Grade 9 Agricultural Studies

Index

CHAPTER 1
General farming, Agricultural production factors and agricultural resource conservation

MODULE 1
Agricultural Production factors

As discussed in grade 8, 4 production factors land, capital, labour and entrepreneurship (management) are used to produce a commodity using the various agricultural resources.

Agricultural resources as related to the factors of production.

When farming/working the land, we can only use the resources that are available in that specific area to ensure that enough food is produced and available for consumption by all. These resources differ from area to area and determine the way farmers can farm.

Objectives

The learners should understand the basic production factors and resource use in agriculture.

Upon completion you should be able to answer questions on
The factors of production and basic resources required for farming:

- Land (Natural Resources)
  - Land
  - Water
  - Vegetation
- Capital (Financial resources)
  - Capital (Assets)
  - Credit
- Labour (Human resources)
  - Management
  - Labour
- Entrepreneurship
  - Explain how entrepreneurship is linked to using opportunities to create business.

Keywords/terms and concepts – Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

Concept/Term	Explanation
Interest	Money paid regularly from were obtained at a particular rate for the use of money lent, or for delaying the repayment of a debt
Diverse	Showing a great deal of variety; very different
Biodiversity	Refers to all species and living things on Earth or in a specific ecosystem
Topography	The arrangement of the natural and artificial physical features of an area.
Vegetation	Plants, trees, and flowers can be referred to as vegetation
Botanical	Something derived from a ***plant***, source
Credit worthiness	Lender determines that you will default on your debt obligations, or how worthy you are to receive new credit.
Permeability	Describes how water (or other liquid) and air can move through the **soil**
Assets	An item or property owned by a person or company, regarded as having value.

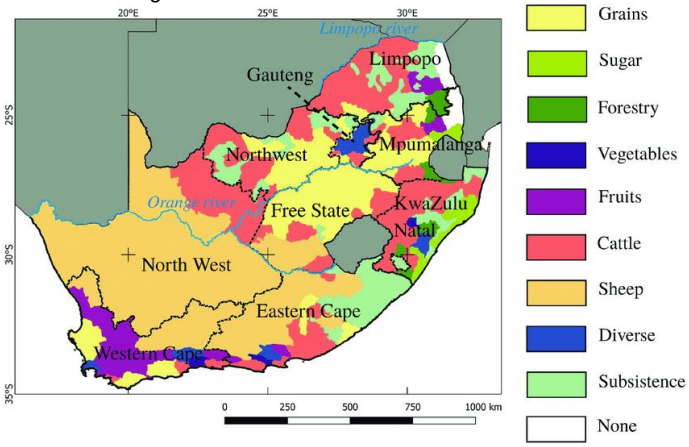
Factors of Production
It is important that the factors of production are understood and how it influences each production enterprise or farming unit.

1. Land and Natural resources
South Africa comprises an area of 122 million ha that, and in future the population could grow to 60 million. However, the food production capacity of any country is limited by the following factors:

- soil conditions.
- vegetation
- topography
- Climate (rainfall, temperature, light)

These climate-soil combinations leave only 12% of the country suitable to produce rain-fed crops. With only 3% considered truly fertile land, South Africa falls short of other countries, such as India, where arable land covers 53% of the country.

South Africa is a rich and diverse country. It has a range of vegetation types, biodiversity, climates, and soil types. Based on this diversity the country can be divided into distinct farming regions, and farming activities range from intensive crop production in winter rainfall and high summer rainfall areas, to more extensive cattle ranching in the bushveld and sheep farming in the more arid regions.



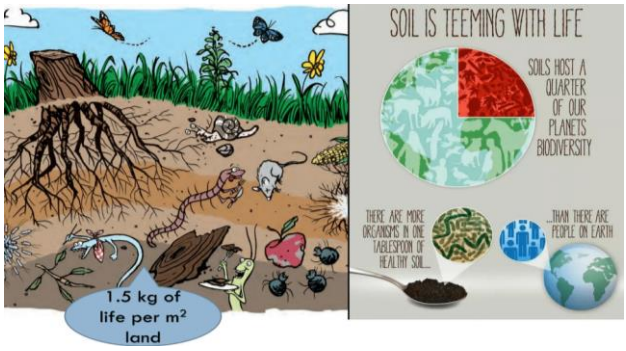
Map of main production areas for some commodities

Natural resources or land ability to produce is determined by:

- Soil

Importance of soil

Soil is the basis of all life. See the illustration below.



Soil is composed of the weathering products of mother rock (small pieces of rock, smaller than 2mm in diameter or mineral particles) together with soil air, soil water, organic matter and living organisms and it serves as

- growth medium for plants.
- anchor the plant through its roots
- absorbs water and other inorganic nutrients from the soil.

Since soil is an essential medium for food production, it needs to be conserved at all costs and, where possible, it should be improved to ensure sustainability.

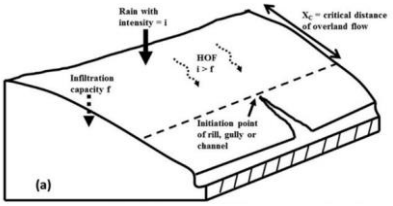
The production ability of soil, is influenced by:

- its effective depth, texture, and permeability (see soils later)
- climate or location
- correct management practices and agricultural capacity of the soil.
- sensitivity to change or to destruction (degradation)

- Terrain or topography (elevation, slope, aspect, or orientation)

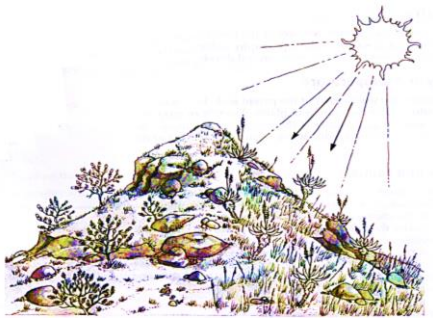
Terrain or relief (also topographical relief) involves the production ability or characteristics of the soil of the of land surface. This is usually expressed in terms of the mountains, hills, and contours. It includes height above sea level, the slope of the area and the amount of exposure to sun radiation or orientation.

- **Slope**
  - The slope determines the cultivation capacity of the soil and the ease with which degradation takes place. Soils with similar texture but on different slopes will differ with regards to erosion and the uptake of water. The possibility of erosion increases as the incline and length of the slope increases.
  - An increase in gradient makes it difficult to work the soil. Steep slopes must be contoured carefully (or divided into terraces) to prevent erosion.



- **Aspect or orientation**
  - The orientation of the slope means the direction the slope faces.

- **In** the southern hemisphere, north-facing slopes are subject to the direct rays of the sun, which increases soil temperatures and makes the soil dry out more quickly. For this reason, south-facing slopes in the drier areas of Southern Africa usually have denser vegetation than north-facing slopes.



North facing slopes in South Africa is warmer than south facing slopes.

- **Elevation**
  The **elevation** of a geographic location is its height above or below a fixed reference point, most commonly Earth's sea level.

- **Climate as a natural resource**

There are *many factors* which *influence the climate* over a period, eg temperature, humidity, precipitation of rain, winds, solar radiation, atmospheric pressure and other meteorological conditions, but only the following major factors will be discussed.

- **Water (Rainfall)**
  All forms of life revolve around water, it is the single most important element that are needed by humans, animals and plants. Without water, no agricultural production, would be possible.
  South Africa is a dry country that receives on average only 464 mm rainfall per year. It is less than half of the world's average rainfall of 1 000 mm per year. Of this 464 mm, 89% returns to the atmosphere through transpiration and evaporation, while 9% flows into the ocean as surface water. Only 2% is infiltrated into the soil and supplements underground water sources.

- **Temperature**
  Air and soil temperatures determine biochemical, physiological and physical processes in plants. Plants can only grow between certain minimum and maximum temperatures, but within these extremes there is an optimal temperature at which plants will grow best.

- **Light**
  Through the process of photosynthesis, green plants change light energy into chemical energy / carbohydrates that can be used for nutrition. If all other environmental factors are favorable, the available light energy determines the level of production.
  Besides the effect that daylight length (photo period) has on the total amount of energy, it also influences the development of flowers in plants and the fertility of certain sheep breeds.
  Since many crops are produced for their fruit and seeds, the length of the photo period determines the success of specific crops in certain areas. Photo period also influences the vegetative growth of crops.

- **Wind**
  The effect of wind is mostly indirect, ie
  - it can increase or lower the temperature according to circumstances.
  - Wind tends to increase the rate of evaporation and transpiration and therefore

affects soil moisture and humidity. This can lead, for example, to forest fire conditions and local droughts.
- In areas suffering from heavy winds, plants can be blown over that restrict production.

- **Vegetation** (plant coverage, botanical composition)
  Different species of vegetation are found in areas based on their requirements. The vegetation found in an area determines the
  - **Plant coverage**
    The vegetative structure of plants influences both the *habitat* and other *organisms* found in that area.
    Trees spread out their leaves so that each leaf receives sunshine, but do not allow much sunlight to reach the ground under the trees, so fewer plants will grow there except those that do prefer shade.
    In a *forest* the *temperature* and *humidity* are much more *constant* and there is a *low light intensity.* In *open fields* the sunlight is not cut off by the leaves of trees and *plants grow densely on the ground.*

    Plants grow in the soil and their remains fall back to the ground when they die. The *decayed remains* are mixed up in the soil and become part of it.
    This influences the
    - *fertility,*
    - *water capacity,* and the
    - *temperature* of soils.

    The roots of trees grow deep and help to *break up the rocks in the soil. Plants and plants roots keep the soil in one place and prevent soil erosion.*

  - **Botanical composition**
    In a community some plants are less important in determining the nature and function of the whole community than others. Only a very few species or groups of species exert the major controlling influence by virtue of their numbers, size, production, or other activities. **I**f the *dominant* (eg the tree species) is removed it will result in *important changes,* not only in the biotic community, but also in the physical environment (ie the microclimate), whereas the removal of a *non-dominant* (eg a grass species) will produce much *less change. D*ominant species are those which have the largest contribution to the productivity in the community.

2. Capital or Financial resources

Finances on the farm is more complex than just quickly discussing it. Any business needs to be profitable (need to make money to stay in the business). In doing so the business will use capital and credit to finance the farming operation.

- **Capital and assets.**

  Capital is the money or wealth needed to produce goods and services. In the most basic terms, capital is money. All businesses must have capital to purchase resources to maintain their production processes or operations.

  As seen in grade 8 some resources like land, tractors etc. or an item or property that is owned by a person or company, do have a certain value. If an item is regarded as having value, it is known as an asset. Assets can be made available as financial capital to get money to continue with the production process.

  Capital can be obtained by

  - selling the produce/products he after the harvest. This type of capital is usually referred to as owner's capital.

- capital may also take the form of cash in selling other assets like real estate, equipment, vehicles, and so forth which may be disposed of or exchanged for cash in the market.

The biggest portion of capital needed/owned in a farming business is usually the land (if the farmer owns it, it is an asset).

NB - Capital can also be converted into a negative value if the farmer applies incorrect cultivation practices and over cropping, as it will decrease the value of the land. (educators should explain this to leaners)

Capital is thus an instrument of production, as anything used in production is capital. Capital therefore refers to anything that can be used for productive purposes. Land, fixed improvements, machinery, equipment, livestock, fertiliser, fuel, and so on are all required in a farming business to produce a product.

THUS - The amount of money a consumer or business has available to borrow—or their creditworthiness—is based on their assets.

Capital (Credit) obtained from through a bank to purchase things can be divided into different duration terms.

- **Long-term capital (fixed capital)**

  It is an expensive asset and is long term in nature. This capital cannot be traded easily. Examples are land and fixed improvements, as well as capital invested in vineyards, orchards and plantations.

- **Medium-term capital (movable capital)**

  Medium-term capital is used over a few production terms and will usually not change in form during the production process. The capital or capital assets will not be destroyed in the production process, for example tractors, breeding cattle, machinery.

- **Short-term capital (working/floating capital)**

  Short-term capital is usually short term in nature and is only involved in the production process during a single year. It is usually consumed within one year (production season) and includes production resources such as pesticides, feeds, fertiliser, seed and fuel, as well as capital required to pay wages, reparations, contract work and transport.

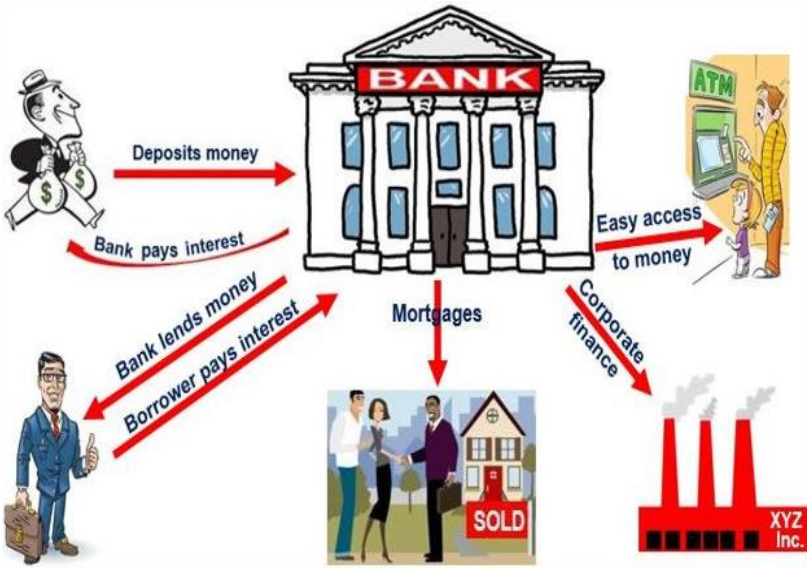
"Capital is thus a necessary factor of production like any other factor, but it has a cost," In the case of debt (credit) capital, the cost is the interest that the farmer must pay to borrow funds.

Understanding Credit

- **Credit** is an arrangement you make with a company or individual to receive money, goods, products, or services, that you will need to pay back later. It is also a measure of your financial reliability and can be used for small or large purchases. The amount of money a consumer or business has available to borrow—or their creditworthiness—is thus based on the assets they have.

Credit or loans can be provided by

- banks



Services a bank provide.

- Credit providers, Cooperation's (Senwes, Afgri etc.) and other people lend money to individuals to buy items like a car, home or for a production loan (to produce a product).

Every loan – and its conditions for repayment – is governed by state guidelines to protect consumers from unsavory practices like excessive interest rates. In addition, loan length (short, medium- and long-term credit) and default terms should be clearly detailed to avoid confusion or potential legal action.

- Mortgage: When you need to by a farm or a home loan, you take out a mortgage. The loan is secured by the property you're purchasing (collateral)

  Eg. The most common form of buying on credit is with credit cards. People tend to make purchases with credit cards because they may not have enough cash on hand to make the purchase. Accepting credit cards can help increase sales at retailers or between businesses.

NB to understand the basics of capital and credit it is important that learners are exposed to a in class scenario where the above can be tested and applied.

Let us look at the following explanation of capital and credit.

A farmer owns 75 ha of land, a tractor, trailer and other required machinery, labour to plant/sow the land, seeds purchased to plant, and fertilizer he had bought. He also uses manure from his dairy cows to fertilise the fields. All these things which the farmer uses to produce crops are agricultural capital.

Based on the above example capital for this farmer can thus be divided into different forms:
- Long term capital (fixed capital) – the 75ha land,
- Medium term capital (movable capital) – tractor, trailer, etc.
- Short term capital (floating/working capita) – seeds, fertiliser and manure (he can sell the access) etc
What about the labour, is that capital? – No, the labourers "sell" their time to the farmer to do a certain amount of work.

If the farmer wants to expand his operation and he approach a financial institution to borrow money to buy 20ha of land worth R350 000, his creditworthiness is based on the value of the following assets (capital) he has.
- Fixed capital - 75 ha land value of R 750 000
- Movable capital - tractor R 70 000 and trailer R 30 000

The total value of his assets is thus R 850 000. The bank can now provide a loan on credit to the value of R350 000 (excluding interest), the loan is secured by the existing property and the property he is purchasing. (This is known as collateral). Because it is property (fixed capital) the loan is structured over 10 years and is it refer to the use of long-term credit, therefore a lower interest rate could be offered over the total period of the loan.

3. Labour or Human resources

A farm cannot operate without workers. Employment in the agricultural sector includes employment in the following areas.

- Management: this includes the decision makers and the supervisors sometimes other than the owner.

  Good management practices in relation to human resources are important to,
  - define the roles and responsibilities for everyone on the farm and
  - communicate it to them.
  - continually assess their labour needs and see how those needs line up with their current work force.

- Labourers as a human resource tend to crop or animals on a farm
  Various types of labours are employed on the farm.
  - eg, permanent labour eg. farm workers or
  - temporary farm workers like supervising operators, accountants and
  - seasonal labour eg. (shearers, pruners, etc.)

4. Entrepreneurship / Owner

- The entrepreneur is the one that initiates the process of production by mobilizing the other factors of production (land; labor; and capital).
- Entrepreneurship involves taking on risk and organizing production through establishing new businesses and exploring new ideas and new products.

- He organizes, manages and controls the affairs of the firm. He is the risk bearer and in consideration of this the profit maker as well.
- Simply put the entrepreneur is the owner of the business.

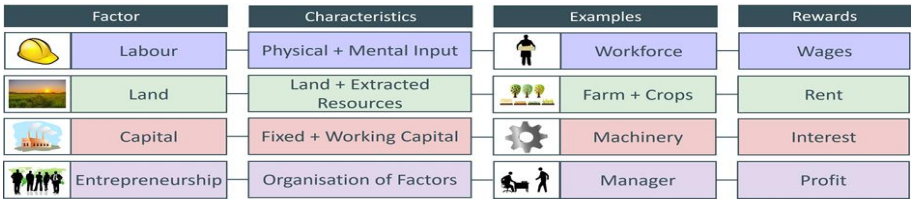
A business opportunity presents itself when?
- There is a possibility of offering a new product or service to the market.
- The product or service fulfils the demands and preferences of the customers.
- The product can be used to solve problems.
- There is a change in the environmental factors,
  - political,

- economic,
- social,
- technological

The process of identifying, evaluating and selecting a business opportunity start by identifying the needs and wants of the customers.

Activity: The educator should create a scenario where the learner needs to borrow money for the planting of your crop.

Summary



Module questions.

1 Name the 4 factors of production that play a role in agricultural production. (4)
2 Discuss the importance of soil as a natural resource. (4)
3 Briefly explain how a farmer can obtain capital to assist in the production. prosses of a commodity. (6)
4 Name the different types of capital found and give appropriate examples. (6)
5 Briefly discuss your understanding of credit. (4)
6 Name the Human resources playing a role in agricultural production and discuss each briefly. (6)
7 Explain the importance of the entrepreneur as a factor of production. (4)

Module 2
Conservation of agricultural resources

Better management of our agricultural resources can improve agricultural production.

The effect of pollution can be seen in all-natural resources and there are many contributors, from ourselves as individuals to big corporations. Agricultural pollution can be defined as the contamination of the soil, air and water environments resulting from farming activities.

Agricultural activities such as ploughing, seedbed preparation, crop spraying, fertilizer spreading and applying slurry may all contribute to pollution. Run-off from farm roads and yards, the surface of fields and dusty roofs after rainfall are all potential sources of pollution.

This pollution arises over a wide geographical area and is dependent on what happens on the surface of the land. Although individually Small, pollution on a larger catchment scale can be significant, considering the cumulative effect which these separate discharges can have on the environment.

The great barrier reef in Australia is a good example as effected by agricultural pollution. Pollution occurs thousands km away, end up in rivers and then washed to the ocean.

Objectives

The learners should understand, degradation (erosion and chemical) and prevention of the following natural resource in agriculture.

Upon completion you should be able to answer questions based on pollution, degradation (erosion and chemical) and prevention of the following natural resource in agriculture.

- Water
- Soil
- vegetation

Keywords/terms and concepts – Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

Concept/Term	Explanation
A biobed	Is a lined structure filled with biomix: a mixture of topsoil, a peat substitute and straw. The biomix removes the pesticides from contaminated water, which can then be re-used

Contamination	The action or state of making or being made impure by polluting or poisoning
Pollution	The introduction of contaminants into the natural environment that cause adverse change.
Degradation	Process through which the natural environment is compromised in some way, reducing biological diversity and the general health of the environment
Catchment	**Catchment** is the process of collecting water, in particular the process of water flowing from the ground and collecting in a river
Run-off	Flow over and away from a surface
Gully	A **gully** is a landform created by running water, eroding sharply into soil, typically on a hillside
Bund	A stonewall used especially to control the flow of water.
Gabion	A basket or container filled with earth, stones, or other material and used to prevent erosion

Adverse effects of high- input agriculture and potential pollution sources which are associated with farming practices and which can harm the environment.

- Overuse of natural resources, causing depletion of groundwater, and loss of forests, wild habitats, and of their capacity to absorb water, causing waterlogging and increased salinity:
- Contamination of the atmosphere by ammonia, nitrous oxide, methane and the products of burning, which play a role in ozone depletion, global warming and atmospheric pollution:
- Contamination of food and fodder by residues of pesticides, nitrates and antibiotics.
- Contamination of water by pesticides, nitrates, soil and livestock water, causing harm to wildlife, disruption of ecosystems and possible health problems in drinking water;
- Build-up of resistance to pesticides in pests and diseases including herbicide resistance in weeds
- Damage of farm and natural resources by pesticides, causing harm to farm workers and public, disruption of ecosystems and harm to wildlife.
- Erosion of genetic diversity – the tendency in agriculture to standardize and specialize by focusing on modern varieties, causing the displacement of traditional varieties and breeds:
- New health hazards for workers in the agrochemical and food processing industries

How does pollution occur?

- Soil particles are dislodged by water and wind during the erosion process. These particles end up in rivers or land.


Soil particles in water eroded from soil

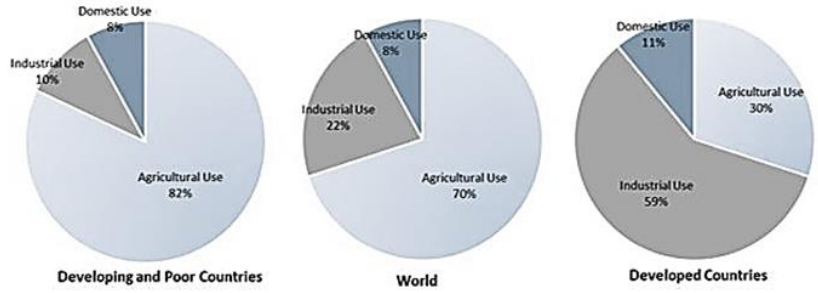

Dust storm due to an exposed soil cover.

- Losses of nutrients or agrochemicals from land or water represent not only a financial loss to farming but can also damage the environment.
- Excess nutrients, such as nitrogen and phosphorus, harm soils, rivers, and estuaries by causing algal blooms and by changing the natural balance of plants, insects and other life.

- In the wrong place, pesticides can kill river insects and fish and can remain in river sediments for many years.
- Run-off from dirty yards, roads and grazing fields or land that has been spread with livestock slurries can also contribute to the bacterial contamination of inland and coastal waters and the failure of environmental quality standards. Fellow farmers downstream may experience poor quality water or incur extra expense in dealing with the effects of pollution including the possibility of disease transmission.
- In addition, groundwater (i.e. water held below the surface of the land; an important source of drinking water in rural areas) can be put at risk as a result of the leaching or percolation of nutrients and pesticides from the surface of the land. Groundwater is also important in maintaining river flow and for other aquatic environments. If it becomes polluted, surface waters are also at risk.
- Poor management of waste, plastic, chemicals, and soil that all end up in water sources.

1 Water

Agriculture is the industry that use most of the available surface and groundwater. The availability of water is a factor that influence agricultural production. It is important that farmers and industry that occupy the largest surface area to produce commodities, ensures that conservation practices are employed to prevent pollution of water as a resource.



Water use in the different sectors in the world.

To produce more food, we must ensure that all the water used in agriculture returns in a clean state to the environment.

In “conventional” agriculture a great deal of chemical substances is used, like pesticides, fertilizers and weedkillers. These substances are not wholly absorbed by the plants but inevitably end up polluting rivers and underground water strata and degrade water as a resource. Among the most dangerous substances for human health produced by agricultural pollution are nitrates.

Water is an irreplaceable resource used to produce food and foodstuffs. To face the increasing growth in the world population, and request for food, a massive rise in use of water for agriculture is envisaged. It is therefore our duty to learn to use water with less wastage, in agriculture too!

Cows drinking water from a polluted stream.

Preventing water pollution

It is important to remember that practices employed in one prevention control measure, could also influence the other.

Some examples

- Good practices for the reduction of pollution in agriculture are buffer strips and measures that reduce surface run-off from fields. (see prevention of soil erosion)
- Carefully plan all storage and handling arrangements for livestock slurries and manures

Slurry dam where wet manure is stored

Application of slurry on the field

- Maintain a suitable distance from any watercourse including ditches (e.g. 10m) or drinking water supplies (e.g. 50m), especially when handling or applying fertilisers, organic wastes, pesticides or other chemicals. Always store empty plastic container used to transport pesticides in a secure place.

- Follow application rates for every input, especially of nutrients, pesticides, and other chemicals through careful planning.
- Animal feedstuffs, silage effluent, agricultural fuel oil, dirty water, fertilisers, veterinary medicines, chemicals and pesticides should all be stored in suitable places at your farm. Dispose these products where it cannot cause any pollution.
- Ensure that reedbed, wetland or infiltration systems are installed to reduce the risk of pollution. Adopt "good housekeeping" and waste minimisation practices (such as a biobed) that aim to prevent pollution of our resources.

Watch the video about biobeds and its use.

Activity: Discuss ways your school can protect and enhance your local environment, and how to minimise the impacts of diffuse agricultural - or ordinary pollution of water, land, and air. Once you decide on a plan implement it at your school.

2 Soil

Soil is an integral part of our natural environment. Soil also influences the flow of chemical substances (gasses) and water between the earth and the atmosphere. Human activities like the use of pesticides, fungicides, and herbicides have had a negative / an adverse effect on soil quality. In addition to agricultural pollution, industrial waste and urban activities also cause soil pollution.

Prevention and control of soil degradation and pollution are as important as air and water pollution control. In fact, soil's impact on air and water quality is crucial as it is home to a wide range of organisms, plays a big role in the distribution of plant species and soil health. (see soil as a natural resources)

What is Soil degradation?

Soil degradation is the physical, chemical and biological decline in soil quality. It can be the loss of organic matter, decline in soil fertility, and structural condition, erosion, adverse changes in salinity, acidity or alkalinity, and the effects of toxic chemicals, pollutants or excessive flooding. This decline in soil condition is caused by its improper use or poor management, usually for agricultural, industrial or urban purposes. Soils are a fundamental natural resource and are the basis for all terrestrial life.

Avoiding soil degradation is crucial to our well-being. **If** current loss and pollution of soil is not prevented and stopped the World's topsoil could become unproductive within the next 60 years.

Soil degradation causes include agricultural, industrial, and commercial pollution;

- loss of arable land due to urban expansion, erosion
- overgrazing, and
- unsustainable agricultural practices
- and long-term climatic changes.

Some examples/causes of soil degradation:

- Erosion takes place. Soil erosion can be either wind or water (erosion by water can be surface erosion or gully erosion) in both instances the topsoil is removed by either water or wind and deposited elsewhere. Water erosion usually start small eg. with surface erosion if not acted against it will result in much bigger soil losses.

Example of surface (rill) erosion

Example of gully erosion

Damage caused by water erosion is usually influenced by the intensity of the rainfall, slope, infiltration capacity of the soil.

- Mono cropping results in the loss of organic matter and soil fertility,


Pine forest before cutting of trees


Pine forest after trees were cut

- the build-up of chemicals in soil and water


Build-up of certain minerals and chemicals in the soil leads to bare patches.


Build-up of nitrate in rivers across SA rivers and the world

- the loss of vegetation through overgrazing


Overgrazing is a big problem in many grazing areas across South Africa that lead to erosion.

Prevention of soil and water degradation

For agricultural land management, soil conservation methods such as

- biological control practices and
- mechanical control should be used.

Prevention of soil degradation

- Use biological control practices where possible.
  Biological practices refer to crop-related soil management. Crop related control measures include.
  - crop rotation,
  - strip cropping,
  - planting along the contours,
  - protector belt,
  - crop residues and use of organic composts.

  Establishing permanent cover crops on new areas can help reduce erosion caused by rain thus ensuring increased soil fertility and formation.
  Implement minimum tillage practices and practice conservation farming practices.

Strip planting

Leaving organic matter on the soil

Protector belt

Windbreaks

- The mechanical methods of soil erosion control include.
  - the use of contours and contour ploughing,
  - gully control,
  - and building cabions/bunds to stop water.

In excessive sloping areas, building cabions/bunds across the slope helps to prevent erosion.

Contours and contour ploughing and planting limits soil erosion

Gully control using bunds/stone walls/gabions to stop erosion and rebuild eroded areas

- Prevent spraying to much chemical pesticides as it builds up in the soil and reach toxic levels that will kill the soil fauna.

- Build-up the soil fauna and organic component of the soil using correct cultivation practices like conservation farming practices. This will increase the infiltration and water storage to allow more plant to grow that minimise erosion.

- Stop over grazing. Allowing grass to reach maturity allow grasses to develop strong root systems that support proper grass regrow and bind the soils with their roots.

Grass grazed continuously does not have enough roots to hold soil and support regrowth

Vegetation
Natural vegetation covers the earth's surface. Preserving Natural Vegetation is important in slowing down water runoff. Vegetation provides erosion control, storm water detention, biofiltration, and aesthetic values to your area. Preserving natural vegetation means protecting desirable trees, vines, bushes, and grasses from damages.

Vegetation conservation
Listed below are noteworthy benefits and reasons to preserve natural vegetation:

- It is easier to process higher quantities of storm water runoff than newly seeded areas.
- Natural vegetation has a higher filtering capacity than storm water runoff by intercepting rainfall, promoting infiltration, and lowers the water table through transpiration.
- Natural vegetation provides a fully developed habitat for wildlife.
- Natural vegetation provides as a shield and screen against noise and visual disturbances.
- Natural vegetation usually requires much less maintenance than planting new vegetation.

Activity: Create a poster on the sources of Agricultural pollution, its consequences and prevention.

Module questions

1. How can we prevent pesticide mixtures polluting our natural resources?
2. Briefly describe soil degradation.
3. Which is the most common form of erosion?
4. Does erosion only take place on cultivated lands/fields?
5. Discuss how over grazing contribute to soil degradation and water pollution.
6. Why do thunderstorms often cause soil erosion?
7. What is the result of soil erosion?
8. How can organic matter in the soil help to prevent soil erosion?
9. Why should we never plough up and down the slope of the land?
10. How can we stop erosion in a gully?
11. Briefly discuss the role of vegetation in protection the soil.

Module 3

Farming systems and farming methods
As seen in grade 8 two distinct farming systems exist in South Africa i.e.

- Commercial agriculture - (Large scale farming and Small-scale farming), and
- Subsistence agriculture.

Agricultural production in these systems is based/structured around the grouping of individual farming systems that have the following characteristics:

- have similar resource bases.
- consist of similar business patterns.
- experience similar domestic livelihoods and limitations.
- could utilise similar development strategies and interventions

Both produce similar crops and livestock, they differ mainly in the scale of operation, method of production and market orientation.

Objective

Learners should understand and distinguish between the farming methods used in south Africa to produce food and fibre to sell either for an income or subsistence use.

Upon completion you should be able to answer questions on the farming methods used in South Africa.

- Intensive farming
- Extensive farming
- Mixed farming
- Other non-traditional methods

Keywords/terms and concepts – Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

Concept/Term	Explanation
Profitability	A business's ability to produce a return on an investment based on its resources in comparison with an alternative investment.
Efficiency	Ability to do things well, successfully, and without waste
Extensive	Covering or affecting a large area, obtaining a relatively small crop from a large area with a minimum of capital and labour.
Commercial	Refers to activities of commerce—**business** operations intended for an exchange on the market with the goal of earning profits.
Intensive	Method of farming which aims at the increase of yield per acre by using increased labour, capital,
Sustainable	Meeting our own needs without compromising the ability of future generations to meet their own needs
Non-traditional	Not adhering to past practices or conventions
Conventional	Based on or in accordance with what is generally done or believed.
Production system	Methods used in industry to create goods and services from various resources.
Urbanization	Process with an increase in the number of people living and working in a city or metropolitan area
Nomadic	a form of pastoralism when livestock are herded to find fresh pastures on which to graze

Farming methods (production system)

A farming method is the method of farming (how I farm) that is used within a farming system, all of which are designed to produce nutritious, delicious and sustainable products possible.

Agricultural activities range from intensive crop production and mixed farming in winter rainfall and high summer rainfall areas to extensive cattle ranching in the bushveld and sheep farming in the arid regions.

Maize is most widely grown, followed by wheat, sugar cane and sunflowers and other crops. Citrus and deciduous fruits are exported, as are locally produced wines and flowers.

The choice of a farming method is based on the following.

- Profitability: The potential profitability of the different systems must be considered when investigating future market trends.
- Efficiency: The profitability of production is determined by the efficacy of production systems,
- Markets: The distance to and from markets should be considered as transport costs affect profitability.
- Natural resources and climate: The interaction between natural resources, climate and population determine the physical foundation of farming systems.
- Policies relating to the access and control of natural resources: Legislation may limit the use of natural resources in order to protect them from increasing levels of deterioration or accessibility to everyone (e.g. minerals mining laws).
- Human capital and education: A shortage of skilled workers is restrictive to development.

Farming methods in South Africa

Agricultural activities range from intensive crop production and mixed farming in winter rainfall and high summer rainfall areas to cattle ranching in the bushveld and sheep farming in the arid regions.

- **Mixed farming**

Mixed farming when farmers manage a mix of different crops and/or animals. The best-known form of mixed farming is when crop residues are used to feed the animals and the excreta from the animals are used as nutrients for the crops.

Other forms of mix farming take place where grazing under fruit-trees keeps the grass short, or where manure from pigs is used to "feed" the fishpond.

- **Extensive – livestock (nomadic pastoralism) or agronomy**

Large regions in South Africa fall within this category since it is determined by environmental factors such as the type of grazing and the carrying capacity of the land.

This system requires a small input of labour, fertiliser and capital in relation to the total territory of the farm.

Extensive farming refers mostly to sheep and cattle farming with large camps where cattle can graze freely in areas with low agricultural productivity but can also refer to the large-scale cultivation of crops, for example wheat, barley and other cereal crops.

