

Guide to training manual



The **ABC**

**OF WEED MANAGEMENT IN
CASSAVA PRODUCTION IN NIGERIA
CURRICULUM**

INTRODUCTION

Cassava is widely grown in Nigeria and other tropical and subtropical areas of the world. It is rich in carbohydrates, calcium, vitamins B and C, and essential minerals. However, nutrient composition differs according to variety and age of the harvested crop, soil conditions, climate, and other environmental factors during cultivation. Every part of cassava is useful, the leaves are used as vegetable for humans or fodder for animals, while the roots are major sources of carbohydrates. Yield of cassava in Africa and Nigeria is being stymied by several factors including poor weed control. Weeding takes 50-80 percent of total farm budget. In most communities, women are the main actors in hand weeding, a tortuous activity that leads to back ache and other forms of stress. Yield losses of cassava under weed infestation are estimated at between 50 and 90 percent. Poor weed control and other agronomic constraints impede cassava production and put yield of cassava in Nigeria at about 8 tons per hectare (t/ha) (FAO, 2013).

The cassava weed management curriculum has been carefully designed to transfer relevant and up-to-date knowledge, skills and competencies in cassava weed control to learners. Based on carefully selected and specific learning objectives, relevant contents and various pedagogical techniques have been included to provide stimulating learning experiences for the learners through classroom interactions and out-of-class/field activities to promote hands-on and concrete experiences for meaningful learning. Bearing in mind that the end users of the curriculum would consist of adult learners, their learning characteristics became a major consideration in selecting the methods of instructional delivery which include; class interactions, group presentations, lecture methods, demonstrations, relevant video clips/documentaries, images/pictures, case studies, field work etc. Both facilitator and learner activities are elicited to foster mutual understanding of what is expected from each party and provide a guide to the facilitator for effective learning. The reflection and assessment activities are to enable the facilitator evaluate the learning process and measure the quality and quantity of knowledge and skill learned in the course.

Please kindly note that this curriculum is a guide to the training manual, it cannot serve the purpose of a training manual.

Every part of cassava is useful



Weeding takes
50-80%
Total farm budget



Women are
the main
actors

THE STRENOUS ACTIVITY RESULTS
TO BACK-ACHE

Estimations of yield losses
due to weed infestation
50-90%

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THEME I: STEPS IN SETTING UP A CASSAVA FARM

Topic 1		Uses of Cassava
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. State different types of food that can be derived from cassava b. Identify nutritional and health benefits of cassava c. Recognise cassava and cassava wastes as sources of animal feed d. Discover industrial benefits of cassava
Content		<ul style="list-style-type: none"> ✓ Types of foods that can be gotten from cassava ✓ Nutritional value(s) of cassava ✓ Health benefit(s) of cassava ✓ Cassava as direct animal feed or as concentrate mixtures
Method of Delivery		<ul style="list-style-type: none"> • Classroom Discussion • Lecture Method • Demonstration with relevant visuals/aids
Learning Activities	Facilitator	<p>Provide general introduction/information on cassava.</p> <p>Deliver engaging lessons on the selected contents i.e. types of foods that can be derived from cassava, its nutritional and health benefits, etc.</p> <p>Show learners relevant images/visuals to concretise learning.</p> <p>Request learners to identify common uses of cassava in their locality</p> <p>Ask learners relevant questions for feedback on their learning.</p>
	Learner	<p>Actively listens to facilitator's explanations and illustrations on Uses of Cassava</p> <p>Contribute to the classroom interaction by listing and identifying the uses of cassava that are common in his/her locality</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals, textbooks, images, marker pens, white/interactive boards, flip charts, video clips, Internet links/ blogs, etc.
Reflections and Assessments		<p>Reflect on the uniqueness/needs of cassava as a source of food for humans and animals, as well as its industrial value</p> <p>Do we have sufficient cassava to cater for these needs?</p> <p>Observation of learners' interest, and participation during classroom interaction</p> <p>Classroom quizzes, and assignments.</p>



