Horticultural Crops Production

Level II

Learning Guide #52

Unit of Competence: - Carry out Crops Regulation and Canopy Maintenance

Module Title: - Carrying out Crops Regulation and Canopy Maintenance

LG Code:-AGR HCP2 M13LO1-LG-52

TTLM Code:-AGR HCP2 TTLM 0120v1

LO1: Prepare for work

Instruction Sheet	Learning Guide #52

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Obtaining and confirming work instructions
- Selecting and checking tools and equipment
- Selecting materials for specific work
- Carrying out Pre-operational and safety checks
- Identifying and reporting OHS hazards for specific work
- Selecting and preparing Chemicals
- Selecting, using and maintaining Suitable safety and personal protective equipment (PPE)

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Obtain and confirm instructions for the work
- Select and check tools, equipment and machinery for specific crop work
- Select materials for specific work according to instructions
- Carry out pre-operational and safety checks on specific tools, equipment and machinery for the work.
- Identify and report OHS hazards for specific work.
- Select and prepare chemicals to be used during crop regulation and canopy maintenance.
- Select, use and maintain suitable safety and personal protective equipment (PPE)

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1 to Sheet 7”.
4. Accomplish the “Self-check 1to Self check 7” **in page -6, 9, 11, 14, 16, 18 and 21** respectively.

Information Sheet-1	Obtaining and confirming work instructions

Crop regulation: - is defined as one of the management practices of horticultural crops that are done to improve the growth and development of a given horticultural crop so as to have quality product and marketable yield. Basically, it covers the process of thinning and pruning of horticultural crops to control yield and quality. Majorly, plants that require crop regulation may include the thinning and regulation of flower, root crops, pulm oil tree, fruit or vegetable crops. Therefore, you should have to identify all these horticultural crops which needs crop regulation one by one.

Crop regulation is important operation in different crop production. It allows growers to manipulate the size of their crops to meet their customers' requirements for color, integrity, size, and shape. Crop regulation relies on the principles that crop size is directly related to crop load. For many crops, the heavier the crop load, the smaller the produce. This learning module gives brief information on crop regulation and crop regulation techniques. It covers the process of regulating crops by thinning and pruning flower, fruit or vegetable crops to control yield and quality.

Canopy in a fruit tree refers to its physical composition comprising of the stem, branches, shoot and leaves. Canopy density is determined by the number and size of the leaves. Canopy architecture is determined by the number, length and orientation of the stem, branches and shoots. Canopy managements of the fruit trees deals with the development and maintenance of the structure in relation to size and shape, orientation of branches and light interception for the maximum productivity and quality.

The basic concept in canopy management of a perennial tree to make the best use of land and the climatic factors for an increased productivity in three dimensional approaches. Canopy management includes a range of techniques to after the position and the amount of leaves, shoots and fruits in space which determines, to a large extents the plant geometry structure including spatial distribution of leaf area and leaf orientation.

Canopy management refers an interrelation of the physiology underlying the relationship between vegetative growth and production.

1. Orchard architecture largely depends upon orchard production system which is a combination of variety, rootstock, tree spacing, training and pruning

2. These factors strongly interact to develop a specific production system and determined yield, fruit quality and longevity of the trees.

3. In perennial fruit crops, cultural practices like nutrition, irrigation, planting density, rootstocks training system, pruning and growth retardants can be used as potential means to alter the shoot vigour, size and shape of the canopy and the microclimate at the canopy and thereby increase yield and quality.

Canopy management refers an interpretation of physiology of light penetration and interception which are critical components of overall tree productivity. Thus, the ultimate goal of canopy managements is to optimize carbon allocation in fruit sinks without disturbing growth and development in other parts of the tree. The influence of temperature, light, humidity and tree vigour on the productivity and quality of fruit and manipulation of tree canopy through training systems, pruning practices and use of growth retardants for the best utilization and harvest. In the last few years, significant development and strong formation have taken place in the development of tree canopy forms and new production system. High yield of good quality fruits produced under such systems are attributable to high light interception and distribution within the canopy. Therefore, for optimum interception and distribution of light for quality fruit production, canopy management requires focus on proper stock stem combination, training and pruning and other management practices to make last use of the space, and to keep the orchard in healthy condition.

Advantages of crops regulation and canopy maintenance

- ✓ Small trees are better in capturing and converting sunlight in to fruit then large trees.
- ✓ Safety risk for the harvest (pickers) of bigger trees.
- ✓ Improve quality
- ✓ Improve yield
- ✓ Support more high quality products
- ✓ Reduce diseases

- ✓ Improve air flow
- ✓ Reduction in extra expense in harvesting at large trees.
- ✓ To improve sunlight penetration

The instructions to be obtained in crop regulation and canopy maintenance are

- ❖ standard Operating Procedures (SOP),
- ❖ specifications,
- ❖ work notes, or
- ❖ Verbal directions from manager, supervisor or senior operator

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is crop regulation? 5 points
2. What is canopy? 4 points
3. Discuss the advantages of crop regulation and canopy maintenance. 6 points
4. List the instructions to be obtained in crop regulation and canopy maintenance. 5 points

Note: **Satisfactory rating - 20 points** **Unsatisfactory - below 20 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Selecting and checking tools and equipment

Proper tools are essential for satisfactory pruning and thinning. The choice of which tool to use depends largely on the size of branches to be pruned and the amount of pruning to be done. If possible, test a tool before you buy it to ensure it suits your specific needs. As with most things, higher quality often equates to higher cost.

Selections of appropriate tools, equipments and machineries which are important for crop regulation have a key role in safe handling, operating and keeping the health and quality of the crop to be regulated. Some of the major uses of the selecting appropriate tools, equipments and machineries include;

- Keeping the health and quality of the crop.
- Reducing crop damage during pruning and thinning activities.
- Speeding up the task of crop regulation.
- Reducing disease contamination.

Tools, equipments and machineries appropriate for crop regulation include rubber mallets, sticks, spray equipment, knives, handsaws, hand and battery-powered secateurs, pneumatic snips and compressors, hedge trimmers both manual and powered, small chainsaws, chippers, ladders, picking platforms, powered ladders, lopping shears, Pole pruners and scissor lifts.

To perform the crop regulation work in safe manner, you should have to be provided with these tools, equipments and machineries and you should have to indentify and select each of these tools, equipments and machineries physically.

At the time of undertaking crop regulation and canopy maintenance activities, we use different tools and equipments. Before starting canopy maintenance operation, we have to collect those materials required. Application equipment and machinery may include:

Backpack spray equipment; tractors and trailed or 3-point linkage spray equipment, pumps and pump fittings.

Pruning tools, equipment and machinery may include

- ✓ knives,
- ✓ handsaws,
- ✓ hand and battery-powered secateurs,
- ✓ pneumatic snips and compressor,
- ✓ hedge trimmers both manual and powered,
- ✓ small chainsaws,
- ✓ specialized mechanical pruning machinery,
- ✓ chippers,
- ✓ ladders,
- ✓ picking platforms,
- ✓ Powered ladders and scissor lifts.

Plant training equipment may include trellising and specialized training systems.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the advantages of selecting and using appropriate tools, materials and equipments during crop regulation and canopy maintenance activity. 4 points
2. List tools, materials and equipment used during crop regulation and canopy maintenance. 8 points

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

Answer Sheet

You can ask your teacher for the copy of your answer

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Selecting materials for specific work

There are a number of tools that can be used for pruning. They are secateurs, loppers, long reach pruners, tree pruning systems and saws. There are also scissors designed for use in the garden, which you can use when cutting flowers or dead heading plants with thinner stems.

Fig3.1 Pruning tools and equipments

		**Secateurs** There are a number of secateurs to choose from in this section, most of which are available with two different types of blade. Secateurs are also available in different sizes and for use left handed.
		**Garden scissors** When cutting flowers or deadheading plants with thinner stems it is best to use scissors designed for the purpose. Long reach cut and hold models are useful for deadheading and gathering high growing flowers.

Fig. 3.1. Selecting materials for specific work

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Explain the concept of select materials for specific work. 4 points
2. Discuss that all tools, materials and equipments have their own purpose they formed for. 6 points

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

Answer Sheet

Score = _____

Rating: _____

You can ask your teacher for the copy of your answer

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Carrying out Pre-operational and safety checks

While using different tools, equipments and machineries, there may be faulty items and structural damage that may result in OHS hazards.

Before using, these tools, equipments and machineries, checking that they function properly and safe to use important.

This must be done by responsible who have technical skill and knowledge concerning the tools, equipments and machineries.

During horticultural crops regulation program you have to check all tools, equipments and machineries to be used for crop regulation before use. Ask yourself such questions:

- Are all the materials functional and sufficient enough in number?
- Are all free from any contaminants?
- Is there any material which needs maintenance?

Then check and report to your supervisor the condition of these materials. After reporting the condition of materials, your supervisor will guide you what to do if there is insufficient of materials to perform this particular work.

Some of the major importance of pre-operational and safety checking of crop regulation tools, equipments and machineries includes:-

- ❖ To identify the functionality of the tools.
- ❖ To regulate and maintain if there is broken tools.
- ❖ To fit the number of tools with the workers
- ❖ To remove some tools which are rust and contaminated with diseases
- ❖ To use appropriate tools depending on the type of horticultural crop.

Therefore, Carrying out pre-operational and safety checks on crop regulation tools, equipments and machineries is very important to perform the crop regulation task in well organized and safe manner.

Tools, equipment and machinery are calibrated and adjusted according to manufacturers guidelines and enterprise work procedures

Safety check is especially important to minimize damage incidence and infection of plant on which crop regulation activities are undertaken.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the importance pre-operational and safety checks before using tools, materials and equipments during crop regulation and canopy maintenance. 10 points
2. Explain how tools, materials and equipments checked before use? 5 points

Note: **Satisfactory rating – 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-5	Identifying and reporting OHS hazards for specific work

Hazards are anything that may result in injury to the person or harm to the health of the person. And risk is the probability of that injury or harm to occur. Since your body's defense system cannot always win the fight against these hazards, it is important for you to learn what hazard exist in your workplace and what controls are necessary to prevent exposure. Hazard awareness will help you when you work with your colleagues, farmers and employers to eliminate hazards.

Some of OHS hazards that may exist in crop regulation activities may include:-

- disturbance or interruption of services,
- solar radiation, dust, noise, chemicals and hazardous substances,
- manual handling, moving vehicles,
- machinery and machinery parts, sharp tools and equipment,
- Uneven surfaces and flying and falling objects.

Work place hazards may be identified through:-

- visual inspection of the area,
- understanding of site plans,
- Enterprise work procedures.

Poor handling of different harvested products and equipments will leads to:

- Loss of quality
- Color and shape change
- Reduce marketability of the product
- Contamination with disease and it highly affects the worker in different ways.

Therefore, you should have to be aware of in identifying and assessing any OHS hazards that may exist in your work place and you should have to record and report to your supervisor in order to take the appropriate safety measures to create healthy working environment and to reduce OHS hazards.

Self-Check -5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the OHS hazards that may exist during crop regulation and canopy maintenance. 5 points
2. How crop regulation OHS hazards are identified? 5 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-6	Selecting and preparing Chemicals

There are many types of chemicals used at the time of crop regulation activities (pruning and thinning). These may include fungicides, chemicals that are used for disinfecting pruning and thinning tools and equipments, growth regulators.

