

## ACTION FOR LIVELIHOOD ENHANCEMENT IN NORTHERN UGANDA (ALENU)

### AGROECOLOGICAL GUIDE FOR ONION PRODUCTION



## Trainers' Guide

November, 2020



## ACKNOWLEDGEMENTS AND **DISCLAIMER**

This manual is developed by a consortium consisting of four NGOs (Caritas Switzerland, Advance Afrika, Agency for Accelerated Regional Development, and Gulu Women Economic Development and Globalization) for the implementation of the Action for Livelihood Enhancement in Northern Uganda (ALENU) Project that is funded under the Development Initiative for Northern Uganda (DINU), a government of Uganda programme supported by the European Union (EU) and supervised by Office of the Prime Minister.

The manual formulation process included a review of a number of manuals for which we are indebted, namely:

- Infonet Biovision website: <https://infonet-biovision.org/>

Pictures and text extract of these sources have been used in this manual.

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## ABOUT ALENU PROJECT

Under the Development Initiative for Northern Uganda (DINU), a Government of Uganda programme supported by the European Union (EU) and supervised by Office of the Prime Minister, Caritas Switzerland has received a grant to implement the Action for Livelihood Enhancement in Northern Uganda (ALENU). ALENU is implemented by a consortium consisting of four NGOs (Caritas Switzerland, Advance Afrika, Agency for Accelerated Regional Development, and Gulu Women Economic Development and Globalization).

### **Objectives and Results**

ALENU is a 40-month action that focuses on improving livelihoods through increased and diversified food production, enhanced market opportunities and better maternal and child nutrition in six districts of the West Nile and Acholi sub-regions. Its overall objective is, “to consolidate stability in Northern Uganda, eradicate poverty and under-nutrition and strengthen the foundations for sustainable and inclusive socio-economic development.” And the specific objective: is, “to increase food security, improve maternal and child nutrition, and enhance household incomes through support to diversified food production and commercial agriculture and through improving household resilience (notably to climate change) and women empowerment. The three main result areas are: Result 1.1: Increased production of diversified food; Result 1.2: Increased market accessibility; and Result 1.3: Improved nutritional status

### **Districts and Sub Counties**

Agago (Wol and Lokole); Amuru (Amuru and Lamogi); Omoro (Odek and Lakwana); Nebbi (Erussi and Atego); Pakwach (Pakwach and Panyimur); Zombo (Kango and Athuma)

## Main Activities

### Result 1.1: Increased production of diversified food

Select HHs; develop Family Development Plans; develop seasonal Production and Marketing Plans; set up group demonstration gardens; conduct farmer field school sessions; facilitate outreaches by local government extension staff; organize seasonal agro-input fairs; build capacity of agro-input suppliers; form commodity-based cooperatives; train VSLA Mentor; train Farmer Group (FG) members in VSLA; link SACCOs/ progressive FGs with formal banks.

### Result 1.2: Increased market accessibility

Provide FGs with Business Development Services; organize/ promote sub-county farmer markets; facilitate learning visits to model farmers/private sector actors; create added value for commodities; organize a multi-stakeholder platform and annual cross-sector dialogues; achieve progress in certification, quality control, branding and contracting.

### Result 1.3: Improved nutritional status

Train VHTs/Health Workers on good nutrition practices, child health, family planning and WASH; empower cultural and religious leaders to sensitise community; increase access to prevention and curative health services; improve nutrition and sanitation practices at HH level; train VHTs on family planning, provide family planning services; conduct annual couples conference and community dialogues on family planning/GBV; conduct community dialogues for out-of-school adolescents on sexuality/ family planning, provide health services; advocate for supplies of FP commodities; facilitate debating clubs and youth peer groups in schools; collaborate with faith-based medical bureau.

## Approaches

- **Holistic Family-Centered Approach:** All household members will benefit from a combination of bundled services customized to meet their specific needs, address their vulnerabilities and strengthen their capacities at the collective and the individual level and in view of reducing poverty and malnutrition.
- **Village Savings and Loan Association (VSLA) and Linkage Banking:** Provide simple savings and loan facilities in a community that does not have easy access to formal financial services. Strong VSLAs will be registered at district level and linked to formal financial institutions or federated into SACCOs for better financial inclusion.
- **Farmer Field School (FFS) with Peer-to-Peer Demonstration-based Extension Approach:** Promote practical knowledge among smallholders on improved technologies through participatory, experimental, problem solving

and discovery-based learning and hence increase yields, food adequacy and collective marketing for better market positioning.

