Cassava Agronomy Training Modules (1-8)

Farmer Field Fora At Asueyi and Akomadan.

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Module 1: Site selection

1.1 Learning Outcomes

At the end of this module participants will be able to:-

a. Access litigation free land.
b. Identify the signs of domestic animal activities on land.
c. Identify suitable soil types for cassava production.
d. Conduct physical tests to confirm soil types and their suitability for cassava production.
e. Recognize the soil conditions to avoid when selecting a site for cassava production.

1.2 Introduction

Selecting a good site for cassava cultivation is an important step towards success as a cassava farmer. Good site selection leads to good yield and good yields lead to high profitability. Poor site selection may result in wasted money, wasted labour, wasted time and poor yields.

1.3 Identifying suitable soil types for cassava production

Cassava production requires good soil. Cassava does well on soils which are easy to work and allow easy root penetration. Loamy and Sandy loam soils are therefore best for cassava production. Loamy and Sandy loam soils have the ability to hold water, soil nutrients, organic matter and soil living organisms to support plant growth. Clayey soils are not good for producing cassava because they do not allow easy root penetration and expansion**.**

The following are the general important considerations for selecting a site:-

1. Avoid shallow soils
2. Avoid Steep slopes.
3. Water-logged areas.
4. Stony and gravely soils.
5. Avoid Compacted Soils
6. Avoid locations close to settlements to prevent destruction by ruminants.
7. Look for good vegetative cover e.g. presence of broad leaf soft stem plants
8. Find out the cropping history of the site (look for good vegetative cover)

1.31 Physical tests for soil suitability

Activity 1: Soil type test

Step 1: Dig and fetch a hand full of wet soil

Step 2: Mould it into a ball

Step 3: Try breaking up the ball with a strike

Observations and interpretation

1. If the ball breaks into several pieces on the strike it is definitely loamy or sandy loam and will support commercial cassava production.
2. If the ball is difficult to break or only breaks into 2 or 3 pieces, it is likely clayey and will not be suitable for commercial cassava production.
3. If the soil is difficult to form into a ball it is most likely sandy and will not support commercial cassava production.

Activity 2: penetration test

NB: Generally soils deeper than 50 cm (about a cutlass length) are good for cassava production.

Try pushing a cutlass into the soil at about 4 separate spots on the land while it is wet.

Observations and their interpretation

If the cutlass length is able to penetrate the soil, it is likely lose enough to allow cassava root penetration.

If the cutlass is not able to penetrate at more than 3 test locations, it is most likely hard and will hinder cassava root penetration.

1.4 Accessing Land Free from domestic animals

The following are the **4 'Ss'** for spotting the activities of domestic animals on land:-

1. **Sight: -** Look out for any domestic animals roaming the land during your visits to the land

2. **Smell:** - The smell of any domestic animals like goats, cattle and pigs tells that they visit the land often. Look out for other evidence of their presence or visit such as burrows.

3. **Stool:** - Presence of domestic animal stool or excreta is a good sign that they visit the land.

4. **Signs of grazing:** - Look out for any signs of domestic animals grazing activities on the land.

1.4.1 How to avoid domestic animal activities on your farm:-

1. Find a site away from a community or settlement.

2. Fence the land with durable materials to avoid disturbance by domestic animals.

1.5Accessing Litigation Free Land

The following are the things to do:-

1. Conduct a background check on the ownership of the land by asking people in the community about the owner and history of the land.

2. Identify the rightful owner and schedule a meeting.

3. At the meeting inquire about *the availability of the land*, the type of ownership s/he possesses (e.g. family ownership, personal ownership, leasehold etc) and whether s/he would sell or rent it out to you.

4. Negotiate and come to an agreement with the owner on the terms of use s/he will be willing to deliver the land to you.

5. Obtain a written or verbal agreement on the terms of your acquisition in the presence of two (2) or three (3) witnesses.

6. Fulfill your part of the agreement.

Module 2: Land Clearing

2.1 Learning Outcomes

At the end of this module participants will be able to:-

a. Undertake different land clearing methods for cassava production
b. Manage tree branches, twigs and other thick biomass after clearing without burning the entire field.
c. Understand different soil fertility management practice.
d. Understand the benefits of good land preparation methods.
e. Safely use and dispose off agrochemicals

2.2 Introduction

The activities required to be undertaken when clearing a piece of land depend to a good extent on the nature of the vegetation involved. Generally however, without regard to the land preparation method adopted, care should be taken to avoid harming the soil.