Chemicals

i. Pesticides (fungicides)

ii. Commercial growth hormones

ii.Spraying equipments

1. Manually Operated Knapsack
2. Motorized knapsack
3. Vehicle mounted Sprayers- Boom Sprayers

- Spraying of chemicals should be :-
  - Environmentally Sound
  - Economically Viable/feasible

Self-Check -6	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the importance of chemicals during crop regulation. 5 points

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-7	Selecting, using and maintaining Suitable safety and personal protective equipment (PPE)

Basically, selecting and using suitable personal protective equipments during horticultural crop regulation activity is important to:

- Protect from different OHS hazards
- Improve the quality and health of the crop regulation work
- Reduce contamination from disease
- Keep workers safety
- Perform the task in well organized manner

In any activities, selecting proper personal protective equipments needs attention miss-selection of **PPE** result in unsafe work condition.

When selecting PPE, remember:

- ✓ You need to consider and introduce other means of protection first. Provide PPE only as a last resort after taking all other reasonably practicable measures
- ✓ Engineering controls provide long-term solutions and are often cheaper than providing, replacing, maintaining and storing PPE
- ✓ Controls at source protect all workers in the area, while PPE only protects the wearer
- ✓ It is essential to involve your workers in the selection process, as they often have detailed knowledge of the way things work or the way they do tasks, which can help you.

Also, while using PPE, we have check for safety and purpose. Make sure that PPE:

- ✪ Is effective and gives adequate protection against the hazards in the workplace;
- ✪ Is suitable and matches the wearer, the task and the working environment, so it does not get in the way of the job being done or cause any discomfort;
- ✪ Does not introduce any additional risks, e.g. limits visibility;

- ✪ Is CE (common era) marked to confirm that it has been made to an appropriate standard;
- ✪ Is compatible with any other PPE that has to be worn. Safety spectacles may interfere with the fit of some respirators.

To use the equipment effectively, workers need suitable information, instruction and training. Make sure all equipment is checked before use and cleaned, maintained and stored in accordance with the manufacturer's instructions.

Personal protective equipments (PPE) that are used in crop regulation work may include;

- ❖ Hard hat,
- ❖ halter, and waterproof or spray clothing,
- ❖ Boots
- ❖ Overalls
- ❖ Gloves
- ❖ Goggles
- ❖ Face mask
- ❖ Hearing protection, and
- ❖ Sun hat and sunscreen lotion.

Therefore, before starting the crop regulation operation make sure that you have all these suitable personal protective equipments in order to have successful regulation operation.

The size of PPE should be fit with your size, if the PPE is faulty, it should be maintained or a new one should be provided, and if the number of the PPE is not sufficient only people with the PPE should work the job.

Self-Check -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the importance of selecting and using of appropriate personal protective equipments (PPE) during crop regulation activity. 6 points
2. What are the criteria used to check PPE equipments before use? 4 points
3. List and explain the importance of all personal protective equipments used during crop regulation and canopy maintenance.10 points

Note: **Satisfactory rating - 20 points** **Unsatisfactory - below 20 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

References:

1) Practical Manual on Canopy Management in Fruit Crops-Dr. Gorakh Singh (2010). Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, New Delhi-110001

2) Smart, R. E., J. K. Dick, I. M. Gravett, and B. M. Fisher. 1990. Canopy management to improve grape yield and wine quality: Principles and practices. South African Journal of Enological Viticulture 11:3-17.

3) http://www.epd.gov.hk

Horticultural Crops Production

Level II

Learning Guide #53

Unit of Competence: - Carry out Crops Regulation and Canopy Maintenance

Module Title: - Carrying out Crops Regulation and Canopy Maintenance

LG Code:-AGR HCP2 M13LO2-LG-53

TTLM Code:-AGR HCP2 TTLM 0120v1

LO2: Identify crop regulation requirements

Instruction Sheet	Learning Guide #53

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Identifying plants that require crop regulation
- Determining the purpose and methods of crop regulation
- Locating Services using site plan
- Determining access to the site

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Identify plants that require crop regulation.
- Determine the purpose and methods of crop regulation.
- Locate services using site plans and in consultation with the supervisor.
- Determine access to the site in consultation with the supervisor

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1 to Sheet 4”.
4. Accomplish the “Self-check 1 to Self-check 4” **in page -26, 30, 32 and 34** respectively.

Information Sheet-1	Identifying plants that require crop regulation

Identifying plants that require crop regulation is first step in carrying out crop regulation activities. Basically, before starting crop regulation activity, identifying the plant materials to be thinned or pruned is the central part of crop regulation. Therefore, carefully you should have to know and identify different plant materials to be regulated. This is because there are variety of horticultural crops (vegetables, fruits, flowers, tubers, root crops…etc) which have different plant materials to be thinned or pruned.

Unwanted growth in fruits and vegetable and other trees are including:

- Non-fruiting wood such as suckers and water shoots;
- damaged limbs or those that have died back,
- congested shoots,
- excessive fruit, flowers, or leaves
- non-fruiting wood such as suckers

Plant materials to be regulated may include: -

- ❖ branches,
- ❖ leafs,
- ❖ flowers,
- ❖ buds,
- ❖ roots,
- ❖ stems,
- ❖ Suckers…etc.

Identification will be based on the type of horticultural crop and purpose of crop regulation. The major importance of knowing and identifying plant materials to be thinned or regulated is to:-

- ➢ Successfully perform the crop regulation activities
- ➢ Reduce crop losses during thinning or pruning
- ➢ Save the wastage of time and money
- ➢ Reduce contamination
- ➢ Have healthy and quality crop yield
- ➢ Reduce regulating unwanted horticultural plants and plant materials…and so on

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the plant materials to be regulated? 8 points
2. Discuss the importance of knowing plant materials to be regulated before undertake plant regulation. 6 points

Note: **Satisfactory rating - 14 points** **Unsatisfactory - below 14 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Determining the purpose and methods of crop regulation

Purpose of crop regulations may include:-

- Leaf removal, branch removal,
- applying or removing shade cloth, bird or hail netting,
- lifting and lowering of trellises,
- positioning canes and branches to shape, form,
- correct or control growth,
- provide clearance for services,
- access or cultural practices,
- prevent disease or damage,
- promote health,
- control capacity and vigor,
- manage the canopy and fruit and flower production,
- Control yield and quality to meet market requirements.

To achieve the above purposes we have to use different methods. These methods are:-

Thinning:-by removal of flowers or crops using hands, sticks, and shakers and thinning sprays.

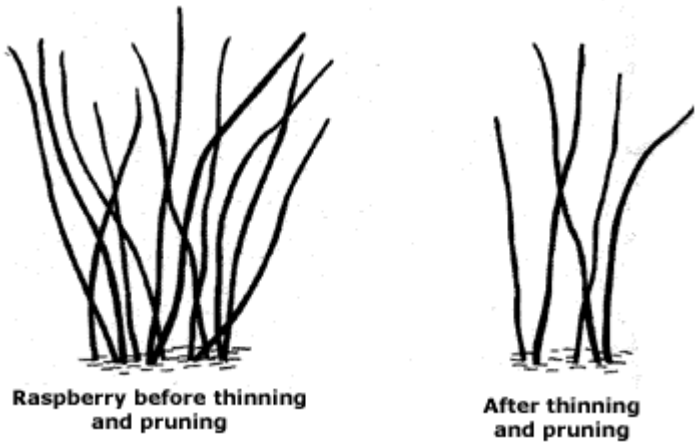

Fig.2.1 thinning of plants

Pruning: - methods such as winter or summer pruning, minimal pruning and hand clean up after machine pruning.


Fig2.2 pruning of plants

Training: - is a practice in which tree growth is directed into a desired shape and form

It is controlling the direction, shape and size of plants. Buds are young shoots that become leaves, flowers or branches. A grower trains plants to improve flower or plant appearance and management, improve flower and fruit size and quality and to protect plants from damage.


Fig2.3 training of plants

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the purposes of crop regulation? 6 points
2. Discuss the method of crop regulation. 5 points
3. Define thinning, pruning and training of plants. 9 points

Note: **Satisfactory rating - 20 points** **Unsatisfactory - below 20 points**

You can ask your teacher for the copy of your answer

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-3	Locating Services using site plan

Preparing site plan is very important for horticultural crops regulation. Before the implementation of crop regulation activities we should consider whether we get the available services at the time of regulation or not. Crop regulation services include:

- ❖ Different vehicles-used for equipment and human transport
- ❖ Different materials, tools ,PPEs and equipments –used for crop regulation

Different services may damage during crop regulation activities, therefore we have to identify and save them from damaging.

Services may include:-

- Above ground outlets for water supply,
- irrigation fittings,
- low overhead power (electricity)

Depending on crop regulation site, different services are located. The major services required for crop regulation site are:

- ❖ Health centre
- ❖ Water for drinking and washing
- ❖ Restaurants
- ❖ Store

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the services that located at crop regulation site. 6 points
2. What is the importance of identifying service around crop regulation area? 4 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	Determining access to the site

Accesses that are required for crop regulation site are determined according work situations. The ***major accesses*** that must be recognized are:

- ✓ Roads
- ✓ Electricity
- ✓ Labor
- ✓ Machines and equipments

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the major accesses that must be recognized crop regulation area? 6 points

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask your teacher for the copy of your answer

Answer sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Horticultural Crops Production

Level II

Learning Guide #54

Unit of Competence: - Carry out Crops Regulation and Canopy Maintenance

Module Title: - Carrying out Crops Regulation and Canopy Maintenance

LG Code:-AGR HCP2 M13LO3-LG-54

TTLM Code:-AGR HCP2 TTLM 0120v1

LO3: Undertake Crop regulation

Instruction Sheet	Learning Guide #54

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Erect safety equipment around the crop regulation site during and between work periods
- Identifying plant material to be thinned or pruned
- Undertaking crop regulation program
- Operating safely Crop regulation tools, equipment and machinery
- Recording and reporting Signs of diseases and pests

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Erect safety equipment around the crop regulation site during and between work periods
- Identify the plant material to be thinned or pruned.
- Undertake the crop regulation program
- Open safely and effectively crop regulation tools, equipments and machinery
- Record and report signs of diseases and pests

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 6.
3. Read the information written in the information “Sheet 1 to Sheet 5”.
4. Accomplish the “Self-check 1 to Self check 5” **in page -38, 40, 55, 57 and 59** respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page 60.
6. Do the “LAP test” **in page – 61** (if you are ready).

Information Sheet-1	Erect safety equipment around the crop regulation site during and between work periods

Safety equipments that are used during undertaking crop regulation must be erected around crop regulation site. These safety equipments may include: a structure such as a fence that is intended to prevent access or keep one place separate from another. These safety equipments are basically required to separate one working area from another. It is important to avoid disturbance, damage and limit operational areas where the work to be taken place. Also these safety equipments are used as boundary between two task areas. For example, signage and barriers are common safety equipments.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Explain safety equipments used during crop regulation. 6 points
2. List the safety equipments used during crop regulation? 4 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Identifying plant material to be thinned or pruned

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Before undertaking crop regulation, identifying plant materials that require regulation activities is important.