Nomadic care of livestock is an extreme example of extensive farming, where shepherds continually move their animals between pastures that are supplemented by seasonal rain.

Extensive sheep and cattle farming

Extensive crop production

Nomadic pastoralists in Kenya

- **Semi-intensive**

Where the amount of land is a limiting factor, semi-intensive systems are usually followed. It is a combination of intensive and extensive farming. Animals can sometimes be kept in shelters but are also allowed outside to search for food.

- **Intensive – livestock and agronomy**
  This method usually requires a high capital outlay per hectare of land and more labour, permanent buildings and/or structures for the housing of workers, as well as for animals or plants that need protection.

High yielding crops and high input cost and labor use per ha are characteristics of intensive farming

Feedlotting and broiler production are examples of intensive farming methods

Intensive farming practices include high yield crop production with the help of correct fertiliser application and amount according to soil type, pest management and keeping animals indoors or under concentrated conditions such as in feeding pens and modern dairies. Precision farming as an intensive farming method is a farming management concept based on observing, measuring, and responding to inter and intra-field variability in crops and animals.

Although food production per unit/hectare is increased, with crop growing it has a less detrimental effect on the environment while livestock branches have a greater negative effect due to accumulation of waste materials such as animal dung and contaminated water.

- **Organic or grass-fed meat**

Organic farming prohibits chemical inputs and has less harmful effects on the environment, but often produces less per hectare and at higher costs.

Farming has evolved over the years from traditional ways of growing fruit and vegetables to more innovative sustainable methods, and even in South Africa, we are beginning to see a marked shift towards looking for innovative solutions to various problems like ensuring fresh produce makes its way to communities that need it.

Given challenges that traditional farming methods face, including: the effects of climate change, water scarcity, growth of population and changing political environments (land ownership in particular in the South African context), it's no surprise that Innovative farming methods are constantly emerging to simplify processes, help guarantee higher yields, and bring the produce itself closer to the communities it serves.

Methods of farming that go beyond the traditional approach which have recently surfaced include:

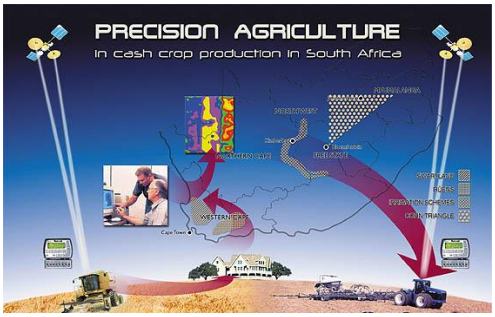
Farming method	Description
Urban Farming • **Small Space Farming** • **Window Farming** 	With urbanization gaining popularity, people are moving from the rural to urban areas in the search for work. This has led to shrinking of an entire generation of traditional farmers in rural areas. Urban farming has taken hold of suburban residents and is now gradually moving into cities as well. We see farming from backyards and in vacant spaces where people are growing food for themselves and their communities at large. In some parts of Africa, sack farming has also taken root in urban and suburban areas to supplement income and/or diet.
• **Rooftop farming** 	Rooftop Farming is the cultivation of fresh produce on the top of buildings within the CBD of major cities. The most effective form is hydroponics techniques using a specially designed Greenhouse. Rooftop Farming allows for a completely organic form of farming.
• **Urban Hydroponic Farming/Vertical farming**	This is a method of farming without the use of soil. Hydroponics technique

grows plants using mineral nutrient solutions in water.
Hydroponics save on land use (the systems can be stacked and take on a smaller space for higher yields), it used up to 90% less water than traditional farming methods and can potentially eliminate the season ability that is a reality for traditional farming methods.

- **Aquaponics**

Aquaponics.is a completely closed-loop system.
This method is similar to hydroponics with the difference being
in aquaponics there is the use of fish instead of nutrients to give food to the plants (fish waste) and in reverse the plants clean water for the fish. The benefit of this system is the closed loop, where the plants feed the fish and vice versa.

- **Precision Farming/Agriculture**



Precision agriculture (PA), sometimes referred to as satellite farming, is a farming management concept based on observing, measuring and responding to inter and intra-field variability in crops and animals through the use of technology.
This method allows farmers to analyse and manage the soil before planting crops which reduces risks of lost harvests. With the introduction of drone technology, farmers can now manage and detect problems in minutes, which is much more convenient and cost effective as compared to the traditional method of routine patrols which could take hours on large scale farms.

What is precision agriculture?

Each method of farming, whether it is urban or rural in nature, has its own pros and cons:

Traditional farming methods	Innovative farming methods
• Range of products can be produced • Productivity is very high • High transportation costs due to geographic landscape • Seasonal which affects production • Less technical • Not popular to younger generations • Risks associated with farming are relatively high	• Capital investment often high • Variables are controllable • Less transport costs • Less contamination • Mitigates urbanization effects • Interesting to young people • Productivity high (can be done all year round) • Risks are limited • Larger plants cannot be produced

Activity: Collect pictures of different farming methods, categorise them on a poster/task

Module questions – The educator can add more questions t each module to ensure learners understand each modules content.

1. What is a farming method? (2)
2. Give 6 aspects that will determine which farming method to follow. (6)
3. Name 4 different farming methods. (4)
4. What is the difference between an extensive farming method and an organic farming method.? (4)
5. Briefly discuss 5 other farming methods that is not known as traditional farming methods. (12)

Module 4

Division of the farm

In grade 8 we discussed the buildings or layout of farm buildings on the farm. In grade 9 we will look further into the camps and the layout there of on a farm.

The first requirement for preserving or improving the quality of the soil/land is the adaptation of a farming system (discussed in grade 8) or method (Grade 9) to the existing natural conditions.

If a farmer does not divide the farm into well-planned units, he may have a few successful years in the beginning but later the bad effects of his lack of planning will show.

It is important to managed and apply conservation practices and farming methods when using soil within each system.

Example of a farm map: Indication irrigation fields, dry lands, and grazing fields.

Objective

Learners should understand the concepts and explain the division and fencing on the farm.

Upon completion you should be able to answer questions on the following concepts

- Camps: Pasture (grazing, wetlands), dry land, irrigated fields, gardens (house and vegetable) and orchard.
- Fences
  - Importance of fencing
  - Permanent fencing
  - Electrical fencing
  - Security fencing

Keywords/terms and concepts: Words or terminology that learners struggle with should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology.
(See https://worksheets.theteacherscorner.net/)

The farm is usually divided into the following areas.

- **Farmyard and roads**

  In grade 8 you have seen the importance of the farmyard and its layout. Apart from an access road from the main road, an access road is needed from your farmyard to all the camps on the fam to execute various duties in these camps. The following areas are

closely situated to the farmyard each with its own function.

- *Gardens*

Suitable soil, water and plenty of care are needed in gardens. Gardens add to the beauty of the farm but should not be too large. Trees, hedges and shrubs form excellent windbreaks and also provide welcome shade in the hot weather. The vegetable garden can supply the family with the fresh vegetables needed for a healthy diet. Surplus vegetables can be sold to provide additional cash income.

- *Orchards*

The farm orchard provides the family with the necessary fresh fruit. It may also provide the farm with a useful cash in come from the marketing of the fruit, fruit may be eaten fresh, dried, or made into jam, fruit juice etc.

Fruit trees can only be grown successfully in a suitable climate in the right soil. The farmer must know which kind of fruit and which cultivar will do well on his farm. He also must know how to look after his trees.

- **Camps**

Camps are used to divide your farm further into sections and to assist you to manage each camp on its own merit. Camps can be divided into:

- **Pastures and wetlands**

Pastures can either be natural veld or cultivated pastures. To use, control and preserve the veld successfully, camps should be made. Usually, the camps on a farm have the same kinds and the same quality of vegetation. The camps should be grazed in turn (in rotation applying conservation agriculture). After a camp has been grazed the animals are moved to a fresh camp. The vegetation which has been grazed then has a chance to grow again before the next grazing. The camp will then be able to provide good grazing when animals are again put into it.

Some breeds of animals do very well in camps and require little or no extra feeding. However, a unit should not be grazed to the point where soils can easily be eroded. Animals such as sheep and horses (short grazers) should not be left to eat all the vegetation.

Wetlands are areas you cannot use due to waterlogging conditions certain times of the year should be fenced off for later use during drier spells.

- **Dry lands**

All the lands (or fields) on a farm should be divided into which crops can be grown. The lands with the best soils should preferably use the high-income crops.

Permanent cover crops should be planted on lands that are likely to be damaged by erosion.

Row crops such as maize should be planted in rotation with other crops, every other year. It is important that a proper system of crop rotation and fertilising should be followed.

- **Irrigation lands**

Lands that do not have enough natural moisture should be irrigated to ensure good crops.

The following factors should be kept in mind when introducing an irrigation system:

- the possibility of soil erosion,
- drainage requirements,
- what type of crops will be grown?
- the costs involved (initial costs as well as maintenance costs),

- the quantity and quality of available water.

Fences

Like any farm investment, fencing must be utilised thoughtfully and how well or how badly a farmer plans and erects those fences will lead to either improvement or deterioration of his lands and stock. It is said that the erection and maintenance of farm fencing reflect a farmer's managerial ability. A neat and effective fence makes a good impression on a visitor; and since it confines animals to where they should be, it helps greatly in maintaining good relations with neighbours.

Fences are used to

- protect or divide property,
- secure the various units and camps on the farm
- improve the farms appearance and layout,
- partitioned various veld types to form camps where grazing can be utilised optimally and rested periodically according to seasonal requirements.
- properly manage your veld – rotational grazing should be used
- confine animals - Fences protect stock against vermin and discourage stock thieving. Fences make it easy to divide farm stock into appropriately sized herds.
- or to exclude animals

It is said that the erection and maintenance of farm fencing reflect a farmer's managerial ability. A neat and effective fence makes a good impression on a visitor; and since it confines animals to where they should be, it helps greatly in maintaining good relations with neighbours.

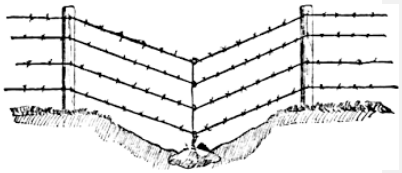
A good fence should have the following features:

- It should be in a **perfectly straight line** from straining post to straining post, with all the post standards standing in perfect alignment.
- The **straining, corner and gate posts should be sturdy**, **be set vertically** into the ground and be well anchored.

Good fence

Not so effective fence

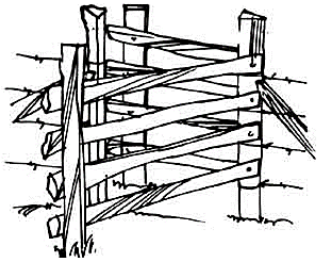
- All the other posts, standards and droppers should stand erect and maintain the same height above ground level. In this way, the undulations of the ground are followed.



- **Straining posts should not be too far apart** – the closer they are the closer the standards are together, the sturdier the fence.

- The more wire strands in a fence of a particular height, the more difficult it is for man or stock to creep through them. **Fences should be planned for the type of animals** the farmer wants to keep or farm with.

If fences are not high enough livestock can easily jump over the fence

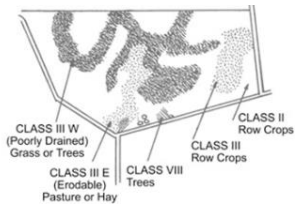
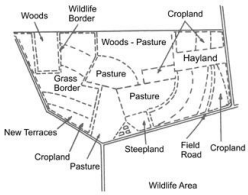
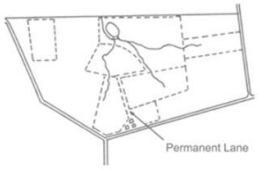


- **Passageways through or over fences** – if fences cross a normal pathway, a passageway should be inserted or build over the fence line to ensure safe passage for humans but not the farm animal. This will stop people from climbing through fences.

- A **good fence should always been erected with good quality material**. Heavy galvanized steel wires are an investment for years to come.

Planning Fences on the farm
Fencing is a long-term investment. Good fences should last from 25 to 50 years. Planning is the key to good fencing. This is true whether you fence an area for the first time or replacing old, worn-out fences.

Steps in dividing areas on your farm

Step 1 – draw a map of your farm and add land capability.  	**Step 2** - Use the sketch of your land and divide it into the areas that it are best suited for:  (1) permanent pastures or hay production, (2) woodlands not to be pastured, (3) woodlands that can be pastured and (4) cultivated crop production
Step 3 – Locating gates - Wherever possible, locate gates and passageways for livestock and equipment in the corner of each field closest to farm buildings. If you have fields on opposite sides of a road or highway, locate gates opposite each other so livestock can go directly across. -	**Step 4** - Locate permanent lanes to avoid erosion yet allow access to as many fields as possible. The entrance to the farm if the house and farm buildings is not close to the road, should be a permanent lane without any gates except an Automatic gate when entering the homestead or farmyard. 

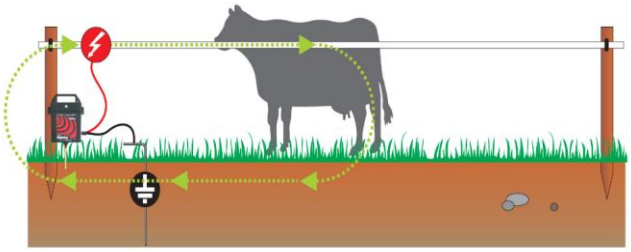
Fences on the farm can be divided into:

- Permanent fences (Farms border fence and camps)— those intended to last for many years with minimal repairs — should be well constructed and made of good materials.
  - Conventional fences

A good fence can never be erected with inferior material. Heavy galvanized wires are an investment for years to come.

- Temporary fences — those intended to stay in place only a short time — need not be so sturdily constructed and may be made of less expensive materials.
  - **Locating Temporary Fences**
    - Temporary fences are intended for use over a period of a few weeks or months. After that they will be removed and used in some other location or stored until needed.
    - Movable fences cost less to build than permanent fences, but they are not as effective and will not last more than one to three years the way most of them are built.
    - They do not take the place of permanent fences but can be beneficial in some instances.
    - They are easily moved to allow pastures to be rotated and are especially desirable for intensive rotational grazing programs. They can also help adjust the size of a temporary pasture to the number of livestock being grazed.

- Electric fences
  Conventional fences are not always impenetrable but with the help of electric fencing, the ultimate purpose of a fence can be reached. Electric fencing however can serve several purposes, namely animal control, or security.



How does an electrical fence work? Scan the QR code below to find out.

Working of an electric fence

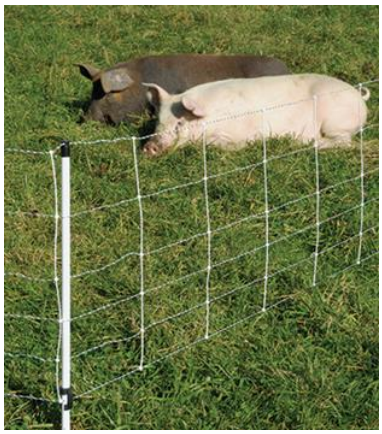
An electric fence energiser converts mains or battery power into a high voltage pulse. The energiser releases this pulse through an insulated wire onto the fence line approximately once every second. The pulse is commonly referred to as the shock which is felt when an animal or intruder contacts the fence.

a. Temporary electric fences

The temporary or movable fence is usually made with one or two strands of smooth wire or a rope or tape with small electric wires woven into it, nets with wire woven into it is the latest addition.

Tape or rope is more flexible than smooth wire and much easier to handle and move from one location to another. It is also more visible, an important factor when a fence is to be moved periodically to new locations where livestock are not used to seeing it.

Corners and end posts in temporary electric fences require less bracing than permanent fencing. Line posts may be small with wide spacing since the fence will generally be used for a short period of time.




Temporary electric fences

b. Permanent electric fences.

These fences have from two to eight smooth wires placed on stronger posts. Instead of using the earth for a return path, many electric fences use alternate wires as the hot wire and the grounded return to the charger. This arrangement enables a completed circuit when an animal touches any two adjacent wires and improves the performance of the fence tremendously in drought conditions.

Cost of permanent electric fence is much less than that of comparable barbed or woven wire fences. Some of the advantages of electric fencing are:

- low initial cost,
- low operating cost, and
- portability.

They can be used to protect or extend the use of old permanent fences and they can be used to protect livestock or poultry from many predators.

- Security fences

The need for security fences has increase as farmers, because of their remote locations have become easy targets for criminals. These fences should be erected around their house or home stead to ensure safe movement between essential building and to increase their safety.

From a security point-of-view, electric fencing not only offers the possibility of deterring, but also of detecting and alarming / monitoring. An electric fence acts as a 24-hour patrolman, patrolling your entire perimeter every second. An electric fence, being a barrier on the perimeter of what you are protecting, offers extended reaction time as opposed to conventional security systems which only alarming once the intruder enters or attempts to enter your home.

For better security purposes the fencing material can be adapted to increase the level of security needed.

Chapter 1 Module 4 questions

1. Name 5 areas of the farm that need to be fenced of.
    a. Fields
    b. Camps
    c. Homestead
    d. Orchards
    e. Irrigation fields
    f. Wetlands
2. Briefly discuss the use of fences
    a. protect or divide property,
    b. improve the farms appearance and layout,

c. partitioned various veld types to form camps where grazing can be utilised optimally and rested periodically according to seasonal requirements.
d. Properly manage your veld – rotational grazing should be used
e. confine animals - Fences protect stock against vermin and discourage stock thieving. Fences make it easy to divide farm stock into appropriately sized herds.
f. or to exclude animals

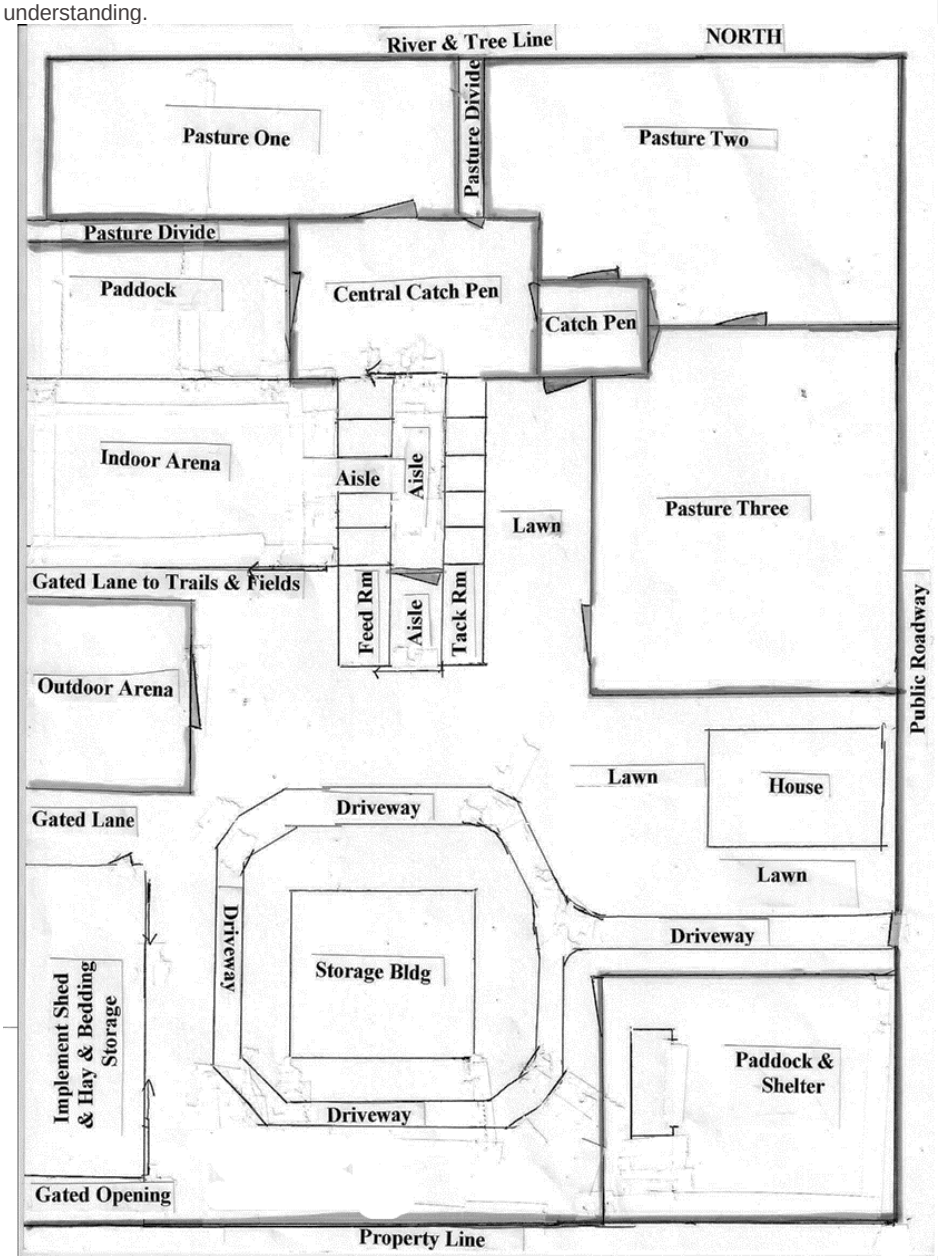
3. Name the three types of fences.
    a. Permanent
    b. Temporary
    c. Electric fences
4. Discuss briefly how an electric fence operate.

    An electric fence energiser converts mains or battery power into a high voltage pulse. The energiser releases this pulse through an insulated wire onto the fence line approximately once every second. The pulse is commonly referred to as the shock which is felt when an animal or intruder contacts the fence.

5. Discuss the features of a good fence.
    a.
6. Why is it necessary to erect a temporary fence?
    a. Temporary fences are intended for use over a period of a few weeks or months. After that they will be removed and used in some other location or stored until needed.
    b. Movable fences cost less to build than permanent fences, but they are not as effective and will not last more than one to three years the way most of them are built.
    c. They do not take the place of permanent fences but can be beneficial in some instances.
    d. They are easily moved to allow pastures to be rotated and are especially desirable for intensive rotational grazing programs. They can also help adjust the size of a temporary pasture to the number of livestock being grazed.

Activity:

Use the farm map below and indicate where and which type of fence you will erect on the property below. You must use all types of fences as discussed above. Also discuss reasons why you would use the type of fencing. You can add new fences to illustrate our understanding.



CHAPTER 2

Module 1

In South Africa, the Occupational Health and Safety Act (the OHS Act) provides regulations for the following:

- The health and safety of all the people in the workplace.
- The activities of people at work.

The OHS Act applies to all employers and workers. Everyone using or entering areas where work is done must know about the dangers and hazards in the area.

General Farm and workshop Safety

Machinery such as tractors and power tools, pose a great injury risk on the farm. It is important to be safety conscious when dealing with any job that requires the use of machinery and tools. Statistics show that most machinery related accidents occur as the result of human negligence. Errors include taking shortcuts to save time, failure to read the operators manual, ignoring a warning, improper or lack of instruction and failure to follow safety rules.

The most utilized pieces of equipment around the farm are tractors, trucks, wagons, mowers, spreaders, grinders, blowers, augers, post hole diggers, shredders, balers, rakes, combines, and all-terrain vehicles (ATVs).

The workshop tools add further to the injury list. No matter how different they are in structure, they all, if used improperly or carelessly, can be fatal.

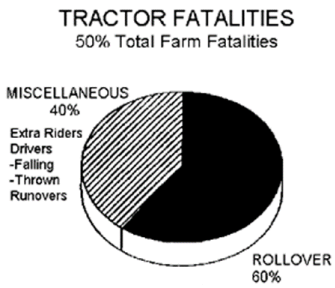


Fig1: Farm fatalities involving tractors.

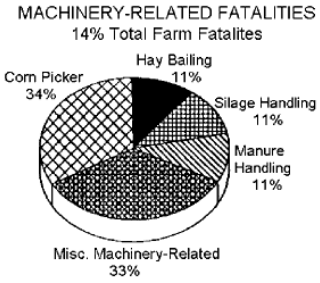


Fig2: Machinery related fatalities

Objective

Learner should understand the OHS act and able to apply general safety rules in real life situations.

Upon completion you should be able to answer questions and apply workshop and farm safety rules.

- Safety on the farm and in the workshop.

Keywords/terms and concepts – Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

Key term	Meaning

Asphyxiation	**asphyxiation** is a condition of deficient supply of oxygen to the body that arises from abnormal breathing

The following are a set of basic workshop rules applicable to your school's workshop and a normal workshop. These rules are not necessarily ALL the rules. So, when you work in a workshop, make sure that you know what their rules are.

General workshop rules and precautions

WHAT, WHEN, WHERE	**Requirement/Precaution when applicable**
Workshop location and surface	- Buildings where machinery and power tools are stored should be located far enough away from structures that house livestock and hay in case of fire. - Keys should always be removed from all equipment or machinery to prevent children or unauthorized people from starting them. - Floor surfaces should be level and smooth, free of bumps and protruding rocks. - Machinery storage buildings should not be used to store debris.
Always before working and during work	- Keep the work area neat and clean - All tools and accessory equipment should be kept picked up and stored in their proper place, e.g., air hoses, oil cans, spare tires, jacks.
Workshop entrance and ventilation -	- Enter and leave the workshop in an orderly manner - Doors of the sheds should be wide enough to accommodate width of widest machinery - Make sure there are enough working lights in the work area - Exits should be clearly marked. - Doors should be locked to keep children out - Adequate ventilation to allow the removal of poisonous/harmful gasses
Clothing inside workshop	- Use the correct PPE when working in the workshop and on the farm
Workshop/farm **Before work:** Handling,	- Use the correct tools for the task, - Do not throw or misuse tools, - Clean and store tools in the correct place after using them - Report missing or damaged tools. - Inspect electrical tools to make sure that their cables and plugs are in a good condition before using them.
Workshop /Farm **While working.** Use tools safely:	- Never play the fool or joke around in the workshop - Never throw tools down on the workbench. - Always ensure garden equipment is visible and in an upright position. - Use cooling liquids and lubricants, PPE and eye protection when cutting threads, sawing, drilling or grinding. - Keep sharp points away from the body. Chisel away from your body. - Be aware of points where your hand or fingers can be pinched when tightening nuts and bolts. - Use tools how they are intended to be used. - Make sure the workpiece is well secured in a vice or clamp when cutting, sawing, drilling or grinding. - Always keep the sharp ends of tools pointing down when moving around - Use safety curtains to protect other people from welding rays. Use goggles when using the grinder - Keep floors dry and clean - Use extraction fans in dusty areas.
After working	- Always put tools down carefully. Regularly lubricate and clean machinery like drills and bandsaws. - Inspect electrical tools to make sure that their cables and plugs are in a good condition before using them.

	- Always clean the floors and tidy up after work has been completed, after completing a task and at the end of the day. - Place each tool back in its place at the end of the lesson
Maintenance of equipment	- Protect the surface of the drill press by drilling on a piece of wood. - Lubricate the moving parts of tools and machines. - Cover tools with a thin layer of oil before putting them away to protect them from rust - Report broken tools, like hammer shafts, that need repair immediately.
Electrical and fuel	- Fuel storage tanks should preferably be located below ground, and a minimum of 40 feet from the nearest structure. Fuel cannot be stored in the same structure as machinery or power tools. Tanks should be properly vented. If above ground, the area around the tank should be free of litter, weeds and any fuel spills that could aid in starting or accelerating the spread of a fire. Fuel tanks should be adequately protected from being struck by machinery. An approved fire extinguisher should be located near all fuel pumps and tanks. - Electrical lines coming into the building should be high enough to facilitate equipment passing underneath. - Electrical systems in machine sheds should be sufficient for the power tools and equipment that will require the use of electric current. - Electric outlets should be of the three-prong grounded type.

There is a saying on the farm “prevention is better than cure”. The same applies to the injuries that can happen on a farm. If we can recognize potentially hazardous areas on machinery, we can treat them with caution and with safety in mind.

These areas include.

Area	Where	Danger	Injury
Pinch points	two rotating surfaces meet such as feed rollers, gears or a belt running around a pulley	Extremities can be caught in pinch points directly or be drawn in by loose fitting clothing that has become entangled in the rotating parts	resulting injury is usually amputation.
Shear points	edges of two surfaces come together in a manner to cut a softer material placed between the surfaces	on shrubbery shears or grain augers	resulting injury is usually amputation.
Cutting points	designed to cut such as mowers and harvesters.	blades move with a rapid motion often unseen by the eye	resulting injury is usually amputation.
Crush points	objects are joined; either with both ends moving towards each other or with one being stationary	Fingers and hands are often injured by crushing between a draw bar and wagon hitch.	Numerous fatalities occur when people helping the operator or the operator him/herself is crushed between pieces
Springs	A spring is compressed, 'energy' is 'stored' within the spring. When the spring is expanded, the energy is released. The larger the spring the greater the amount of energy produced.	When springs break, they explode with great force and can inflict serious damage. Ensure regular inspection.	Various
Wrap point	PTO and turning points	See later	

Causes of injuries on the farm.

- **chemicals** – pesticides and herbicides can cause injuries such as burns, respiratory illness or poisoning.
- **confined spaces** – such as silos, water tanks, milk vats and manure pits may contain unsafe atmospheres, which can cause poisoning or suffocation.

- **electricity** – dangers include faulty switches, cords, machinery, or overhead power lines and can result in electric shock.
- **heights** – falls from ladders, rooftops, silos, and windmills are a major cause of injury such as broken bones and sometimes death.
- **machinery** – hazards include tractors without roll-over protection structures (ROPS), power take-off (PTO) shafts, chainsaws, augers, motorbikes, and machinery with unguarded moving parts injuries such as .
- **noise pollution** – noise from livestock, machinery and guns can affect your hearing.
- **vehicles** – crashes or falls from motorbikes, two-wheel and quad bikes, tractors and horses can result in major injuries.
- **water** – drowning can occur in as little as five centimetres of water. Dams, lakes, ponds, rivers, channels, tanks, drums, and creeks are all hazards. Young children are particularly at risk.
- **weather** – hazards include sunburn, heat stroke, dehydration, and hypothermia.

Work related injuries such as

- Slipping on wet surfaces and tripping over equipment, causing:
    - Bruises
    - Cuts
    - Sprains
    - Broken bones
- Falling objects can cause bruises, cuts and broken bones.
- Working with the wrong tools, workpieces with sharp edges, and high-speed revolving equipment can cause cuts and lacerations.
- Looking directly at welding in progress can cause arc eyes.

While Operating Machinery.

- Tractor overturns are the leading cause of death on the farm.
- A roll-overprotective structure or ROPS is designed to prevent workers from being crushed underneath the tractor and save lives. See illustration below of a frontend loader with a roll overprotective structure.

Follow these steps to prevent the likelihood of rolling over while on a tractor.

- avoid operating tractors near ditches.
- Terrain changes and hard to see holes can increase your chances of tipping over.
- It is also important that you turn slowly, especially when on a sloped surface.
- Turn downhill if you feel like you are losing control.
- When carrying a load, such as a hay bale, keep it low to the ground. Do not overload the trailer.

- Only one person should be on a tractor at a time, extra riders can be thrown off and run over.
- It is a good practice to continually look before moving the tractor and make sure that there are no children near the farm equipment.
- Keep a safe distance from moving equipment and parts.

ATV's are now used on the farm as it is quicker and easier to manoeuvre. It is important to remember that it is not a toy and to challenge each other in a drag race. The same safety applies to them than any other farm machinery or equipment.

Power Take-Off Shafts (PTO)
The extremely high-speed rotation of the PTO can lead to a wide range of injuries including amputations or death. In fact, PTOs are a leading cause of lost limbs for farmers. Often farmers become entangled because of their loose clothing, hair, jewellery, and/or boot laces


Protected PTO shaft of a tractor to prevent injury.


Simulation of PTO danger. An overall sleeve caught by an open PTO.

Aspects to consider in preventing PTO injury,

- inspect the shaft before operation,
- make sure the shield is always in place,
- avoid wearing lose clothing or other items and keep a safe distance when operating the PTO.
- Make sure the PTO is turned off before dismounting the tractor.
- Lastly, never step over a PTO; take the extra time to walk around it to prevent injury.

NB - Respect the equipment
It is important to note that operating any type of machinery can be potentially dangerous and poses many risks to farm workers.

Safety on the farm does not only relate to machines and vehicles, but animals can also be just as dangerous as machines.

Livestock Handling and safety
Wrong livestock handling is one of the leading causes of injury on a farm.

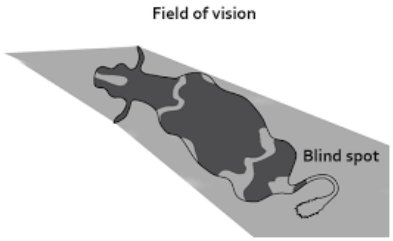
- Knowing animal behaviour and natural tendencies, a worker can reduce stress to the animal and simultaneously, prevent injury to him or herself.

Watch the video on Stockmanship

The following points should be kept in mind when working with livestock:

- Larger animals are usually more dangerous than smaller ones.
- Mothers will protect their young from danger.
- Males are typically more aggressive than females.
- Animals are naturally territorial and can be frightened, become aggressive, and behave unexpectedly.
- Loud noises are frightening to livestock and should be reduced when handling livestock.
- When possible, avoid cornering an animal. This tends to make them feel threatened and that increases the likelihood of being injured.

- Extra precaution should be taken when approaching cattle horses, cattle, or mules from behind.



- The blind spot for these animals is directly behind them so, it is important to remember you should never approach the animal from behind, Instead, approaching them from the side or front is a much better practice.
- It is a good idea to design an escape plan in case you find yourself in a dangerous situation while working near an animal.

Preventing injury on the farm and in the workshop when carrying and lifting material

- Use proper lifting techniques:
  - Bend using your knees, not your back!
  - Do not twist your back when carrying something. Instead move your feet to turn in a different direction.
  - Keep the object you are lifting close to your body.
  - Push a load rather than pull it.
  - Walk slowly.
- Applying the general safety rules and using the correct PPE makes it possible to avoid most of these injuries.

Module questions

1. Name 7 causes of injuries on the farm and the injury each is responsible for. (14)
2. Discuss 5 potential areas found on machineries that can cause injury and briefly discuss each. (10)
3. List 5 precautions that applied to the vegetable garden. (5)
4. List 8 precautions that apply to working in the workshop. (8)
5. What precautions should be taken when working with a tractor? (5)
6. Discuss 6 important aspects that should be kept in mind when working with livestock? (6)

CHAPTER 3
Module 1
Agricultural machinery

Agricultural machinery is machinery used in farming for agriculture. There are many types of equipment used by farmers they are hand tools (done in grade 8), power tools and machinery like tractors, balers cutters etc. This equipment is used in both organic and nonorganic farming.