- **Market Systems Development (MSD) and Value Chain Approach (VCA):** Make markets work for the benefit of the poor by tackling the underlying causes of market failure and strengthening the functions of market actors as well as the rules and norms that govern the market system.
- **Agro-ecology:** Apply ecological and social concepts and principles to the design and management of food and agricultural systems to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food system (FAO).

## Key stakeholders

Stakeholder	Role
<b>Target farmers and their households</b>	Main beneficiaries, participate in selection of market commodities and peer-extension agents (CBTs, Poultry Paravets, Agroecology Champions, VSLA Mentor and Market Committee Members), various capacity building activities and monitoring and learning meetings
<b>Local Governments</b>	Oversee implementation of activities and align the Action with the district priorities, involved from planning stage and play a major role throughout the implementation as advisors, extension workers, or beneficiaries of capacity building
<b>Community members</b>	(VHTs, cultural and religious leaders, senior women and male teachers, youth Mentors), contribute to changing attitudes and practices, involved at all project cycle stages.
<b>Private sector</b>	Expand market system and offer production inputs (seeds, tools, etc.), loans, services (market information, advisory service, quality control, vet services etc.), transport and, as traders and processors, purchase the products of target farmers and farmer groups
<b>Advance Afrika, AFARD, Gwed-G</b>	Local implementing partners, in charge of implementation based on a mix of geographical and technical division of responsibilities
<b>Caritas Switzerland</b>	Consortium coordinator and donor, ensures independent project supervision, in charge of MEL and quality assurance including capacity building of co-applicants, and the development of a network of strategic contacts with development partners
<b>Ugandan Government</b>	Supervising (OPM) and contracting authorities (National Authorizing Officer/ Ministry of Finance, Planning and Economic Development)
<b>EU</b>	Main donor

Beneficiaries total 35'900 individuals (farmers and their household members, local government officers, community and private sector members, and the staff of implementing partners).

## **0. Training concept**

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### **0.1. Pedagogical approach**

The training is based on elements of the FFS approach and adult learning theories. The following elements are important:

- The training should be conducted in a participatory and highly interactive way because involvement and learning are enhanced when participants contribute to the discussion. It is therefore essential that participants are encouraged to share their own experiences before the theoretical material is brought to them.
- Similarly, practical exercises, where participants apply what they learn directly in a demonstration field, will enhance learning.
- The demonstration field should be located on the farm of one of the participants (host farm). All training sessions will take place in this field. The host farmer must look after the field between training sessions.
- The training plan must follow the cropping calendar for the product concerned, so that the farmer can apply what he has learned directly at home (see the proposed training calendar below). Ideally, the participants should meet every week or second week on a learning cycle comprising 8-10 meetings.
- Where appropriate, encourage participants to try different things and make small “experiments”, either at home or on the demonstration field (for example, applying different types of fertilizer) and observe the effect these treatments can have on the crop.
- If possible, the facilitator should visit farmers in their fields to give them feedback on how they implement their crop at home and help them find solutions to the problems they face.

The participatory method and learning-by-doing will create a direct link between the training and the challenges farmers face when implementing new techniques at home. This will enable them to develop their observation and innovation skills and to find solutions on their own to the problems they may face. It is recommended to start each training session with the practical part, before the facilitator gives technical advice at the end of the training sessions.



The training should promote as much as possible a production that includes the principles of agroecology. The general principles of agroecology are described in Chapter 0.2. These general principles can be explained and discussed during the first training session.

Specific aspects of agroecology, such as soil fertility management, crop rotation, pest and disease management, are discussed in more detail in the corresponding chapters and in a separate booklets. They should be explained and discussed during training sessions devoted to these topics.

### **Recommended structure of a training session:**

- 1. Welcome**
- 2. A look back at what has happened since the last meeting.** (10-20 minutes)  
**In the participant fields:** Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their successes and ask questions if they have any.  
**In the demonstration field:** Also take a few minutes to observe with the participants what has happened in the demonstration field since the last session. What has changed, how have the plants grown? What disease problems can be seen? Do they find insects, other organisms? How is the soil, the humidity, etc.? Facilitators can ask the participants to focus on aspects related to the topic of the day.
- 3. Introduction of the topic of the day and short brainstorming to identify what the participants know already about this topic.** (10-20 minutes)  
For each chapter, some guiding questions are proposed to stimulate the discussion.
- 4. Exercises in the field (2 hours).** Practical aspects of the topic of the day are directly applied in the field by the participants, with the support of the facilitator. The participants shall then apply these techniques at home as well.
- 5. Summary (20-30 minutes):** the facilitator summarizes important aspects of what has been learned during the sessions and give some more technical advice if necessary.

