The availability of this product is due to the financial support of the National Department of Agriculture and the AgriSETA. Terms and conditions apply.
Before we start...

Dear Learner - This Learner Guide contains all the information to acquire all the knowledge and skills leading to the unit standard:

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The full unit standard will be handed to you by your facilitator. Please read the unit standard at your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your facilitator.

This unit standard is one of the building blocks in the qualifications listed below. Please mark the qualification you are currently doing:

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Please mark the learning program you are enrolled in:

- Learnership
- Skills Program
- Short Course

Your facilitator should

You will also be handed a Learner Workbook. This Learner Workbook should be used in conjunction with this Learner Guide. The Learner Workbook contains the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed as part of your Portfolio of Evidence, which will be required during your final assessment.

You will be assessed during the course of your study. This is called *formative assessment*. You will also be assessed on completion of this unit standard. This is called *summative assessment*. Before your assessment, your assessor will discuss the unit standard with you.

Enjoy this learning experience!
How to use this guide ...

Throughout this guide, you will come across certain re-occurring "boxes". These boxes each represent a certain aspect of the learning process, containing information, which would help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:

**What does it mean?** Each learning field is characterized by unique terms and definitions – it is important to know and use these terms and definitions correctly. These terms and definitions are highlighted throughout the guide in this manner.

**ACTIVITY**

You will be requested to complete activities, which could be group activities, or individual activities. Please remember to complete the activities, as the facilitator will assess it and these will become part of your portfolio of evidence. Activities, whether group or individual activities, will be described in this box.

**Examples** of certain concepts or principles to help you contextualise them easier, will be shown in this box.

**How am I doing?** The following box indicates a summary of concepts that we have covered, and offers you an opportunity to ask questions to your facilitator if you are still feeling unsure of the concepts listed.

**My Notes ...**

You can use this box to jot down questions you might have, words that you do not understand, instructions given by the facilitator or explanations given by the facilitator or any other remarks that will help you to understand the work better.

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# What are we going to learn?

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What will I be able to do?

When you have achieved this unit standard, you will be able to:

♦ In this workbook you will gain knowledge about how to manipulate agricultural plants to grow it optimally and to obtain the highest quality crop from it.

Learning Outcomes

At the end of this learning module, you must is able to demonstrate a basic knowledge and understanding of:

♦ Names and functions of tools and materials used in plant manipulation.
♦ The use of elementary trellising methods.
♦ The use of elementary fruit and flower manipulation methods.
♦ The purpose of developing knowledge in the field of plant manipulation.
♦ The principles of pruning.
♦ The elementary guidelines applied in plant manipulation.
♦ Safe handling procedures of tools and material.
♦ The Occupational, Health and Safety Act.
♦ Maintaining hygienic procedures of tools and material as to prevent spreading of diseases.
♦ Elementary plant physiology and anatomy are relevant to pruning and manipulation.

What do I need to know?

It is expected of the learner attempting this unit standard to demonstrate competence against the following unit standards:

♦ NQF 1: Select, use and care for hand tools, basic equipment and infrastructure
♦ NQF 1: Demonstrate a basic understanding of the structure and function of a plant in relation to its environment.
♦ NQF 1: Demonstrate an understanding of the basic concept of sustainable farming systems.
Introduction

Growers often neglect the annual training and pruning of fruit trees. Without training and pruning, however, fruit trees will not develop proper shape and form. Properly trained and pruned trees will yield high quality fruit much earlier in their lives and live significantly longer.

A primary objective of training and pruning is to develop a strong tree framework that will support fruit production. Improperly trained fruit trees generally have very upright branch angles, which result in serious limb breakage under a heavy fruit load. This significantly reduces the productivity of the tree and may greatly reduce tree life. Another goal of annual training and pruning is to remove dead, diseased, or broken limbs.

Proper tree training also opens up the tree canopy to maximize light penetration. Light penetration is essential for flower bud development and optimal fruit set, flavor, and quality. Although a mature tree may be growing in full sun, a very dense canopy may not allow enough light to reach 12 to 18 inches inside the canopy. Opening the tree canopy also permits adequate air movement through the tree, which promotes rapid drying to minimize disease infection and allows thorough pesticide penetration. Additionally, a well shaped fruit tree is aesthetically pleasing, whether in a landscaped yard, garden, or commercial orchard.
Session 1 Using the right tools

After completing this session, you should be able to:
SO 1: Use tools and / or equipment for a pre-determined manipulation method in the correct way.

In this session we explore the following concepts:
♦ The right tools.

1.1 The right tools

There are various types of tools used in pruning and training of plants. The size of the plant material determines the best tool for the job. The section below discusses the major tools used, during pruning and manipulation.

Pruning Shears

Pruning or hand shears are used for cutting stems (branches) that are up to 2 cm in diameter.

There are 2 basic types of pruning shears.

The scissor-type shears have curved blades that overlap (scissor action) when making a cut.

Anvil-type shears have a sharp top blade that cuts against a flat surface (anvil). Each of the types of shears are available in various sizes.
In general the scissor-type shears are used on softer tissues such as when pruning young tomato shoots.

A sharp, scissor-type shears will make closer cuts and is less likely to crush stem tissue than anvil-type shears. However harder tissues such as dead branched of fruit trees will be more easily cut using an anvil type shears.

Hand shears are not of much use when stems larger than 2 cm diameter are pruned. Larger branches are better pruned using Lopping shears.

Types of pruning shears

As mentioned before, there are two common types of pruning shears: bypass and anvil. Bypass shears (scissor-type) have two curved blades that slide past each other like a pair of scissors (1). One blade is usually thick, with a mildly tapered edge; the other blade is thinner and sharpened. Anvil shears have one flat blade (anvil) and a second, straight-edged sharp blade that closes against the anvil (Figure 2). It is assumed that a bypass shears can make a neater cut, with less crushing and tearing of the wood, but testing has shown that bypass shears will actually crush the branch more than a sharp anvil shears. Most professional pruning shears are the bypass type; homeowner shears are available in both types

Maintenance

Cleaning the shear after use will prolong the life of the tool. A solvent may be required to remove sap from the blades. Avoid cutting anything except branches if you want to keep your blades in good condition. A pruning shear is not a wire cutter. Oiling the blade after cleaning will help prevent rust. The cutting blade should be sharpened as needed

Lopping Shears

Branches from 20 to 30 mm in diameter can be effectively cut with a lopping shears. Lopping shears are similar to hand shears, except that the blades are larger and stringer, attached to too long handles.

The long handles allow for greater leverage so cuts can be made through larger branches.

Lopping shears can also be used for pruning difficult-to-reach places.
Pruning Saws

- A pruning saw is used to cut on branches larger than 30 mm in diameter.
- Various types of pruning saw are available.
- A pole pruning saw is mounted on an extendable pole, allowing the user to reach the branches from.

Chain Saws

- Chain saws often used by when cutting branched from large trees.
- Chain saws consist of a motor driven chain that cuts through wood. Never use a chain saw unless training has been provided.

Other tools and materials used in the manipulation of plants

- Tying material
- Specialised Equipment – generally only used by researchers
  - Light intensity reader
  - Sunlight leaves Shadow leaves reader
Please complete Activity 1, 2 and 3 in your learner workbook

My Notes ...