2.3Land clearing methods

2.3.1 Light vegetation cover

Steps to follow:-

1. Clear the weeds by slashing with a cutlass or spraying with herbicides.
2. If the weed were slashed with a cutlass, leave the vegetation for about a week to dry up.
3. Construct your ridges or mounds by incorporating the dried weeds into the soil. You may also use the vegetation as mulch by using them to cover your mounds.
4. If the vegetation was sprayed with weedicides, allow about 2 weeks before constructing your mounds and ridges.
5. Avoid burning the plant debris as much as possible,

2.2.2 Thick vegetation cover

1. Weed or clear undergrowth.
2. Coppice or prune the trees to open up the land to sunlight. Allow a few of the trees to stand to create a cool environment around the farm.
3. Leave the vegetation for about 2 weeks to dry up.
4. Remove tree stumps and other unhelpful woody debris to make way for construction of mounds and ridges.

5. Undertake controlled burning of the dried debris (*see module 3 for advice on controlled burning*).

2.4 Soil as a growing medium

Cassava is a heavy feeding crop which requires a good supply of soil nutrients, air and water to grow. The soil stores and provides these resources. Most soil nutrients are obtained from plant debris through the breaking down activities of soil living organisms.

It is therefore important to always aim at increasing the presence of organic matter in your soil.

2.4.1 Some Benefits of soil organic matter

1. It is a source of slow nutrient release to the soil.
2. It increases the ability of soil to hold water.
3. It cools the soil.
4. It improves soil structure and root penetration.
5. It binds the soil and prevents runoff and soil erosion.

2.4.2 Soil fertility management Practices

The following are some practices for managing/ maintaining the fertility of your soil:-

1. Maintain a good mass of organic matter in the soil by
   a. Incorporating weeds after clearing.
   b. Applying weeds as mulch.
   c. Applying poultry manure.
   d. Applying domestic food waste and even wood ash from coal pots and other domestic cooking stoves.
2. Apply inorganic fertilizers.
3. As much as practicable, avoid burning.

2.5 Benefits of good land preparation

1. Maintains soil organic matter and sustains its benefits for the plants.
2. Conserves the soil and its nutrients.
3. Improves soil water holding capacity.
4. Causes minimum disturbance to the soil and improves soil health.
5. Improves crop yields and leads to increased profitability.

2.6 Safe use of Agrochemicals

Using agrochemicals for weed control or any other purposes must be done with utmost caution to protect yourself and the environment

The following are some safety tips to follow whenever you pour, mix or apply agrochemicals:-

1. Protect your hands by wearing plastic hand gloves.
2. Protect your nose by wearing a nose mask.
3. Protect your eyes by wearing goggles or glasses with side shields.
4. Protect your body by wearing an overall.
5. Protect your feet by wearing wellington boots.
6. Read the label carefully and mix according to the manufacturer's prescription.
7. If the application is by sprinkling or spraying with a knapsack, stand with your back facing the wind direction and spray in the same direction as the wind to avoid the chemical depositing on your body.
8. After application, wash yourself well with soap and water and keep your protective gear in a safe place away from children.
9. Do not wash or dispose off chemical containers in water bodies.

Module 3: Planting Material Sourcing/ Acquisition and Controlled burning

3.1 Learning Outcomes

At the end of this module participants will be able to:-

a. Identify and select disease and pest free planting materials.
b. Know the benefits of using improved planting materials.
c. Recognise the disadvantages of slash and burn.

3.2 Introduction

The sources, type and physical characteristics of the planting material used for commercial cassava production are very important to the health and productivity of a farm. Planting materials may also be selected based on the purpose to which the final produce will be put.

3.3 Planting material sourcing, selection and acquisition

When sourcing for planting materials, the following are the things to consider:-

a. Pay a visit to the farm (source of planting material) to assess the conditions of the growing plants.
b. Look for good looking, healthy and strong cassava plants.
c. Check the leaves for any wrinkles or folding signs and also for the presence of any pests and diseases.
d. Do not select cassava plants with bruises or symptoms of pests and diseases damage.
e. Select materials whose internodes are not too wide (at least 2-5 cm)
f. Select plants with uniform internodes. Irregular internode lengths could be a sign of mealy-bug infestation.
g. Select the young hardwood portion of stem for planting. Its best to select plants which are between 8-15 months old.
h. Do not use the top green portion and the bottom portion of the stem.

