iron,
4. removing toxic substances like alcohol and poisons from the blood and converting them to safer substances,
5. producing heat to help maintain the temperature of the body.

Summary of the main functions of the different regions of the gut

Assessment

1. The system responsible for all the organs and tissues which are concerned with the movement of materials from one part of the body to another where they are either used or removed is called _____ system
2. The ____ is responsible for the control of blood glucose and also those the work of converting glucose to glycogen.
3. ____ splits carbohydrates like starch and glycogen into monosaccharides like glucose
4. The gut performs ____ major functions
   a. 2
   b. 4
   c. 3
   d. 5
5. The breathing in of air into the lungs is called ____
   a. Respiration
   b. Expiration
   c. Inspiration
   d. Aerobic Respiration
6. One of the following is not part of the male reproductive system
   a. Testes
   b. Vulva
   c. Seminal vesicle
   d. Prostate glands
7. Mono- gastric animals are also called ____ animals
8. The ____ is responsible for transporting food to the stomach
9. _____ are actions carried out by animals in response to certain stimuli without first thinking or planning for them
10. The _____ system includes all the organs and tissues associated with the exchange of gases between the animal and its environment leading to the release of energy

Answers

1. Circulatory
2. Liver
3. Amylase

4. B
5. C
6. B
7. Non-ruminant
8. Oesophagus
9. Reflex actions
10. Respiratory

WEEK 6 & 7

TOPIC: Reproduction in Farm Animals

Introduction

The reproductive system or genital system is a system of sex organs within an organism which work together for the purpose of sexual reproduction. Many non-living substances such as fluids, hormones, and pheromones are also important accessories to the reproductive system. Unlike most organ systems, the sexes of differentiated species often have significant differences. These differences allow for a combination of genetic material between two individuals, which allows for the possibility of greater genetic fitness of the offspring.

Animals

In mammals, the major organs of the reproductive system include the external genitalia (penis and vulva) as well as a number of internal organs including the gamete producing gonads (testicles and ovaries). Diseases of the human reproductive system are very common and widespread, particularly communicable sexually transmitted diseases.

Most other vertebrate animals have generally similar reproductive systems consisting of gonads, ducts, and openings. However, there is a great diversity of physical adaptations as well as reproductive strategies in every group of vertebrates.

Vertebrates

Vertebrate animals all share key elements of their reproductive systems. They all have gamete producing organs or gonads. In females, these gonads are then connected by oviducts to an opening to the outside of the body, typically the cloaca, but sometime to a unique pore such as a vagina or intromittent organ.

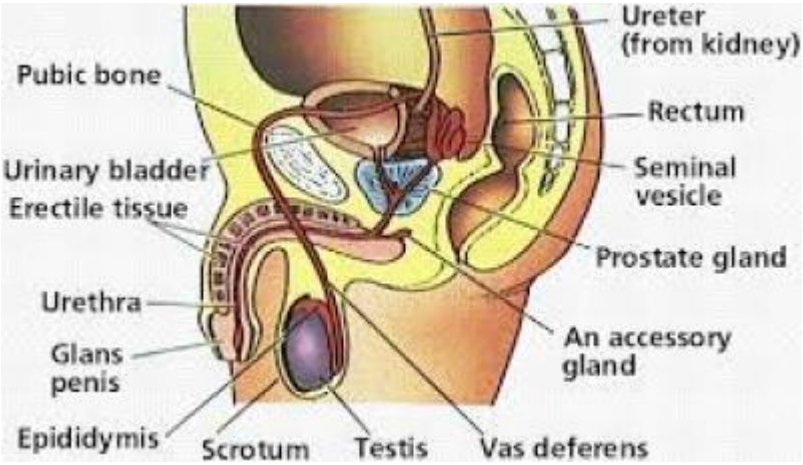
Humans

The human reproductive system usually involves internal fertilization by sexual intercourse. During this process, the male inserts his erect penis into the female's vagina and ejaculates semen, which contains sperm. The sperm then travels through the vagina and cervix into the uterus or fallopian tubes for fertilization of the ovum. Upon successful fertilization and implantation, gestation of the fetus then occurs within the female's uterus for approximately nine months, this process is known as pregnancy in humans. Gestation ends with birth, the process of birth is known as labor. Labor consists of the muscles of the uterus contracting, the cervix dilating, and the baby passing out the vagina (the female genital organ). Human's babies and children are nearly helpless and require high levels of parental care for many years. One important type of parental care is the use of the mammary glands in the female breasts to nurse the baby

