Horticultural Crops Production

Level-III

Learning Guide-58

Unit of Competence: - Prepare and apply chemicals

Module Title: - Preparing and applying chemicals

LG Code: AGR HCP1 M14 LO1-LG-58

TTLM Code: AGR HCP1 TTLM 0120v1

LO1: Determine the need for chemical use

Instruction Sheet	Learning Guide #58

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

- Identifying nature and level of the pest, weed infestation or disease
- Assessing need for action
- Assessing the requirement for chemical
- Undertaking Hazard and risk analysis of different chemical options
- Identifying and confirming requirement for chemical application

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 –**

- Nature and level of the pest, weed infestation or disease as identified
- Need for action is assessed
- Assess the requirement for chemical use as an option within an integrated pest management strategy
- Hazard and risk analysis of different chemical options is undertaken
- Requirement for chemical application including coverage by appropriate insurance is identified and confirmed

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 -4, 8, 11, 14 and 18 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 in page 19.
6. Do the “LAP test” in page – 20 (if you are ready).

Information Sheet-1	Identifying nature and level of the pest, weed infestation or disease

1. Introduction

A pest is any animal or plant detrimental to humans or human concerns, including crops, livestock and forestry, among others.

A pesticide is any substance used to kill, repel, or control certain forms of plant or animal life that are considered to be pests. Pesticides include herbicides for destroying weeds and other unwanted vegetation, insecticides for controlling a wide variety of insects, fungicides used to prevent the growth of molds and mildew, disinfectants for preventing the spread of bacteria, and compounds used to control mice and rats. Because of the widespread use of agricultural chemicals in food production, people are exposed to low levels of pesticide residues through their diets.

1.1 Identify the Nature and Level of the pest in the crop

Crop inspection should be carried out frequently (weekly), during the life of a crop to establish the incidence, population dynamics and distribution of pests throughout the field and to facilitate timely intervention. Records of each inspection must be made and retained to enable monitoring of the development of the Infection or Infestation.

1.1.1. Pests must be identified correctly

Pesticide / Chemical application can only be effective when the Target Pest: Crop Recommendation on the product label is the same as the Target Pest: Crop situation in the field.

Failure to correctly identify pests and select the appropriate pesticide to use are very common problems in the small holder Farming Sector and result in additional cost and crop loss for the farmer, together with the associated risks to operators, consumers and the environment.

In your role as a Development Agent, (DA), you will be expected to be able to help the farmers to examine crops and identify any pests and diseases that are present.

When you are not sure of the identification, collect samples of the problem and seek advice from the local Government Plant Clinic.

The procedure to be used to identify the nature and level of pest in a crop by Crop Inspection, (Scouting).

- Look at the field and move in a certain pattern to represent the whole farm and stop in the locations for Visual observation
- If field is long and narrow: a Zig zag pattern is preferred
- If field is square /rectangular: can use diagnols
- use transect or stepwise movement to pick representative samples At the locations
- Make counts/estimates to determine infestation rate, pest and degree of infestation/severity
- Make notes on crop and environmental information
- Collect samples for identification

1.2 Types of Pest Organisms

Technically the term 'Pests' includes all types of organism that can cause damage to plants (crops), i.e. Weeds, Insects, Acarids (Mites), Nematodes, Vertebrate Pests, Fungi, Bacteria, Mycoplasma and Mycoplasma like organisms and Viruses**.**

In the industry, this group is often split into four sub-groups:

- Weeds: Any plant growing where it is not wanted
- Pests: Insects, Acarids (Mites), Nematodes and Vertebrate Pests
- Diseases: Fungi, Bacteria, Mycoplasma and Mycoplasma like organisms and Viruses
- Disorders: Malformation of plant growth caused by abiotic (non-living) factors, e.g. humidity, high or low temperature, exposure to bright sunlight, nutrient imbalance, exposure to toxic gasses, etc.

Self-Check -1	Written Test

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

1. What is the pest? 5 points
2. What is pesticide? 5 points
3. List and describe the group of pests. 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-2	Assessing need for action

2.1. Assess the need for action

The presence of a pest within a crop does not automatically means that treatment is justified.

Neither does the absence of a pest today mean that treatment is not justified as a preventative measure.

Various infection, (infestation), Thresholds; Damage, Aesthetic, Economic, and Zero Tolerance together with an understanding of the effect of the environment on the population dynamics of the target pest can be used to help to decide when treatment is necessary.

Useful definitions	
Damage Threshold	The Damage Threshold is the level of infection (infestation) where the pest damage starts to affect the growth and yield potential of the crop.
Aesthetic Threshold	The Aesthetic Threshold is the level of infection (infestation) where the pest damage starts to affect the appearance of the crop. This is important for ornamental crops.
Economic Threshold	The Economic Threshold is where the value of the crop loss due to the pest infection (infestation) equals the cost of treatment.
Zero Tolerance	Zero Tolerance applies to export crops where the presence of any pests or specific named pests will not be acceptable by the receiving country or the client.

In the Small Farmer sector, Farmers and Advisers (DAs) most usually need to consider the likely value of the crop and the potential loss that could be caused by the identified pest in the prevailing crop and weather situation.

Here action is only justified when the potential crop loss has greater value than the cost of treatment i.e. the Economic Threshold is exceeded.

Value of the crop will depend on: The yield potential (Variety + Fertilizer use + Irrigation), the actual crop population in place and the expected market price.

The potential loss due to an identified level of pest damage, infection or infestation is more difficult to establish.

In major crops, e.g. Cotton and Cereals loss due to particular pest infestations or infections has often been determined in experimental conditions. Here pest infection / infestation can be defined in a number of ways, e.g. number of plants infected / m^2, number of leaves infected per plant of per m^2 or number of insects found on a sample of leaves collected at random from the crop.

In minor crops, e.g. Vegetables the need for treatment is more likely to be based on risk assessment and previous experience. Farmers will consider:

- Crop scout results; the number of incidences sited, the distribution in the crop and the rate of increase of the pest population
- Prevailing and expected weather conditions
- Age of the crop and time to harvest
- Experience from previous years production

Self-Check -2	Written Test

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

1. Define the following terms. 12 points
   A. Damage threshold
   B. Aesthetic threshold
   C. Economic threshold
   D. Zero threshold

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-3	Assessing the requirement for chemical

3.1. Assess the requirement for chemical (pesticide) use

Integrated pest management (IPM) is a coordinated system of controlling pests. IPM uses information about the biology of the pest to optimize control measures.

IPM focuses on cultural and biological control methods as the first line of defense. This means that the need for chemical pesticides is reduced.

Different control and management practices are utilized in IPM with the objective of achieving long term results. There are four principal steps:

1. Identification of threshold pest level at which action needs to be taken
2. Monitoring and identification of pests
3. Prevention – the use of management practices to reduce the likelihood of pests
4. Control – once the pest has been correctly identified, monitoring has shown it has reached a threshold level, and preventative measures are no longer appropriate, control measures will be used.

Within an IPM strategy, Pesticide application is 'last choice' and is to be used only when other cultural and biological treatments do not give or are not giving effective control.

Typical examples of these circumstances would be in instances where:

- Cultural controls, variety selection, crop rotation, management of the crop canopy, adjustment to the fertilizer programme, etc. have not provided a satisfactory level of control so pesticide application is needed to reduce the pest population quickly to below the economic threshold or
- Cultural control is not available or is ineffective when weather conditions are favorable for infection

  e.g. Early and Late Blight control on Tomatoes or Potatoes In this case appropriate pesticide application should be used for preventative and later curative purposes

  Or

- Biological control is being used in greenhouses but the Pest:
  Predator balance has been disturbed and pesticide treatment is necessary for pest population reduction until a working balance is restored.
  In this instance it is very important to consult the Technical expert for Biological Control and only use pesticide products that are compatible with the biological agent being used.

Self-Check 3	Written Test

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

1. Discuses integrate pest management (IPM) 6 points
2. Write the four principle steps of integrate pest management. 4 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-4	Undertaking Hazard and risk analysis of different chemical options

4.1 **Hazard and risk analysis of different chemical (pesticide) options**

After the decision has been made that Pesticide Treatment is necessary and justified, the hazards and risks of the various pesticide products needs to be considered so that the most appropriate product is chosen.

4.2 Factors to be considered when selecting pesticide product to use

- Products registered in Ethiopia for the target pest and crop to be treated
  (Only greenhouse producers of non-edible crops have special permission from MoA to use products not yet registered in Ethiopia)
- Products already available in the farm store and additional products available in the market
- Treatment cost per ha (Note that more expensive products to buy may be cheaper to apply if the application rate is lower do your sums!)
- Chemical hazards to people and the environment check:
  - Toxicity to Humans and choose the safest product
  - Post-Harvest interval (PHI) this is particularly important for crops within a few weeks of harvest (Residues in produce are a danger to consumers)
  - High leaching potential and toxicity to fish Try to avoid using these products near to rivers and streams of on land liable to flooding
  - Toxicity to pollinators Neonicotinoid products e.g. Gaucho, a commonly used seed dressing, are currently being banned in several European countries due to their effect on Bees
  - Broad spectrum or Selective action Pesticide Products with selective action are less damaging to biodiversity. Use of broad spectrum products is only really necessary if you have multiple types of pest present in the crop that are controlled by the broad spectrum product. Selective action in herbicides allows a selective product to be used in a growing crop
- Mode of action Contact v Systemic. In a dense crop canopy the good coverage needed for control with contact acting pesticide products is sometimes difficult to achieve so in this case a systemic product may give a better result.

For Herbicides you need to consider whether it is sufficient to kill the leaves or do you need basipetal translocation to kill the roots as well.

- Active ingredient and Chemical group this should be different to products that have already been applied to the crop to be treated to reduce the risk of developing pesticide resistance.
- Presence of known resistance on your farm Reusing a product that has in recent years been shown to be ineffective on your farm will not give adequate control, not even if used at a higher than label recommendation
- Restrictions to use Look for only applications per crop and if contract farming, check that the product is acceptable to the Client.

Giving due consideration to each of these factors will ensure that effective control is achieved with least possible risk to operator, consumer and the environment.

Self-Check -4	Written Test

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

1. What the factors to be considered when selecting pesticide product to use? 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-5	Identifying and confirming requirement for chemical application

5.1. Additional Enterprise requirement for chemical (pesticide) application

Traditionally, pesticides have been applied to crops using a calendar programme of regular sprays, applied on a 'just in case basis' rather than on an 'as needed basis'.

This practice has led to pesticides being over used or used when not necessary resulting in high cost, higher than necessary risk to operators, pesticide resistance, higher levels of residue in produce placing the consumer at risk and a higher pollution load and detrimental effect on the environment.

A Calendar programme of spraying is still being used in some instances, usually where a farmer is afraid to lose a crop and/or does not have the skill or commitment to inspect crops regularly and make accurate judgment about whether pesticide application is necessary. In your future role as a DA you will need to give these farmer advice and training which will we hope lead to effective pest control with less use of pesticide.

Aside from this situation, there are however one or two instances where precautionary use of pesticide may be a clause within a contract, e.g. where a guaranteed supply of crop product is necessary to fulfill market contracts or now more likely where crops are insured against loss. Use of Crop insurance is not yet widespread in Ethiopia and Policies available are more focused on loss due to adverse weather (flooding and drought) rather than losses due to pests. Insurance companies however are always keen to reduce risks so when purchasing a Policy it is important to read the small print to check 'is pesticide treatment for named pests' required.

Guideline

The guidelines are aimed at decision-makers, managers, field supervisors and spray operatives. However, it must be emphasized that in some countries legislation is already in place to control safe and efficient pesticide use and application. Accordingly, local legislation, or voluntary codes must be the first point of reference with this set of guidelines offered as additional information. This is an important point, as compliance with local legislation may have legal significance in the event of a claim against the poor field performance of a

pesticide. For other countries, the guidelines might serve as a guide until appropriate legislation is in place.

Operator training

Operators of spray equipment must receive suitable training before handling and applying pesticides. Training should be provided by a recognized provider and courses are frequently offered by local training groups, agricultural colleges, government extension departments, spray equipment manufacturers and the chemical industry. The satisfactory completion of a course may result in a recognized certificate of competence to cover:

- safe product handling,
- delivery of the product to the target
- Instruction on using the relevant spray equipment.

It is important that as technology moves forward, field spray operators are be kept up to date with new methodology to help ensuring that pesticides are safely used. In some countries where spray operators are licensed, they can only renew their operator's license if they attended regular refresher courses. Operator training is best be organized and provided through sustainable permanent national structures.

Spray equipment selection

The selection of appropriate and suitable spray equipment is essential safe and effective pesticide use. International and national equipment testing schemes have been established in many countries where after thorough testing under laboratory and field situations, sprayers are given l certificates of approval. Where testing is not in place equipment manufacturers can be required to confirm that a sprayers complies with the requirements in countries where testing is mandatory or the equipment meets the appropriate FAO guidelines.

Equally important when selecting spraying equipment is access to spare parts, service and support facilities.

Ideally, equipment selection should not be based primarily on cost. Safety, design, comfort and ease of use must be major considerations, and ease of maintenance must be a high priority. Knapsack sprayer maintenance should require only simple tools.

The combination of operator training to a recognized standard, combined with the selection of appropriate spray equipment will contribute to improving the accuracy of pesticide delivery as well as protecting the environment.