33.1 Sources of improved planting material

It is beneficial to obtain your planting materials from a certified source.

Some of the sources of certified improved planting materials are

1. Agriculture Research Stations (Mampong and Wenchi)
2. District Directorates of Agriculture (Techiman North, Tuobodom and Offinso North District office, Nkenkasu)

3. Agricultural Extension Agents.
4. Secondary and Primary planting material multiplication centers.
5. Other Ministry of Food and Agriculture certified cassava farmers.

3.4 Improved cassava varieties

Improved cassava varieties have a high yielding potential. This means that for the same piece of land, the improved varieties generally give higher yields than local varieties.

The following are some of the attributes of the improved varieties:-

1. Fast growing
2. High yielding
3. Early or late maturing depending on need
4. Good processing attributes
5. Drought tolerant
6. Does not rot easily.
7. Tolerates weeds, pests and diseases better.

3.5 Slash and burn

Burning an entire field after weeding to make way for planting or ridges and mounds construction is what is termed slash and burn. Slash and burn may come with immediate benefits but it has long term bad effects for your land.

3.5.1 Immediate benefits of slash and burn

1. It makes land easy to work by reducing the mass of vegetation on the field.
2. The ash from the burning provides nutrients in a ‘quick’ form for first season crop productivity.

3.5.2 Disadvantages of slash and burn agriculture

1. It kills beneficial soil living organisms such as worms and insects.
2. It destroys soil nutrients.
3. It exposes the land to agents of erosion which may lead to the washing off of soil particles containing nutrients including the burnt ash.
4. It hardens the soil.
5. It destroys soil structure.

3.5.3Controlled burning

Controlled or spot burning gives you the advantages of burning but saves your soil from wholesale long term damage.

Steps to follow when undertaking spot burning:

1. Gather the dried woody and other thick and obstructive weeds at various spots on the field.
2. Burn the heaps in turn.
3. Keeping a watchful eye on each heap as you burn and make sure they do not get out of hand.
4. Manage any unintended fire outbreak and ensure that all the heaps are out of fire before leaving the farm.

Module 4: Field Layout

4.1 Learning Outcomes

At the end of this module participants will be able to:-

1. Properly layout a field.
2. Understand the importance and benefits of good field layout and good plot orientation

4.2 Introduction

The judicious use of land space is a major consideration in cassava production. A disorganized field layout is costly as well as less productive. Using a properly organised field layout increases productivity and profitability of cassava fields.

4.3 Field Layout

The recommended spacing for commercial cassava production is 1mX1m. At this interval, one must achieve a plant population of 10,000 stands per hectare or 4,000 stands per every acre of land.

The following are the step to follow in laying out your field:-

1. Line and peg your field at an interval of 1m x 1m apart.
2. Raise mounds and or ridges to a height between 0.4m and 0.6m on the 1m marks in both directions by incorporating weeds and other organic materials.
3. If ridges are constructed, orient them across the slope of the land to maximize water capture. (You may leave alleys at regular intervals to allow easy movement on the field).
4. You may tie ridges by raising soil to about 0.2m height at 10m intervals in alternating fashion between rows for water harvesting.
5. You may also raise soil to 0.2m height at alternate intervals between mounds for water harvesting purposes.
6. Cover the mounds or ridges with some weeds and other organic materials to serve as mulch.

NB: 1m is approximately one and half cutlass length long.

4.3.1 Benefits of good field layout

1. Maximizes the use of land and maximizes productivity.
2. Gives control and allows you to work your land easily.
3. Helps in planning your field activities and allocating farm resources.

4.3.2 Benefits of good plot orientation

1. Reduces the effect of the forces of erosion on the farm.
2. Maximizes water capture and water infiltration rate for plant growth.

Module 5: Planting Material Preparation and Planting

5.1 Learning Outcomes

At the end of this module participants will be able to:-

1. Properly prepare planting material before planting
2. Recognize the benefits of good planting material preparation
3. Properly orient planting materials and plant cassava in rows.