The female reproductive system has two functions: The first is to produce egg cells, and the second is to protect and nourish the offspring until birth. The male reproductive system has one function, and it is to produce and deposit sperm. Humans have a high level of sexual differentiation. In addition to differences in nearly every reproductive organ, numerous differences typically occur in secondary sexual characteristics.

Male Reproductive System

The male reproductive system is a series of organs located outside of the body and around the pelvis region of a male that contribute towards the reproduction process. The primary direct function of the male reproductive system is to provide the male sperm for fertilization of the ovum.

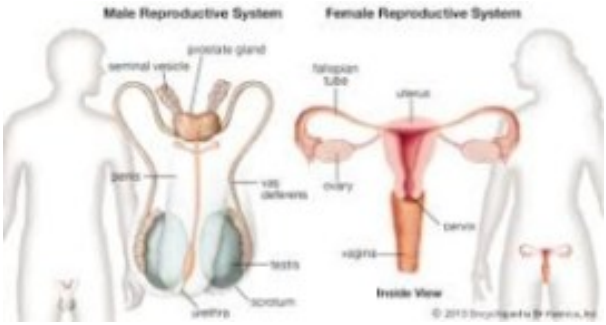


Male Reproductive System

The male reproductive system consists of a pair of testes that produce **sperm** (or **spermatozoa**), ducts that transport the sperm to the penis and glands that add secretions to the sperm to make **semen.** The major reproductive organs of the male can be grouped into three categories. The first category is sperm production and storage. Production takes place in the testes which are housed in the temperature regulating scrotum, immature sperm then travel to the epididymis for development and storage. The second category are the ejaculatory fluid producing glands which include the seminal vesicles, prostate, and the vas deferens. The final category are those used for copulation, and deposition of the spermatozoa (sperm) within the male, these include the penis, urethra, vas deferens, and Cowper's gland.

Major secondary sexual characteristics includes: larger, more muscular stature, deepened voice, facial and body hair, broad shoulders, and development of an adam's apple. An important sexual hormone of males is androgen, and particularly testosterone.

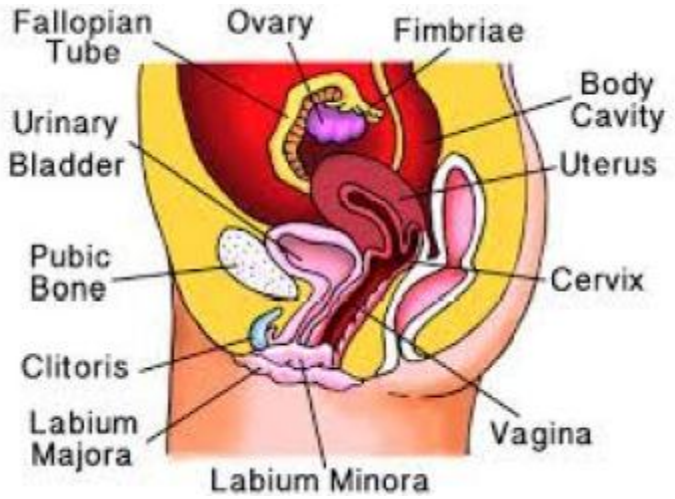
The testes release a hormone that controls the development of sperm. This hormone is also responsible for the development of physical characteristics in men such as facial hair and a deep voice.