Farmers used a vast range of equipment for agriculture purposes like:

- Land Processing
- Soil and Plant Fertilizing
- Harvesting and Transportation

Objective

The learner should be able to identify, explain and understand the purpose and function of the farm machinery or self-propelled implements.

Upon completion you should be able to answer questions and identify, explain and understand the purpose and function of the following farm machinery or self-propelled implements.

- **Harvesting:** Combine Harvester, silage cutter (Forage harvester).
- **General:** crop spryer, slasher, balers, rakes, hammer mill, lawn mowers etc.
- **Machines:** Tractors and trailers, trucks, excavators, drones etc

Keywords/terms and concepts – Words or terms that learners struggle with should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology.
(See https://worksheets.theteacherscorner.net/)

Now let's get into details of farm machinery types, uses, and their importance.

Implement / Machine	Function / Use / Purpose
Combine harvester  **Combine Harvester video**	The modern **combine harvester**, or simply **combine**, is a machine designed to efficiently harvest a variety of grain crops (wheat, maize, soybean and sunflowers). The name derives from its combining three separate harvesting operations—reaping, threshing, and winnowing—into a single process. The separated straw, left lying on the field, comprises the stems and any remaining leaves of the crop with limited nutrients left in it: the straw is then either chopped, spread on the field and ploughed back in or baled for bedding and limited-feed for livestock. Combine harvesters are one of the most economically important labour-saving inventions, significantly reducing the fraction of the population engaged in agriculture
Forage harvester / Silage cutter	A **forage harvester** (also known as a **silage**

	**harvester**, **forager** or **chopper**) is a farm implement that harvests forage plants to make silage. Silage is grass, corn or other plant that has been chopped into small pieces, and compacted together in a storage silo, silage bunker, or in silage bags. The silage is then fermented to provide feed for livestock. Haylage is a similar process to silage but using grass which has dried. **Forage harvester video**
Slasher 	Rotary Slasher is a sturdy implement which is most suitable for slashing pasture topping and shrubs. It also very well suffices the purpose of maintaining grasslands. **Rotary slasher video**
Disc cutter Haymaker 	Cuts (mows) grass or other plants that grow on the ground. Fast, clean cutting of your grasses that helps you get the most from your hay fields. Does not damage the grass like slashers. **Disc cutter video**
Raking of hay 	Collect the grass in single line for baler to pick up. **Cutting, raking, and Baling video**
Baler	A **baler**, most often called a **hay baler** is a piece of farm machinery used to compress

Commented [EN1]:

 **Video of a fast baler and wrapping**	a cut and raked crop (such as hay, cotton, flax straw, salt marsh hay, or silage) into compact bales that are easy to handle, transport, and store. Often, bales are configured to dry and preserve some intrinsic (e.g. the nutritional) value of the plants bundled. Different types of balers are commonly used, each producing a different type of bale – rectangular or cylindrical, of various sizes, bound with twine, strapping, netting, or wire.
Crop sprayer 	Agricultural equipment used to apply pesticides by covering crops with chemicals to kill harmful insects and diseases, sometimes from an aircraft. **Crop spaying using tractor**
Hammermill  **Electrical or enjin driven**  **Tractor powerd using the pto powersource**	A **hammer mill** is a mill whose purpose is to shred or crush aggregate material into smaller pieces by the repeated blows of little hammers. Hammermills are used on a farm to make feedstuffs finer for animal feeds to increase the feeds digestibility.
Tractors	A tractor is a farm vehicle that is used to pull farm machinery and to provide the

	energy needed for other equipment and machinery to work.
Trailers and trucks 	Trucks are used to transport equipment, and the valuable produce that farms produce. A **trailer** is an unpowered vehicle towed by a powered vehicle. It is commonly used to enhance the capacity of a truck for the transport of farm produce, goods and materials.
Excavators and loaders 	Large, powerful machine used on a farm with a container connected to a long arm at the back, used for digging up the ground and loading or moving large amount of material using a bucket in front. Screen QR code to watch the video on an excavator at work
Drones 	A drone, in technological terms, is an unmanned aircraft. Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASes). Essentially, a drone is a flying robot that can be remotely controlled or fly autonomously through software-controlled flight plans in their embedded systems, working in conjunction with onboard sensors and GPS **Some uses** • Measure plant health and identify crop health with drone maps • Monitor livestock and fences • Spraying crops etc.

Activity: Find pictures of the farm machinery above and create a collage
Find videos of each group of machinery and share it with the rest of your class.

Module 2

Identification and use of power tools.

Using Power Tools

Farmers daily use one or more power tool on the farm. Battery operated power tools provide the freedom to work anywhere on the farm without worrying about the availability of electricity as with electrical power tools. The cordless version, however, tend to be less powerful than the standard corded circular saw, so for tough jobs and heavier lumber, go with the old standby -- a good quality corded circular saw.

The types of power tools are determined by their power source:

- electric - an electric current or battery power
- pneumatic - containing or operated by air or gas under pressure.
- liquid fuel - Fuel-powered tools are usually operated with gasoline.
- Hydraulic – Oil put under pressure is used to move parts of the tools.
- powder-actuated- Powder-actuated tools, like nail gun, "Hilti guns" or "Ramset guns". operate like a loaded gun and must be treated with extreme caution.

Objective

The learners should be able to identify, effectively use and maintain (basic care) of workshop machines (power tools) and equipment's.

Upon completion you should be able to identify, use and answer questions on maintenance for power tools, **machines, and workshop equipment (as listed in section 2)**

- Select the appropriate tool for use in a specific task.
- Demonstrate how to use, care for, and maintain machines and workshop equipment.

Keywords/terms and concepts – Words and terminology should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

When working with power tools,

- appropriate personal protective equipment such as safety goggles and gloves must be worn to protect against hazards that may be encountered while using hand tools.
- Workplace floors shall be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.
- Remove material that can hinder you while you are busy with your powertool.
- Power tools must be fitted with guards and safety switches; they are extremely hazardous when used improperly.

To prevent hazards associated with the use of power tools you should observe the following general precautions:

- Never carry a tool by the cord or hose.
- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
- Keep all people not involved with the work at a safe distance from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.

- Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
- Maintain tools with care; keep them sharp and clean for best performance.
- Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance when operating power tools.
- Wear proper apparel for the task. Loose clothing, ties, or jewellery can become caught in moving parts.
- Remove all damaged portable electric tools from use and tag them: "Do Not Use."

Identifying and use of tools.

Tool Identifying	Use and function
Corded/cordless circular saw  	A circular saw is used to cut wood. A. Cordless circular saw is easier to use in tight or awkward situations than its corded counterpart. In addition, there is no cord getting in your way or potentially throwing your cut out of line. A rotary saw is a relatively recent addition to the power-tools arsenal. It can drill directly into material such as wood, laminate or drywall, and make free-form cuts in any direction. With the right bit, it can even be used to cut through marble.
Planes 	A power hand-plane is a great tool for taking off varying depths of wood. The depth of the cut is adjustable, and a pass over the wood surface will result in a smooth, clean edge with good corners on either side. This tool serves the same basic function as a regular block-plane, but gets the job done much faster and with much less effort.
Router 	Routers are used to remove wood from specific areas of wood stock. Two of the basic varieties are the standard router and the plunge router. A standard router is typically used to remove wood from around the edges of a piece of wood. A plunge-router can do that as well, but it can also be pushed directly into the wood.  Router at work in the workshop

Welders **Arc**   Mic or Flux cored welder 	**Arc welding** is a welding process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals when cool result in a binding of the metals. It is a type of welding that uses a welding power supply to create an electric arc between a metal stick ("electrode") and the base material to melt the metals at the point of contact. Arc welders can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. This welder is a versatile flux core arc welder (FCAW) designed to use self-shielding flux-cored welding wire. This eliminates the need for gas and regulators that normal MIG welders require. With all welders a welding helmet is required for protecting your eyes against the sparks TIG welding MIG Welding
Scroll saw.  	Used for making exact, delicate cuts with its narrow blade. To use the scroll saw, the wood being cut is moved in relation to the blade, not vice versa. The wood rests on a flat table which helps in making precise cuts, and the table can be tilted for making beveled or angled cuts. A tension-footer holds the wood steady and prevents bouncing that might be caused by the vibration of the tool. A jigsaw is a great power tool for making custom cuts in plywood or other thin materials. Some convert to a powered handsaw for cutting heavier pieces of lumber.
Sanding tools 	Palm sanders are ideal for sanding flat surfaces in a small amount of time. Random orbital sanders are used for some of the same jobs as palm sanders. The spinning surface will slow down as increasing pressure is applied to the sander, which helps reduce the chances of over-sanding more delicate pieces. Detail sanders are useful for getting into tight, hard-to-reach places.

	Belt sanders are suited for heavier jobs and should be used with caution as they will remove a lot of wood in a hurry. A belt sander is not recommended for use for more delicate jobs such as when restoring or refinishing fine furniture or antiques.
Rotary tool 	Versatile tool that can be used for detail work in a variety of applications and on several different materials. They utilize interchangeable heads and blades for such things as cutting, sanding, polishing, engraving and removing rust. A flex-arm is a valuable accessory that's especially useful for engraving since it lets the user hold the rotary tool much like a writing instrument.
Oscillating tool 	Oscillating Multifunction Tools are the ideal solution for cutting, sanding, and scraping in small spaces. These affordable, lightweight tools are perfect for renovation, repair, and automotive projects, as well as hobbies. Available in both corded and cordless configuration. Many options to choose from.
Plasma cutter 	**Plasma cutting** is a process that cuts through electrically conductive materials by means of an accelerated jet of hot plasma. Typical materials cut with a plasma torch include steel, stainless steel, aluminum, brass and copper, although other conductive metals may be cut as well. Plasma cutting is often used in fabrication shops, automotive repair and restoration, industrial construction, and salvage and scrapping operations. How does a plasma cutter work
Standing drill press 	A standing **drill** pressor **drilling machine** is a tool primarily used for making round holes in material intended for. It is fitted with a bit, either a drill or driver, depending on application, secured by a chuck. Some standing drills can stand on the floor. Others fit on the workbench to save floor space

Spraygun 	Air gun spraying uses generally larger equipment. It is typically used for covering large surfaces with an even coating of liquid. Spray guns can be either automated or hand-held and have interchangeable heads to allow for different spray patterns. How to spray paint
Disc grinder  	An angle **grinder**, also known as a **disc grinder** or side **grinder** is a handheld power tool used for grinding (abrasive cutting) and polishing material. The type of material cut or polished is determined by the type of disc used.
Mitre (Miter) Saw 	A **miter saw** or **mitre saw** is a saw used to make accurate crosscuts and miters in a workpiece by positioning a mounted blade onto a board. A miter saw in its earliest form was composed of a back saw in a miter box, but in modern implementation consists of a powered circular saw that can be positioned at a variety of angles and lowered onto a board positioned against a backstop. Powered miter saws are also commonly referred to as **chop saws**
Grinder metal chop saw. 	An **abrasive saw**, also known as a **cut-off saw** or **chop saw**, is a **circular saw** which is typically **used** to cut hard materials, such as **metals**, tile, and concrete. The **cutting** action is performed by an **abrasive** disc, like a thin **grinding** disc. **Abrasive saws** typically **use** composite friction disk **blades** to abrasively cut through the required.

Commented [EN2]:

Chainsaw  	Is a portable gasoline-,(petrol) electric-, or battery-powered saw that cuts with a set of teeth attached to a rotating chain driven along a guide bar. It is used in activities such as tree felling, limbing, bucking, pruning, cutting firebreaks in wildland fire suppression, and harvesting of firewood. How to safely use a chainsaw

Maintenance of your power tool

1. **Cool Down Heated Tools**

   Overworking a tool puts a lot of stress on its motor and can cause it to overheat. This mostly happens when you are trying to work through a difficult material, like drilling into concrete or sawing a very hard wood. Overheating can also occur if you run a tool too long without stopping. If your tool seems like it is getting hot, stop what you are doing and give it a break until it can cool down. This will help save you from wearing out the motor or burning out parts.

2. **Clean Regularly**

   For your best tool maintenance, power tools should be cleaned at the end of every shift and before they are stored away for the night. You can wipe dirt and other particles from the outside casing with a good cleaning cloth. Compressed air is the best option to clean the particles from the tool's vents; cleaning your tool's exhaust vents with a brush could push the dirt farther into the tool and inadvertently cause more damage later.

3. **Lubricate**

   Lubrication is a must to keep all the moving parts on your power tools working properly. Check the tool maintenance section of your owner's manual and follow the manufacturer's instructions on how to correctly lubricate your particular tool's model and which lubricant to use. Keeping your tool well-lubed keeps the parts from chafing, heating and corroding.

4. **Sharpen Bits and Blades**

   Using old and worn-out drill bits or saw blades means you have to work your power tool even harder to get the job done. This causes extra stress on the motor which can damage parts or cause the tool to overheat with stress. Likewise, it is also important to make sure you are using the right bit for the material you are working.

5. **Tool Storage**

   Power tools need to be stored in a dry, clean place. Storing power tools in a moist environment can lead to problems with the electrical components and cause corrosion. This can cause safety issues or cause your tool to stop working completely. Tools also should be stored inside a case or cabinet when not in use. This helps eliminate excess dust and particles getting into the tools through the vents when not in use.

6. **Battery Care**

   Lithium ion batteries are the current standard for power tools. One of the most important factors to keeping your lithium ion battery well maintained is to manage heat. Allowing a battery to overheat can fry it beyond repair. Store your batteries in a climate-controlled area and avoid leaving it in places where the temperature spikes (such as in the back of an enclosed truck). Do not let the battery run completely down before recharging it.

Tool Maintenance Is Key

Implementing daily maintenance routines is the best way to prevent problems with your power tools. A simple dusting can remove dirt and particles that could otherwise end up in your gears or start corroding your electrical system. Keeping your tools clean, cool, and effectively oiled is a sure way to get the most out of power tools.

The correct handling and operation of your power tool ensure a long lifetime of use. The owner's manuals for power tools can come in handy even after becoming familiar with the basic operation of tools. But like most owner's manuals, they tend to become lost and scattered over time.

Consider keeping all the owner's manuals for the power tools in a shop in a ring binder. In that way, the manuals are more likely to stay clean, flat, readable, and easy to locate than they would if crammed into the bottom of a drawer.

Questions

1. Name the types of power tools with appropriate examples.
2. List 10 general precautions in the use of power tools.
3. Discuss 6 aspects that should be kept in mind in maintaining your power tools?

Module 3

Application of alternative energy on the farm

Renewable energy and farming are a winning combination. Wind, solar, and biomass energy can be harvested forever, providing farmers with a long-term source of income. Renewable energy can be generated and used on the farm to replace other fuels or sold as a "cash crop."

Objectives

Identify the use and application of the alternative energy sources:

- Upon completion you should be able to Identify the use and **application of:**
  - Wind
  - Solar
  - Hydro
  - Biogas
  - Biofuel

as alternative source of energy on the farm

Keywords/terms and concepts – Words or terminology should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column A and B to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

The alternative energies that can be applied by farmers are:

1 Wind power

Farms have long used wind power to pump water and generate electricity. Recently, wind developers installing large wind turbines on farms provide power to electric companies and consumers. Where there are strong winds, developers may pay a yearly fee for each turbine installed. Each turbine uses less than half an acre, so farmers can plant crops and graze livestock right to the turbine's base.

2 Biomass/Biofeul energy

Biomass energy is produced from plants and organic wastes—everything from crops, trees, and crop residues to manure. Biomass energy can be divided into biofuel and biogas energy.

- **Biofuels**

In contrast to biomass energy sources, biofuels make use of animal and plant life to create energy. In essence they are fuels that can be obtained from some form of organic matter.

Biofuel is fuel that is produced through contemporary processes from biomass, rather than by the very slow geological processes involved in the formation of fossil fuels, such as oil. Since biomass technically can be used as a fuel directly (e.g. wood logs), some people use the terms biomass and biofuel interchangeably. Often, however, the word biomass simply denotes the biological raw material the fuel is made of, like torrefied pellets or briquettes.

They are renewable in cases where plants are used, as these can be regrown on a yearly basis. However, they do require dedicated machinery for extraction, which can contribute to increased emissions even if biofuels themselves do not.

Crops grown for energy could be produced in large quantities, just as food crops are. Corn is currently the most widely used energy crop to be converted into a biofeul. Perennial crops

require less maintenance and fewer inputs than do annual row crops such as corn, so they are cheaper and more sustainable to produce if used as a biofeul.

Crops and biomass wastes can be converted to energy on the farm or sold to energy companies that produce fuel for cars and tractors and heat and power for homes and businesses.

3 Biogas

Biogas is produced after organic materials (plant and animal products) are broken down by bacteria in an oxygen-free environment, a process called anaerobic digestion. Biogas systems use anaerobic digestion to recycle these organic materials, turning them into biogas, which contains both energy (gas), and valuable soil products (liquids and solids).

4 Solar energy

The amount of energy from the sun that reaches Earth each day is enormous. All the energy stored in Earth's reserves of coal, oil, and natural gas is equal to the energy from only 20 days of sunshine. While drier areas such as the Karoo and Northern Cape have more sun than other parts of the South Africa, most areas receive enough sunshine to make solar energy practical.

Solar energy can be used in agriculture in several ways,

- saving money,
- increasing self-reliance, and
- reducing pollution.

Solar energy can cut a farm's electricity and heating bills. Solar heat collectors can be used to dry crops and warm homes, livestock buildings, and greenhouses. Solar water heaters can provide hot water for dairy operations, pen cleaning, and homes. Photovoltaics (solar electric panels) can power farm operations and remote water pumps, lights, and electric fences. Buildings and barns can be renovated to capture natural daylight, instead of using electric lights.

5 Hydroelectric electricity

What many people are not aware of is that most of the cities and towns in the world rely on hydropower and have for the past century. Every time you see a major dam, it is providing hydropower to an electrical station somewhere. The power of the water is used to turn generators to produce the electricity that is then used. It is non-polluting, entails no waste or produces toxic gases, and environment friendly.

What can you do? The options that make the most sense for you, depend on your local renewable resources found on your farm

A farm map with various farm activities.

1. Identify the alternative energy sources used and suggest the application of the energy generated. Also suggest where you will be able to generate and apply other energy sources not indicated here.

CHAPTER 4: Plant production and Horticulture

MODULE 1: Soil as medium for production

Soil is one of the primary production factors needed for agricultural production. However, the characteristics of soil influences the usability of soil for production**.** All these factors have an influence on the quality of soil from which production must take place.

Objective : Explain the following concepts of soil as a medium for production:
Upon completion you should be able to answer questions on :

- **Soil Structure**
- **Soil Temperature**
- **Soil Water**
- **Soil reaction**
- **Soil Organic Matter**
- **Soil Air**

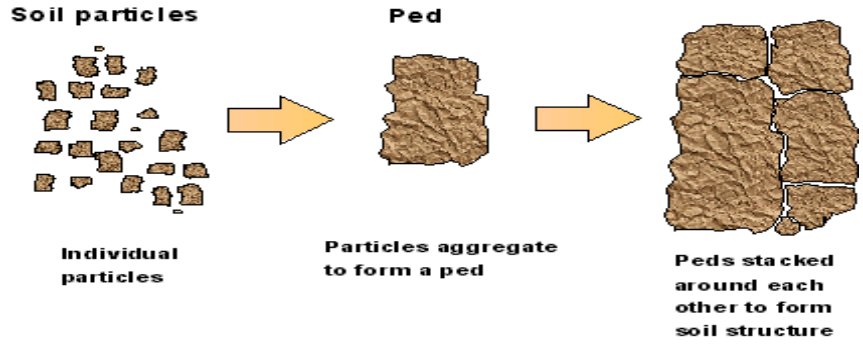
Keywords/terms and concepts – Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column a and b to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

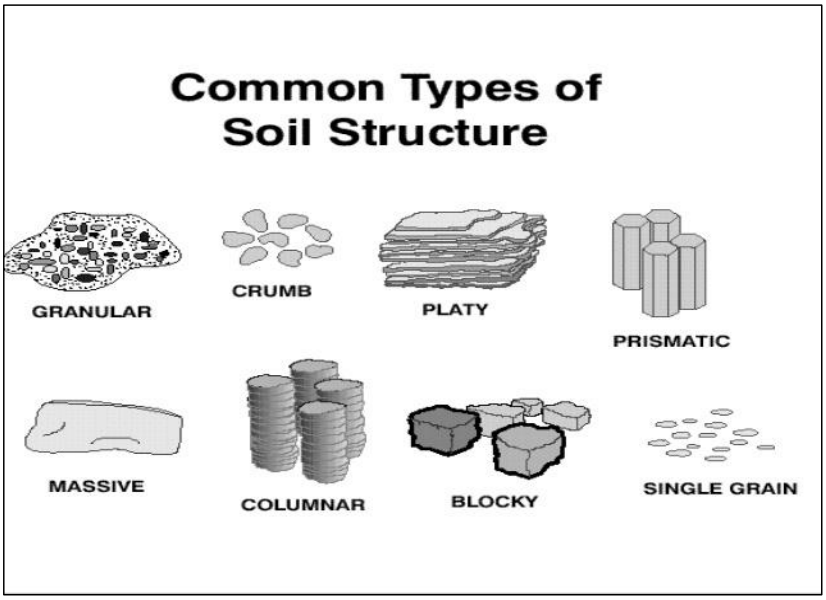
Key terms and concepts	Meaning
Peds	**Peds** are aggregates of **soil** particles formed as a result of pedogenic processes; this natural organization of particles forms discrete units separated by pores.
Macro-pores	A macropore is a continuous **soil pore** that is significantly larger than the intergranular or interaggregate **soil pores** (micropores).
Micro- pores	With diameters less than 0.08 mm, **micropores** are small **soil pores** usually found within structural aggregates.
Mulching	A mulch is a layer of material applied to the surface of soil. A mulch is usually, but not exclusively, organic in nature
Evaporation	**Evaporation**, the process by which an element or compound transitions from its liquid state to its gaseous state
Transpiration	Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems and flowers.
Soil reaction	**Soil reaction** is an indication of the acidity or alkalinity of **soil** and is measured in **pH** units.

Soil structure

Soil structure describes the arrangement of the solid parts of the soil and of the pore space located between them. It is determined by how individual soil granules clump, bind together, and aggregate, resulting in the arrangement of soil pores between them.

Soil structure has a major influence on water and air movement, biological activity**,** root **growth and** seedling **emerge**





Soil Temperature: As influenced by:

- **Composition of the Soil:**

Since the soil is a lot granular medium consisting of solid, liquid and gaseous phases, the thermal regimes of the soil will depend upon its volumetric composition, the size and arrangement of the solid particles and also interface relationship between the solid and liquid phases.
Among the solid materials, the soil is composed of partly mineral matter and partly organic matter. Soils containing much more mineral matter get heated more easily than those soils containing higher amount of organic matter.

- **Soil Structure:**

Soil structure also influence soil temperature by controlling pore spaces resulting from the different types of arrangement of soil particles like open and close systems of packing etc. Soils having spheroidal type of structure warm up more quickly because there are no prevailing conditions of waterlogging.

- **Soil Texture:**

Light textured sandy soils, in general, absorb heat very quickly than heavy textured clayed soils. Heavy soils carry a greater quantity of water and due to this reason it warms up very slowly.

- **Soil Moisture:**

Soil moisture plays a vital role in controlling its thermal regime. The specific heat of water is high than the soil. Moist soils have a higher specific heat than dry soils. Consequently, a moist soil has a lower temperature than dry soil. Moist soil gets heated very slowly and it is cooler than the dry soils.

- **Soil Colour:**

Dark soils tend to have higher temperatures, however**,** in a dark soil where colour is caused by large amounts of humus, the larger amounts of water held by the humus may offset the increased heat absorption due to the dark colour.

- **Vegetation:**

Soils covered with different types of vegetation absorb less heat as compared to soils without vegetation cover. Vegetation acts as an interceptor of heat on the soil surface and thereby reduces the thermal regime of the soil.

- **Irrigation and Drainage:**

Irrigation raises the humidity of the air, lowers the air temperature over the soil and reduces the daily soil temperature variations. Drainage decreases the heat capacity of wet soils, which raises the soil temperature. This plays an important role in warming up the soil in the spring.

- **Topography:**

The slope of the land especially ground slope also influence the soil temperature. The temperature of the ridged fields is higher than those that are level. The orientation of the slope will also affect soil temperature. Soils on the Northern slope are typically warmer than soils on the Southern slope in Southern Africa.

- **Compactness of the Soil:**

Compactness of the soil surface increases the density and the thermal conductivity. Compacted soils have better heat conductivity than loosened soil. Tillage, on the other hand, creates surface mulch which reduces heat flux from the surface to the sub-surface layers.

- **Climate:**

Climate has a profound influence on the thermal regime of the soil. Soils in temperate climate are cooler than those soils in tropical climate.

- **Season:**

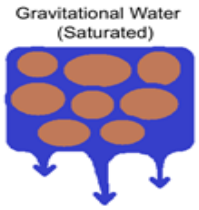
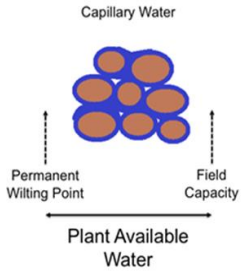
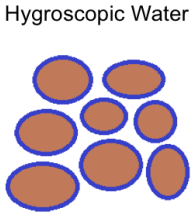
Soil temperature differs with the seasonal variations of the year. The summer months like mid-day represent the peak of the global radiation and the maximum temperatures. The winter months have an effect similar to daily night temperatures which is much lower. The temperature of the surface soil is always higher than the air temperature.

Soil Water

Though the soil particles often lie close to each other, yet some angular space is always present there. All such spaces in the soil are collectively called pore space.

The pore space comprises a constant volume in the soil (40-60% of total soil volume) which remains filled with water and gases in varying proportions. In a “dry” soil, water occupies a very small proportion of this space. In a “wet” soil, it is water that occupies most of this space. The soil, in fact, acts as a water reservoir for plants.

Soil water is the term for water found in naturally occurring soil. There are three main types of soil water - gravitational water, capillary water, and hygroscopic water - and these terms are defined based on the function of the water in the soil.

	**Gravitational Water** Gravitational water is free water moving through soil by the force of gravity. It is largely found in the macropores of soil and very little gravitational water is available to plants as it drains rapidly down the water table in all except the most compact of soils.
	**Capillary Water** Capillary water is water held in the micropores of the soil, and is the water that composes the soil solution. Capillary water is held in the soil because the surface tension properties (cohesion and adhesion) of the soil micropores are stronger than the force of gravity. However, as the soil dries out, the pore size increases and gravity starts to turn capillary water into gravitational water and it moves down. Capillary water is the main water that is available to plants as it is trapped in the soil solution right next to the roots if the plant
	**Hygroscopic Water** Hygroscopic water forms as a very thin film surrounding soil particles and is generally not available to the plant. This type of soil water is bound so tightly to the soil by adhesion properties that very little of it can be taken up by plant roots. Since hygroscopic water is found on the soil particles and not in the pores, certain types of soils with few pores (clays for example) will contain a higher percentage of it.

Soil water conservation:

There are several conservation methods to reduce excessive soil water loss. Most provide additional advantages such as building soil structure, improving organic matter or weed control.

The two major water loss pathways from cropping systems include evaporation and transpiration. Evaporation losses occur directly from the soil, while transpiration losses are through plants. A plant can be pictured as a pump, drawing water from the soil and moving it to the leaves where it is lost to the atmosphere through tiny openings called stomata. These two losses are usually combined and referred to as evapotranspiration (ET). Evapotranspiration values are highest when the soil is near field capacity and the air is warm, dry and moving.

Methods to conserve soil moisture includes:

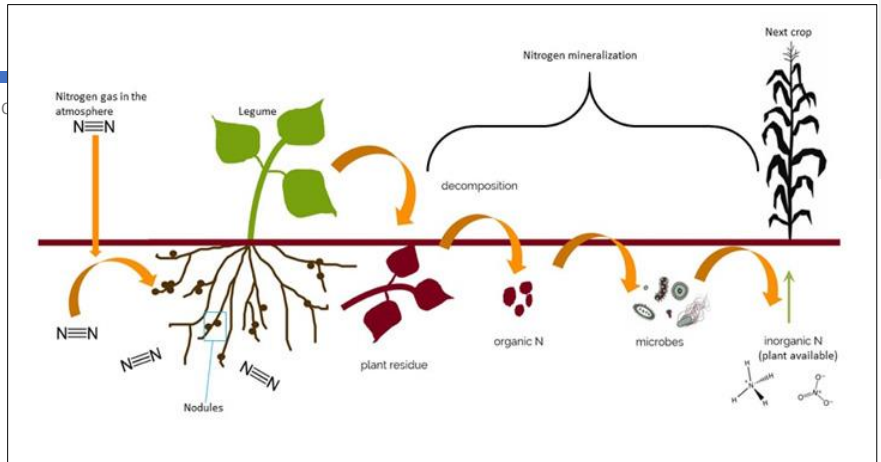
- **The addition of organic matter**
  Organic matter is material such as plant residues and animal manure. It influences many of the physical, biological and chemical properties of soil. Some of these properties include structure, water holding capacity, nutrient content, biological activity, and aeration.

- **Conservation tillage and residue management**
  Maintaining soil organic matter levels is difficult if the soil is intensively tilled (such as the annual use of a moldboard plow). Reducing tillage means leaving more residue, tilling less often and less invasively than with conventional tillage. No-till is the most extreme version of reduced tillage where the soil is undisturbed prior to planting.

- **Crop Rotation**
  Crop rotations between different types of crops (eg. row crops and “soil building” crops such as forages) is a recommended practice, especially for vegetable growers. Growing a different crop each year prevents organic matter loss, improves soil structure and reduces the incidence of weeds and pests. Generally, the longer the rotation, the better. Crop rotations can also lead to greater efficiency in soil water utilization. For example, deep rooted crops following shallow crops can take advantage of the extra reserve of deep moisture which was unavailable to the shallow rooted crop.

- **Mulching**
  For arable soils, the most effective conservation practices for reducing surface evaporation are those that provide some degree of surface cover for the soil. A cover can be best provided by mulches or by tillage practices that leave plant residues on the soil surface. A mulch is any material placed on a soil surface for the purpose of reducing evaporation or controlling weeds. Mulches act as barriers to movement of moisture out of the soil. They can be either natural (eg. straw, wood chips, peat) or man-made (eg. transparent or opaque plastic sheeting). Mulches can also control soil temperature, depending on the type of mulch being used.

- **Green Manuring**
  Green manure is plant material which is grown for the sole purpose of eventually being incorporated into the soil while still lush and fresh. Green manuring adds organic matter to the soil, returns nutrients to the soil and improves soil structure.



Soil reaction

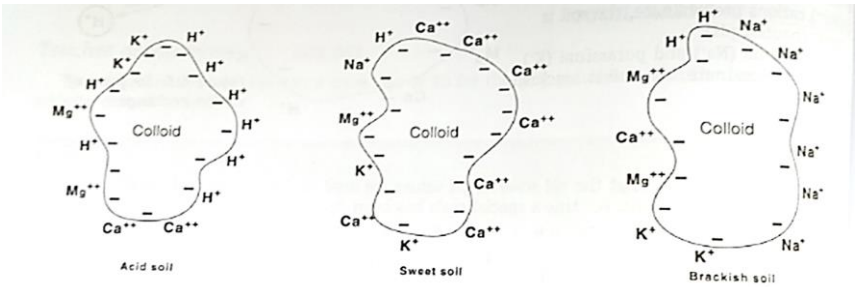
The degree of acidity or alkalinity of a soil is called soil reaction. This is measured in the pH of the soil. This is the most important characteristic for plant growth factors because it determines the availability of plant nutrients and the amount of toxic substances in the soil. The soil pH has an influence on the fertility as well as the productivity of the soil. Soil micro- organisms and plants responds to soil reaction because it tends to control much of their chemical environment.

There are THREE main categories of soils according to their pH levels:

Acidic soil contains a large amount of Hydrogen atoms.

Sweet soil contains large numbers of Calcium, Magnesium and Potassium ions and are also called alkaline soils.

Brackish soil contains also other minerals such as potassium ions but also a large amount of Sodium ions and are very alkaline.



Soil organic matter.

Soil organic matter – the product of on-site biological decomposition – affects the chemical and physical properties of the soil and its overall health. Its composition and breakdown rate affect: the soil structure and porosity; the water infiltration rate and moisture holding capacity of soils; the diversity and biological activity of soil organisms; and plant nutrient availability. Soil organic matter is especially important for the following in soils:

- Nutrient Supply
  Organic matter is a reservoir of nutrients that can be released to the soil. As a revolving nutrient fund, organic matter serves two main functions:
  - As soil organic matter is derived mainly from plant residues, it contains all of the essential plant nutrients. Therefore, accumulated organic matter is a storehouse of plant nutrients.
  - The stable organic fraction (humus) adsorbs and holds nutrients in a plant-available form. Organic matter releases nutrients in a plant-available form upon decomposition.

- Water-Holding Capacity
  Organic matter behaves somewhat like a sponge, with the ability to absorb and hold up to 90 percent of its weight in water. A great advantage of the water-holding capacity of organic matter is that the matter will release most of the water that it absorbs to plants.
- Soil Structure Aggregation
  Organic matter causes soil to clump and form soil aggregates, which improves soil structure. With better soil structure, permeability (infiltration of water through the soil) improves, in turn improving the soil's ability to take up and hold water.
- Erosion Prevention
  This property of organic matter is not widely known. Data used in the universal soil loss equation indicate that increasing soil organic matter from 1 to 3 percent can reduce erosion 20 to 33 percent because of increased water infiltration and stable soil aggregate formation caused by organic matter.

How to improve the organic matter of soils.

Building soil organic matter is a long-term process, but it is an important process for farmers. It can be done through the following:

- Reduce or Eliminate Tillage
  Tillage improves the aeration of the soil and causes a flush of microbial action that speeds up the decomposition of organic matter. Tillage also often increases erosion. No-till practices can help build organic matter.
- Reduce Erosion
  Most soil organic matter is in the topsoil. When soil erodes, organic matter goes with it. Saving soil and soil organic matter go hand in hand.
- Soil-Test and Fertilize Properly
  Proper fertilization encourages growth of plants, which increases root growth. Increased root growth can help build or maintain soil organic matter, even if you are removing much of the top growth.
- Cover Crops
  Growing cover crops can help build or maintain soil organic matter. However, best results are achieved if growing cover crops is combined with tillage reduction and erosion control measures.