<table>
<thead>
<tr>
<th>Concept (SO1)</th>
<th>I understand this concept</th>
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<td>The correct tools for the manipulation method are selected.</td>
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<td>Equipment is used safely and in such a way to prevent damage to tools and the plant material.</td>
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<tr>
<td>Tools or material are used appropriately to predetermined manipulation method.</td>
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My Notes ...

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Session 2

Developing frameworks as part of plant manipulation

After completing this session, you should be able to:
SO 2: Develop frameworks as part of plant manipulation methods.

In this session we explore the following concepts:

- Identify the correct stage of plant growth for the crop and the selected manipulation method.
- Develop the plant framework appropriate for the identified trellising system.

2.1 Plant training and trellising

Incorrect training of plants will interfere with the production of the crop. In tree crops poor shape has a direct effect on production and harvesting costs.

In tree crops unnecessary corrections made young trees often leave large wounds that are the ideal entry point diseases. Such wounds could also slow down the growth rate.

- Balanced growth in a Tree refers to balance between.
- Above soil parts and below soil.
- Sunlight exposed leaves and Shadowed leaves
- Old leaves and New leaves.

Some trees crops such as plums are may be trellised. This means that the trees are deliberately shaped into a specific shape to induce balance and make cultivation practices easier.

Production of crops such as tomatoes, cucumbers and peppers under protection, the plants are trained, pruned and trellised to increase growth and production. Trellising and pruning is also applied in certain field crops such as tobacco and field grown indeterminate tomato varieties.
Pruning vs. Training

Historically, fruit trees shape and structure have been maintained through pruning. Training plants, however, is a much more efficient and desirable way to develop shape and structure.

Pruning is the removal of a portion of a plant to correct or maintain its structure. Training is a practice in which the plant’s growth is directed into a predetermined desired shape and form. Training young plants is essential for proper development. In some fruit tree crops it may be better to direct tree growth with training rather than to correct it with pruning.

In deciduous fruit, pruning is mostly done during the winter, commonly referred to as dormant pruning. Training in these crops includes summer training and summer pruning as well as dormant pruning. The goal of tree training is to direct tree growth and minimize cutting.

Dormant Pruning vs. Summer Pruning

Trees respond differently to dormant and summer pruning.

Dormant pruning is done during late summer and autumn. If a large portion of the tree is removed during the winter, while the tree is dormant, the tree's energy reserves in the roots remain unchanged. In the spring, the tree responds by producing many new vigorous, upright shoots, called suckers, which can shade the tree and inhibit proper development. Heavy dormant pruning also promotes excessive vegetative vigor, which uses much of the tree's energy, leaving little for fruit growth and development.

Timing of dormant pruning is critical. Pruning should begin as late in the winter as possible to avoid cold injury. A good rule to follow is to prune the latest blooming trees first and the earliest blooming last. Another factor to consider is tree age. Within a particular fruit type, the oldest trees should be pruned first. Younger trees are more prone to winter injury from early pruning. The ideal timing for dormant pruning may differ between crops.

Summer pruning eliminates an energy loss of the food-producing portion of the tree and reduces tree growth. Pruning can begin as soon as the buds start to grow, but it is generally started after vegetative growth is several centimeters long. Summer pruning should be limited to removing the upright and vigorous current season's growth using only thinning cuts. To minimize the potential for winter injury, summer pruning should not be done after the end of July.

With the exception of single stemmed fruit trees like papaya and date palms, tropical and subtropical fruit trees are also pruned, mainly to ensure light penetration and to control tree size. In pineapples and bananas the fruit are borne at the tips of the stems and after harvesting the whole stem is removed. A new stem branching from the base of the old stem will produce the new crop.
## Types of Pruning Cuts

**Thinning Cut** - removes an entire shoot back to a side shoot. Thinning cuts do not invigorate the tree.

**Heading Cut** - removes only the terminal portion of a shoot. This type of cut promotes the growth of lower buds as well as several terminal buds below the cut.

**Bench Cut** - removes vigorous, upright shoots back to side branches that are relatively flat and outward growing. Bench cuts are used to open up the centre of the tree and spread the branches outward. *This is a major cut and should only be used when necessary.*

When making pruning cuts, it is important to use techniques that will allow the cut surface to heal quickly. Rapid healing minimizes the incidence of disease and insect infection. Pruning cuts should always be flush with the adjacent branch without leaving stubs.

Many wound dressing or pruning paints are available as. The ideal treatment is to make proper pruning cuts and allow the tree to heal naturally.

### 2.2 Training tree crops

Since field crops are not trained and tropical fruit trees are not normally trained in the same way as deciduous trees, this section will only deal with frameworks on deciduous trees.

The shape of the tree to which it is to be trained vary widely. select This section focuses primarily on the central leader and open centre training systems used in medium density orchards. A list of fruit trees conventionally trained to each system is also included. A fruit tree may be trained to any system. Depending on the form and function of the desired shape, you may want to train a tree to a non-traditional system.

Whatever system is chosen, keep in mind that the objectives of training and pruning are to achieve maximum tree life and productivity.

#### Central Leader Training - Apple, Cherry, Pear, Pecan, Plum

A central leader tree is characterized by one main, upright trunk, referred to as the leader. Branching generally begins on the leader 35 to 90 cm above the soil surface allowing movement under the tree.

During the first year, 3 to 4 branches, (collectively called a *scaffold whorl*), are selected. The selected scaffolds should be uniformly spaced around the trunk, not directly across from or above one another. Above the first scaffold whorl, leave an area of approximately 36 to 60 cm free of branches to allow light into the centre of the tree. This light slot is followed with another whorl of scaffolds. Alternating scaffold whorls and light slots are maintained up the leader to the desired maximum tree height (See Figure 1).
The shape of a properly trained central leader tree is similar to that of a Christmas tree. The lowest scaffold whorl branches will be the longest and the higher scaffold whorl branches will be progressively shorter to allow maximum light penetration into the entire tree.

**Developing a central leader trained tree at planting**

Fruit trees are frequently purchased as un-branched whips ranging from 10 to 20 mm diameter. The tree should be planted in early winter with the graft union approximately 5 cm above the soil surface. Just before the buds start to grow in the spring, the tree should be headed, or cut off, 80 to 90 cm above the soil surface. The height at which the tree is headed depends upon where you want the first whorl of branches to develop. Once the tree is headed, the permanent branches are selected from buds growing within 10 to 30 cm below the heading cut (see Figures 1 and 2).
Figure 1. Pruning a central leader tree

**At Planting**
As the buds begin to swell, head the tree at 75 to 90 cm above the soil surface.

**Dormant Pruning**
Head the tree at 60 to 76 cm above the highest branch of the first scaffold whorl.

**Top View**

**First-Year Summer Pruning**
Summer prune when new growth is 8 to 10 cm long. Leave a as the new leader, and remove b and c. Select four uniformly spaced laterals for the first scaffold whorl, and remove the remaining lateral branches.

**After pruning the third year**
Three scaffold whorls have been developed with three to four branches uniformly spaced around the tree in each whorl. A light slot of 45 to 60 cm is left between each scaffold whorl. Note the Christmas-tree shape that allows light penetration to the lower branches and interior of the tree.