Self-Check -5	Written Test

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

1. Discuss the following terms. 15 points
   A. Guide line
   B. Operator training
   C. Spray equipment selection

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Operation sheet -1	Identifying nature and level of pest (Scouting)

The steps to be used to identify the nature and level of pest in a crop by Crop Inspection, (Scouting).

1. Look at the field and move in a certain pattern to represent the whole farm and stop in the locations for Visual observation
2. If field is long and narrow: a Zig zag pattern is preferred
3. If field is square /rectangular: can use diagnols
4. use transect or stepwise movement to pick representative samples At the locations
5. Make counts/estimates to determine infestation rate, pest and degree of infestation/severity
6. Make notes on crop and environmental information
7. Collect samples for identification

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 2 hours.

Task 1. Perform scouting

Reference

https://en.wikipedia.org/wiki/Pest (organism)

https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1916&context=extension_curall

https://cms.ctahr.hawaii.edu/epp/Education/Study-Guide-Packets/APC-Core/APC-Unit1

https://en.wikipedia.org/wiki/Crop_scouting

Horticultural Crops Production

Level-III

Learning Guide-59

Unit of Competence: - Prepare and apply chemicals

Module Title: - Preparing and applying chemicals

LG Code: AGR HCP1 M14 LO2-LG-59

TTLM Code: AGR HCP1 TTLM 0120v1

LO2: Prepare appropriate chemical

Instruction Sheet	Learning Guide #59

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

- Reading and understanding chemical label and MSDS
- Checking Labels
- Preparing chemicals
- Identifying and following legislation and regulations
- Identifying control measurements of OHS hazards and risks

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 –**

- Chemical label and MSDS are read and understood
- Labels are checked to ensure chemicals meet user requirements and specifications
- Chemicals are prepared from those registered for the intended purpose, and to suit the organization's chemical use strategy
- Legislation and regulations concerning chemical use are identified and followed
- OHS hazards and risks and risk control requirements associated with use of the chemicals are identified

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 -26, 29, 33, 36 and 41 respectively.
5. If you earned a satisfactory evaluation from the "Self-check" proceed to "Operation Sheet 1 in page 42.
6. Do the "LAP test" in page – 43 (if you are ready).

Information Sheet-1	Reading and understanding chemical label and MSDS

1.1. Chemical (pesticide) label and MSDS

1.1.1. Important Sources of Information about a Pesticide Product

Product Label The label attached to the product container

Information sheet Additional Information Sheet supplied with the product

Materials Safety Data Sheet, (MSDS) Produced by the Manufacturer and is available from the supplier or can be found on the internet

Information on the product label is targeted for users / farmers and includes:

Product details: ▪ Product Name and Active ingredient ▪ Formulation ▪ Concentration of active ingredient ▪ Type of pesticide ▪ Chemical Group ▪ Registration number	**Instruction for use:** ▪ Mode of Action ▪ What pests and crops can be treated ▪ Growth stage when the product may be used ▪ How much to use Quantity of product / litter of spray Quantity of product / hectare
Manufacturing details: ▪ Name and contact details of the Manufacturer ▪ Batch Number and Date of Manufacture Quantity of product in the container	**Safety information:** ▪ Type of Danger to people ▪ Type of the danger to the environment ▪ First Aid ▪ Emergency Help line
Pictograms: Hazard warning What to wear for measuring and mixing What to wear for application Store securely out of reach of children Dangers to livestock, wildlife and fish	**Restrictions:** ▪ Only … applications per crop ▪ Use only pre-flowering ▪ Re-entry Interval (REI) ▪ Pre-Harvest Interval (PHI)

The Product MSDS is a more technical document which includes more advanced, detailed and technical information that is particularly relevant for Management, Medical and Emergency services. Topics included are:

- Physical and chemical properties of the product
- Health effects of exposure to the product
- Hazard evaluation relating to product transport handling, storage and use
- Protection of workers at risk of exposure and
- Emergency procedures

After the pesticide to apply has been selected and the product has been issued from the stores, the next stage is to check the label to ensure that you are well informed about the product that you are going to use.

The information that you need for application is all provided on the label.

The MSDS provides additional detail that is interesting background information for you and useful technical detail if you or one of your team is taken ill whilst spraying.

Details about the Hazard warning signs and advice pictograms are provided in the Introduction to this manual.

Please ensure that your Team members are briefed about the toxic properties of the material that is to be applied, understand how the risks involved in handling this product are to be minimized and how the product is to be used.

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 Important Sources of Information about a Pesticide Product? 6 points
2. Write and discuss the Information on the product label is targeted for users / farmers? 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-2	Checking Labels

2.1. Check that the correct chemicals (pesticides)

The pesticide label is a legal document. This is defined under the Pest Control Products Act. It is illegal to use a pesticide in any way other than for the purpose and in the manner stated on the label. Label information serves as a legal guide for proper handling and use. Critical information is lost if a label is removed or damaged. A pesticide can only be sold legally with a label on the container that is in good condition. Ensure that the container has a valid Canadian label before buying or handling a pesticide. It should provide the Pest Control Products Act registration number. If the label is lost or cannot be read after purchase, ask for a replacement from the vendor. Attach the new label to the container. A pesticide cannot be identified without the label. The label ensures safe handling and proper application rates.

Before accepting the product pesticide labels answer the following questions:

- Ingredients: What's in the product?
- Signal word: How toxic is the product?
- Precautionary statements: How can the product be used safely?
- First aid information: What should I do if it gets in my eyes, mouth, lungs or on my skin?
- Environmental hazards: What special restrictions are placed on this product to protect the environment?
- Personal protective equipment (PPE): What should I wear? Should I use gloves when I use this product?
- Directions for use: How and where should I use the product? How much is okay?
- Storage and disposal: How does the product have to be stored? What should I do with leftovers that I don't need?
- Manufacturer's contact information: How can I get in touch with the company?
- Phone number: Where can I get more information about this product?
- EPA Registration number: What is the unique product number?

Figure 2.1. Checking label of pesticide (read labele)

This is the final check before application:

If the answer to this question is YES it is OK to proceed

If the answer to this question is NO do not proceed, and consult with your Line manager.

Do not buy or store a pesticide unless it has a proper label attached.

Self-Check -2	Written Test

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

1. What is pesticide labele? 5 points
2. What are the questions before accepting the product pesticide? 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-3	Preparing chemicals (pesticides)

3.1 Selecting Pesticides

Pesticides can be important tools in pest management, but by their nature, pesticides are toxic. Pesticide products can pose risks to humans, animals and the environment. Before choosing a pesticide, it is important to read and understand the directions on the product label.

❖ Steps for Selecting Pesticides

1. Correctly identify the pest.
2. Read the product label.
3. Prepare appropriate application equipment
4. Review the rates.
5. Look for alternative uses on other turf and ornamental pests common in your landscape.
6. Check the chemicals group or class.
7. Check for ease of use.
8. Calculate the cost per gallon of mixed spray.

Figure 3.1. Pesticide (chemical) selection

3.2. Criteria for selecting a pesticide

1. **Safety is top priority**

   Questions to ask include what is the toxicity level of the pesticide; how mobile is the pesticide and in what fashion can it be distributed (through air, soil, water, etc.); what is the residual life of the pesticide; and what are the environmental hazards listed on the label?

2. **Species specificity**

   this is especially important to look for before using toxic chemicals since certain pesticides only affect the target animals or plants. Try to avoid getting broad spectrum pesticides that have potential to kill or harm many beneficial species along with the pest. If such a pesticide is the only option, try doing spot treatments to reduce the likelihood of affecting non-target organisms.

3. **Effectiveness**

   For pesticides, it is a bit difficult to measure effectiveness because it can vary depending on where the chemicals are being applied. In a lab, for instance, a chemical may kill a large percentage of the target pest because it is a controlled environment, but in a real life situation, the number may be much smaller due to other factors such as killing off natural enemies, temperature changes, etc. Evaluating uses of a considered pesticide in similar situations as that of your school may help in estimating the kind of effect it will have.

4. **Endurance**

   An animal or plant's endurance to the effects of a pesticide may vary. Watch for success in pest control: if it at first seems to work well but then later populations grow despite continued use, there may be some built up resistance.

5. **Pesticides vary in their speeds of interaction**

   choosing a pesticide should be determined based on circumstances. If it is an emergency, a shorter lived, fast acting and more acutely toxic material (such as organophosphate for cockroaches) may be necessary. But a longer lasting, slow acting and less toxic material (such as boric acid) may be better for chronic pest problems.

6. **Cost**

   this is always a consideration when deciding what chemicals to use. Determination of cost often is done by measuring dollars per volume-some new materials that are effective in lower doses may be more expensive than older pesticides that need larger amounts to do the job. A small container of more concentrated material may seem more expensive, but may be as effective as three times that much in another kind of pesticide.

7. **Once a pesticide is selected, notify**

   Give notification to personnel, students, and parents about what pesticide will be (or has been) used and where it is going to be (or has been) applied so they are aware of any possible exposure. Ideally applications should be done when buildings are unoccupied, but regardless, it is best to give advanced notice that an application is scheduled so that everyone can take appropriate steps to ensure the safety of those involved.

❖ Check that the Chemicals (pesticides) are registered for the intended purpose and comply with the enterprise chemical use strategy

The Registration Number is shown on the label

- Check ….Is the product registered in Ethiopia for the crop and target pest that you plan to treat (Note application of some products not registered in Ethiopia is currently still allowed for export flowers grown in greenhouses)

If the answer to this question is NO. Do not proceed, and consult with your Line manager. Use of products not registered in Ethiopia is illegal for all crops except export flowers where a registration for use on flowers in an acceptable country must be shown on the label.

With regard to the 'chemical use strategy' of the organization, usually only farms involved in production of Certified, (MPS, Global GAP & Fair Trade), Flowers and Vegetables face additional restrictions on pesticide product selection. In these certification schemes, use of pesticides that are particularly damaging to the environment, or those that are highly poisonous, or those that are banned in the receiving country for the produce will not be allowed.

Self-Check -3	Written Test

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

1. List and describe the criteria for selecting a pesticide? 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-4	Identifying and following legislation and regulations

4.1 Legislation and regulations concerning chemical (pesticide) use

Legislation is the act of making and enacting laws. Legislation includes:

- Acts (made by the parliament), which set up the legislative schemes
- Regulations (made under the authority of an act), which provide details of the legislative scheme.

Failing to comply with legislation may result in enforcement action by the body responsible for administering the legislation. Legislation is generally administered by government departments. Authorities established under legislation independent of government may also administer legislation.

Where failure to comply is an offence under legislation, the person in breach is liable for prosecution.

Compliance with Australian Standards and Codes of Practice is not enforceable, unless they are referred to in an act or set out in Regulations. However, pest control operators (PCOs) should adhere to these guidelines, as they provide a minimum benchmark for the conduct of activities.

The primary federal statutes that give the EPA the authority to regulate pesticides are the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA). This page includes a brief overview of the major rules and regulations pertaining to pesticides. New and proposed rules are published in the Federal Register and are then codified into the Code of Federal Regulations (CFR). For more information, see the resources below or contact NPIC for assistance.

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): Gives the EPA authority to regulate the sale, use and distribution of pesticides.
- Federal Food, Drug, and Cosmetic Act (FFDCA): Gives the EPA authority to set limits on the amount of pesticide residues allowed on food or animal feed. These limits are called tolerances (link to tolerance page).

- Food Quality Protection Act of 1996 (FQPA): This act amended FIFRA and FFDCA by increasing the safety standards for new pesticides used on foods. FQPA also required older pesticides and previously established tolerances (link) to be periodically re-assessed using the new, tougher standards.
- Pesticide Registration Improvement Act (PRIA): Establishes the fees and time-lines associated with pesticide registration (link to registration page) actions.
- Endangered Species Act (ESA): Requires the EPA to assess the risk of pesticides to threatened or endangered species and their habitats.

Legislation relating to the Use of Pesticides in Ethiopia can be sourced from the internet and includes:

- ❖ Proclamation No 674/2010 titled ‘Pesticide Registration and Control Proclamation.
- ❖ Proclamation No 377/2003 titled ‘Labour Proclamation’
- ❖ Proclamation No 300/2002 titled ‘Environnent Pollution’
- ❖ Regulation No 207/2011 ‘Code of Practice for the Floriculture Sector’

Self-Check -4	Written Test

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

1. Write the sourced of Legislation relating to the Use of Pesticides in Ethiopia. 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-5	Identifying control measurements of OHS hazards and risks

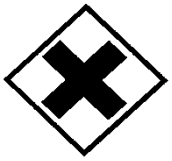
5.1 Identify OHS hazards and risk control requirements for pesticides

Information about the type of hazard properties of a pesticide is found on the Pesticide Product Label. Check the color band at the base of the label and the pictograms.