### **Recommended training program**

It is important that the training units are delivered at a time that is appropriate to the crop production schedule, so that participants are then able to apply the new knowledge gained directly at home.

Where appropriate, some training units may be combined (e.g., common varieties (Unit 1) and nursery establishment (Unit 3)). Other units may also be offered in two separate sessions to address or deepen different aspects (e.g., pest and disease management (Unit 6)).

Topic	Duration	Timing
1. Importance of onion growing and common varieties in Uganda. What is agroecology?	2-3 hours	4 weeks before planting time
2. Land selection and preparation (including soil fertility management)	3 hours	4 weeks before planting time (ev. 2 sessions)
3. Nursery establishment and management	3 hours	4-6 weeks before planting
4. Transplanting	3 hours	Day of planting
5. Weeding	3 hours	3-4 weeks after planting
6. Pests and diseases management	2 sessions of 3 hours	5-10 weeks after planting
7. Harvesting	3 hours	Week 17-20 after planting
8. Record keeping and gross margin calculation	2 sessions of 2-3 hours	Before/during the cropping season. End of cropping season

## 0.2. What is agroecological farming?

Agroecology is farming that aims at feeding a growing population while conserving and nurturing the natural resource base. Agroecological farmers want to improve food yields for balanced nutrition, strengthen fair markets for their production, enhance healthy ecosystems, and build on traditional knowledge and customs. Their objective is to create stable food production systems that are resilient to environmental perturbations such as climate change and disease.

Agroecology views farmland as an ecosystem – a complex network in which every living and nonliving component of the system is important and affects every other component, either directly or indirectly. Since farmland provides many services to us humans (such as food production, clean water or biodiversity) we have to take care of it. Key principles of agroecological farming therefore include:

- Protect the environment and use natural resources efficiently and sustainably;
- Reduce the use of chemicals as far as possible;
- Make use of organic/biological measures and resources, and try to recycle what you can;

- Rather prevent problems (such as pests and diseases) than having to treat them;
- Let nature help you;
- Practice agriculture for the good of people and the environment.

Topics in which agroecological farming differs particularly from conventional farming are especially soil fertility management and pest and disease management<sup>1</sup>.

### **Soil fertility management**

Instead of simply using chemical fertilizers to boost crop growth, agroecological soil fertility management considers crop rotations or intercropping with legumes (that can fix nitrogen from the air ), the use manure and compost, and beneficial organic matter management to keep soils healthy and fertile. Reducing tillage operations and protecting the soil with a permanent cover helps maintaining the soil fertile and healthy. Some practical guidelines on how to prepare and use soil fertility amendments are given in a separate leaflet.

### **Pest and disease management**

To reduce the use of chemicals as far as possible, agroecological pest and disease management applies many practices to prevent pests and diseases from building up and creating losses:

- Cropping patterns such as crop rotations, intercropping, or trap/catch/push crops can break pest and disease cycles (and provide numerous other benefits), while anti-parasite crops may scare away (repel) or trap certain pests;
- Use resistant and tolerant varieties (quality seed, seed treatments, ...);
- Strong plants are less susceptible to pests and diseases (soil fertility, micro-climate, weeding, nurseries, effective micro-organisms and the like, ...);
- Introduce and nurture beneficial organisms (habitat, e.g. agroforestry, to enhance diversity);
- Adequate fertilization and irrigation (not too much N or humidity);
- Physical control: traps, enclosures/netting, by hand, scaring away, removing diseased plants, ...;
- Organic pesticides: produced by farmers, small businesses;
- Go regularly to the field and observe thoroughly.

Some recipes and guidelines to produce and use such measures are explained further-on or in a separate leaflet.