Reproductive System

Female Reproductive System

The human female reproductive system is a series of organs primarily located inside of the body and around the pelvic region of a female that contribute towards the reproductive process. The human female reproductive system contains three main parts: the vagina, which leads from the vulva, the vaginal opening, to the uterus; the uterus, which holds the developing fetus; and the ovaries, which produce the female's ova. The breasts are involved during the parenting stage of reproduction, but in most classifications they are not considered to be part of the female reproductive system.



Female Reproductive System

The vagina meets the outside at the vulva, which also includes the labia, clitoris and urethra; during intercourse this area is lubricated by mucus secreted by the Bartholin's glands. The vagina is attached to the uterus through the cervix, while the uterus is attached to the ovaries via the fallopian tubes. Each ovary contains hundreds of egg cells or ova (singular *ovum*).

Approximately every 28 days, the pituitary gland releases a hormone that stimulates some of the ova to develop and grow. One ovum is released and it passes through the fallopian tube into the uterus. Hormones produced by the ovaries prepare the uterus to receive the ovum.

The lining of the uterus, called the endometrium, and unfertilized ova are shed each cycle through the process of menstruation. If the ovum is fertilized by sperm, it attaches to the endometrium and the fetus develops.

Other Mammals

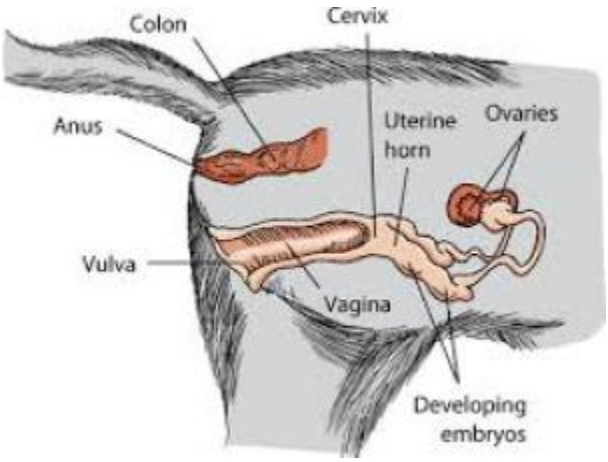
Most mammal reproductive systems are similar, however, there are some notable differences between the “normal” mammal and humans. For instance, most mammalian males have a penis which is stored internally until erect, and most have a penis bone or baculum. Additionally, males of most species do not remain continually sexually fertile as humans do. Like humans, most groups of mammals have descended testicles found within a scrotum, however, others have descended testicles that rest on the ventral body wall, and a few groups of mammals, such as elephants, have undescended testicles found deep within their body cavities near their kidney.

The reproductive system of marsupials is unique in that the female has two vaginae, both of which open externally through one orifice but lead to different compartments within the uterus; males usually have a two-pronged penis which corresponds to the females’ two vaginae. Marsupials typically develop their offspring in an external pouch containing teats to which their newborn young (joeys) attach themselves for post uterine development. Also, marsupials have a unique prepenial scrotum.The 15mm (5/8 in) long newborn joey instinctively crawls and wriggles the several inches (15 cm), while clinging to fur, on the way to its mother’s pouch.

The uterus and vagina are unique to mammals with no homologue in birds, reptiles, amphibians, or fish. In place of the uterus the other vertebrate groups have an unmodified oviduct leading directly to a cloaca, which is a shared exit-hole for gametes, urine, and feces. Monotremes (i.e. platypus and echidnas), a group of egg-laying mammals, also lack a uterus and vagina, and in that respect have a reproductive system resembling that of a reptile.