Soil air

The quantity and composition of soil air is important because it determines the amount of oxygen available to plant roots for respiration. The composition of soil air can change drastically as a result of changes in soil water content, bulk density and the activities of micro-organisms.

Plant roots and micro-organisms within the soil respire – they therefore need an electron acceptor during the oxidation of hydrocarbons to obtain energy. Plant roots and aerobic micro-organisms use oxygen. Should the oxygen concentration in the soil become too low, or the concentration of carbon dioxide become too high, the plant roots and micro-organisms cannot respire and they will die.

Soil water and soil air are mutually exclusive and the interaction between these two is reliant on the amount of water available in the soil. In dry soils air fills the pore-spaces between soil particles and in wet soils these spaces are filled with water.

Module Questions:

1) Briefly explain the role of soil structure in plant growth (5)

2) Explain how soil temperature will influence seed germination (4)

3) Enough organic matter in soil is one of the most important factors whereby a soil can be classified as " healthy" Describe the factors, important for plant health that is being influenced by soil organic matter (8)

MODULE 2: Soil Cultivation

Objective : Demonstrate an understanding of reasons , methods and purpose in Soil preparation, Irrigation and Drainage

Cultivation, also known as tilling or soil refinement, is the act of digging into or cutting up an existing soil bed to better prepare it for planting.

Upon completion you should be able to answer questions on :

- **Soil preparation**
- **Irrigation systems**
- **Types of drainage systems**

The objectives of soil cultivation are based on the following principles:

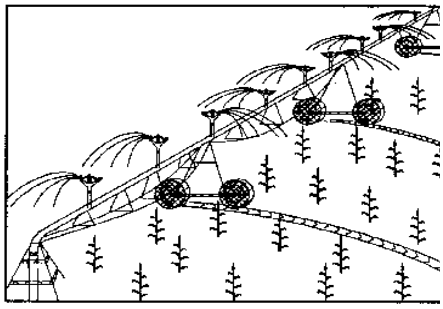
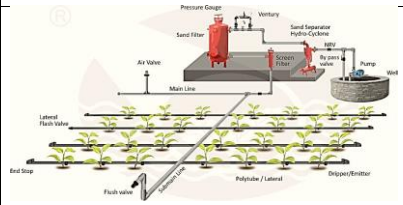
- elimination of undesirable plants, reducing competition with the established crop;
- achievement of favourable conditions for sowing or for placing vegetative material into the soil, so allowing germination, emergence and good plant development;
- maintenance over the long term of fertility and productivity
- preserving the soil organic matter and avoiding erosion; ·
- elimination of hard pans or compacted layers to increase water infiltration through the soil whilst avoiding erosion; ·
- incorporation and mixing of lime, fertilizers or agro-chemical products into the soil;
- incorporation of organic and agricultural residues;
- land levelling to facilitate better quality of work with machinery during sowing and up to the time of harvest.

Soil cultivation is done with two long term visions in mind.

- First ensuring optimal plant growth and
- secondly to ensure soil health

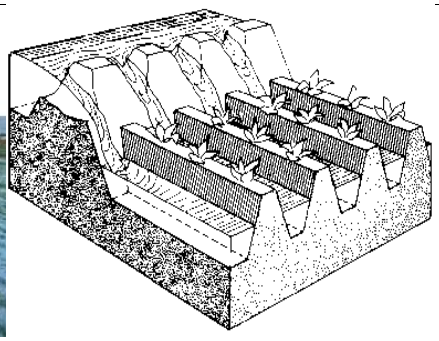
The term irrigation can be defined as a controlled way to apply water for agricultural purposes, through systems that is man-made and can supply water when rains cannot supply

Irrigation Systems

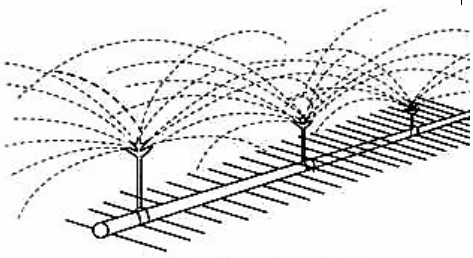
Centre- Pivot systems are normally for the irrigation of very large areas. These systems are a type of overhead drip or fine spray system	
Drip irrigation is where small amounts of water is supplied directly to the roots of a plant. The supply is done through different applicators - orifices, emitters, porous tubing, perforated pipe, etc. These systems do not require high pressures and a calculated control of the water supply is done.	

Flood / furrow irrigation can only be done when there is enough water available to flood big sections of land

.



Sprinkler irrigation is a method of applying irrigation water which is similar to natural rainfall. Water is distributed through a system of pipes usually by pumping. It is then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground. The pump supply system, sprinklers and operating conditions must be designed to enable a uniform application of water.
Sprinkler systems can also be used in Green houses and nurseries.

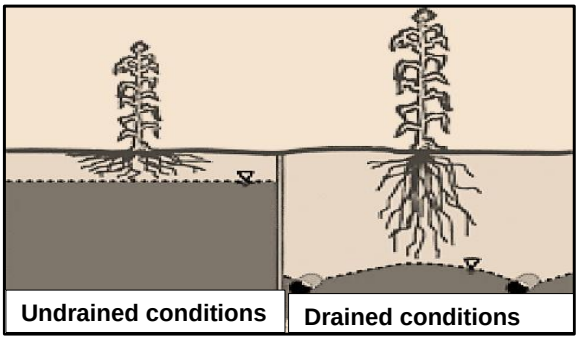


Drainage:

Drainage is the natural or artificial removal of a surface's water and sub-surface water from an area with excess of water. The internal drainage of most agricultural soils is good enough to prevent severe waterlogging (anaerobic conditions that harm root growth), but many soils need artificial drainage to improve production or to manage water supplies.

***Drainage**, in agriculture, is the removal of excess water from the **soil**, either by a system of surface ditches, or by underground conduits as required by **soil** conditions and land contour.*

The function of the drainage system is amongst other to control the water table, and to collect, transport, and dispose of the water through an outfall or outlet



The selection of a drainage system depends on the area that needs to be drained and the resources available.

There are two main types: (1) surface drainage and (2) sub-surface drainage

- Surface drainage systems are usually applied in relatively flat lands that have soils with a low or medium infiltration capacity, when the drainage problem is mainly that of shallow water tables or in lands with high-intensity rainfalls that exceed the normal infiltration capacity, so that frequent waterlogging occurs on the soil surface.

Surface drainage systems includes.

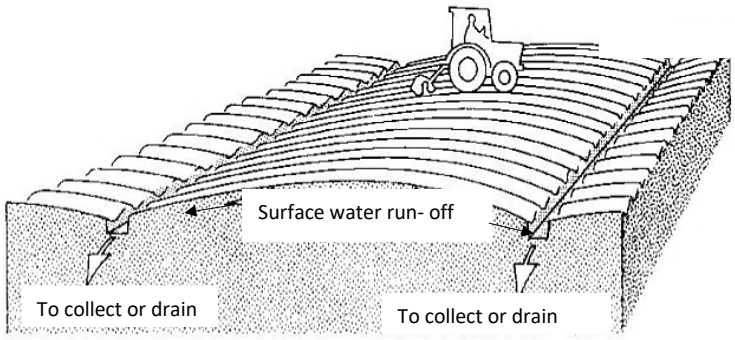
- Bedded systems, used in flat lands for crops.
- Graded systems used in sloping land for crops.

The bedded and graded systems may have ridges and furrows.

DESIGN OF SURFACE DRAINAGE SYSTEMS:

Surface drainage involves the removal of excess water from the surface of the soil.

This is done by removing low spots where water accumulates by land forming or by excavating ditches or a combination of the two.

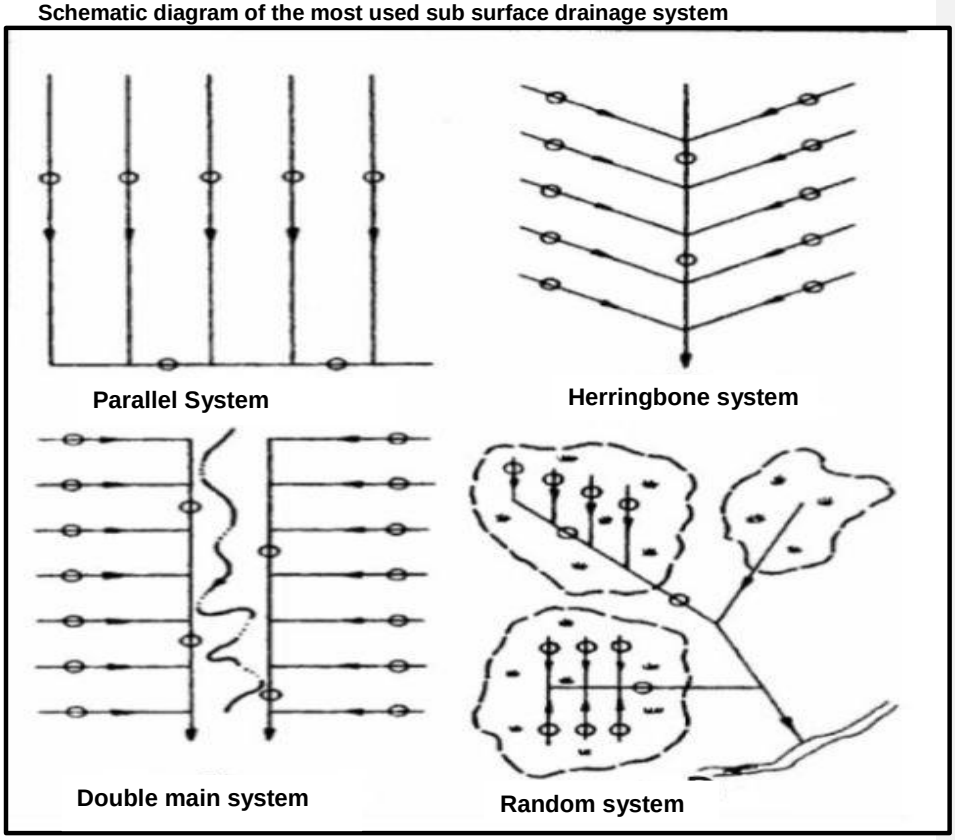


Subsurface drainage systems:

Subsurface drainage is concerned with removing water that percolates through or is contained in the underlying soil substrate. This water, typically the result of a high water table or exceptionally wet weather, can accumulate under soil area by two main means:

- **Gravity flow**. Water from surrounding areas can be absorbed by the soil then flow by gravity to planted areas
- **Capillary rise**. Capillary rise is the rise in a liquid above the level of zero pressure due to a net upward force. Often, capillary rise is a problem in areas of high groundwater tables.

Schematic diagram of the most used sub surface drainage system



Activities:
Using practical to determine soil cultivation depth of implements for the effective preparation of soil- Gr 9

Videos of machines used for cultivation practices.

Compile a poster on micro (drip, micro-jets, mini popups) and macro (flood, centre pivot, side-roller, dragline, rain gun sprinkler, overhead etc.) irrigation systems and methods

Module Questions :

1) List FIVE reasons for soil cultivation (5)

2) Describe what will inform a farmer when selecting a suitable irrigation system for his crops (6)

3) Briefly explain why it would sometimes be necessary to implement a drainage system on a piece of land (3)

MODULE 3: Alternative planting mediums:

Planting or growing mediums are used in situations where it is not suitable to use soil. This can be due to various reasons, such as the quality of the soil and also the weight of soil. Especially in nursery and hydroponic environments soil is not a suitable growing medium for plants.

Often also referred to as "substrate" or "potting soil", a growing medium is a material, other than soil on the spot, in which plants are grown. In grade 8, you have been exposed to a variety of different planting mediums, with different characteristics.

Objective: Describe the reasons for the use of alternative planting mediums:

Upon completion you should be able to answer questions on:

- **The requirements for a suitable planting medium**
- **The reasons for using a planting medium**

Growing media are used by the horticulture industry as well as consumers to support the development of plants. The growing medium ensures that the plant can healthily grow by providing it with a range of essential elements:

- an optimum rooting environment for physical stability
- storage of air for the roots
- water absorption and retention --> availability to the plant when needed
- supply of nutrients for the roots

Growing media are used to grow a wide variety of plants including vegetables, fruits, floriculture ornamentals, tree and shrub ornamentals and specialty plants.

The range of growing media constituents used includes peat, coir pith, wood fibers, bark, composted materials i.e. green waste, and bark. Mineral constituents like perlite, pumice, clay and vermiculite are also used. Growing media are often formulated from a blend of such raw materials, usually enriched with fertilizers, lime and sometimes biological additives in order to achieve the correct balance of physical, chemical and biological properties for the plants to be grown. Having the right growing media mix is as important for an optimal plant growth as water and fertilisers.
Plant species differ considerably in their need for water and nutrients, and therefore need different kinds of growing media to provide the best growing conditions. Due to this, a wide range of different kinds of growing media are available on the market. The horticulture industry uses thousands of different growing media mixes.
In this context, the growing media industry chooses different materials based on their performance, the plants' needs, availability and sustainable development considerations.
For example:

- for young trees and shrubs a substrate with wood fibers or bark is often used as it provides more physical stability
- clay is frequently used for plants with high water needs as it can store the water longer
- perlite is a material used to enhance the drainage of water

In sum, the right growing medium provides growing conditions that are predictable and reliable for the grower, contributing to higher yields and more efficient growing.

- Activities: Collect and identify the different planting mediums.

Test water holding capacity and drainage of the collected alternative mediums

Module questions:

1) What will inform a farmer on which alternative growing medium to use? (4)

2) Why is it important to know the water holding capacity of an alternative medium before using it (3)

3) Look at the list of any 6 alternative mediums that you have done in Gr 8. Tabulate them into Organic and Inorganic mediums (6)

MODULE 4: Requirements of optimal plant growth.

Plants need five things in order to **grow**: sunlight, proper temperature, moisture, air, and nutrients. These five things are provided by the natural or artificial environments where the **plants** live. If any of these elements are missing they can limit **plant growth**

Objective : Explain and understand the requirements of optimal plant growth.

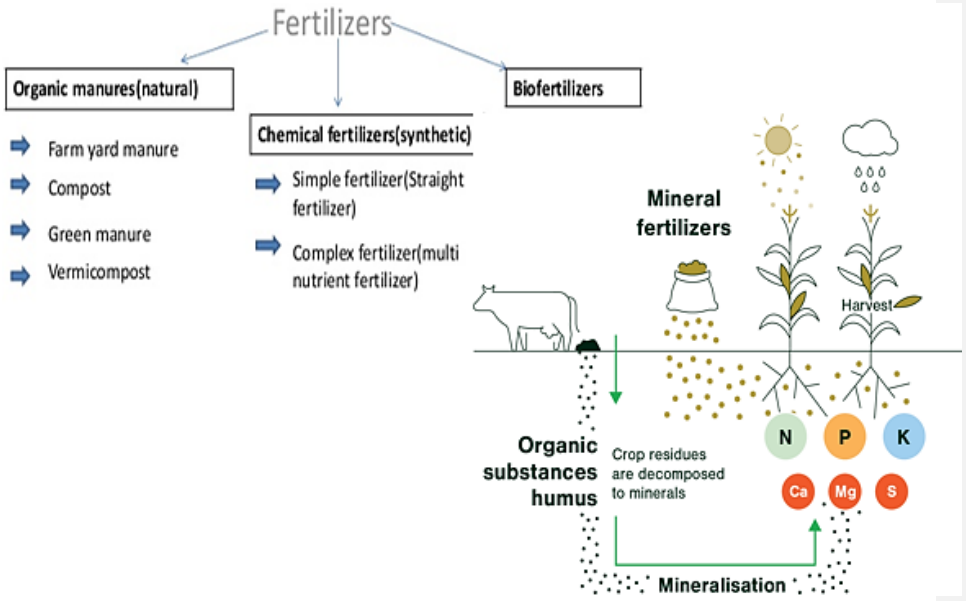
Upon completion you should be able to answer questions on :

- **Soil Nutrients**
- **Various Organic fertilizers**
- **Various Synthetic fertilizers**

Nutrients in the soil:

Soil is a major source of nutrients needed by plants for growth. The three main nutrients are nitrogen (N), phosphorus (P) and potassium (K). Together they make up the trio known as NPK. Other important nutrients are calcium, magnesium and sulfur. These are being called the macro-nutrients. Plants also need small quantities of iron, manganese, zinc, copper, boron and molybdenum, known as trace elements or micro- nutrients, because only traces are needed by the plant.

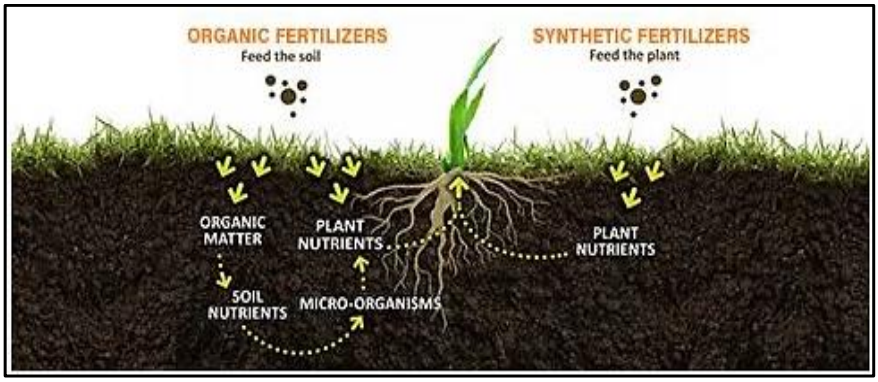
The different types of fertilizers, which add nutrients to the soil:



Nutrients can be added to the soil via several methods, depending on the farming system:

Organic and " Natural " farmers prefer not to use any synthetic/ artificial fertilisers.

Synthetic fertilisers are " man made" and usually change the chemical status of the soil



The difference in the soil reaction of organic and synthetic fertilisers

Types of Organic fertlisers:

Organic fertilizers improve soil where they are used. They not only assist with water retention, they also make the soil lighter so that more air is available to the plant roots. Organic fertilizers don't waste nutrients like their chemical counterparts. Nor are they likely to create a build-up of salts that could dampen plant growth. These types of fertilizers even tend to be less likely to burn tender plant roots than synthetic products.The slow working nature of organic fertilizers is beneficial if you're looking to improve your soil over time. Farmers should also be aware that organic fertilizers are biologically active. This means that their components can change over time. The most commonly used organic fertilizers used by farmers are:

Compost:

Compost is organic matter that has been decomposed in a process called composting. This process recycles various organic materials otherwise regarded as waste products and produces a soil conditioner (the compost).Since organic matter is broken down into humus by micro – organisms and soil animals, the conditions for compost making must be favourable for these living organisms, there must be enough air, water and warmth

Compost is rich in nutrients. It is used, for example, in gardens, landscaping, horticulture, urban agriculture and organic farming. The compost itself is beneficial for the land in many ways, including as a soil conditioner, a fertilizer, addition of vital humus or humic acids, and as a natural pesticide for soil. In ecosystems, compost is useful for erosion control, land and stream reclamation, wetland construction, and as landfill cover.

Materials that can be used to make compost can be any organic material, such as leaves, grass cuttings, vegetable rests and even including cattle and chicken manure, as long as there is no synthetic material included

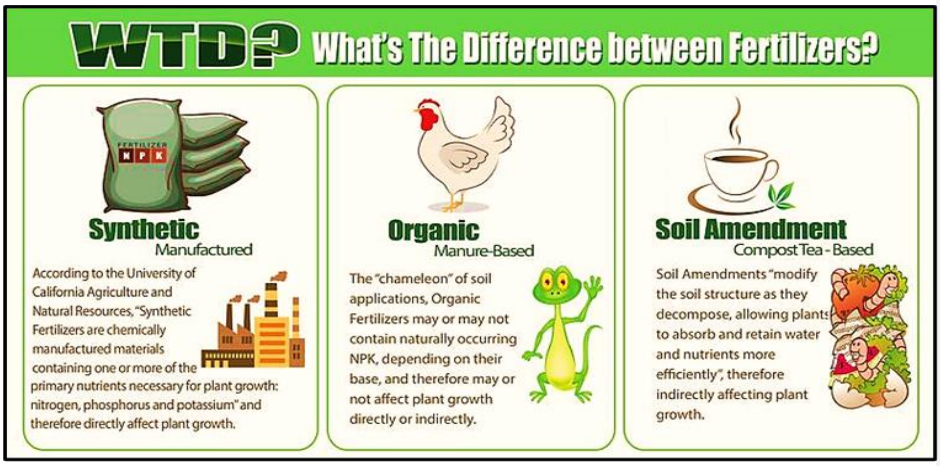
Green Manure

Green manuring is the addition to the soil of plant material that is still in an immature, succulent stage The plants used for green manure are often cover crops grown primarily for this purpose e.g legumes and clovers. Typically, they are ploughed under and incorporated into the soil while green or shortly after flowering. Green manure is commonly associated with organic farming and can play an important role in sustainable annual cropping systems. Green manures are typically used to improve the soil structure, decrease water and nutrient loss and to prevent soil erosion

Animal Manure

Animal manure consists out of excreta collected from stables and barnyards with or without litter; used to enrich the soil. It can improve the soil structure (aggregation) so that the soil holds more nutrients and water, and therefore becomes more fertile. Animal manure also encourages soil microbial activity which promotes the soil's trace mineral supply, improving plant nutrition. It also contains some nitrogen and other nutrients that assist the growth of plants.

Mulch
Mulch is a layer of plant waste such as fallen leaves, grass cuttings, sawdust and the remains of crops, which can be left on the soil. As the mulch breaks down into humus, it adds minerals to the soil and improves the soil structure. Mulch also stops weeds from growing and reduces evaporation to keep the soil wet.
Other: Bone- meal, Ash, Seaweed extract, Fish meal and dried blood meal.



Inorganic or Synthetic fertilisers.

Inorganic fertilizers exclude carbon-containing materials except ureas. Inorganic fertilizers, also referred to as synthetic fertilizers, are manufactured artificially and contain minerals or synthetic chemicals. For example, synthetic nitrogen fertilizers are typically made from petroleum or natural gas. Phosphorus, potassium and other trace elements in inorganic

fertilizers are often mined from the earth. Inorganic fertilizers or chemicals come in different forms like dry, liquid, slow-release, pelletized, and soluble solutions. Inorganic fertilizers provide plant nutrients in a readymade form and release the nutrients quickly so that the plants are able to get the nutrients as soon as possible. If there is an emergency and the plant is to be fertilized soon, inorganic will be the right choice. Inorganic fertilizers have the necessary amounts of the three main nutrients that the plants require to help them to survive and flourish. However, the concentration of nutrients increases the risk of burning the plant. As Inorganic fertilizers tend to leach, excessive use can lead to a buildup of salts in the soil, causing damage to the plant.

Inorganic fertilisers can be divided into straight fertlisers, which contains only one major mineral such as nitrogen , phosphorus or potassium and mixed fertilisers which contains a combination of the major mineral substances and some times some trace elements. Mixed fertilisers can also be called compound fertilisers.

The functions of the major mineral nutrients (Macro- elements) that is needed by plants are as follows:

Nitrogen:

Nitrogen is so vital because it is a major component of chlorophyll, the compound by which plants use sunlight energy to produce sugars from water and carbon dioxide (i.e., photosynthesis). It is also a major component of amino acids, the building blocks of proteins. Without proteins, plants wither and die.

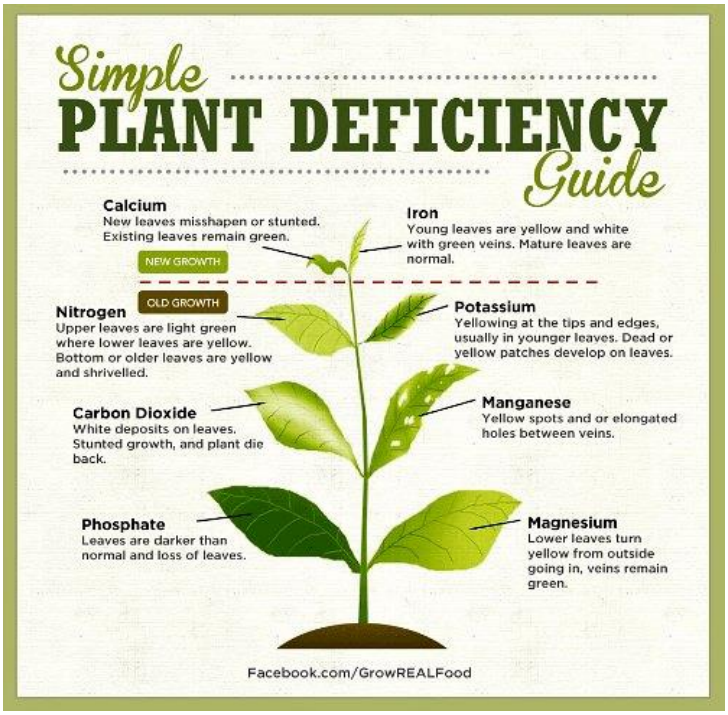
Phosphorus:

All living organisms require phosphorus. Plants, in particular, need phosphorus for normal development and timely maturity. They use it for photosynthesis, storage and transfer of energy, respiration transformation of sugars and starches, nutrient movement within the plant and transfer of genetic characteristics from one generation to the next, among various other functions.

Potassium:

Potassium has many different roles in plants: Potassium is associated with the movement of water, nutrients and carbohydrates in plant tissue. It's involved with enzyme activation within the plant, which affects protein, starch and adenosine triphosphate (ATP) production. The production of ATP can regulate the rate of photosynthesis. In Photosynthesis, potassium regulates the opening and closing of stomata, and therefore also regulates CO2 uptake.

Deficiency symptoms develop and show most of the time in the leaves of plants if, especially the macro- nutrients is not adequate :



Application of organic fertilisers:

2 Parts of Nitrogen(N)
3 Parts of Phosphorous (P)
2 Parts of Potassium(K)
Of which only 22% is active

How many kg of each element in this 10kg bag?

N: 2/7 = 0,28x 22% =6,28% of the bag
P:3/7 = 0,42 x 22% = 9,4% of the bag
K : 2/7= 0,28x22% = 6,28% of the bag

Therefore there is :

N: 6,28% x10kg = $\frac{6,28}{100}$ x 10 = 0,628kg N in the bag

P : 9,4% x 10kg = $\frac{9,42}{100}$ x 10 = 0,940kg P in the bag

K: 6,28% x10kg = $\frac{6,28}{100}$ x 10 = 0,628kg K in the bag

Activity: Summarize the Functions and Deficiency symptoms of the THREE macro- nutrients on a poster

Module Questions

1) Differentiate between Organic and Inorganic (Synthetic) fertilizers (4)

2) List FOUR Organic fertilizers and provide a short description of each (3 marks each) (12)

3) Provide ONE function and ONE deficiency symptom of the three Macro- minerals (6)

Methods to increase production.

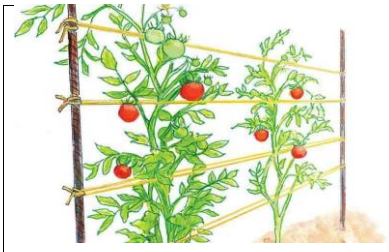
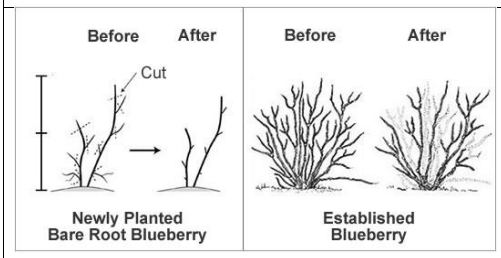
There are several ways whereby plant production can be increased. To increase plant production the factors that has an influence on production needs to be enhanced. Therefore, plant manipulation's aim is to increase e.g sunlight, air, water and nutrients available to the plant

Objective : Understand manipulation to increase production.

Upon completion you should be able to answer questions on :

- **Trellising**
- **Pruning**
- **Manipulation of plant density and plant population**

Amongst other methods the major methods of manipulating plant involve trellising, pruning and the manipulation of plant density/ plant population.

	Trellising: There are numerous plants that can be trellised e.g tomatoes, grapes, roses and even fruit trees. The main aims of trellising is to " open" up the plant to receive more sunlight and air. Furthermore, it provides support to the plant, prevent the fruit from lying on the ground and creates space for horticultural management such as pest and disease management, irrigation and fertilization
	Pruning. Pruning is done to a host of plants, such as fruit trees, roses and grapes. Here the aim is to reduce plant growth to allow more space for photosynthesis and allow more nutrients and water to the remaining plant parts. The result of pruning is less but larger fruit and/ or flowers. Pruning is often done to stimulate new growth and to get rid of old plant material which will not produce quality products
	Plant density/ Population By manipulating plant density, the competition for sunlight , air and nutrients can be reduced. Irrigated crops can have a higher plant population because there is more water available. The nutrient supply should then be addressed to provide sufficient minerals for the growth of plants under the " intensified " system

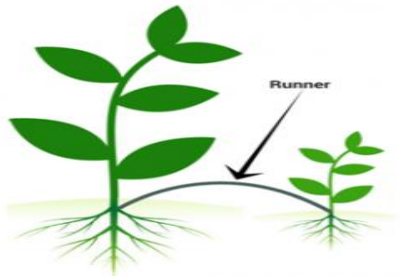
Activities: Show videos on manipulation for increased production
Learners should demonstrate how to prune a schrub/ tree e.g. Roses

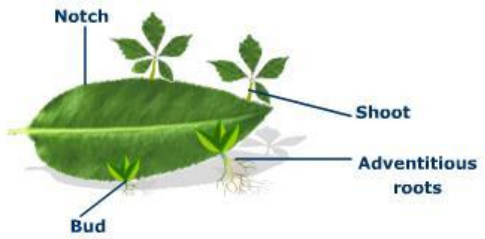
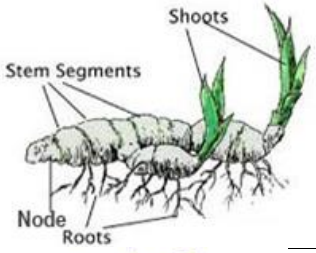
Vegetative plant reproduction

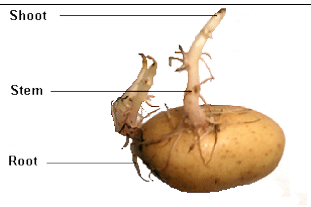
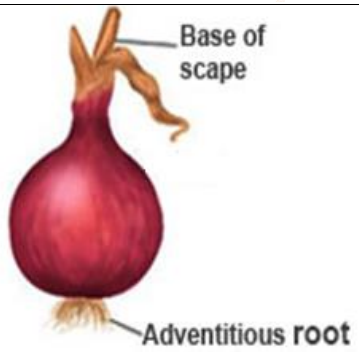
There are several parts of plants that can be used to propagate plants. A plant **cutting** is a piece of a plant that is used in horticulture for vegetative (asexual) propagation. A piece of the stem or root of the source plant is placed in a suitable medium such as moist soil. If the conditions are suitable, the plant piece will begin to grow as a new plant independent of the parent, a process known as **striking**. A stem cutting produces new roots, and a root cutting produces new stems. Some plants can be grown from leaf pieces, called leaf cuttings, which produce both stems and roots.

From cutting to plant. -:)

Types of vegetative propagation:

Type:	Description
	**Runners** Stems that grow along the ground. New plants and roots grow out at the nodes

	**Plantlets / Offsets** New plants develop on the stem of the parent plant. The offsets may have their own roots or be connected at the stem above the soil
	**Corms** are short thick underground stems. There are buds at the bottom of the scale- like leaves that develop into new plants
	**Tuberous roots** are roots that stores food. Buds form at the stem end which develop into new plants using the stored food.
	**Rhizomes** Underground stems with buds at the joins of scale like leaves. Rhizomes grow larger every year and plants form at the buds to form clumps of plants

	**Tubers** are the swollen ends of underground stems. Buds on the tubers grow into new plants
	**Bulbs** are small underground stems covered in fleshy leaves. New green leaves and a flower stalk develops from the bulb in the growing season. Buds that develop into new bulbs
	**Cuttings** to be taken from the previous year's growth-normally in winter. Then rooted. (rooting hormones increases success) There are different types of cuttings depending on the type and age of material that it is taken from: • Softwood cuttings • Semi- hardwood cuttings • Hardwood cuttings

Some plants form roots much more easily than others. Stem cuttings from woody plants are treated differently, depending on the maturity of the wood:

- Softwood cuttings come from stems that are rapidly expanding, with young leaves. In many species, such cuttings form roots relatively easily
- Semi-hardwood cuttings come from stems that have completed elongation growth and have mature leaves.
- Hardwood cuttings come from fully matured stems, and are often propagated while dormant.

Most plant cuttings are stem pieces, and have no root system of their own, they are likely to die from dehydration if the proper conditions are not met. They require a moist medium, which, however, cannot be too wet lest the cutting rot. A number of media are used in this process, including but not limited to soil, perlite, vermiculite, coir, rock wool, expanded clay pellets, and even water given the right conditions. Most succulent cuttings can be left in open air until the cut surface dries, which may improve root formation when the cutting is later planted.

The environment for cuttings is generally kept humid—often attained by placing the cuttings under a plastic sheet or in another confined space where the air can be kept moist—and partial shade to prevent the cutting from drying out. Cuttings in the medium are typically watered with a fine mist to avoid disturbing plants. Following the initial watering, the aim to keep the soil moist but not wet and waterlogged; the medium is allowed to almost dry out before misting again. A rooting hormone may be administered to "encourage" growth and can increase the success rate of plant growth

There are ways of improving the growth of stem cutting propagations:

Intensifying light allows cuttings to root and sprout faster, though the heat thus generated could cause the propagation material distress

Providing the right soil

Depending on the type of soil being used, several additives may need adding to create good soil for cuttings. These additions may include:

Chalk; to increase the pH-value of the soil; a pH of 6-6.5 is to be maintained
organic substance/humus; to increase nutrient load; keep to a bare minimum though
Sand or gravel; to increase the soil's water permeability
For example, with plain potting soil, a third of the container should be filled with sand, to make suitable soil for cuttings.

Providing the right humidity

Although several options can be used here, usually semi-white plastic is used to cover the cuttings. The soil below and from the cuttings themselves is kept moist, and should be aerated once in a while to prevent formation of molds. A plastic bottle can be used as a small greenhouse to provide the right humidity level.