Plants that require crop regulation are:-

- ✓ vegetables,
- ✓ fruits,
- ✓ ornamental and shade trees when they are victim of overloading of flower and fruits,
- ✓ Lack of sunshine and overgrowth problem that may reduce final yield and quality.

Also plant regulation is required to remove diseased or insect-infested wood, to increase airflow and reduce some pest problems, and removing crossing and rubbing branches.

Based on function of crop regulation, identifying plants that require crop regulation is important element of crop regulation.

- Pruning of a plant/plant parts include;

  -Removal of unwanted growth:-

  - Dead wood
  - Diseased, damaged, dead, non-productive branch
  - Structurally unsound and crowded branch
  - Excessive shoots
  - Suckers and shoot/water sprouts

Identification will be based on the type of horticultural crop and purpose of crop regulation. The major importance of knowing and identifying plant materials to be thinned or regulated is to:-

- ➢ Successfully perform the crop regulation activities
- ➢ Reduce crop losses during thinning or pruning
- ➢ Save the wastage of time and money
- ➢ Reduce contamination
- ➢ Have healthy and quality crop yield
- ➢ Reduce regulating unwanted horticultural plants and plant materials…and so on.

Self-Check –2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the plant materials to be pruned or thinned? 6 points
2. What are the importances of knowing plant materials to be pruned or thinned? 6 points

Note: **Satisfactory rating - 12 points** **Unsatisfactory - below 12 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-3	Undertaking crop regulation program

To undertake the crop regulation program, you should have to be equipped with:-

- All the necessary tools, equipments and machineries
- The type of horticultural crops to be regulated and the purpose of crop regulation
- The available OHS requirements and corresponding care and PPE
- The method of crop regulation
- The plant materials to be regulated
- Some chemicals which are used for crop regulation purpose and …etc

Having done all the necessary preconditions to undertake the crop regulation program, now start the crop regulation operation carefully and strictly according to your purpose and OHS requirements.

Some of the basic OHS requirements that should be done during the crop regulation activities may include:-

- identifying hazards;
- assessing and reporting risks;
- cleaning, maintaining and storing tools, equipment and machinery;
- appropriate use of personal protective equipment including sun protection,
- safe operation of tools, equipment and machinery;
- safe handling, use and storage of chemicals and hazardous substances;
- correct manual handling;
- basic first aid;
- personal hygiene and
- reporting problems to supervisors

Crop regulation activities are important to control crop growth and manage yield and quality. It is done by pruning, training and thinning.

1. **Pruning**

Pruning is one of the methods of crop regulation. The main reasons for pruning ornamental and shade trees include safety, health, and aesthetics. In addition, pruning can be used to stimulate fruit production and increase the value of timber. Pruning for safety involves removing branches that could fall and cause injury or property damage, trimming branches that interfere with lines of sight on streets or driveways, and removing branches that grow into utility lines.

Safety pruning can be largely avoided by carefully choosing species that will not grow beyond the space available to them, and have strength and form characteristics that are suited to the site.

Pruning for health involves removing diseased or insect-infested wood, thinning the crown to increase airflow and reduce some pest problems, and removing crossing and rubbing branches. Pruning can best be used to encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather. Removing broken or damaged limbs encourage wound closure.

Pruning for aesthetics involves enhancing the natural form and character of trees or stimulating flower production. Pruning for form can be especially important on open grown trees that do very little self-pruning.

All woody plants shed branches in response to shading and competition. Branches that do not produce enough carbohydrates from photosynthesis to sustain themselves die and are eventually shed; the resulting wounds are sealed by wound wood (callus). Branches that are poorly attached may be broken off by wind and accumulation of snow and ice. Branches removed by such natural forces often result in large, ragged wounds that rarely seal. Pruning as a cultural practice can be used to supplement or replace these natural processes and increase the strength and longevity of plants.

Producing strong structure should be the emphasis when pruning young trees. As trees mature, the aim of pruning will shift to maintaining tree structure, form, health and appearance.

Proper pruning cuts are made at a node, the point at which one branch or twig attaches to another. In the spring of the year growth begins at buds, and twigs grow until a new node is formed. The length of a branch between nodes is called internodes.

Pruning types

The types of pruning are three namely:-

1. Formative/frame pruning
2. Maintenance pruning
3. Rejuvenation/renewal pruning

1. Formative/frame pruning

- Also named structural pruning
  - i. nursery structural pruning
  - ii.field structural pruning
- Practiced on young/immature/non bearing fruit tree
- Started in a nursery, but normally carried out when the tree is 2-3 age at field
- Generally started at the start of the rainy season
- pruning should be minimal from juvenile to the productive stage
- Avoid severe pruning, because it delays early fruit production

Fig.3.1 formative/structural pruning

2. Maintenance pruning

- Done on matured/bearing fruit tree
- Begins at 3-4/5 years after planting
- Yearly operation soon after harvest
- Preserve the plant production status i.e. consistent high yield production by:-
  - maintaining good shoot and flower production resulted in good fruit production
  - establishing a balance between vegetative and reproductive growth
- Normally carried out during the dry season before fruiting commences
- Excessive pruning can cause the plant to revert to a vegetative state b/s it can stimulate excessive vegetative growth, but suppress fruit bearing

Fig.3.2 maintenance pruning

3. Rejuvenation/renewal pruning

- Also named as back-pruning
- Is done when the fruit tree becomes old/aged or un productive
  - Becomes less vigour
    - Annual shoot growth decreases
    - Decreased vegetative and reproductive growths
    - Decline in production
- brings back declining trees, back in to production through severe pruning
  - severe pruning stimulates:

✓ vigour/vegetative shoot re-growth of the plant

✓ The vegetative growth is renewed and the trees bear satisfactory crops thereafter.

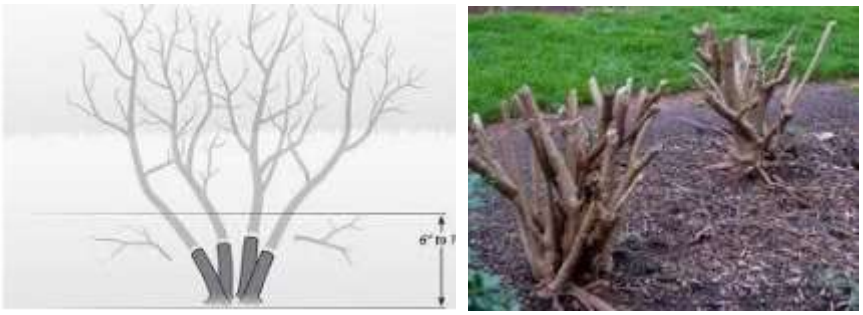

Fig. 3.3 Rejuvenation pruning

Types of pruning cuts

1. Heading back
2. Thinning out

1. Heading back: - removes the terminal portion of a shoot or branch

Forms/methods of heading back

i. Hedging:-cutting back the sides of trees to prevent or alleviate crowding

- Should be done before crowding

ii. Topping: -Removal of apical dominance of the main branch/reduce height of tree

- Should be done before trees have become excessively tall

-Topping and hedging can be done:-

- Manually :-using hand-held equipments
- Mechanically:- Vehicle mounted pruners/Boom pruners

- hedging machines, topping machines

2**.** Thinning out: -Involves the removal of complete branches to its point of origin

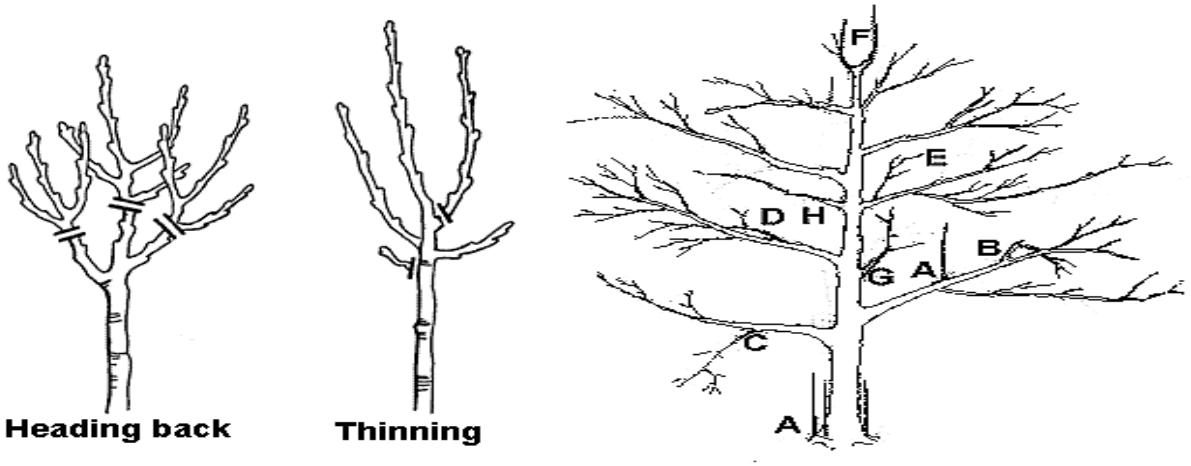

Fig.3.4 prune cutting

Suggested Pruning Cuts

A. Suckers. B. Stubs or broken branches. C. Downward-growing branches

D. Rubbing or criss-crossing branches E. Shaded interior branches

F. Competing leaders G. Narrow crotches H. Whorls

Failure to control tree size

- The failure to control tree size will result in:-
  - Larger, tall trees
  - Interior limbs and twigs will die
  - Pushing the fruit-bearing growth further and further from the center
  - Annual yield decrease
  - Damage to trees, fruit, and equipment.
  - Much more difficult pest management
  - Unlikely harvesting of fruit in the tops of canopy

Factors to be considered in pruning

a. Time of pruning
b. Extent of pruning

a. Time of pruning

Pruning time should be done in reference to**:-**

i.Season

ii.Climatic conditions

iii.Growth stage

i. Season

- Winter/dormancy pruning
  - Early winter: recommended, if it is only with mild frost:-
  - Late winter:- mostly recommended due to mild frost
- Summer
  - Early summer :-recommended, if it is for good vegetative shoot growth when there is less disease prevalence in summer - adjusted towards the beginning of the rainy season, so as to avoid desiccation and death of branches
  - Late summer:-recommended, if it is for good vegetative shoot growth if there is more disease prevalence in the summer season

ii. Climatic conditions

- Temperature
  - Minimum: low temperature, frost prevalence:-not recommended
  - Optimum:-recommended ,due to optimum
  - Maximum: high temperature, heat stress/desiccation:-not recommended
- Moisture (deficient, adequate)
  - Deficient/stress/insuffient:-not recommended
  - Adequate/sufficient:-recommended

iii. Growth stage

- Reproductive: not recommended
- Vegetative :-
  - Active growth:-not recommended
  - Inactive growth/dormant:-recommended

b. Extent of pruning

i.Light pruning:- minimal pruning

ii.Medium pruning:- moderate pruning

iii.Heavy pruning: severe/excessive pruning

- The amount/extent/ percentage of live tissue that should be removed depend on:_
  - Tree size
  - Species
  - Age
  - pruning objective

i.Tree size

- Comprises height and hedge row of the tree
- More size:-severe pruning
- Maderate size :moderatre pruning
- Less size:-minimal/light pruning

ii. Species

a. Growth habit:

- More Vigour:- tropical species:-minimal/light pruning
- Medium vigour: sub-tropical species:-moderate pruning
- less vigour:-temperate species:-severe pruning

b. Bearing habit:-

- regular bearing :- regular annual pruning
  - i. fruiting/bearing on current season/ one-year-old wood: severe pruning
  - ii. Fruiting on previous wood:-light pruning
  - iii. Fruiting on both current and previous season wood:-moderate pruning
- irregular bearing:-irregular annual pruning
  - i. After heavy crop:- light pruning
  - ii. After light crop:- severe pruning

- Fruit trees that are pruned moderately and regularly produce better fruit and maintain health longer.

iii. Age of the tree

b. Young : Minimal/light pruning

c. Mature: Moderate pruning

d. Old/aged:-severe/heavy pruning

- Heavy pruning in:-
  - Young fruit tree:- delays maturity/bearing time up to two years
  - Matured fruit tree :- yield reduction due to:-
    - unbalanced vegetative and reproductive growth
- The severity of pruning in matured/bearing increases as the tree increases its bearing area i.e. when densely foliated
- Pruning is therefore carried out to achieve a balance between shoot growth and fruit production

iv. Pruning objective

- For strong frame work development: formative/frame/structural pruning:-minimal pruning
- For Maintenance of production:- maintenance pruning:-moderate pruning
- for vegetative re-growth/rejuvenation: rejuvenation/renewal pruning:-severe pruning

Cares to be taken during pruning

- Pruning cuts should be smooth, clean and slant
- Avoid lacerate cuts (injured by tearing of bark)
- Use sharp pruning tools to avoid tearing of bark
- Clean/disinfect the pruning tools
- Flush cuts with the adjacent branch without leaving a stub.
- Cut close to the bulge on the main stem leaving no stub

-stub left will give rise to fungal infection due to delay in healing

2. Training

A primary objective of training 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 tree's productivity and may greatly reduce its 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. For most deciduous tree fruit, flower buds for the current season's crop were formed the previous summer. Light penetration is essential for strong 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 adequate light to reach 12 to 18 inches inside the canopy. Opening the tree canopy also permits air movement through the tree, which promotes rapid drying to minimize disease infection and allows thorough spray penetration. Additionally, a well-shaped fruit tree is aesthetically pleasing, whether training and pruning; however, fruit trees will not develop proper shape and form. Properly trained and pruned trees will yield high-quality fruit much sooner and live significantly longer.

Training is achieved with or without pruning by:-Staking/supporting, tying ,trellising or spreading/positioning on a pergola. It starts with the stems of trees, when they are very young and young.

Pre-Commercial training in hardwoods is done later than softwoods, preferably when they reach a height of 6 to 9 meters (20 to 30 ft). This additional time allows the stems to straighten and self-prune lower branches off valuable lower bolts. This will also help prevent the formation of epicormicbranches, which develop from dormant buds under the bark. They form on the main stem and reduce the value of the finished product.

Spacing is generally wider than a softwood site since hardwoods grow fewer stems per hectare.

Spacing hardwood clumps to one or two stems will result in valuable stems later.

However, wider spacing may encourage epicormic branching. A good compromise would be spacing to 8 feet (2.4m), which would discourage branching while producing a 6 inch stem at commercial thinning time.

Sprouts are caused by growth of dormant buds near the ground on remaining stumps. This occurs immediately after cutting, but is more noticeable after the felling of mature trees. These sprouts grow very fast as they develop from an established root system.

Release one or two widely spaced stems per stump. Selected stems should be positioned on the stump as close to the ground as possible. This will encourage sprouts to develop their own root system as the stump begins to decompose. Sprouts that leave the stump in a J-shape are preferable to those of a V-shape. The V-shape is more likely to collect debris and introduce rot to the developing clump. J-shaped sprouts are also more likely to grow their own root systems.

Long-term benefits of a Pre- Commercial Training (PCT) includes:

1. **Diameter growth of remaining trees will increase** due to reduced competition. This focuses available energy on the site into the growth of fewer trees. The result is larger, faster growing, and healthier crop trees.

Growth lost in the removal of some stems will be redirected into remaining trees. Some growth acceleration may be due to the addition of organic material left from the treatment.

2. **Trees are ready for harvest sooner**, shortening the rotation of the stand.

3. **Harvest costs will be reduced.** Fewer stems, similar sizes and uniformly spaced trees will reduce the costs of harvesting. Usable or merchantable volume will be increased at harvest time.

Unmanaged stands lose a portion of their volume in stems that are too small to be commercially processed. Thinning puts more growth in merchantable size ranges.

4. Reduction of short-lived, less desirable species will improve stand composition. Leaving too many fast growing species will reduce choices at commercial thinning and harvest times. At an early age these trees will out-compete more valuable species.

5. Larger crowns and root systems produce more wind firm trees that are better suited for commercial thinning and selection cuts later on.

6. Trees will suffer much less from the physical damage caused by wind whipping. This encourages development of stronger stems and branches. Young trees will better adapt to conditions around them increasing their durability to physical damage.

3. Thinning

Fruit Thinning

To control fruit size, some fruits are removed before they enlarge. Some plants, particularly cucurbits, produce female flowers and set fruit so early that vegetative growth is still insufficient to support the normal growth of the fruit. When this happens, further vegetative growth is restricted, while additional fruit setting and development is equally affected.

A thinning cut removes an entire branch back to a side shoot branch. Thinning cuts do not invigorate the tree near the cut in comparison to some of the other pruning cuts.

Thinning hardwood

Some considerations should be made when planning Pre-Commercial training in hardwood stands. Crop trees selected for hardwood saw logs or veneer logs should be a high value species of crops. At the Pre-Commercial training stage, they should show good form - straight stems, no forks, right angle branching and no signs of insect or disease. Choose trees that are fast growing, usually specimens that are dominant or co-dominant.

Trees selected for wildlife should be long-living, mass producers.

When and where

Thinning is done on dense young softwood stands that are less than 20 years old and between 2 and 6 meters in height. In these stands, growth will have slowed due to competition among trees. Stands older than 20 years may have already begun thinning themselves and the dominant trees may be taking over.

Although stand quality may be improved from a thinning, growth benefits would be reduced.

Thinning should be done as soon as side branches begin to die. This will help trees respond faster to the thinning. However, thinning is not commonly done on stands less than 2 meters in height because live branches will likely be found on the stem near the ground, making thinning difficult. Better trees may not yet exhibit dominant characteristics and some species may be subjected to insect damage (e.g. White pine weevil damage).

Doing your thinning early will help avoid volume losses of crop trees

• Shade foliage adapted to growing just under the canopy in a thicket will now be in full sunlight.

Needles with cell arrangements suited for shade conditions are now in full sun. Many leaves fall off reducing the growth capacity of the tree.

• If the stand is left too long before doing a thinning, winds can sway the stems more than they have grown accustomed, which can damage feeder roots. The pulling action physically tears off the fine feeder roots. Reduction of the nutrient gathering capacity of the tree reduces growth until roots grow back.

• Snow and ice storms can bend and break tall, small diameter trees with short crowns.

• The cost of thinning larger trees is greater. Larger trees require more time to cut and fell. Selecting crop trees is also more difficult due to crowded working conditions and higher crowns. It is easier to remove preferred species in this situation.

Early, frequent thinning avoids drastic changes in habitat.

Typical stands that benefit from a thinning are:

- Those that are dense and have obvious interference of branches between the crowns.
- Those with an average tree height between 2 and 6 meters (6 and 20 ft).

How to do thinning

Choose the best season

Thinning may be done any time of year, but certain times have advantages. Spring is generally a poor time. Trees are active moving sap to new leaves and shoots. Crop or leave trees will be susceptible to damage by both machinery and falling trees.

Avoid thinning on exposed sites in the fall. In fall wind can cause most of the blow downs. The roots of remaining crop trees, even if slightly injured by thinning machinery, will be more susceptible to disconnection from the ground.

Winter and summer are the best times for thinning. The only exception to this is on sites susceptible to wind damage. These sites can be wind firm through the winter months once the ground is frozen. If winter snow arrives before the ground freezes the root mat, trees can

be susceptible to wind damage. Winds during winter storms are some of the strongest of the year. Wet snow and ice can make wind resistance greater, creating problems that are more serious in high winds.

Care must be taken when using heavy equipment during a thinning. If the roots of the leave trees, especially those close to the stem, are damaged by heavy tires they will be more susceptible to wind throw.

Leave behind trees valuable for wildlife and biodiversity. These include trees with cavities or twig nests, and species not commonly found. Trees that were selected during previous treatments should be included again. It is recommended to leave behind a minimum of five wildlife trees per hectare. Long-lived, wind firm species are preferable.

Select the equipment and extraction method

Most types of extraction equipment can be used for a thinning. When selecting a method and equipment, consider the type of product, trail patterns, equipment size, and time of year, topography, and soil type and equipment availability. Available equipment, such as your own tractor, often determines what type of equipment will be used. This is OK as long as the job is properly planned.

Avoid using heavy equipment on wet or fine textured soils such as clay, unless the soil is dry or frozen. Uneven terrain can cause some problems with unstable types of equipment, such as small tractors. These and other factors will determine what method and piece of equipment is best suited to your thinning. If in doubt, ask a fellow woodlot owner or a forest professional.

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the methods of plant regulation? 10 points
2. Discuss the types of plant pruning. 6 points
3. Explain Pre- Commercial Training (PCT). 4 points

Note: **Satisfactory rating - 20 points** **Unsatisfactory - below 20 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	Operating safely Crop regulation tools, equipment and machinery

After checking the materials, tools, equipments and machineries the remaining thing is to know how to adjust and calibrate. In order to adjust and calibrate these tools, equipments and machineries you have to

- ❖ Read the manuals about recommended and appropriate usage of tools, equipments and machineries
- ❖ Ask your supervisor about those, if you didn't know
- ❖ Refer in different books about tools, equipments and machineries function.
- ❖ Equipment is operated and maintained according to work instructions and enterprise OHS procedures.

During crop regulation and canopy maintenance tools, equipments and machineries must be operated. Operation must be carried out by a person who has technical skill and knowledge in relation to tools, equipments and machineries operation. Operating tools, equipments and machineries is important to assess faulty and that they are safe for the next task. Also it is necessary to maintain tools, equipments and machineries if there any faulty items.

Self-Check -4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page.

1. Explain operating safely Crop regulation tools, equipment and machinery during crop regulation activity. 5 points
2. Define equipment calibration and adjustment? 10 points

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-5	Recording and reporting Signs of diseases and pests

Through undertaking different activities on farm site, investigating for presence of disease and pests, recording signs and reporting for responsible person is crucial for final success of production agriculture. Any crop field requires continuous monitoring to minimize risks of diseases and pests. Daily recording disease sign and symptom is required to take action when damage becomes serious.

- Signs of diseases and pests are recorded and reported to the supervisor. Through undertaking different activities on farm site, investigating for presence of disease and pests, recording signs and reporting for responsible person is crucial for final success of production agriculture. Any crop fields require continuous monitoring to minimize risks of diseases and pests. Daily recording disease sign and symptom is required to take action when damage becomes serious
- Problems and anomalies are identified and reported to the supervisor. These problems and anomalies may include: - presence of insects, diseases, mechanical damage, and irrigation problems.