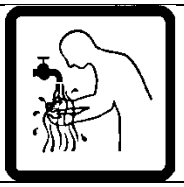
Level of hazard (How poisonous to people and livestock):

Class I a & I b Toxic	**Class II Hazardous**	**Class III Caution**	**Class IV Safe in normal use**
These products are very poisonous	These products are harmful / poisonous	These products are less poisonous but should be handled with care	

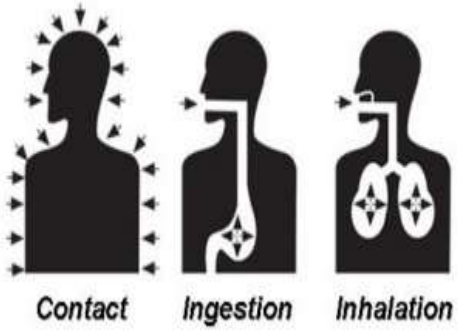
Hazard Warnings

Flammable	Oxidizing Agent	Corrosive	Poisonous	Hazardous
				

Square pictograms found on the label are for information and advice on how to mix, apply and store the pesticide:

				
Dangerous for livestock and wild life	**Dangerous for fish**	**Store pesticides Securely**	**Please wash after spraying**	

Pesticides enter the body in a number of ways:

	**Absorption** Pesticide soaks through the skin on any part of the body when contact is made with the pesticide
	Ingestion Swallowing pesticide directly or eating or drinking contaminated food and water
	Inhalation Breathing in fumes

- **Danger exists when**
  - ✓ A person works with a dangerous product
  - ✓ A person makes contact with a dangerous product
  - ✓ A person stays in contact with the dangerous product for some time
- **Types of poisoning**
  - Acute: Symptoms appear almost immediately after exposure
  - Chronic:Pesticide builds up in the body from a number of exposures
- **Symptoms of pesticide poisoning**
  - ✓ Irritation and itching; Red itchy skin, sore eyes, sore throat, coughing
  - ✓ Nausea and vomiting
  - ✓ Tiredness, nervous twitching, fits and loss of consciousness
  - ✓ Difficulty breathing
  - ✓ Infertility or Deformity in new born children
  - ✓ Death

5.1.1 Occupational Health and Safety (OHS)

Occupational Health and Safety means any health or safety issues that relate to activities in the work place.

In Ethiopia the basic requirements for OHS are described in the Labor Proclamation No. 377/2003 and the Country OHS Policy. Each Region may also have additional requirements based on the Federal Law.

In relation to OHS the aims of the Regulatory framework are to:

- Ensure that a safe and healthy workplace is provided for all employees
- To explain the responsibilities of the Employer and the Employees

5.2 The responsibilities for OHS in the work place

5.2 .1 Duties of the Employer

- To provide a Safe and healthy work environment
- To providing information, instruction, training and supervision to the employee to ensure that all employees are informed about hazards in the work place and are able to follow safe work procedures

- To ensure that equipment is maintained in a safe working condition and that the necessary PPE is provided and used correctly
- To establish a forum where workers and management can meet to discuss and resolve issues relating to OHS on the farm
- To report to the Authorities, work related accidents and illness that has required referral to medical services (Clinic or Hospital)
- To establish appropriate insurance for accidents in the workplace or to pay compensation to an employee who becomes ill or is injured as a result of work place activities

5.2.2 Duties of the Employee

- An employee shall work with due regard for their own safety and that of other people in the workplace. No fooling around; it's not clever to take risks.
- To follow instructions and safe working procedures at all times
- To use correctly and care for the PPE provided
- To report to the Line Manager any working practices of equipment that they consider dangerous
- To cooperate with the Employer in all matters relating to OHS

5.3. Hazards and Risks

- Hazards are described as anything that has the capacity to cause harm

(E.g. Poisonous pesticide products and heavy containers)

- Risk is the chance that an identified Hazard can actually cause harm

(Risk is reduced by use of PPE and implementation of Safe Working Practices)

- Risk Assessment is a process that is undertaken in the Work place to identify hazards and the safe working practices that must be implemented to reduce the risk that the identified hazard will cause harm

- Activities to minimize risk are prioritized according to the following principles:
  - Eliminate the hazard

  (E.g. Use other methods of pest control, e.g. Resistant Variety)
  - Separate people from the hazard

  (E.g. remove other workers from the area when spraying is happening)
  - Use safer products

  (E.g. Select Class 3 or 4 Pesticides and avoid Class 1, where possible)

- Develop and implement Safe Working Practices

  (E.g. Develop safe working procedures, train workers and provide supervision to ensure that procedures are followed)

- Provide protection for employees

  (E.g. Provide PPE) Safe working practices and the use of Personal Protective Equipment (PPE) will minimize the risks to personnel and the environment

The type of hazard, poisonous, hazardous, flammable, etc. is shown in the center of the line of pictograms at the base of the label.

Self-Check -5	Written Test

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

1. What is occupational health and safety? 4 points
2. Write the difference b/n hazard and risk? 6 points
3. What are the symptoms of pesticide poisoning? 5 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Operation Sheet 1	Preparing chemical (pesticide)

Steps for Selecting Pesticides

1. Correctly identify the pest.
2. Read the product label.
3. Prepare appropriate application equipment
4. Review the rates.
5. Look for alternative uses on other turf and ornamental pests common in your landscape.
6. Check the chemicals group or class.
7. Check for ease of use.
8. Calculate the cost per gallon of mixed spray.

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 3 hours.

Task 1. Prepare chemical (pesticide)

Reference

https://s3.wp.wsu.edu/uploads/sites/2061/2014/01/10StepsSelectingPesticides.pdf

https://www.chemservice.com/news/2016/09/how-to-choose-the-right-pesticide/

http://npic.orst.edu/pest/select.html

Horticultural Crops Production

Level-III

Learning Guide-60

Unit of Competence: - Prepare and apply chemicals

Module Title: - Preparing and applying chemicals

LG Code: AGR HCP1 M14 LO3-LG-60

TTLM Code: AGR HCP1 TTLM 0120v1

LO3: Prepare to use chemicals according to the label and MSDS

Instruction Sheet	Learning Guide#60

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

- Selecting and checking personal protective equipment
- Following pre and post-operative checks on equipment
- Identifying ,and reporting damage, wear and malfunctions equipment
- Following requirements for the selection, preparation and adjustment of application equipment and tools
- Identifying and calculating mixing rates
- Following directions, standards and legislative requirements for mixing chemicals

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 –**

- Personal protective equipment is selected and checked for use according to the product label and Material Safety Data Sheets
- Requirements for pre and post-operative checks on equipment are followed
- Damage, wear or malfunctions of any equipment is identified and reported or repaired
- Requirements for the selection, preparation and adjustment of application equipment and tools for the appropriate chemicals are followed
- Mixing rates are defined and calculated
- Directions, standards and legislative requirements for mixing chemicals are followed

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 6”.
4. Accomplish the “Self-check 1 to Self-check 6” in page -49, 52, 56, 65, 69 and 72 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and 2 in page 73 and 74.
6. Do the “LAP test” in page – 75 (if you are ready).

Information Sheet-1	Selecting and checking personal protective equipment

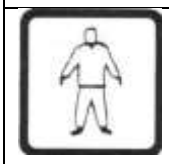
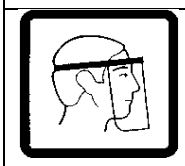
1.1 Select Personal Protective Equipment (PPE)

Personal protective equipment (PPE) is protective clothing, helmets, goggles, or other

Garments or equipment designed to protect the wearer's body from injury or infection.

The hazards addressed by protective equipment include physical, electrical, heat, chemicals, biohazards, and airborne particulate matter. Protective equipment may be worn for job-related occupational safety and health purposes

Tabel1.1 Personal Protective Equipment (PPE)

 **Gumboots**	Please wear the trousers over the Gumboots to prevent spray mix running from the overalls or spray suit into the boots. Contamination inside the boots results in repeated exposure of the feet to chemicals
 **Overalls**	Cotton overalls give some protection to the clothes and body but you will need to add a long Apron for Measuring and mixing and additional waterproof protection for the Back and legs when spraying. A waterproof spray suit gives better protection.
 **Gloves**	Gloves should be made of Nitryl Rubber or PVC. The cuff of the glove should be worn inside the sleeve to prevent spray running up your arm Do not use Cloth or leather gloves for pesticides as the pesticide will soak through
 **Dust Mask**	Acts as a physical barrier to protect your mouth and nose from dust. It is more comfortable to wear than a respirator but is not a safe substitute for a Respirator. Best to only use this for handling fertilizer and sweeping the floor
 **Face Shield**	Protects your whole face from splashes but does not protect your mouth and nose from fumes. Useful when measuring in mixing pesticides when the Label does not indicate that a respirator is necessary

 **Goggles**	Protects your eyes from splashes and spray drift Select goggles with ventilation and eye shield to the sides to prevent sideways splash penetration and fogging of the lenses
 **Respirator**	Protects your mouth, nose and lungs from fumes when used correctly Filters should be for 'organic vapors and Gasses' and should be replaced regularly The mask should make a sung fitting to the face and not be worn as an ornament on top of the head or below the chin!

1.2. Checking personal protective equipment

1.2.1 Assessing PPE

the conditions in every workplace will be different, which means that a risk assessment needs to be carried out to see what PPE is required. If you are unsure, then ask your supplier about the suitability of equipment for different tasks. In some cases, this may involve getting specialist advice from the manufacturer.

You will need to answer certain questions before making your decision. This includes

- Whether the PPE will reduce overall risk and is it suitable to the environmental conditions?
- Can it be adjusted to fit the employee correctly in all situations?
- And if more than one item of PPE is needed, will they be compatible?

1.2.2. Choosing PPE

you need to make sure you are choosing PPE that is up to standard. Look for the CE mark which means it complies with the PPE Regulations from 2002. Make sure you are choosing equipment that is suitable for the person who will be wearing it. You are also required to provide adequate training in the correct use of the equipment.

1.2.3. Maintenance

Under the regulations you are obliged to make sure all equipment is in good working order. This includes storing it in the correct way when not being used, for example, by use of a dedicated space such as a dry, clean cupboard. Equipment should be regularly inspected for cleanliness and state of repair. Any specific repair work should be carried out by a specialist, including fitting spare parts.

Self-Check -1	Written Test

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

1. What is personal protective equipment (PPE)? 4 points
2. List and describe the types of personal protective equipments (PPE)? 14 points

Note: Satisfactory rating – 16 points Unsatisfactory – below 16 points

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-2	Following pre and post-operative checks on equipment

2.1. Requirements for pre and post-operative checks on PPE

Pre and post-operative checks on PPE are part of the management of PPE

PPE is expensive and only gives adequate protection to users when it is

- The right type
- The correct fit
- Well maintained.

Users will need instruction and supervision to ensure that

- Cleaning
- Maintenance
- Correct storage practices are implemented.

Pre and post-operative checks on equipment and follow up action relating to problems identified are essential to ensure that the equipment is in good working order when needed and when taken to the field.

2.1.1 Guidelines for the management of PPE

- Discuss the type required, specification and size of items needed with the Farmer or Farm Procurement Officer before purchase
- Where possible, allocate PPE to individuals and number or name the items. This makes it easier to follow up problems when PPE has not been cared for correctly. Issue of PPE should be recorded and signed for by the recipient.
- Establish and follow a cleaning routing

  Boots, spray suits and gloves are washed on the outside before removal

  Goggles and face shield are washed and handled carefully to avoid scratching. Respirators should be wiped clean carefully after use. Do not wet the filter. If respirators are to be shared wipe the mask with disinfectant between users.

  Cotton overalls should be washed separately from the family laundry.

  All PPE should be thoroughly dried before placing in store

- Spray suits, overalls and face shields should be stored hanging

  Gloves and boots should be stored in such a way as the inside ventilates and dries between uses.
- Respirators and goggles should be stored in a bag or bucket with lid to keep them clean and protect the straps from losing their elasticity.
- PPE should be check pre and post operation to ensure that management rules are followed and the equipment remains in safe condition for use

2.2 Pre and post-operative checks on equipment

The application or protective equipment should be checked before and after operation in order to keep the equipments in proper condition. Therefore, the following points should be considered on the equipments:

1.3. Cleaning the equipments before and after use

- Each parts of the sprayer should be rinse several times to maintain in good condition
- Prior to store the sprayer, wash with detergent and rinse several times to remove the detergent.

1.4. Maintenance of equipment before and after use

- ✓ Check the application equipments for leaking hoses and gaskets especially where the parts are joined together.
- ✓ Check nozzles for wear and to make sure they are not plugged. If they are blocked, do not clean them using a hard object. This could damage the orifice.

Self-Check 2	Written Test

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

1. Discusses the requirements for pre and post-operative checks on PPE? 5points
2. What are the guide lines for the management of PPE? 5points
3. What are the consideration points on the equipments before and after operative? 5points

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

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-3	Identifying and reporting damage, wear and malfunctions equipment

3.1. Identify and report Damage, wear and malfunctions of PPE

Any damage or malfunction of PPE, found by members of the spray team should be brought to the attention of the team Leader /supervisor.

- Minor damage should be repaired promptly
- Respirator filters must be replaced after the recommended number of hours of use or if the operators has difficulty breathing or starts to smell pesticide whilst wearing the respirator
- Requests for replacement should be made in writing by the Supervisor to the Owner/Manager when the PPE is clearly nearly worn out

3.1.1 Identify PPE Failure

1. Incorrectly worn PPE – PPE that is not fitted or used correctly

Workers need to be sufficiently trained in how to fit and wear protective equipment. The onus is on the employer to provide workers with instructions and also to ensure workers follow these instructions. The effectiveness of PPE is greatly reduced if it is worn incorrectly or if it does not fit right.

