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FACULTY OF AGRICULTURAL SCIENCES

DEPARTMENT OF
CROP AND SOIL SCIENCES

FPY/SIWES PRACTICAL GUIDE MANUAL

CRP 407
CROP PROTECTION: PEST AND DISEASE CONTROL

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SEED DRESSING TECHNIQUES

1.0 INTRODUCTION

In agriculture and horticulture, seed treatment or seed dressing is a chemical, typically antimicrobial or fungicidal, with which seeds are treated (or "dressed") prior to planting. Less frequently, insecticides are added. Seed treatments can be an environmentally more friendly way of using pesticides as the amounts used can be rather small. Using specific products and specific techniques can improve the growth environment for the seed, seedling, and young plant. Seed dressing is the most common method of seed treatment. The seed is dressed with either a dry formulation or wet treated with a slurry or liquid formulation of the seed treatment chemicals. Seed treatment is a term that describes both products and processes while seed dressing is the process.

2.0 OBJECTIVES OF SEEDDRESSING

1. To protect germinating seeds and seedlings against soil and seed borne pathogens/insects.
2. To enhance seed germination and vigour potentials
3. To ensure early and uniform establishment and growth
4. To enhance nodulation in legume crop.
5. To prevent spread of plant diseases
6. To enhance uniform crop stand, even in adverse conditions (less/high moisture).

3.0 PROCEDURE FOR SEED DRESSING/ TREATMENT

There are several pre-sowing treatments which are used for agricultural seeds, including the application of pesticides for the control of soil or seed borne pathogens, modification of seed shape/size and pre-germination before sowing

1) Seed dressing:

This is the most common method of seed treatment. The seed is dressed with either a dry formulation or wet treated with a slurry or liquid formulation. Dressings can be applied at both farm and industries. Low cost earthen pots can be used for mixing pesticides with seed or seed can be spread on a polythene sheet and required quantity of chemical can be sprinkled on seed lot and mixed mechanically by the farmers.

2) Seed coating:

A special binder is used with a formulation to enhance adherence to the seed. Coating requires advanced treatment technology, by the industry. Seed coating or film coating is a technique by which additives such as pesticides, nutrients or nitrifying bacteria can be applied to the seed's external surface (i.e. the testa). But in contrast to pelleting, the coating conforms to the seed shape and does not normally modify

the seed shape. A film forming polymer containing the required active ingredient is sprayed onto the seeds while they are suspended in a column of air, which is either heated or unheated. A colouring agent is added and the coating material dry quickly resulting in free flowing coated seed.

3) Seed pelleting:

The most sophisticated Seed Treatment Technology, resulting in changing physical shape of a seed to enhance palatability and handling. Pelleting requires specialized application machinery and techniques and is the most expensive application. Pelleting facilitates the manual and mechanical handling of seeds that are either small or awkwardly shaped seed. Individual seeds are encased in an inert material such as montmorillonite clay. Pelleting materials can also be used to incorporate pesticides or form a coating for seed dressing.

4) Thermal seed treatment

Thermal seed treatments have been one of the earliest seed treatments used in agriculture. They may be based on warm water (45 °C, 2 h), hot-water treatments (52 °C, 10 min) and/or hot air/steam treatments. Warm or hot water treatments were shown to prevent/reduce *Fusarium* disease development effectively often showing similar efficiency to chemical seed dressing.

5) Essential oils

The need for organic treatments to replace the use of disallowed chemicals treatments which had become with orthodox seeds has been indicated with the use of essential oils and organic acids. This is recommended under organic agriculture.

ADVANTAGES AND DISADVANTAGES OF SEED DRESSING

Advantages of seed dressing

a) It prevents further growth of pathogens that might have adhered to the seed for sowing.
b) It protects the sown seed and seedling from acquiring soil borne diseases.
c) It ensures even germination and uniform growth.
d) It facilitates microbial inoculation for nodulation in leguminous crops.

Disadvantages of seed dressing

1) Most of the techniques/methods are beyond the capability of our farmers. For instance, the coating and pelletting techniques.
2) Treated seeds are more costly thus increasing of the cost of production.
3) Treated seeds are poisonous and not good for consumption. This creates room for wastage of seeds.
4) Domestic animals and children are at risk in the presence of treated seeds.

Recommendation of seed treatments for crops

Crop	Pest/Disease	Seed Treatment	Remarks
Sugarcane	Root rot, wilt	Carbendazim (0.1%) 2 g/kg seed *Trichoderma* spp. 4-6 g/kg seed	For seed dressing metal seed dresser/earthen pots or polythene bags are used.
Rice	Root rot disease	*Trichoderma* 5-10 g/kg seed (before transplanting)	-do-
	other insects/pests	Chloropyriphos 3g/kg seed.	-do-
	Bacterial sheath blight	*Pseudomonas fluorescens*0.5% W.P. 10 gm/kg.	-do-
	Root knot nematode	Seed soaking in 0.2% of Monocrotophos for 6 hours	-do-
	White tip nematode	Seed soaking in 0.2% solution of Monocrotophos	-do-
Chillies	Anthracnose spp. Damping off	Seed treatment with *Trichodermaviride* 4g/kg, Carbandazim @ 1g/100 g seed.	-do-
	Soil borne infection of fungal disease	*Trichodermaviride*@ 2 gm/kg. seed and *Pseudomonas flourescens,* @10g/kg,Captan 75 WS @ 1.5 to 2.5 g a.i./litre for soil drenching.	-do-
	Jassid, aphid, thrips	Imidacloprid 70 WS @ 10-15 gm a.i./kg seed	-do-
Pigeon pea	Wilt, Blight and Root rot	*Trichoderma* spp. @ 4 g/kg. seed	For seed dressing metal seed dresser/earthern pots or polythene bags are used.
Pea/cowpea	Root	Seed treatment with	-do-

	rot	- *Bacillussubtilis* - *Pseudomonasfluorescens* Soil application @ 2.5 – 5 kg in 100 kg FYM or Carbendazim or Captan 2 g/kg seed	
	White rot	Thiram + Carbendazim 2 g/ kg seed Carbendazim or Captan 2 g / kg seed	-do-
Tomato	Soil borne infection of fungal disease Early blight Damping off Wilt	*T. viride* @ 2 g/100gm seed. Captan 75 WS @ 1.5 to 2.0 g a.i./litre for soil drenching. *Pseudomonas fluorescens*and *V. clamydosporium*@ 10g/kg as seed dresser.	For seed dressing metal seed dresser/earthern pots or polythene bags are used.
Leguminous Vegetables	Soil borne infection	*Trichodermaviride* @ 2 gm/100g seed.	-do-
	Nematode	Carbofuran/Carbosulfan 3% (w/w)	-do-
Wheat	Termite	Treat the seed before sowing with any one of the following insecticides. Chlorpyriphos @ 4 ml/kg seed or Endosulfan @ 7ml / kg seeds	For seed dressing metal seed dresser / earthern pots or polythene bags are used