Topic 2		Basic Steps in Setting up a cassava farm
		Sub-Topic: Site Selection
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. Identify the type of soil required for planting cassava. b. State the factors to consider in cassava site selection. c. Describe indicators of a good soil for cassava site selection. d. Carry out a soil test for cassava plantation e. Identify appropriate agency/institution to contact for a soil test.
Content		<ul style="list-style-type: none"> ✓ Types of soil required for cassava plantation. ✓ Factors to consider or avoid in setting up a cassava farm i.e. annual rainfall, soil topography, soil fertility, etc. ✓ Indicators of good soil(s) for cassava plantation worm cast, etc. ✓ How to carry out a soil test for cassava plantation ✓ Agency/institution that could assist with soil test
Method of Delivery		<ul style="list-style-type: none"> • Lecture Method • Demonstration method • Classroom Discussion • Presentation of images, pictures, video clips or documentaries.
Learning Activities	Facilitator	<p>State the importance of site selection in cassava plantation.</p> <p>Guide classroom interaction on the contents i.e. type of soil(s) that are required for cassava plantation, factors to consider in cassava site selection, indicators of a good soil, etc.</p> <p>Present learners with relevant images/visuals to concretise learning.</p> <p>Provide any other information as may be required.</p> <p>Demonstrate how to carry out soil test for cassava farm.</p> <p>Ask learners relevant questions for feedback(s) on their learning.</p>
	Learner	<p>Actively listens to facilitator's explanations and illustrations on site selection for cassava plantation.</p> <p>Share personal unconventional experiences (if any) on site selection for cassava plantation.</p> <p>Ask relevant questions from the facilitator</p>
Resources		<p>Relevant training manuals, textbooks, pictures, marker pens, white/interactive boards, relevant video clips,</p> <p>Relevant internet links/ blogs, etc.</p>
Reflections and Assessments		<p>What are the likely consequences of not adhering to the discussed principles in site selection by cassava farmers?</p> <p>Observation of learners' involvement in classroom interaction</p> <p>Short quizzes, and assignments.</p>

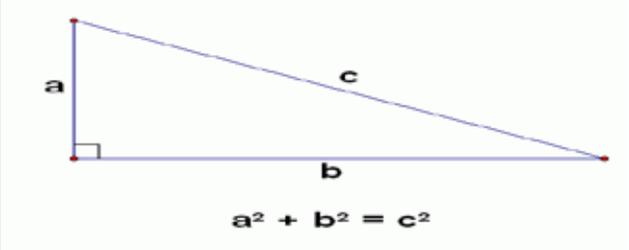


Topic 3		Basic Steps in Setting up a cassava farm
		Sub-Topic: Measurement of Selected Site
Learning Objectives	<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> Discover the purpose/benefits of site measurement in cassava production Identify tools required for site measurement Acquire site measuring technique(s) Gain hands-on experience(s) on site measurement by carrying out a site measuring activity 	
Content	<ul style="list-style-type: none"> ✓ Reasons, and benefits of site measurement in cassava production ✓ Appropriate tools/devices required/needed effective site measurement ✓ Site measuring techniques ✓ Field activity on field site measurement 	
Method of Delivery	<ul style="list-style-type: none"> • Field activity(ies) • Out-of-class instructional delivery • Out-of-class interactions • Active field observation • Presentation of images, tools, etc. • Practical demonstration with appropriate tools, etc. for site measurement. 	
Learning Activities	Facilitator	<p>State the importance of site selection in cassava plantation.</p> <p>Guide classroom interaction on the contents i.e. type of soil(s) that are required for cassava plantation, factors to consider in cassava site selection, indicators of a good soil, etc.</p> <p>Present learners with relevant images/visuals to concretise learning.</p> <p>Provide any other information as may be required.</p> <p>Demonstrate how to carry out soil test for cassava plantation</p> <p>Ask learners relevant questions for feedback(s) on their learning.</p>
	Learner	<p>Actively listens to facilitator's explanations on the purpose(s)/reasons and benefits of site measurement for cassava plantation.</p> <p>Observe facilitator's demonstrations with appropriate site measurement tools/devices</p> <p>Carry out practical site measurement activity to gain hands-on experience</p> <p>Ask relevant questions from the facilitator</p>
Resources	<p>Relevant training manuals, textbooks, measuring tapes, rulers, squares, GPS, angle locator, angle gauge, pictures, markers, etc.</p>	
Reflections and Assessments	<p>Would you judge any agricultural practice as good if proper site measurement is not considered?</p> <p>Observation of learners' activities during practical session</p> <p>Assessment of learners' display of measuring techniques during practical session.</p>	

ACTIVITY 1: Topics 1 and 2 - Measurement of selected site for cassava cultivation



Estimated time: 4 hours

Facilitator/Demonstrator	Resources
<ul style="list-style-type: none"> The facilitator demonstrates by measuring a straight line of 10m on the cleared land with a tape or rope and pegs. Measure an angle of 90° and then measure another 10m. The 10m measurement can be achieved with the use of a tape or straight-lined pegs, the angle can be measured through the use of the protractor, compass or the Pythagoras theory (using pegs and tape) 	<ul style="list-style-type: none"> A fertile land with features of fertile soil (e.g. soil cast, surrounding good vegetation, etc.) of 10m x 10m, GPS (Geographic Positioning System), measuring tape, rope, 20 pegs, protractor, hand squares, compass, etc., should be available. 