**Steps in Pruning:**
Leave only one trunk for the central leader. Remove branches with crotch angles less than 60 degrees. Remove all branches directly across from one another on the leader. Space lateral branches uniformly around the leader to prevent crowding as the limbs grow in diameter.
Figure 2 Newly planted apple tree which has been headed back

Summer pruning

After the new vegetative growth has reached 8 to 10 cm in length, summer pruning should begin. The first step is to select one upright shoot near the top of the tree which is to become the leader. After selecting the leader shoot, remove all other competing shoots for approximately 10 cm below it and re head the tree above this leader (See Figures 3 and 4).
At this time, side shoots (laterals) should be spread out to form an angle of 60 to 70 degrees between the leader and the side shoots. This angle is referred to as the branch or crotch angle. Branches that do not have a wide branch angle are overly vigorous and have a weak point of attachment to the leader. These branches frequently break under a heavy fruit load. Spreading the lateral branches will also slow the growth of the branches to a manageable level and promotes the development of secondary or side shoots on the scaffolds. When growth is 7 to 10 centimeter, toothpicks or springed clothespins can be used to spread branches (See Figure 5). After the branch angle is attained, clothes pegs are moved to the ends of longer limbs to weigh down the branches as they start to grow upward.
During the first year, limit pruning to the removal of shoots growing upright or downward. Summer is the optimal time to select the leader and scaffold branches and remove undesirable growth. Branches lower than the desired height should also be removed. A young orchard or tree should be summer trained and pruned once a month through July to remove unwanted growth and to properly orientate young branches. Summer pruning will greatly reduce the amount of dormant pruning needed.

Failure to summer prune in the first year will result in an improperly trained tree, and drastic dormant pruning will be required to correct tree structure.

**Succeeding Years**

Managing the central leader is one of the most important aspects of dormant pruning. The leader should be headed at approximately 60 to 80 cm above the highest whorl of scaffolds to promote continued branching and scaffold whorl development. Dormant pruning should also eliminate dead, diseased, and damaged wood. Unwanted growth, such as upright growing shoots and laterals with sharp branch angles not removed during summer pruning, should also be removed at this time. Un-branched lateral branches should be headed back by approximately 1/4 of their length to encourage side branches and to stiffen lateral branches.

Summer pruning in succeeding years should eliminate competing shoots where dormant heading cuts were made (on the central leader and laterals) as in the first year. Summer is also the optimal time to remove unwanted side shoots and excessive growth. All laterals should have a wide branch angle, and spreading of lateral branches is essential for many varieties. Lateral branches will need to be spread for about the first five years, using a larger spreader each year.

Spreaders can be made with 6.5 cm² wood pieces with a finishing nail driven in the end and cut off at an angle. Spreaders are frequently made in lengths of 15, 30, and 46 cm (See Figure 6).

**Figure 6. Wooden limb spreaders can be made from wood and finishing nails in various lengths.**

Spreading branches in later years reduces vigour and promotes fruit development on the lateral branches. The reduced growth rate and the weight of the crop load will also help pull the branches down to a proper angle. However, it is important
that the young tree is not allowed to crop too early where the weight of the fruit pulls the branches below horizontal. Once the branches are below horizontal, they are weak and non-productive and need to be removed and replaced (See Figure 7).

![Figure 7 Well-trained apple trees. Note the branch angles and the development of scaffold whorls.](image)

Another objective of dormant pruning is to control the length of the lateral branches. In order to maintain the Christmas tree shape (Figure 1), lateral branches need to be cut back. Once the tree has reached its desired height and lateral spread, it will be necessary to mold and hold the lateral branches and the central leader with heading cuts. This can be done by cutting the laterals and leader back into two year old wood to a side growing shoot. It is a good rule to cut back to a side shoot that is close to the same diameter as the lateral or leader being cut.

### Mature Trees

Mature trees that have been properly trained and summer pruned will require minimal pruning. The first step would be to remove dead, diseased, and damaged wood and then upright shoots and shoots below horizontal. To prevent shading, it is important to maintain the Christmas tree shape by heading lateral branches with mold and hold cuts. See Figure 8. For quality fruit production, it is also essential that the light slots between the scaffold whorls be maintained.

![Figure 8. Mature, well-trained apple trees, left, and pecan trees, right. Note that the distance between branches needs to be increased for larger trees.](image)
Mature fruit trees that have not been properly trained frequently do not have a true central leader shape. For those trees, the objectives of training and pruning as discussed earlier must be considered. In many cases, too many lateral branches and upright limbs (some may be 6 or more inches in diameter) have been left and need to be removed to allow proper light penetration. This pruning needs to be done during the dormant season.

Neglected trees often have overgrown tops that act as an umbrella, shading the rest of the tree. The tops of these trees need to be cut back or removed. Remember, if the principles of pruning are followed, there are no perfect cuts and no incorrect cuts. However, do not remove more than 30 percent of the tree top to avoid shifting the tree into an excessively vegetative state with little fruit development.

**Modifications of the Central Leader**

♦ Multi-leader Tree

A multi-leader tree is the goal of another training system and an ideal option for pear varieties that are susceptible to firelight. With a multi-leader tree, if one leader is infected with firelight, it may be removed without loss of the major portion of the tree. See Figure 9.

Figure 9. An apple tree trained to a multi-leader system. This would be an ideal training system for pear trees in North Carolina where firelight is a threat.

The multi leader tree uses the same concept as the central leader tree except there are several leaders in the center of the tree. Each leader is maintained the same as an individual central leader tree. The only difference in training a multi leader from the central leader is that in the first and second year instead of removing the competing leaders, several should be left and maintained. On the tree in Figure 1, it would be necessary to leave shoots a, b, and c for a multi leader tree. However,
it would be necessary to put spreaders between the selected leaders to get the shape of the tree in Figure 9.

♦ Higher Density Central Leader Training Systems

In the commercial apple industry, there is much interest in higher density orchards with 1,000 or more trees per acre. The first requirement for higher density systems is smaller trees, which is accomplished with size controlling rootstocks. Two of the better known higher density training systems is the slender spindle and vertical axe. Both are modified central leader trees with branches continually along the central leader to the top of the tree. Light penetration is not a problem as the maximum height of the tree is limited to approximately 6 to 12 feet, with a canopy spread of 3 to 4 feet outward from the leader.

There are many other types of higher density training systems, some with elaborate trellis systems. The slender spindle type tree is the most popular high density training system. High density training systems, however, will not be discussed in this bulletin because of the differences in management practices.

♦ Open Center or Vase Training – Peach, Nectarine, Plum

With the open center system, the leader is removed, leaving an open center. Instead of having a central leader, the open center tree has 3 to 5 major limbs, called scaffolds, coming out from the trunk. This training system allows for adequate light penetration into the tree, which minimizes the shading problem prevalent in higher vigor trees such as peach.

♦ At Planting

At planting, peach trees should be set so that the graft union will be 5cm above the soil surface. As the buds begin to swell, the unbranched trees (whips) are generally headed approximately 76 to 90 cm above the soil surface. As discussed with the central leader system, new branches will come from the buds that are 15 to 23 cm below the heading cut.

Trees that are branched at planting are handled differently than the whips. The work that needs to be done under the tree determines the appropriate height for branching, which is usually 60 to 80 cm. Remove branches that are too low. If there are 3 to 4 uniformly spaced branches around the tree that can be selected as scaffolds, the tree is headed just above the highest selected scaffold. Any remaining branches not selected as scaffolds should be removed. However, if there are less than 3 scaffolds the tree should be cut back to a whip and the side branches removed. See Figures 10a and 10b.