	Bunt/False smut/loose smut/covered smut	Thiram 75% WP Carboxin 75 % WP Tebuconazole 2 DS @ 1.5 to 1.87 g a.i. per kg seed. *T. viride*1.15 % WP @ 4 g/kg.	-do-
Cruciferous vegetables	Soil / Seed borne diseases (Damping off) Root knot nematode	Seed treatment with *Trichodermaviridi*@ 2 g / 100 g seeds Captan 75% WS @ 1.5 to 2.5 g a.i./litre for soil drenching. *Pseudomonasfluorescens*and *Verlicilliumclamydosporium*@ 10g/kg seed as seed dresser.	-do-
Potato, yam, cassava	Soil and Tuber borne diseases	Seed treatment with MEMC 3% WS @ 0.25% or boric acid 3% for 20 minutes before storage.	-do-
Maize, sorghum, millet	Loose smut Covered smut Leaf stripe Termite	Carboxin 75% WP Thiram 75% WP @ 1.5 to 1.87 gm a.i./kg seed. Treat the seed with Chlorpyriphos @ 4 ml/kg seed.	-do-

Capsicum, pepper	Root knot nematode	*Pseudomonas fluorescens 1% WP, Paecilomyceslilaciriusand Verticilliumchlamydosporium* 1% WP @ 10g/kg as seed dresser.	-do-

Source: Directorate of Plant Protection, Quarantine and Storage

4.0 CONCLUSION

Seed treatment describes both products and processes. Seed dressing is the most common method of seed treatment. Conventional agrochemicals have been used widely for seed treatment for many years to protect seed against various stresses in the seedbed

Using specific products and specific techniques can improve the growth environment for the seed, seedling, and young plant. Different seeds require different methods of dressing depending on the type and for which purpose. For obvious reasons it is essential to dress your seeds before sowing

5.0 PRACTICAL ASSIGNMENT

a. As an extension agent in a rural area with high prevalence of head smut and covered smut, which seed dressing chemical will you recommend?

b. To avoid wastage from the above, what quantity of maize seed per hectare will you recommend for dressing?

c. One of the consequences of climate change is the frequent occurrence of termites on our farms. What are your recommendations for termite control with respect to seed dressing?

d. Which method of seed treatment will you recommend for cowpea nodulation?

e. Which method of seed treatment will you recommend for amarantus seed?

6.0 REFERENCES

1) Rishi P. Singh (2015). Seed treatment technologies. In: Advances in Agronomy. Vol.147 289pages.
2) Department of Seed Science and Technology (2014). Seed Dressing. Tamil Nadu Agricultural University, Coimbatore-641003, India

CALIBRATION OF SPRAYERS

1.0INTRODUCTION

Calibrating a knapsack or compression sprayer is a simple task which takes little time. A sprayer with a pressure gauge is the best one to use because the pressure gauge assists in ensuring an even output is maintained. There are a few points to remember before calibrating the sprayer:

- it must be clean, serviced, and operating according to the manufacturer's instructions

- only use water to calibrate the sprayer - **calibration is never carried out using chemicals**
- the accuracy of the calibration depends on whether you are able to use the pump to produce a constant pressure, and walk at a constant rate. This is why a pressure gauge is so valuable. If your sprayer is not fitted with a pressure gauge, you will need to operate the pump at a constant rate - so choose a rate you find comfortable.

As every sprayer has a different capacity, different nozzles with higher or lower output, a different operator who works at a different speed and pumps at a higher or lower pressure, calibration is the only answer.

2.0 OBJECTIVES OF CALIBRATION

a) To determine the quantity of water to use in a given area of land
b) To determine the quantity of pesticide to procure
c) To ensure even coverage of the target pests
d) To reduce or minimize wastage of spray materials.

3.0 TERMINOLOGIES FOR CALIBRATION

- **Coverage**. The more droplets impinging per unit area, the better the efficacy of the spray.
- **Dosage**: The Dosage of a pesticide is the quantity of the pesticide that will give the desired control (below the economic threshold level) of the pest. Lower doses do not give the desired protection while higher doses have no additional benefit and are wasted.
- **Dosage Rate**: This is the recommended rate of a pesticide for a particular soil type, pest and Crop. This is usually expressed in mass(Kg),or Volume(Ltr) of product per treated hectare(10,000m^2) for a full application
- **PHI (Pre-Harvest Interval):** This is the Minimum permitted time between the last spray and Harvest.

- **Flow rate:** This is the rate at which the spray liquid is emitted through the nozzle and is expressed in millimeters per second(ml/sec) or liters per minute.
- **Application or Dilution rate**: This refers to the Volume of spray mixtures(litre) of water or diluent to be applied to a fixed area. The rate is variable e.g 150-300litres per hectare.
- **Swath Width:** This is the width of spray at a time by a given nozzle of a particular angle and is expressed in metres.

4.0 PROCEDURE IN CALIBRATION OF OLD OR NEW SPRAYER

Three measurements to collect when calibrating a new/old knapsack

1) The walking speed of the operator expressed in kilometres per hour (Kph)
2) The output per minute of the sprayer expressed in Litres
3) The width of each pass of the sprayer, commonly known as the Swath Width expressed in metres: *then* Put on your protective clothing- very important
   Put together your new or old knapsack correctly and half fill with water only to calibrate it.

Assess walking speed of operator as follows

The walking speed of the operator expressed in kilometres per hour (Kph)

- Measure a distance of 100 metres
- Put the knapsack on your back and start pumping, walk at a steady walking pace, spraying with the nozzle at knee height and recite the word 'one thousand' over and over again making one pump stroke per 'one thousand'.
- Time yourself in seconds, and take an average from 2x100 metre passes.
- The formula is **360 divided** by **time to travel 100 metres** equals **x Kph**

Measure the output of the sprayer as follows

The output per minute of the sprayer expressed in Litres

- When the knapsack is up to pressure, release the trigger and hold the nozzle right into a metric calibrated vessel and time for one minute
- After a minute, assess how much water has been sprayed out and express this as a litre
- If you have more than one nozzle such as on a trolley sprayer, multiply the single nozzle output by the number of nozzles.