<sup>1</sup>and efficient irrigation, sustainable water use

# 1

## Importance of onion growing and common varieties in Uganda

### A. Learning objectives

At the end of this session, participants will:

- Understand the importance of onion growing for income and nutrition
- Have reflected on the reasons why they would like to grow onions
- Know the characteristics of different varieties of onions commonly grown in Uganda and be able to choose varieties adapted to the growing conditions of their farm and production objectives.
- Understand the principles of agroecology

### B. Duration

1.5 hour

### C. Learning aids

- Flip charts
- Marker pens
- Masking tape
- Training manual
- Different varieties of onions (if available) or pictures of these varieties

### D. Activities and exercises

#### Introduction (20 minutes)

The trainer will introduce the topic of the day. He may discuss the following questions with the participants:

- Why is it important for you to grow onions? How will onion production fit within your farms? For which purpose do you want to grow onions (self-consumption, as a source of income)?
- What could be the benefit to grow onions?
- What could be the main problems for you to grow onions? How to overcome these problems?

- What do you know about agroecology? What does it mean in onion production?

### Exercise choosing the right variety (30 minutes)

The facilitator gathers on a table a sample of the onion varieties available in Uganda (or pictures of them, if fresh onions are not available).

The facilitator asks the participants to discuss (either in groups first, or directly in plenum) the following questions:

- Which of these varieties / plant types do you know, how do you call them?
- Which one have you already grown, eaten? Which one do you prefer and why?
- What advantages and disadvantages do you know from these varieties / plant types?
- Which variety would you choose to grow for which purpose

The exercise can be closed by a degustation of the different varieties!

### Summary by the facilitator (30-60 minutes)

- The facilitator summarizes the discussion by explaining the importance of growing onions and presenting the information concerning the different varieties of onions.
- He summarizes the main principles of agroecology and point out that these principles will be addressed in specific sessions during the whole production cycle
- He explains which varieties of tomatoes are more adapted to an agroecological production and why

## E. Content

### 1.1 The importance of growing onions.

Onion is a biennial vegetable grown in temperate regions as an annual crop. Onions are especially suitable for smallholder farming in many countries because they require a small amount of initial capital. Onions require a small piece of land and they take a relatively short time to mature. Onions can be grown year-round in the tropics where irrigation is possible. The crop also plays an important role in medicine.

Onion are mainly grown because of the following reasons.



- For food – they form an important ingredient of various dishes as sauce or salads
- For generating income- they are high income crops and easy to sell

## 1.2 Qualities of a good seedling for transplanting

The facilitator should emphasize that if seedlings is not properly managed in the nursery bed, they may not be very good for transplant, the trainer should emphasize the key qualities to consider when one is buying or selecting good seedlings for transplanting.

- Healthy and disease-free seedling
- Vigorous growth
- Have 4-6 true leaves
- Pencil thickness
- Free from physical deformities


It is recommended to purchase seed/seedling from a reputable supplier/stockist. Seedlings sourced from unreliable suppliers may affect production through the following:




- Variety not true to type
- Uneven bulb size
- Bulbs ripening at different time
- Reduced yields level
- High persistence of pests and diseases

## 1.3 Selected varieties of onions commonly grown in Uganda



Which variety to choose depends on local conditions and the purpose of growing and intended use (self-consumption, selling in the village, on supermarket, for hotels, processing). Therefore, it is important to think about the intended use of the onion you will cultivate, the market preferences, and to choose the varieties accordingly

The common onion varieties grown in Uganda are Bombay red and Red Creole. These varieties have only medium yield potentials, but they are very popular. Other onion varieties are the hybrids Jambar F1, Red Passion F1, Red Pinoy and Early Red Max.

Variety	Maturity	Yield	Attributes
Red Creole 	150 days after transplanting	16,000 kg per acre	<ul style="list-style-type: none"> <li>• A popular variety which produces red, flat-round, globular bulbs</li> <li>• It has very pungent taste</li> <li>• Excellent in storage</li> </ul>

<p>Bombay Red</p> 	<p>150 days from transplanting</p>	<p>16,000 kg per acre</p>	<ul style="list-style-type: none"> <li>• Variety for dry and warmer conditions</li> <li>• Produces small to medium sized bulbs, which are globe shaped, deep purple red color.</li> <li>• Good storage capability and transport</li> </ul>
<p>Jambar F1</p>  <p><b>Figure 1 Source: Farming with Michael</b></p>	<p>90 days from transplanting</p>	<p>25'000 kg per acre</p>	<ul style="list-style-type: none"> <li>• Short day variety, requires 11-12 hours of day length to perform well</li> <li>• Suitable for both cool and warm areas</li> <li>• Early maturing variety</li> <li>• The bulbs are deep red and uniform (large -extra large)</li> <li>• Shelf life of 6 months after proper curing and harvesting</li> </ul>
<p>Red Passion F1</p>  <p><a href="https://www.smartfarmingug.com/product/red-passion-f1/">https://www.smartfarmingug.com/product/red-passion-f1/</a></p>	<p>120 days</p>	<p>25'000 kg per acre</p>	<ul style="list-style-type: none"> <li>• Deep red hybrid onion</li> <li>• Very good drying and keeping quality</li> <li>• Tolerant to pink rot disease</li> <li>• Produces good grade onions</li> <li>• Uniform maturity</li> <li>• Can store for up to 6 months</li> <li>• Plant spacing 30×10</li> </ul>