Topic 4		Basic Steps in Setting up a cassava farm
		Sub-Topic: Land Preparation and Tillage
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. Identify the process of land preparation for a cassava farm b. Describe methods of land clearing and their benefits. c. Explain the step by step use of herbicides in land preparation for cassava farm d. Highlight the importance of land tillage and non-tillage. e. Describe the recommended spacings in a tillage system for cassava farm
Content		<ul style="list-style-type: none"> ✓ Process of land preparation for a cassava farm. ✓ Different land clearing methods (manual and mechanical) and their benefits. ✓ Step by step use of herbicides in land preparation for cassava farm ✓ The importance of land tillage and non-tillage. ✓ Recommended spacing in a tillage system for cassava farm
Method of Delivery		<ul style="list-style-type: none"> • Lecture Method • Demonstration method • Classroom Discussion • Presentation of images, pictures, video clips or documentaries.
Learning Activities	Facilitator	<p>State the importance of land preparation and different methods of land preparation, highlight their advantages and disadvantages.</p> <p>The procedure for use of herbicides in land preparation. This will include types of herbicides, when to use each type of herbicide, mixture rates, spraying equipment and patterns, etc.</p> <p>Tillage systems for cassava farm, importance of tillage, tillage tools and equipment.</p> <p>Tillage spacing for different tillage systems for a cassava farm.</p>
	Learner	<p>Actively listens to facilitator's explanations and illustrations on land preparation.</p> <p>Share personal experiences on the preparation of land for cassava in his/her locality.</p> <p>Share experience on the use of herbicides and site selection for cassava farm</p> <p>Describe practices in terms of tillage systems</p> <p>Ask relevant questions from the facilitator</p>
Resources		<p>Relevant training manuals, textbooks, pictures, marker pens, white/interactive boards, relevant video clips,</p> <p>Relevant internet links/ blogs, visit to a cassava field, demonstration on the herbicide application, etc.</p>
Reflections and Assessments		<p>Observation of learners' involvement in classroom and field interaction</p> <p>Short quizzes, and assignments.</p>

Topic 5		Basic Steps in Setting up a cassava farm
		Sub-Topic: Planting Materials selection and handling
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. State the importance of a good planting material and their characteristics. b. Identify varieties of cassava and their features. c. Describe how to handle and cut cassava stem for planting. d. Identify cassava stem storage systems. e. Explain how to treat planting materials before planting.
Content		<ul style="list-style-type: none"> ✓ Importance and characteristics of a good cassava stem as planting material. ✓ Varieties of cassava and their features. ✓ How to handle and cut cassava stem for planting ✓ Storage systems for cassava stems ✓ Methods of treating cassava stems for planting.
Method of Delivery		<ul style="list-style-type: none"> • Field activity(ies) • Out-of-class instructional delivery • Out-of-class interactions • Active field observation • Presentation of images, tools, etc. • Practical demonstration.
Learning Activities	Facilitator	<p>Explain to the learners planting material, varieties of cassava and their characteristics</p> <p>State factors to consider while selecting a cassava stem for planting.</p> <p>Demonstrate how to cut the planting stems and their measurements</p> <p>Describe the treatments given to cassava stem cuttings before planting and storage/preservation systems for stem cuttings.</p> <p>Present relevant images/videos/documentaries.</p>
	Learner	<p>Actively listens to facilitator's explanations</p> <p>Observe facilitator's demonstrations with appropriate materials and measuring tools/ devices</p> <p>Carry out practical site activity to gain hands-on experience</p> <p>Ask relevant questions from the facilitator.</p>
Resources		Relevant training manuals, textbooks, measuring tapes, rulers, squares, cassava stems, pictures, markers, cutlasses, video clips, etc.
Reflections and Assessments		<p>Observation of learners' activities during practical session</p> <p>Assessment of learners' display of measuring techniques during practical session.</p>



Topic 6		Basic Steps in Setting up a cassava farm
		Sub-Topic: Planting of cassava
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. Identify different methods of planting cassava b. Demonstrate different cassava planting styles/techniques c. Demonstrate planting distance and calculate plant population d. Replace non-sprouted cutting after initial planting
Content		<ul style="list-style-type: none"> ✓ Introduction to planting a cassava field. ✓ Methods of planting cassava (mechanical and manual), advantages and disadvantages of each method. ✓ Machines and tools used in cassava planting. ✓ Cassava planting distance and calculating the plant population ✓ How to replace non-sprouted cutting after initial planting.
Method of Delivery		<ul style="list-style-type: none"> • Field activity(ies) • Out-of-class instructional delivery • Out-of-class 2, 3 or more interactions • Active field observation • Presentation of images, tools, etc. • Practical demonstration.
Learning Activities	Facilitator	Describe/define a planting material, varieties of cassava and their characteristics, factors to consider while selecting a cassava stem for planting, How to cut the planting stems and their measurements, Treatments given to cassava stem cuttings before planting, Storage/preservation systems for stem cuttings.
	Learner	Actively listens to facilitator's explanations Observe facilitator's demonstrations with appropriate materials and measuring tools/ devices Carry out practical site activity to gain hands-on experience
Resources		Relevant training manuals, textbooks, measuring tapes, rulers, squares, cassava stems, pictures, markers, cutlasses, etc.
Reflections and Assessments		Observation of learners' activities during practical session Assessment of learners' display of measuring techniques during practical session.