Activities:

Apply the principals of optimal plant growth to make seedlings/ and or cuttings for your hydroponic system or open field.

- Learners should be able to demonstrate various methods of vegetative plant propagation.
- Use these seedlings /cuttings to produce a crop. (Must be able to process into an edible crop)
- Use equipment correctly in order to space plant according to the requirements of specific plants
- Apply compost or fertilizer to the soil manufactured by Gr 8.

MODULE 5: Explain and understand the economic importance of relevant crop production in your area.

Our agricultural sector is one of the world's most diverse, consisting of commercial and subsistence crop farming systems, including vegetable, fruit. nuts and grain production. The well-developed commercial farming supplemented by smaller farmers is the back bone to the country's agricultural economy.

Objective:

Explain and Understand the economic importance and production of crops related to your area.

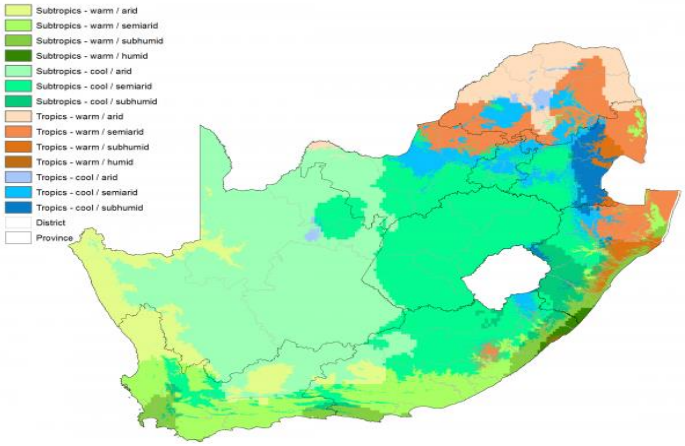
Upon completing this you should be able to answer questions on the production and economic importance of crop production related to your area:

- Field crops (Maize, wheat, sunflower etc.)
- Fruits (Stone, Deciduous, citrus, tropical, nuts etc.)
- Vegetables (Root, Leave, Pod)
- Tree crops (Forestry)
- Ornamental (Trees and flowers)
- Pastoral (grasses, legumes)
- Beverage crops
- Spice crops
- Herb crops

As seen in grade 8 various agricultural crops is being produced in south Africa. South Africa is one of the world's largest producers of: chicory roots (4th); grapefruit (4th); cereals (5th); green maize and maize (7th); castor oil seed (9th); pears (9th); sisal (10th); fibre crops (10th).

South African climate ranges from subtropical to Mediterranean, allowing for a multiple of farming opportunities. The country's biodiversity ensures that products such as grains, fruit and wine exported and preferred for its exceptional quality.

Agro-Ecological Zones of South Africa



Each of the agri-climatic regions of Southern Africa have its own unique climatic conditions that allowed for a vast range of products to be produced across south Africa:
These zones or regions can be divided into:

(a) Subtropics cool sub humid and semi-arid (Highveld Region)

In Southern Africa - that is the area south of the Limpopo River - the interior plateau of the summer rainfall region is known as the Highveld. This is the most important crop

cultivation area of the Republic of South Africa.
Maize is the main crop which is cultivated. During favorable seasons enough maize is produced for a part to be exported overseas. White maize is the staple diet of the largest part of the population of South Africa. Yellow maize is a very important animal feed.

(b) Tropical warm (Bushveld Region)

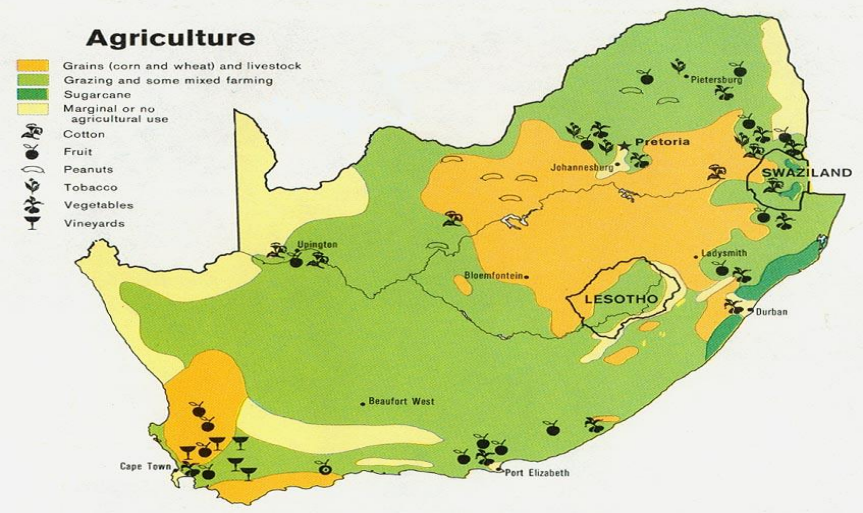
To the north of the Highveld one finds the lower-lying savannah region - the so-called Bushveld. The rainfall here is lower and more erratic than in the Highveld.
Maize, grain sorghums, ground nuts, sunflowers and castor oil are cultivated here. Oil seeds are converted to a variety of products such as cooking oil and lubricants.

(c) Tropical (warm and cool)

This region, which is located mainly in Kwa Zulu Natal and the Northern part of Limpopo and parts of Mpumalanga differs in altitude. Is in general very hot. The rainfall varies between 750 and 1250 millimeters per year. Sugarcane and many tropical fruits are produced in this region

(e) Subtropical (arid and semiarid) or Winter Rainfall Region

This area, lying in the southern and south-western parts of the Western Cape Province, is traditionally the wheat center of the RSA (today, however, 60- 70% of the wheat of the Republic is produced in the Province of the Free State). During favorable seasons enough wheat is produced in the RSA to supply the total requirements of Southern Africa. Wheat is an extremely important food for the greater part of the population of the RSA. Barley, oats and rye are cultivated in rotation with wheat. Barley is used for the brewing of beer and for animal feeds. Oats is a very important breakfast cereal and an excellent animal feed.



HORTICULTURAL CROPS

The horticultural crops which are cultivated in Southern Africa mainly under *irrigation* and *semi-irrigation* can be classified as follows (with some examples):'

(a) *Vegetable Crops* .

The value of the total vegetable production of the Republic of South Africa represents more than 5% of the total value of agricultural produce. Of the total vegetable production more than 55% reaches the fresh produce market. Of the remaining 45% a part is used in frozen form. The rest of the vegetable crop is used for the canning industry.

In the Western Cape most horticultural crops are cultivated under irrigation. This takes

place in the region stretching from Great in the East, up to the Olifants River in the West. In the Northern Cape vegetables are produced in the Vaalharts irrigation scheme and along the Vaal River, especially at Douglas.

The Lowveld of Eastern and Northern Transvaal possesses a very large agricultural potential. Here the production of summer vegetables can take place during winter months. This is possible because the area is completely frost-free.

Vegetables are also cultivated near large centers such as Johannesburg, Pretoria, Port Elizabeth, and Cape Town where circumstances allow it. Intensive tunnel cultivation of vegetables is also applied here.

Vegetables can be regarded as the most important food of man. They supply the necessary vitamins and minerals. Vegetable which belong to the legume family are also a very good source of proteins.

(b) *Fruit*

Modern refrigeration and transport facilities enable the South African fruit producer to compete with other countries on the European markets. About 43% of all the apples, 31 % of the pears, 50% of the plums and 70% of citrus production are exported. A smaller part is used by the canning industry and converted to fruit juices and canned fruit. The rest is sold on the local markets.

On the basis of temperature requirements fruits can be divided into four groups (with some examples of each):

(i) Tropical Fruit (eg bananas and paw-paws)

Tropical fruit can only be successfully *cultivated* where the *temperature* is *never lower than 10°c.* In Southern Africa this condition exists in parts of the Limpopo, Mpumalanga and in, the *coastal areas of KwaZulu/Natal.* Tropical fruit is therefore cultivated mainly in these areas.

(ii) Subtropical Fruits (eg citrus fruit and avocados)

Subtropical fruit trees *require* a certain amount of *cold* for their *normal development.* These fruits therefore occur in a wider region in Southern Africa. Along *rivers* in the *Western* and *Eastern cape Province* much *citrus* production takes place. Also in the Mphumalanga a *variety* of *sub-tropical fruits* are cultivated.

(iii) Deciduous Fruits

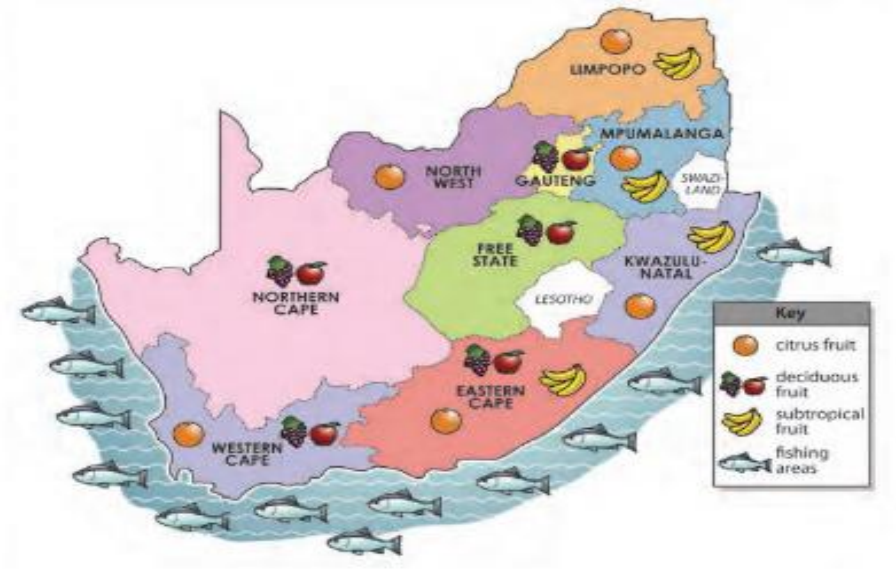
Stone-fruit (eg peaches, plums and apricots) Core-fruits (eg apple and pears)

Deciduous fruit trees require some cold during the resting period to be able to develop normally during spring. These requirements make the cultivation of this kind of fruit in the warmer areas of Southern Africa uneconomical. The winter rainfall region of the Western Cape therefore produces the largest part of this crop in the RSA. The Free State and Mpumalanga also contributes to large quantity of stone and berry fruits. Berry fruits are also grown in the *eastern* parts of the *Free State.*

/iv) Vines (eg table and wine grapes)

Most of the wine and table grapes is been produced in the Western Cape. Table grapes are commercially cultivated in some parts of the Northern Cape for the export market.

FRUIT: What grows where?



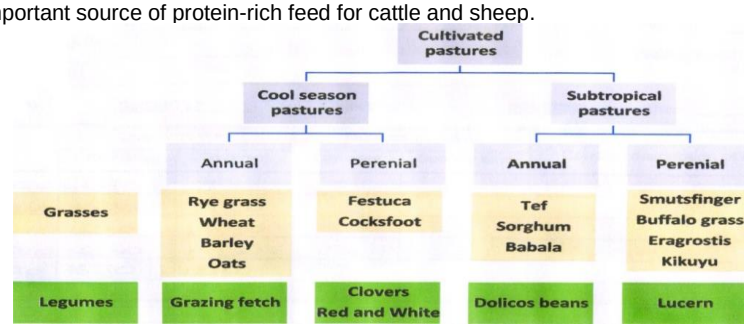
Based on morphological differences pasture crops can be divided into two main groups:

(a) Grasses (fam: Gramineae)

The family Gramineae *(grasses)* is the *most important* of all the flowering *plants.* All the grain crops such as *maize, wheat, barley, oats* and *rye* belong to this family.

(b) The Legume Crops (fam: Leguminosae)

The family Leguminoae *(Legumes)* is the most important *source* of the world's *protein* requirements. It is also indirectly responsible for providing proteins in that it forms the most important source of protein-rich feed for cattle and sheep.



Division of cultivated pastures into cool season pastures and subtropical pastures

Tree crops

Commercial forestry is much like any other farming practice. The crops are considered a renewable resource, used to make sawn timber, pulp, paper, poles, mining timber, matches, charcoal and cellulose-based products. Specific species of trees are planted, harvested and replanted in sustainable rotation. This ensures that there are trees at various stages of growth and maturity, ready to harvest for generations to come.

Investment by the Forest Products sector into technology and innovation has opened the door

to many new and exciting markets, enabling South Africa's commercial forests to service the automotive, pharmaceutical, chemical, cosmetic, aeronautical, textile, food and medicinal industries.

In doing so, our farmed trees are providing a renewable, sustainable and carbon neutral alternative to fossil fuel based products and in turn, more value is extracted from each tree, ensuring less goes to waste.

Trees used in forestry can be classified into hard woods and soft Woods

- Hardwood species –
  - Wattle wood and bark that's been used in tanning of leather
  - Eucalyptus – wood for furniture, poles for construction, eucalyptus oils medicinal purposes

- Soft wood species
  - Pine – light wood furniture, paper and matches

Activity: Choose one crop to show the economic importance of it in your community

MODULE 6: Pest, disease and Weeds control.

Upon completion you should be able to answer questions on :

- **Explain and Understand weed, pest and disease control.**
  If the principles are applied incorrectly it can be detrimental to production and it can become expensive to rectify any problems.

Biological Control

	Biological control or **biocontrol** is a method of controlling pests such as insects, mites, weeds and plant diseases using other organisms. It relies on predation, parasitism, herbivory, or other natural mechanisms, but typically also involves an active human management role. It can be an important component of integrated pest management (IPM) programs.

Biological pest control is a method of controlling pests such as insects and mites by using other organisms. It relies on predation, parasitism, herbivory or other natural mechanisms, but typically also involves an active human management role

There are three basic strategies for biological pest control: classical (importation), where a natural enemy of a pest is introduced in the hope of achieving control; inductive (augmentation), in which a large population of natural enemies are administered for quick pest control; and inoculative (conservation), in which measures are taken to maintain natural enemies through regular reestablishment.

Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids, pathogens, and competitors. Biological control agents of plant diseases are most often referred to as antagonists. Biological control agents of weeds include seed predators, herbivores and plant pathogens.

Techniques such as crop rotation, companion planting (also known as intercropping or mixed cropping), and the selective breeding of pest-resistant cultivars have a long history

Biological control can be an important component of an integrated pest management programme.

Manual/ Mechanical Control

Manual and Mechanical Control involves the physical removal of pests and weeds either by hand or machine. In the case of pests the pests needs to be removed by hand or using traps

Cultivation by ploughing exposes insect pests to predators such as black-headed gulls.

Mechanical pest control is the use of hands-on techniques as well as simple equipment and devices, that provides a protective barrier between plants and insects. This is referred to as tillage and is one of the oldest methods of weed control as well as being useful for pest control; wireworms, the larvae of the common click beetle, are very destructive pests of newly ploughed grassland, and repeated cultivation exposes them to the birds and other predators that feed on them

Crop rotation can help to control pests by depriving them of their host plants. Crop rotation would help by not planting crops of the same groups in consecutive seasons. Eg for example by alternating maize and dry- beans.

Trap cropping

A trap crop is a crop of a plant that attracts pests, diverting them from nearby crops. Pests aggregated on the trap crop can be more easily controlled using pesticides or other methods. However, trap-cropping, on its own, has often failed to cost effectively reduce pest densities on large commercial scales, without the use of pesticides, possibly due to the pests' ability to disperse back into the main field.

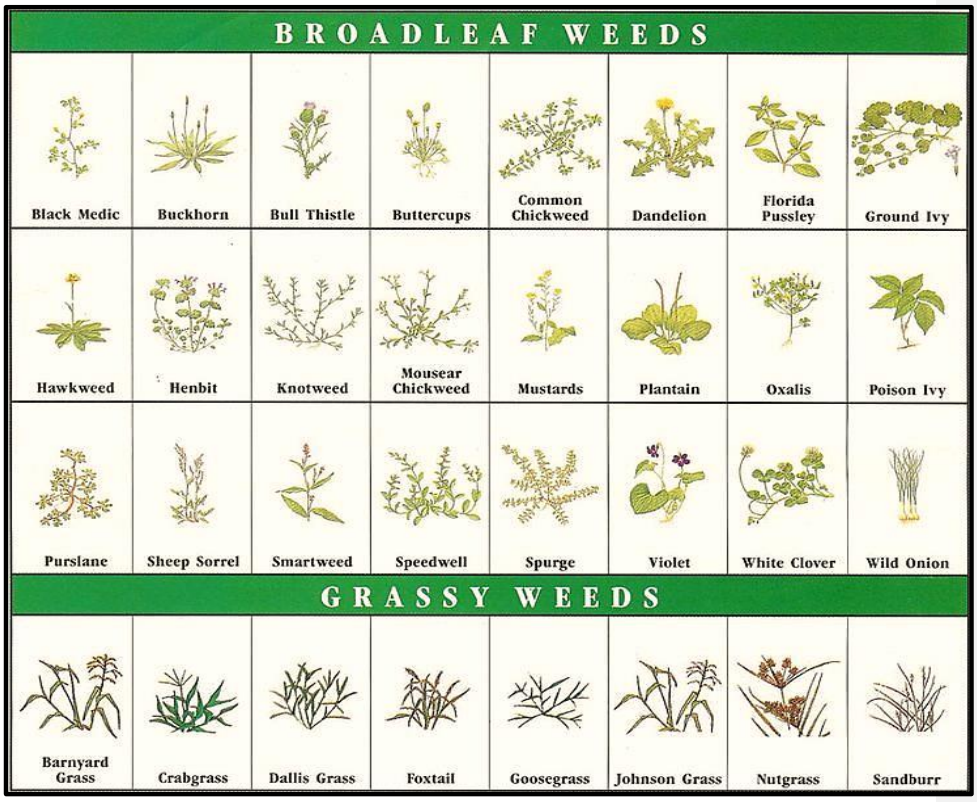
Weeds can be removed by various manual or mechanical methods, such as using a rake or a hoe (manual) or even disking the weeds into the soil between the rows (mechanical).

Activity : Identify the different pests which are found within the garden. Discuss the best way to rid garden of said pests –depending on the severity of the occurrence.

Chemical Control:

Chemical control is using pesticides, fungicides and bactericides to **control pests** and **diseases.** Problems with **chemical control** include residues, crop damage, killing of beneficial **insects** and poisoning of humans and their animals.

Weeds can be defined as any wild plant that grows in an unwanted place, especially in a garden or field where it prevents the cultivated plants from growing freely. Weeds compete with crops for space, nutrients, water and light. Weed infested crops grow poorly and can lead to crop failure.



There are several methods to control and / or eradicate weeds in a crop:

In **chemical weed control**, **chemicals** called **herbicides** are used to kill certain plants or inhibit their growth. **Chemical weed control** can also be an option in integrated **weed** management that refers to the integrated use of cultural, manual, mechanical and/or **chemical control** methods. The critical point is to choose a herbicide that will remove the weeds without harming the crop.

Herbicides can be divided into non- selective and selective herbicides.

Non- selective herbicides will kill most plant including the cultivated crop and must therefore be applied to the field before planting.

Selective herbicides are usually used for soil or foliar application. Selective herbicides can be applied for either broad leave weed or grass type of weeds depending on the type of crop.

Chemical control of insects (Pests)

Pesticides may be contact, stomach or systemic poisons.

Contact pesticides:

A contact pesticide is a pesticide designed to exterminate pests directly upon contact. Extremely lethal to the target, contact pesticides can be natural, inorganic, or even organic products that often leave residue behind. Most contact pesticides come in the form of aerosols or foggers.

Stomach poisons:

Stomach poison. A pesticide that is ingested by a pest and absorbed into its body, causes its death. Examples are compounds containing arsenates or fluorides. Many baits are also stomach poisons.

Systemic pesticides: Systemic pesticides are water-soluble, so they easily move throughout a plant as it absorbs water and transports it to its tissues. Typically, these chemicals are applied to soil and taken up through plants' roots; less commonly, they are applied to foliage or injected into tree trunks.

Chemical Control of Plant Diseases

A variety of **chemicals** are available that have been designed to **control plant diseases** by inhibiting the growth of or by killing the **disease**-causing pathogens. **Chemicals** used to **control** bacteria (bactericides), fungi (fungicides), and nematodes (nematicides) may be applied to seeds, foliage, flowers, fruit, or soil.

There are various methods whereby these chemicals can be applied:

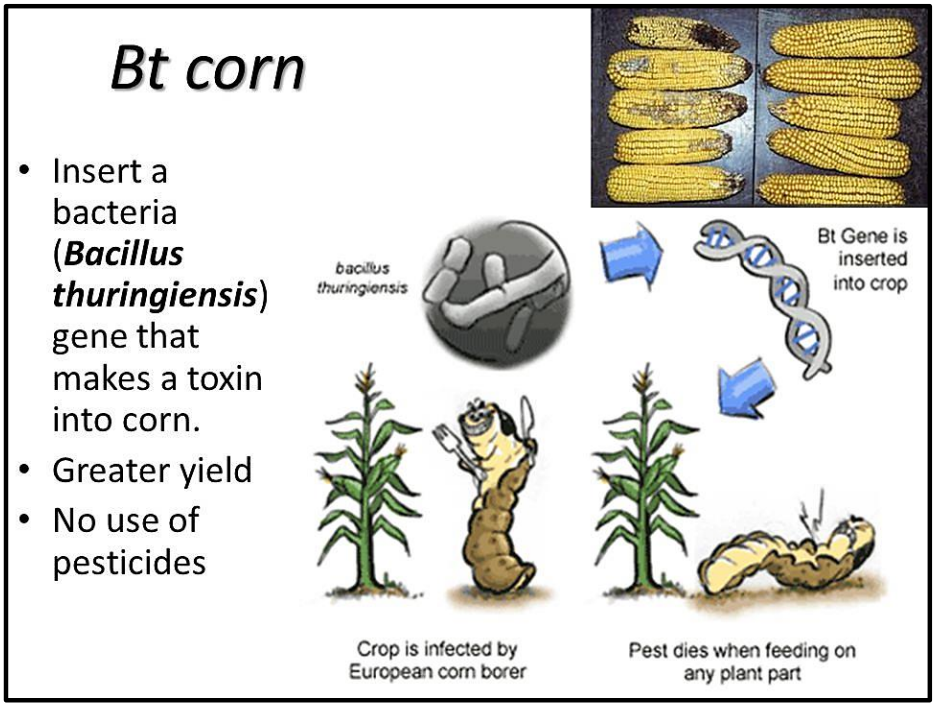
Dusting: This usually implies a chemical in a powder form to be dusted over the plants.

Spraying: The chemical is in a liquid form, normally with an adhesive and sprayed over the plants

Fumigation: Fumigation is a method of pest control that completely fills an area with gaseous pesticides—or fumigants—to suffocate or poison the pests within. ... This method also affects the structure itself, affecting pests that inhabit the physical structure, such as woodborers and drywood termites

Genetic control

Genetic engineering of crops for insect resistance is the introduction of specific DNA sequences into crop plants to enhance their resistance to insect pests. The DNA sequences used usually encode proteins with insecticidal activity, so that in plants which contain introduced DNA, an insecticidal protein is present.



Activity: Identify weeds and different ways to eradicate it.

- Demonstrate different forms of weeding as well as safety precautions when chemical weeding is selected-wearing of masks and goggles.
- Explain to pupils the advantages and disadvantages of manual and chemical control.

Animal Production

MODULE 1: Introduction to livestock production in South Africa

Learning objective

At the end of this unit learners should be able to demonstrate the knowledge of the following content.

- Understand the livestock industry in South Africa
- Know the general economic importances of livestock industry
- Explaining and understanding the purpose of all common South African animal breeds with reference to two examples found in the local area

Keywords/terms and concepts – not all words or terms are listed in the table, some words should be highlighted by the educator who can also develop word searches, crossword puzzles and matching Columns A and B to strengthen biological terminology.
(See https://worksheets.theteacherscorner.net/)

Keyword	Meaning
Ruminants	Animals that chews the cud regurgitated from its rumen.
Non-ruminants	Animals that do not chew the cud
Regurgitation	A backward flowing of food from the stomach
Rumination	The process by which the cow regurgitates previously consumed feed and chews it further
Subsistence farming	The practice of growing crops and raising livestock sufficient for family use with little excess if any, sold or exchanged for some other product
Commercial farming	Farming for a profit, where food is produced by advanced technological means for sale in the market
Biodiversity	Describes every living organism within a single ecosystem or habitat, including number and diversity of species and all environmental aspects.
Marbling	Are the white flecks of intramuscular fat in meat, most notably red meat
Fecundity	Ability to produce a lot of crops, fruit or young animals. It is the potential for reproduction of a recorded population as opposed to a sole organism
Endangered	An endangered species is a one that is very likely to become extinct in the near future
Extinct	No longer in existence
Extensive production	is a farming system that uses small inputs relative to the land area being farmed
Intensive production	is a type of farming with higher levels of input and output per cubic unit of agricultural land area
Silage	grass or other green fodder compacted and stored in airtight conditions, without first being dried, and is used as animal feed in the winter

Introduction to livestock production in South Africa

In South Africa, stock farming is the more viable agricultural activity in a large part of the country. Approximately 80% of South African agricultural land is suitable for extensive grazing. Areas for grazing declined owing to expanding human settlements and other activities such as mining, crops, forestry and conservation. 80% of the total cattle heads are for beef and the remaining 20% is for dairy. Approximately 60% of the 13.84 million cattle available in South Africa are owned by commercial farmers and 40% by emerging and communal farmers. Beyond their role in generating food and income, livestock are a valuable asset, serving as a store of wealth, collateral for credit an essential security net during bad times. Globally, livestock contribute 15 percent of total food energy and 25 percent of dietary protein. Livestock production in South Africa is also the subject of regular public debate. Concerned citizens frequently raise questions about issues such as the role of modern technology in animal production, animal welfare, loss of natural systems and biodiversity, use of water in a water-scarce country, impact of livestock products on human health, and more recently the contribution of livestock to greenhouse gas emissions.

Different farm animals and their products

Animal Breed	**Beef cattle**	**Dairy animals**	**Dual purpose**	**Sheep**	**Goats**	**Pigs**
Products and services from the animal	• Beef • Skin	• Milk • Cheese	• Meat and milk	• Mutton • Wool	• Meat • Fibre • Pelt	• Meat
Animal Breed	**Poultry/ Ostriches**	**Horses**	**Game**	**Bees**	**Rabbit**	**Pet Animals**
Products and services from the animal	• Eggs • Chicken • Feathers • Leather	• Sport and Recreation • Transport	• Meat • Tourism • Transport	• Honey • Wax	• Meat • Fur • Wool	• Company • Recreation

Economic importances of livestock industry

Livestock production in South Africa is a significant contributor to food security, clothing, and provides many social and economic attributes to the country. It provides a flow of essential food products (meat, eggs, wool) throughout the year, a major source of government revenue and export earnings, sustain the employment and income of millions of people in rural areas. The sale of livestock and their products often constitutes the main source of cash income in rural areas.

ACTIVITY 1

1.1 Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A- D) next to the question number (1.1.1- 1.1.10) in the ANSWER BOOK. for example, 1.1.11 A

1.1.1 The taming of wild animal is known as…

A Breeding
B Domestication
C Mastication
D Reproduction

1.1.2 Main reason for the development of new animal breeds and plant cultivars is …

A adaptation
B higher production
C better quality
D All of the above

1.1.3 The statements below refer to extensive farming system

(i) Few animals in a large area
(ii) Feedlot is an example
(iii) Minimum investment in equipment
(iv) Low production in relation to size

Choose the correct combination.

A (i), (ii) and (iv)
B (i), (ii) and (iii)
C (ii),(iii) and (iv)
D (i), (iii) and (iv)

1.1.4 … is an example of a ruminant animal

A Ostrich
B Goat
C Pig
D Horse

1.1.5 Bees are mainly kept for its …

A Meat and wool
B Honey and meat
C Wax and honey
D Honey and wool (5 X 2) (10)

MODULE 2: Farming with different ruminant animals

Learning objective

At the end of this unit learners should be able to demonstrate the knowledge of the following content.

- Differentiation between ruminants and non-ruminants
- Identification and differentiation between cattle breeds of meat, milk and dual purpose
- Explaining and understanding the purpose of all common South African animal breeds with reference to two examples found in the local area

Keywords/terms and concepts – not all words or terms are listed in the table, some words should be highlighted by the educator who can also develop word searches, crossword puzzles and matching Columns A and B to strengthen biological terminology.
(See https://worksheets.theteacherscorner.net/)

Keyword	Meaning
Polled animal	are livestock without horns in species which are normally horned
Bos taurus	refers to cattle breeds of European origins
Bos indicus	A zebu humped cattle breed from India.
Colostrum	is the first form of milk produced by the animals immediately after birth
Vaccination	administration of a vaccine to animals to help them develop an immunity from diseases
Deworming	Giving anthelmintic drug to animals to get rid of internal parasites
Roughages	Indigestible part of feed which provides bulk to the diet and promote normal bowel movement
Concentrates	feed mixed with another to improve the nutritive balance of the total
Culling	reduction of inferior or surplus farm animal population by selective slaughter.
Immersing	Dip or submerge in a liquid
Supplements	animal feeding stuff that contains added nutrients

Introduction

Ruminants

Ruminants are animals that chew the cud. Cud is un chewed grass taken into the rumen which is returned to the mouth (regurgitation) for re-chewing. Examples include Goats, Sheep, Cattle, Antelopes and Buffalos. Non-ruminants have simple stomach and they do not chew the cud. Non-ruminants are also known as monogastric animals

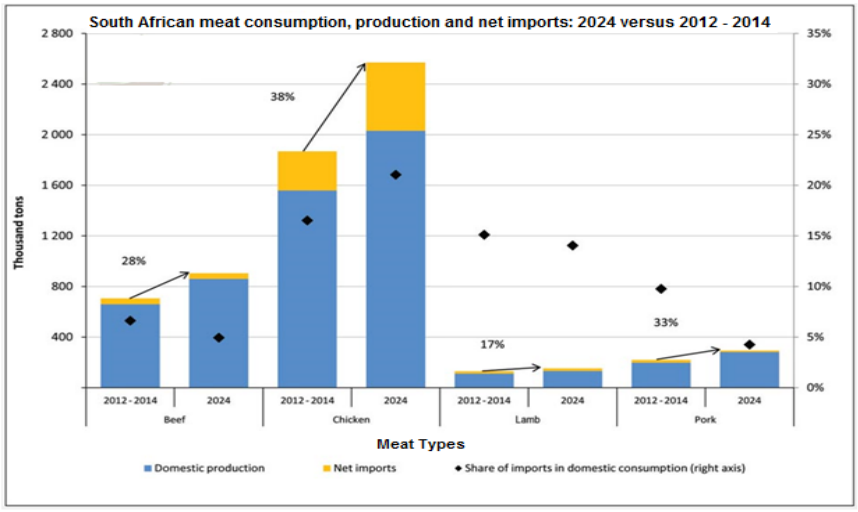
CATTLE BREEDS

Introduction

In today's economic changes, some people in South Africa are already getting in touch with cattle farming business. They want to raise huge numbers of cattle for their different purposes. Mainly cattle are raised for meat, milk and other by products such as hides. Different cattle breeds are classified according to their produce as presented below.

BEEF PRODUCTION

South Africa produces 85% of its meat requirements, with 15% imported from Namibia, Botswana, Swaziland, Australia, New Zealand and the European Union (EU). Local demand generally outstrips production as shown in the graph showing meat products' imports below, even though there are untapped reserves in the communal farming areas. Cattle ranches are found mainly in the Eastern Cape, parts of the Free State and KwaZulu-Natal, Limpopo and the Northern Cape. Popular beef breeds include the indigenous Afrikaner and Nguni and locally developed Bonsmara and Drakensberger. European and American breeds such as Charolais, Hereford, Angus, Simmentaler, Sussex, Brahman and Santa Gertrudis are maintained as pure breeds or used in crossbreeding.



Beef cattle producers vary from highly sophisticated commercial (who rely on high technology) to communal subsistence producers (who rely on indigenous knowledge and appropriate technology). Three major groups of beef cattle farmers co-exist in South Africa, namely

- **The commercial beef producer –** Where production is relatively high and comparable to developed countries. Their production is generally based on synthetic breeds and/or crossbreeding, using Indicus / Sanga types and their crosses as dams.
- **The emerging beef cattle farmer –** Who own or lease land (LRAD beneficiaries). Their cattle generally consist of indigenous crossbred or exotic type of animals.
- **The communal beef cattle farmer –** Who farm on communal grazing land. Their cattle are mostly of indigenous types.

Beef production systems

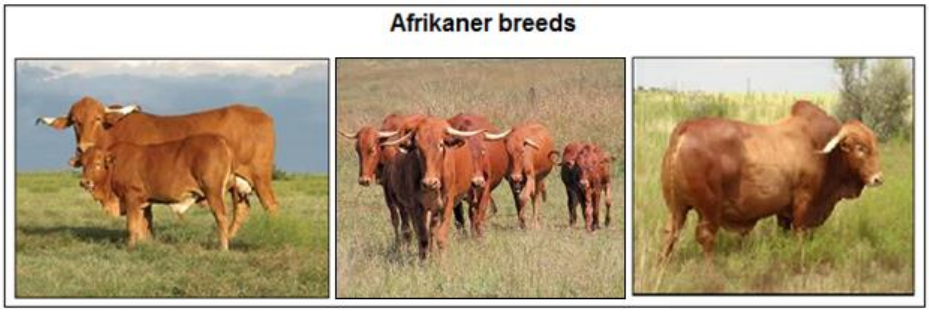
Beef production systems are classified according to the age at which animals emanating from a production unit are sold. The production unit could be a farm or one of the enterprises in a larger undertaking. A full description of a system includes the age, mass and carcass class at which animals are marketed, as well as the breeding, management and feeding practices followed. In South Africa there are three main types of beef production systems, namely;

- Cow-calf production - mainly produces calves for sale.
- Purebred breeding - produce bulls for the cow-calf operation
- Slaughter cattle production - cattle from the cow-calf system are fattened for slaughter

Common beef breeds in South Africa

The most commonly used beef breeds are Nguni, Brahman, Afrikaner, Bonsmara, Drakensberger, Simmentaler, Hereford, Bora, Beefmaster and Angus. Some examples with pictures are provided below.

Afrikaner breeds



Country of origin	Purpose	Note the following
South Africa	• Production of beef • Crossbreed for improved meat quality	• Often crossbred with other breeds to improve meat quality.