<p>Red Pinoy</p>  <p><a href="https://www.royalseed.biz/onions.php">https://www.royalseed.biz/onions.php</a></p>	<p>90 days from transplanting</p>	<p>25'000-30'000 kg per acre</p>	<ul style="list-style-type: none"> <li>• Well adapted to rainfed and irrigation</li> <li>• Strong pungency</li> <li>• Long shelf life of up to 6 months at room temperature</li> <li>• Deep red attractive bulbs with a high market demand.</li> </ul>
<p>Early Red Max</p>  <p><b>Figure 2 Early Red Max</b> (Source: East African Seed Company)</p>	<p>75-90 days after transplanting</p>	<p>20'000-25'000 kg/acre</p>	<ul style="list-style-type: none"> <li>• early maturing</li> <li>• high yielding with medium sized globe shaped red bulbs at maturity stage</li> <li>• highly demanded in the market</li> </ul>



# 2

## Land selection and land preparation for onion planting

When: 4 weeks before transplanting (possibly together with chapter 1)

### A. Learning objectives

After completing this module, participants will:

- Understand the factors to consider in selecting a suitable site for onion production
- Understand how onion plants interact with other plants and how to plan crop rotation considering spatial and temporal arrangement of onion plants.
- Learn the best practices of land preparation for onion production.
- Know how to manage soil fertility and how to prepare compost and manage manure (can be addressed in a separate session – see separate leaflet for Activities and exercises and content)

### B. Duration

3 hours

### C. Learning aids

- Land where the onion plot will be implemented
- Tools for land preparation such as Hoes, Pangas, Slashers, Axes

### D. Activities and exercises

**Look back at what has happened since the last meeting.**(10-20 minutes)

Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their successes and ask questions if they have any.

## **Introduction and practical selection of the land for the onion plot (1 hour)**

This activity should take place directly in the area where the onion plot will be implemented

1. The trainer introduces the topic of the day. He then asks the participants and discuss with them the following questions with the participants, possibly directly in the area where the onion plot will be implemented:
  - How would you choose an appropriate site for growing your onions?
  - Which aspects would you look at or take into consideration?
2. Based on the discussion, the participants are asked to list the criteria on a flip chart.
3. The facilitator asks then the participants to choose the right location to implement the onion plot and justify their choice. Alternatively, they can assess the plot that has already been selected using the criteria that have been discussed.

## **Exercise: preparing the land for onion plantation (1 hour)**

The participants, together with the facilitator, will practically prepare the land for onion plantation.

## **Optional: Exercise soil fertility management and compost and manure management**

- › see separate leaflet Soil fertility management

## **Facilitator's summary (30 minutes)**

- › The facilitator sum up important points of land selection and proper land for onion production based on the aspects presented in the sub-chapter E. Content below and on the separate leaflet Soil fertility management

## **E. Content**

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### **Land selection for onion growing**

- Onions grow well in sandy loam soils with good fertility. Fertility can be seen from the vegetation growing in the area.
- Soils with small gravels are suitable for onion production.
- The land should not be prone to flooding and it should have a gentle slope to facilitate drainage.
- There should not be many trees as they will lead to lots of shade in the field and yet shade affects the development of onions.
- The land should not have been used for production of onions or garlic in the last 1 year. This will help minimize pests and diseases build up.

### **Crop rotation is essential to minimize pest and diseases!**

- Crop rotation is a major component of organic farming, affecting both soil conditions and pest cycles.
- Wait 3-4 years before planting onions again at the same location
- A rotation with non-solanaceous crops for 3-6 years will avoid pest problems in onions.