ACTIVITY 2: Cassava Stem Cutting for Planting and Planting Methods.



Estimated time: 3 hours

Activities	Resources
<ul style="list-style-type: none"> The facilitator demonstrates by showing how to select a good planting material devoid of disease and bruises with complete nodes. Cut the stem into planting pieces (showing the minimum and maximum number of nodes and internodes) of about 25cm – 30cm and plant to demonstrate different planting methods e.g. slant, flat etc. Highlight the maximum and minimum planting depth. 	<p>A good, healthy and mature cassava field should be prepared/identified in advance; healthy harvested cassava stem should be made available in advance. Sharp knife/ machete, well prepared ridges/mounds (participants may be asked to prepare ridges/mounds); treatments for cuttings before planting (if any) etc.</p>
	



THEME II: WEED MANAGEMENT AND CHEMICAL WEED CONTROL

Topic 7		Weed Control
Learning Objectives		<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> Give a definition of weed and list types of weed. Enumerate different weed classifications Identify weeds as the major constraints to cassava production. Identify methods of controlling weeds in a cassava farm. Get hands-on experience on instruments used for weeding in cassava farm Acquire weed control techniques Demonstrate weed control techniques by carrying out a weed control exercise
Content		<ul style="list-style-type: none"> ✓ Weed and weed classification. ✓ Types of weed. ✓ Weed control methods (manual, mechanical, chemical, etc.) ✓ Advantages and disadvantages of different weed control methods. ✓ Weeds as major constraints to cassava production ✓ Instruments or equipment used in controlling weeds in cassava farm ✓ Weed control activity(ies)
Method of Delivery		<ul style="list-style-type: none"> • Field activity(ies) • Out-of-class instructional delivery • Out-of-class 2, 3 or group interactions • Active/field observation • Presentation of images, tools, etc. • Practical exercise/demonstration with appropriate tools, etc. for weed control.
Learning Activities	Facilitator	<p>Guide discussion on weed control as the major constraint to cassava production.</p> <p>Provide information to the learners on the methods of controlling weeds in a cassava farm. i.e. manual, mechanical, chemical, etc.</p> <p>Demonstrate/show learners the instruments/equipment used in weed control and under which category each of them belongs.</p> <p>i.e. cutlass and hoe for manual weed control, etc.</p> <p>These instruments could be real (real objects) or pictures, etc.</p> <p>Assign practical work/exercises to individuals or group of learners on weed control.</p> <p>Observe/monitor practical activities and provide any other information as may be required.</p>
	Learner	<p>Actively listens to facilitator's explanations on weed control</p> <p>Participate in interactions on the methods of weed control.</p> <p>Observe facilitator's demonstrations with appropriate weed control tools/equipment</p> <p>Participate in individual or group practical on weed control to gain hands-on experience</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals/kits, textbooks, cutlasses, hand hoes, rakes, weed pullers, herbicides, hand- weeders, chemical sprayer, etc.
Reflections and Assessments		<p>Considering the principles of sustainable development, which of the weed control methods would you adopt for your cassava farm and why?</p> <p>Observation of learners' activities during practical session</p> <p>Assessment of learners handling of weed control tools/techniques.</p>

Topic 8		Chemical Weed Control
Learning Objectives		<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> Explain what chemical weed control is all about Discuss the benefits of using chemical/herbicides to control weeds Discuss the advantages and disadvantages of chemical weed control Types of herbicides and their mode of action Identify and explain meanings of herbicides labels and symbols Develop/gain experience (skills) on how to use chemical weed control Develop safety considerations/precautionary measures in applying chemical weed control
Content		<ul style="list-style-type: none"> ✓ Chemical weed control ✓ Why use chemical to control weeds and benefits of using chemicals/herbicides to control weeds ✓ Advantages and disadvantages of chemical weed control ✓ Meanings of signs and symbols of herbicides labels ✓ How to use herbicides to control weeds in a cassava farm ✓ Safety consideration/precautionary measures in chemical/herbicides weed control ✓ Limitations to chemical weed control
Method of Delivery		<ul style="list-style-type: none"> • Classroom/field activity(ies) • Out-of-class instructional delivery • Active/field observation • Presentation of images, tools, etc. relevant to chemical weed control • Practical exercise/demonstration with appropriate tools, etc. for chemical weed control.
Learning Activities	Facilitator	<p>Presents an engaging lesson on what chemical or herbicide weed control is.</p> <p>Lead discussion on advantages and disadvantages of chemical weed control.</p> <p>Provide information to the learners on the reasons for using chemical/herbicide weed in a cassava farm.</p> <p>Lead discussions on the meanings of signs and symbols of herbicide labels.</p> <p>Demonstrate/show learners the tools/implements used in chemical/herbicide weed control. i.e. herbicide sprayer, chemicals, etc.</p> <p>Assign practical work/exercises to individual or group of learners on chemical weed control.</p> <p>Observe/monitor practical activities of learners and provide any other information as may be required.</p>
	Learner	<p>Actively listens to facilitator's presentation on chemical weed/herbicide control</p> <p>Participates and contributes to discussions on reasons for the use chemical weed control in a cassava farm.</p> <p>Observe facilitator's demonstrations with appropriate chemical weed control tools/implements.</p> <p>Participates in individual or group practicals on chemical weed control to gain hands-on experience</p> <p>Asks relevant questions from the facilitator</p>
Resources		<p>Relevant training manuals/kits, textbooks, markers, herbicides, chemical sprayer, rubber gloves, rubber boots, nose cover, face masks, chemical spraying kits, etc.</p>
Reflections and Assessments		<p>Observation of learners' involvement during practical session</p> <p>Assessment of learners handling of chemical weed control tools.</p>