Bonsmara breeds

Country of origin	Purpose of the breed	Note the following
South Africa	• High quality meat	• Cross between Afrikaner, Hereford and Shorthorn

Brahman breeds

Country of origin	Purpose of the breed	Note the following
United States of America	• For the meat	• high tolerance of heat, sunlight and humidity, and good resistance to parasites

Nguni breeds



Country of origin	Purpose of the breed	Note the following
South Africa	• For the meat	• Adapted to the African environment

Sussex breeds



Country of origin	Purpose of the breed	Note the following
England	• Meat production	• Quiet and easy to handle great pre-potency in a crossbreeding program

Beefmaster


Country of origin	Purpose of the breed	Note the following
United States of America	• Beef production	• Beefmaster cattle are 50% Brahman, 25% Hereford, and 25% Milking Shorthorn

Hereford breeds



Country of origin	Purpose of the breed	Note the following
England	• Beef production	• Generally docile and fast growing cattle with good beef quality

Simbra breeds



Country of origin	Purpose of the breed	Note the following
United States of America	• Beef production	• A cross between Simmental with Brahman

Ramognola breeds



Country of origin	Purpose of the breed	Note the following
Italy	• Beef production and can be used as draught animals	• A robust animal showing marked evidence of thickness and muscularity

The problem with subsistence beef farming - Learning from history

In the past subsistence farmers used to produce beef calves and raise them over a number of years, however, input costs then were not as high as they are currently, and regular rainfall allowed for an abundance of grazing. If we are farming this way today, we would not only suffer crucial cash flow constraints, but input costs would be exorbitant, however it has been noticed that communal farmers follow this exact strategy; feeding oxen in winter with lucerne or other rations leads to some animals costing above R20 000 over eight years, while only selling for R7 500 on auction.

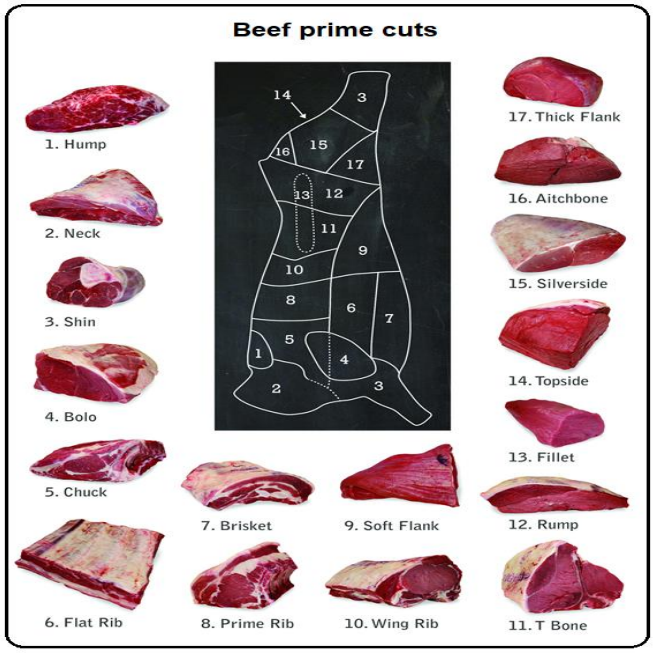
This is a devastating loss, because an eight-month-old calf may sell for the same price. Such a weaner is highly sought-after by feedlots. It costs the producer of the weaner little in terms of inputs, while the farmer generates an income much sooner than had the animal been kept for a period of years. However, the question of why a young weaner sells for the same price as an eight-year-old ox, three times its weight, is raised.

Knowledge of raising and managing beef animals is important for the farmer because consumers have got their own preferences in terms of their tenderness and quality of which is not the case with subsistence farming. Livestock producers are continuously breeding animals that produce better quality meat, grow faster, thereby reducing input costs, and are better suited to the farming environment.

Many farmers do not start off with the best possible animals in terms of genetics and environmental suitability. As a result, they struggle to market animals that do not meet the requirements of the red meat industry in terms of conformation of the carcass, fat distribution and so forth. If these producers do find buyers, they are paid considerably less than those that have produced good-quality beef cattle. Farmers need to make the right decision in terms of genetics and environment from the beginning and learn more about their farming environment,

Purpose of beef farming
Beef animals are mainly kept for the production of different products of meat and milk

Prime valuable beef cuts
Prime cut beef is produced from young, well-fed beef cattle. It has abundant marbling and is generally sold in restaurants and hotels. Prime roasts and steaks are excellent from dry-heat cooking such as broiling, roasting or grilling.



Organic beef farming

If the farmer farms with beef cattle, and the farming operation is thriving and have accumulated some savings, and cash flow is no longer a major issue, the farmer could allow some calves to grow into oxen. A growing sector of farmers rear grass-fed cattle, free of hormones, prepared feeds without flavourants and other growth stimulants. Some butchers will pay a premium for this kind of meat. While this 'humanely produced' meat may not be as tender as that of younger animals, it can become tenderer when properly matured, and is very nutritious and tasty.

ACTIVITY 2

Identify the cuts shown below

DAIRY FARMING

The milk producing areas in South Africa can accordingly be divided into six regions based on the production systems currently prevalent in the regions and the markets they serve. These are KwaZulu- Natal, Southern Cape, Western Cape, Central Highveld and Free State, Central Eastern Cape and Southern Eastern Cape. It has been stated that more than 80% of South Africa is dry to semi-arid with an unreliable rainfall. This makes most of the country unsuited for intensive agricultural production systems like dairy farming. Dairy farming in SA focuses on raising female cattle for long-term production of milk which may be either processed on-site or transported to a dairy for processing and eventual retail stores. Most dairy farms sell the male calves born by their cows, usually for veal production, rather than raising non-milk-producing stock.

Many dairy farms also grow their own feed, including corn, alfalfa and hay. This is fed directly to the cows or stored as silage for use during the winter season. Additional dietary supplements are added to the feed to increase quality milk production. The dominant variable in livestock farming is the supply of feed and water for the animals. It follows that

environmental factors, which includes temperature, rainfall (quantity and distribution), sun hours and soil types, play a significant role in livestock farming. In dairy farming fresh milk is a relatively perishable product which need to be transported to the available markets. Distance to the market need to be taken into consideration when planning dairy production.

Dairy breeds

There are different breeds of dairy cattle that are farmed with in SA. The most popular breeds are the Holstein (Friesland), Jersey and Ayrshire, but there are other breeds like the Guernsey, Milk Shorthorn, S.A. Dairy Swiss, Dexter, and Simmentaler which are less popular in South African dairy farming.

Holstein breeds



Country of origin	Purpose of the breed	Note the following
Holland	• Milk production	• Highest milk productions in the world

Ayrshire breeds



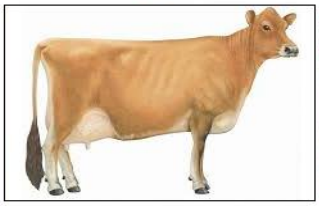
Country of origin	Purpose of the breed	Note the following
Scotland	• Milk production	• Ayrshire milk is referred to as "the ideal drinking milk" • Milk not excessively rich and good for making yoghurt, cheese and ice cream

Guernsey breeds



Country of origin	Purpose of the breed	Note the following
Island of Guernsey in the English Channel	• Milk production	• Unique producer of rich yellow coloured milk gave her the title "Golden Guernsey" • Milk have more protein, cream, calcium, vitamin D and A than average milk

Jersey breeds


Country of origin	Purpose of the breed	Note the following
British Channel Island of Jersey	• Milk production	• High butterfat and protein • Ability to thrive on locally produced feed

DUAL-PURPOSE CATTLE BREEDS

Dual-purpose breeds are cattle bred for both meat and milk. Examples include Pinzgauer, Red Polled, Milking Shorthorn, Brown Swiss, South Devon, Simmentaler, etc. They occur widely and although they are mainly kept for their meat, milk which is sold as industrial milk or cream to supply the farmer with a steady income.

Pinzgauer

Country of origin	Purpose of the breed	Note the following
Pinzgau region of the federal state of Salzburg in Austria	• Meat and milk production	• Becoming more popular as they are hardy and well adapted to high temperatures

Milking Shorthorn

Country of origin	Purpose of the breed	Note the following
Britain	• Meat and milk production	• Milking/Dairy Shorthorn cattle are also known for high levels of fertility, grazing efficiency, and ease of management that result in the breed being highly suitable for low-input dairy operations in various production environments.

CALF REARING IN DAIRY FARMING

Rearing calves requires a lot of patience, as they are easily excited and stressed. The farmer can learn how to castrate, dehorn, and give vaccinations under the supervision of an experienced cattle producer or veterinarian. Keep calves in an area that allows you to observe them quite closely for two weeks. This enables you to prevent the spread of disease. Calves should have access to plenty of fresh water and feed. Consult a veterinarian for a health program that lowers the risk of disease for newly received calves. One of the simplest ways to add to the value of your calves is to make sure they are well fed, properly castrated, dehorned, vaccinated, and clearly identified.

Calf rearing programme

A successful calf rearing program improves health status, reduces pre-weaning mortality and ensures a dairy heifer delivers its first calf before it reaches the age of two years. The calf feeding takes place in 4 phases:

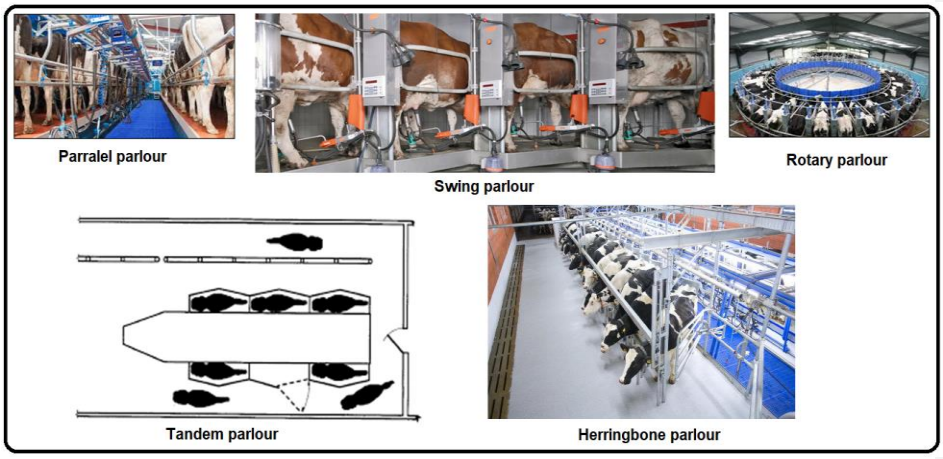
- Colostrum phase (3 - 4 days)
- Pre-ruminant phase (3 days to 20 - 30 days)
- Transition stage (Liquids & dry feeds)
- Post-weaning stage (dry feeds)

Creaming

Cream is a dairy product composed of the higher-fat layer skimmed from the top of milk before homogenization. In un-homogenized milk, the fat, which is less dense, eventually rises to the top. In the industrial production of cream, this process is accelerated by using centrifuges called "separators". The milk is put in a closed container in big centrifuge machine. When the centrifuge machine is switched on the milk is rotated at very high speed in a container. Due to this process, milk separates into cream and skimmed milk.

Milking parlour

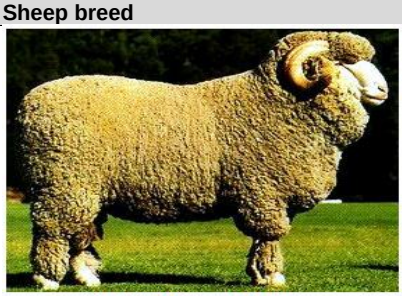
It is part of a building where cows are milked on a dairy farm. Cows are brought to the milking parlour to be milked and are then returned to a feeding area. Cows may also be milked in their housing area using bucket milkers or a pipeline milking system. There are different types of milking parlours available in the market.



SHEEP FARMING

In South Africa sheep farming is mainly about the production of wool, meat and pelt from different breeds meant for specific purpose. The following are examples of sheep breeds.

Common breeds of sheep in South Africa

Sheep breed	Country of origin	Purpose
 South African Merino	South Africa	Fine and soft wool
	Spain	Merino wool

 Dorper	South Africa	Developed by crossing Dorset Horn and the Blackhead Persian sheep for mutton
 Hampshire	United Kingdom	Crossed of Southdown with the Old Hampshire breed for wool and mutton
Sheep breed	**Country of origin**	**Purpose**
 South African mutton merino	South Africa	Wool and meat production
 Suffolk	Bury St. Edmunds in Suffolk	Good for meat and wool Terminal sire used on cross-bred ewes in Scotland

 Dorset horn	Dorset in south-west England	Dorset Horn is an endangered British breed
 Blackhead Persian	Somalia	Fat-tailed breed Meat production
Sheep breed	**Country of origin**	**Purpose**
 Karakul	Central Asia	For milk, meat, pelts and wool
 Dohne Merino	South Africa	For meat and wool production

 Damara	Egypt Eastern Asia	Fat-tailed sheep Meat production

The South African sheep shearing industry

Sheep shearing is a skill performed by shearers and it is a recognised sport in South Africa and around the world, it is worth bearing in mind that it is a profession too. South Africa and Lesotho dominate the sport. In South Africa 60% to 65% of all sheep are shorn by blade shearers, which amounts to about nine million sheep a year. By comparison, just 400 000 New Zealand sheep are shorn with blades and the country has only 53 active blade shearers. Training programmes are managed by National Woolgrowers Association which trains 700 sheep shearers a year. They also hold regional championships in rural Eastern Cape, allowing young shearers to go up against each other. By training young rural shearers, the National Woolgrowers Association decreases the industry's dependence on Lesotho migrant labour.

Typical mass shearing of sheep today follows a well-defined workflow:

- Remove the wool
- Throw the fleece onto the wool table
- Skirt, roll and class the fleece
- Place it on the appropriate wool bin
- Press and store the wool until it is transported

Different lines (classes) of wool are usually shorn from sheep locks, bellies and skirtings, broken fleece, backs and fleece wool.

GOAT FARMING

South Africa contributes almost 50% to the Southern African goat population with approximately 5.62 million animals distributed throughout nine provinces. Approximately 2 million of these animals are found in the Eastern Cape Province, almost 1 million in Limpopo Province and just over 700,000 in KwaZulu-Natal Province. The remaining provinces share the remaining 1.8 million animals. The Angora goat population of approximately 640,000 goats is the major contributor to the income generated in the formal goat sector, by supplying more than 50% of the global mohair clip. The commercial meat goat industry, consisting of the Boer, Savannah and the Kalahari Red breeds makes up 1.3 million goats, with commercial dairy goats being the smallest sector, with approximately 4000 registered dairy goats. Milk and progeny goats can be kept for subsistence or commercial production. Goat's milk can be marketed as fresh (frozen) milk, dried milk, cheese or yoghurt and ice cream. Surplus animals can be sold or slaughtered.

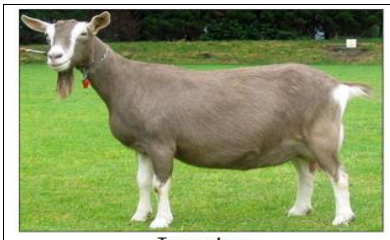
Milk production

Goat's milk is higher in protein and minerals than cow's milk. Planning is important when starting a dairy goat enterprise. Goat's milk is usually sold fresh or frozen and should be in sealed containers (usually plastic bottles or sachets). Fortunately freezing does not affect quality. Processing into powder is too expensive for most producers. Folic acid supplements may be necessary as goat's milk may be deficient in this acid. Hygiene is of the utmost importance in milk production. If possible, pasteurisation must be carried out during which the milk is heated to 73 °C for 15 seconds (or 63 °C for 30 minutes in the case of cheese). The challenge for small scale farmers is that pasteurisation plants are expensive, alternatively milk may be heated on the stove. Boiling should be avoided because it will change the structure of the milk and that may affect the taste.

Dairy breeds of goats

In South Africa, there are seven goat breeds that are officially recognized by the Animal Improvement Act No. 62 of 1998, which includes the Angora goat for mohair production, three meat types namely the South African (SA) Boer, Kalahari Red and Savanna breeds and three dairy breeds consisting of the Saanen, Toggenburg and British Alpine.

Sheep breed	Country of origin	Purpose
 Saanen	Switzerland	The high-yielding Saanen is the major breed in South Africa producing milk

 Toggenburg	Switzerland	Good milk producer
 British Alpine	England	Milk production

Dairy products derived from goat milk

There are several products available in the market generated from goat milk. The final product should be attractive to the consumer, distinctively packaged, of consistent good quality, readily available and acceptably priced. Milk sold to cheese manufacturers will not fetch the same price as that of fresh milk sold direct to customers.

Goats for mohair production

The mohair industry in South Africa consists of approximately 644,000 Angora goats, most of which are still farmed within the Eastern Cape. The Angora Goat Breeders' Society was established in 1892 and is known today as the Angora Ram Breeders**.**

Angora goat

The first Angora goats were imported to South Africa during 1838, followed by another 3000 goats between 1856 and 1896.

Angora goats



Country of origin	Purpose of the breed	Note the following
Turkey	• Good quality mohair	• The Karoo and semiarid Eastern Cape region proved to be well suited to the Angora goats

Meat goats

The main meat goat breed is the Boer goat, considered the best meat goat breed in the world. It has the best feed-to-meat conversion rate. The breed shows excellent growth traits, meat and carcass characteristics with yields often exceeding 50%.
The other two main meat goat breeds in South Africa are the Kalahari Red and the Savanna, also considered 'Boer goats' but with specific colouring. DNA tests showed there is a bigger genetic difference between the Boer and the Kalahari Red than the Boer and the Savanna goats. The Kalahari Red is regarded as an indigenous goat breed originating from Southern Africa.

South African Boer goat

The South African Boer goat has the oldest official history with the establishment of the South African Boer Goat Association in 1959.

Boer goats

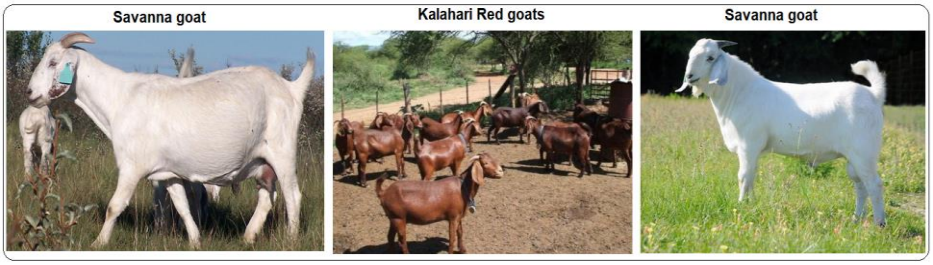


Country of origin	Purpose of the breed	Note the following
South Africa	• Good quality meat	• Have fleshy, well-developed broad briskets, well-sprung ribs, broad backs and muscular legs

Savanna

Kalahari Red and Savanna goat

The origin of the Kalahari Red and Savanna goat breeds is not as well documented and according to available literature but originated from indigenous goat of South Africa



Country of origin	Purpose of the breed	Note the following
South Africa	• Meat production	• Name derived from Kalahari Desert • Red coat protect itself against sunlight

South African indigenous goats

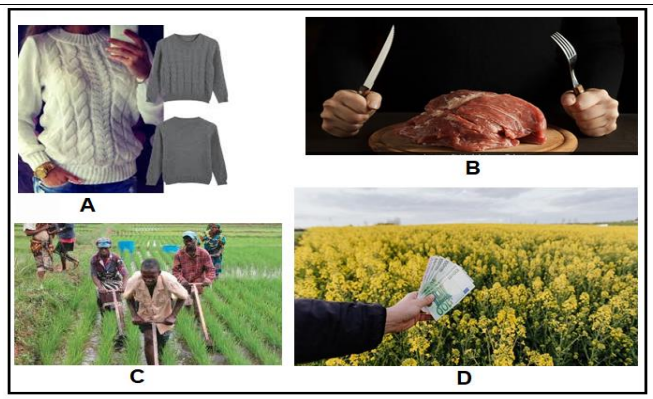
South African indigenous goats are mostly characterized based on color variations and phenotypic characteristics such as ear length and horn shape. There is virtually no distinct breed identification, and populations are often named or identified according to the geographical region where they are kept. Various types are known, such as the Pedi, Nguni and Xhosa Lop ear ecotypes.

South African indigenous goat breeds

Country of origin	Purpose of the breed	Note the following
South Africa	• Multipurpose and are used for meat, hides and sometimes even milk	• The goats are for used for by subsistence farmers for household food production

ACTIVITY 3

3.2.1	Name the type of farming mainly used in beef production.	(1)
3.2.2	Give the economic importance of livestock indicated in the pictures A - D below.	(4)



MODULE 2: Farming with different non-ruminant animals

Learning objective

At the end of this unit learners should be able to demonstrate the knowledge of the following content.

- Differentiation between ruminants and non-ruminants
- Identification and differentiation between breeds of pigs, poultry, horses, donkeys
- Explaining and understanding the purpose of all common South African animal breeds with reference to two examples found in the local area

Keywords/terms and concepts – not all words or terms are listed in the table, some words should be highlighted by the educator who can also develop word searches, crossword puzzles and matching Columns A and B to strengthen biological terminology.
(See https://worksheets.theteacherscorner.net/)

Keyword	Meaning
Pasteurisation	is a process in which packaged and non-packaged foods are treated with mild heat, usually to less than 100 °C, to eliminate pathogens and extend shelf life
Harvesting	is a process in which packaged and non-packaged foods are treated with mild heat, usually to less than 100 °C, to eliminate pathogens and extend shelf life
Pathogen	Disease causing organisms
Bacterial diseases	refer to a large variety of diseases caused by bacteria
Viral diseases	occurs when an organism's body is invaded by pathogenic viruses
Farrowing	The process of giving birth (parturition) in swine.
Sustainable	A viable solution for human lifestyle requirements that will ensure the health of our planet's ecosystem and its ability to support plentiful life on Earth indefinitely.

Organic farming	farming method involving growing crops without use of synthetic fertilizers and pesticides, rather relies on ecologically balanced agricultural practices
Dosing/Drenching	Administering chemicals or medicines to animals in liquid form to treat internal parasites

Introduction

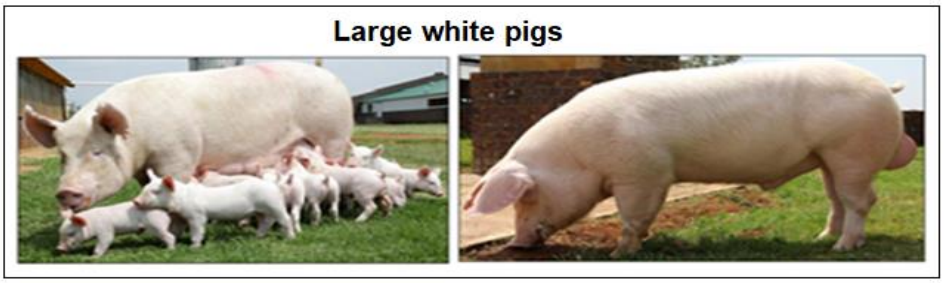
Non-ruminant farm animals

The focus of this module is on the non-ruminant farm animals, which include pigs, poultry and horses. The non-ruminant animal has an uncomplicated or simple stomach as compared to the ruminant animal, which has a stomach with four compartments, and they do not chew the cud. Non-ruminant is also referred to as a monogastric.

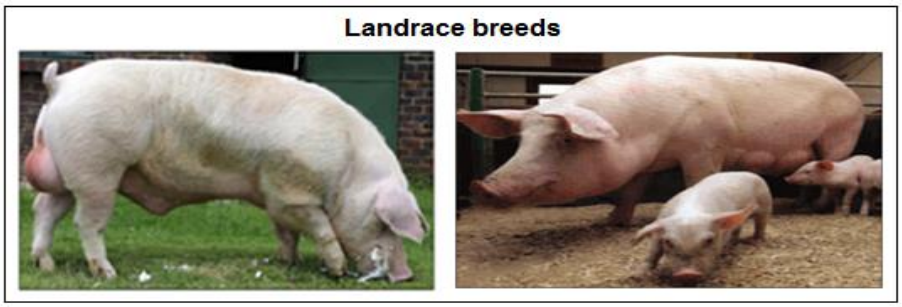
PIG PRODUCTION

The profit (money) made by the pig farmer depends on the number of pigs sold per sow on the farm over a period of one year. The profit made is therefore influenced by the ability of the farmer to manage the farm in such a way that the sows produce a maximum number of piglets that can be marketed in the shortest time possible. The breed used by the farmer may also influence productivity. There are different breeds of pigs in South Africa.

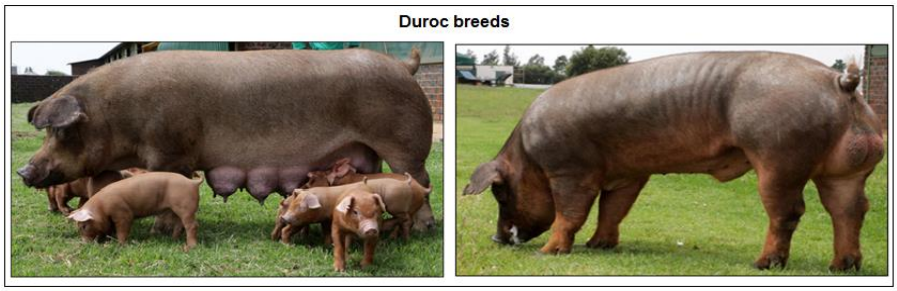
Different pig breeds common in South Africa



Country of origin	Purpose of the breed	Note the following
England	• Pork production • Breeding purpose	• Produce large healthy litter with better growth rate and feed efficiency



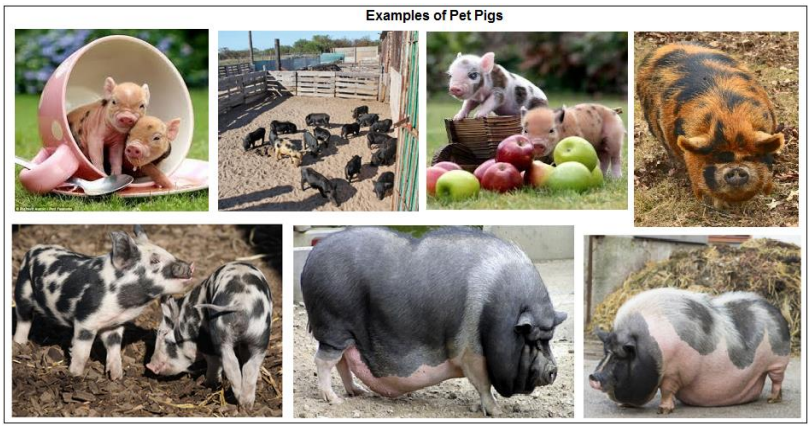
Country of origin	Purpose of the breed	Note the following
South Africa	• Pork production • Breeding purpose	• Known for its femininity, tameness, milk ability and mothering ability



Country of origin	Purpose of the breed	Note the following
United States of America	• Produces meat of a higher quality	• Known to be a superior genetic source for improving eating quality of pork

Pigs as pets

Pigs can make loveable household pets, but their bulky frames put them at a disadvantage of being big and fat. Thanks to 'miniature' breeds that the pig has made its debut on the pet scene. The Vietnamese pot-bellied pigs, although far smaller than pigs bred for ham and bacon, can still grow to a fair size, making them difficult to keep around the house.



Common pet pig breeds in South Africa

Teacup pet pig

It was in England where they started experimenting with breeding miniature pigs in 1998. It apparently took nine years to develop four different breeds and 24 generations to develop what has become known as the 'teacup' pig.

Pot-bellied pet pig

The pot-bellied pig originated from Vietnam, and they tend to be smaller in size as compared to those standard European or American farm pigs. Pot-bellied pigs descended from the wild boar, and they can also be used for crossbreeding with other pig breeds.

Caring For pet pigs

The pigs do not smell. Hence, there is no need for bathing them in case you have petted them in the house. The average lifespan of Vietnamese pot-bellied pigs is approximately 15 years since they are ever healthy when compared to other pig breeds.

Management of pet pigs

Housing

Indoors – need to be housetrained, as they can be destructive causing much damage, and they are very sensitive to environmental temperatures and prone to hypothermia and hyperthermia. Pigs do not have sweat glands need wallowing pond in order to cool down. Separate clean drinking water must be provided (tend to urinate in wallow!)

Diet

Feed them with food sufficient in fibre to avoid constipation. Grazing, horse ration, fruits, vegetables, Lucerne, hay and kitchen scraps can be fed, but avoid fatty foods such as dairy products, ice cream, cakes etc. NEVER feed them with dog pellets – high protein with low fibre may cause gastric ulcers and constipation.

Breeding:

- Puberty about 6 – 7 months
- Heat every 21 days, lasts three days
- Litter size 4 – 12
- Should be sterilized at 2 – 4 months (spay or anti-GnRH vaccine)
- Boars develop a strong smell after maturity.

Training:

- Can be trained to use a litter box, walk on a leash attached to a harness
- Use only positive reinforcement, may become aggressive if punished
- Teach young pigs to be picked up at an early stage

General Care:

- Soft brush for daily grooming, hooves must be trimmed
- Tusks can be trimmed in piglets, and removed at four months
- Ears should be cleaned with alcohol and cotton balls if they become very dirty
- Deworm twice a year

POULTRY FARMING

Introduction

Whether you are planning to raise your chickens for meat or eggs, there are lots of poultry breeds that you can keep in South Africa. There are predominantly layer breeds that you can keep for eggs, broiler breeds that you can keep for meat, dual purpose poultry breeds.

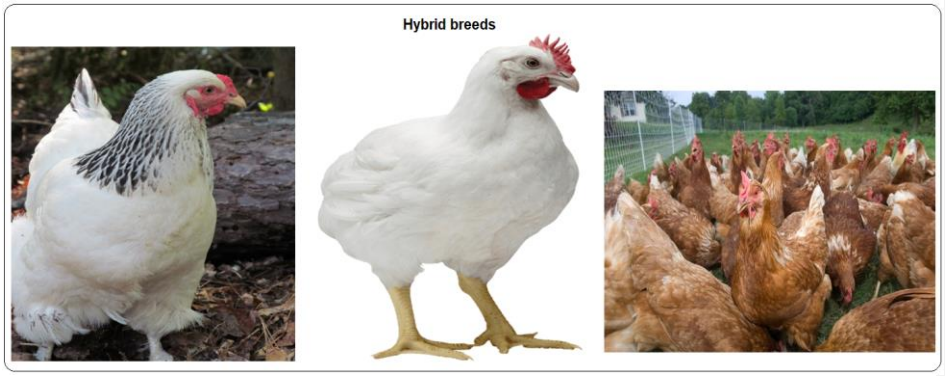
Egg layers

They are chosen because of their excellent egg production. For years, the **White Leghorn** chicken has been a very popular industry workhorse in South Africa when it comes

to egg production. The hen has a small and light body and lays numerous white eggs. Another popular layer breed is the **Black Australorp** chicken, which is a docile (quiet) chicken and lays light brown eggs which are generally popular with many South African buyers. Another breed is the New Hampshire which originated in New Hampshire, U.S.A.

Broilers /Meat /Table breeds

Hybrid chickens in South Africa are mainly used as broilers for meat production. They have *hybrid vigour*. For example, they will lay more eggs and produce more meat than the special or the dual-purpose chicken breeds. They usually lay large eggs, which could either be white or brown, depending on the chicken breed. The hybrid chickens also have a very good feed efficiency. The male chicks of the hybrid layers grow very fast and can be slaughtered for extra income from poultry meat sales. They grow faster than pure breeds and have excellent feed conversion ratio making them very profitable to grow as they produce more breast meat than pure poultry breeds



Dual purpose poultry breeds

They are poultry breeds that can be kept for both meat and eggs. Good examples include the **Plymouth Rock** and the **Rhode Island Reds**. They are not suitable for large scale commercial egg production because they generally don't produce sufficient eggs. They also do not grow fast enough for meat production.

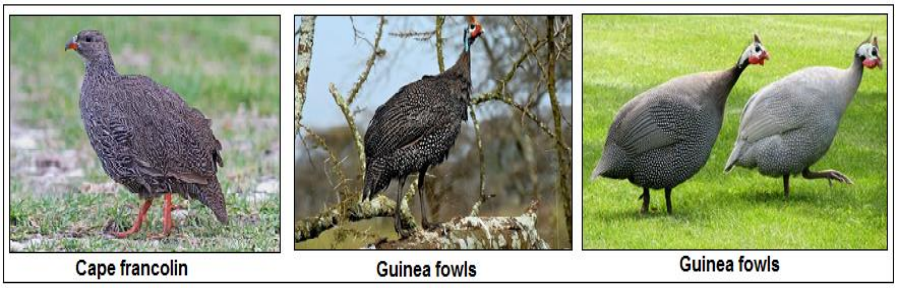
Plymouth Rock

Red Island Reds

Game birds and other poultry

Introduction

This section looks at poultry like game birds, waterfowl, pheasants, turkeys and quail – these are birds not covered in poultry and birds farming section. Game birds played a major role in human survival throughout ancient history, and all domestic turkeys and chickens also originate from them.



Cape francolin

Guinea fowls

Guinea fowls

Farmers often regard game birds as a pest, yet they constitute an additional source of income because of hospitality and ecotourism services. Game birds infrastructure support other forms of eco-tourism and recreational land use, such as hiking, birding, mountain-biking or to simply escape from cities.

Horse farming

Introduction

Horses in South Africa are used in a wide array of activities. They are very effectively utilised in poorer communities as draught animals, for general transport and as an agile means of tracking stock animals in remote and rural areas where vehicles are inadequate or unavailable. Horses are also extensively used in sport and leisure and in some cases are considered champion athletes that can have large commercial values attached to them.

The most popular horse breeds

There are many horse breeds in South Africa, they come in all sizes, shapes, and colours and there's a breed for almost any purpose. Even so, in the whole diversity of horse breeds, there were always certain special breeds that were considered to be better than others.