Establish the swath width

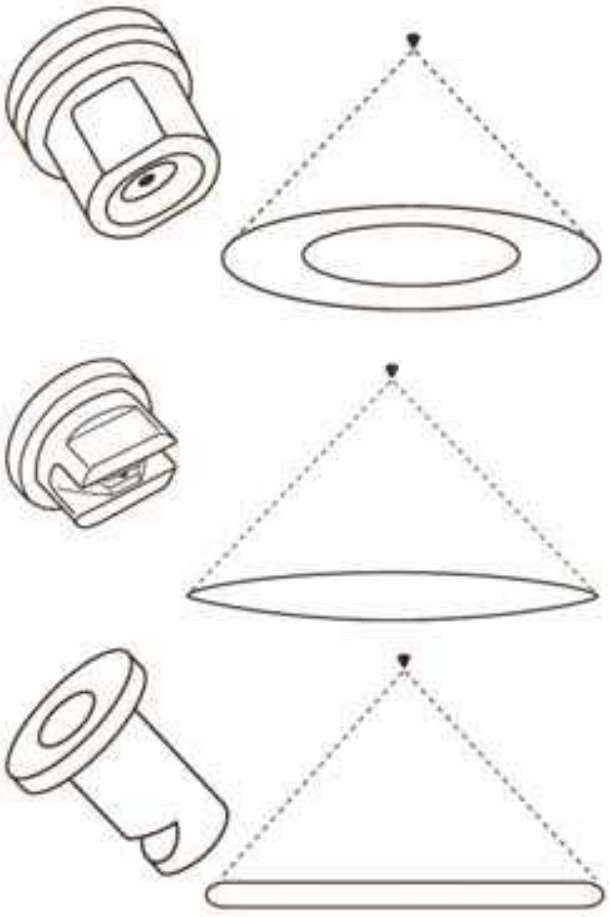
The width of each pass of the sprayer, commonly known as the Swath Width expressed in metres.

- Walking along a dry piece of tarmac, once the sprayer is up to pressure and walking at the previously discussed speed holding the nozzle at knee height, spray continuously for 10 strides then stop and quickly.
- Measure with a tape the wet footprint width of the spray before it dries.

Know your Nozzle Type

- **Cone Nozzle** (Most commonly used for Fungicides and Insecticides.
- **Flat fan nozzle -** general purpose andspray booms.

- **Deflector** (anvil) nozzle - for herbicides



Deflector

Overall output of the sprayer per Hectare

- **600** multiply by the **output of sprayer** divided by **the operator speed** divided by the swath width equals the **total output in Litres of the operator and knapsack per Hectare** (L/ha spray volume).
- The Spray Volume is actually the amount of chemical and water per Ha.

So 5 Ltrs of chemical per Ha in a minimum of 200 Lts of water per Ha will actually be 5 Lts of chemical and 195 Lts of water to make up the overall 200 Ltrs of Spray Volume per Ha

ADVANTAGES OF CALIBRATION

1) To avoid wastage of pesticides.
2) To protect the environment.
3) It facilitates or aids planning for spray.
4) Better way to control pests.

DISADVANTAGES OF CALIBRATION

1) It is time consuming as you have to calibrate each time you pick a new or old sprayer.
2) It requires some level of literacy.
3) Calibration is subject to mistakes, which could be costly.

5.0 CONCLUSION

Before you use any herbicide for spraying, read the label to know the dosage rate per hectare as this will greatly help to ensure under dosage. Your walking speed should be as constant as possible which is usually one meter per second. Both old and new sprayers should be calibrated before use.

PRACTICAL EXERCISES

1. Assuming you take 100 seconds to travel 100 meters, what is your walking speed in kilometers. Ans360 /100=3.60km/hr
2. Take a measured jar, prepare your sprayer with water half full and to full pressure. Direct the nozzle into the jar and press trigger to release the water. Time yourself to spray for a minute. What is the volume of your spray?
3. Fill your sprayer with water to half level position. Pump to high pressure. Stay in one position on a dry slab. Hold the spray nozzle at knell level and release trigger to spray for 10 seconds. Use measuring tape to measure the width of spray quickly before it dries. This is your swath width in meters.

6.0 REFERENCES

1) Okechukwu, R. (2015). Knapsack calibration. IITA, Ibadan.
2) www.agrigem.co.uk
3) Ciba-Geigy product training manual, 1988.

PESTICIDE DOSAGE CALCULATION AND APPLICATION

1.0 INTRODUCTION

Pesticides are not sold in its pure form because they are highly toxic, thus they are often diluted with any carrier to avoid the hazards of poisoning to applicator and

environment. The pure forms of pesticides (technical grades) are only used in analytical and toxicological studies. Pesticides are commercially manufactured in various formulations (by adding various additives) like emulsifiable concentrates, water-dispersible powders, dusts, granules, solutions etc. The strength or active ingredient is mentioned on the label. The liquid concentrates must be diluted, usually with water, before use.

2.0 OBJECTIVES

a) To identify the various types of chemicals of pesticides (insecticides, herbicides and fungicides) available in the market.
b) To quantify the amount of pesticide to use per hectare.
c) To quantify the amount of pesticide to use per tank load.
d) To determine the quantity of active ingredient or acid equivalent per hectare (kg ai/ha).

3.0PROCEDURE

Let us see some commercially available pesticides:

Insecticides: Endosulfan 35EC, Malathion 50EC, Metasystox 25EC, Dimethoate 30EC, Phorate 10G, Carbafuron 3G,

Herbicides: Atrazine 50 WP, Simazine 60 WP, Paraquat 24WSC, Fluchloralin 45EC, Alachlor 50EC or 100G, Butachlor 50EC or 5G, Glyphosate 41WSC, Propanil 35EC, 2, 4-D Ethyle ester 18 & 35%, 2, 4-D Amine salt 58 & 72%, 2, 4-D Sodium salt 80 & 85P etc.

Fungicides: Carbendazim 50 SC, Carbendazim 50 WP, Copper Oxychloride 50WP, Difenconazole 24.9EC, Dithianon 5, 10EC, Dithianon 5SC, Hexaconazole 5, 10EC, Hexaconazole 5 SC, Mancozeb 80, 75 WP, Miclobutanil 10 WP, Propiconazole 10, 25 EC, Tebuconazole 24.9 EW, Tricyclozole 75 WP etc.

Pesticides are recommended in three ways for its field application such as amount of pesticides per hectare (kg/ha), amount of active ingredient or acid equivalent per hectare (kg a.i./ha) and concentration of solution to be applied (eq 0.07 % of endosulfan).

Before application or purchase of pesticides it is always necessary for farmers to estimate the amount of insecticides or herbicides or fungicides that would be required for application on his farm of definite size. This is part of the planning process so that he will buy only the quantity needed.