■ Summer Pruning

After the new vegetative growth is approximately 3 to 4 inches long, it is time to select the shoots that will become the major scaffolds. The lowest scaffold should be 24 to 32 inches above the soil surface to avoid interfering with cultural work under the tree, such as harvesting and weed control. It is best to select 3 to 4 scaffolds that are uniformly spaced around the tree, with wide branch angles, and not directly across from another scaffold. See Figure 10a.
Figure 10a. Training and pruning young peach trees. 
Left: Well-branched peach tree to be trained to an open-center system. 
Right: 3 to 5 well-spaced scaffolds are selected and the tree is headed above the highest scaffold.

During the summer, these shoots should be spread out to a 45 to 60 degree angle and held in place with a toothpick or clothespin. All other upright growth should be removed. It is best to come back through every month during the summer to remove upright growth that is shading the primary scaffolds and to make sure that the scaffolds have been spread to a proper angle. Many times the crotch angle is proper initially, but as the scaffolds grow, they turn upright.

A spring clothespin placed on or near the end of a shoot will pull the scaffold down to a proper angle. Extreme care must be taken when using the clothespins as weights. Periodic checking is essential to assure that the scaffolds are not too flat.

Figure 10b. Training and pruning young peach trees. 
Left: Tree after heading, branches lower than 60 cm are also removed. 
Right: Top view of uniformly spaced scaffolds.
Succeeding Years

After the first year of growth, the primary scaffolds should be selected and properly trained outward. Scaffolds should be headed during the dormant season of the first three years to promote continued lateral branching on the scaffolds and to stiffen and strengthen the scaffold. Scaffolds should be headed to outward growing shoots similar in angle to those being removed. Bench cuts should be avoided. See Figure 11a.

Figure 11a. The dormant pruning of a mature open-center peach tree. Left: Tree before pruning. Right: Heading a scaffold to an outward growing shoot.

If summer pruning is being practiced, undesirable shoot growth can be removed as soon as growth is 4 to 6 inches long. Summer pruning can also be used to direct scaffold growth outward to the desired growing points instead of waiting until the dormant season.

For bearing trees, the goal of dormant pruning is to remove vigorous upright growth on the scaffolds and trunk that was not removed during the summer. See Figure 11b.
Figure 11b. The dormant pruning of a mature open-center peach tree.
Left: Removal of vigorous upright shoots in the center of the tree.
Right: Tree after pruning.

The upright growth left in the tree during the growing season may shade out lateral growth near the trunk. This shading causes lateral fruiting wood only on the ends of the scaffolds, which results in broken scaffolds under a heavy fruit load. It is best to keep the fruiting wood on the scaffolds as close to the tree trunk as possible to reduce tree breakage and to produce the highest quality fruit.

Also, during the dormant season, damaged, dead, and diseased wood, such as cankers, should be removed from the tree. Shoots with shriveled and dried fruit from the previous season, called mummies, should also be removed from the orchard to reduce disease pressure for the coming season.

2.3 Canopy management

Canopy management refers to the way in which tree leaf cover is managed to ensure that:

♦ The correct amount of sunlight reaches the leaves for photosynthesis.
♦ The correct light conditions occur within the canopy (which will affect e.g. fertility) and make sure that all leaves contribute to photosynthesis.
♦ The canopy is well aerated which assists with improved disease control and lower need for chemical spraying.
♦ Lower humidity occurs less around the Fruit, so the risk of disease is lowered.
♦ More free air moves through the canopy to ensure that Fruit/leaves/shoots dry off quickly after irrigation/rain and so prevent fungal diseases, while also reducing the need for chemicals against disease.
♦ Overall, a better quality Fruit is obtained.

Goals of canopy management includes:

♦ Vegetative growth and Fruit development compete with each other for the products of Photosynthesis.
♦ Excessive vegetative growth causes problems of competition between the shoot growth tips and the Fruit for nutrients.
Excessive vegetative growth overshadow the canopy in the Fruit zone.
Excessive vegetative growth causes uneven ripening since all Fruit aren’t exposed to the same light conditions. Similar problems occur regarding colouring of Fruit.
Overshadowing will decrease bud fertility—the buds depend on sunlight to retain fertility, i.e. to produce leaves, tendrils, shoots, Fruit in future.
The shoots will ripen poorly and be inferior future shoots for fruit production.
If there are too many leaves in the canopy, problems are observed with humidity (causes rot and disease) and poor aeration (contributes to disease).

Please complete Activity 5, 6 & 7 in your learner workbook

<table>
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<th>Concept (SO 2)</th>
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<th>Questions that I still would like to ask</th>
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<tr>
<td>The correct manipulation method is identified.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The correct stage of plant growth for the crop and the selected manipulation method is identified.</td>
<td></td>
<td></td>
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<tr>
<td>The manipulation method is executed correctly.</td>
<td></td>
<td></td>
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<tr>
<td>Trellising methods may include, but are not limited to, Central leader system, Tattura system, two-wire system, slanted cap, factory-cap, and/or Façade system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The trellis is applied by taking into account the height of the stem, the spacing of bearers, shoots and spindles.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The plant framework is developed appropriate for the identified trellising system.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The growing points and bearing units are manipulated according to the identified trellising method.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The plant is shaped to determine the position of bearing units according to the identified cultivation practice.</td>
<td></td>
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</tr>
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</table>
Session 3

Understand flower and fruit management principles

After completing this session, you should be able to:
SO 3: Understand flower and fruit manipulation principles.

In this session we explore the following concepts:
♦ To understand the flower and fruit manipulation principles.
♦ Identify the correct spray chemicals for flower/fruit manipulation.

3.1 Leaf thinning

This is when leaves are removed from the base of the shoot. It is done in cultivars sensitive to rotting, removing some leaves around the fruit give the fruit better exposure to sunlight, sprays and prevents humidity for 2 reasons:
♦ In cultivars that grow very lush removing some leaves prevents overly dense canopies. This often includes removing up to a 1/3 of the leaves from the base to the apical tip.
3.2 Bud break and dormancy
Deciduous fruit require a minimum number of cold units (cold unit = 1 hour below 7°C) to break bud dormancy (trigger the flower and vegetative buds to open. Apple trees are more prone to bud dormancy if winters are not cold enough, trees can then be sprayed with chemicals* that will break bud dormancy. Subtropical fruit crops like mangoes, avocados and litchis also need a cold period during winter for flower induction and chemical sprays can also be used in cases of insufficient cold.
Chemical sprays that are also used to prevent excessive fruit drop if fruit set is low. In order to produce high quality fruit, the number of fruit per tree must be reduced in cases of high fruit set. Manual thinning by experienced workers is a standard practice, but chemicals are also available for fruit thinning.

**Chemical manipulation**

The chemicals used are plant growth regulators and/or hormones that regulate metabolic processes in plants. A list of these chemicals and recommendations for their use in different crops is available in a publication “A Guide The Use of Plant Growth Regulants, Defoliants and Desiccants” published by, and available from the National Department of Agriculture, Directorate of Agricultural Production Inputs.