The Nooitgedachter

Country of origin	Purpose of the breed	Note the following
South Africa	• Riding horse with outstanding stamina	• It is a rare breed, with only about 400 purebreds in existence. • More popular as a show horse, good jumper, excels in gymkhana, polo, endurance, riding and hacking

Boerperd

Country of origin	Purpose of the breed	Note the following
South Africa	• riding horse with outstanding stamina	• The Boerperd is a very strong horse

Vlaamperd

Country of origin	Purpose of the breed	Note the following
South Africa	• riding horse with outstanding stamina	• excellent driving ability, making the breed popular as a harness horse, both in tourism and festivals • popular as riding horses in dressage

Arabian

Country of origin	Purpose of the breed	Note the following
Arabian Peninsula	• Riding horse	• harness horse, both in tourism and festivals

Clydesdale

Country of origin	Purpose of the breed	Note the following
Scotland	• Draught horse and recreation	• harness horse, both in tourism and festivals

Thoroughbred

Country of origin	Purpose of the breed	Note the following
England	• for racing and jumping	• High spirit and tolerance

American saddle horse

Country of origin	Purpose of the breed	Note the following
Lesotho and South Africa	• used for racing • For hacking, trekking or polo	• Good for racing with stamina

Basotho pony

Country of origin	Purpose of the breed	Note the following
South Africa and Lesotho	• Racing, hacking, trekking or polo	• Famous for stamina, docility and hardy

Hackney

Country of origin	Purpose of the breed	Note the following

Great Britain	• Ideal for carriage driving	• Popular for showing in harness events

Donkeys and mules

Introduction

A mule is the offspring of a male donkey (jack) and a female horse (mare). Horses and donkeys are different species, with different numbers of chromosomes. Of the two first-generation hybrids between these two species, a mule is easier to obtain than a hinny, which is the offspring of a female donkey (jenny) and a male horse (stallion)..

Donkey

Country of origin	Purpose of the breed	Note the following
Different breeds for different countries	• Draught animals	• Member of horse family

Mule

Mules are reputed to be more patient, hardy and long-lived than horses and are described as less obstinate and more intelligent than donkeys

Country of origin	Purpose of the breed	Note the following
Different breeds for different countries	• Riding and carrier animals • Ploughing	• Offspring of a male donkey and female horse

Miniature horses

Introduction

Miniature horses are horses defined by their small height. They can be found in many nations, particularly in Europe and America, and are the result of centuries of selective breeding. Miniature horses are generally bred to be friendly and to interact well with people.

Country of origin	Purpose of the breed	Note the following
Europe	• Racing, hacking, trekking or polo	• Horses defined by their small height • Can be found in any nation

ACTIVITY 4

Choose the correct answer from the ones given below

1.1 Dairy breed which produces yellow milk rich in vitamin A and D
A Jersey
B Ayrshire
C Guernsey
D Friesland

1.2 Beef breed of S.A origin
A Beef Shorthorn
B Brahman
C Hereford
D Bonsmara

1.3 Sheep breed raised for its long, fine wool
A German Merino
B Dohne Merino
C Wool Merino
D Mutton Merino

1.4 A bird raised for its meat, skin and feathers
A Guinea fowl
B Peacock
C Ostrich
D Song Bird

1.5 The member of the Big Five
A Springbok
B Buffalo
C Girraffe
D Kudu

MODULE 3: Game ranching and other forms of farming

Learning objective

At the end of this unit learners should be able to demonstrate the knowledge of the following content.

- Identification and differentiation between game animals
- Understanding of rabbit farming
- Understanding beekeeping

Keywords/terms and concepts – not all words or terms are listed in the table, some words should be highlighted by the educator who can also develop word searches, crossword puzzles and matching Columns A and B to strengthen biological terminology.
(See https://worksheets.theteacherscorner.net/)

Keyword	Meaning
Artificial insemination	the medical or veterinary procedure of injecting semen into the vagina or uterus.
Homeothermic	having a relatively uniform body temperature maintained nearly independent of the environmental temperature
Radiation	is the transfer of energy with the help of electromagnetic waves
Conduction	is the transfer of heat energy by direct contact
Convection	is the movement of heat by actual motion of matter
Protozoan diseases	Diseases caused by protozoa
Fungal diseases	Diseases caused by fungi
Internal parasites	Parasites that lives in the intestinal tract of an animal and takes its nourishment from it
External parasites	are the parasites that live on the outside of the body

Game farming (game ranching)

Introduction

Game farming involves the raising of wild animals for a variety of products, including meat, hides and feathers. Game is any animal hunted for food or not normally domesticated. Game animal are also hunted for sport.

The type and range of animals hunted for food in different parts of the world are influenced by climate, animal diversity, local taste and locally accepted view about what can or cannot be legitimately hunted.

The criteria used to select species for farming

Easy to capture, adaptability to domestic conditions, ability to produces marketable meat and other desired products within reasonable diet. Ability to be breed in captivity, pleasant disposition, temperament which makes it unlikely to panic. Game farming include the ostriches, crocodiles, grass cutters, snails, deer, antelope, camels, and also the elephant, lion, rhinoceros, leopard and buffalo referred to as the big five.

Advantage of Game Animals over Domestic Animals

- Wild animals are more resistance to several diseases
- Wild animals can survive in marginal lands
- Killing out percentage of wild animals is generally very high.
- Higher utilization and conversion of forages to lean meat.
- Wild animals can survive with little or no water.

Importance of game production

- Game animals are hunted for food, and they constitute the major source of animal protein available to the rural populate.
- Hunting and bush meat trade provides the main source of income for a large network of people ranging from hunters and farmers
- Wildlife based industries such as tourism and other products have been shown to be a major foreign currency earner, contributing significantly to the national economy and providing jobs for a large number of people.

Harvesting of game animals

Game cropping

Game cropping is defined as the taking of animals from a wild herd in numbers that will not endanger the viability of the wild population. Cropping may be done

- Either as a management technique to prevent the animals from overpopulating their environment

- Harvesting to provide bush meat and other wild animals products for local consumption
- It could also be done for income generation.

Game cropping is not restricted to state initiative in protected area but may also be regular harvesting techniques on game ranches and private lands.

Game culling

Game culling is management tool with the primary objective of reducing animals' populations. Provision of meat in this case becomes an ancillary objective.

Culling animals in conservation areas has continued to be a controversial issue. While conservation scientists and protected area managers argue for its use as a management tool to control herbivore populations, extreme conservationists consider it morally wrong. Culling, as a game management tool has been used in some protected areas in some parts of Africa for different reasons:

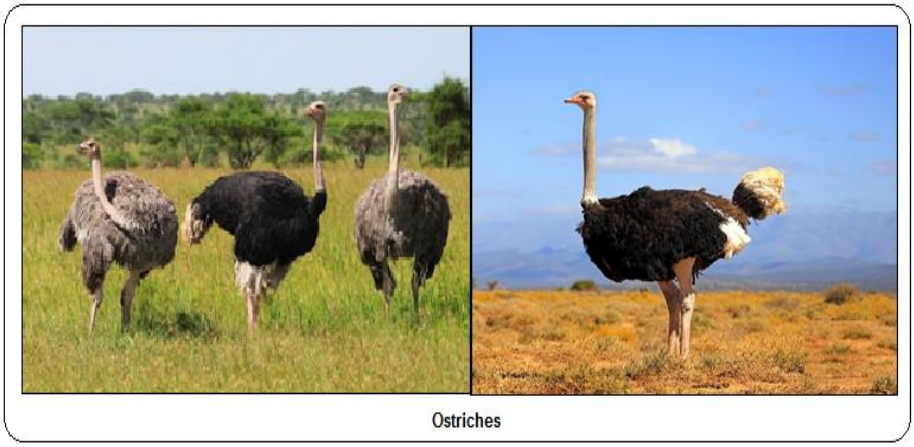
- To prevent or reduce habitat degradation caused by high densities of herbivorous animals
- As a species protection strategy in cases where there is abundance of local species than a rare species part of the abundant one is culled to reduce competition and provide the necessary protein

Ostrich farming

Introduction

Ostrich farming in South Africa is small compared to the local beef, chicken and pork farming industries, but contributes up to 75% of the world's production of ostrich products. The main ostrich products from South Africa are fresh and processed ostrich meat, leather products and feathers. Around 1820 South African ostrich feathers were first harvested for export from wild hunted ostriches, but in 1821 a law was published, which prohibited the hunting of ostriches in South Africa.

Ostrich farming started during the 1860s in the arid regions of the Karoo and Eastern Cape in South Africa. These hardy birds were well-adapted to the dry and open inland areas of these regions. In 1865 there were only 80 tame ostriches in South Africa, but numbers increased rapidly, because of the use of egg incubators. In 1875, South Africa had more than 32 000 ostriches.



Ostriches

Production areas of Ostriches in South Africa

Historically, ostrich production centred on the town of Oudtshoorn in the Western Cape. Even today, Oudtshoorn is considered the 'ostrich capital' due to the volume of ostrich products from this area. Between 80% and 90% of South Africa's ostrich production comes from the Western Cape with various volumes from the Eastern Cape, Northern Cape and some production from Limpopo.

Management of ostriches

Farming ostriches is environmentally friendly; steroid, hormone and force-feeding free. Ostriches are free roaming livestock and feed on all natural ostrich feed. Ostriches require little or no handling once they reach four or five months of age. However, they need to be vaccinated against Newcastle Disease three months before slaughter and also need to be treated against ticks and be kept in a quarantine camp (which is free of any vegetation) fourteen days prior to slaughter.

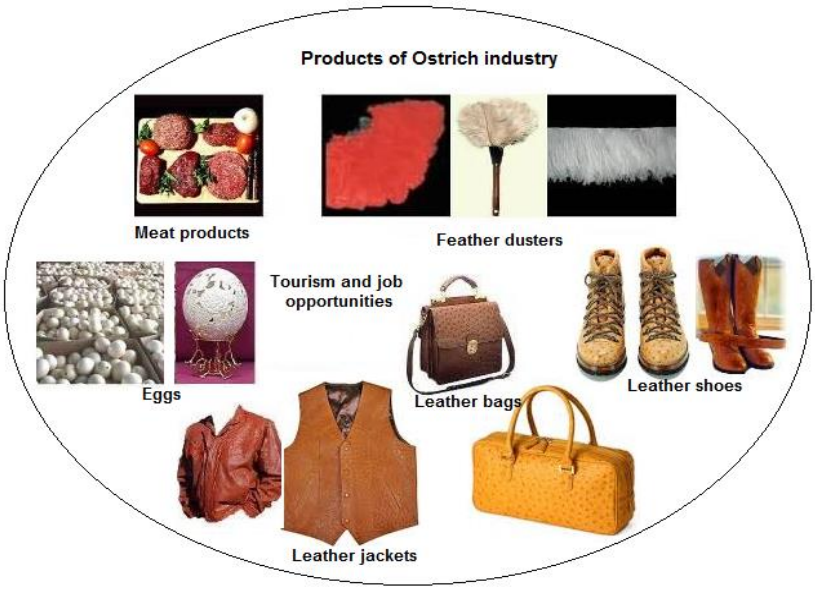
South Africa ostrich exports and imports

The major export destinations for ostrich meat are Belgium (35%), Germany (20%), Switzerland (17%), Netherlands (14%) and France (10%). Exports of fresh meat is prohibited when there is an outbreak of a disease such as avian flu, only pre-cooked meat continues as normal.

Ostrich products

Ostriches are kept for the production of the following products ostrich meat, leather, feathers, eggs and a great variety of ostrich curios and gifts. Durable feathers are used in

feather dusters and the more colorful and attractive ones in stage productions, carnivals, as fashion accessories and for stylish garments. Globally ostrich meat is regarded as high-quality red meat due to the fact that it is low in cholesterol and fat, versatile and tasty. Expensive leather is also manufactured from the skin.



Three biggest problems of the industry

1. A lot of capital is required for feeding i.e. high feeding costs
2. It needs a lot of land to keep ostriches (22,8 hectares per ostrich)
3. High mortality due to the fact that ostrich chicks are being born without immunity during the first month.

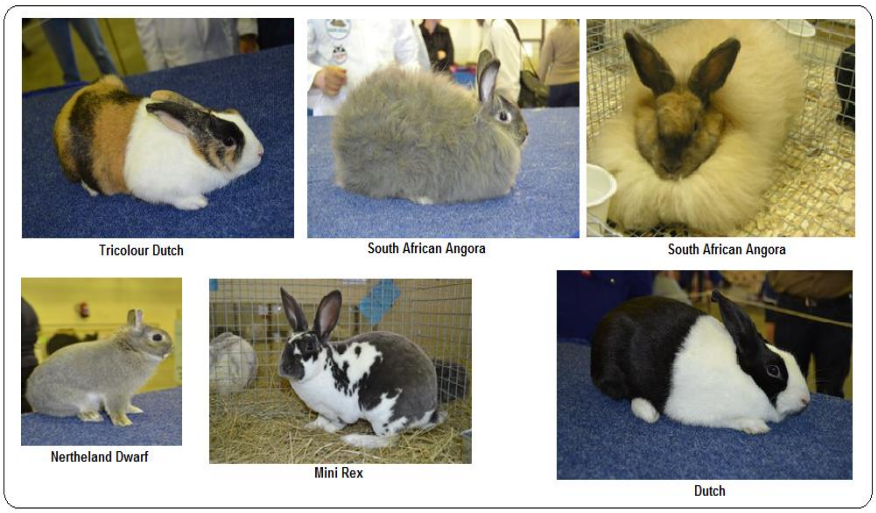
Rabbit farming

Rabbit farming in South Africa involves the breeding of rabbits for the meat industry as well as for the use of fur and wool. This can be done at large commercial scale on as well as on subsistence farming level.

Rabbits farmed are mainly New Zealand Whites and New Zealand Reds that were imported in the late 1940's from England. Marion Keller was one of the first commercial producers who started to farm in Johannesburg with meat rabbits and angoras for fur and wool.

The South African Rabbit Council was formed around 1950 in Johannesburg. The aim was to support the growing rabbit industry with knowledge, shows and marketing support. South Africa is one of the few countries in the world free of two major killer diseases - myxomatosis and viral haemorrhagic disease. As a result, borders are closed to imports, so breeders have to work with the stock they have, improve on it and farm well. South Africa have an endangered rabbit called the riverine rabbit. There are very few of these indigenous rabbits left.

Different rabbit breeds common in South Africa



Basic Requirements for a Good Rabbit Cage

Before buying rabbits, it is important to decide on their housing, type of cage, size and position. It is most expensive to buy cages, it is more economical to build your own with the following basic requirements

- A safe secure hutch that offers protection from the weather. This includes shade from the sun and complete protection from rain and wind.
- A hutch should have a minimum of 0.6 m² floor space and a minimum of 0.5 m in height. The rabbit needs to be able to hop from one end to the other comfortably and lie down full length without touching the sides.
- Protection from all predators.
- Rabbits must always be protected from heat.
- When kept in wire cages it is important to give the rabbit a rest pad to sit on

Housing

Nest boxes

Nest boxes are a vital piece of equipment and can be made in many ways. Most farmers choose to use wooden boxes, either placed in the cage or clipped onto the outside of the cage with a hole in the cage for the doe to get in and out of. Alternatively, a 25-liter or 5-liter plastic water can also be cut to create cosy, easily cleaned boxes.

Advantages of farming with rabbits include the following

- Mature early and can be mated when five to eight months old, depending on the breed.
- Need very little space compared to other meat animals
- Rabbits do not compete for human food

RABBIT PRODUCTS

Rabbits yield a range of products for consumption and trade. The products can be further processing into products such as the meat, fur, pelts and manure to add value. Rabbit liver can also be processed into a very high value paste. Rabbit meat is very nutritious and tasty. It has the highest digestible protein content of all farm animals. The secret to happy healthy rabbits is cleanliness and good feeding.

Skinning of rabbit carcases at the abattoir and packaging

To ensure their survival, rabbit farmers must adhere to five internationally acknowledged rules.

- **Freedom from Thirst, Hunger and Malnutrition**
- **Freedom from Discomfort**
- **Freedom from Pain, Injury and Disease**
- **Freedom to Express Normal Behaviour**
- **Freedom from Fear and Distress**

Current challenges for rabbit farming in South Africa

1. No or few off-takers for the rabbit meat, which ultimately implies that negotiating and price setting power lies with the off-taker
2. Few suppliers of cages and the prices charged for cages would be regarded as expensive for start-up farming operation resulting in high initial capital outlays
3. No commercial suppliers of feed, or feed is difficult to find and hence some rabbit farmers have resorted to using horse pellets as a horse and a rabbit have similar digestive systems
4. Few abattoirs which are certified to slaughter rabbits in the whole country

Cages that are dirty, with a build-up of urine and manure will result in an outbreak of coccidiosis. Stress and Heat stroke are major killers of rabbits. In many South African households it is becoming more and more difficult to provide family with high quality protein, an essential for growth and good health.

Beekeeping (Honey farming)

Keeping bees can be for recreational purposes if the farmer wants an outdoor hobby and love the environment or it can be for commercial purposes as an income generator through either honey production or pollination services or both. Even as a hobby beekeeper (Apiarists or Apiculturists) may end up producing honey through the hard work and marvelous ingenuity of the honeybee colony. In learning all new interests you can read about the subject in a book or on the internet; you can go on a course and you can practically

work on your new interest. There are also some other good books available by South African authors. The farmer would be well advised to go on a local basic beekeeping course.

Requirements to start a beekeeping business

There are bour basic requirements needed to start a beekeeping business

1. A basic understanding of how the
    - honeybee colony is structured,
    - the honeybee works in the hive and
    - forages in the field
2. A suitable place to keep your first beehive
3. Your first colony of bees and a beehive to keep them in
4. Proper protective clothing and the basic tools to start working on your bees

Nutrition

The bees gather protein-rich pollen from the aloes and citrus trees. The farmer may also feed sugar water solution to provide the carbohydrates they need which are in short supply in the wild during wintertime. Bees need a balanced protein and carbohydrate diet to stay healthy. The sugar solution consists of 75kg white sugar and 210 litre water. About 1500 hives need to be fed 1000 litres of the mixture a day with hives in groups fairly close to one another.

Management

Beekeepers implement what is called hive management and hive manipulation. Hive management includes checking for pests and diseases, common and feared problems for today's beekeepers. The most serious diseases include American and European foulbrood. Then there's the possibility of invasions by the Cape honeybee (Apis mellifera capensis). These disrupt breeding in honeybee (Apis mellifera scutellata) hives. One aspect of hive manipulation, meanwhile, involves ensuring there's enough space in each hive for the queen to reach each brood frame to lay her eggs.

Pollination

Specific formulae calculate how many hives per hectare are needed for each crop being pollinated. For example, macadamia orchards typically require five to seven hives per hectare and apple orchards about two to three hives per hectare.

Facts about honey bees

1. Honey bees are super-important pollinators for flowers, fruits and vegetables. This means that they help other plants grow. Bees transfer pollen between the male and female parts, allowing plants to grow seeds and fruit.
2. Honey bees live in hives (or colonies). The members of the hive are divided into three types:
    - **Queen**: One queen runs the whole hive. Her job is to lay the eggs that will spawn the hive's next generation of bees. The queen also produces chemicals that guide the behaviour of the other bees.
    - **Workers**: These are all female and their roles are to forage for food (pollen and nectar from flowers), build and protect the hive, clean and circulate air by beating their wings. Workers are the only bees most people ever see flying around outside the hive.
    - **Drones**: These are the male bees, and their purpose is to mate with the new queen. Several hundred live in each hive during the spring and summer. But come winter, when the hive goes into survival mode, the drones are kicked out!
3. What are these *buzzing* bugs most famous for? Delicious **honey**! But did you know they produce honey as food stores for the hive during winter? Luckily for us, these efficient little workers produce 2-3 time more honey than they need, so we get to enjoy the tasty treat, too.
4. If the queen bee dies, workers will create a new queen by selecting a young larva (the newly hatched baby insects) and feeding it a special food called "**royal jelly**". This enables the larva to develop into a fertile queen.
5. Honey bees are fab flyers. They fly at a speed of around **25km per hour** and beat their wings **200 times per second**.
6. Each bee has **170 odorant receptors**, which means they have one serious sense of smell. They use this to communicate within the hive and to recognise different types of flowers when looking for food.
7. The average worker bee lives for just five to six weeks. During this time, she'll produce around a twelfth of a teaspoon of honey.
8. The **queen can live up to five years. She is busiest in the summer months, when she can lay up to 2,500 eggs a day!**
9. Honeybees are also brilliant boogies to share information about the best food sources, they perform their '**waggle dance**'. When the worker returns to the hive, it moves in a figure-of-eight and waggles its body to indicate the direction of the food source.
10. Sadly, over the past 15 years, colonies of bees have been disappearing also known as 'colony collapse disorder, and the reason remains unknown, resulting in billions of honey lost.

Challenges about this type of farming

Theft is a big challenge for beekeeping business, as a result commercial farmer with hives situated in different places away from each other are forced to hire guards to protect the hives 24 hours a day.

ACTIVITY 5

1.2 Match Column A and Column B. Write the correct answer next to the correct number.

	COLUMN A	COLUMN B
1.2.1	Feed prepared by cutting green maize and store it under special conditions to be fed in winter	Colostrum Concentrates Vaccines Silage Yoghurt Roughages
1.2.2	A dairy product	
1.2.3	First milk in cows a few hours after giving birth rich in antibodies	
1.2.4	Injection given to animals to develop their immunity	
1.2.5	Feeds introduces to calves that assist in the development of the stomach	

(5)

MODULE 3: Basic requirements for optimal animal production

Learning objective

At the end of this unit learners should be able to demonstrate the knowledge of the following content.

- Basic requirements for optimal animal production
- Effect of Climatic Factors on Livestock Performance
- Animal Care and Health
- Breeding and selection
- General Housing Requirements

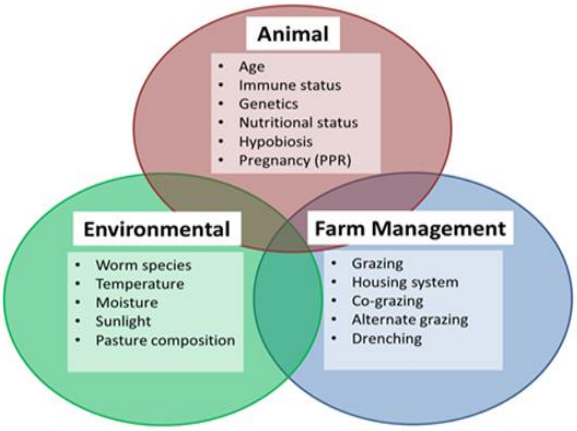
Keywords/terms and concepts – not all words or terms are listed in the table, some words should be highlighted by the educator who can also develop word searches, crossword puzzles and matching Columns A and B to strengthen biological terminology.
(See https://worksheets.theteacherscorner.net/)

Keyword	Meaning
Ad lib	the feed is available at all times
Quarantine	To restrict movement of animals for the purpose of checking for diseases before they are introduced to the herd
Immunity	Ability of an organism's body to resist diseases
Cages	is an enclosure used to confine, contain or protect animals
Cross breeding	produce (an animal or plant) by mating or hybridizing two different species, breeds, or varieties.
Hybrid vigour	he tendency of a cross-bred individual to show qualities superior to those of both parents.

Basic requirements for optimal animal production

The capacity of an animal to produce differs between species, breeds and strains as a result of genetic factors. However, a complex of inter-related factors in the animal husbandry will influence the animal's ability to utilize that capacity for growth, development and production.

Livestock production has become highly scientific and efficient because of the high cost of labour, land, feed, and money. Most brood-cow herds, which require a minimum of housing and equipment, are managed so as to reduce costs through pasture improvement and are typically found in relatively large areas and herds.



Environmental factors

Progress in breeding and feeding for further increase in production and efficiency can be limited by environmental factors

Climatic Factors

Temperature

Temperature affects the physiological functions of domestic animals, and for most farm animals a mean daily temperature in the range 10 to 20°C is referred to as the "comfort zone". At the upper and lower critical temperatures the physical regulation will not be sufficient to maintain a constant body temperature and the animal must, in addition, decrease or increase its metabolic heat production.

Humidity

Poultry do not have sweat glands, so all evaporative heat loss must originate from the respiratory tract. Other livestock species have varying abilities to sweat and in descending order they are as follows: Horse, donkey, cattle, buffalo, goat, sheep and pig.

In a hot-dry climate evaporation is rapid, but in a hot humid climate the ability of the air to absorb additional moisture is limited and the inadequate cooling may result in heat stress. Too low humidity in the air will cause irritation of the mucous membranes, while too high humidity may promote growth of fungus infections. High humidity may also contribute to decay in structures. If possible keep the relative humidity in the range of 40 to 80%.

Radiation

The heat load on a grazing animal can be considerably increased by direct solar radiation and radiation reflected from clouds or the ground. A white hair coat will absorb less radiant energy than a dark, but the heat penetrates deeper in a white, loose coat. Furthermore, solar radiation may adversely affect the animal's skin in particular breeds having unpigmented skin.
Heat gain by radiation can be effectively reduced by the provision of a shaded area. It must, however, be sufficiently large to allow space between the animals so that the heat loss by other means is not reduced.

Air Movements

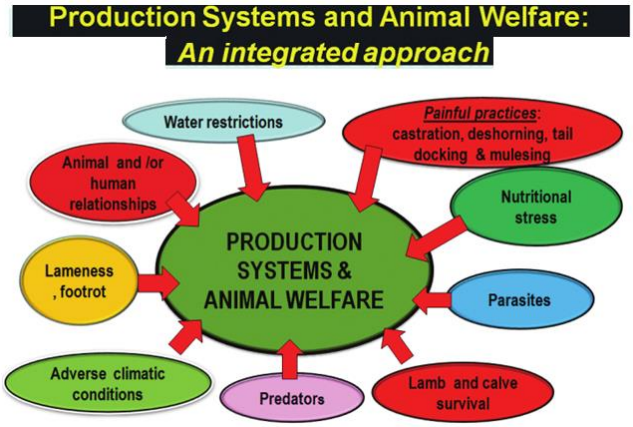
Air movements will assist in heat loss by evaporation and by conduction/ convection as long as the air temperature is lower than the skin temperature. When the air temperature approaches the skin temperature rapid air movements are experienced as comfortable, but at low temperatures it will lead to excessive cooling of unprotected skin areas (cold draught).

Precipitation

Heavy rain may penetrate the fur of an animal and decrease its insulation value. A strong wind can in such circumstances lead to excessive cooling. However, a naturally greasy hair coat will resist water penetration and with the provision of a shelter for the animals the problem may be avoided altogether.

Effect of Climatic Factors on Livestock Performance

When the environmental temperature exceeds the upper critical level (18 to 24°C, depending on the species) there is usually a drop in production or a reduced rate of gain. Furthermore, when the temperature falls outside the comfort zone, other climatic factors assume greater significance. Dairy Cattle show a reduced feed-intake under heat stress resulting in lowered milk production and reduced growth. European cattle (Bos Taurus) produce well at temperatures ranging from 4 to 24° C even at high humidity. In contrast, Zebu cattle (Bos Indicus), which are native to warm climates, have a comfort zone of 1 5 to 27° C and milk production begins to drop only when temperatures rise above 35°C.



Heat Regulation

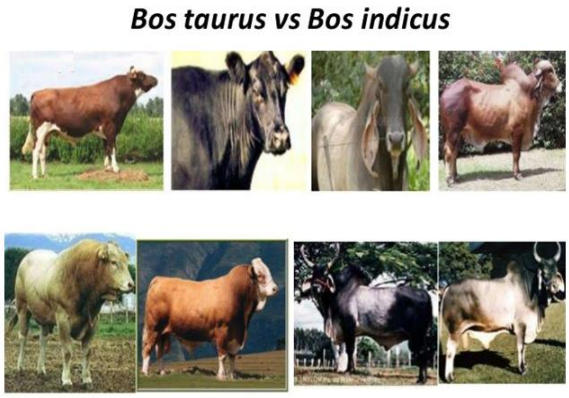
All domestic livestock are homeotherms, that is, they maintain relatively constant internal body temperatures, usually within a 1 to 2° C range.

Normal Body Temperatures of Domestic Animals and Humans

The body temperature of most domestic animals is considerably higher than the environmental temperature to which they are exposed most of the time. They maintain their body temperatures by balancing internal heat production and heat loss to the environment.

Cattle

The Zebu is characterized by a hump, large ears and loose, thin skin including a prominent dewlap. These characteristics promote heat loss by convection and evaporation and thus efficient body temperature regulation under hot climatic conditions. In addition, the Zebu has less subcutaneous fat, a lower body volume for the surface area, and short smooth hair all of which contribute to the animal's comfort under hot conditions. The European breeds on the other hand have thick skin held tightly to the body, long hair and a large amount of fat which serve as insulators, traits desirable for cold or temperate climates.



Pigs

Pigs require a change in ambient temperature as they age and grow, and like cattle, they show a decreased feed intake when under heat stress. Piglets survive and develop best at 30 to 32°C initially followed by a gradual reduction to 20°C over the first three weeks

Sheep

Sheep can tolerate a wide range of temperatures but should be protected from wind and rain. However, a long period of high ambient temperatures inhibits reproduction. Heat stress also reduces lambing percentage, decreases the incidence of twinning, and decreases the birth weight of lambs.

Goats

Goats are affected by temperature, humidity and rain. In hot climates, goats need shelter from intense heat during the day. In humid areas they need protection from prolonged heavy rain. Excessive wetting from rain can cause pneumonia and an increase in parasitic infestation.

Poultry

The environmental requirements for poultry vary with age. Chicks should be started at 35° C. After one week the temperature is reduced gradually to 24°C by the fifth week. Broilers and young turkeys reared at ambient temperatures below 18°C are heavier than similar stock reared within the 18 to 35°C range, but their feed conversion efficiency will be less.

Rabbits

Rabbits are affected most by sun and heat, wind, rain and draughts. Sunlight is of benefit to breading stock and the growing young, but it will also fade the coat of coloured rabbits and discolour a white one.

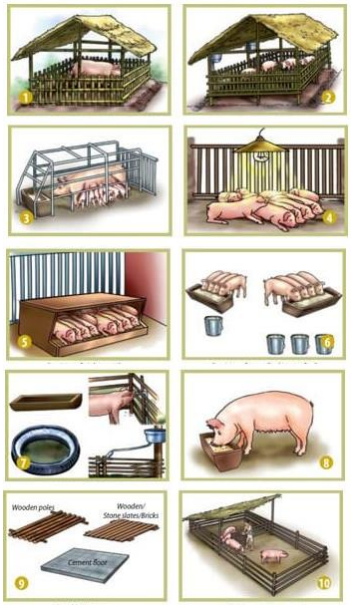
Horses

Horses do not require warm surroundings, but they do not easily tolerate draughts, dampness and high humidity. When exposed to high temperatures and vigorous exercise, horses sweat and the evaporation of this perspiration cools the skin and helps to maintain normal body temperature.

Housing

Management

Animal housing design is mainly concerned with the physical environment, in particular climatic and mechanical factors, but all other factors should also be considered in order to create a good layout, where healthy, high yielding animals can be provided with correct feeding, can be easily handled and can produce without stress or suffering physical harm.



Care and Health

Disease remains a major profit-limiting factor in animal production in many tropical countries. Sanitary control measures should be incorporated in any building design, so that good hygienic standards can be easily maintained. An animal which is well fed and watered and in good condition will have a high resistance to disease. New-born stock should always receive colostrum (first milk), which contains antibodies.

Manure Handling

Careful waste management is needed:

- to utilize the fertilizing qualities of the manure, urine and other wastes
- to maintain good animal health through sanitary facilities
- to avoid pollution of air and water and to provide good hygiene around the farmstead.

The method of disposal depends on the type of wastes being handled. Solids can be stacked and spread on fields at the optimum time of year, while liquids must be collected in a tank and may be spread from tank-wagons.

Footbaths

The floor of the baths should be studded with hard stones set into the concrete to provide grip, and to splay the hoofs apart to loosen any mud between them. If water supply is extremely limited, footbath water can be collected in settling tanks and reused later.

Dipping tanks

The dipping tank is designed to a size and shape to fit a jumping cow and allow her to climb out, while economizing as far as possible on the cost of construction and the recurrent cost of acaricide for refilling.

Catwalk and handrails are provided to allow a person to walk between the splash walls to rescue an animal in difficulty. In addition to providing shade, a roof over the dipping tank reduces evaporation of the dip-wash, prevents dilution of the dip-wash by rain, and in many cases, collects rainwater for storage in a tank for subsequent use in the dip. A jumping place on the dipping tank should be a narrow steep flight of short steps to ensure that:

- animals can grip and jump centrally into the dip,
- their heads are lower than their rumps at take-off,
- they jump one at a time, and
- dip-wash splashing backwards returns to the dip.

Cattle Spray Race

A spray race site requires the same features as a dip site and these have already been described. The only difference is that the dip tank has been changed for a spray race. The race consists of an approximately 6m long and 1m wide tunnel with masonry side walls and a concrete floor.

A spray pipe system on a length of 3 to 3.5m in the tunnel having 25 to 30 nozzles place in the walls, ceiling and floor, discharge dip liquid at high pressure and expose the cattle passing through to a dense spray. The fluid is circulated by a centrifugal pump giving a flow of 800 litres per minute at 1.4 kg/ cm² pressure. Hand spraying is an alternative method that can work well if carried out by an experienced person on an animal properly secured in a crush.

Nutrition

Feed is the biggest cost factor in animal production and can amount 60 to 80 % of the total cost of production. Correctly fed animals will ensure:

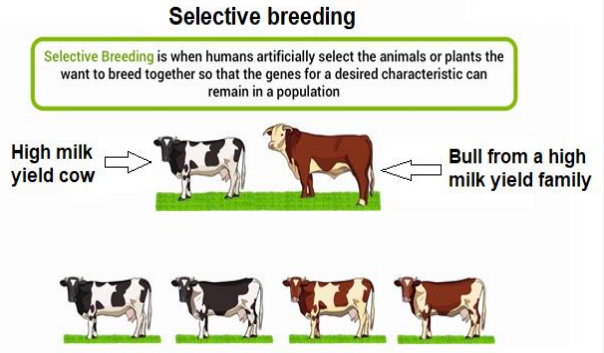
- efficient reproduction and growth
- efficient feed utilisation
- good-quality meat
- Maximum profit for the farmer.

Animals must therefore be fed the correct quantity of the right feed mixture according to various classes that include;

- Lactating animals
- Pregnant animals
- Animals in production
- Animals in the feedlot
- Dry animals

Breeding and selection

Day length or photoperiod varies with latitude and season and has a direct influence on animal performance, especially on the breeding season for sheep and egg production of poultry. The composition and management of cattle herds vary considerably. At one extreme, nomadic herdsman graze their entire herd as one unit. The small holder with only a few head may keep his heifer calves for replacements or sell them. At a closer examination it will be found that several factors influence the number of animals of various categories found in the herd. A number of cows in a dairy herd will be culled each year for reasons of low milk yield, infertility, disease, old age, etc.