2. PPE that is not cared for or stored correctly

Most PPE comes with proper care, cleaning and storage instructions. PPE that is not correctly maintained can become damaged and ineffective. For example protective headwear is often thrown in the back of a Ute or left in the heat in a car. Such actions affect the effectiveness of the protective headwear, and death or serious injury can occur as a result. PPE should be cared for, cleaned and stored according to the manufacturer's instructions, with regular checks for damage. If damage occurs or the product exceeds its lifespan the product should be replaced immediately.

3. Incompatible PPE – Items of PPE which undermine each other's effectiveness

Sometimes, wearing incompatible pieces of PPE together can greatly reduce the protection of both pieces of PPE. For example, if you wear protective ear muffs and safety glasses, the arms of the safety glasses can interfere with the seal of the ear muffs and thus reduce hearing protection.

4. Inappropriate PPE – Wearing PPE that is not fit for purpose

The PPE assigned to workers must be suitable for the nature of the work and any hazard associated with the work. A worker at a global manufacturing company recently sued his employer of 34 years for failure to provide him with the correct type of PPE resulting in personal injury. The worker was instructed to repair a hydraulic press and was using a jack to open it when his hands slipped due to the amount of oil on the equipment, causing him to fall and fracture his wrist.

5. Uncertified PPE – Untested, Unproven, Unreliable

Standards Australia are a not-for-profit organisation charged by the commonwealth government with meeting Australia's need for contemporary and internationally aligned safety standards. Their experts determine a set of specifications that products need to meet to ensure that they are safe, reliable, and perform as intended.

3.2.2. Avoid injury due to PPE Failure

- Ensure workers receive adequate training on the correct use, fit, care and storage of their PPE.
- Ensure you provide workers with PPE that is both compatible and fit for purpose.
- Only buy products that have been independently tested and certified safe. Waiting for an accident to put PPE to the test compromises the safety of your workers.

3.2 faults and troubleshooting in knapsack sprayers

Insufficient sprayer pressure, poor atomization: If the water ball valve is lifted by dirt, the inlet valve can be removed and the dirt can be removed with a cloth; if the cup is damaged, the new cup can be replaced; if the joint is not installed Sealing ring, or leaking due to damage to the sealing ring, can be installed or replaced.

Spraying does not form fog: If the inclined hole of the nozzle body is blocked by dirt, the inclined hole can be dredged; if the cleaning nozzle hole can be disassembled due to the nozzle whole blockage, the hard object orifice such as wire or copper needle cannot be used to prevent the hole from expanding.

To make the spray quality worse; if the filter in the casing is clogged or the ball is suspended by the water valve, the filter should be cleaned and the dirt on the ball should be cleaned.

The switch leaks or does not move: If the switch cap is not tightened, tighten the switch cap; if the washer on the switch core wears, replace the washer; the switch does not move,

because it is placed for a long time, or used for too long, the switch The core is adhered by the etch of the agent, and the parts should be removed for cleaning in kerosene or diesel oil; if it is difficult to remove, it can be immersed in kerosene for a period of time, and then removed and removed, and hard objects cannot be used.

Water leakage at each joint: If the joint is loose, tighten the nut; if the gasket is not flattened or damaged, the gasket should be flattened or the gasket replaced; if the gasket is hardened by shrinkage, it can be softened in animal oil before use.

- Finally report to supervisor or manager if the personal protective equipment (PPE):
    - Damaged personal protective equipments and knapsack sprayers
    - Insufficient personal protective equipments
    - Incompatible personal protective equipments
    - Inappropriate or not fit to the purpose
    - Uncertified personal protective equipments
    - Contaminate personal protective equipments
    - Insufficient sprayer pressure, poor atomization of knapsack
    - Damaged nozzles etc.

Self-Check 3	Written Test

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

1. How to avoid injury if PPE is failure? 6 points
2. List and describe the personal protective equipment and knapsack sprayer part failures. 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-4	Following requirements for the selection, preparation and adjustment of application equipment

4.1 Selection, preparation and adjustment of pesticide application equipment

Tools and Equipment required for pesticide application in the field falls into the following categories;

- operator safety
- mixing
- application

1.1.1. Equipment required for operator safety includes:

1. **Personal protective equipments (PPE)**

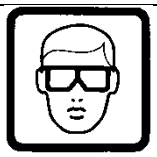
						
Boots	Overalls & Spray Suit	Gloves	Dust Mask	Face Shield	Goggles	Respirator

Figure 4.1 type of PPE

2. **Eye Wash.** this may be a purpose designed piece of equipment but in practice is more likely to the a clean 1 liter bottle of boiled and cooled water

Figure 4.2 eye wash

3. **Telephone and contact details** for the manager or the farm owner or spray service provider and the local clinic

Figure 4.3 telephone

4. **A First Aid kit.** This is desirable for treatment of general accidents in the field but in practice only found of the large commercial farms.

Figure 4.4 first aid kit

Figure 4. 5. Always seek medical advice if you think someone might have pesticide poisoning.

4.1.2 Equipment required for measuring and mixing

1. Weighting balance for Powder and granular products

Figure 4.6. Weighting balance

2. Liquid products measuring jugs with clear measurement marking in the appropriate units.

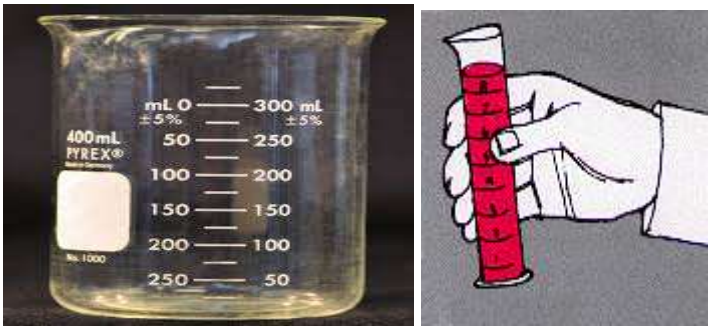


Figure 4.7 liquid pesticide measurement tool

3. 200 liter drum for mixing and stirrer where mixing is not carried out directly in the spray tank.

Figure 4.8. 200 L empty tanker

4. Equipment for calibration: a bucket and few 1 or 2 liter graduated jugs, stopwatch and tape measure; 30m.

4.1.3 Equipment for Application

There are many types of equipment in use for application of pesticides and the choice of what apparatus to use will depend on;

Table 1. Various types of equipment available and in common usage in Ethiopia:

Type	Appearance	Comments on use
Knapsack		This is the equipment of choice of the small holder farmer. It is affordable, available and reasonably effective for low growing crops, particularly vegetables. Lance extensions are available to facilitate spraying tall crops but use for spraying fully grown trees is not advisable. Pesticides are applied as water based solutions and an Operating pressure is 1 – 3 bars, and a range of droplet sizes, (course – fine), is possible depending on nozzle type and aperture

Motorized knapsack		Also in use in the small farmer sector. The equipment is more expensive, needs more maintenance and is very heavy to use. Pesticides are applied as water based solutions but at an Operating pressure that is higher than for the manual knapsack gives greater penetration of the crop canopy. A rannnge of droplet sizes is possible (course – fine), depending on nozzle type and aperture. This together with the higher operating pressure gives better coverage with the spray mix and greater penetration of the crop canopy
Trolley mounted Sprayer		Found in use in most commercial greenhouse operations in Ethiopia. This equipment typically comprises a 250 - 1000l tank and motorized pump mounted on a small trolley and usually fitted to a long hose with a multi nozzle claw lance or a wheeled vertical boom.
Tractor mounted boom sprayer		Used for large scale field (horizontal boom) and orchard (angled or vertical boom) The size and complexity of these pieces of equipment varies and you should refer to the operating manual for instruction for calibration, operation and maintenance
ULV (Ultra Low volume) **applicators**		These applicators may be hand held or tractor mounted motorized devices used for application of low volumes of oil based pesticide products. ULV application involves the use of very fine droplets … microns, which drift through the crop canopy. This is particularly useful for vertical crops e.g. Cotton and trees. Crop coverage can be very good but the small droplet size and drift means that this method is quite high risk for operators, local communities and the environment

4.2 Prestart check of equipment:

Checks on equipment and follow up action relating to problems identified are essential to ensure that the equipment is in good working order when needed and when taken to the field.

Routine maintenance and repair to keep equipment in good working order is essential to accurate application of pesticide and the safety of the operator.

4.2.1 Routine Pre-start checks take place before mixing and filling the tank.

The specific details of what should be checked will be described in the equipment handbook. The general principles that apply are however:

- Is the tank clean? visibly empty and not too smelly
- Are the filters clean? see equipment handbook for location of filters
- Check tank, carrying straps, hoses and wheels for physical signs of damage
- Put some water in the tank and check the system for visible leaks and the nozzles for leaks, drips and distortion of droplet pattern

Repair any defects found and do not start work until the equipment is safe to use and able to deliver the pesticide accurately.

Note:

In farms where equipment is well managed and cared for by motivated and trained staff, Observations during use and Post-operative checks of equipment are made so that repairs and routine maintenance are completed before the equipment is needed again.

Problems found during operation, post-operative and pre-start checks that cannot be resolved by the Team should be reported in writing by the Team Supervisor to the Owner/manager; date item of equipment, nature of problem, name and signature of supervisor.

4.3 Adjustment of Equipment to deliver the application rate required.

This is a relatively complex process as many variables are involved.

The desired Application Rate for a product is stated on the product label.

There are two pieces of information to look for:

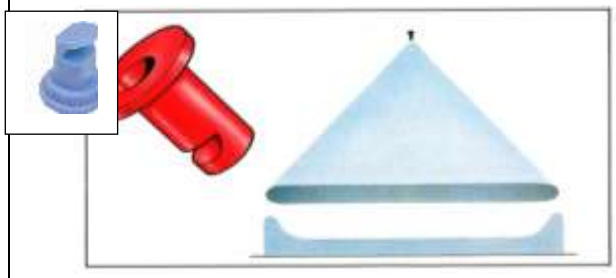
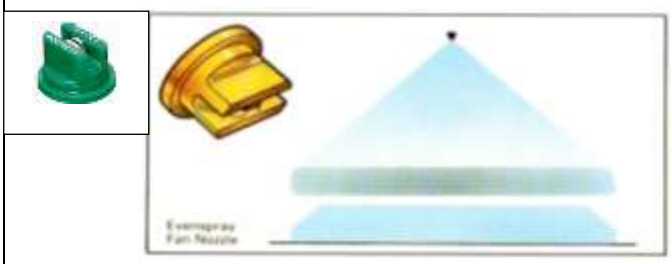
- Amount of product to be applied / hectare
- The amount of water (spray mix), to apply / hectare

When setting up the sprayer, application rate will be affected by:

- Forward speed or walk speed. fast speed gives low application rate and slow speed gives high application rate
- Operating pressure. Low pressure gives low application rate and course (big) droplets whilst high pressure gives high application rate and fine (small) droplets
- Nozzle output. For a given type of nozzle this is dependent on hole size. big hole gives high output and small hole gives low output

Selection of Nozzles type

Small Farmers in Ethiopia are working with 4 basic types of nozzle

	
Anvil or Deflector Wide swath and Large (Course) droplets Used for Herbicide	**Evenspray Flat Fan** Medium and fine droplets often used for Insecticides and Fungicides

		
Hollow Cone Fine droplets Often used for Insecticides and fungicides	**Full Cone** Fine droplets	**Adjustable Cone** Aperture is adjustable so many droplet sizes and outputs are possible

Figure 4.9. Types of nozzle

4.4 Procedure to set up (Calibrate) a Knapsack sprayer for spraying

This is the procedure that is most commonly used in Ethiopia.

a) Measure the area of crop or field that is to be sprayed
b) Select and fit the nozzle that is most suitable for the type of product and crop to be sprayed. Take care not to cross thread or over tighten the fittings
c) Half fill the tank with water
d) Measure the area of crop/field that you can spray in one minute
   - Use normal walk speed for spraying ….approximately 1m/sec
   - Position the nozzle about 50cm from the ground or crop surface
   - Pump sufficiently for spraying
   - For a flat / overhead application hold the lance steady and in a straight line as you walk or for under and over leaf application move the lance head in a gentle under and over arc as you move forward

     Keep the nozzle 50 cm from the ground or crop surface whilst you work.

     Pump, Walk and Spray normally for 1 minute
e) Measure the area that you have sprayed in m^2 and record your answer
f) Now measure the output of the nozzle that you have used

- Pump sufficiently to produce spray output
- Place the nozzle in a 1 liter measuring jug and spray into the jug for 1 minute
- Measure the amount of water in the jug and record your answer.
  This is the amount of spray mix that would be applied in 1 minute using this nozzle, pressure and walk speed

g) Calculate the application rate using the formula:

$$\text{Volume of spray applied/ha} = \frac{\text{Volume ml applied in 1 minute x 10}}{\text{Area sprayed in 1 minute}}$$

Check that your answer is similar to the application rate specified on the label

If your answer is much higher (10%) fit a nozzle with a lower output

If your answer is much lower (10%) fit a nozzle with a higher output or walk a bit slower

In either case repeat the exercise until your application rate is similar to that on the label.