Dogs

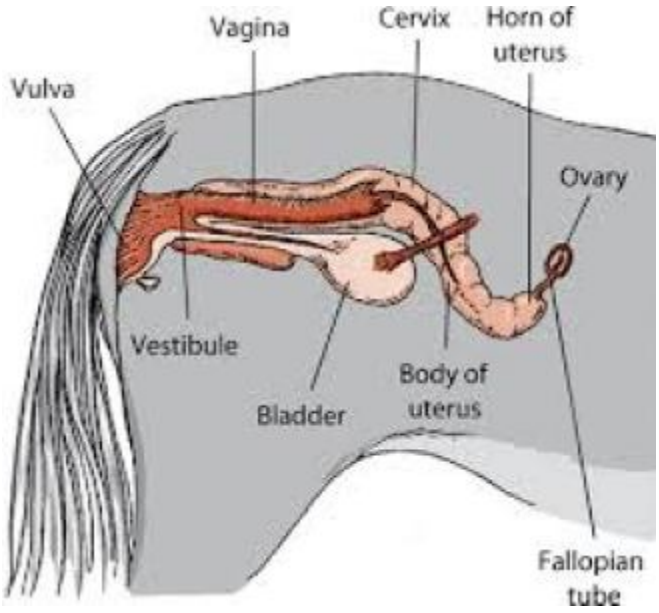
In domestic canines, sexual maturity (puberty) occurs between the ages of 6 to 12 months for both males and females, although this can be delayed until up to two years of age for some large breeds.



Dog Reproductive System

Horses

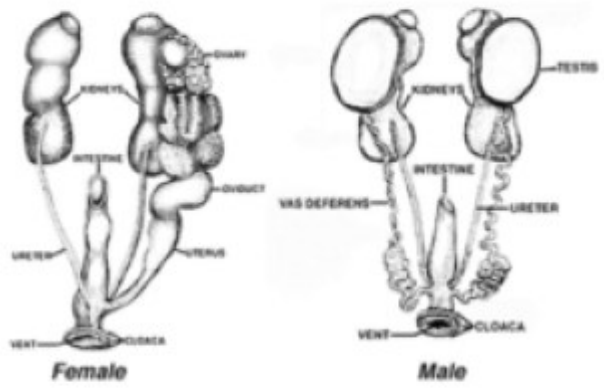
The mare's reproductive system is responsible for controlling gestation, birth, and lactation, as well as her estrous cycle and mating behavior. The stallion's reproductive system is responsible for his sexual behavior and secondary sex characteristics (such as a large crest).



Horse Reproductive System

Birds

Male and female birds have a cloaca, an opening through which eggs, sperm, and wastes pass. Intercourse is performed by pressing the lips of the cloacae together, which is sometimes known as intromittent organ which is known as a phallus that is analogous to the mammals' penis.



Bird Reproductive System

Bird Reproductive System

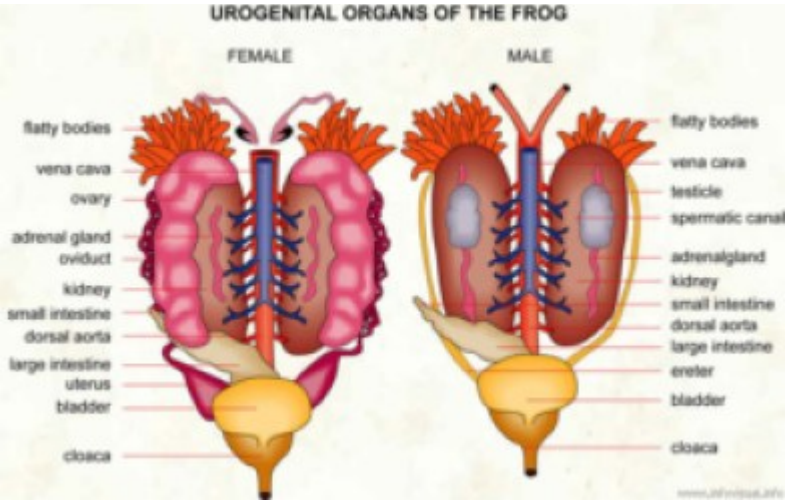
The female lays amniotic eggs in which the young fetus continues to develop after it leaves the female's body. Unlike most vertebrates female birds typically have only one functional ovary and oviduct. As a group, birds, like mammals, are noted for their high level of parental care.

