

# CA with Root Crops

## Learning Outcomes – Participants will:

1. Realize that CA is also possible for Root crops
2. Understand the challenges and limitations of using CA in root crops
3. Practice CA with root crops

## Pre-Requisites:

1. Situation Analysis: (Why CA? What is CA?)
2. Participants should already have experience using CA with grain crops

**Timing of this Lesson:** This lesson should take place 3-4 weeks before the time of planting

## References and further reading:

-  CFGB. 2017. Conservation Agriculture for Root Crops. [Conservation Agriculture Newsletter](#), June 2017.
- Fasinmirina, J. T. a. J. M. R. 2011. [Conservation tillage for cassava \(\*Manihot esculenta crantz\*\) production in the tropics](#). Soil & Tillage Research, 113, 1-10.
- Howeler, R. H., Ezumah, H. C., & Midmore, D. J. 1993. [Tillage systems for root and tuber crops in the tropics](#). Soil Till. Res., 27, 211-240.
-  FAO. 2013. [Save and Grow Cassava - A Guide to Sustainable Production Intensification](#). FAO, Rome.

## Materials Needed:

1. Posters: “Conservation Agriculture” and “CA Root Crops”
2. Magic markers & flip chart
3. A field already planted to CA root crop (if possible)
4. or pictures of root crops under CA (see Appendix B)
5. A plot of land for practical demonstration
6. Root crop seeds/cuttings
7. Manure, compost and/or fertilizer
8. Hoes for a half the number of participants
9. 2 machetes
10. Tape measure
11. Planting string/teren rope
12. Wood stakes

## Preparation:

1. Review all discussion questions and be prepared to guide the discussion appropriately.
2. Be familiar with agronomic recommendations for the common root crops in the area.
3. If possible, organize this training near a field already planted to root crop using CA.

## Learning Activities (Total time required = 3 hours)

### I. Introduction: (30 minutes)

#### A. Role Play

1. Use a role play between two farmers: one argues that it's not possible to grow root crops with CA, and the other one argues that it's possible. *Make sure during the discussion they bring out the challenges (why CA is not commonly used for the root crops) and the advantages.*

#### B. Discussion Questions:

1. Have any of you tried CA on any root crops?
2. If "yes," please tell us your experience
3. What are the main challenges in using CA for root crops?
4. *Explain that the goal of this lesson is to discuss how to use CA on root crops commonly grown in their area.*

### II. Discussion of CA Strategies for Root Crops: (60 minutes)

A. How is growing root crops different from growing grain crops? *Allow participants to give their answers, but be sure they mention the following:*

- Roots need to expand and develop in soil
- Good water drainage is important for some root crops
- Some root crops need to be grown on hills or ridges
- Soil is disturbed during harvesting

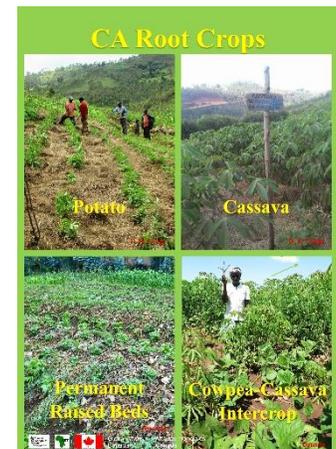
#### B. CA Principles with root crops

##### 1. Present the CA Poster:

- a) What are the 3 principles of CA?
- b) Which of these principles is most difficult to practice with root crops? *Explain that Minimum Tillage does not always mean zero tillage. The key strategy is to use the least soil disturbance possible. If soil is poorly drained, CA root crops can be grown on permanent raised beds.*

##### 2. Present the CA Root Crops Poster:

- a) What CA principles do you see being used in these pictures?
- b) Which of these practices could be used in your community?



### **C. Facilitation towards a systematic CA application/adoption**

1. Taking into account these considerations, which root crops can you try to produce with CA?
2. How can you use CA on these crops?
  - *For each CA principle, discuss ways to apply it for the root crops they have chosen. Write these on a flip chart for all to see*

### **III. Demonstration of CA Root Crops (1.5 hours)**

#### **A. Visit an established CA field with a root crop if available**

#### **B. Practical demonstration**

- Go to a piece of land where participants will be involved in planting a root crop under CA principles.
- Ask them to review the strategies they have chosen (written on the flip chart) for respecting the CA principles in planting this root crop
- Plant the plot using the discussed CA techniques
- *As root crop techniques differ from region to region and crop to crop, use practices adopted and deemed appropriate to the local situation.*

#### **C. Debriefing and concluding discussions**

1. Ask if they have any unanswered questions or issues
2. Action planning: Ask what they will put into practice on their farms: Which crops? When?