Self-Check-4	Written Test

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

1. List and discuss the Equipment required for operator safety (site)? 10 points
2. List and discuss the Equipment required for measuring and mixing pesticide. 5 points
3. List and discuss the Equipment required for application pesticide. 10points

Note: Satisfactory rating – 25 points Unsatisfactory – 25 below points

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-5	Identifying and calculating mixing rates

5.1. Calculate and mixing rates

5.1.1. Calculating the correct amount of chemical

Pesticides purchased for spraying programs will come in the form of pesticide concentrate. This concentrate is very strong and must be diluted before use by mixing a small volume (amount) of the pesticide with a larger volume of water.

It is necessary to work out how much of the concentrate will be needed for the spraying job and how much water it must be mixed with. Only enough pesticide solution to fill the sprayer should be mixed at any one time.

The steps for calculating the correct amount of chemical are outlined below.

a. Check the pesticide label to find the application rate at which the concentrate should be used. The application rate of a particular pesticide is the amount of mixed pesticide solution (chemical plus water) which is needed to treat an area of a particular size.
   Some examples are:
b. Work out the area to be sprayed. This may be the area of a floor or the combined areas of skirting boards or the combined area of external (outside) building foundations.
c. Using the application rate stated in the instructions, calculate the amount of pesticide concentrate needed for the size of the area to be sprayed.
d. Calculate how much water is needed to dilute the pesticide to the correct strength.

   It is very important that these calculations are done correctly. If they are not done correctly the pesticide will not be the right strength for the job.
   Help can be obtained from people such as the community nurse, school teacher, EHP supervisor or an EHO.

5.1.2. Mixing the chemical

Once the amount of the concentrate and the amount of water needed to dilute it have been worked out, the water and the chemical can be mixed. This dilution exercise should be carried out carefully because the pesticide chemical is dangerous.

These are the rules which should always be followed when diluting pesticide concentrates:

a. Always work in the open and avoid breathing the fumes.

b. Read the label and put on the appropriate protective equipment as indicated.

- Depending upon the type of pesticide it may be appropriate to wear a respirator.

c. Mix water and concentrate in a large clean container, such as a 10 L bucket. This container and any measuring cups must be used only for this purpose. They should be clearly labelled 'DANGER - POISON: DO NOT TOUCH'. When they are not being used they should be stored safely in the equipment shed.

d. Put a small amount of water into the bucket first. Place the required amount of pesticide into the water.
Rinse the measuring cup with clean water and add this solution to the bucket. Stir it so that it is thoroughly mixed into the water. Pour this solution into the sprayer tank and then add the rest of the water to the tank. Make sure this water is well mixed into the pesticide solution.

e. Stir the solution carefully with a flat paddle (stirrer) and avoid splashing.
The safest paddles are made of plastic, aluminum or steel because these materials are impervious. This means the pesticide cannot soak into them. They can be washed and used again. Wooden paddles soak up the pesticide and must be disposed of immediately after use. This must be done with extreme care. It is best to bury them along with the empty pesticide containers.
Never leave the paddles lying around after use as they will be a danger to small children.

Figure 5.1. Concentrated pesticide diluted in water according to the instructions on the bottle or packet.

5.2. Basic formulas to calculatie and mix chemicals

Refer back to the label and find the Amount of product to be applied / hectare

1. To calculate how much product you will need to spray your crop or field use the formula:

$$\text{Amount of product needed} = \frac{\text{The amount to be applied /ha x Field area } m^2}{10{,}000}$$

2. To calculate how much spray you need to mix to spray your crop or field use the formula:

$$\text{Amount of spray needed (Liters)} = \frac{\text{Volume (ml) applied in 1 minute x area to be sprayed}}{\text{Area sprayed in 1 minute x1,000}}$$

3. To calculate how many knapsacks you will need to spray the crop or field use the formula:

$$\text{Knapsacks needed} = \frac{\text{Amount of spray needed to spray the field (Liters)}}{\text{Volume of Spray Tank (Liters)}}$$

Self-Check-5	Written Test

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

1. Write the basic formulas to calculate chemicals (pesticides) 9 points
2. What are the rules to diluting pesticide concentrates. 6 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-6	**Following directions, standards and legislative requirements for mixing chemicals**

6.1. Directions, standards and legislative requirements for mixing pesticide

Directions for mixing are found on the product label or in the Product leaflet

General principles are before you start work:

- All the team must put on the necessary PPE specified on the product label
- Check your instructions and be clear about how much water and how much product are needed, what adjuvants are required and what mixing procedure is to be used and if you are planning to use two different pesticides in the mix (Tank mix) check the labels to ensure that the products are compatible. Then
- Place your mixing tank in a site not used for empty crates and harvested produce
- Check that your mixing tank is clean and that you have your products and measuring equipment readily to hand
  If you are mixing directly into the spray tank, check that the outlet valves are closed.
- Put half of the water that you need into the mixing or spray tank
- Add the acidifier to lower the pH if this product is necessary
- Measure the product needed (Liquids)
    - Put your measuring cup on to a stable flat surface where you can read the scale easily
    - Agitate liquid products carefully and pour in the amount of product needed and put the lid securely back on to the bottle
    - Pour the product into the tank and stir
- Measure the product needed (Powder)
    - Use the scoop provided to measure the amount of product needed
    - Put the product into a bucket and mix with a small amount of water until you have a smooth cream
    - Add this mixture to the tank, rinse the bucket three times and put the rinse water into the tank.

- If you have emptied the container of pesticide rinse the container three times and put the rinse water into the tank. Puncture the container
- If you are using two different pesticides in the mix (Tank mix) use the order of mixing given on the product label. it's usually liquid product first
- Add the wetting agent if this is being used. Note Use of a wetting agent is not always advisable so check the label
- Turn on the tank sprayer motor to agitate the mix or in a barrel stir well. Then fill the tank to the required level and agitate / stir again.

If you have done centralized mixing in a barrel, transfer the mix carefully into the knapsacks using a small bucket

Remember, some pesticide products will settle over a period of time so stir the remainder of the spray mix thoroughly before refilling the knapsacks

Self-Check-6	Written Test

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

1. What are the general principles before mixing of chemicals (pesticides)? 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Operation sheet -1	Calibrating a Knapsack sprayer for spraying

Steps to set up (Calibrate) a Knapsack sprayer for spraying

1. Measure the area of crop or field that is to be sprayed
2. Select and fit the nozzle that is most suitable for the type of product and crop to be sprayed. Take care not to cross thread or over tighten the fittings
3. Half fill the tank with water
4. Measure the area of crop/field that you can spray in one minute
5. Measure the area that you have sprayed in m^2 and record your answer
6. Now measure the output of the nozzle that you have used
7. Calculate the application rate using the formula:

$$\text{Volume of spray applied/ha} = \frac{\text{Volume ml applied in 1 minute x 10}}{\text{Area sprayed in 1 minute}}$$

Operation sheet-2	Calculating and mixing pesticides

Steps for calculating the correct amount of chemicals

1. Check the pesticide label to find the application rate at which the concentrate should be used.
2. Work out the area to be sprayed.
3. Calculate the amount of pesticide concentrate needed for the size of the area to be sprayed.
4. Calculate how much water is needed to dilute the pesticide to the correct strength.

Steps to mixing the chemicals

1. Always work in the open and avoid breathing the fumes.
2. Read the label and put on the appropriate protective equipment as indicated.
3. Mix water and concentrate in a large clean container, such as a 10 L bucket.
4. Put a small amount of water into the bucket first. Place the required amount of pesticide into the water.
5. Stir the solution carefully with a flat paddle (stirrer) and avoid splashing.
   use the Basic formulas to calculatie and mix chemicals from the information sheet-5

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 2 hours.

Task 1. Calibrate knapsack sprayer for spraying

Task 2. Calculate and mix pesticides

Reference

https://www.researchgate.net/publication/270793645_CALIBRATION_OF_A_KNAPSACK_SPRAYER

http://psep.cce.cornell.edu/Tutorials/core-tutorial/module17/index.aspx

Horticultural Crops Production

Level-III

Learning Guide-61

Unit of Competence: - Prepare and apply chemicals

Module Title: - Preparing and applying chemicals

LG Code: AGR HCP1 M14 LO4-LG-61

TTLM Code: AGR HCP1 TTLM 0120v1

LO4. Apply chemicals

Instruction Sheet	Learning Guide#61

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

- Assessing and controlling Meteorological conditions and forecasts
- Identifying hazards of particular chemicals
- Assessing and controlling Risks to others and the environment
- Following application equipment calibration procedures
- Interpreting procedures and precautions for the use of the chemicals
- Determining requirements for chemical handling and application
- Applying chemicals safely
- Following chemical spills or accident procedures
- Making first aid 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 –**

- Meteorological conditions and forecasts are assessed prior to and during application
- Hazards of particular chemicals are identified
- Risks to others and the environment are assessed and controlled
- Application equipment calibration procedures are followed
- Procedures and precautions for the use of the chemicals are interpreted from labels
- Requirements for chemical handling and application are determined from directions
- Chemicals are applied safely and effectively according to directions
- Chemical spills or accident procedures are followed
- First aid equipment is made available on site

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 9”.
4. Accomplish the “Self-check 1 to Self-check 9” in page -80, 83, 86, 90, 94, 97, 100, 103, and 106 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1to operation sheet 3 in page 107, 108 and 109 respectively.
6. Do the “LAP test” in page – 110 (if you are ready).

Information Sheet-1	Assessing and controlling Meteorological conditions and forecasts

4.1 Assess Meteorological conditions and forecasts prior to and during application

Meteorological conditions during and in the hours after spraying can have a big impact:

- Too windy and the spray drifts on to other crops, people and the environment. This causes potential residues in neighboring crops, poisoning of people and pollution in the environment
- Too hot and the spray evaporates very quickly giving poor control of target pests and pollution of the atmosphere. Crops are also more sensitive to scorch if they are sprayed when hot and or under water stress. It also very uncomfortable for operators who are tempted to remove their protective clothing. More danger!
- Rain, during or soon after application washes the pesticide off the plant resulting in poor control of the target pest and environmental pollution of soil and water. Application of some products directly after rain is also not advisable. check the label

Therefore you should:

- Plan to carry out spraying in the early morning or that latter part of the afternoon when it is cooler
- Check the weather forecast for rain before starting work.
  If rain is forecast, check with the Boss and reschedule the spraying
- Check the wind conditions in the field
  A little wind is desirable. Smoke just off vertical and leaves rustling gently
  Too much wind is a problem and again, check with the Boss and re-schedule the spraying

Self-Check -1	Written Test

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

1. Discusses the meteorological conditions during and in the hours after spraying. 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-2	Identifying hazards of particular chemicals

4.2 Identify Hazards of particular chemicals (pesticide)

Hazards and safety advice relating to the application of a pesticide product are shown on the label. Please check the pictograms to the right of the center panel. More details are also provided in the information panel on the right hand side of the panel.

Information will also be found in more detail in the information leaflet supplied with the product

Left Hand Panel *Application details*	Centre Panel	Right Hand Panel **Operator and Environmental safety**
• **Mode of action** **Explains how the product works, e.g. contact, stomach poison, active on larval stage.** • **What pests and what crops can be treated** **What pests are killed and what on what crops the product can be used to control these pests.** Note: Registration of a product is given for specific crop/pest combinations where the product has been tested and shown to be safe and effective. • **When the product may be used** **Any guidelines about when the product can or cannot be used** **E.g. pre-flowering, two applications only per crop, etc.** • **How much to use** ***Quantity of concentrate / liter of spray*** Quantity of concentrate / hectare	**Product Name** **Active ingredient** **Registration No. ……..** **Formulation and Chemical Group** **Function and Mode of Action** **Pack size & Concentration or % a.i.** **Manufacturer** **Batch No. …….**  Storage What to wear to measure and mix Liquid or solid Application method What to wear when spraying Wash after spraying Danger to the environment **Toxicology color and Danger Warnings**	• **Nature of the danger to people** **Explains how the pesticide may be absorbed and what the major symptoms of serious contamination will be.** E.g. Absorbed through the skin and causes mild skin irritation**.** • **Nature of the danger to the environment** Says what aspects of the 'environment may be damaged. E.g. poisonous to fish or bees. • **First Aid** What to do if there is an accident and people become contaminated. • **Emergency Help line** Who to contact or where to find information

Self-Check -2	Written Test

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

1. Write and discuss the operators and environment safety hazards during chemical application? 10 points
2. Write the information's that have in the left and center panel? 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

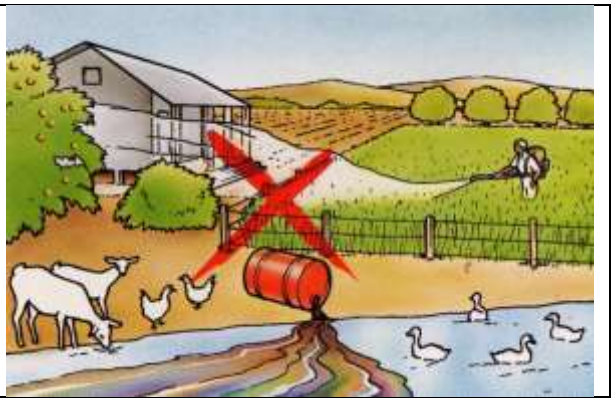
Name: _____ Date: _____

Answer sheet

Information Sheet-3	Assessing and controlling Risks to the environment

3.1. Assess and Control Risks to others and the environment

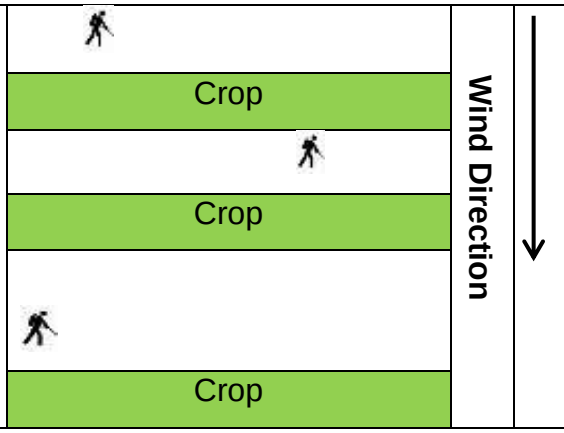
The actual actions needed to minimize risk will depend on International Good Practices, Laws and Regulations, Farm Procedures and 'Local' Risk Assessment. You also need to take responsibility for your own safety and that of your colleagues so follow instructions and behave sensibly.