Topic 9		Pre-Emergence Weed Control
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. Identify what pre-emergence herbicides are b. Identify types of pre-emergence herbicides to use for a cassava farm c. Recognize the proper time to apply pre-emergence herbicides for a cassava farm d. Develop/gain experience on how pre-emergence herbicides works
Content		<ul style="list-style-type: none"> ✓ What are pre-emergence herbicides? ✓ Types of pre-emergence herbicides, their active ingredients, and relevance to cassava farming ✓ How pre-emergence herbicides work ✓ When/how to use pre-emergence herbicides on a cassava farm.
Method of Delivery		<ul style="list-style-type: none"> • Classroom discussion • Presentation of types of pre-emergence herbicides relevant to cassava farming. • A short video clip/documentary on application of pre-emergence herbicides. • Practical exercise on how to apply pre-emergence herbicide on a cassava farm.
Learning Activities	Facilitator	<p>Presents an engaging lesson on pre-emergence weed control</p> <p>Provide information to the learners on the types, time and methods of applying pre-emergence herbicides on a cassava farm.</p> <p>Presents short video clips/documentary on pre-emergence herbicide weed control.</p> <p>OR</p> <p>Leads practical field activity to expose learners to methods of applying pre-emergence weed control in a cassava farm.</p> <p>Observe/monitor practical activities of learners and provide any other information as may be required.</p>
	Learner	<p>Actively listens to facilitator's presentation on pre-emergence weed control.</p> <p>Participate and contributes to discussions on types, time and how to apply pre-emergence herbicides in a cassava farm.</p> <p>Participate in individual or group practical on pre-emergence weed control to gain hands-on experience.</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals/kits, textbooks, short video clips, markers, pre-emergent herbicides, chemical sprayer, face masks, rubber gloves, rubber boots, nose cover, chemical spraying kits, etc.
Reflections and Assessments		<p>What pre-emergence herbicides are available for use?</p> <p>Observation of learners' involvement during classroom interaction and during practical session</p> <p>Short quizzes, group work etc.</p>

Topic 10		Post-Emergence Weed Control
Learning Objectives		At the end of the lesson, the learners will be able to: <ul style="list-style-type: none"> a. Identify post-emergence herbicides and their active ingredients (A.I). b. Identify types of post-emergence herbicides to use for a cassava farm c. Recognize the proper time to apply post-emergence herbicides for a cassava farm d. Develop/gain experience on how post-emergence herbicides works
Content		<ul style="list-style-type: none"> ✓ What are post-emergence herbicides ✓ Types of post-emergence herbicides, their active ingredients and relevance to cassava farming ✓ How post-emergence herbicides works ✓ When/how to use post-emergence herbicides on a cassava farm.
Method of Delivery		<ul style="list-style-type: none"> • Classroom discussion • Presentation of types of post-emergence herbicides relevant to cassava farming. • A short video clip/documentary on application of post-emergence herbicides application. • Practical exercise on how to apply post-emergence herbicide in a cassava farm.
Learning Activities	Facilitator	<p>Presents an engaging lesson on post-emergence weed control</p> <p>Provide information to the learners on the types, time and how to apply post-emergence herbicides in a cassava farm.</p> <p>Presents short video clips/documentary on post-emergence herbicide weed control...</p> <p>OR</p> <p>Leads practical field activity to expose learners to how they could apply post-emergence weed control in a cassava farm.</p> <p>Observe/monitor practical activities of learners and provide any other information as may be required.</p>
	Learner	<p>Actively listens to facilitator's presentation on post-emergence weed control</p> <p>Participates and contributes to discussions on types, time and how to apply post-emergence herbicides in a cassava farm.</p> <p>Participates in individual or group practical on post-emergence weed control to gain hands-on experience</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals/kits, textbooks, short video clips, markers, post-emergence herbicides, chemical sprayer, face masks, rubber gloves, rubber boots, nose cover, chemical spraying kits, etc.
Reflections and Assessments		<p>Pre-emergence or post-emergence herbicide? Which would you rather have?</p> <p>Observation of learners' involvement during classroom interaction and during practical session</p> <p>Short quizzes, group work etc.</p>