Self-Check- 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the advantages recording and reporting signs of diseases and pests during crop regulation. 6 points
2. What are the diseases and pests that may exist during crop regulation? 4 points

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Operation Sheet 1	Undertaking crop regulation program

Operation sheet 1.1 Steps of plant regulation by pruning method

1. Select the plants going to be pruned
2. Identify plant parts going to be pruned from selected plants
3. Select and prepare tools, materials and equipments used for pruning
4. Under take pruning activities
5. Apply post pruning treatments to pruned plants
6. Clean and store all used tools, materials and equipments properly
7. Complete pruning activity

Operation sheet 1.2 Steps of plant regulation by thinning method

1. Select the plants going to be pruned
2. Identify plant parts going to be thinned from selected plants
3. Select and prepare tools, materials and equipments used for pruning
4. Under take thinning activities
5. Clean and store all used tools, materials and equipments properly
6. Complete thinning activity

Operation sheet 1.3 Step of plant regulation by pruning method

1. Select the plants going to be trained
2. Identify plant parts going to be trained from selected plants
3. Select and prepare tools, materials and equipments used for training
4. Under take plant training activities
5. Apply post treatments to trained plants
6. Clean and store all used tools, materials and equipments properly
7. Complete plants training activity

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instruction: Given necessary templates, tools and materials you are required to perform the following tasks within 6 hours.

Task 1. Undertake plant regulation work

a. **Perform plant pruning activity**
b. **Perform plant thinning activity**
c. **Perform plant training activity**

References:

1) Practical Manual on Canopy Management in Fruit Crops-Dr. Gorakh Singh (2010). Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, New Delhi-110001

2) Smart, R. E., J. K. Dick, I. M. Gravett, and B. M. Fisher. 1990. Canopy management to improve grape yield and wine quality: Principles and practices. South African Journal of Enological Viticulture 11:3-17.

3) http://www.epd.gov.hk

Horticultural Crops Production

Level II

Learning Guide #55

Unit of Competence: - Carry out Crops Regulation and Canopy Maintenance

Module Title: - Carrying out Crops Regulation and Canopy Maintenance

LG Code:-AGR HCP2 M13LO4-LG-55

TTLM Code:-AGR HCP2 TTLM 0120v1

LO4: Erect and maintain trellises

Instruction Sheet	Learning Guide #55

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Conducting Work with workplace environmental and workplace procedures
- Checking Existing trellises for signs of disrepair
- Preparing and checking Appropriate tools and equipment
- Selecting materials for trellis installation
- Laying out and assembling Posts and supports
- Erect trellis and posts and strain assemblies
- Attaching and tensioning foliage and trellis wires
- Carrying out trellis installation and maintenance
- Recognizing and rectifying Problems and anomalies

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Conduct work in accordance with workplace environmental guidelines
- Check existing trellises for signs of disrepair
- Prepare and check appropriate tools and equipments trellises erection and maintenance
- Select materials for trellis installation
- Lay out posts and supports and run out wire according to instructions
- Erect trellis ends and posts and strain assemblies
- Attach and tension foliage and trellis wires
- Carry out trellis installation and maintenance
- Recognize, rectify and/or report problems and anomalies

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1 to Sheet 9”.
4. Accomplish the “Self-check 1 to Self-check 9” **in page -66, 70, 74, 85, 89, 93 and 94** respectively.

Information Sheet-1	Conducting Work with workplace environmental and workplace procedures

- Instructions are guide lines for the operation and may concern with:-
  - Procedures
    - steps of activities/sequences of activities
    - how to operate the toos/equipment/on,off
  - Safety measures to be taken (man, animal, plant, environment0
    -Handling, operating, cleaning/washing , storage, disposal of wastes
  - Calibration
    - Tools and equipments, power
    - Chemicals (mixing ratio, rate of application, flow rate)
- Instructions are sources of information and can be written or oral
  i. Written; note books, manuals, reports, books, tables, pamphlets/broshers,
  ii. Oral: directions from super visors and managers as a result of direct communication
- For written instructions:- carefully reading , understanding and interpretation
  e.g. A.I. , EC 60% WP 40%, cc, cm^3, ml, ppm
- Oral instruction/directions:- listen attentively, write notes correctly and understand the directions/instructions given

Self-Check- 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the work place guides that should be followed during crop regulation work. 7 points
2. What are the advantages of following instruction during crop regulation work? 3 points
3. Explain the differences of oral instruction and written instruction. 5 points

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Checking Existing trellises for signs of disrepair

Trellises/Staking

It refers to support some vegetables with some wood, bamboo, rope etc. With few exceptions, all viny vegetables are staked.

A trellis is a latticed and gridded wooden structure that is used for keeping plants growing upward. It can also be used to create private areas of a garden (such as privacy screens or walled off spaces) or to form specific breaks between different areas of a garden.

Consisting of horizontal crosspieces and vertical supports, it is often placed against a structure, such as a wall or a fence. However it can also be free-standing, if adequately supported. The trellis is usually shaped either as a rectangle or a square but can be formed into other shapes. Trellis can also be formed into artistic architectural designs such as pergolas or walkway covers.

Trellis is ideal for climbing plants and plants that like to attach by spiralling around something. This includes creepers, climbers, fruit trees, shrubs, young trees, vegetables and flowers. Fruit trees can be espaliered, a method to pin fruit trees to specific and confined directions for growing (to make fruit retrieval easier and to keep the size of the tree under control).

Common materials for trellis include willow, bamboo, pine (often treated), thin wood, metal (wire), monofilament, waterproof synthetic materials and repurposed items. It can be purchased ready-made from hardware stores, garden centers and nurseries, or you can make your own using lightweight yet strong wood. A trellis must be sturdy enough to hold the plant as it grows.

Importance of trellises/Staking

Climbing vegetables such as pole beans and peas, and sprawling vegetables such as tomatoes, cucumbers and melons will benefit from staking. Benefits of training by stalking are:

- Increasing the density of plant and making better use of space.

- Allowing air to circulate and sunshine to penetrate into the plants, obtaining higher yield and good quality of products. So, it helps produce better products.
- Keeping shoots and fruits off the ground and keeping them from rotting.
- Preventing pests and diseases
- Making soil operation easier.
- Desired shape to the vine which facilitates

✓ Cultivation, spraying and harvesting operations

- Establish strong frame work of the vine
- Better crop maintenance, high yield and quality
- Leaf orientation as well as expansion
- Uniform fruit distributions and ripening on the vines
- Ensure economic returns

Staking facilitates management operations, such as irrigation, inter-tillage and harvesting.
Trellis can be used in the garden context to create a illusion. This refers to an "illusion" in which a garden space can be made to appear larger than it actually is by the placement of trellis in a design pattern that suggests depth. This can be done by the shape of the trellis (such as an archway made from trellis attached to a plain single colored wall, suggestive of a hole to step through into the beyond. Or, it can be done with the use of a mirror, such as placing a mirror in the centre and surrounding it with trellis as a border, including climbing plants. The mirror reflects back the garden, making it appear as if there is more garden space and the trellis border amplifies the sense of space. In the case of using a mirror, be sure to hide the mirror edges well underneath the trellis edges, to give the impression of no edge and thus enhancing the illusion of depth and space.

Many plants can benefit from being planted alongside a trellis. Here are some plants that are typically grown against a trellis:

- Honeysuckle
- Climbing, rambling roses
- Passion flower
- Morning glory (*Ipomoea purpurea*)

- Star jasmine (*Jasminum* spp.)
- Clematis
- Grapes
- Pole beans (*Phaeolus vulgaris*)
- Scarlet runner beans (*Phaseolus coccineus*)
- Peas (*Pisum sativum*)
- Cucumber (*Cucumis sativus*)
- Squash
- Wisteria
- Apples (espalier)
- Plums (espalier)
- Peaches (espalier)
- Apricots (espalier)

Self-Check- 2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define trellises/staking. 5 points
2. What are the importance/advantages of trellises? 8 points
3. List the plants grown on trellises. 7 points

Note: **Satisfactory rating – 20 points** **Unsatisfactory - below 20 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-3	Preparing and checking Appropriate tools and equipment

To know the rules of pruning is most important, but of equal importance is using the correct tools. Equipment can he limited to a few items if the proper ones are selected. Select tools that will do the job, keep a sharp edge, and are relatively easy to sharpen and handle. Some of the most commonly used pruning tools are shown below. Good equipment properly cared for does a better job and lasts longer. Store equipment in a dry room and keep it sharp and in good operating condition. When pruning diseased plants, disinfect all shears and saw blades after each cut to prevent spreading disease to healthy plants. An example of this is pruning fire blight from pears, pyracantha or cotoneaster. Use alcohol or bleach to disinfect equipment between each cut. Mix at the rate of one part bleach to nine parts water.

Power equipment such as lightweight chain saws can he purchased or rented. These are particularly useful in cutting fallen trees or large limbs. Only professional arborists should use power saws for pruning in trees because there are many ways a person can be hurt.

Hedge shears are used mainly for shearing plants into hedges or formal shapes. The most common type is manually operated; however, if large areas of hedges are involved, power-driven shears may he more practical. Pruning saws, both rigid or folding, are very useful for cutting larger branches that cannot be handled by hand shears. Tree saws are available for removing large tree branches. Pruning saws, which usually cut on the pull stroke, are preferred over a carpenter's saw because they cut faster and easier. The teeth in these saws are set for a wider cut allowing the sawdust to kick out resulting in less binding in green wood.

Pole pruners are used for removing tree branches that cannot be reached from the ground. Two types are generally available. One has a small tree saw attached to the end and can be used for removing small as well as large branches. The other, more commonly used pruner is similar to a large pair of loppers. A cutting action is brought about by pulling on a rope or a lever. Regardless of the type selected, pruners are available in various lengths. The wood or aluminum poles are either one piece or may consist of collapsing sections. Do not work around electrical power lines when using pole pruners. This is especially true when using those with aluminum handles as aluminum is an excellent conductor of electricity.

Lopping shears are for cuts larger than those made with hand shears. Usually they will cut branches up to 2 inches or more depending on the size of the blade opening and the tree species. Loppers also work well on plants with stickers or thorns. Exercise care when using loppers around electrical wires. Select loppers with handles that are a comfortable length to use.

There are many kinds of hand pruning shears. Most of them are designed for cutting stems up to ½ inch in diameter. If one has to push or twist the shears to make a cut, the branch is too large. To make a close cut with the least effort, place the blade against the branch or trunk from which the limb is to be removed.

Other tools, which are sometimes necessary, are chisels, gouges, pruning knife and mallets. These all come in handy when repairing storm damage or other wounds.

Self-Check- 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the advantages preparing and checking appropriate tools and equipment. 5 points

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	Selecting materials for trellis installation

While they support your plants, trellises can also provide an interesting focal point in the garden.

Spend a week or two touring British flower gardens, and you'll come home with a whole new appreciation for how climbing plants can enhance a garden. Everywhere you turn the walls are covered with roses and climbing hydrangeas; the trees and shrubs are threaded with clematis; pergolas, arches and fences are draped in honeysuckle and ivies; obelisks and tripods are woven with sweet peas, morning glories and thunbergia; passion vines, jasmine, mandevillea and bougainvillea fill pots and planters of every shape.