3.1.1 Requirements for 'good practice' when spraying pesticides

To protect yourself and members of your team

- Ensure that you are all wearing the correct PPE and wearing the PPE correctly
- Do not spray when it is too hot or windy
- Allow time for rest breaks in your work schedule
- Make sure that everybody washes their body thoroughly after spraying



- If you are getting wet or you can taste and smell the pesticide you are in the wrong place and not properly dressed. Please move and put on additional PPE

Requirements for 'good practice' when spraying continued ……

To protect other people	• Move all unprotected workers out of the area that you are to spray • Move workers in adjacent areas to a safe distance • Do not allow drift on to adjacent crops and harvested produce • Communicate the Harvest Interval, (PHI) to concerned management and put up a notice in the field • Do not spray near to or allow spray drift to contaminate water sources, personal belongings, domestic housing, livestock and children play
To protect the environment	• Do not spray close to water sources • Ensure that your spray team get 'Good coverage' but not 'Run Off' …… Good coverage gives good control and reduces the need for frequent applications of pesticide. Reducing Run Off reduces wastage and cost but also protects the soil micro flora and fauna and reduces the risk of pesticide leaching out of the soil to contaminating water, killing fish and polluting water used for drinking • Work carefully to avoid spillage and the risk of pesticide spillage causing environmental pollution

Self-Check 3	Written Test

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

1. Write and discuss the requirements for ‘good practice’ when spraying pesticides to control the risk? 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-4	Following application equipment calibration procedures

4.1. Application Equipment and Calibration

Calibration is the process of measuring and adjusting the amount of pesticide your equipment will apply over a target area. It is a critical “first step” in making certain that your equipment is applying pesticide uniformly and at the correct rate. Calibrating your equipment will save you money, by not wasting pesticides from over application; and time, by preventing the need for re-application from under application. Over applying pesticides also can result in excess residues on or in plants, soil, and surface or groundwater. Remember that exceeding the label rate of application is a violation of the law! To apply pesticides at the proper rate, properly calibrated application equipment is essential. Such equipment mitigates environmental and human health concerns, reduces the chances of over- or under-applying pesticides, and optimizes pesticide efficacy. Equipment should also be checked frequently for leaks and malfunctions.

4.1.1. Best Management Practices

- Use an appropriately sized applicator for the size of area being treated.
- Ensure the spray technician is experienced, certified, and properly trained.
- Minimize off-target movement by using properly configured application equipment.
- Properly calibrate all application equipment at the beginning of each season (at a minimum) or after equipment modifications.
- Check equipment daily when in use.
- Use recommended spray volumes for the targeted pest to maximize efficacy.
- Calibration of walk-behind applicators should be conducted for each person making the application to take into consideration their walking speed, etc.

4.1.2 Procedures to calibrate a sprayer

1. Prepare sprayer

- ✓ Rinse supply tank and fill with clean water.
- ✓ Remove nozzle; check and clean if necessary.
- ✓ Flush pump, hose, and lance with clean water.
- ✓ Apply pressure (i.e. pump) and check sprayer for leaks.

2. Determine walking speed of spray person

- ✓ Fill tank with clean water.
- ✓ In an actual paddy, mark starting point with a stake.
- ✓ Using your wristwatch, begin 1 minute trial. Walk at a constant and normal speed, carrying the filled sprayer on your back. Pump the sprayer handle with one hand to maintain pressure and direct the nozzle with the other hand to obtain a spray swath of approximately 1m width.
- ✓ Stop walking at the end of exactly 1 minute and mark the stopping point with a second stake.
- ✓ Measure the distance between the starting and stopping points. Record the distance in meters. Walking speed can be expressed in terms of m/minute.
- ✓ Repeat trial at least three times to obtain an average walking speed.

3. Calculate area sprayed in one minute

If the spray swath was kept at (approximately) 1m, the area sprayed in one minute can be calculated easily using the known walking speed:

Area sprayed in one minute = spray swath (1m) x walking speed (m/minute). The answer is expressed in terms of m^2/minute.

4. Determine nozzle discharge in one minute

- ✓ Fill sprayer with clean water and pump sprayer handle to build up pressure.
- ✓ Dip end of nozzle into a graduated cylinder.

- ✓ Using your wristwatch, begin 1 minute trial. Open the cut-off valve and spray into the graduated cylinder. Make sure none of the spray escapes.
- ✓ Cut off the discharge at the end of exactly 1 minute.
- ✓ Note the volume (in liters of liquid collected. This is the nozzle discharge, expressed in terms of liters/minute (1/min).
- ✓ Repeat trial at least three times to obtain an average nozzle discharge.

Now you can easily compute the rate of spraying'

Rate of spraying = (nozzle discharge (1/min)) / (area sprayed (m^2/min))
($1/m^2$)

Since most pesticide application rates are given in terms of 1/ha, the rate of spraying should be converted to the same units of measurement'

Rate of spraying = $1/m^2$ x $10000m^2$/1 ha = 1/1 ha ha

i.e., simply multiply the rate calibrated for $1/m^2$ x 10000.

It is however good practice to monitor application in the field and to check the output of the nozzles at least weekly.

Problem solving at a glance	
Problems observed	Possible causes
Spray mix is leftover after completion of spraying	• Spray man has walked too fast • Nozzle or filters are partially blocked
Spray mix runs out before the total area to be sprayed has been treated	• Spray man has walked too slowly • Spray man has pumped harder that during the calibration process • Nozzle has become worn so the aperture is bigger Check the output and compare the result with the output measured during calibration

Self-Check -4	Written Test

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

1. What is calibration? 5 points
2. Write the best management practices during pesticide calibration? 10 points
3. Write and discuss the procedures to calibrate sprayer? 10 points

Note: Satisfactory rating – 25 points Unsatisfactory – below 25 points

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-5	**Interpreting procedures and precautions for the use of the chemicals**

5.1. Check Procedures and precautions for the use of the chemicals (pesticide)

Please read the label to ensure that you have followed all of the recommendations and advice. Label requirements should have been checked thoroughly before Spray Instructions are issued but mistakes can happen and as the Spray Supervisor responsible in the field, you are the last person that can prevent mistakes in product selection and application before the application takes place.

5.2. Basic procedures and precautions in pesticide usage

A. Purchase

- ✓ Purchase only JUST required quantity e.g. 100,250,500 or 1000 ml for single application in specified area.
- ✓ Do not purchase leaking containers, loose, unsealed or torn bags.
- ✓ Do not purchase pesticides without proper/ approved LABELS.

B. Storage

- ✓ Avoid storage of pesticides in the house premises.
- ✓ Keep only in original container with intact seal.
- ✓ Do not transfer pesticides to other container.
- ✓ Never keep them together with food or feed/ fodder.
- ✓ Keep away from the reach of children and livestock.
- ✓ Do not expose to sun-light or rain water.
- ✓ Do not store weedicides along with other pesticides.

C. Handling

- ✓ Never carry/ transport pesticides along with food materials.
- ✓ Avoid carrying bulk - pesticides (dusts / granules) on head, shoulders or on the back.

D. Precautions for Preparing Spray Solution:

- ✓ Use clean water.
- ✓ Always protect your NOSE, EYES, MOUTH, EARS and HANDS.
- ✓ Use hand gloves, face mask and cover your head with cap.
- ✓ Use polyethylene bags as hand gloves, handkerchiefs or piece of clean cloth as mask and a cap or towel to cover the head
- ✓ Read the label on the container before preparing spray solution.
- ✓ Prepare spray solution as per requirement.
- ✓ Do not mix granules with water.
- ✓ Concentrated pesticides must not fall on hands etc. while opening sealed containers.
- ✓ Do not smell the sprayer tank.
- ✓ Avoid spilling of pesticide solution while filling the sprayer tank.
- ✓ Do not eat, drink, smoke or chew while preparing solution.
- ✓ The operator should protect his bare feet and hands with polyethylene bags.

E. Equipment

- ✓ Select right kind of equipment.
- ✓ Do not use leaky, defective equipment.

- ✓ Select right kind of nozzle.
- ✓ Don't blow/clean clogged- nozzle with mouth. Use old tooth- brush tied with the sprayer and clean with water.
- ✓ Do not use same sprayer for weedicide and insecticide.
- ✓ Never re-use empty pesticide container for any purpose

F. Precautions for applying pesticides

- ✓ Apply only at recommended dose and dilution.
- ✓ Do not apply on hot sunny day or strong windy condition.
- ✓ Do not apply just before the rains and also after the rains.
- ✓ Do not apply against the wind direction.
- ✓ Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
- ✓ Containers, buckets etc. used for mixing pesticides should not be used for domestic purposes.
- ✓ Avoid entry of animals and workers in the fields immediately after the spraying.

G. Disposal

- ✓ Left over spray solution should not be drained in ponds or water lines etc. 'throw it in barren isolated area, if possible.
- ✓ The used/ empty containers should be crushed with a stone / stick and hurried deep into soil away from water source.
- ✓ Wash the sprayer and bucket etc. with soap water after spraying.

Self-Check-5	Written Test

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

1. Write and discuss the basic procedures and precautions in pesticide usage. 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-6	Determining requirements for chemical handling and application

6.1. Requirements for pesticide handling and application

Basic requirement for operator safety and effective application of the product whist spraying are provided on the product label. Farms may however develop additional procedures and rules for spraying, e.g. farms that comply with MPS and Global GAP will implement rules about how many hours an operator may spray on any one day or during a week.

Please read the label and check with your Line manager about additional requirements before starting work.

Chemicals used to manage insects, rodents, weeds, molds and germs all have the potential to cause harm to workers. Pesticides come in different forms, including sprays, liquids, powders, granulates, baits and foggers. The Canadian Centre for Occupational Health and Safety in Hamilton, Ontario, offers the following advice to help mitigate the risks associated with using pesticides:

1. Working safely

- Choose the least hazardous product for the task being performed.
- Keep the label intact and make sure it is readable.
- Only use product as intended
- Wear appropriate personal protective equipment
- Thoroughly clean all spills and isolate the spill area.
- Do not burn pesticides or pour them down a drain.
- Wash skin and change clothes after using a pesticide.
- Discard contaminated leather boots, shoes and belts.
- Clearly label treated surfaces where residue may remain.
- Keep people away from the applied area until the pesticide has dried.

2. **Mixing pesticides**

- Ventilate areas where chemicals are mixed.
- Mix at the recommended rate and only use the amount directed by the label.
- Avoid creating dusts or splashes.
- Keep containers below eye level.
- Never transfer pesticides into cups or bowls that may be confused with food containers.

3. **Storage pesticides**

- Lock pesticide storage areas.
- Post warning signs on entrances and walls.
- Maintain an inventory of the quantity, type and age of products.
- Place products on non-absorbent shelves and upright and off the floor.
- Keep pesticides away from highly permeable soil and areas that may flood.
- Store pesticides in a temperature-controlled environment.
- Check containers for leaks or defects and tightly seal and store in original containers.
- Separate pesticides from flammable and combustible materials.
- Keep spill-cleaning equipment and a first aid kit outside or near storage areas.
- Keep pesticides away from food, utensils or water.

Self-Check-6	Written Test

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

1. Write the requirements of pesticide mixing? 5 points

1. Write the requirements of pesticide storage? 5 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-7	Applying chemicals (pesticides) safely

7.1. Apply Chemicals (pesticides) safely and effectively

Operators and Supervisors of spraying should be vigilant throughout the application process. The weather may change, tools and equipment may develop faults and operators become tired and less careful.

Safe and effective operation requires prompt intervention when problems arise.

Check that spray men do not remove their PPE when they get tired and hot. Organize the work so that adequate rest breaks are provided.

Check that instructions about application technique are followed throughout the spraying activity.

Effective application requires that attention is given to placement of the spray and leaf coverage during application.

You need to know:

- Is the pest mobile or static? (Will the pest move around and make contact with a droplet or must the droplet make a direct hit?)
- Does the pest live in the shoot tip, on the upper leaf surface or below the leaf surface
- Is the product that you are using contact or systemic.

Instructions about placement and coverage may be included in the product leaflet or can be provided by your line manager. Over time you will be expected to build up your own knowledge to make decision about what placement and coverage is needed for the different pests and products used on the farm.