## APPENDIX A: ROOT CROP PRODUCTION TECHNIQUES UNDER CA FROM DIFFERENT CONTEXTS

### Cassava production under CA: Experiences from Rwanda, DR Congo and Ethiopia

<i>Steps</i>	<i>DR Congo<sup>1</sup></i>	<i>Ethiopia<sup>2,3</sup></i>	<i>Rwanda</i>	<i>Comments from the writer and document references</i>
<b>Land preparation/Tillage</b>	<p>Slightly disturb the soil while ploughing/making ridges on hard soils for the first time, and making planting stations while the soil is not much compacted</p> <p>Hole: 10-20 cm depth</p> <p>Mulch before or after planting depending on mulch availability</p>	<p>Piece of land is covered with mulch before or when the dry season starts</p> <p>Planting stations dug to put cassava cuttings</p> <p>No beds, but soil heaped around the plant during planting time</p> <p>No more cultivation, but add mulch around the plant to keep soil moisture and let the mulch material decompose</p>	<p><b>Scenario 1:</b> Deep Planting holes: - 30-40 cm depth; - 40-50 cm wide With much manure then cover with the topsoil then mulch before planting 1 cutting/hole</p> <p><b>Scenario 2:</b> Plant on mounds: For the first time, create ridges of 70-60cm width and 30-40 cm distant; then and for the following seasons dig planting holes of 20-30 cm depth on ridge top</p>	<p>Planting cassava without prior tillage in degraded soils may produce lower yields in the initial years; once soil health is restored, however, untilled land can produce high yields at a lower cost.</p>
<b>Fertilization</b>	<p>Farmers use manure or compost, 2-3 handfuls/hole. No inorganic fertilizer</p>	<p>Some farmers apply compost in the planting station a week or more ahead of planting, then cover with mulch. No inorganic fertilizer</p>	<p>Compost and/or manure @ 2-10 kg/planting station. No inorganic fertilizer though cassava is among subsidized fertilizer crops in Rwanda</p>	<p>Farmers can improve soil fertility by intercropping legumes, and mulching boosts root yields. When combined with fertilizer, alley cropping with leguminous trees and the use of organic compost or farmyard manure can produce</p>

<sup>1</sup> Experience from Muku FS Project and our interviews and observation

<sup>2</sup> Experience from Terepeza Development Association (TDA) of Wolaita Kale Heywot Church

<sup>3</sup> Cassava is now becoming cash crop. Farmers produce it for house consumption and markets as well

<i>Steps</i>	<i>DR Congo<sup>1</sup></i>	<i>Ethiopia<sup>2,3</sup></i>	<i>Rwanda</i>	<i>Comments from the writer and document references</i>
				higher crop yields and net incomes
<b>Planting modes and spacing</b>	1 cutting/station Oblique position  1x1 m <sup>2</sup> spacing	Use their usual depth and spacing.	Cutting planted obliquely following the sunrise direction.  1x1 m <sup>2</sup> spacing	When grown as a monocrop, cassava is usually planted with spacing of 1x1 m, making 10,000 plants per hectare.  Stems of 15-20 cm long from healthy stems have a higher rate of sprouting and produce higher root yields. Plant in an upright position.
<b>Intercropping</b>	Some farmers have started trying some GM/CCs	Intercrop 1-2 rows of pigeon pea between two rows of cassava.	Not intercropped where tried under CA	Growing cassava in associations, sequences and rotations increases net income, reduces the risk of crop failure, and supplies additional food for the household. Plant the space between cassava rows with early maturing legumes, including common beans, cowpeas, and groundnuts.
<b>Pesticide application</b>	Use of green/liquid manure as fertilizer locally made from different crops (Titonia, pepper, etc.) but also against some cassava pests	No use of chemicals in a CA experience so far.	No chemical treatment	Farmers should plant varieties with tolerance or resistance to cassava mosaic and brown streak where it is present. Use ecological practices, such as mulching, maintaining soil organic matter, and intercrops to provide a habitat for pest predators.

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<b>Weeding</b>	Manually uprooting some weeds		Manual weeding, though there are not many weeds once mulched.	Mulch and cover crops help to reduce weed infestations. Optimum planting density, fertilization, and varieties with vigorous early growth suppress weeds.
<b>Harvesting, post-harvest handling and use</b>	Uproot plants by hand since due to mulching & moisture the soil becomes lighter	Famers take care to minimize soil disturbance by carefully uprooting cassava.	In sandy soils it's easy to uproot the whole plant with most of the tubers. Using a hoe for the remaining ones.	Uprooting with less much use a hoe. The root is not the only useful part of the plant– young cassava leaves make a nutritious vegetable, and plant tops can be fed to cattle, pigs, chickens and silkworms
<b>Yield potential</b>		Since mulch helps improve soil moisture, cassava tubers with CA yield more in less time than the conventional farming	Harvest up to 6 kg from one plant	Yields range from 6.5 to 40 tons/ha, and can be harvested between 8-20 months depending on variety and soil

**Potato production under CA - Experience from Peace & Development Network, Rwanda**

**Steps:**

- 1- Dig planting stations with minimum disturbance
- 2- Mulch mostly between rows
- 3- Manure (1-2kg/hole)
- 4- Plant on 40x60 cm spacing
- 5- Weed manually

Pictures taken in Musanze (l) and Burera (r)