There are four categories of calculations that are often carried out. Let us see the methods for calculating the pesticide dose with some example.

a) Quantity of chemical to put in a tank of a sprayer
b) How many tank loads do you need per hectare
c) Area of coverage of a tank load
d) Active ingredient per hectare

Below are the calculations to provide answers to the questions above.

a) **How much chemical concentrate (at label Dose Rate per Ha) to put in a full knapsack**

This is worked out as follows

- Tank Capacity (TC) multiplied by the Dose Rate (DR) divided by the Spray Volume (SV) = Amount of Concentrate (C) in Litres to put in a full knapsack.
  Let us say that we have a 15 Litre knapsack and a chemical which is applied at 5 Litres per Ha and our calibrated Spray Volume per Ha is 200 Lts.
  TC multiplied by DR divided by the SV = C
  Answer is 15 multiplied by 5 divided by 200 = 0.375 Litres

b) **How many tankfuls will one use to cover or spray one Ha**
Divide the Spray Volume (SV) by the Tank Capacity (TC) to get number of full tanks per Hectare
E.G. SV (200) divided by TC (15) equals number of tanks per Hectare
200 divided by 15 = 13.33 tanks/ha

c) **How many square metres will one single full tank cover? OR How much will one tank cover at this spray volume per Ha**
Divide the number of square metres in a full Hectare which is 10,000 by the number of tanks per Hectare to get the answer thus –
10,000 divided by 13.33 equals 750 sqm per each full tank.
Assessing beforehand the area to be sprayed is therefore important.

ADVANTAGES

1) It reduces wastage of chemicals.
2) When only the required quantity is used, less damage is done to the environment.
3) It is part of planning of farm business enterprise.
4) The impact on the target pest is assured.

DISADVANTAGES

1) Some calculations are involved which discourages some farmers
2) Calibrations are subject to mistakes, which could be costly

5.0 CONCLUSION

Pesticides should be diluted before use on farms as their pure states are highly toxic. Dilution in this case should be done correctly in order to impact on the target pest. This will ensure that both the environment and the user are protected in addition to reducing wastage of materials.

WORKED EXAMPLES

1) If recommended as kg a.i./ha:

Rate of herbicides is given mainly in terms of a.i. or a.e. /ha

$$\text{Quantity of material required per hectare} = \frac{\text{Rate of application}}{\text{Active ingredient in \%}} \times 100$$

Example: Find out the quantity of simazine 80WP to be sprayed in one hectare area if rate of application is 3 kg a.i. /ha

Quantity of simazin/ha =3/80 x 100 = 3.75 kg WP/ha

For the calculation of this type we must know the a. i. present in the commercial product.

2) If recommended as kg/ha:

Experience has shown that to spray one hectare with a hydraulic nozzle sprayer in good working condition and a 15 liter sprayer, one will need 300 liters of solution, i.e. 20 sprayer loads.

Example: To control grasses, 5 liter of propanil should be applied per hectare. It means

1 liter = 1000 ml

20 sprayers (15 L capacity each) per ha

5000 ml/ 20 = 250

i.e. 250 ml per 1 small Kap-sac sprayer and 20 loads will be required.

3) If recommended as per cent concentration:

By Formulae

$$\text{Amount of pesticide} = \frac{\text{Volume of spray solution (liter)} \times \text{Per cent strength of pesticide solution to be sprayed}}{\text{per cent strength of pesticide given (a.i./l or kg)}}$$

Example: Amount of malathian 25 EC when applied as 0.025 per cent solution

$$= \frac{300 \times 0.025}{25}$$

$$= 0.3 \text{ liter or } 300 \text{ ml/ ha}$$

REFERENCES

1) Milton D. Taylor (2017). Pesticide rate and dosage calculations. UGA Extension Special Bulletin 28 Georgia Pest Management Handbook, Georgia, USA.

2) Rakesh Kumar Singh (2010). Calculation based on pesticides. Agropedia, NAIP.

3) Okechukwu, R. (2015). Knapsack calibration. IITA, Ibadan.

APPLICATION OF CHEMICAL AND OPERATION OF SPRAYERS

1.0 INTRODUCTION

Farmers procure pesticides for use on their farms for intended purposes. These can only be achieved if the pesticide calculation is correctly done and the right

sprayer selected and carefully calibrated. These, we had done in the previous chapters

2.0 OBJECTIVES

Our objectives for this chapter are as follows

1) To quantify the amount of chemical and water to put in the sprayer
2) To determine the area to apply the chemical
3) To avoid wastage of chemicals

3.0 PROCEDURE

Before you mix your chemical to spray a given area, determine the amount of chemical and water that is required. This is to avoid wastage and or under dosage.

Below is the calculation.

a) Measure the area to be sprayed with a metric measuring wheel.

b) If the spray volume is 200 lts per Ha and the Dose Rate is 5 Lts per Ha - 200 divided by 10,000 multiplied by the area (sqm) that needs application. This will determine how much water to use on the area.

Answer: 5 divided by 10,000 multiplied by the area sqm that needs treating will tell you how much chemical concentrate is required for the job. That is 5/10000 x 5000m2 = 2.50 LT of the chemical

c) When calibration is completed and you are about to start a spray job

- Half fill the sprayer with water, add the required amount of chemical and then fill to the full mark.

Please note that if your calibrations show that you only need half a knapsack for the job in hand then work on 50% of the figures and do not mix up more than you require for the job in hand.

d) At the end of the spray job

- If you have chemical or spray volume left over, your area is smaller than you originally measured or you have not done it correctly!!
- Equally, if you run out of spray solution before you have covered all the area, you may have applied too much by walking too slow or over lapping spray swaths.

4.0 CONCLUSION

It is very essential you know the area to spray and after calculating the required quantity of chemical, then apply. You are expected to be mindful of your speed and

avoid overlapping of sprayed area. This will require an assistant to guide you as you spray.

5.0 REFERENCES

1) Rakesh Kumar Singh (2010). Calculation based on pesticides. Agropedia, NAIP.

2) Okechukwu, R. (2015). Knapsack calibration. IITA, Ibadan.

SAFETY PRECAUTIONS AND DEMONSTRATION OF FIRST AID IN PESTICIDE POISONING

1.0 INTRODUCTION

All pesticides are poisonous. Extra care should be taken to avoid poisoning of the applicator and damage to the environment. Damage to both man and environment will arise if too much quantity has been added to the water or where a faulty application equipment was used. There are a number of precautionary measures to take when planning to use a pesticide and even during usage.

Before you use any chemical, look out for its hazard classification which is always written on the label. For example

- Class I pesticides: extremely / highly hazardous **DO NOT USE**
- Class II pesticides: moderately hazardous **take great care**
- Class III pesticides: slightly hazardous **take care**
- Unclassified / Class IV pesticides: **unlikely to be hazardous still take care**

This will guide you on the level of extra care required in the handling of pesticides.