Coverage and placement needs to be checked at the start of spraying and periodically during the day. If you are not getting good coverage of the target, check how the operator is managing the lance.

Steps to better spraying chemicals (pesticides)

1. Read the label: reading the label gives you information required for optimal pest control. The label also contains information to curb off-target movement.

2. Think about spray nozzles: you are faced with the challenge of selecting proper nozzles, ones that provide necessary spray coverage to kill the targeted pest yet minimize

3. Pick the best nozzle

4. Use a pattern check: what does a spray-pattern check do? It checks your spray pattern, obviously!

5. Calibrate your sprayer: calibration helps you get the right amount of product on the weed, insect, or fungi you're targeting.

6. Check wind speed

7. Consider using a sprayer weather station

8. Monitor impact of sprayer speed changes

9. Check for cross contamination

10. Check hoses for trapped chemical

11. Clean filter systems

Figure 7.1. Spraying pesticide

Self-Check-7	Written Test

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

1. What is important applying chemical safely? 4 points
2. Write the steps to better chemical (pesticide) application? 11 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-8	Following chemical spills or accident procedures

8.1. Procedures for Chemical (pesticide) spills or accident

Chemical spill is

the inadvertent release of a liquid chemical regarded as hazardous to human health, irrespec tiveof the volume or place of release indoors or environmental

which, in a workplace, is identified with hazardous materials labels.

Procedures for chemical spillage in the field are essentially the same as for transport and storage, i.e. Work carefully to minimize the occurrence and if spillage happens, contain, soak up, scrape up and bag the contaminated material and surrounding soil for disposal.

However accident can still happen so if an accident does happen the following actions should be taken to minimize the risks of contamination of people, livestock and the environment:

- Remove all unprotected people to a safe distance
- Put on appropriate protection; gum boots, overall and gloves as a minimum plus spray suit and respirator if the spillage is large or the product has the hazard warning for **poison** on the label

- Contain the spillage using dry sand or soil, brush up the spillage and sand and place in a strong plastic sack until disposal is possible

- Mend or reposition the container concerned to prevent on-going leakage
- Inform the Farm Manager or Owner of the farm and pesticide concerned

To decontaminate a vehicle and surrounding area:

- **Small spillage**; move the vehicle to an open area. Not near to a river or open drain and wash with copious amounts of water.
  Do not let animals drink or children play in the washing water.
- **Large spillage**, guideline more than 1 liter,

If the spillage is contained within the vehicle, move the vehicle to a quiet area and isolate the vehicle from people and livestock.

If the spillage is leaking from the vehicle and there is contamination of the highway; leave the vehicle in situe and isolate the vehicle from people and livestock

Then in either of these cases for large spillage, inform the owner of the pesticide or the farm manager if he/she is not present at the time of the accident and contact the local Ministry of Agriculture for advice about how to proceed.

Self-Check-8	Written Test

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

1. What is chemical spill? 4 points
2. What are the accident reports during chemical spill? 6 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-9	Making first aid equipment

First Aid is the emergency aid or treatment given to someone injured, suddenly ill, etc., before regular medical services arrive or can be reached.

9.1. General First Aid Guidelines

Swallowed poison. Induce vomiting ONLY if emergency personnel on the phone or the product label tells you to do so. It will depend on what the person has swallowed; some petroleum products or caustic poisons will cause more damage if the person is made to vomit. Always keep Syrup of Ipecac on hand (1 ounce for each child in the household) to use to induce vomiting if recommended by emergency personnel. Be sure the date is current.

Poison in eye. Eye membranes absorb pesticides faster than any other external part of the body; eye damage can occur in a few minutes with some types of pesticides. If poison splashes into an eye, hold the eyelid open and wash quickly and gently with clean running water from the tap or a gentle stream from a hose for at least 15 minutes. If possible, have someone else contact a Poison Control Center for you while the victim is being treated. Do not use eye drops or chemicals or drugs in the wash water.

Figure 9.1. Eye wash

Poison on skin. If pesticide splashes on the skin, drench area with water and remove contaminated clothing. Wash skin and hair thoroughly with soap and water. Later, discard contaminated clothing or thoroughly wash it separately from other laundry.

Inhaled poison. Carry or drag victim to fresh air immediately. If you think you need protection such as a respirator and one is not available to you, call the Fire Department and

wait for emergency equipment before entering the area. Loosen victim's tight clothing. If the victim's skin is blue or the victim has stopped breathing, give artificial respiration (if you know how) and call rescue service for help. Open doors and windows so no one else will be poisoned by fumes.

9.2. First aid equipment required

Requirements are the same as for Pesticide stores:

- Eye wash
- Telephone contact and emergency numbers to call in the event of a serious accident is important
- To have a first aid box nearby for treatment of physical injuries and headache is useful

Figure 9.2. First aid required equipments

Self-Check-9	Written Test

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

1. What is first Aid? 4 points
2. List the equipments required for first Aid? 6 points
3. Write the general first Aid guide lines? 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Operation sheet-1	calibrating a sprayer

Procedures to calibrate a sprayer

1. Prepare sprayer
2. Determine walking speed of spray person
3. Calculate area sprayed in one minute
4. Determine nozzle discharge in one minute
5. Now you can easily compute the rate of spraying

Use the formula from the information sheet-4

Operation sheet-2	Spraying chemical (pesticides)

Steps to better spraying chemicals (pesticides)

1. Read the label: reading the label gives you information required for optimal pest control.
2. Think about spray nozzles:
3. Pick the best nozzle
4. Use a pattern check
5. Calibrate your sprayer
6. Check wind speed
7. Consider using a sprayer weather station
8. Monitor impact of sprayer speed changes
9. Check for cross contamination
10. Check hoses for trapped chemical
11. Clean filter systems

Operation sheet-3	Disposing chemical spillage

Procedures of disposing chemical spillage

1. Remove all unprotected people to a safe distance
2. Put on appropriate personal protective equipments
3. Contain the spillage using dry sand or soil, brush up the spillage and sand and place in a strong plastic sack until disposal is possible
4. Mend or reposition the container concerned to prevent on-going leakage
5. Inform the Farm Manager or Owner of the farm and pesticide concerned

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 4 hours.

Task 1. Calibrate sprayer

Task 2. Spray chemical (pesticide)

Task 3. Dispose chemical spillage

Reference

http://www.thisland.illinois.edu/57ways/57ways_20.html

http://www.fao.org/pesticide-registration-toolkit/registration-tools/assessment-methods/method-detail/en/c/1186994/

http://www.marylandgolfbmp.org/application-equipment-and-calibration/

Horticultural Crops Production

Level-III

Learning Guide-62

Unit of Competence: - Prepare and apply chemicals

Module Title: - Preparing and applying chemicals

LG Code: AGR HCP1 M14 LO5-LG-62

TTLM Code: AGR HCP1 TTLM 0120v1

LO5. Clean up following chemical application

Instruction Sheet	Learning Guide#62

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

- Selecting tools or equipment
- Defining and following Requirements for cleaning equipment and sites
- Defined requirements for disposing of unused chemicals, empty containers or spilled material
- Following procedures for reporting chemical spill

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 –**

- Tools or equipment required to clean up chemicals are selected
- Requirements for cleaning equipment and sites are defined and followed according to directions and standards
- Requirements for disposing of unused chemicals, empty containers or spilled material are defined from directions and standards
- Procedures for reporting chemical spills are followed

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 4”.
4. Accomplish the “Self-check 1 to Self-check 4” in page -115, 117, 120 and 122 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to “Operation Sheet 1 and operation sheet 2 in page 123 and 124.
6. Do the “LAP test” in page – 125 (if you are ready).

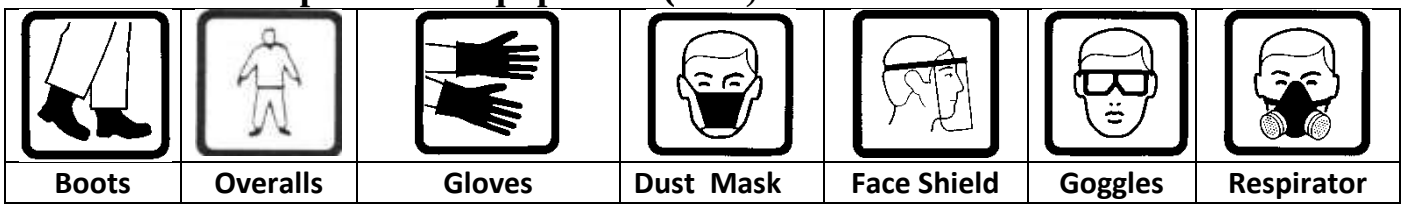
Information Sheet-1	Selecting tools or equipment

5.1 Tools or equipment required to clean up chemicals

Tools and equipment required for cleaning up spillage in the field are;

- ❖ Personal protective equipments
- ❖ Shovel
- ❖ Bucket
- ❖ Dry soil (sand)
- ❖ Sponges
- ❖ Glass polishing cloths.
- ❖ Cleaning brushes
- ❖ A dustpan and brush.
- ❖ A plastic caddy to carry the essentials.

1. Personal protective equipments (PPE)



2. Shovel 3. Bucket 4. day soil

Figure 1. Chemical spillage cleaning tools and equipments

Dry soil to contain and soak up spillage (Usually found on site)

Bucket with lid or strong plastic sack to contain the contaminated soil

Self-Check -1	Written Test

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

1. Write the tools or equipments required for cleaning spill chemicals. 5 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-2	Defining and following Requirements for cleaning equipment and sites

2.1. Requirements for cleaning equipment and sites

Each organization using pesticides should develop and document a procedure for cleaning equipment and the site where application has taken place.

This procedure should be made known to all operators

The aims of the procedure are to:

- Clean mixing and application equipment to preserve the life of the equipment and to prevent cross contamination between applications of different products.
  - ✓ Tanks should be triple rinsed inside and out using a small amount of water on each occasion
  - ✓ Rinse water should be flushed through the hoses and nozzles
  - ✓ Filter should be removed, washed in clean water and replaced
- Dispose of water used for cleaning in such a way as the risk of pollution of the environment is minimized and people and animals do not come into contact with the contaminated water.
  - ✓ In small scale reinstate should be sprayed out on to the land beneath the crop that has just been sprayed.
  - ✓ Do not spray directly on to the crop as this will dilute the pesticide applied for pest control.
  - ✓ On a large commercial far, the rinsate can similarly be sprayed out under the crop canopy of the sprayed crop or more likely due to logistics will be drained into a designated soak away or constructed wetland.

Self-Check -2	Written Test

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

1. Discuss the requirements for cleaning spry equipments and site? 8 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-3	Defined requirements for disposing of unused chemicals, empty containers or spilled material

3.1. Disposal of unused chemical, empty containers or spilled material

3.1.1. Disposal of unused pesticide:

Here we need to distinguish between Pesticide concentrate which is still in its' original container and pesticide spray mix.

- Pesticide concentrate which is still in its original container should be returned to store and the return recorded in the stock card
- Pesticide spray mix which has not been used can be handled in several ways according to farm needs and policy:
  - First choice is to use the spray mix constructively by application to a different block of the same crop where the target pest is also a problem ….. this reduces wastage, potential pollution and cost
- Use/disposal in this way should be recorded as spray application. Do not re-spray the crop in the target Block as this can result in over application, crop scorch and residues in harvested produce
  - Second choice is the spray out the solution on to fallow land or designated field margin not accessed by people or animals
  - Third choice is to empty the excess spray mix into a designated waste pit …. See diagram overleaf
  - Disposal should be recorded, product name and approximate volume and reported in writing to the Farm Owner / Crop Protection Manager / Farm Manager as appropriate according to the farm management structure.

Waste Pit Management

The waste pit should be sited where there is no risk of flooding or any leachate from the pit running into water courses.

Line the pit with a clay and cement mix to slow down any seepage

Fill the pit with layers of waste, soil and organic matter

Erect a warning sign and fence

When full cap with soil and plant trees

❖ Empty Pesticide Containers should be cleaned and handled in accordance with farm procedures.