Three things to consider when selecting a trellis are:-

1. Choose supports that are sturdy enough for the vines you want to plant. Supports should be made of weatherproof materials (such as galvanized or powder-coated steel, painted or treated wood), especially if you are planting a perennial vine.
2. Also think about whether you want the support — as well as the plant — to be a decorative garden feature, or if the support's only job is to show off the plant. Decorative plant supports can serve as interesting focal points in the garden (arbors marking an entryway, an obelisk marking the end of a pathway), or can provide a sense of enclosure by screening views and/or delineating boundaries (fences, trellis panels, walls, pergolas).
3. And last, think about what kinds of plants you want to grow. A climbing rose requires a different type of support than a sweet pea; pole beans need a different support from a tomato or cucumber plant. To learn more about which types of supports suit which types of plants, read How Plants Climb.

Here are seven choices, both functional and decorative.

1. Arches

These structures can add distinctive flair to your garden, no matter what the season. Design and placement are critical. Spend some time in your garden determining what style and scale structure would be compatible with your house and landscape.

These structures are most often made of wood, which can be painted or stained to resist the elements. Steel and plastic versions are also available, and are a smart choice if the style suits your garden.

Fig. arch trellis installation

2. Flat trellises

These are often used to define a space or provide a sense of privacy. They may be freestanding, or can be anchored to a wall or posts. Sometimes permanently located, they are also relatively easy to move around the garden if you want to try out different effects. Examples of flat trellises would be wood lattice panels, metal trellises of various kinds, and those made of plastic mesh.

Fig4.2 flat trellises

3. Obelisks, tripods and teepees

Both functional and decorative, these structures add a strong vertical element that can serve as a focal point in the garden. Like exclamation points, they're most effective when not overused. Make sure the structure is tall enough to support the type of plant you want to grow. Scarlet runner beans and vigorous varieties of morning glories, for instance, want a support that's 8 to 10 feet tall; they'll quickly overpower a 4-foot tripod. Bamboo canes make inexpensive and attractive teepees for the vegetable garden.

Fig 4.3 Obelisks, tripods and teepees

4. Cages and ladders

Vegetable supports should be sturdy and made of durable materials, and tall enough for the plants they'll support. Choices include a traditional cage, a tower, a teepee, or a ladder.

Our new Vertex Lifetime Tomato Cage is available for both compact (determinate) tomato varieties as well as tall-growing (indeterminate) tomato varieties.

Fig. 4.4 cages, ladder trellises

5. Fencing and porches

There are climbers to suit almost every type of fencing you can imagine—even chain-link fences. Climbing roses look beautiful draped over a post-and-rail fence. When they get a little help from strings or plastic netting, sweet peas look terrific growing against a picket fence. Porch railings and banisters can be wrapped with plastic trellis netting.

Fig.4.5 fencing porches trellises

6. Walls

Not many of us have beautiful 10-foot-high walls of aged brick around our gardens. But you might consider growing plants on one wall of your house, the wall of an outbuilding, or the "wall" of a neighbor's fence. There are a couple options for training plants against a wall.

Clinging plants like Boston ivy, can attach themselves to almost any wall with no other support necessary. Most other plants will need to attach themselves to a wall-mounted trellis or a system of wires and eye bolts.

Fig 4.6 trellises installed on the wall

7. **Twiggy branches**

Ubiquitous in Britain, where they are usually called "pea sticks" because they are ideal for supporting sweet peas. Collect some branches about 3 to 5 feet in length, and then simply push them into the soil. The more tiny twigs, the better. Branches from shrubs often work better than trees.

Why do the Brits love them so much? They're free! But they're also quick to install, almost invisible when covered with vines, and can be composted at year's end.

One last idea from England that's super-easy: Try growing a climber up through an existing shrub or tree. Clematis are ideal for this job. Years ago, I planted *Clematis* 'Henryii' at the base of a white birch. At first I had to help it up with some strings, but it quickly found its way into the branches above and every year, it puts on a stunning display with its huge white flowers. Clematis are also happy to thread their way through shrub roses and lilacs. Another plant that I often saw growing up through hedges was *Tropaeolum*, also known as canary creeper. If your climate is temperate enough, passion vines are also good weavers.

So don't let the Brits have all the fun. Try combining a couple of these supports with a some interesting climbing plants and let them take your garden to new heights.

Fig4.7 twiggy trellises

Self-Check- 4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the advantages of selecting materials for trellis installation during crop regulation work? 5 points
2. Explain the three things to be considered when selecting a trellis. 6 points
3. Discuss the different types of trellises materials. 4 points

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-5	Laying out and assembling Posts and supports

When looking at pictures of an established vineyard, it can be hard to remember that grape vines are not always the tame, manicured plants we commonly see. Grape vines are climbing vines, which can form to a wide variety of shapes and styles. The meticulous organization characteristic of modern vineyards is attributed not to the intrinsic nature of the plant, but to the trellis system – the wires and stake infrastructure of a vineyard used to train these malleable vines to the optimal size and shape. These systems are crucial in viticulture to control vine vigor and yields, optimize air movement and attain the perfect fruit to leaf ratio.

Pinot Noir vineyards are commonly planted using a trellising and vine training system called Vertical Shoot Positioning, or *VSP*. In this canopy management system, movable wires are used to contain the new vine growth and train vine shoots in a narrow, vertical curtain. VSP trellising is ideal for small, low vigor vines such as Pinot Noir due to narrow row spacing, maximum light penetration and optimum airflow. This positioning has played an integral role in cultivating the extreme Sonoma Coast, as VSP spacing and light maximization encourages fruit ripening and development in the otherwise challenging, cool climate, while optimum air flow decreases risk of mildew and rot to which Pinot Noir is susceptible.

As viticulture research has made leaps and bounds over the past decades, winemakers and viticulturalists have been able to push the boundaries on where fruit of superior depth and quality can ripen. VSP trellising has played an integral role in the cultivation of the extreme Sonoma Coast.

Fig 5.1 Trellises lay out

Shoot positioning is an important element of canopy management in the vineyard. Proper shoot positioning results in orienting shoots to create a uniform distribution of foliage that minimizes shading of fruit. An open canopy is essential to the productivity of the vine as well as fruit quality. Not only is shoot positioning important for the current growing season, it also has an impact on productivity in the following year. Sunlight encourages the development of more fruitful buds for next year's crop.

Shoot positioning also has a positive impact on disease incidence and severity. Disease pressure is lessened due to increased air flow and sunlight penetration.

The manner in which shoot positioning is approached will depend on the trellis and training system in place. In a low cordon trellis system, such as Vertical Shoot Positioning or VSP, the process is sometimes referred to as "tucking," since canes are tucked upward between a set of catch wires as they develop. Tucking of shoots will need to be done several times during the growing season. On high cordon systems such as Geneva Double Curtain or GDC, and bi-lateral cordon, shoots are positioned so they grow downward and out from the cordon. This process is sometimes referred to as "combing." Downward positioning will reduce the vigor of shoots and will assist in attaining optimal canopy density. Shoot positioning is performed on the interior of the GDC trellis to maintain two, distinct canopies — often referred to as "center breaking." This task must be done at every shoot positioning pass.

In most training systems, shoots can be positioned manually or mechanically with specialized equipment. It is usually done one to two weeks after bloom, before tendrils have become firmly attached. Two or three shoot positioning passes will be needed for best results.

Fig. 5.2 Shoot vertical positioning

Self-Check- 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the advantages of trellises lay out. 5 points
2. Define shoot vertical positioning. 5 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-6	Erect trellis and posts and strain assemblies

In this canopy management system, movable wires are used to contain the new vine growth and train vine shoots in a narrow, vertical curtain. VSP trellising is ideal for small, low vigor vines such as Pinot Noir due to narrow row spacing, maximum light penetration and optimum airflow. This positioning has played an integral role in cultivating the extreme Sonoma Coast, as VSP spacing and light maximization encourages fruit ripening and development in the otherwise challenging, cool climate, while optimum air flow decreases risk of mildew and rot to which Pinot Noir is susceptible.

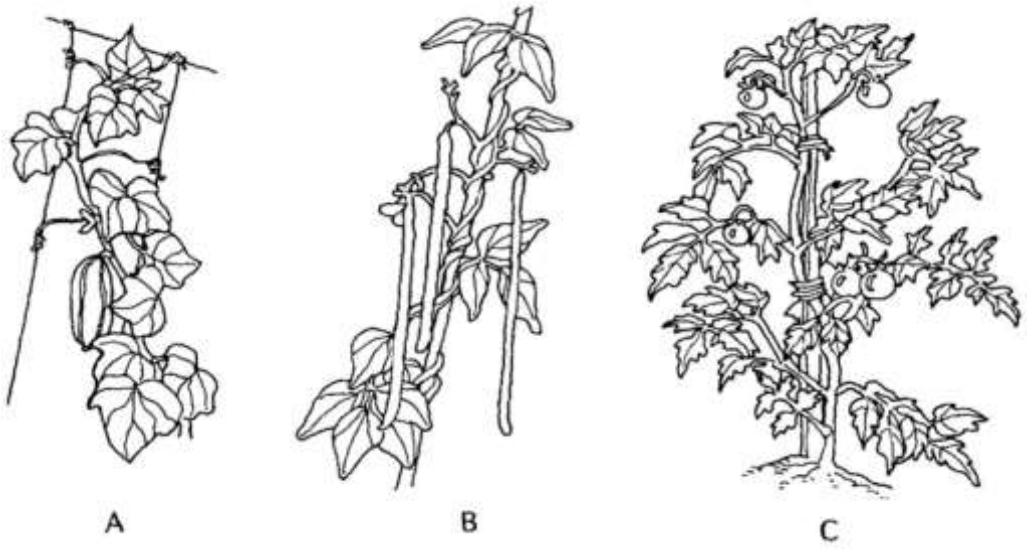

Fig.6.1 Methods of staking: A ***for climbing plants,*** B ***for twining plants***, and C ***for plants that do not have the ability to climb or twine***

Self-Check- 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss about erect trellis and posts and strain assemblies. 6 points

Note: **Satisfactory rating – 6 points** **Unsatisfactory - below 6 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-7	Attaching and tensioning foliage and trellis wires

Originally, trellises we hung on pre-cemented wall hooks and secured with bast or similar, fibrous material. This was so they could be easily removed should the wall need any repairs or maintenance but even with modern anchors, a trellis can be quickly detached if, for example, the façade needs renovating. Almost all of FassadenGrün's holders also provide a seal.

Usually, it is the lateral slats which are anchored to the wall and, once secure, the vertical slats are then positioned and screwed over them. Very large trellises, multiple meters wide, are divided into individual panels or trellis grids, which can then be removed separately. We recommend that you measure and demarcate the points at which you want to drill rather than taking a spontaneous approach.

When fitting a trellis you should also be aware of providing sufficient distance between it and the wall so that your plants do not feel suffocated. First, the gap between the wall and the back of the trellis cross bar is measured. For the individual trellis holders it is 1-5cm.

Fig.7.1 Attaching and tensioning foliage and trellis wires

Self-Check- 7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Explain the importance of attaching and tensioning foliage and trellis wires. 8 points

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-8	Carrying out trellis installation and maintenance

Canopy management refers an interrelation of the physiology underlying the relationship between vegetative growth and production.