2.0 OBJECTIVES

1) To identify the class and type of pesticide you are going to handle
2) To select the right product for a particular problem
3) To determine a condition of pesticide poison of an applicator
4) To demonstrate first aid procedures in pesticide poisoning

3.0 PROCEDURE

1) **Read and understand the product label**
   The product label contains important information on product features and on risks relating to product use, together with adequate measures to take in the case of an emergency.
2) **Practice good personal hygiene**
   Always have clean water available when working with chemicals.Do not eat, smoke or drink whilst handling, working with or applying crop protection chemicals and do not work alone. Always have a companion in the field
3) If someone shows any of these symptoms after being exposed to pesticides, medical advice should always be sought. These include vomiting, convulsions, loss of reflexes, unconsciousness, inability to breathe, fever, muscle twitching, thirst, constriction of eye pupils (eye pupils become small) and increased rate of breathing.
4) Apply first aid as fast as possible and take the patient to the nearest medical centre. Carry along the chemical container with the label.

Approach to First Aid

If someone shows any of these symptoms of pesticide poison after being exposed to pesticides, medical advice should always be sought. Please conduct the under listed actions as First Aid.

- Find out if possible the way the poison entered the body. This may either be through the mouth, nose, skin or eyes.
- If the pesticide has been inhaled, move the person to fresh air.
- If the pesticide is in the person's eyes, quickly wash the eyes for 15 minutes with clean, gently running water. If there is no running water, bathe eyes from a container, frequently changing the water.
- If the pesticide is on the skin, remove all contaminated clothing and wash the affected area thoroughly with soap and water.
- If the patient is not breathing, apply artificial respiration if possible.
- If the pesticide is swallowed, and only if the person is conscious, rinse the mouth with plenty of water and read the label on the pesticide container for further instructions.
- Keep the patient warm and comfortable.

However, always follow the first aid instructions on the pesticide container label**.** If in doubt, seek medical advice.

4.0 CONCLUSION

All pesticides are poisonous and where it has become very necessary to use, follow instructions for use on the label and be extra careful in the handling. Avoid over dosage or under dosage and use the correct/functional sprayer always. No matter how strong you are, do not spray alone in case of accident. Be safety conscious always and where you suspect a case of poisoning, follow the first aid instructions and finally see your doctor for further medical attention.

WORK EXERCISES

a) List five (5) symptoms of pesticide poisoning
b) You will be your first reaction to a pesticide labeled as CLASS I
c) How will you manage a child that has mistakenly swallowed a pesticide?
d) While working with a CP knapsack sprayer and accidently the hose busted spilling the chemical on him. Please advise him on what to do to reduce the chemical poison.

REFERENCES

1) Ciba-Geigy product training manual, 1988.

2) Okechukwu, R. (2015). Knapsack calibration. IITA, Ibadan.

FARM TOOLS AND SANITATION

1.0 INTRODUCTION

Farm tools are work implements frequently used for farm operations. These operational tools are prune to wear and tear which should be maintained, repaired or replaced. Proper farm tool sanitation, maintenance, and end-of-season storage keep tools in top condition for several years' use. Sanitation is one of the most

important aspects of operating an agricultural enterprise especially food processing facility. Poor sanitation could have an adverse effect on product safety and could result in poor product quality especially dairy products. Weed seeds, bacteria, viruses, and fungi could be carried over to the next season, another farm or location. This could course the spread of plant pests and diseases as they might infect future crops.

Some examples of farm tools include teat and other dairy processing equipment, cutlass, hoe, garden fork, trowel, rake, secuteurs, sprayers, watering can, sickle, wheel barrow, spade, head pan, garden fork, spanner, screw driver, axe, file, empty containers etc.

1.1 Materials for Sanitation

- Detergent
- Sanitizer
- Container(s) as needed for mixing and using detergent(s) and sanitizer(s) or for washing tools
- Brushes, sponges, or towels for scrubbing tools and equipment
- Clean water (microbial equivalent to drinking water)

2.0 OBJECTIVES

1) To be able to identify and list farm tools used on our farms.
2) To ascertain when a farm tool is due to maintain/sanitize.
3) To reduce the spread of pathogens on our farms.
4) To ensure quality products to consumers.
5) To prolong the lifespan of our farm tools and equipment.

3.0 PROCEDURE

The under listed steps will suffice in the sanitation of our farm tools and equipment.

1) **Gather tools and equipment** that are due for cleansing and sanitation in a location.
2) **Clean tools and equipment with soap and water.** Use a wire brush to dislodge dirt, debris, and plant material. Rinse well.
3) **Disinfect tools to kill pathogens.**

There are many commercial disinfectants available at your local store. Follow directions on how to use, which are often written on the box or bottle.

4) **Sharpen blades and shovels with a flat file.**
5) **Coat wood and metal with protective oil.**

Linseed oil is natural oil extracted from flax seeds. It preserves and prolongs the life of woods. WD-40 is penetrating oil that lubricates tools for smooth operation. It is sold in a handy spray for easy application. Coat surfaces, cutting edges, and bare metal parts.

How to make your own disinfectant

In a large basin, combine 1 part bleach: 9 parts water. Soak tools for 30 minutes. Rinse thoroughly with water to prevent corrosion. When tools are dry, coat metal with protective oil to prevent rust (see step 5). Do not reuse bleach to soak a second set of tools. Mix a fresh batch of bleach solution for optimal effectiveness.

Alcohol, ethanol or isopropyl, can be used to disinfect tools. Dip tools in alcohol or use alcohol wipes. No rinse required.

ADVANTAGES

1. It reduces the spread of pathogens
2. Leaned and sanitized tools create ecstatic appeal for use
3. It prolongs the lifespan of tools and equipment
4. It reduces pesticide poisoning as well maintained sprayers prevent leakages
5. Transfer of weeds and pathogens are greatly reduced

DISADVANTAGES

1) Removal of sap build-up, algae, mildew, mold are often very difficult. Special skilled persons are required to do this.
2) Disinfectants and sanitizers are poisonous and so its usage in the food industry is often risky.

4.0 CONCLUSSION

General farm sanitation is essential for proper crop and animal growth, development and optimal yield. Farm tools and equipment should be regularly cleaned and sanitized in order to reduce incidences of pests and diseases on our farms. Equipment and tools should be well maintained as the cost of procuring new ones is often high. Though costly and time consuming, farm tools sanitation is an essential aspect of our farm operations.

Work Exercises

a) List farm tools available at your field practical site.
b) State the steps that you will take to sanitise a plough that has finished operations for the year. Mention the materials you will use for the maintenance and sanitation.
c) You were confronted with your poultry birds pecking on each other. After consulting with your local vet officer, you were advised to debeakthe birds. Outline your approach to the maintenance of the tool used. State two advantages of this tool.
d) You have worked with your cutlass on a stony ground for a whole day. How do you renew the sharpness of your tool for next day work?