General Housing Requirements

Animas will be more efficient in the reproduction and production (milk, eggs, meat wool etc.) if they are protected from extreme heat and cold weather. Thus, in tropical and subtropical climates shade becomes an important factor. If cattle are kept in a confined area, it should be free of mud and manure in order to reduce hoof infection to a minimum. In deciding which orientation to build, the following factors need be considered:

Feeding and Watering Equipment

The dimensions of the trough must be chosen to conform to the height, reach and required width of the feeding space for the animals to be fed, while providing enough volume for the amount of feed distributed at each feeding time. Although timber construction is simple to install, concrete should be considered because of its greater durability. Feed troughs separates the cattle by vertical rail barriers, to reduce competition during eating. The barrier may also reduce fodder spillage because the cow has to lift her head before withdrawing it from the trough. A simple roof constructed over the feed trough and the area where the cows stand to eat will serve as a shade and encourage daytime feeding in bright weather while serving to protect the feed from water damage in rainy periods.

Animal housing facilities and handling facilities

Drinking water for animals must be clean. Impurities may disturb the microbiological activities in the rumen. In dairy cows the need for water will increase with milk yield. The size of a water troughs depends on whether the herd is taken for watering periodically or is given water on a continuous basis. If water is limited, the length of the trough should be such that all of the cows can drink at one time.

ACTIVITY 6

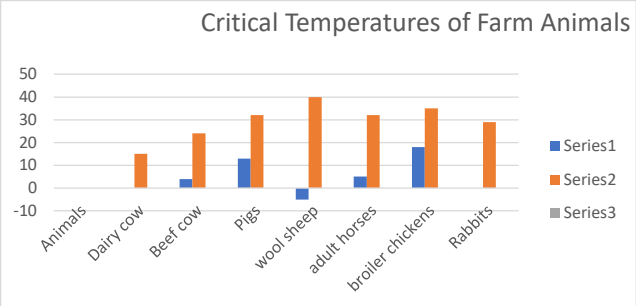
6.1 Write down the correct word for each of the following statements

(a) Feeds given to animals to make up for the nutrients in short supply
(b) The type of farming that rely on natural feeds which have no additives and artificial stimulants.
(c) Cattle kept for their meat.
(d) Farmers who keep and raise their animals for only the consumption of their families.
(e) Oral application of remedies.
(f) Consumption of feed by calves as much as they need.
(g) Farmers who farm with bees.
(h) A management tool of reducing the numbers of game animals through slaughtering (8)

6.2 Indicate the products/purposes of the following animals

(a) Jersey
(b) Dohne merino
(c) Landrace
(d) Saanen
(e) Boer Goat
(f) Karakul sheep
(g) Angora Goat
(h) Dorper
(i) New Hampshire
(j) Through breed
(k) Mule
(l) Antelope
(m) Rabbit (13)

6.3	Explain the meaning of the following terms in poultry (a) Free range egg production (b) Hybrid chicken		(4)
	6.3.1	Explain Three main characteristics of a hybrid broiler chicken	(3)
6.4	Ecotourism		
	6.4.1	Explain the concept ecotourism	(3)
	6.4.2	Briefly discuss the importance of ecotourism to both the visitors and the host.	(5)
	6.4.3	Discuss the importance of game farming	(5)
6.5	Rabbit Farming		
	6.5.1	Give Five basic requirements for keeping healthy rabbits	(5)
	6.5.2	State Three advantages of farming with rabbits	(3)
	6.5.3	Give Three challenges of farming with rabbits in S.A.	(3)
6.6	Bee Farming		
	6.6.1	Explain the following terms in relation to bee farming: (a) Queen (b) Workers (c) Drones (d) Honey (e) Pollination (f) Royal jelly (g) Waggle dance	(7)
6.7	Ostrich Farming		
	6.7.1	Name the province which is a hub for ostriches	(1)
	6.7.2	Name Four products from ostriches	(4)
	6.7.3	Give the most expensive product derived from the skin of ostriches and mention two uses of it.	(3)
	6.7.4	State Three problems of ostrich industry.	(3)
6.8	Farm management		
	6.8.1	Name Four factors influencing the production of animals	(4)
	6.8.2	Graph showing critical production temperatures for various animals.	



(4)

Animals
Series1: Critical lowest temperatures (°C)
Series2: Critical Highest temperatures (°C)

4.4.3	Identify TWO animals that can still produce under very cold weather	(2)
4.4.4	Identify TWO animals that need to be sheltered in cold weather below 10°C	(2)
4.4.5	Give THREE measures to protect animals against adverse conditions	(2)

CHAPTER 1

BUSINESS PLANNING AND PRACTICES

A **business plan** is a formal written document containing the goals of a business, the methods for attaining those goals, and the time-frame for the achievement of the goals. It also describes the nature of the business, background information on the organization, the organization's financial projections, and the strategies it intends to implement to achieve the stated targets.

Whether business is big or small must include same core elements as follow:-

- A convincing reason for the business to exist
- A differentiating product or service description
- Clearly defined target market
- Competitive analysis
- Statement of goals and objectives
- Marketing & financial plan

Objectives:

Upon completing this module, learners should be able to :-

- Define & explain terminology used
- Understand and develop basic SWOT analysis

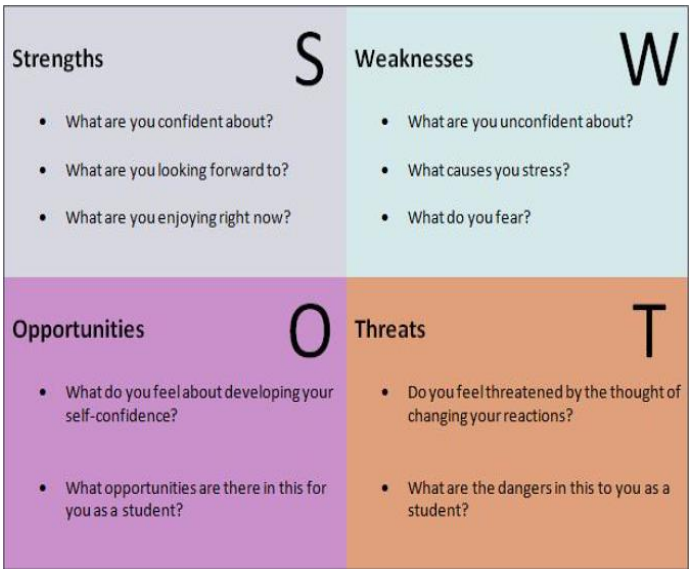
Key words/terms and concepts
Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

TERMS	DEFINITION
SWOT analysis	is a strategic planning technique used to help a person or organization identify ***strengths, weaknesses, opportunities, and threats*** related to business competition or project planning.
Strengths	The ability to produce goods, profits and jobs
Weakness	The state of being weak, lacking strength, firmness or vigor
Opportunities	Set of circumstances that make it possible to do something
Threats	Anything that could cause damage to your organization or product
Business venture	Is a business enterprise which the expectation of gain is accompanied by the risk of loss or failure
Budget	An estimate of income and expenditure for a set of time
Income	Money received, especially on regular bases for work or through business
Expenditure	The total amount of money that a person/Organization spends
Competition	An activity involving two or more businesses in which each tries to get people to buy its own goods in preference to the other
Risk	Is the potential for uncontrolled loss of something which is of value
Inventory	An itemized list of current assets in an organization

MODULE 1: INTRODUCTION TO DEVELOPMENT OF BASIC SWOT ANALYSIS

SWOT analysis is intended to specify the objectives of the business venture or project and identify the internal and external factors that are favorable and unfavorable to achieving those objectives. It is a strategic planning technique used to help a person or organization identify ***strengths, weaknesses, opportunities, and threats*** related to business competition or project planning.

Users of a SWOT analysis often ask and answer questions to generate meaningful information for each category to make the tool useful.



Example: Fresh Fruit and Vegetable shop (**SWOT analysis)**

STRENGTH

1.Great location for the shop

- The shop located in a ***local community***.
- Far from the city center, ***the bills for renting is much cheaper***, so the cost of sales could be reduced.
- There is a 24/7 fitness center around the shop, lots of people have the habit getting some fruits to gain the nutrition after gym.
- The ***competition is not fierce***, as there is not the same kind of business nearby.

2.Business type

- The shop specialized in fruits and vegetable.
- We have got much more kinds of fresh product comparing with shopping center.

OPPORTUNITY

1.Marketing plan

- We plan to apply the pickup and delivery service for individual customer.
- The customer can not only order goods through the phone, but also logging on our website. In the same time, we can give them a free quotation, in order to meet their needs.

2.Pay more attention to the supplying section

In the present, we mainly order the fruits and vegetables from the suppliers. We have ***to spare more budget*** into it such as the cost of goods, the fees of delivery. Besides, it probably takes a long while to wait for the arrival of goods. In the future, it is highly possible for us ***to open our own farm***. On basis of that, we can not only reduce the cost of sales, but also the quality of goods could be guaranteed.

WEAKNESSES

1. It cost a lot to start our business, we have to buy the products and fill our shop. It cost every much in setting up a new business.
2. Finance remains the main weak point for new business man. As it is very difficult to borrow money from banks. We have to take a loan to set up business. So we have to think about the instalment of loan payment and interest of loan.

THREATS

1. ***Competition*** has increased a lot in market, so it remains
   a doubt in mind of every new business man that his business wills success or not.
2. Vegetables are ***seasonable***, as in every season, the vegetables are changed, so it is very difficult to bring a huge variety of products in store.
3. Vegetable and fruit business is highly depending on whether as any change in weather, it affects the production of vegetable and fruits.
4. ***Risk*****,** especially when we have disaster such as drought,
   hard storms and floods. Prices of vegetables and fruits always vary with growth of vegetables and fruits.
5. In this condition people change their mind for buying the products and also quantity of products.

COMPETITION IN FRUITS & VEGETABLES INDUSTRY

Company name (Brand)	Major products
Reliance Fresh	Fresh fruits & Vegetables
Parle agro	RTS, Juice
Mapro	Jam, Squash, Cordial
Godrej Agrovet	Fresh fruits & Vegetables
Bharti Retail	Fresh fruits & Vegetables

ACTIVITY 1.1

Module possible questions

1. Define the following terms: -
   (a) Competition (2)
   (b) Risk (2)
   (c) Business venture (2)
2. Briefly explain what is meant by SWOT analysis (2)
3. Differentiate between Income and Expenditure (2)
4. Use the example given above to do SWOT analysis for your school gardening project(12)

SWOT analysis rubric	
SWOT abbreviation written in full	4
Each analyzed category	4 x 2

MODULE 2 BASIC RECORD KEEPING

Farming is a business and good **farm records keeping** helps the **farmer** to plan and do realistic forecasting. **Records keeping** provides valuable information on the methods that work and why others did not. In budgeting, the **farmer** can better predict price changes of inputs and produce from expenditure and sales **records kept** from earlier seasons.

Objectives:

Upon completing this module, learners should be able to :-

- Define & explain terminology used
- Understand basic record keeping
- Compile and update school/farm inventory

Key words/terms

TERMS	DEFINITION

Inventory	Document record showing list of lists of all the Items present on the farm
Physical records	Records of physical items or activities on the farm
Financial records	Records of income and expenditure in the farm

Record keeping refers to an **automated or manual system responsible for collecting, organizing, and categorizing records** to facilitate their preservation, use, retrieval and disposition. This system has four main components for its efficient performance such as Records; People; Processes and Tools. **Farm records** such as: - Crops records, Animal records and Financial records are essential in farming business.

Importance of farm records

- they help the farmers to measure and analyze farm production and make sound farm management decisions
- they provide a clear direction on what actions to take on a farm.
- They help farmers with planning their farming activities and remind farmers to pay their debts on time.
- Help farmers to get loans from banks
- give the history of the farm so that farmers may assess the productivity of the farm.
- physical records help farmers to follow farming activities properly such as the dates of sowing, furrowing and harvesting and other important dates.

Types of farm records

There are two types of farm records.
1. Physical records
2. Financial records

Physical records
These are records of the physical items or activities that are done on the farm.eg the farm *dairy, climatic records, production records and inventory records.*

Financial records
They analyze the farm's *income and expenditure*. They include the income and expenditure account, the profit and loss account and the farm budget.

2.1 INVENTORY FOR REGULAR STOCK KEEPING

Farm inventory involve the farm records that shows the lists of all the Items present on the farm at a particular time, examples are farm equipment, machinery farm building, farm plots, animals, crops furniture, etc. An **inventory** is generally done at least once a year and involves the counting of everything on the **farm**, including hectares of land, tons of grain in stock, animals and so on. The **inventory** will also include the money value in Rand of the assets. Walk around the **farm** and make a general inspection of **farm** assets.

Objectives:

Upon completing this module, learners should be able to :-

- Define & explain terminology used
- Identify type & components of inventory
- Explain importance of keeping inventory
- Design format & complete inventory

Key words/terms

TERMS	DEFINITION
Inventory	Is list of goods, items or stock available in a business or farm
Records	Information created, received and maintained as evidence and information by the company
Assets	It is a resource with economic value that a farmer controls with the expectation for future benefit

The type and components of an inventory record

It is the list of all that the farmer owns and owes at a given time, with the values for each item. The farm inventory is the corner stone for all the farm records.

Types of inventory

1. Tools inventory
2. Farm structure inventory
3. Special commodity inventory
4. Special material inventory

Importance of keeping inventory

1. It provides the opportunity to measure success
2. It controls expenditure
3. It helps in proper planning
4. It helps you to response to your customers as quickly as possible

ACTIVITY 2.1.1

Study the picture below and use the prepared inventory list that follow to update your school farm records

Farm/Garden Equipment Inventory List

Name of farm/school:_____ Name of person taking inventory: _____

Date : _____

	#	Quantity	Condition of item	Number in good condition	Number damaged	Remarks

ACTIVITY 2.1.2
Module possible questions

1. What is meant by the term Record keeping? (2)
2. Explain the following types of farm records
   (a) Farm records (2)

(b) Inventory records (2)
(c) Financial records (2)

3. Differentiate between record keeping and Inventory (2)
4. Briefly discuss the importance of record keeping in the farm (2)

2.2 BASIC BUDGET

A budget gives you the freedom to spend your money the way you want to, rather than wondering where all of it went at the end of the month. It's a way for you to make your money work for you to reach your goals. If you're still hung up on the word "budget," try calling it your "spending plan" instead.

Objectives:

Upon completing this module, learners should be able to :-

- Define & explain terminology used
- Understand the purpose of budgeting
- Differentiate between Income and expenditure
- Differentiate between profit and loss
- Draw basic budget for production enterprise
- Calculate profit/loss

Key words/terms

TERMS	DEFINITION
Budget	Is an estimate of income and expenditure of a business at a set period of time. It has a planning and a control function
Income	Refers to money received, (especially on a regular basis for work, selling of goods/services and through investments) by the farm
Expenditure	funds used by a business, organization, or corporation to attain new assets, improve existing ones, or reduce a liability**.**
Profit	Is a financial gain, especially the difference between the amount earned and the amount spent

Important Steps when drawing up your basic budget:

1. **Add up your monthly income.**

List all of the income you receive each month at the top of the page. Add these numbers up. The total is the pot of money all of your expenses must come from.

2. Identify your necessary expenses.

Next, list all of your necessary expenses. These are the expenses you will definitely have every month.

3. Identify your discretionary expenses.

Now list out extra expenses that aren't necessities. Eating out, cable, movies, concerts, shopping, saving for vacation, and similar expenses.

4. Add up your monthly expenses and compare to your income.

Add up all of the numbers you identified in #2 and #3. This total is how much money you're spending every month.

Compare the total in #4 (expenses) and the total in #1 (income). Hopefully, the income total is higher. If not, look for discretionary expenses you can cut

Reasons for budgeting

A budget helps you gain control of your finances. Think of a budget as a financial roadmap.

Budgeting helps you achieve goals.

A good budget keeps you honest.

Budgeting helps improve habits.

Budgeting helps you avoid debt and improve credit

Example of a budget

Maximum expected costs	Amount	Minimum expected returns	Amount
Fertilizers	R224.00	Sale of maize	R333.00
Seed	R554.00	Sale of vegetables	R576.00
Pesticides	R777.00	Sale of sorghum	R333.00
Labor	R200.00	Sale of wheat	R1457.00
TOTAL	R1,755.00	Total.	R2699.00

Income and Expenditure

It shows how much money the farm makes and how much is spent in the running of the farm.

Example

INCOME		EXPENDITURE	
Item	**Amount**	**Item**	**Amount**
Sale of onions	R45.00	Compost	R20.00
Sale of cabbages	R56.00	2 Kg king onion seeds	R10.00
Sale of beetroot	R300.00	50 Kg ammonium nitrate	R55.00
TOTAL INCOME	**R401.00**	**TOTAL EXPENDITURE**	**R85.00**

ACTIVITY 2.1.3

Use the information above to calculate the net profit.

A grade 7 Agric studies learner started a fruit drying business. She struggled a bit at first but was successful afterwards. The parents supported the business by providing capital to purchase packaging plastic wraps and labels. The learner sold the dried fruits to school and earned a total amount of R120.00. The learner decided to make list of business income and expenditure as shown below

INCOME				
DATE	**AMOUNT**	**TOTAL**		
14/03/2020	R120.00	R120.00		
EXPENSES				
DATE	**ITEM**		**VALUE**	**TOTAL**
12/03/2020	Ingredients		R40.00	R40.00
13/032020	Wraps		R10.00	R10.00
14/032020	Labels		R20.00	R20.00

The learner managed the business well and made a **profit**. Sometimes business spend more than the learner earn and then make a **loss**.

ACTIVITY 2.1.4

1. Look at the learner's income and expenditure on the previous activity. How much profit has the learner made? (Profit = Income – Expenditure)
2. Observe the learners' money in savings account and at income and expenses. Is the profit the same as the amount in bank account? Why or why not?

3. **Profit or loss of a business** is the difference between its income and expenses. Study the table below, work out the following and write down ***Profit*** or ***Loss*** next to each amount.

Income	Expenses	Profit or Loss
38 089	29 867	
17 512	20 970	
5 769	5 025	
9 871	10 101	
48 721	52 810	

ACTIVITY 2.1.5

Module possible questions

1. Define the following terms: -
   (a) Budget (2)
   (b) Income (2)
   (c) Expenditure (2)

2. Provide reasons why budgeting is important (5)

3. Describe four steps to consider when drawing up your business budget (4)

CHAPTER 2

MARKETING AND PRICE SETTING

Marketing refers to activities a company undertakes to promote the buying or selling of a product, service, or good. It is the business process of creating relationships with and satisfying customers. Because marketing is used to attract customers, it is one of the primary components of business management and commerce

Objectives:
Upon completing this module, learners should be able to: -

- Define & explain terminology used
- Conduct market research
- Understand principles in price determination

Key words/terms and concepts
Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

TERMS	CONCEPTS
Formal marketing	management of the distribution of goods and services by government or other entity
Informal marketing	is the form of marketing where producers market their products as they please.
Controlled marketing	management of the distribution of goods and services by government or other entity
Marketing	from the production to activities involved in taking product the consumption points
Selling	The exchange of goods and services for money
Advertising	Advertising is a means of communication with the users of a product or service.
Demand	quantities of a good that consumers are willing and able to buy at different prices
Supply	quantities of a good that producers are willing and able to sell or produce at different prices
free market	a large market in which there is a large number of buyers and sellers, so that no one can control the market price
Exotic touch	Characteristic of a distant foreign country
Tropical touch	A sense of summer being created

MODULE 1: BASIC MARKETING CONCEPTS

Marketing research is a method of obtaining a wide range of information and activities necessary to run a business. Marketing research covers **gathering, recording, and analysis of information** about transfer and sale of goods and services from producer to consumer. The objective of marketing research is to **offer analyzed facts and knowledge** in order to overcome problems and to make the right marketing decision at a right time.

Creating a greengrocer poster for your school

After setting up your store, filling it with shelves and boxes for food, and setting a luminous sign on it, all you need to do is **adding a pleasure seeking, tropical or exotic touch to your store**, and fill it with customers. ***Communicate your offers, discounts, or unique fruits or vegetables*** by using the ***visual appeal*** of these products and their properties.

Example in communicating your offers:

ACTIVITY 1.1

Design a poster to market your school's production enterprises and extra mural activities available

1. Relevant poster (with content & pics)	(1)
2. Use of high quality images/photos	(1)
3. Use of varied fonts	(1)
4. Contact for more information	(1)
	04

Advertising is always present, though people may not be aware of it. In today's world, advertising uses every possible media to get its message through. It does this via television, print (newspapers, magazines, journals etc.), radio, press, internet, direct selling, hoardings, mailers, contests, sponsorships, posters, clothes, events, colours, sounds, visuals and even people.

The advertising industry is made of companies that ***advertise***, ***agencies*** that create the advertisements, ***media*** that carries the ads, and a host of people like ***copy editors***, ***visualizers, brand managers, researchers***, ***creative heads*** and ***designers*** who take it the last mile to the customer or receiver. A company that needs to advertise itself and/or its products hires an advertising agency.

1.2 MARKETING TYPES

Marketing of Agricultural product can either be **Formal or Informal**. In **formal marketing**, producers/sellers can publicly advertise their prices and locations which is usually referred to as controlled marketing. **Controlled market** may be defined as a system where the Government controls the forces of supply and demand such as who enter the market and/or what prices may be charged. In **informal marketing**, sellers need to trade through bilateral bargaining so as to remain anonymous from the taxing authority.

ACTIVITY 1.2

FORMAL MARKETING	INFORMAL MARKETING
	
Characteristics	Characteristics

MODULE 2: BASIC PRINCIPLES OF SUPPLY AND DEMAND ON PRICE SETTING

Objectives:

Upon completing this module, learners should be able to: -

- Define & explain terminology used
- Understand basic principles of supply and demand
- Differentiate between supply and demand
- Identify supply and demand graph

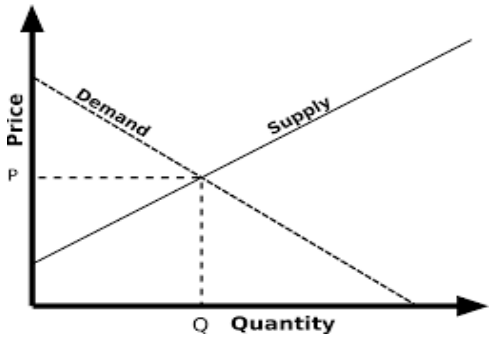
The **law of demand** says that at higher prices, buyers will demand less of an economic good. The **law of supply** says that at higher prices, sellers will supply more of an economic good. These two laws interact to determine the actual market prices and volume of goods that are traded on a market

What is demand?

When a lot of people want something, we say that it is in demand. For example, there is always a demand for bread. In some other things there is high demand for a while and then the demand drops. Clothing for instance goes in and out of fashion.

What is supply?

Supply refers to the number of items that a producer can offer for sale. When the brown clothing is in fashion, a producer will aim to make enough items to supply the shops. Sometimes there is bigger demand than what producers supply. Producers and shops can then charge much higher prices



How much money you're willing to spend will determine which techniques you choose for your business.

Basic principle of Demand and Supply is that the:

- The law of demand says at higher prices, buyers will demand less of an economic good or product.
- The law of supply says that at higher prices, sellers will supply more of an economic good.
- These two laws interact to determine the actual market prices and volume of goods that are traded on a market.
- Several independent factors can affect the shape of market supply and demand, influencing both the prices and quantities that we observe in markets.

OVERVIEW OF SOME AGRICULTURAL PRODUCTS IN SA

The increase in the population level of the country has fueled the **demand** for cereals. **Maize** is the ***staple food*** in the country, consumed in its direct form, and is used for **products**, such as ***sweeteners, bread, and cornmeal*****.**

Wheat is also another major staple food in the country, which is mostly imported, as it is economical to import rather than produce it domestically.
The **major fruits** consumed in the country are ***apples, pears, litchis, mangoes, plums, peaches, apricots, grapefruit, pineapples, avocados, and lemons*****.**
There is also an **increasing demand** for products derived from fruits, such as *fruit juices and jams*, that drives the market in the country.
The ***most demanded vegetables*** in the country are ***lettuce, chicory, pumpkins, tomatoes, and carrots***. Most of the country's oilseed demand is met by domestic production.

ACTIVITY: 2.2

Think about how forces of supply and demand affect the prices of fruit.

1. In other towns, pears may cost R1.25 each when they are in season. At other times, they can cost as much as R5 each.

   a. If you were an avocado supplier, when would you rather sell your fruit? (2)

   b. Why don't all avocado suppliers wait for the price to rise before they sell their fruit? (2)

2. Investigate the availability and price of a particular fruit over a period of six months. (Do not use fruit such as apples or bananas that are supplied all year and will not show big price changes)

Moth	1st	2nd	3rd	4th	5th	6th
Availability(yes/no)						
Price						

CHAPTER 3

HARVESTING

Key words/terms and concepts
Not all words or terminology is listed in the table, some words should be highlighted by the educator. Educators can develop word searches, crossword puzzles and matching Column to strengthen terms and terminology. (See https://worksheets.theteacherscorner.net/)

TERMS	CONCEPTS
Harvesting	is the process of gathering a ripe crop from the fields
Processing	is the transformation of agricultural products into food, or of one form of food into other forms
Value adding	is the difference between the price of product or service and the cost of producing
Storage space	an enclosure, cubicle, or room that is fully enclosed and equipped with a door designed to be locked for security by the occupant
Packaging	described as a coordinated system of preparing goods for transport, warehousing, logistics, sale, and end use
Primary Agric products	are goods that are available from cultivating raw materials without a manufacturing process
Secondary Agric	Are processed primary agricultural products

products	
Product	Any product of agriculture deriving from crop or animal production

MODULE 1: FARM PRODUCE HARVESTING

Objectives:
Upon completing this module, learners should be able to :-

- Define & explain terminology used
- Identify and select harvesting and storage equipment
- Apply processing, value adding and packaging of Agricultural produce
- Provide appropriate examples of the harvesting concepts

Harvesting 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**.

The harvest of products is a critical and very important time on the farm. Harvest planning is very important and can make the whole production process a success or failure. Various factors must be taken into account in the harvesting process, the following being the most important:
• Time of harvest
• Quantity of labour
• Availability and quantity of harvesting equipment
• Start and end date of harvest
• Harvesting method
• Protective clothing for harvest.

Some root crops and tree fruit can be left in the field or orchard and harvested as needed, but most crops reach a period of **maximum quality** — that is, **they ripen or mature** — and will deteriorate if left exposed to the elements. The appearance of the product is important and therefore products for the fresh produce market are harvested by hand.
Harvesting can be **Manually** (by hand) or **Specialized**(mechanization)

Manual/Hand harvesting	Specialized/Mechanical harvesting
	
	

	Advantages	Disadvantages
Manual/Hand harvesting	• Cheap • Low maintenance • No damage to the product	• Very slow; take a long time • Products are not so clean • Only small areas can be

	• Selective harvest: Products can be selected and not randomly	harvested • Depends on weather conditions • Labour intensive • Poor working conditions
Specialized/Mechanical harvesting	• Quick • Effective - less labour • Can harvest large areas • Specialized • Capital Intensive.	• Expensive • Requires high maintenance • Increases high unemployment rate

Examples of Product harvesting chain from fields/animal to consumption/storage

STORAGE SPACE

Storage is an important marketing function, which involves holding and preserving goods from the time they are produced until they are needed for consumption.

Storage methods are determined by various factors. The following are examples of different methods that can be used in agriculture to store products: -

- Cold storage at temperatures below 10^0C degrees - fruit and vegetables
- Freezing rooms - ready processed products such as meat
- Underground structures - grain
- Air-tight storage - grain
- Silos - grain
- Tanks - Wine
- Drums
- Traditional storage in clay pots, buckets, bamboo, etc.

- Plastic bags and coverings - silage
    - Bunkers - silage

ACTIVITY: 1
Complete the table below by identifying the storage space/facility, product stored and method of preservation.

STORAGE SPACE/ FACILITY	STORAGE NAME	PRODUCT STORED	METHOD OF PRESERVATION
	**A** **(1)**	**1** **(1)**	**2** **(1)**
	**B** **(1)**	**3** **(1)**	**4** **(1)**
	**C** **(1)**	**5** **(1)**	**6** **(1)**
	**D**	**7** **(1)**	**8**

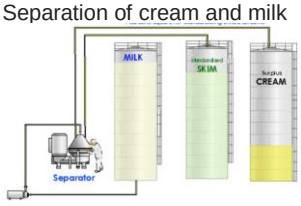
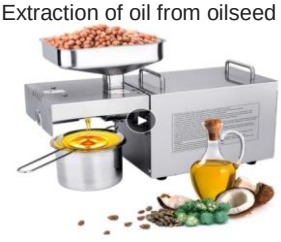
	(1)		**(1)**

CHAPTER 4

PROCESSING AND VALUE ADDING

Food processing is the transformation of agricultural products into food, or of one form of food into other forms. Food processing includes many forms of processing foods, from grinding grain to, make raw flour, to home cooking, to complex industrial methods used to make convenience foods.
Processing may involve conversion of primary agricultural products into an edible product that can be sold in general trade. This can be done in two different ways: - i.e**. Primary** and **Secondary conversion**.

Primary conversion
Conversion of the primary product so that it can be converted to other products. Certain products be used by humans and animals after the primary conversion. Examples are:
ACTIVITY 1.1

Agric produce	Processing	Primary product
	Milling of corn/wheat 	
	Separation of cream and milk 	
	Extraction of oil from oilseed 	

Secondary conversion

Conversion of the processed primary product to edible products. Examples are:
• baking bread with wheat flour
• make porridge and cornflakes from maize flour
• Preparation of butter from cream.

VALUE ADDING

Adding value is the process of changing or transforming a **product** from its original state to a more valuable state. Many raw **commodities** have intrinsic **value** in their original state. For example, **field corn grown**, **harvested** and **stored** on a farm and then fed to livestock on that farm has **value**. Adding value can be done on a number of agricultural products such as:-

AGRICULTURAL PRODUCT	ADDED VALUE PRODUCT
FRUIT	Fruit juice, dried, prepacked
MEAT	Biltong, cooked
EGGS	Scrambled, graded
POULTRY	Slaughtered, chicken portions
VEGETABLES	Graded, packaged, dried
MILK	Sour milk, cheese, butter
WOOL	Sheared, graded & packed
POTAOES	Washed, packed in bags, chips

PACKAGING OF FARM PRODUCE

What is packaging?

Packaging refers to the **outer and inner covering used to enclose a product**. It is the first point of contact between the brand and potential customers and greatly influences the customer's buying decisions. The packaging should provide adequate protection to the packaged product from any form of damage. **Packaging facilities** will depend on the type of product. Whatever the size of the container/facility, good practice must be applied at all times.

Product packaging varies from store to store, so if you're selling your crops at a grocery store, it's always a good idea to have a conversation with them about packaging expectations. Below are a few ideas that may work well in packaging:

ACTIVITY 1.2

Copy the table below and use the information provided to develop a poster on "**Product value**

adding & packaging" of Agricultural products

PRODUCT	VALUE ADDING	PACKAGING MATERIAL
		Plastic 
		Metals (steel, tin, aluminium)
		Glass
		Wood
		Cardboard & papers

Rubric:

1. Neat, relevant picture on relevant category	12
2. Developed poster	02
TOTAL MARKS	14

Chapter 1. Module 1

1. Name the 4 factors of production that play a role in agricultural production. (4)
2. Discuss the importance of soil as a natural resource. (4)
3. Briefly explain how a farmer can obtain capital to assist in the production.
4. prosses of a commodity. (6)
5. Name the different types of capital found and give appropriate examples. (6)
6. Briefly discuss your understanding of credit. (4)
7. Name the Human resources playing a role in agricultural production and discuss each briefly. (6)
8. Explain the importance of the entrepreneur as a factor of production. (4)

Chapter 1. Module 2

1. How can we prevent pesticide mixtures polluting our natural resources?
2. Briefly describe soil degradation.
3. Which is the most common form of erosion?
4. Does erosion only take place on cultivated lands/fields?
5. Discuss how over grazing contribute to soil degradation and water pollution.
6. Why do thunderstorms often cause soil erosion?
7. What is the result of soil erosion?
8. How can organic matter in the soil help to prevent soil erosion?
9. Why should we never plough up and down the slope of the land?
10. How can we stop erosion in a gully?
11. Briefly discuss the role of vegetation in protection the soil.

Chapter 1. Module 3

1. What is a farming method? (2)
2. Give 6 aspects that will determine which farming method to follow. (6)
3. Name 4 different farming methods. (4)
4. What is the difference between an extensive farming method and an organic farming method.? (4)
5. Briefly discuss 5 other farming methods that is not known as traditional farming methods. (12)

Module answers

Chapter 1 Module 4 questions

2. Name 5 areas of the farm that need to be fenced off.
    1. Fields
    2. Camps
    3. Homestead
    4. Orchards
    5. Irrigation fields
    6. Wetlands

3. Briefly discuss the use of fences
    1. protect or divide property,
    2. improve the farms appearance and layout,
    3. partitioned various veld types to form camps where grazing can be utilised optimally and rested periodically according to seasonal requirements.
    4. Properly manage your veld – rotational grazing should be used
    5. confine animals - Fences protect stock against vermin and discourage stock thieving. Fences make it easy to divide farm stock into appropriately sized herds.
    6. or to exclude animals

4. Name the three types of fences.
    1. Permanent
    2. Temporary
    3. Electric fences

5. Discuss briefly how an electric fence operate.

    An electric fence energiser converts mains or battery power into a high voltage pulse. The energiser releases this pulse through an insulated wire onto the fence line approximately once every second. The pulse is commonly referred to as the shock which is felt when an animal or intruder contacts the fence.

6. Discuss the features of a good fence.
    1. Should be in a straight line, straining post to straining post.
    2. Corner posts and gate posts should be sturdy and vertical.
    3. Posts should be vertical and fence line the same height above ground.
    4. Straining posts not too far apart
    5. Fences should be planned for the type of animal to keep.
    6. Ensure passageways over or through fences for humans.
    7. Use always good material in setting your fence.

7. Why is it necessary to erect a temporary fence?
    1. Temporary fences are intended for use over a period of a few weeks or months. After that they will be removed and used in some other location or stored until needed.
    2. Movable fences cost less to build than permanent fences, but they are not as effective and will not last more than one to three years the way most of them are built.
    3. They do not take the place of permanent fences but can be beneficial in some instances.
    4. They are easily moved to allow pastures to be rotated and are especially desirable for intensive rotational grazing programs. They can also help adjust the size of a temporary pasture to the number of livestock being grazed.