5.2 Introduction

Good planting material preparation maximises the use of planting materials and improves establishment rate. Poorly prepared planting materials may rot easily in the soil. This may lead to a waste of money and time for refilling.

5.3 Planting material preparation

The following are the step to follow when preparing cassava planting materials for planting:-

1. Gather all your planting materials to one location or a number of locations on your field.
2. Cut the stems into small pieces of lengths 10 - 20cm using a sharp cutlass.
3. Each cutting must have about 6 nodes.
4. Use a sharp cutlass to avoid multiple cuts with split ends.

5.3.1 Benefits of good planting material Preparation

1. Prevents wastage and maximizes the reach of planting materials.
2. Prevents destruction of the planting materials by insect pests and bacteria.
3. Improves establishment rate of planting materials.

5.4 Planting steps

The following are the steps to follow when planting your prepared cassava planting materials:-

1. Dig holes 10-15cm deep on top of ridges or mounds.
2. If ridges, cut a stick of 1m length and use as a guide for your planting interval as you walk the length of the ridge.
3. Place cuttings horizontally and cover with thin layer of soil
4. Ensure to cover your ridges with your organic mulch.

Module 6: First Weeding & Fertilizer Application

6.1 Learning Outcomes

At the end of this module participants will be able to:-

a. Refill cassava fields correctly
b. Manage weeds appropriately on ridges and mounds.
c. Appreciate the benefits of timely weed control in cassava production.
d. Employ the 4 Rs of fertilizer application.
e. Apply other soil improvement options.

6.2 Introduction

Good weed management is an essential cultural practice in cassava production. It prevents competition between the cassava and the weeds for the scarce soil resources. It also prevents pest and disease infestation and supports productivity. Similarly, the availability of soil nutrients in the right form, quantities and at the right time also supports productivity of cassava fields.

6.3 Refilling

Stem cuttings may fail to sprout if they are destroyed by insect pests such as termites or are affected by unfavourable environmental conditions. Undertake refilling when stem cuttings fail to sprout 2-3 weeks after planting. This ensures that the correct plant population density is maintained. Steps for undertaking refilling:-

1. Remove the dead old cutting.

2. Replace dead cutting with a fresh healthy cutting.

6.3 First weeding

Early weed management frees crops from competing for sunlight, water, nutrients and other essential resources. In the case of cassava most of its rooting system is produce during the first 4 months, early weed management therefore enables it to produce more root network. Below are some points to note about the first weeding:-

1. Undertake first weeding within 2 to 3 weeks after planting.
2. Use mechanical weeding methods such as hoeing or slashing with a cutlass.

3. Avoid the use of chemicals as they may destroy the young fragile cassava crops.
4. If chemicals are not avoidable, use shields to prevent contact with the young cassava crops while taking personal safety precautions.
5. Employ an integrated approach for weed management by ensuring proper land preparation, applying dead cleared weeds as mulches and intercropping and managing suitable leguminous cover crops such as mucuna.
6. Reshape mounds or ridges during the first weed control.

6.4 Soil fertility management Practices

There are various soil fertility management practices. The following are some practices you can use:-

1. Maintain a good mass of organic matter in the soil by
    a. Incorporating weeds after clearing.
    b. Applying weeds as mulch.
    c. Applying poultry manure, compost or cow-dung at 4t/ha or 400g per plant (about 1 milk tin full).
    d. Applying domestic food waste
2. If the soil is acidic, apply lime or even wood ash from coal pots and other domestic cooking stoves.
3. Apply inorganic fertilizers.

6.4.1 Inorganic fertilizer application

When applying deciding to apply inorganic fertilizers think of the **4 Rs-**

1. Right Time **2. Right Type**

3. Right Quantity **4. Right Method**

A. Right Time

Apply your fertilizer after sprouting (or within the first 4 months of planting) to maximise the benefit of fertilizers to cassava - This is the period where most of the rooting system develops

B. Right Type

Apply **NPK 15 – 15 – 15** to your cassava- Cassava is a heavy feeder and so requires a good and balanced supply of all the essential nutrients.

C. Right Quantity

Apply 8 bags of 50kg per hectare i.e. 40g (two crown cocks) per plant at one month after sprouting.