5.0 REFERENCES

L. H. Bailey1917) Standard Cyclopedia of Horticulture. The MacMillan Company,New York, New York.

Agricultural Tools (2004). Florida Centre for Instructional Technology, College of Education, University of South Florida, USA.

IDENTIFICATION OF INSECT WARNING SIGNS, PEST MANAGEMENT AND SYMPTOMS OF DISEASES

1.0 INTRODUCTION

Pest identification is the first step in any pest management situation. Accurate identification is the most important step as misidentification is a common cause of control failure. Insect identification is based on morphological features such as the structure of mouthparts, wings, legs, antennae, etc. The type of damage observed in the field and where the pest is located on the plant will also help determine which pests are present.

Many insect pests have chewing mouthparts and eat plant tissue. Caterpillars of many butterflies and moths as well as larval or adult stages of several beetles feed on leaves, fruit, roots or other specific plant parts. Most plants are also hosts to one or more species of aphids, leafhoppers or plant bugs. These insects have sucking mouthparts for puncturing plant tissues and sucking out sap. This causes damage to leaves, flowers or fruit. Sucking insects can also cause crop losses by spreading diseases from infected to healthy plants. Typically, different pest species will attack a crop at a specific time of year or stage of plant growth or under specific environmental conditions. Other insects, such as wireworms, feed on roots. Cutworms feed at ground level, girdling young seedlings.

2.0 OBJECTIVES

a) To identify the different types of insect pests on our field and the crops they attack
b) To identify the nature of destruction done to the crops
c) To distinguish between nutritional disorders, insect pest attack and diseses
d) To identify the appropriate control measure to adopt.

3.0 PROCEDURE

Farmers sometimes mistake symptom sof nutritional deficiencies -- yellowing leaves, stunting, weak growth, poor production -- as indications of insectpests which are not true most at times. The most frustrating thing about pests is that you often don't realize they have moved in. Larger pests, such as mice or rats, are nocturnal so their night-time movements often go unnoticed. These situations play out to make identification more difficult and tricky.

SIGNS TO LOOK OUT FOR IN ISECT ATTACK

a) Droppings and odour.

Most insects and pests leave a tell-tale indication of their presence with their droppings. If you notice a collection of unknown droppings within your farm you should go on alert for a potential pest infestation. If you see droppings, look in the vicinity for other pest or insect warning signs to identify a nest location or pathway into your home. Obviously, once droppings start to amass, they will also develop a stronger smell. In some cases, you may notice a smell before you notice droppings. These are signs of the likely presence of insect pests on the farm or home.

b) Holes, Crevices and Tracks

Any gaps in the foundation or access points to your garage or home make it easy for pests to come and go as they please. Even a small existing hole might be an invitation for a pest to dig a little deeper and burrow straight into your home. Such activity may create smaller piles of dirt or other materials, so pay attention to both the exterior and interior of your home and garage for these warning signs. Additionally, as insects and pests move around in search of water, food and mates they may also leave tracks that show their movement. These tracks can also be helpful in identifying how pests may have entered or exited your home.

c) Sounds and Activity

Larger pests, such as rats, mice and racoons tend to be most active at night. This means that you're more likely to notice critter-like sounds such as whining, squeaking, scratching or scurrying as you settle down for the night or if you are awake in the middle of the night. Typically, these types of sounds come from an area such as the walls or attic - these spaces are typically not frequented by humans and can sometimes provide an easy pest access point to your home. To check for a presence of pests, make sure to look in crawlspaces, attics or any places where you heard sounds coming from.

Tools and Materials needed

The under listed items are required for proper identification

- notebook
- magnifying glass
- camera
- jar (for collecting samples)
- insect field guide

Procedure for identification involves the following steps

1) Examine the Plant

If you suspect an insect is causing problems, examine the plant. Check the leaves, top and bottom, looking for insects, caterpillars, and egg masses. As you touch the leaves, watch for scurrying or flying insects. Jot down notes, take a photo, or collect a sample so you can research the possible culprits using a field guide or gardening reference. Delay spraying until you have made positive identification. Many insecticides will kill not only pests but also beneficial insects, including predatory insects that eat the pests and pollinators like honeybees.

2) Identify the Type of Pest

Entomologists (insect specialists) often categorize insects by how they feed.
Chewing insects eat leaves. Symptoms include holes, ragged edges, and "skeletonizing" -- eating the tissue between leaf veins. Examples include weevils, caterpillars, flea beetles, and Japanese beetles. Look for the telltale frass (excrement) of the larger of these pests.

Sucking insects pierce a hole in plant tissue and suck out the fluids. Signs include stippling on foliage or silvery bronze leaves and discolored blooms. Examples include spider mites, aphids, thrips, and leafhoppers. These pests often leave behind moltings -- the outer skin they shed as they grow.
These signs as explained in steps 1 and 2 should be carefully assessed as warning signs of the presence of insect pests.

Also note that these insect warning signs are different from nutrient deficiency signs and disease symptoms.

How to differentiate between nutrient deficiency signs, disease symptoms and insect pests damage

Symptom/signs	Disease	Nutrient deficiency/ environmental stress	Insect pest incidence
Physical damage to crop	*	*	✓
Evenly distributed among Many plants	*	*	✓
Occur in clusters	✓	*	✓
Scattered in pockets in the	*	*	✓

field			
Localised, affects small number of plants	*	*	✓
Occur at specific time of the year	*	*	✓

4.0 INTEGRATED PEST MANAGEMENT

Insect pests cause enormous loss to farms through direct and indirect invasion on various plant parts. Use of chemicals has been one of the conventional methods to reduce these losses; however, now-a-days due to various unwarranted side effects, pest management is relying upon many other options along with pesticides. The integration of all these options is called IPM (Integrated Pest Management). Integrated Pest Management is a strategy to manage pests on the basis of a systems approach that looks at the whole farming ecosystem. This includes understanding how the pests interact with their plant hosts, with the general climatic conditions, plant health and nutrition and with each other.

Integrated Pest Management provides farmers with choices about how to manage pests safely and effectively. Almost all farmers do at least some IPM through normal crop production practices. IPM utilizes a wide range of pest control strategies or tactics. The goal of this strategy is to prevent pests from reaching economically or aesthetically damaging levels with the least risk to the environment.
Pesticide use is and will continue to be significant in food and fibber production, forestry, turf and landscape maintenance, and public health.

Pest management has shifted from relying heavily on pesticides to using an integrated approach based on pest assessment, decision making, and evaluation. Also, chemical pesticides are not always effective. Pests can become resistant to pesticides. Furthermore, pests may survive in situations where the chemical does not reach pests, is washed off, is applied at an improper rate, or is applied at an improper life stage of the pest.