Reptiles

Reptiles are almost all sexually dimorphic, and exhibit internal fertilization through the cloaca. Some reptiles lay eggs while others are viviparous (animals that deliver live young). Reproductive organs are found within the cloaca of reptiles. Most male reptiles have copulatory organs, which are usually retracted or inverted and stored inside the body. In turtles and crocodilians, the male has a single median penis-like organ, while male snakes and lizards each possess a pair of penis-like organs.

Amphibians

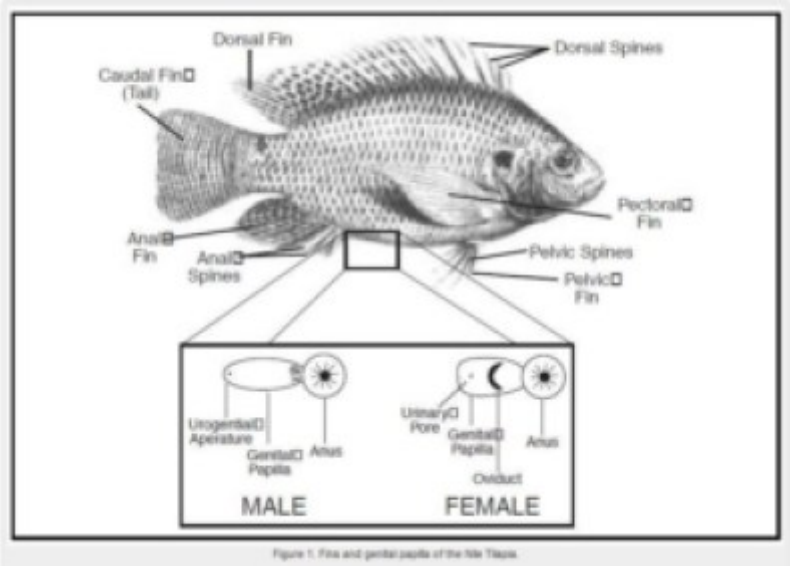
Most amphibians exhibit external fertilization of eggs, typically within the water, though some amphibians such as caecilians have internal fertilization. All have paired, internal gonads, connected by ducts to the cloaca.



Frog Reproductive System

Fish

Fish exhibit a wide range of different reproductive strategies. Most fish however are oviparous and exhibit external fertilization. In this process, females use their cloaca to release large quantities of their gametes, called spawn into the water and one or more males release “milt”, a white fluid containing many sperm over the unfertilized eggs. Other species of fish are oviparous and have internal fertilization aided by pelvic or anal fins that are modified into an intromittent organ analogous to the human penis. A small portion of fish species are either viviparous or ovoviviparous, and are collectively known as livebearers.



Fish Reproductive System

Fish gonads are typically pairs of either ovaries or testes. Most fish are sexually dimorphic but some species are hermaphroditic or unisexual.

Invertebrates

Invertebrates have an extremely diverse array of reproductive systems, the only commonality may be that they all lay eggs. Also, aside from cephalopods, and arthropods, nearly all other invertebrates are hermaphroditic and exhibit external fertilization.

Cephalopods

All cephalopods are sexually dimorphic and reproduce by laying eggs. Most cephalopods have semi-internal fertilization, in which the male places his gametes inside the female's mantle cavity or pallial cavity to fertilize the ova found in the female's single ovary. Likewise, male cephalopods have only a single testicle. In the female of most cephalopods the nidamental glands aid in development of the egg.

Practice Question

How does Internal fertilization occur in Humans?

Answer

You are expected to describe the reproductive process stating how the male organ is inserted into the female organ i.e the sperm fuses with the ovum via sexual intercourse.