### **Land preparation for onion growing**

- The land must be dug and allowed to rest for at least one month. During this period, there is also decomposition of the trash/rubbish to manure for improved soil fertility.
- Deep ploughing by use of hand hoes or tractors is recommended to remove most of the weed roots and soften the soil for easy movement of water and air in the soil, but also make it easy for bulb formation and expansion.
- Second tillage is then done to produce a fine bed. This will improve crop establishment and growth.
- Apply mulch to conserve soil and water and reduce evaporation.
- If you are planning to plant in the second rains, open your land (1st digging) at the end of the 1st rains. This will enable you to have the land ready for planting by the time the second rains start.

# 3

## Nursery establishment and management

When: 4-6 weeks before transplanting

### A. Learning objectives

At the end of the session, participants will:

- Understand the factors to consider during nursery site selection for onion growing and the attributes of a good onion nursery site.
- Be able to apply the different management practices for quality seedlings production in onion growing.
- Find quality seed for planting.
- Understand the timing of seedling availability in onion production

### B. Duration

3 hours

### C. Learning aids

- Seed
- Watering can
- Spray pump
- Panga
- Hoes, Poles
- Dry grass
- Tying materials

### D. Activities and exercises

**Look back at what has happened since the last meeting.** (10-20 minutes)

- **In the participant fields:** Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their successes and ask questions if they have any.
- **In the demonstration field:** Also take a few minutes to observe with the

participants what has happened in the demonstration field since the last session. What has changed, how have the plants grown?

### **Introduction** (15 minutes)

The trainer will introduce the session of the day (nursery operations in onion growing). At this point the trainer should also make it clear to the participants that the session will involve practical work and will take some time. To stimulate the discussion, the trainer can ask the following questions:

- How do you plant onions? Do you do a nursery? If yes, how do you do it (which steps, timing)?
- Why do you think it is important to have an onion nursery?
- What are attributes of a good nursery site?
- Where do you procure you the seed? How can you recognize quality seeds?

### **Demonstration** (2 hours 30 minutes)

This is to be done at the demonstration site and the trainees will practically participate in the different activities to establish a nursery that are described in the subchapter E. Content. During this session, the group nursery is established. The knowledge gained from the demonstration nursery will be used by the members in their fields at household level.

### **Facilitator's summary** (15 minutes)

The facilitator will summarize what has been discussed and done to establish and manage a nursery. He will emphasize why it is very important to carry out all the recommended good practices in the nursery timely and safeguard the nursery site well against any form of destruction.

## **E. Content**

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- A nursery bed is a prepared plot of land for raising seedlings. It acts as a temporary home for young plants until they are eventually planted in a main garden.
- A poorly constructed and managed nursery bed will lead to poor germination or diseased seedlings, the seedlings may fail to grow when transplanted.

### **The purpose of the nursery is therefore to grow seedlings:**

- Of the right variety and in sufficient quantities.
- Of the right size, health and strength at the beginning of the planting season.

### **Qualities of a good nursery bed:**

- A gentle slope fertile and well drained piece of land
- Close to water source for irrigation of the seedlings
- Should never be put in a water logged area

- Located in less weed infested area
- In areas with a lot of water, raise the nursery bed 10-15 cm above the ground
- The soil should be dug deeply
- Not neighboring onion or ginger gardens
- Should be near the main garden to avoid damage of seedlings at transplanting

### **Nursery bed preparation, sowing and watering**

The following steps should be followed when implementing a nursery:

1. Choose a good location with a good drainage.
2. Clear the land.
  - Measure 1.2 metre wide of any length, dig it well, ensuring that stones and roots lying underneath are dug out and thrown outside the nursery
  - Construct the bed by heaping the soil to a height of 15 cm above the ground. The top of the constructed bed should be 1 metre wide with sliding sides.
  - The soil should then be mixed thoroughly with farm yard manure where applicable
  - Charcoal dust and ashes can also be mixed in the bed to correct the acidity of the soil and keep away worms

### **Sowing seeds in the nursery beds**

#### **Planting and planting depth**

- The bed should be watered thoroughly on the evening before sowing.
- Spacing: 30cm x 10cm or at spacing of 15cm between rows (1 plant per hole).
- Cover the seeds lightly and mulch the bed with dry grass.
- Gaps fill within 1 week of transplanting for even growth.
- Onion should be transplanted at a depth of 2.5-3 cm deep when its already pencil size
- Add water to the planting hole before planting for better establishment

#### **Maintenance of nursery bed**

- Mulch the seed bed after sowing until germination
- Provide enough shade to the seedlings after germination, 1 metre above the bed
- Thin the seedlings properly, remove weak or disease seedlings and keep the bed weed-free
- Provide enough water to the seedlings.