D. Right Method

Apply the fertilizer in a ring fashion around the crop.

Module 7: 2nd Weeding & Pests and diseases management

7.1 Learning Outcomes

At the end of this module participants will be able to:-

a. Identify cassava pests and diseases
b. Undertake different techniques for Managing cassava pests and diseases
c. Create and manage fire belts around their farms

7.2 Introduction

Like all other crops cassava productivity may be reduced by the presence of weeds, pests, diseases and bush fires. Cassava pests and diseases may be spread by the use of infested planting materials or from adjoining infested farms and vegetation. If pests and diseases are identified and destroyed or completely avoided in time, your farm will be saved from the losses associated with such infestation. Bush fires may also destroy cassava farms during the dry season. It is therefore important to protect your farm from fire.

7.3 Cassava pests-Insects

The following are the main insect pests of cassava:-

7.3.1. Cassava mealybug-

Cassava mealybug attacks the growing tips first, producing poorly developed shoots and shortening of internodes. Infested plants have masses of insects with cotton like appearance clustered on the stem and leaves.

Figure 1: *Cassava mealybug infection*

7.3.2. Green mite

The cassava green mite attacks cassava leaves and causes them to become reduced in size and deformed as they mature. The green mite is mainly a dry season-pest.

Figure 2: *Cassava plant damaged by cassava green mite*

7.3.3 Termites

Termites destroy the base of cassava stems and may cause complete stems to die-back. Termite damage incidence increase during the dry season.

Figure 3: *Termite infested Cassava plant*

7.3.4. Variegated grasshoppers.

Figure 4: *Variegated grasshopper feeding on cassava leaves.*

7.3.5. Scale Insects

Figure 5: *Cassava stem completely destroyed by scale insects*

7.4 Cassava Diseases

Several diseases affect the cassava. The major diseases of cassava are:

7.4.1 Cassava Anthracnose Disease (CAD) (caused by a fungus)

Figure 6: *Cassava stem showing cankers of Cassava Anthracnose Disease*

7.4.2 Cassava Bacterial Blight (CBB) (caused by a bacterium)

Figure 7. *Cassava plant damaged by Cassava Bacterial Blight (CBB)*

7.4.3 Root rot diseases (mostly caused by fungi)

Figure 8: *Cassava storage root destroyed by root rot disease*

7.4.4 African Cassava Mosaic Disease (ACMD) (caused by a virus)

Figure 9: *Cassava leaves with patches of Cassava mosaic disease*

7.5 Managing Cassava Pests and Diseases

The following are some methods for managing cassava pests and diseases:-

7.5.1 Planting material related methods

a) Ensure to select and use healthy planting material for establishing your farm. You may consult the appropriate agencies such as DDAs for healthy planting materials or advice.
b) Where the only available source of planting materials has cankers or 'sores, dip the stem cuttings in dilute solutions of suitable fungicides before planting in order to destroy the fungal spores.
c) You may also select cassava varieties which are tolerant to diseases. Most improved varieties are tolerant to pests and diseases.
d) Destroy any plant debris with diebacks and fungal growths and other diseases through controlled burning.

7.5.2 Other useful methods of controlling diseases of cassava

a) Ensure to always maintain a clean farm as most pests and diseases spread when weeds are not properly controlled.
b) Plant early. Early planting produces vigorous growing plants that can withstand diseases better in the dry season.
c) Plant your cassava in well-drained soils. Water-logged or easily flooded lands lead to fungal rots.
d) Avoid planting cassava continuously on the same piece of land. Crop rotations are useful in reducing inoculum pressure by disrupting the lifecycles of pathogens.
e) Avoid damaging your cassava roots during weed control. Wounds are good entry points for cassava rot causing organisms.
f) Inspect your farm regularly and immediately remove on sight, fruiting bodies of parasitic mushrooms which attack cassava. Ensure to handle them carefully and burn them completely.
g) Avoid continuously cropped soils. Fertile soils will support a healthy crop of plants that can stand up better against diseases therefore.