3.1.2. Typical procedures to dispose empty chemical container

- ♦ Drain the last dregs of product concentrate into the spray mix
- ♦ Triple rinse the containers and put the rinsate into the spray mix before making the mix up to its final volume
- ♦ Puncture the container to prevent reuse for unauthorized purposes; Typically food and water storage
- ♦ Return the clean damaged containers to the store for safe storage until disposal is possible
- ♦ Disposal methods to be used will depend on the type of container:
  - ✓ Paper and cardboard packaging can be burnt in an incinerator and the ashes buried in a designated waste pit
  - ✓ Plastic and metal containers can be re-cycled by authorized recycling companies or can be buried in the waste pit

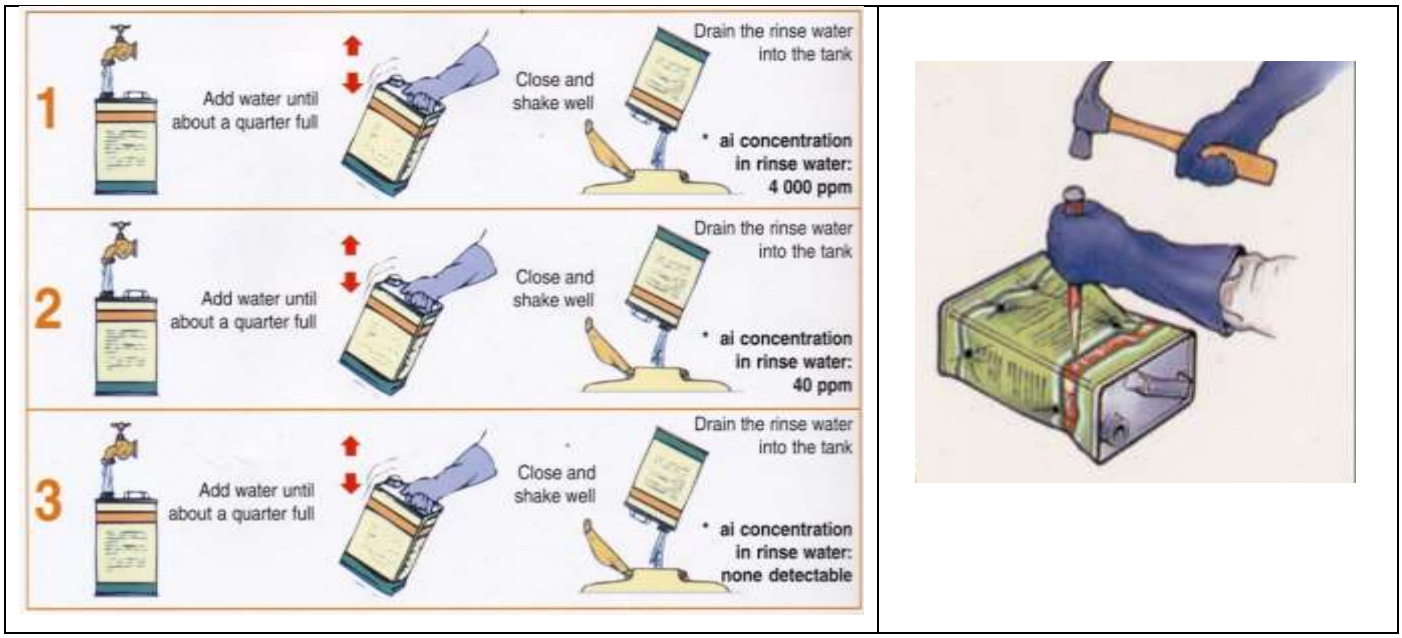


Figure 3.1. Dispose empty containers

Self-Check 3	Written Test

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

1. Discuses disposing of unused pesticide? 10 points
2. Discusses the typical procedure of disposing empty chemical containers? 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-4	Following procedures for reporting pesticide spill

4.1. Procedures for reporting pesticide spillage

Chemical spills in the environment can have a devastating impact on environmental health. These toxins can soak into the ground, get into the water, or can become airborne and enter the human body, causing serious health consequences.

The following are basic steps for reporting pesticide spillage

1. Prepare format paper for reporting pesticide spill
2. Date of the pesticide spillage
3. Site of product pesticide spillage
4. Name of the product (pesticide) spillage
5. Amount of spill pesticide approximate
6. How and why the spillage occurred
7. Clean up action taken
8. Complete reporting

Spillage should be reported in writing to the appropriate line manager:

- Name of product
- Approximate amount spilt
- Site of spillage
- Clean up action taken
- Brief details of how and why the spillage occurred

Table 1. Sample format for report spill chemicals (pesticides).

NO	date	Product Name	Amount of spill	Site of spill	Clean up action taken	How the spill
1						
2						
3						

Self-Check -4	Written Test

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

1. What information are reported to manager or supervisor when chemical is spill.
   8 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Operation sheet-1	disposing empty chemical container

Procedures to disposing empty chemical container

1. Drain the last dregs of product concentrate into the spray mix
2. Triple rinse the containers and put the rinsate into the spray mix before making the mix up to its final volume
3. Puncture the container to prevent reuse for unauthorized purposes; Typically food and water storage
4. Return the clean damaged containers to the store for safe storage until disposal is possible

Disposal methods to be used will depend on the type of container:

Operation sheet -2	Reporting pesticide spillage

The following are basic steps for reporting pesticide spillage

1. Prepare format paper for reporting pesticide spill
2. Date of the spillage
3. site of pesticide spillage
4. Name of the product (pesticide) spillage
5. Amount of spill pesticide approximate
6. How and why the spillage occurred
7. Clean up action taken
8. Complete reporting

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 2 hours.

Task 1. Dispose empty chemical containers

Task 2. Report pesticide spillage

Horticultural Crops Production

Level-III

Learning Guide-63

Unit of Competence: - Prepare and apply chemicals

Module Title: - Preparing and applying chemicals

LG Code: AGR HCP1 M14 LO6-LG-63

TTLM Code: AGR HCP1 TTLM 0120v1

LO6. Record application details

Instruction Sheet	Learning Guide#63

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

- Recording Application of chemicals
- Recording details of the specific chemical
- Recording Inventory of personal protective equipment and application equipment
- Following procedures and requirements for reporting application

Making records of injury or poisoning 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 –**

- Application of chemicals is recorded according to organizational procedures, label directions and legislation.
- Details of the specific chemical concerned are recorded correctly in the chemical inventory according to regulations
- Inventory of personal protective equipment and application equipment is recorded
- Procedures and requirements for reporting application details to senior management or client are followed
- Records of injury or poisoning associated with application of chemical are made and provided to the appropriate person.

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below 3 to 5.
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 -130,132, 134, 136 and 139 respectively.
5. If you earned a satisfactory evaluation from the “Self-check” proceed to the next.

Information Sheet-1	Recording Application of chemicals

1.1 Record Application of chemicals

In Ethiopia, application records are kept in accordance with organizational procedures. Therefore the type of information that is recorded varies between farms and organizations.

A small farmer will typically make a diary record showing:

- Date of operation
- Field, area sprayed, crop and target pest
- Pesticide used, total amount of product, dilution rate and volume of spray used
- Pre-harvest interval (PHI) and date when harvest is possible

The farmer may also note the weather at the time of spraying and who did the spraying

A larger scale commercial farmer will usually record spraying details in a 'Spray Book or file with application pre-printed record preform.

Details noted will include:

- Spray Instruction reference
- Date of application
- Field, area sprayed, crop and target pest
- Chemical used, total amount of product, dilution rate and volume of spray used
- Pre-harvest interval (PHI) and date when harvest is possible
- Weather at the time of spraying
- Problems encountered or reasons for difference between amount of product specified in the spray instructions and the actual amount applied
- Names of members of the spray team and signature of the spray Supervisor responsible for the application.

Spray records are useful management tools:

- Product name, amount of product used /ha and dilution rate, and weather at the time of spraying are all useful pieces of information for problem solving if subsequent scouting results show crop phytotoxicity or failure to adequately control the target pest
- Spray date, PHI and earliest possible harvest date allow for planning of harvest and sales and help to ensure that the PHI is actually observed

- Names of operators enables hours worked with chemicals to be monitored (important when an operator is a fulltime spray man)
- Amount of product used is essential data for evaluation of the cost of crop production
- In commercial farms certified for the Market Labels needed for market access, e.g. Global GAP, MPS or Fair Trade, spray records form part of the traceability chain that demonstrates that pesticides are being used responsible, workers are protected and product should be free from harmful residue at point of sale.

Table 1.1. Sample format for record pesticide application

No	Application date	Area sprayed	crop	Target pest	Type of chemicals	rate of chimerical
1						
2						
3						

Self-Check -1	Written Test

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

1. What activities must be recorded during chemical application? 10 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-2	Recording details of the specific chemical

2.1. Update pesticide stock records and stock inventory to show after application

Spray application records show the actual amount of product applied and this figure should be deducted from the stock balance in the Bin Card and the Pesticide Inventory

Accurate recording of Pesticide issue, use and balance in store allows for monitoring of use and re-ordering when necessary.

An application record must be created for each application, and kept for two years. After the application is completed you must provide the customer specific pesticide application information in writing. The information shall be provided immediately for 1) applications where the customer must be informed of post application safety precautions, 2) landscape applications and 3) structural residential applications; other application types require the information be provided within 30 days. If you want to provide this information electronically, the customer must consent to electronic notification prior to the application.

The following elements that must be required for recorded application.

- The brand or product name
- The EPA registration number
- The total amount applied
- The month, day, and year
- The location of the application
- The crop, commodity, stored product, or site
- The size of area treated
- The name of the certified applicator
- The certification number of the certified applicator

Self-Check -2	Written Test

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

3. What is the important of record application? 4 points
4. Write the elements required for record application. 6 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-3	Recording Inventory of personal protective equipment and application equipment

3.1. Inventory of Personal Protective Equipment, PPEs and Application Equipment

The inventory of PPE and Spraying Equipment are management tools used to show what is in use and what is in stock. This data is useful for re-ordering and for financial audit.

Record inventory personal protective equipment

- Type of personal protective equipment
- Used personal protective equipment
- New or unused personal protective equipment
- Storage condition of personal protective equipment
- Damaged personal protective equipment
- Replaced or maintained personal protective equipment etc.

Record inventory pesticide spray equipments

- Type of spray equipment(knapsack)
- Number of spray equipment(knapsack)
- Equipment number used
- New or unused spray equipment
- Storage condition of spray equipment
- Damaged spray equipment or parts of spray equipment
- Replaced or maintained spray parts or equipment etc.

Self-Check 3	Written Test

Directions: Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers.

5. Write the record inventory of personal protective equipments. 5 points
6. Write the record inventory of pesticide spray equipments. 5 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-4	Following procedures and requirements for reporting application

4.1. Procedures and requirements for reporting application details

Here the reporting line depends on the prevailing circumstance:

- On a Commercial farm the Spray Supervisor/Crop Protection Supervisor will report daily to the Farm Manager; Report to include; the actual spraying operations complete and any discrepancy from the days programme or problems encountered to the Farm
- Where a commercial farm is involved in contracted production of labelled product for export, the Client may periodically request copies of pesticide use records for investigation if residues have been found in produce or just a routine 'due diligence' operation. Similarly when these commercial farmers contract production to out-growers, the Commercial farm will carry out the same procedures.
- A Spray Service Provider will report to the farm Owner, the details of the operation carried out, usually accompanied by the Invoice for the work completed
- Where a small farmer has used contract 'Day Labor' for spraying, the Farmer will make follow up at the end of the day and the labor will expect to be paid for the work completed, Payment usually being X birr per knapsack applied.

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 requirements for reporting applications? 5 points

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

You can ask your teacher for the copy of your answer

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Information Sheet-5	Making records of injury or poisoning

5.1. Records of injury or poisoning associated with application of pesticide

A pesticide poisoning occurs when chemicals intended to control a pest affect non-target organisms such as humans, wildlife, plant or bees. There are three types of pesticide poisoning. The first of the three is a single and short-term very high level of exposure which can be experienced by individuals who commit suicide, as well as pesticide formulators. The second type of poisoning is long-term high-level exposure, which can occur in pesticide formulators and manufacturers. The third type of poisoning is a long-term low-level exposure, which individuals are exposed to from sources such as pesticide residues in food as well as contact with pesticide residues in the air, water, soil, sediment, food materials, plants and animals.

There are two types of pesticide poisoning:

7. Acute poisoning

This happens when someone has been exposed to a high dose of pesticide. This could occur when the pesticide is being mixed, for example, or if a hose breaks drenching the person or bystanders with liquid pesticide solution. Another example might be accidental ingestion of a pesticide, such as a child swallowing the chemical.

8. Chronic poisoning

This results from a person being exposed to a small amount of pesticide on many occasions over a long period of time. Chronic poisoning may happen when the operator repeatedly uses pesticide improperly, especially if they does not wear protective clothing and equipment or wears protective clothing which is not clean or is worn out, like wearing cracked or torn gloves.

5.2 Symptoms of pesticide poisoning

Signs which may indicate that pesticides may be affecting a person's health. However, these symptoms may be caused by other illnesses. The possibility of poisoning should always be considered when a person may have been exposed to pesticides.

The following are symptoms of poisoning

- headache
- irritation of nose and throat
- eye irritation
- fatigue
- changes of mood
- skin irritation
- weakness
- restlessness
- nervousness
- vomiting
- unconsciousness

5.2. Accident Reports (record)

- Date time and place of the accident
- Names of the injured persons
- Names of persons providing assistance
- Type of the pesticide poisoning to the person
- What happened
- Treatment provided (First Aid and at the local clinic)

Self-Check-5	Written Test

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

1. What is pesticide poisoning? 5 points
2. Write the accident records or reports. 5 points
3. List the symptom of pesticide poisoning. 10 points

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

You can ask your teacher for the copy of the correct answers.

Score = _____

Rating= _____

Name: _____ Date: _____

Answer sheet

Reference

https://en.wikipedia.org/wiki/Pesticide_poisoning

http://nasdonline.org/1002/d000989/what-to-do-in-a-pesticide-emergency.html

https://www1.health.gov.au/internet/publications/publishing.nsf/Content/ohp-enhealth-manual-atsi-cnt-l~ohp-enhealth-manual-atsi-cnt-l-ch5~ohp-enhealth-manual-atsi-cnt-l-ch5.16

NO	TTLM developer Name	Back ground Qualification	College Address	College Name	Cell Phone	E-mail
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Profile of trainers participate on special Horticultural Crop Production TTLM development for level-III at Adama 2020