In general ethylene, available as ‘Ethephon’ is used on different crops for flower induction (pineapples), for improving fruit colour (citrus, pineapples, apples, cherries etc). **Gibberellic Acid**, also referred to as 'gibberellins’ is used for delaying harvest (citrus), fruit-set improvement (pears), chemical thinning (grapes), flower inhibition (mangoes), and berry size improvement (grapes). **Paclobutrazol** is a growth retardant used in different tree crops and ornamentals to control the size of trees and shrubs.

The internodes of branches of treated trees are much shorter than those of untreated trees. The same chemical can in some cases be used to stimulate flowering.

**Auxins and cytokinins** are used in different crops for yield increase (maize, Lucerne, barley, chicory, citrus etc.

Pruning is another way of reducing the number of fruit per tree by thinning out bearing shoots as in peaches, or spurs as in pears and apricots. A spur is a very short branch that can produce flowers and fruit for more than one season. Manual fruit thinning is a standard procedure that is applied in many fruit bearing crops.

My Notes …

Please complete Activity 8 and 9 in your learner workbook
<table>
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<th>Concept (SO 3)</th>
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<tr>
<td>Fruit and flower manipulation principles are listed.</td>
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<td></td>
</tr>
<tr>
<td>The correct spray chemicals for flower/fruit manipulation are identified.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical manipulation on the fruit and flowers of an identified crop is carried out correctly.</td>
<td></td>
<td></td>
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My Notes ...
Session 4

Apply simple, correct pruning principles appropriate to the crop

After completing this session, you should be able to:
SO 4: Apply correct simple pruning principles appropriate to the crop.

In this session we explore the following concepts:

- Explain the elementary pruning principles.
- Execute the pruning actions correctly.

4.1 Apple pruning

Tree Form - Apple
All scaffold limbs evenly distributed around the tree.

Figure 11. A tree properly trained to a modified central leader after the third dormant season.

Figure 12. A bearing tree with a proper tree framework.

Figure 13. A bearing tree properly trained to a central leader training system.
Figure 14. A bearing tree trained to a multiple leader training system.

Figure 15. Single whip (a) or branched peach tree (b,c) as received from the nursery with appropriate training cuts. ( = pruning cut).
Fruit trees are trained one of four basic methods: a modified central leader, a central leader, a multiple leader, or an open centre. Since a modified central leader is the most widely accepted system, it will be discussed first.

4.2 Training methods

Fruit trees are trained one of four basic methods: A modified central leader, a central leader, a multiple leader, or an open centre. Since a modified central leader is the most widely accepted system, it will be discussed first.

4.3 Pruning mature trees

The two main objectives in pruning mature trees are to maintain appropriate height and spread and to renew good fruiting wood. If the tree has been pruned every year, shoot growth and fruiting wood should be fairly well distributed throughout the tree. Continue to prevent unbalanced or dense growth by selective thinning.
A poorly trained tree often possesses upper limbs that shade the lower along with an excessive amount of suckers (Figures 18, 19). First, correct this inefficient tree shape by pruning the top heavier than the bottom in an effort to gradually obtain a conical-shaped tree. A good place to cut an umbrella shaped limb is just before it begins to droop downward.

Always head to an upward growing lateral whenever possible. Heading cuts should be used to stiffen flimsy shoots, which may break with the weight of a fruit load.

Figure 18. A neglected apple tree in need of corrective pruning. Upper limbs tend to shade the lower limbs. Suckers and water sprouts are abundant. Scaffold limbs should be headed back over a 2 or 3 year period. Upper limbs should be correctly pruned before lower limbs. Whenever possible, head to an upward growing lateral. Remove some water sprouts completely and some partially. ( ≠ pruning cut).

Training and pruning of apple

Dwarf and Semi-dwarf Apple cultivars grown on dwarfing or semi-dwarfing rootstocks with less than 3 and 5 m within and between row spacing, respectively, are best trained to a central leader system. Trees grown in this intensive manner may require stakes or a wire trellis for support. To help maintain an upright central leader, remove flower blossoms from the leader to prevent bending from a fruit load. Confine tree height to between 2.5 to 3.5 m. Scaffold limbs may be pruned as needed to control tree width, to induce branching and to stiffen the limb.
Cultivars grown on a semi-dwarfing rootstock such as MM 106 or MM 111, which will achieve 65-85% of standard tree size, are not usually staked and are grown at wider spacing.

The training and pruning system recommended for most apple cultivars on semi-dwarfing rootstocks in non-intensive planting is the modified central leader.

**Spur-type Apple** Spur-type apple trees such as 'Star krimson', 'Goldspur', 'Grandspur', 'Lawspur', 'Romespur', and 'Starkspur' cultivars are generally trained to a central leader or a modified central leader system. Spur-type trees should possess a greater number of scaffold limbs (6 to 10) than non-spur trees and tend to be about 70% the size of a non-spur tree. They are known as spur-type trees because they produce many small spurs instead of shoots. These long-lived spurs produce most of the fruit and as a consequence, the fruiting area remains close to the trunk. Also since these spurs are long-lived, there is not as much need to prune in order to stimulate new fruiting wood.

Clothespins during the first year and wire spreaders or notched boards during the subsequent years should be used to widen the crotch angles of scaffold limbs since there is a tendency for these spur-type apples to produce upright growth with narrow crotch angles. Spreading helps to initiate early fruit bud formation and earlier bearing. If lower scaffold limbs become low in vigour or if there is a need to renew fruiting wood, one may head back scaffold limbs in an effort to increase productivity.

**Standard Non-spur Delicious Apple** Generally a modified central leader or a multiple leader is recommended over a central leader training system. These full size trees produce many branches with relatively wide crotch angles. Fruit is borne on shoots and spurs and the fruiting zone tends to move toward the outside of the tree. Spurs of non-spur 'Delicious' are productive for only a relatively short time compared to spur-type trees. Therefore limbs with older spur systems should be pruned regularly. Some pruning of the tree interior will help encourage productive fruiting wood to form in this area. Yearly pruning is essential to confine tree size since mature apple trees are often 45 feet in height and spread.

**Tip Bearing Apples** Cultivars such as 'Granny Smith' and 'Rome Beauty' have a strong upward growth habit and as a result produce limbs with narrow crotch angles. Fruit laden scaffold limbs sometimes require some kind of support. Due to their inherent growth characteristics a central leader training method is best. More fruit is borne on one-year-wood compared to other apple cultivars.

The fruiting zone tends to move toward the periphery of the tree. Therefore, pruning should encourage the development of young one- to three-year-old wood by numerous small to medium thinning cuts toward the outside of the tree. One must prune to limit tree spread before it interferes with cultural operations.

**The need for pruning**

Trees are pruned to maintain a specific shape, size, quantity & quality of crop that comes from your Orchard.
If no pruning is done

♦ The plants will grow wild.
♦ The plants will outgrow the trellis that you have put in place.
♦ The number of Fruit that grow will increase dramatically, but the quality will become unacceptable.
♦ Each Tree will not produce the best quantity & quality Fruit in balance.
♦ All the different Trees will start producing different quantities & quality of Fruit.
♦ Eventually your Orchard will not produce any real Fruit for harvesting.

The reasons for pruning

♦ Pruning of fruit trees is done when the plants are dormant and cannot be damaged by the pruning process.
♦ In South Africa pruning is normally done between July and the end of August.