7.6 Fire Protection

Every year, bush fire destroys large cultivated farm lands. Protecting your farm from bush fire is therefore an important activity towards the end of the growing season. The following are some steps to take:-

1. Ensure clean or weed free farms towards the end of the rainy season
2. Construct fire belt by weeding 3-5 m wide around the perimeter of the farm in October or November
3. Collect the weeds and do controlled burning

Module 8: Harvesting & Planting Material Conservation

8.1 Learning Outcomes

At the end of this module participants will be able to:-

a. Assess yields of cassava fields before harvesting or selling.
b. Appreciate the benefits of yield assessment.
c. Undertake harvesting in a way that reduces crop damage
d. Undertake a variety of planting material conservation methods

8.2 Introduction

Assessing the yield of a cassava field is a necessary activity before harvesting or selling to a potential buyer. Yield assessment enables you to have a good idea of the productivity level of your cassava field. Harvesting must also be done in a way that reduces damage and loss. Ultimately, the planting materials need to be saved for subsequent production.

8.3 Yield assessment

Yield assessment is the process of estimating the yield of your cassava farm before harvesting or selling to a buyer. It involves harvesting small portions across the length and breadth of your farm to determine yield per unit area and using that information to calculate or estimate the yield of the entire farm as well as the potential monetary value of cassava produced on your field.

8.3.1 Yield Assessment steps

The following are the steps to follow when undertaking yield assessment:-

1. Demarcate an area (minimum 2m x 2m or maximum 4m x 4m) preferably at 3 different points on the farm to represent the entire field.
2. Harvest all the cassava in the demarcated area.
3. Weigh the harvested tubers from the harvested area.
4. Use the weight obtained to estimate the yield of your farm in acres.

For instance, if you after demarcating and harvesting an area of 3m X 3m, at 3 different locations on your farm you obtain a total weight of 81 kgs, do the

following calculations to obtain the approximate weight or number of tubers per acre:-

Step 1: Unit sampled areas = 3m X 3m = 9m

Step 2: Total sampled area = 9m X 3 =27m^2

Step 3: Total sampled weight = 81kg

Step 4: Estimated yield per acre = 81kg X $\frac{4{,}000m^2}{27m^2}$ = 12,000 kg/ acre

Step 5: Estimated yield per acre (in tons per acre) = $\frac{12{,}000kg}{1{,}000kg}$ = 12 t/acre

You can us the conversion table below for your calculation:-

Area demarcated	**Multiplication Factor**
2m X 2m X 3 reps	Number or Weight X 0.33
3m X 3m X 3 reps	Number or Weight X 0.15
4m X 4m X 3 reps	Number or Weight X 0.08

8.3.1 Benefits of yield assessment

The following are the benefits of undertaking yield assessment before harvesting or selling your farm to a buyer:-

1. It gives you reliable information which serves as a tool for price negotiate with buyers.
2. It gives you a good judgment of how much to expect after the sale.
3. It helps you to plan your logistics, labor and other requirements for harvesting.
4. It helps you to avoid regret after the sale is done.

8.4 Harvesting

The maturity period for early maturing cassava varieties is between is 6-12 months. Late maturing varieties may take between 12 to 18 months to mature. The following are some point to note about harvesting your cassava:-

1. Know the maturity period of your cassava variety and harvest at the appropriate time. Harvesting too early will result in low yield while harvesting too late may lead to rot, fibrous roots and destruction by rodents.
2. Undertake harvesting early in the day to maintain the freshness of your harvested cassava.
3. Avoid injuring the cassava roots when harvesting to prevent rapid deterioration.

8.4.1 Harvesting technique

1. Cut the stalk about 0.4m to from the ground
2. Where the soil is moist, pull the remaining stalk by hand in a shaky or vibrating motion to one direction first and then to the alternate direction.
3. Where the soil is dry, dig around the mound or ridges with hoes and earth chisel to loosen the soil before pulling with your hand to avoid damaging the roots.
4. Dig the soil with hoes or earth chisel in a scraping fashion to remove any broken roots still stuck in the soil.

8.5 Planting Material Conservation

The following are some methods for conserving cassava planting materials:-

1. Establish a dedicated planting material multiplication field of your desired cassava varieties and harvest for planting as and when needed.

2. Reserve a portion of your farm during harvesting and coppice for planting during the subsequent year. Ensure to protect them from bushfire during the dry season by creating a fire belt around it.

2. Pack harvested planting materials under a shade near your house. Frequently water them to prevent desiccation and also protect them from damage by animals.