Topic 11		Caution in Pre and Post Emergence Herbicide Use
Learning Objectives		<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> Identify when and how to apply herbicides in a cassava farm Recognise active ingredients in a pre and post-emergence herbicides Classify herbicides on pre and post emergence basis. Indicate how to calculate the quantity of herbicides per hectare for application in a cassava farm Recognise the appropriate sprayer and method with which herbicides can be applied in a cassava farm.
Content		<ul style="list-style-type: none"> ✓ When and how to apply herbicides in a cassava farm ✓ List of active ingredients in a pre and post-emergence herbicides. ✓ Types of selected herbicides for pre and post emergence in cassava farming. i.e. Fusilade forte (Fluazifop-p-butyl), Primextra Gold (Atrazine and S-metolachlor), Lagon (Dimethoate 480 g/L), etc. ✓ Quantity of herbicides needed per hectare in a cassava farm ✓ Appropriate sprayer and method of applying herbicides in a cassava farm.
Method of Delivery		<ul style="list-style-type: none"> • Classroom discussion • A short demonstration on methods of determining the required glyphosate per hectare in a cassava farm. • Presentation of images, pictures, etc.
Learning Activities	Facilitator	<p>Guide an interactive session on the appropriate time to apply post-emergence herbicides in a cassava farm and how to apply it.</p> <p>Provides information on types of selected pre-emergence herbicides for pre-planting, pre and post emergence weed control in cassava farming. i.e. Fusilade forte (Fluazifop-p-butyl), Primextra Gold (Atrazine and S-metolachlor), Lagon (Dimethoate 480 g/L), etc.</p> <p>Demonstration on methods of determining the required quantity per hectare in a cassava farm.</p> <p>Show the sprayer that works best in a cassava farm and method(s) of using it.</p> <p>Observe/monitor practical activities of learners and provide any other information as may be required.</p>
	Learner	<p>Actively participate in the interactive session on the appropriate time to apply glyphosate in a cassava farm and how to apply it</p> <p>Contributes to discussions on types of selected glyphosate for pre-planting, pre and post emergence weed control in cassava farming.</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals/kits, textbooks, short video clips, markers, glyphosate, Knapsack sprayer, face masks, rubber gloves, rubber boots, nose cover, chemical spraying kits, etc.
Reflections and Assessments		<p>Why herbicides pre-cautionary measures are necessary in cassava farming?</p> <p>Observation of learners' involvement during classroom interaction and during practical session</p> <p>Short quizzes, group work etc.</p>

Topic 12	Herbicides Application. Sprayers, Spraying Methods and Steps for Calibrating a Knapsack Sprayer	
Learning Objectives	<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> Know methods of herbicides application Prepare knapsack sprayer for use Identify basic principles and steps of calibrating a knapsack sprayer for maximum results Explain/indicate the formula for calibrating a knapsack sprayer Demonstrate knapsack sprayer calibrating skills Discuss the importance/benefits of calibrating a knapsack sprayer for weed control in a cassava farm. Clean sprayer after use 	
Content	<ul style="list-style-type: none"> ✓ Reading and understanding of herbicide label, signs, and symbols such as NAFDAC registration number, manufacturing date, expiration date, precautionary measures, product's active ingredient, percentage concentration, direction for use, note to physician etc. ✓ How to prepare knapsack sprayer for use 	
Method of Delivery	<ul style="list-style-type: none"> • Lecture method • Classroom discussion/interaction • Field/site activities • Short video clips on knapsack calibration • Outdoor demonstration method • Presentation of images, pictures, etc. 	
Learning Activities	Facilitator	<p>Shows learners how to prepare knapsack sprayer for use</p> <p>Provides information on principles and steps of calibrating a knapsack sprayer for maximum results.</p> <p>Show video clips/documentaries on knapsack sprayer calibration.</p> <p>Give practical activities to learners on knapsack sprayer calibration.</p> <p>Observe/monitor practical activities of learners and provide any other information as may be required.</p> <p>Basic principles and steps of calibrating a knapsack sprayer</p> <p>Practical knapsack spraying demonstration/activities</p> <p>The importance/benefits of calibrating a knapsack sprayer for cassava farm weed control.</p> <p>How to/methods of cleaning knapsack sprayer after use</p>
	Learner	<p>Observe facilitator's demonstration of how to prepare knapsack sprayer for use.</p> <p>Actively listens to principles and steps of calibrating a knapsack sprayer.</p> <p>Watch recommended video(s)</p> <p>Carry out practical activities on knapsack sprayer calibration.</p> <p>Ask relevant questions from the facilitator</p>
Resources	<p>Relevant training manuals/kits, textbooks, short video clips, markers, knapsack sprayer, water, face masks, rubber gloves, rubber boots, nose cover, chemical spraying kits, measuring tape and pegs, stop watch, measuring cylinder, etc.</p>	
Reflections and Assessments	<p>What are the likely consequences of improper knapsack sprayer calibration?</p> <p>Observation of learners' involvement during classroom interaction and practical session</p> <p>Short quizzes, group work etc.</p>	