There are no hard and fast rules that dictate the shape into which a tree should be pruned, but each Tree is pruned according to its own merits according to:

♦ The cultivars.
♦ The shape of the trellis system.
♦ The yield desired (the amount of fruit per Ha).
♦ The quality of the fruit required.

4.4 Basic anatomical feature

When pruning large limbs and branches of woody plants, it is important to learn to recognize the branch bark ridge (BBR) or branch collar.
This key anatomical feature is a unique part of a tree or shrub’s structure, which is critical to healing and wound wood production.

The appearance of the branch bark ridge can vary from species to species.

However, it is generally recognized as a slightly swollen area where a branch meets a limb or the main trunk.

When making a pruning cut, it is important to cut just to the outside of the BBR, thereby leaving this structure in place.

Incorrect cuts include those made too far away from the BBR, which leave a stub, and those cut flush to the trunk or limb, which remove the BBR in the pruning process).
Position of Shears:

In order to make a good cut, pruning shears need to be held correctly.

◊ They should be held upright since they are designed to cut properly in this position.
◊ Here, left- and right-handed shears can be an important factor.

If shears are held upside-down, they will not be in the correct position, angle, or orientation to make a clean, controlled cut.

Proper Pruning Cuts--Small Branches and Twigs:

There are three things to consider when making cuts on small branches and twigs:

◊ Angle of cut: in order to optimize the surface area of the cut for healing, cuts should be made at a 45° angle (Figure 2).
◊ Distance to the next bud: the optimum distance to the next bud is about ½ inch. When cuts are made closer or farther away, the bud is damaged or too long a stub remains, respectively, and healing will be inhibited).
◊ Inward- vs. outward-facing buds: this can be used to manipulate the direction of the new growth and the shape of the plant. By pruning back to an inward-facing bud, the new growth will be toward the centre of the plant, which will make it denser. Pruning back to an outward-facing bud will produce new growth away from the centre of the plant and make it more open (Figure 3).
Many mistakes are made when people prune large or heavy branches. In many cases, the pruning process often results in damage to the tree. Pruning of a large or heavy limb (any limb greater than about 2 inches in diameter) should be a three-step process in order to avoid tearing or ripping the bark while making the cut. When a single cut is used, the weight of the branch or limb may cause the limb and bark to tear several feet down the trunk before the cut is completed.

**Three-Step Process (Figure 4):**

*First Cut:* this cut is made at the underside or bottom of the limb, approximately 11-12 inches from the trunk. The cut should be made about halfway into the branch.

*Second Cut:* this cut is made on the top of the limb, approximately 15 inches from the trunk (i.e., farther than the first cut). This cut removes most of the branch or limb.

*Third Cut:* the final cut is made at the branch bark ridge. Since the weight of the limb has been removed, this final cut can be made with precision and without the risk of damage to the bark.
Harmful Practices

Pruning Paints and Dressings:

The use of pruning paints and dressings has been a controversial issue over the years.

Current research indicates that there is minimal value in treating correctly pruned cuts, since the branch bark ridge and subsequent wound wood production by the tree or shrub are the best defenses against disease organisms and insects.

This current suggestion is based on scientific rather than the anecdotal or "emotional" evidence of the past.

Research has determined that, in many cases, pruning paints and dressings, particularly those made with turpentine, mineral spirits, creosote, or pentachlorophenol compounds, actually seal in moisture and potential disease organisms and inhibit natural wound healing and wound wood production by killing the wood.
Pruning dressings usually serve a purely cosmetic, emotional purpose. Although they make you feel better, they can actually harm the tree.

**Pruning vs. Shearing:**

Most people don’t distinguish between these techniques since both are used to remove unwanted plant growth. However, *pruning* is the focus of this discussion. Pruning is the process when individual branches are cut selectively. Shearing is the process when all branches are cut indiscriminately. The latter technique is useful in specialized situations such as maintaining formal hedges or topiaries.

### 4.5 Formative pruning

**The maiden tree**

A maiden whip (that is, a one year old tree with no side shoots) should be pruned to a bud with two buds below it at about 30” from the ground immediately after planting in order to produce primary branches during the first growing season.

A feathered maiden (that is, a one year old tree with several side branches) should have its main stem pruned back to three or four strong shoots at 30” from the ground. Side shoots should be shortened by two thirds of their length to an upward or outward facing bud. Lower shoots should be removed flush with the stem.

**The two year old tree**

Remove any lower shoots and prune between three and five of the best placed shoots by half to an upwards or outwards facing bud in order to form what will become the tree’s main structural branches.

Remove any inwards facing shoots.

**The three year old tree**

Prune the leading shoots of branches selected to extend the framework by half to a bud facing in the desired direction. Select four good laterals to fill the framework and shorten these by a half. Prune any remaining laterals to four buds to form fruiting spurs.

**The four year old tree**

The tree will have begun to fruit and only limited formative pruning is now required. Shorten leaders by one third and prune laterals not required to extend the framework to four buds.

**From year five onwards**

The tree is considered to be established and should be annually pruned as described in the following section.

There are basically three types of pruning that are applied once the main shape of the tree has been established. These are:
Manipulate plants

Primary Agriculture
NQF Level 1
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Spur pruning;
Spur bearing varieties form spurs naturally, but spur growth can also be induced.

Renewal pruning;
This also depends on the tendency of many apple and pear trees to form flower buds on unpruned two year old laterals. It is a technique best utilised for the strong laterals on the outer part of the tree where there is room for such growth.

Regulatory pruning;
This is carried out on the tree as a whole, and is aimed at keeping the tree and it’s environment healthy, eg, by keeping the centre open so that air can circulate, removing dead or diseased wood, preventing branches from becoming over crowded (branches should be roughly 18” apart and spurs not less than 9” apart along the branch framework), and preventing any branches from crossing.

Pruning of tip bearers
Tip bearers should be pruned lightly in winter using the regulatory system (see above). Any maiden shoots less than 9” in length should be left untouched as they have fruit buds at their tips. Longer shoots are spur pruned to prevent overcrowding and to stimulate the production of shorter tip bearing shoots the following year. Branch leaders are ‘tipped’, removing the top three or four buds to a bud facing in the desired direction to make them branch out and so produce more tip bearing shoots.

The Pruning technique step by step

Cut out dead, diseased or damaged branches. Cut back into healthy wood below the injury or disease at the base of the plant. A dead or injured branch offers an opportunity for insects and rot organisms to enter. Remove such wood as soon as you notice it.

Cut back wayward or overgrown stems. Remove about one-third of the total number of overgrown stems. Cut back to base of plant all branches that cross or rub against each other.

Remove about one-third of all old mature stems at ground level.

Remove all withered flower clusters unless fruit is desired. Cut back to nearest bud.

Try to maintain the natural shape of the plant: shrubs are pruned, not sheared like hedges or poodles.

Don't cut too much off at any one time. This can spoil the appearance of a shrub for a long time.

Do not cut all shoots the same height. This makes the plant flat on top.
Avoid removing new shoots at the base of the plant unless you want to limit the size of the plant.

Training and pruning Deciduous Fruit Trees

Training and pruning are two most important but often neglected cultural practices. The best training and pruning system depends upon the tree type (species and cultivar). Pruning Severity is determined by the rootstock, tree age, tree vigor and management objectives. Proper training from the beginning will help promote a strong, productive tree, which requires a minimum of pruning later in life.