5.0 DISESE SYMPTOMS

Plant Disease is any abnormal condition that damages a plant and reduces its productivity or usefulness to man. Diseases and disorders of plants occur when normal plant function is disrupted. Several types of microorganisms can cause a reduction in plant health including fungi, bacteria, virus, and nematodes. The occurrence and prevalence of plant diseases vary from season to season, depending on the presence of the pathogen, environmental conditions, and the crops and varieties grown. Environmental stress, nutrient deficiency symptoms resemble disease situations, and so care should be taken to distinguish between these symptoms.

For plant diseases, the steps enumerated below will assist to identify the type of disease and appropriate control measure.

a) Using a shovel, dig out both healthy and symptomatic plants with all possible roots attached.
b) Examine the plant as a whole, noting differences between the two.
c) Look for signs of disease like knots, blackened areas or rot on the root system, discoloration in the inner stem tissue, stem lesions, leaf spots, cankers/blisters, and leaf malformation.
d) Collect sample and send to a plant diagnostic lab for testing and confirmation

6.0 CONCLUSION

Identification of insect pests signs could be tricky as some of the insects enter the crop field to cause damage in the night. Some hide underneath of the leaves or even under the shade of other bigger plants. This calls for continuous monitoring and surveillance with attempts to catch, study and identify. Pest management has shifted from relying heavily on pesticides to using an integrated approach based on pest assessment, decision making, and evaluation. Proper identification of insect pests warning signs will help in proffering the right solution to its control.

WORKING EXERCISE

Take for instance a typical maize plant and identify the insect pests at various stages of growth and proffer solution.

Key to identification of insect pests of maize

Maize growth stage	Part of plant affected	Insect pests	Control measure
Seed	seeds	Seed corn maggots, Wireworms	
Young seedling	Foliage	Cutworms, Thrips, Flea beetles, Diabrotica beetles, Leafhoppers, Lesser cornstalk borer, Fall armyworm, Spider mites, Maize whorl maggots, Borers, Termites , borers, Flea beetles	
Vegetative growth	Stem, leaves	Borers, Grasshoppers, Maize whorl maggots, Fall armyworm, Leafhoppers, Borers, Termites	

Flowering	Flowers, stalk	Fall armyworm, Borers, Corn leaf aphid, Diabrotica beetles, Termites, Maize stem weevils, Grasshoppers	
	Tassel, ear	Borers, Armyworms	
Roots	roots	Wireworms, Flea beetle rootworms, Diabrotica rootworms, Maize bill bug grubs, Flea beetle rootworms, Flea beetle rootworms (p.9) Diabrotica rootworms	
Pre-harvest	Stalk, seed	Armyworms, Corn earworms, Borers, Grain weevils, Grain borers	
Post harvest	Seed	Borers, Grain weevils, Angoumois gr. Moth, Meal moth, Grain borers.	

Adopted from: Alejandro, Ortega C. (1987). Entomologist, Maize Program, CIMMYT

2) What environmentally friendly control measure would you use for the under listed pest situation

Pest	**Host**	**Control measure**
Green mites	Cassava, yam, tree crops	Use natural enemies like predatory hosts
mealybug	Cassava, yam, tree crops	Plant flowering herbs as intercrop and or perimeter crops help build-up the population of natural enemies.
Termites	All crops	Burning plant residues on top of termites' mound would suffocate them.
White flies	Fiber crops, vegetables, fruit trees, and ornamentals.	Neem leaf extract, Neem seed powder extract
mosaic virus, leaf spot	Vegetables, tuber crops, tree crops etc	Control whiteflies as they are the carriers of the disease.

Bacterial soft rot	Vegetables, tuber crops, tree crops etc	Avoid water logged areas, practice rotation, use healthy planting materials
leaf spot	Vegetables, tuber crops, tree crops etc	use healthy planting materials, destroy infested materials, cultural practices
mosaic virus	Vegetables, tuber crops, tree crops etc	use healthy planting materials, cultural practices

7.0 REFERENCES

Renz, M.J; Craig, M.E and Ludwig, G.E.(2006). Pest identification, College of Agriculture, New Mexico State University, Mexico.

Alejandro, Ortega C. (1987). Insect pests of maize: a guide to field identification. International Maize and Wheat Improvement Centre, (CIMMYT), Mexico. 112page.

Field Guide to Non-chemical Pest Management (2009). Pesticide Action Network (PAN) Germany.

DETERMINATION OF DISEASE INCIDENCE AND SEVERITY

1.0 INTRODUCTION

Plant Disease is any abnormal condition that damages a plant and reduces its productivity or usefulness to man. A diseased plant or group of diseased plants is often recognized easily once symptoms or signs become visible; however, it is the quantification of the disease that presents the challenge. The assessment of disease incidence (i.e., the number or proportion of diseased plants in a population) is an apparently simple counting task, but is subject to the usual limitations of interpretation related to sample size. The accurate and precise estimation or measurement of disease severity (i.e., the area or proportion of plant tissue that is symptomatic) can be a formidable task.

Disease incidence is the proportion or amount of diseased plants or parts in a population. D**isease severity** is the proportion of plant area that is affected. Often, disease has to exceed a certain threshold before it reduces the yield of a crop, but it is usually difficult to accurately estimate the yield reduction caused by a specific disease. For example, many diseases occur on senescing tissue that would not have contributed to the yield anyway. Easier diseases to assess are those that kill whole trees in orchards or plantations, and those that destroy the actual harvested product, such as fruit or grain.

2.0 OBJECTIVES

1) To quantify diseased plants in a plant community.
2) To assess the area of the plant population that is affected.
3) To assess yield loss attributable to the disease.
4) To form a decision whether it is economically feasible to control the disease.

3.0 STEPS TO TAKE IN DISEASE INCIDENCE AND SEVERITY

Assessment of the effect of disease (incidence/severity) on crop yield normally involves five steps

1) Developing a descriptive growth stage key for the particular crop species
2) Developing methods to assess the incidence and severity of disease
3) Developing statistically sound methods of sampling crop populations for assessment of the amount of disease
4) Estimating the negative impact of particular levels of the disease on crop yield and quality.
5) Evaluating the economic benefit from various methods available for reducing the amount of disease.

1) **Developing a descriptive growth stage key for the particular crop species**

The first step to quantify the effect of disease is to develop a key that describes the growth and development of healthy plants during the growing season. It should describe development, either from sowing to harvest, in the case of annual plants, or from season to season in perennial plants. Detail drawings or photographs, showing characteristics of the various stages of development, including leaf formation, flowering, fruiting and senescence are needed. Standardized growth keys have been developed for a number of crop plants, enabling comparison between different countries and different conditions.