Topic 13		Safe Use of Herbicides
Learning Objectives		<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> a. Interpret signal words, signs and symbols inscribed on herbicides b. Identify active ingredients in pre and post emergence herbicides and percentages of their concentration c. Identify risks associated with herbicide application. d. Identify preventive and safety measures against poisonous risk of herbicides. e. Interpret the meanings of signal words/signs and symbols inscribed on herbicides f. Utilize Personal Protective Equipment (PPE) during spraying activities to prevent personal exposure to herbicide toxicity g. Demonstrate how to safely remove and maintain PPEs after spraying activities. h. Recognise the dangers associated with mixing different brands or types of herbicides
Content		<ul style="list-style-type: none"> ✓ Interpretation of words, signs and symbols inscribed on herbicides (Manufacturing dates, expiry dates, NAFDAC reg. numbers, etc.) ✓ Pre and post emergence herbicides active ingredients and percentages ✓ Risks associated with herbicide application ✓ Preventive and safety measures against poisonous risk of herbicides. ✓ Meanings of signal words, symbols and inscriptions on labels of herbicides ✓ Personal Protective Equipment safe utilisation and maintenance during and after spraying of herbicides ✓ Dangers associated with mixing herbicides of different types and brands
Method of Delivery		<ul style="list-style-type: none"> • Discussion methods • Issue analysis • Demonstration with relevant materials/resources • Video clips on signs, symbols, etc. inscription on herbicides • Presentation of images, pictures, etc.
Learning Activities	Facilitator	<p>Guide discussion on risks associated with herbicides especially during application</p> <p>Itemise preventive and safety measures against poisonous risks of herbicides and guide the learners to list theirs.</p> <p>Demonstration on the interpretation of herbicides label</p> <p>Show video clips/documentaries on how to identify signs, symbols and signals of labels on herbicides.</p> <p>Demonstrates to learners how to safely utilize Personal Protective Equipment during and after herbicide spraying activities</p> <p>Observe/monitor practical activities of learners and provide any other information as may be required.</p> <p>Guide discussion on the attendant dangers of mixing herbicides of different types and brands.</p>
	Learner	<p>Actively listens and participates in discussions on risks associated with herbicides</p> <p>Participates in listing preventive and safety measures against poisonous risks of herbicides</p> <p>Watch recommended video(s)</p> <p>Carry out practical activities on Personal Preventive Equipment utilisation</p> <p>Ask relevant questions from the facilitator</p>

Resources	Relevant training manuals/kits, textbooks, short video clips, markers, knapsack sprayer, water, face masks, rubber gloves/chemical resistant, rubber boots, chemical proof aprons, dust mask/nose cover, chemical spraying kits, disposable jump suit, goggles, etc.
Reflections and Assessments	When appropriate safety measure is not strictly adhered to who suffers the consequences? Observation of learners' involvement during classroom interaction and practical session Short quizzes, group work etc.

ACTIVITY 3: Weed identification, herbicide selection, knapsack calibration and proper usage of PPE



Estimated time: 4 hours

Facilitator/Demonstrator	Resources required
<ul style="list-style-type: none"> The facilitator demonstrates by showing different types of weeds (broad leaves, narrow leaves, perennial, annual, etc., types of weeds). Presents different herbicides for different types of weed (both pre-emergence and post emergence), show how to identify the types of herbicides, mixture rates, mode of action (contact or systemic), stages at which they can be applied, etc. Demonstrate herbicide application using knapsack sprayer. How to calibrate your knapsack sprayer and spraying techniques. Demonstrate the use of complete Personal Protective Equipment (PPE) while handling herbicides. How to maintain your PPE. 	<p>The fertile land used in activity 1.</p> <p>A good, healthy cassava field with weeds or any field where different types of weed can be observed especially weeds that are likely to be found in a cassava field.</p> <p>Clean water (100 litres), different types of herbicides e.g., glyphosate (Roundup Turbo, Touchdown Forte, Delsate, Sarosate, Glycel, Force up, Clearweed, etc), Fusilade forte, Primextra Gold (S-Metolachlor + Atrazine), Lagon (Aclonifen + Isoxaflutole), etc. knapsack sprayer, measuring cup, funnel, bowl, flip chart and stand, markers, complete sets of PPE, etc.</p>