This bulletin describes types of pruning cuts, reasons for training and pruning, pruning terminology, pruning and tools, when to prune, general rules of training and pruning, training methods, pruning mature trees and accepted methods of training and pruning for different tree types.

Types of pruning cut

There are two basic types of pruning cuts with each serving a specific function:

- **Heading cut.** In this type of cut the tip of a branch or shoot is cut off, thereby inducing lateral branching and a stiffening of the branch (Figure 1a). When a heading cut is made, it may be necessary to prune back some of the resulting growth. A type of heading cut is a heading to a lateral cut where the shoot is cut off directly above a lateral branch. Less new growth will result from this type of cut than a heading cut or a thinning cut.

- **Thinning cut.** This type of cut involves the complete removal of unwanted side branches (Figure 1c). Depending on the crotch angle and branch position, it may be desirable to maintain the branch and head it back some distance from the trunk. (Figure 1b), thus changing the direction of growth of the tree.

Figure 1. Basic types of pruning cuts: (a) heading cut; (b) heading to laterals; (c) thinning cuts (= pruning cut).
**Making the cut**

Pruning cuts should be close as possible to the parent branch, leaving little or no stub (Figure 4). Avoid damaging the bark. When sawing off large limbs, first undercut the limb some distance from the trunk, and then cut from above a few inches further out (Figure 4). The remaining stub should then be cut off parallel to the trunk.

![Figure 4](image_url)

**Deciding on Fertile vs. Infertile shoots or bearers.**

- When you are standing in front of a Tree you have to make some very important decisions with regards to deciding what to leave and what to cut away.
- This is called deciding to choose “fertile” vs. “infertile” shoots.
- It is quite a specialized selection principle, which you will once again only really learn through practice and experience.
- Remember that the fruit that will form in say 2006 has already been influenced by the season of 2004 (i.e. 2 years in advance).
- Generally you will regard only shoots that are at least pencil thickness as worthwhile to keep working with.
- Cut away anything that isn’t growing on top of anything else that is already into its 2nd year of growth.
- When you start cutting bearers, make sure you cut from the inside out (i.e. first of the bearers closest to where the 2 cordon arms fork).
- When you cut a bearer on the left, there has to be one that balances it on the right.
If you get to a point where there is no bearer to balance the bearer on the other arm, you’ll cut the lateral down to the very basal bud. You’ll be shown this in practice.

When you cut a certain amount of bearers on the right cordon arm here has to be the exact amount of bearers on the left cordon arm.

Both cordon arms need to be developed to the same length each time.

You will always cut back to the lower bud position to prevent the build up of bearer positions or infertile bearers.

The buds that we choose for forming cordon arms, laterals & bearers are very important.

There are many aspects that will influence whether they are strong or weak and what their “growth potential” really is.

These factors are:

- Bud position on cane.
- Spacing of bearers
- Light intensity.
- Length of day.
- Temperature.
- Water stress.
- Growth vigour.
- Leaf surface.
- Optimum budding percentage.

If you have too much growth i.e. too many leaves, you place the buds in too much shade, causing less light intensity & less fertile buds.

Please complete Activity 10 & 11 in your learner workbook

My Notes …
### Concept (SO 4) | I understand this concept | Questions that I still would like to ask
---|---|---
Elementary pruning principles are explained. |  |  
The appropriate pruning method for a specified crop is identified. |  |  
Unwanted growth is removed according to the pre-determined manipulation method. |  |  
Unwanted growth includes, but is not limited to shoots, branches, stems, etc. |  |  
Pruning actions are executed correctly. |  |  

**My Notes ...**
# Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Canopy</td>
<td>The crown of a tree or shrub.</td>
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<tr>
<td><strong>Central leader training system</strong></td>
<td>A tree training system where the main vertical trunk remains dominant with scaffold branches arising from its side in almost horizontal direction.</td>
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<td>Deciduous</td>
<td>Term applied to perennial plants that loose their leaves during winter when entering a dormant period.</td>
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<tr>
<td>Dormant buds</td>
<td>Resting buds on a tree usually covered with bracts that will sprout as soon as favorable environmental conditions avail.</td>
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<tr>
<td>Dormant pruning</td>
<td>Pruning during a period when buds are dormant, usually in winter.</td>
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<tr>
<td>Fruit thinning</td>
<td>Manual or chemical removal of some fruit on a plant to improve the quality of the remaining fruit</td>
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<tr>
<td>Fruiting spurs</td>
<td>Very short, stunted shoots arising from larger branches that live and bear flowers and fruit for more year</td>
</tr>
<tr>
<td>Fruiting wood</td>
<td>One-year-shoots of certain species such as peaches, arising from large branches of the tree, and on which flowers and fruit are produced.</td>
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<tr>
<td>Heading back</td>
<td>Removing the terminal ends of shoot at varying distance from the tip in order to force buds below the cut to sprout and form new shoots, thus retarding terminal growth.</td>
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<td><strong>Open center or open vase training system</strong></td>
<td>A training system with a short trunk (&lt; 1m) and primary scaffold branches develop outward and upward at angles of 30° or 45° to form a vase configuration</td>
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<tr>
<td>Primary scaffold branches</td>
<td>Branches arising from the tree trunk, forming the framework of the tree.</td>
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<tr>
<td>Secondary scaffold branches</td>
<td>Branches arising from the primary scaffold branches.</td>
</tr>
<tr>
<td>Suckers</td>
<td>Vigorous shoots arising from the under ground part of the plant, mostly from adventitious buds below the graft union. From the rootstock and should be removed as early as possible</td>
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<tr>
<td>Thinning cuts</td>
<td>Totally removing shoots or branches at the point of origin to open the plant canopy for light penetration.</td>
</tr>
<tr>
<td>Trunk</td>
<td>The portion of a tree between the roots and the first scaffold branches.</td>
</tr>
<tr>
<td>Water sprouts or shoots</td>
<td>Vigorous shoots arising from resting buds on the trunk or older branches from the lower part of the tree, growing upright through the center of the tree.</td>
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</tbody>
</table>
Bibliography

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  - Botany – an introduction to Plant Biology – James D Mauseth
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- **World Wide Web:**
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  - [www.tiaa-crefbrokerage.com/invest_glosry_PrPt.htm](http://www.tiaa-crefbrokerage.com/invest_glosry_PrPt.htm)
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**Manipulate plants**

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<td>2007-10-13</td>
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**PURPOSE OF THE UNIT STANDARD**

A learner achieving this unit standard will be able to train (manipulate) plants using pre-determined methods and techniques under close supervision. This is an entry-level Unit Standard and provides a foundation for learners who are engaged in crop production where plants are grown using trellises and other guiding structures.

Learners will gain specific knowledge and skills in manipulation techniques and will be able to operate in a plant production environment implementing sustainable and economically viable production principles.

They will be capacitated to gain access to the mainstream agricultural sector, in plant production, impacting directly on the sustainability of the sub-sector. The improvement in production technology will also have a direct impact on the improvement of agricultural productivity of the sector.

**LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING**

It is assumed that a learner attempting this unit standard will show competence against the following unit standards or equivalent:

- NQF 1: Select, use and care for hand tools, basic equipment and infrastructure
- NQF 1: Demonstrate a basic understanding of the structure and function of a plant in relation to its environment.
- NQF 1: Demonstrate an understanding of the basic concept of sustainable farming systems.

