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Standard Operating Procedure (SOP): Weed Control and Management

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1. Introduction

Weed control and management are well-planned field operations carried out to prevent, remove, or limit weed infestations so the crops can grow to attain high productivity. The primary goal of weed control is to manage the vegetation in a way that will promote the growth of plants that are beneficial to humans and the suppression of unwanted plants.

2. Purpose

The purpose of this SOP is to serve as a guide for effective weed control and management in cassava field trials. This spans through pre-land preparation to field maintenance activities, including calibration ***of spraying equipment*** and safe herbicide application.

3. Scope

The scope of this SOP covers the eradication of vegetation on trial site (slashing or mowing), pre-land preparation application of glyphosate to kill existing weeds, land preparation operations,

sprayer calibration, pre – emergence herbicide application at planting (pre-planting for seedling nursery), weeding, post-emergence herbicide application and safety practices.

4. Definition of terms

- **SOP:** Standard Operating Procedure
- **PPE:** Personal Protective Equipment
- **Calibration:** This is a process a sprayer carries out to determine the volume of water required for spraying a unit area.
- **Pre – emergence herbicide:** This is a type of herbicide sprayed immediately after planting but not more than 24 hours after the establishment. The herbicide works in the soil to prevent weed seeds from germinating. Pre-emergence herbicide is also called soil herbicide. Examples include Fierce (Flumioxazin + pyroxasulfone) at 0.32 kg ha^{-1} and Lagon (Aclonifen + Isoxaflutole) at 1.25 L ha^{-1}.
- **Post – emergence herbicide:** This herbicide kills the plant by inhibiting photosynthesis and causing cell and total plant death. Examples are glyphosate (touch down, force up etc..) at 4 L ha^{-1}, and Glufosinate ammonium (Lifeline) at 3 L ha^{-1}.
- **DAP:** Days after planting
- **Pre-land preparation herbicide application:** This is the application of herbicide (glyphosate) to kill existing weeds before ploughing or harrowing.

5. Roles and Responsibilities

Weed control Manager:

- Ensures that appropriate herbicides are purchased and stocked for weed control operations.

- Monitors spraying activities.
- Ensures the herbicide application is done without missing critical control points needed to maintain a weed-free trial.
- Ensures all necessary PPE are made available to the sprayers.
- trains staff members on herbicide spraying calibration.
- Ensures stock availability of materials needed for weed control.

Weed control supervisor:

- Ensures the sprayer follows directives on the appropriate herbicide to use and correct dose rate.
- Ensures the sprayer adheres strictly to safety guidelines and precautions for the spraying activities.
- Ensures proper kitting of sprayers by wearing the personal protective equipment (PPE) – field boot, hand gloves, nose guard with respiratory cartridge, head cover, goggles etc.
- Informs the weed control team of newly established field trials that should be sprayed.

Sprayer:

- Calibrates the Knapsack (spraying device) following laid down procedure.
- Sprays the field trial area as instructed and notifies the weed control supervisor after spraying.

Storekeeper:

- Collects herbicide from central store, stores it safely and provides it to the sprayers on request.

- Keeps an inventory of the herbicides used.

6. Procedure/Protocols

- Mow or slash weed, or bush of height between 0.4 and 0.5m. Allow weeds to regrow before spraying glyphosate at 4 L ha^{-1} for total weed kill.
- If the height of existing weeds is below 0.4 m, spray glyphosate directly without first carrying out mowing or slashing operations.
- After planting, spray pre-emergence herbicide (Fierce at 0.32kg ha^{-1} or Lagon at 1.25 L ha^{-1}) on moist field immediately or not later than 24 hours. For seedling nursery, spray pre-emergence herbicide 4 – 5 days prior to transplanting.
- Spray herbicides early in the morning or late in the day (evening).
- Check knapsack for leakage before use.
- It is compulsory the sprayers are well-kitted with PPE (hand gloves, overall clothing, rain boot, respirator nose guard with cartridge, eye shield or goggle, and head cover)
- Pre-emergence herbicide efficacy or weed emergence prevention is anticipated to last for at least 6 weeks after application.
- Hand weeding is encouraged when weeds emerge and are at 4 - 6 leaf stage.
- At 16 WAP, spray a post-emergence herbicide with a spraying guard at the nozzle of the spraying tank to prevent herbicide from coming in contact with the crop plants. Available post emergence herbicides include lifeline (*Glufosinate ammonium*) or glyphosate (torch down, sarosate, force up etc.)
- Wear your PPE - field boot, hand gloves, nose guard with respiratory cartridge, head cover, goggle eye glass, overall dress before any spraying operation.
- Wash your PPE and take a bath immediately after spraying activities.