THEME III: CASSAVA HARVESTING AND ITS USES

Topic 14		Managing Soil Fertility in Cassava
Learning Objectives		At the end of this session, learners should be able to: <ul style="list-style-type: none"> a. Explain the importance of soil fertility in cassava production. b. Identify/describe the signs of a fertile soil. c. List the features of a fertile soil. d. Differentiate between fertile and non-fertile soil.
Content		<ul style="list-style-type: none"> ✓ The Importance of soil fertility in cassava production ✓ Description/signs of a fertile soil. ✓ Features of a fertile soil. ✓ Difference between fertile and non-fertile soil
Method of Delivery		<ul style="list-style-type: none"> • Lecture Method • Demonstration method • Classroom Discussion • Presentation of images, pictures, video clips or documentaries.
Learning Activities	Facilitator	<p>Describe a fertile soil</p> <p>State the importance of fertile soil in cassava production.</p> <p>Guide classroom interaction on the contents i.e. type of soil(s) that are required for cassava production, factors to consider in cassava site selection, features of a good soil, etc.</p> <p>Present learners with relevant images/visuals to concretise learning.</p> <p>Provide any other information as may be required.</p> <p>Ask learners relevant questions for feedback(s) on their learning.</p>
	Learner	<p>Actively listens to facilitator's explanations and illustrations</p> <p>Participates in classroom interactions.</p> <p>Give suggestions on how they identify fertile soil in their localities</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals, textbooks, marker pen, images/pictures, etc.
Reflections and Assessments		<p>Observation of learners' activities during practical session</p> <p>Assessment of learners' display of understanding of a fertile soil.</p>



Topic 15		Cassava Harvesting and Processing
Learning Objectives		<p>At the end of the lesson, the learners will be able to:</p> <ol style="list-style-type: none"> Explain when cassava is ready for harvesting. Identify the best weather/season for cassava harvesting. State the benefits of timely harvesting and implications of late harvesting of cassava. Identify methods of harvesting cassava Recognise the storage limitation of cassava after harvesting. Identify the different products cassava can be processed into. State processing procedure(s) for cassava tubers. Value addition, packaging and labelling of cassava products.
Content		<ul style="list-style-type: none"> ✓ When is cassava ready for harvesting? ✓ Suitable weather/season for cassava harvesting. ✓ Benefits of timely harvesting and implications of late harvesting of cassava. ✓ Methods of harvesting cassava. ✓ Storage limitations of cassava after harvesting. ✓ Types of products that cassava can be processed into. ✓ Cassava tubers processing procedure(s) i.e. traditional and mechanised ✓ Packaging, labelling and NAFDAC registrations
Method of Delivery		<ul style="list-style-type: none"> • Lecture method • Discussion methods • Presentation of pictures, images, realia, etc. • Short video clips showing methods of harvesting cassava.
Learning Activities	Facilitator	<p>Present an engaging lecture on when cassava is ready for harvest and the suitable weather to harvest cassava</p> <p>Lead discussions on benefits of timely harvest and implications of late harvest of cassava.</p> <p>Show video clips/documentaries on methods of harvesting cassava.</p> <p>Guide learners to discuss storage limitations of cassava after harvesting.</p> <p>Promote interaction among learners to identify cassava products.</p> <p>State processing procedures for cassava tubers.</p> <p>Provide any other information as may be required.</p>
	Learner	<p>Actively listen to facilitator's presentation on when cassava is ready for harvesting</p> <p>Participate in classroom interaction/discussions on benefits and implications of timely and late harvesting of cassava.</p> <p>Identify cassava products common in their locality.</p> <p>State common cassava tuber processing procedure(s) in their locality.</p> <p>Watch recommended video(s)</p> <p>Ask relevant questions from the facilitator</p>
Resources		Relevant training manuals/kits, textbooks, short video clips, markers, Pictures/images, cassava harvesting tools, etc.
Reflections and Assessments		<p>What other factors will you consider when harvesting your cassava?</p> <p>Observation of learners' involvement during classroom interaction</p> <p>Short quizzes, group work etc.</p>

Activity 4: A visit to cassava processing center.



Estimated time: 4 hours

Facilitator/Demonstrator	Resources required
<ul style="list-style-type: none">• The facilitator organizes a study visit to two or more different cassava fields showing comparison of different weed control methods and their results.• Visit to a cassava processing center to see different products that can be made from cassava and the processing methods.• Any mechanical harvester.	<p>A vehicle to convey the number of participants to the sites.</p> <p>Arrangements with the centers to fully demonstrate their activities.</p>