**UNIT STANDARD RANGE**

Whilst range statements have been defined generically to include as wide a set of alternatives as
possible, all range statements should be interpreted within the specific context of application.

Range statements are neither comprehensive nor necessarily appropriate to all contexts. Alternatives must however be comparable in scope and complexity. These are only as a general guide to scope and complexity of what is required.

**UNIT STANDARD OUTCOME HEADER**

N/A

**Specific Outcomes and Assessment Criteria:**

**SPECIFIC OUTCOME 1**

Use tools and/or equipment for a pre-determined manipulation method in the correct way.

**OUTCOME RANGE**

Manipulation methods may include, but are not limited to, framework development, flower and fruit manipulation, and pruning.

Tools may include, but are not limited to, pruning shears, tie-back material, etc.

**ASSESSMENT CRITERIA**

**ASSESSMENT CRITERION 1**

The correct tools for the manipulation method are selected.

**ASSESSMENT CRITERION 2**

The correct manipulation method is identified.

**ASSESSMENT CRITERION 3**

The correct stage of plant growth for the crop and the selected manipulation method is identified.

**ASSESSMENT CRITERION 4**

The manipulation method is executed correctly.

**ASSESSMENT CRITERION 5**

Equipment is used safely and in such a way to prevent damage to tools and the plant material.

**ASSESSMENT CRITERION 6**

Tools or material are used appropriately to pre-determined manipulation method.

**SPECIFIC OUTCOME 2**

Develop frameworks as part of plant manipulation methods.

**OUTCOME RANGE**

Trellising methods may include, but are not limited to, Central leader system, Tattura system, two-wire system, slanted cap, factory-cap, and/or Fa **e system.

**ASSESSMENT CRITERIA**
ASSESSMENT CRITERION 1
The trellis is applied by taking into account the height of the stem, the spacing of bearers, shoots and spindles.

ASSESSMENT CRITERION 2
The plant framework is developed appropriate for the identified trellising system.

ASSESSMENT CRITERION 3
The growing points and bearing units are manipulated according to the identified trellising method.

ASSESSMENT CRITERION 4
The plant is shaped to determine the position of bearing units according to the identified cultivation practice.

SPECIFIC OUTCOME 3
Understand flower and fruit manipulation principles.

OUTCOME RANGE
Flower and fruit manipulation principles may include, but are not limited to, temperature, daylight length, bud dormancy breakers, thinning, fruit enlargement, ripening, preparation, and chemical and physical quality improvement methods.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
Fruit and flower manipulation principles are listed.

ASSESSMENT CRITERION 2
The correct spray chemicals for flower/fruit manipulation are identified.

ASSESSMENT CRITERION 3
Physical manipulation on the fruit and flowers of an identified crop is carried out correctly.

ASSESSMENT CRITERION RANGE
Physical manipulation may include, but is not limited to, thinning, shouldering, brushing, and shortening.

SPECIFIC OUTCOME 4
Apply correct simple pruning principles appropriate to the crop.

OUTCOME RANGE
Pruning may include, but is not limited to, summer and winter pruning, and canopy management.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1
Elementary pruning principles are explained.
ASSESSMENT CRITERION 2
The appropriate pruning method for a specified crop is identified.

ASSESSMENT CRITERION 3
Unwanted growth is removed according to the pre-determined manipulation method.

ASSESSMENT CRITERION RANGE
Unwanted growth includes, but is not limited to shoots, branches, stems, etc.

ASSESSMENT CRITERION 4
Pruning actions are executed correctly.

UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS
The assessment of qualifying learners against this standard should meet the requirements of established assessment principles.

It will be necessary to develop assessment activities and tools, which are appropriate to the contexts in which the qualifying learners are working. These activities and tools may include an appropriate combination of self-assessment and peer assessment, formative and summative assessment, portfolios and observations etc.

The assessment should ensure that all the specific outcomes; critical cross-field outcomes and essential embedded knowledge are assessed.

The specific outcomes must be assessed through observation of performance. Supporting evidence should be used to prove competence of specific outcomes only when they are not clearly seen in the actual performance.

Essential embedded knowledge must be assessed in its own right, through oral or written evidence and cannot be assessed only by being observed.

The specific outcomes and essential embedded knowledge must be assessed in relation to each other. If a qualifying learner is able to explain the essential embedded knowledge but is unable to perform the specific outcomes, they should not be assessed as competent. Similarly, if a qualifying learner is able to perform the specific outcomes but is unable to explain or justify their performance in terms of the essential embedded knowledge, then they should not be assessed as competent.

Evidence of the specified critical cross-field outcomes should be found both in performance and in the essential embedded knowledge.

Performance of specific outcomes must actively affirm target groups of qualifying learners, not unfairly discriminate against them. Qualifying learners should be able to justify their performance in terms of these values.

- Anyone assessing a learner against this unit standard must be registered as an assessor with the relevant ETQA.
- Any institution offering learning that will enable achievement of this unit standard or assessing this unit standard must be accredited as a provider with the relevant ETQA.
- Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE
The person is able to demonstrate a basic knowledge of:

- Names and functions of tools and materials used in plant manipulation.
- The use of elementary trellising methods.
- The use of elementary fruit and flower manipulation methods.
- The purpose of developing knowledge in the field of plant manipulation.
- The principles of pruning.
- The elementary guidelines applied in plant manipulation.
- Safe handling procedures of tools and material.
- The Occupational, Health and Safety Act.
- Maintaining hygienic procedures of tools and material as to prevent spreading of diseases.
- Elementary plant physiology and anatomy are relevant to pruning and manipulation.

UNIT STANDARD DEVELOPMENTAL OUTCOME
N/A

UNIT STANDARD LINKAGES
N/A

Critical Cross-field Outcomes (CCFO):

UNIT STANDARD CCFO IDENTIFYING
Problem Solving: relates to specific outcomes:
- Develop frameworks as part of plant manipulation methods.
- Understand flower and fruit manipulation principles.
- Apply correct simple pruning principles appropriate to the crop.

UNIT STANDARD CCFO WORKING
Teamwork: relates to specific outcomes:
- Develop frameworks as part of plant manipulation methods.
- Understand flower and fruit manipulation principles.
- Apply correct simple pruning principles appropriate to the crop.

UNIT STANDARD CCFO ORGANIZING
Self-Management: relates to all specific outcomes.

UNIT STANDARD CCFO COLLECTING
Interpreting Information: relates to all specific outcomes.

UNIT STANDARD CCFO COMMUNICATING
Communication: relates to all specific outcomes.

UNIT STANDARD CCFO SCIENCE
Use Science and Technology: relates to specific outcomes:
- Develop frameworks as part of plant manipulation methods.
- Understand flower and fruit manipulation principles.
- Apply correct simple pruning principles appropriate to the crop.

UNIT STANDARD CCFO DEMONSTRATING
Inter relatedness: relates to specific outcomes:
• Develop frameworks as part of plant manipulation methods.
• Understand flower and fruit manipulation principles.
• Apply correct simple pruning principles appropriate to the crop.

UNIT STANDARD CCFO CONTRIBUTING
Self Development: relates to all specific outcomes.

UNIT STANDARD ASSESSOR CRITERIA
N/A

UNIT STANDARD NOTES
N/A

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