Precautions a sprayer should observe

- Read herbicide label for instructions before use, especially the safety recommendations.
- Spraying operations should be carried out early in the morning or late afternoon.
- Wear all necessary personal protective equipment during mixing and spraying
- Avoid drift of spray or dust that may endanger other crops or animals.
- Avoid spilling spray materials on skin or clothing. If such an accident occurs, wash immediately with soap and water.
- Bathe after applying herbicide and change into fresh clothing.
- Wash clothing after applying pesticides including herbicide-contaminated clothing and take care in disposing of the wash water.
- Store pesticides in their original containers in a locked, properly marked cabinet or storeroom, away from food or feed.
- Dispose of the container following IITA rules. Puncture the container to render it unusable for other purposes.
- Report immediately to clinic in the event of accidental ingestion of a chemical.
- Wash your PPE thoroughly after use.

Calibration

Generally, herbicides are applied in the form of solution. Calibrating a sprayer ensures that it delivers the intended volume of spray mixture to the target area. Calibration is therefore a process carried out to determine the volume of water required for spraying a unit area. Sprayer is the basic equipment used for application of herbicides. Proper application of herbicide depends upon the proper adjustment of all the basic components of a sprayer. Spray pattern varies according to nozzle type, spraying pressure, nozzle spacing and spraying height. Therefore, for uniform and efficient application, it is necessary to standardize the volume of water to use, walking speed,

pressure to be maintained etc. The main aim of calibration is to adjust the application pressure and speed (walking speeds).

Calibration is very important especially:

- When spraying for the first time with a new sprayer
- At the beginning of each season
- After changing of nozzle tips, spraying pressure, or speed.
- When the sprayer has done close to 100 ha of spraying.

Calibration method:

Materials: Sprayer (Knapsack), buckets, water, measuring tape, graduated cylinders, PPE

Preparation of backpack spraying tank for calibration.

- Remove and clean the nozzle.
- Flush pump, hoses, and lance with the clean water after removing the nozzle and strainers (tank sieve).
- Readjust the nozzle and strainers and refill the tank.
- The sprayer is now ready for use.

Calibration:

- Mark an area of 100 m^2 [10 m x 10 m] or 50 m^2 [5 m x 10 m] on a dry or concrete ground.
- Fill a spraying tank with water.
- Spray the calibration plot at your speed and pressure.
- After spraying the calibration plot, determine the volume of water needed to refill the tank to the original level or mark (to estimate the volume of water used).
- Estimate the volume of water used to spray a specified area (i.e., 10 m x 10 m) and determine spray output in litres per hectare.
- Spray volume (L/ha) is computed as the ratio of water used for spraying divided by the area of the land sprayed.
- Use the same nozzle type for calibration and actual spraying.

Example

Area of land sprayed = 100 m^2 = 0.01 ha

Amount of water needed to re-fill = 2000 ml = 2 Liters.

Spray volume (L/ha) = $\frac{2\ (L)}{}$ = 200 Ltr. / Ha

0.01 (ha)

Or

$$\frac{2000 \text{ ml} \times 10{,}000 \text{ m}^2}{100 \text{ m}^2 \text{ (10m x 10m)}} = 200{,}000 \text{ ml / Ha.}$$

200,000ml = 200 liters / Ha

Assume your spray tank is 15 liters.

How many tanks (Loads) do you need to spray a hectare = 200 / 15 = 13.33 Loads

If you are to spray Roundup at the rate of 4 L/ ha, the quantity needed per tank will be

= 4 L/13.33 loads = 0.300 liters = 300 ml [0.300 x 1000]

Steps when mixing:

- Calculate the amount of herbicide needed.
- Fill the sprayer tank at least halfway.
- Add, mix, and disperse dry formulations (Wettable powders, dry flowable, or water-dispersible granules).
- Caution: Never pour concentrated herbicides into an empty tank.
- Never allow a spraying tank containing mixed chemicals to stand without agitations as heavy wettable powders may clog nozzles or settle into corners of the tank.

7. References

Atser, G., Dixon, A., Ekeleme, F., Chikoye, D., Dashiell, K., Ayankanmi, T., Hauser, S. Agada, M.Okwusi, M. Adekoya, G. (2017). The ABC of weed management in cassava production in Nigeria, IITA, Ibadan, Nigeria. 26 pp.

8. Annex: Forms/Templates to be used for monitoring and data collection

Images showing different equipment and herbicides used for Cassava Weed Management

Images showing how to spray herbicide safely and correctly

Proper dressing and Correct way of spraying herbicide

Improper dressing and Incorrect way of spraying

Pre land preparation application of glyphosate on a piece of land with weed cover below knee level.