2) **Developing methods to assess the incidence and severity of disease**

The disease incidence for biotrophic pathogens can be measured by counting the number of plants, leaves, flowers etc that are infected, but the disease severity is assessed by estimating the proportion of total photosynthetic area that is diseased. Whether it is disease incidence, or disease severity, or both, that are measured, depends on the nature of the disease. Because judging the proportion of diseased leaf by eye is unreliable, **disease assessment keys**, showing different disease severities as blackened areas, have been devised for various crops.

3) **Developing statistically sound methods of sampling crop populations for assessment of the amount of disease**

Once the amount of disease has been determined, the next step is to assess, either experimentally or statistically, the effect of different levels of disease on the crop yield. The statistical approach to assessing disease involves statistical analysis of crop yields under different levels of disease that occur naturally in the field. The levels of disease and the crop yields are monitored, but not manipulated, and then yields from different seasons or areas with different levels of disease can be compared to determine the effect of disease on crop yield. An alternative statistical approach to crop loss assessment is the use of questionnaires, filled in by the farmers, that allow disease and pest incidence and severity to be related to the yields they produce.

4) **Estimating the negative impact of particular levels of the disease on crop yield and quality.**

The growth of the crop, its yield potential, the development of the disease and its impact on yield all have to be measured to predict the impact on yield of particular levels of disease. This information can be combined with predictions of likely disease levels to determine whether preventative treatments are worthwhile.

5) **Evaluating the economic benefit from various methods available for reducing the amount of disease**

Disease and crop loss assessments are necessary for evaluating the economic impact of a disease and the benefit of particular control strategies. There is no point in implementing a control measure if it will cost more that the increased crop yield will return.

ADVANTAGES

a) The method is the use of outcomes of real cropping situations in the field, not experimentally manipulated crops.
b) Used to predict and forecast crop losses under different environmental situations
c) Used to determine whether it is economically feasible to embark on a particular control measure
d) Development of a standardised crop key has helped to have an ideal crop situation. This in effect will give the optimal yields of crops under ideal conditions.

DISADVANTAGES

a) In the past, most crop loss assessment has been qualitative, producing vague, inaccurate and sometimes misleading data. One major problem with this is the complex nature of disease development.
b) . Rarely can disease be attributed to just one factor. Assessment of the effect of disease (incidence/severity) on crop yield normally complex.
c) The accurate and precise estimation or measurement of disease severity can be a formidable task because of visual and measurement errors and the need for samples to be representative of the area considered and to be of adequate number.
d) Statistical tools used are subject to the usual limitations of interpretation related to sample size

4.0 CONCLUSION

Plant Disease reduces the productivity or usefulness of plants to man. Symptoms are outward expression of the disease condition which when it becomes visible should be quantified and assessed. The accurate and precise estimation or measurement of disease severity (i.e., the area or proportion of plant tissue that is symptomatic) can be a formidable task.

5.0 ASSIGNMENT

Select a crop like maize and plant 100 stands under an ideal condition ie under green house effect. Monitor the growth and development from planting to harvesting.

Outside the green house, plant 100 seeds of maize and follow all the agronomic practices from planting to harvesting. Then answer the following questions

1. At which age of the plant did you notice disease(s).
2. Where were the symptoms located? Stem, leaf, root, ear, cob?
3. What is the extent of coverage of the disease?
4. Is it worth embarking on a control measure?
5. Make comments with respect to the green house effect on the maize crop.

6.0 REFERENCES

1) Nether, D.A. and Campbell (1994). Estimating disease severity and incidence. In: Epidemiology and management of root diseases, Springer, Berlin, Heidelberg.
2) Kerem, D. (2003). Plant pathology: Infection disease assessment, eResource unit, University of Sydney.

DISEASE ALBUM PREPARATION

1.0 INTRODUCTION

A plant disease is impairment of the normal state of a plant as it modifies or interrupts its vital functions. Crop diseases are common on our farms which most at times are difficult to identify. Students are always encouraged to collect specimens of these diseases and preserve them for better understanding. Disease symptoms appear at various stages of plant growth and development which at the end affects the productivity of the crop. A disease photo album should provide the name of the disease and the crop it affects, the casual organism and possible control measures.

2.0 OBJECTIVES

1) To identify crop diseases for collection
2) To identify materials required for proper preservation of specimens
3) To outline the casual agents and the likely management of the disease
4) To enable researchers conduct diagnosis for studies.

3.0 PROCEDURE

a) Obtain/collect your specimen

Each specimen should consist of a stem with attached leaves and, if at all possible, flowers and/or fruits. The roots of herbaceous plants should also be included. In the case of very large trees, shrubs, or vines, pieces should be selected to illustrate to the greatest extent possible the overall characteristics of the plant and the range of variation in flowers, leaves, and other structures.

b) Assign a collection number.

Data for each collection should be entered in a field notebook and the number should be written on the folded paper containing the specimen. Do not trust your memory for this information.

c) Press your specimen rigidly to expel moisture.

The objective of pressing plants is to extract moisture in the shortest possible time, while preserving the morphological integrity of the plant. A plant press, consists of a wooden frame (for rigidity), corrugated cardboard ventilators (to allow air to flow through the press), blotter paper (to absorb moisture), and folded paper, typically a newspaper (to contain the plant material). The plant press is tightened using straps with buckles or bolts with wing nuts.

d) Preserve in a cool dry place

Plants should be carefully arranged as they are placed in the press to maximize preservation of diagnostic features-leaves, flowers. Fruits should be spread out so that they do not overlap and can be observed from different perspectives.

ADVANTAGES

a) It is ideal for proper study of the plant disease and its control
b) It assists the farmer to appreciate the damages done to the crops and the intervention package proffered.
c) It serves as a reference point for the future

DISADVANTAGES

a) Collection and the entire process is tedious and tasking
b) Preservation of collected materials is costly if the natural form of the diseases should be maintained

WORKED EXAMPLE

Below are samples of diseases for collection, preservation and identification.

A typical disease album with carefully arranged specimens

Disease samples in the field.

Blight

Potato scab
Common scab of potato

Potato leaf infected with a fungal blight.

Tomato leaves puckered and blistered by the tobacco mosaic virus.

Cysts or tiny nodes on soybean plant roots, containing eggs of nematodes.

Cassava plant damaged by cassava mosaic disease

Cassava storage roots damaged by cassava brown streak disease

Cassava leaf with spots caused by cassava green mite

a) Select 3 crops common in your locality and identify the prevailing diseases. Prepare a disease album for the selected crops

4.0 REFERENCES

Rita M. Pelczar, Malcolm C. Shurtleff, and Kelman Michael J. Pelczar (2016). Plant Disease. Encyclopedia-Britainica.

Malcolm C. Shurtleff (Author), Charles W. Averre (2000). Diagnosing Plant Diseases Caused by Nematodes, University of Illionois, Urbana.