Week 8

Topic: Environmental Physiology

Definition of Environmental physiology

This can be defined as effects of the environment on the growth and performance of farm animals. Normal growth and performance are enhanced when climatic factors like temperature, rainfall, wind, relative humidity, sunlight etc. are moderate.

Effects of Changes in Climate on Growth

1. High intensity of radiation affect food intake of farm animals.
2. High relative humidity leads to heat stress in farm animals e.g. cattle, poultry, pig, etc.
3. Extreme low temperature leads to retarded growth or even death of chicks.
4. At high temperatures also, feather coverage in chicks are poorly developed and this may lead to pecking.
5. Wind aids the spread of air borne disease e.g. tuberculosis.
6. High rainfall leads to the multiplication of tsetse-flies which transmits trypanosomiasis.

Effects of Changes in Climate on Reproduction

1. Heat stress causes abortion in farm animals.
2. High temperature decreases ovulation in animals.
3. At high temperature, fertility and hatchability in breeder birds reduces.
4. High temperature leads to low rate of conception or fertilization in farm animals.
5. Light controls sexual maturity.

Effects of Changes in Climate on Milk Production

1. High temperature reduces the rate of milk production in farm animals.
2. High temperature and rainfall do not favour the rearing of daily animals.
3. High relative humidity favours the growth of disease pathogens that can reduce milk production in farm animals.

Effects of Changes in Climate on Egg Production

The effects include;

1. Temperature
2. It reduces spermatogenesis and libido in males.
3. High temperature lower egg production.
4. High temperature reduces hatchability of eggs
5. Egg storage period is reduced under high temperature.
6. High temperature causes a reduction in feed intake while a low temperature encourages more feed intake.

Control of Heat/Temperature

1. Fans or air conditions should be introduced.
2. Enough windows or opening for ventilation should be provided.
3. Vents should be provided at the roof tops.
4. Room heater or lanterns should be used to warm the building when it is cold.
5. Relative Humidity
6. It is very important in incubation of egg.
7. High humidity compounds heat stress.
8. High humidity causes feed to go moldy.
9. It encourages the spread of disease.

Control of Humidity

1. Free ventilation should be allowed when the humidity band is high.
2. Spilling of water in poultry houses should be avoided.
3. Humidifiers or open trays filled with water should be fixed to increase humidity.

Practice Questions

1. List the climatic factors that affect the growth of plant and farm animals
2. List the effects of climatic change on Milk production

3. Whats are the effect of high temperature on Egg Production?

Answers

1. Temperature, Rainfall, Wind, Relative Humidity, Sunlight.

2. High temperature reduces the rate of milk production in farm animals.
   High temperature and rainfall do not favour the rearing of daily animals.
   High relative humidity favours the growth of disease pathogens that can reduce milk production in farm animals.

3. High temperature reduces spermatogenesis and libido in males.
   High temperature lowers egg production.
   High temperature reduces hatchability of eggs
   Egg storage period is reduced under high temperature.
   High temperature causes a reduction in feed intake

WEEK 9 & 10

TOPIC: Livestock Management

Meaning of Livestock

Livestock are domesticated animals raised in an agricultural setting to produce commodities such as food, fiber and labor. The enclosure of livestock in pastures and barns is a relatively new development in the history of agriculture. Livestock management is the care and raising of animals for use or for pleasure.

Importance of Livestock

1.

    1. Livestock are generally raised for profit.
    2. Raising animals (animal husbandry) is a component of modern agriculture. It has been practiced in many cultures since the transition to farming from hunter-gather lifestyles
    3. The meat help with the production of a useful form of dietary protein ad energ**y**
    4. Mammalian livestock can be used as a source of milk, which can in turn easily be processed into other dairy products, such as yogurt, cheese, butter, ice cream etc.
    5. Livestock produce a range of fiber/textiles. For example, sheep and goats produce wool and mohair; cows, deer, and sheep skins can be made into leather; and bones, hooves and horns of livestock can be used.
    6. Manure can be spread on fields to increase crop yields. It serves as fertilizers for the growth of other crops is . The blood and bone of animals are also used as fertilizer**s**
    7. Animals such as horses, donkey, and yaks can be used for mechanical energy. Prior to steam power, livestock were the only available source of non-human labor. They are still used for this purpose in many places of the world, including ploughing fields, transporting goods, and military function
    8. The grazing of livestock is sometimes used as a way to control weeds and undergrowth. Thereby serves as a means for land management