**Figure 3 Well managed onion seedlings in the nursery bed ready for transplanting**

### **Weeds, Pest and disease management in nursery bed**

- Before watering, it is important to gently pull any weeds that are growing in the nursery bed. Such weeds compete with the seedlings for nutrients and water in the soil.
- One of the most common diseases of onions in the nursery is damping off, which causes the stem to rot at the crown, leading to seedling death.
- To avoid damping off, one week after germination, a spray with mancozeb or Dithane M45 is possible (but not recommended in agroecological production).
- Mix 1 tea spoon in 5 litres of water. On the day of spraying, ensure you water first and then spray after watering so that the chemical is not washed off the seedlings during watering. If there are signs of rain, do not spray. Spraying should be done at least 3 hours before or after any rain.

# 4

## Transplanting

When: at week 0

### A. Learning objectives

At the end of the session, participants will be able to:

- Select good seedlings for onion planting.
- Plant onions with the correct spacing.
- Plant onions according to the recommended practices.

### B. Duration

3-4 hours

### C. Learning aids

- Group demonstration field
- Hoes
- Onions seedlings
- Watering cans
- Strings
- Pegs
- Tape measure

### D. Activities and exercises

**Look back at what has happened since the last meeting.** (10-20 minutes)

- **In the participant fields:** Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their successes and ask questions if they have any.
- **In the demonstration field:** Also take a few minutes to observe with the participants what has happened in the demonstration field since the last session. What has changed, how have the plants grown?



### Introduction of the topic of the day (20 minutes)

The facilitator will shortly introduce the topic of the day and the purpose of the activity. To stimulate the discussion, the following questions can be asked:

- How would you transplant your onion plants?
- How would you select quality seedlings?

### Demonstration (3 hours)

The trainees, together with the facilitator will practically transplant the seedlings in the demonstration field of the group. The facilitator must explain all the different activities involved step by step. The knowledge got from the demonstration plot will be used by the trainees in their fields at household level.

### Summary (20 minutes)

The facilitator summarizes the main points of the topic of the day.

## E. Content

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### Timing of seedling transplant

- Age of the seedling is important for establishment and higher bulb yield, this should be done when 3-4 true leaves emerge, before the bulb formation starts. Transplant seedling after 45-55days
- If seedlings overstay in nursery bed for 60 days after sowing bulb formation starts and potential for bulb size development reduced with consequent significant yield reduction.
- Harden the crop by removing shade a week before transplanting as this gives the seedling chances to get used to direct sun.
- Transplant at recommended spacing per crop early in the morning or late in the evening from (6:00am to 10:00am or 4:00 to 6:00pm)
- Plants should receive water as soon as transplanting is done.

### Steps in Transplanting Seedlings

- **Step 1:** The day before transplanting gently water the seedbeds heavily, to loosen the soil for easy pulling and reduced root damage. Do not water on the day you transplant.
- **Step 2:** Use the correct in-row and between-row spacing and mark and dig all planting holes to be transplanted the same day.
- **Step 3:** Remove the seedlings from the seed bed with as much moist soil around its roots as possible. Hold the seedling very close to the root crown as you pull. This minimizes leaf damage during pulling.
- **Step 4:** Place the seedlings carefully in a bucket, basket or bowl and transport them immediately to the planting site
- **Step 5:** Quickly plant the seedling in its planting hole without bending its

roots.

- **Step 6:** Hold the seedling in one hand and using two fingers of the other hand make a hole 3-5cm deep at a marked position. Carefully place the seedling in the planting hole with the roots pointing downwards.
- **Step 7:** Place the soil firmly around the root collar of the seedling with your fingers to keep it upright and to expel any trapped air.
- **Step 8:** Gently water the seedlings and then shade them with leaf twigs or arched dried grass to protect it from the heat of the sun
- **Step 9:** Continue transplanting, watering and shading until all the planting holes are filled.
- **Step 10:** Mulch the shaded seedlings.
- **Step 11:** Any excess seedlings may be sold except for a few which should remain to replace the ones that may die.
- **Step 12:** After a week remove the shading twigs or grass and water twice a week
- **Step 13:** Keep a diary to record all the activities you are doing each day and the dates as well.