1. Orchard architecture largely depends upon orchard production system which is a combination of variety, rootstock, tree spacing, training and pruning

2. These factors strongly interact to develop a specific production system and determined yield, fruit quality and longevity of the trees.

3. In perennial fruit crops, cultural practices like nutrition, irrigation, planting density, rootstocks training system, pruning and growth retardants can be used as potential means to alter the shoot vigour, size and shape of the canopy and the microclimate at the canopy and thereby increase yield and quality.

Canopy management refers an interpretation of physiology of light penetration and interception which are critical components of overall tree productivity. Thus, the ultimate goal of canopy managements is to optimize carbon allocation in fruit sinks without disturbing growth and development in other parts of the tree. The influence of temperature, light, humidity and tree vigour on the productivity and quality of fruit and manipulation of tree canopy through training systems, pruning practices and use of growth retardants for the best utilization and harvest. In the last few years, significant development and strong formation have taken place in the development of tree canopy forms and new production system. High yield of good quality fruits produced under such systems are attributable to high light interception and distribution within the canopy. Therefore, for optimum interception and distribution of light for quality fruit production, canopy management requires focus on proper stock stem combination, training and pruning and other management practices to make last use of the space, and to keep the orchard in healthy condition.

Essential feature of an ideal canopy:-

1) It should have adequate number of fruiting units.
2) It allow sufficient light and ventilation in to canopy
3) It should support adequate foliage and protect the fruits from sunburn.
4) It avoid overlapping of foliage to minimize parasitic leaves.
5) It offers scope for effective coverage of sprays.
6) It should avoid the buildup of microclimate congenial for pest and disease development.

Objective of canopy management:-

1) To get the higher yield with good quality.
2) To maintain a good balance between root and shoot growth.
3) Formation of strong crotches.
4) To remove unwanted, overcrowding, dead disease and pest affected shoots.
5) To regulate the tree architecture or form desire shape for high density planting system.
6) To facilitate the management practices like spraying, harvesting etc.
7) To utilize air, light and temperature efficiently.
8) To regulate exposure of plant to light and air.
9) To make accessibility to machinery between rows.

Canopy maintenance is achieved through:-

- Proper Variety Selection
- Proper Training System/trellis system/supporting systems Selection
- Proper pruning
- Crop Load Adjustments:-balance b/n vegetative and reproductive
- Suitable climatic conditions

Self-Check- 8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss canopy installation. 4 points
2. What are the objectives and advantages of canopy maintenance? 8 points

Note: **Satisfactory rating – 12 points** **Unsatisfactory - below 12 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-9	Recognizing and rectifying Problems and anomalies

Trellis care is governed by the materials it is made from, where it is located and how it was constructed and installed. Wooden posts installed directly into the soil will show signs of rot quickly. A wire trellis will stretch out of shape and a metal structure can rust or become brittle. The paint on a wood trellis will crack and peel over time, exposing the wood to rot.

Always install a trellis strong enough to do its job. Lightweight vinyl trellises, for example, won't support large climbing roses. Install wooden trellises at least a foot from the house to maximize air circulation. Likewise, avoid putting wood posts directly into the ground and instead attach them to a metal stake. A structure that is hinged at the base can be lowered for easier maintenance. Use corrosion- and rot-resistant materials, such as copper or redwood. Liquid wood preservative helps unpainted wood stay rot-free.

Fig. 9.1 poorly installed trellis

Self-Check- 9	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Explain the advantages of recognizing and rectifying Problems and anomalies. 7 points
2. What are the problems resulted from miss installed of trellis? 6 points

Note: **Satisfactory rating – 13 points** **Unsatisfactory - below 13 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

References:

1) Practical Manual on Canopy Management in Fruit Crops-Dr. Gorakh Singh (2010). Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, New Delhi-110001

2) Smart, R. E., J. K. Dick, I. M. Gravett, and B. M. Fisher. 1990. Canopy management to improve grape yield and wine quality: Principles and practices. South African Journal of Enological Viticulture 11:3-17.

3) http://www.epd.gov.hk

Horticultural Crops Production

Level II

Learning Guide #56

Unit of Competence: - Carry out Crops Regulation and Canopy Maintenance

Module Title: - Carrying out Crops Regulation and Canopy Maintenance

LG Code:-AGR HCP2 M13LO5-LG-56

TTLM Code:-AGR HCP2 TTLM 0120v1

LO5: Carry out basic canopy maintenance

Instruction Sheet	Learning Guide #56

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Identifying and removing Unwanted growth
- Pulling out Pruned material
- Performing post-pruning treatments
- Shaping, supporting or Positioning canopy
- Applying Control measures
- Operating and maintaining equipment

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Remove and identify unwanted growth.
- Pull out pruned material of the canopy
- Perform post-pruning treatments on the canopy.
- Shape, support and position canopy
- Apply control measures to regulate exposure of the crop to sun and to protect crop from damage.
- Operate and maintain equipment

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1 to Sheet 6”.
4. Accomplish the “Self-check to Self-check 6” **in page -99, 101, 104, 105 and 108** respectively.

Information Sheet-1	Identifying and removing unwanted growth

Identifying plants that require crop regulation is first step in carrying out crop regulation activities. Basically, before starting crop regulation activity, identifying the plant materials to be thinned or pruned is the central part of crop regulation. Therefore, carefully you should have to know and identify different plant materials to be regulated. This is because there are variety of horticultural crops (vegetables, fruits, flowers, tubers, root crops…etc) which have different plant materials to be thinned or pruned.

Unwanted growth in fruits and vegetable and other trees are including:

- Non-fruiting wood such as suckers and water shoots;
- damaged limbs or those that have died back,
- congested shoots,
- excessive fruit, flowers, or leaves
- non-fruiting wood such as suckers

Identification will be based on the type of horticultural crop and purpose of crop regulation. The major importance of knowing and identifying plant materials to be thinned or regulated is to:-

- Successfully perform the crop regulation activities
- Reduce crop losses during thinning or pruning
- Save the wastage of time and money
- Reduce contamination
- Have healthy and quality crop yield
- Reduce regulating unwanted horticultural plants and plant materials…and so on.

Self-Check- 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are unwanted plant parts to be regulated? 10 points
2. Discuss the importance of knowing plant parts to be regulated? 5 points

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Pulling out Pruned material

After the end of crop regulation and canopy maintenance work, all formed unwanted materials (pruned materials) should be pulled out and collected. These materials may used for another purpose or avoided by disposing in the area designed for this purpose. we have to dis-infect and after dis-infecting, since the dis-infecting chemical has a corrosive nature should be rinsed every working tools and equipment with clean water, then drying with a cotton cloth, after this we should lubricate with oily lubricant (grease), wrapped with polythen sheet/bag (plastic sheet/bag) and keep appropriately in the right storage place. All pruned materials should be avoided properly.

Self-Check- 2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the importance of pulling out pruned materials properly. 5 points

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-3	Performing post-pruning treatments

Post-pruning treatments are treatments applied to the plant/plant parts after pruning

- Post pruning treatment can be done to :-

1. Cut ends/ pruning wound

- The wound treatments on cut parts/surfaces can be :-

a. Artificial treatment

i. Swabbing fungicides using dipped cotton wool

ii. Waxing of grafting wax, if wounds are larger than 2 cm thick

iii. Spraying white latex paint/hydrated lime using a power sprayer to reduce sun burn of the top stumps

b. Natural treatment

- Natural healing, if sufficient precautions are taken
  - using sharp, clean and smooth instruments
  - correct method for making cuts

2. Tools and equipments:

- The treatments on tools and equipments can be:-

-Sterilization/disinfection with chemical

3. Pruned shoots/canopy:

- The treatments on pruned shoots/canopy can be:-

i.Spraying fungicides immediately

ii.Spraying white latex paint/hydrated lime using a power sprayer to reduce sun burn of limb and trunk growing in shade

Prepare chemical spray solutions

- Prepare solutions in the required strength based on current recommended concentrations
  - i. ppm(parts per million) or
  - ii. Percentage (%) bases)

- 1 ppm concentration solution is prepared by dissolving:-
  - 1 mg of the substance in 1lt distilled water
- 1% concentration solution is prepared by dissolving:-
  - ❖ 1 gm of the material/substance dissolved in100 ml of solvent

Chemicals and spraying equipments

i. Chemicals

ii. Pesticides (fungicides)

ii. Commercial growth hormones

ii. Spraying equipments

4. Manually Operated Knapsack
5. Motorized knapsack
6. Vehicle mounted Sprayers- Boom Sprayers

- Spraying of chemicals should be :-
  - Environmentally Sound
  - Economically Viable/feasible

Self-Check- 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Define post prune treatments. 4 points
2. What are post prune treatments? 6 points
3. Explain how chemicals solution prepared for post prune treatments. 5 points

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

Information Sheet-4	Positioning canopy

Regardless of the distance from the wall, perennial shoots that form the plant structure, must never grow behind or wrap around the trellis, otherwise the plants growth, and more specifically girth, can and very often will damage the trellis or growth structure, as with this Wisteria to the right.

Self-Check- 4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is positioning canopy? 10 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-5	Applying Control measures

Damages to a fruit tree canopy

- Wind limb breakage
- Heavy crop load : branch breakage
- Sun burn/sun scald: due to high temperature, less canopy
- Frost due to low temperature
- Hail storm:- less dense canopy
- Bruising of fruits, shading of leave. flowers and fruits
- Disease and insect damage;-Due to crowding of branches, cut wounds

i. Proper pruning and thinning/ canopy maintenance practices
   - ✓ Leaf removal
   - ✓ branch removal
   - ✓ applying or removing shade cloth,
   - ✓ bird or hail netting
   - ✓ Lifting and lowering of trellises/movable wires
   - ✓ Proper positioning of shoots

iii. Proper irrigation and fertilization

iv. Proper chemical spray

Self-Check- 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are damages to canopy? 5 points
2. Discuss measurement of canopy damaged? 5 points

Note: **Satisfactory rating – 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-6	Operating and maintaining equipment

After crop regulation activities are completed, tools, equipments and machineries must be operated. Operation must be carried out by a person who has technical skill and knowledge in relation to tools, equipments and machineries operation. Operating tools, equipments and machineries is important to assess faulty and that they are safe for the next task. Also it is necessary to maintain tools, equipments and machineries if there any faulty items.

Self-Check- 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss operating and maintaining equipments. 6 points

Note: **Satisfactory rating - 6 points** **Unsatisfactory - below 6 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

References:

1) Practical Manual on Canopy Management in Fruit Crops-Dr. Gorakh Singh (2010). Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, New Delhi-110001

2) National Council of Educational Research and training(NCERT),1999.Horticulture, Fruit Production,Practical Manual,New Delhi,India.