Uses of Livestock

Livestock are used by humans for a variety of purposes, many of which have an economic value. Livestock products include:

Meat

Livestock can be used as meat by humans. Meat is a useful form of dietary protein and energy, it is the edible tissue of the animal carcass. Example, Cattle, Goat, Pig, Poultry Birds e.t.c

Dairy products

Mammalian livestock can be used as a source of milk, which can in turn easily be processed into other dairy products, such as yogurt, cheese, butter, ice cream, kefir, and kumis. Using livestock for this purpose can often yield several times the food energy of slaughtering the animal outright. Example of live stock is Cow.

Land Management

The grazing of livestock is sometimes used as a way to control weeds and undergrowth. For example, in areas prone to wildfires, goats and sheep are set to graze on dry scrub which removes combustible material and reduces the risk of fires.

Fertilizer

Manure can be spread on fields to increase crop yields. This is an important reason why historically, plant and animal domestication have been intimately linked. Manure is also used to make plaster for walls and floors, and can be used as a fuel for fires. The blood and bone of animals are also used as fertilizer. Livestock dung can be used as manure.

Labor

The muscles of animals such as horses, donkeys, and yaks can be used to provide mechanical work. Prior to steam power, livestock were the only available source of nonhuman labor. They are still used in many places of the world to plough fields (drafting), transport goods and people, in military functions, and to power treadmills for grinding grain.

Clothing and Adornment

Livestock produce a range of fiber textiles. For example, domestic sheep and goats produce wool and mohair, respectively; cattle, swine, deer, and sheep skins can be made into leather; livestock bones, hooves and horns can be used to fabricate jewellery, pendants, or headgear.

Conservation

The raising of livestock to conserve a rare breed can be achieved through gene banking and breeding programmes.

Feeding and Nutrition

What animals eat has a major impact on their performance, profitability and quality of the end product. For intensive livestock (pigs, poultry and sheep and cattle in feedlots), cereals, legumes and protein meals make up the majority of the diet and are formulated to meet diet specifications. For extensive animals, quality of pastures and year-round supply become major issues.

Genetics and Selection

Genetic improvement is a major factor contributing to the profitability of production systems for livestock and poultry. Breeding and selection have resulted in significant economic gains in beef, lamb, wool, milk, pork, egg and chicken production.

Disease control in Livestock

- Quarantine of a new stock
- Inoculation: A vaccine is injected into the animals to make them develop immunity against certain disease e.g rinders pest.
- Proper sanitation through daily cleaning of feeds,regular removal of dropping and waste products, regular disinfection of pen
- Good management of stock through good feedings, rotation grazing

Control of Intermediate Host and Reservoirs

- Limiting the contact between intermediate and final hosts by improvements in management.
- Direct action may be taken to reduce or eliminate intermediate host populations.
- Reduction in the number of snail intermediate host by chemical (molluscides) or biological control (ducks, Maris species of snails).
- Reduction in the number of snail intermediate hosts by drainage, fencing and other management practices.
- Reduction in the number of insect and tick vectors by chemical (insecticides/acaricides), biological control (hymenopterous insects, entomopathogenic fungi and Bacillus thuringiensis) and genetic control (sterile male technique, chromosomal translocation).
- Use of vaccines (Tickgard) at appropriate times may control the vector population.

Destruction of reservoir hosts is important in controlling certain parasites, e.g., rodents for Leishmania and antelopes for African trypanosomes

Assessment

How can diseases be controlled in Livestock animals?

Explain 4 uses of livestock animals.