3) http://www.epd.gov.hk

Horticultural Crops Production

Level II

Learning Guide #57

Unit of Competence: - Carry out Crops Regulation and Canopy Maintenance

Module Title: - Carrying out Crops Regulation and Canopy Maintenance

LG Code:-AGR HCP2 M13LO6-LG-57

TTLM Code:-AGR HCP2 TTLM 0120v1

LO6: Complete Work activities

Instruction Sheet	Learning Guide #57

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Using Correct manual handling techniques
- Cleaning, sharpening and storing tools and equipment
- Storing materials
- Identifying and reporting Problems and anomalies
- Collecting and disposing waste material
- Maintaining clean and safe work area
- Recording workplace information
- Recording and reported work outcomes

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Use correct manual handling techniques
- Clean, sharpen and store tools and equipments
- Store materials
- Identify and report problems and anomalies.
- Collect and dispose or recycle pruned/waste materials
- Maintain a clean and safe work area
- Record workplace information
- Record and report work outcomes

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 4.
3. Read the information written in the information “Sheet 1 to Sheet 8”.
4. Accomplish the “Self-check 1 to Self check 8” **in page -116, 118, 119, 121, 123, 125,128 and130** respectively.

Information Sheet-1	Using Correct manual handling techniques

At the time of performing different activities, proper handling, moving and lifting of heavy load is important to minimize health risks

Proper methods of lifting and handling protect against injury. Proper lifting makes work easier. You need to "think" about what you are going to do before bending to pick up an object. Over time, safe lifting technique should become a habit.

Safe lifting and material handling means keeping your back aligned and balanced when lifting. Most standard loads fewer than 25kg can be lifted and carried safely by following these steps. You begin by bending from the knees (not the waist), tucking your pelvis and tightening your stomach muscles. You then hug the load close to you, and gradually lift yourself up using the strong muscles in your legs. When carrying the object, be sure not to twist or bend. Then, bend at the knees and slowly slide the load down your body until you can comfortably put the load down

Mechanical Aids

Not all material can (or should) be manually lifted. Carts, bins, hand trucks, dollies, and forklifts are all mechanical aids that can help transport a load without putting undue strain on your back. Pushcarts and bins can be useful for light, awkward material handling tasks, while hand trucks and forklifts can help move heavier, stackable material. When using mechanical aids for material handling, be sure that the load is secured in place before moving, and be sure to push the device rather than pulling it. When manually moving materials, you should seek help when a load is so bulky it cannot be properly grasped or lifted, when they cannot see around or over it, or when a load cannot be safely handled. Workers also should use appropriate protective equipment as necessary to help reduce accident potential. For loads with sharp or rough edges, wear gloves or other hand and forearm protection. To avoid injuries to the hands and eyes, use gloves and eye protection. When the loads are heavy or bulky, the mover should also wear steel-toed safety shoes or boots to prevent foot injuries if the worker slips or accidentally drops a load.

When mechanically moving materials, avoid overloading the equipment by letting the weight, size, and shape of the material being moved, dictate the type of equipment used for transporting it. All materials handling equipment has rated capacities that determine the maximum weight the equipment can safely handle and the conditions under which it can handle those weights All stacked loads must be correctly piled and cross-tiered, where possible. Precautions also should be taken when stacking and storing material. Stored materials must not create a hazard. Storage areas must be kept free from accumulated materials that may cause tripping, fires, or explosions, or that may contribute to the harboring of rats and other pests. When stacking and piling materials, it's important to be aware of such factors as the materials' height and weight, how accessible the stored materials are to the user, and the condition of the containers where the materials are being stored.

The following are the basics steps of safe lifting and handling.

1. Size up the load and check overall conditions. Don't attempt the lift by yourself if the load appears to be too heavy or awkward. Check that there is enough space for movement, and that the footing is good. "Good housekeeping" ensures that you won't trip or stumble over an obstacle.

2. Make certain that your balance is good. Feet should be shoulder width apart, with one foot *beside* and the other foot behind the object that is to be lifted.

3. Bend (the knees; don't stop. Keep the back straight, but not vertical. (There is a difference. Tucking in the chin straightens the back.)

4. Grip the load with the palms of your hands and your fingers. The palm grip is much more secure. Tuck in the chin again to make certain your back is straight before starting to lift.

5. Use your body weight to start the load moving, then lift by pushing up with the legs. This makes full use of the strongest set of muscles.

6. Keep the arms and elbows close to the body while lifting.

7. Carry the load close to the body. Don't twist your body while carrying the load. To change direction, shift your foot position and turn your whole body.

8. Watch where you are going!

9. To lower the object, bend the knees. Don't stop. To deposit the load on a bench or shelf, place it on the edge and push it into position. Make sure your hands and feet are clear when placing the load.

Make it a habit to follow the above steps when lifting anything-even a relatively light object.

Self-Check- 1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the basic steps safe lifting and handling? 10 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-2	Cleaning, sharpening and storing tools and equipment

Many types of tools and equipments are used for crop regulation activities. After completing crop regulation activities, cleaning, maintaining and storing of these tools and equipments is important regular activities. Make sure all equipment is checked after use and cleaned, maintained and stored in accordance with the storage instructions. Cleaning is done in proper way and then faulty items are checked in order to maintain at a right time before starting the next time task. If any fault is found during checking the tools and equipments, maintenance is carried out by responsible person who has skill and knowledge concerning equipments and tools maintenance. After maintenance activities are accomplished, materials are stored at clean and proper place. Retail stores vary considerably from large department stores to much smaller specialty stores; therefore the store keeping policies and procedures can also vary considerably. Team members must be familiar with their store's policies and procedures and occupational health and safety requirements as this will ensure the store looks its best and the correct image is being projected to users.

Storage mechanisms for each and individual tools and equipments must be defined correctly based on variety of tools and equipments. The proper the storage is done, the longer life span of the tools and equipments to use.

Self-Check- 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the activities that should be done following the completion of crop regulation? 7 points
2. Discuss the importance of cleaning, sharpening and storing of tools at the end of crop regulation work. 6 points

Note: **Satisfactory rating – 13 points** **Unsatisfactory - below 13 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-3	Storing materials

Storage mechanisms for each and individual tools and equipments must be defined correctly based on variety of tools and equipments. The proper the storage is done, the longer life span of the tools and equipments to use.

Self-Check- 3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Where should be stored all tools, materials and equipments used during crop regulation and canopy maintenance? 3 points
2. What is the advantage of storing materials properly? 5 points

Note: **Satisfactory rating – 8 points** **Unsatisfactory - below 8points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-4	Identifying and reporting Problems and anomalies

- Problems and anomalies may include:-
  - Presence of insect pests and diseases;
  - Mechanical damage:-frost/chilling damage,
    - sun burn/scald
    - pruning wounds,
    -bruising/scarring of fruits
  - Irrigation problems/moisture stress: leaf, flower and fruit shading

While crop regulation and canopy maintenance problems may occurred and these occurred problems and anomalies must be identified and reported to supervisor to bring solutions for those problems according to enterprise work guidelines.

Self-Check- 4	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the problems and anomalies that may occur during crop regulation work. 6 points
2. What are the importance of identification and reporting of problems and anomalies? 4 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-5	Collecting and disposing waste material

While carrying out crop regulation activities, there different waste materials. So that, after completing crop regulation, these waste materials must be removed from crop site and disposed in proper manner. Waste material may include:

- Small to medium branches.
- Foliage.
- Leaves.
- Sticks.
- Buds.
- Flowers.
- Fruit.
- Bark.

Plant debris and chipped material.

Waste disposal

- Wastes pruned plant parts and others will serve as dwelling sites for insects and diseases and should be removed from the area to reduce pest populations
- Waste disposal refers to disposal of :-

  a. pruned/removed plant materials

  -shoots, branches, leaves, flowers, fruits etc

  b. treatment wastes

  -plastics, papers, plastic bottles

- Pruned waste disposal is more easily accomplished immediately after pruning while it is still moist and green.

Methods of waste disposal

i. Burying/composting: re-use/re-cycle materials in pits

ii. Burning/incineration:- in pits

Self-Check- 5	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the waste materials that found at the end of crop regulation work? 7 points
2. Discuss the method waste material management. 6 points

Note: **Satisfactory rating - 13 points** **Unsatisfactory - below 13 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-6	Maintaining clean and safe work area

Maintaining clean work environment is the responsibility of everyone. These tasks may include:

- disabling unused tools, equipment and machinery and storing neatly out of the way of crop regulation activities;
- safely storing materials on site;
- Using signage and safety barriers during crop regulation and removing them after activities are completed.
- Swiftly and efficiently removing and processing debris and waste from the work area.

Self-Check- 6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss about maintaining clean and safe work area at crop regulation work. 10 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-7	Recording workplace information

Gathering work area information

- Information concerning the work area for canopy maintenance can be gathered from:-

1. Primary sources
2. Secondary sources

1. Primary sources

a. Field assessment/field inspection

- Identify plant parts to be:

-Supported: seedlings, fruiting branches of fruit trees

-Supported and positioned:- seedlings/trunk and fruiting shoots of grape vine

-Removed /identifying unwanted growth

- ❖ completely/entirely:- Thinning out
- ❖ partially:- heading back

- Identify canopy maintenance requirements of identified plant/plant parts

e.g. Training. pruning

b. Discussion, interview, questionnaire with the:

- supervisors, managers and workers

2. Secondary sources:-

I. Reports/books concerning:-

- Production data
- Metrological data
- Time of maintenance and production
- Constraints/limitations and opportunities of production
- Resources available

ii.Manuals and thesis

- Methods
- Procedures and equipment/tools used for/in production

Self-Check- 7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Discuss the advantages of information gathering during crop regulation work? 6 points
2. What are the sources of information that should be gathered? 4 points

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Information Sheet-8	Recording and reported work outcomes

Record Keeping is an essential part of Agricultural activities.

Management of the farm is the first reason to keep a good set of records.

Record keeping can aid in planning of your activities.

Your records should contain the usage of materials on fields, crops, and other related resources along with fertilizer and restricted use pesticide applications, soil amendments, and resulting crop yields.

The producer can use this recorded information to determine the best amendments for subsequent crop plantings as well as to meet certain governmental reporting requirements. Record Keeping can play a major role in the success of your farm in reducing risks. A successful farm business needs records to monitor the progress of their business and help prepare financial statements. Keeping good records can determine if a farm operation is in a good condition and final evaluation of work results. Based on record kept, work out come is reported for supervisor of the work eventually.

Self-Check- 8	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are things that should be recorded during crop regulation and canopy maintenance? 4 points

1. What is the advantage of record keeping of the work out comes? 6 points
2. Discuss the importance of reporting recorded work out comes. 6 points

Note: **Satisfactory rating - 16 points** **Unsatisfactory - below 16 points**

You can ask your teacher for the copy of your answer

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

References:

1) Practical Manual on Canopy Management in Fruit Crops-Dr. Gorakh Singh (2010). Department of Agriculture & Cooperation, Ministry of Agriculture, Govt. of India, New Delhi-110001
2) Smart, R. E., J. K. Dick, I. M. Gravett, and B. M. Fisher. 1990. Canopy management to improve grape yield and wine quality: Principles and practices. South African Journal of Enological Viticulture 11:3-17.
3) Palmer JW, Cai YL, Edjamo Y. 1991. Effect of part-tree flower thinning onfruiting, vegetative growth and leaf photosynthesis in 'Cox's Orange Pippin' apple. Journal of Horticultural Science 66: 319–325.
4) National Council of Educational Research and training(NCERT),1999.Horticulture, Fruit Production,Practical Manual,New Delhi,India.
5) http://www.epd.gov.hk

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