# 5

## Weeding

When: first at 2-3 weeks and second at 7 weeks

### A. Learning objectives

At the end of the session, participants will:

- know when and how to do weeding, pruning, and staking.
- understand the effects of weeds on the yields of onions.
- Be able to apply the different methods of weed control in the onions.

### B. Duration

2-3 hours

### C. Learning aids

- Demonstration field
- Tools for weeding

### D. Activities and exercises

**Look back at what has happened since the last meeting.** (10-20 minutes)

- **In the participant fields:** Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their successes and ask questions if they have any.
- **In the demonstration field:** Also take a few minutes to observe with the participants what has happened in the demonstration field since the last session. What has changed, how have the plants grown?

**Introduction** (20 minutes)

The trainer will introduce the topic of the day. He can stimulate discussion by asking the following questions:

- Do you weed at home. How and why?
- If not, why?
- What is the effect of too much weeds on the onion plants?

- Which weeds are the most problematic in your onion field?

### **Demonstration** (1-2 hours)

This training should be practically done in the group demonstration field.

In a first step, the facilitator can walk through the plot with the participants and ask them to identify the weeds that can be found there.

In a second step, the participants, together with the facilitator, will do weeding. The knowledge got from the demonstration plot will be used by the trainees in their fields at household level.

### **Facilitator's summary** (20 minutes)

The facilitator should really remind the trainees about the important of pruning and staking in Onions since majority of the farmers tend to ignore this.

## **E. Content**

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### **Effects of weeds on onion plants**

- Weeds directly compete with plants for growth factors like sunlight, water, nutrients, space, and this makes the crop weak and susceptible to attack by pathogens.
- Weeds greatly reduce crop yield as well as its general performance.
- Weeds harbor pests and diseases.
- Some weeds can damage the crop by producing toxic substances.
- Weeds cause harvesting problems, especially those that develop late in the crop season.

### **Weed Management**

- Onions develop slower than other vegetable crops and are more susceptible to weed competition especially during the early growth stages. This can result in yield losses.
- Weeds can be controlled successfully if done at the right time, using the right methods.
- Care should be taken to avoid damage to the bulbs when mechanical weed control measures are used.
- Frequent weeding is encouraged as it does not only kill the weeds but also loosens the soil which helps in bulb expansion.
- Generally, 3 hand weeding are given at 1-month interval after transplanting.
- Weeding will greatly help curb pests and diseases.
- Apart from using a hoe, weeds in onions can also be controlled using the following:
  - Planting early maturing onion varieties
  - Using clean seeds that are free from weed seeds
  - Using irrigation water that is free from weed seeds

- Mulching
  - Crop rotation
  - Hand pulling/uprooting the weeds
- There are also chemicals that will control weeds in onions but they also have a number of side effects on the environment if not used with great care. It is not recommended in agroecological production.

**In addition, the following factors are important for a good onion production**

- High temperature favors bulb formation and development, however if temperature exceeds that required for bulb formation, maturity is hastened and bulbs do not grow to maximum size. This lowers yield.
- Fertile well drained soil is also important for onion production
- Bulbs development stage needs substantial amount of moisture during the growing season
- Avoid application of fresh manure as the plants will develop thick necks and too much leaf at the expense of bulb formation.



**A Well managed onion garden kept free from weeds**

# 6

## Pest and disease management

When: during weeks 2-9

### A. Learning objectives

At the end of this session, participants will be able to:

- Know the common pests and diseases affecting onions and their effects.
- Recognize the signs and symptoms of different pests and disease attack in onions.
- Apply the Integrated Pest and Disease management approaches in onion production.
- Understand the critical stages of growth of different pests to target control in onion production.

### B. Duration

2 sessions of 4 hours

### C. Learning aids

- Demonstration garden
- Insect bottle
- Stationery
- Knapsack sprayer
- Jerrycan
- Basin soap
- Pesticides
- Photo cards

### D. Activities and exercises

**Look back at what has happened since the last meeting.** (10-20 minutes)

- In the participant fields: Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their

successes and ask questions if they have any.

- In the demonstration field: Also take a few minutes to observe with the participants what has happened in the demonstration field since the last session. What has changed, how have the plants grown?

### **Introduction** (20')

The trainer will introduce the topic of the day pointing out what is to be learnt, including the different pests and diseases affecting onions and their control. The trainer should inform trainees that training will be a practical one where the trainees will be taken to the group demonstration for different pest and diseases scouting and identification.

The following questions can be used to stimulate the discussion:

- What main pest and diseases affecting onions do you encounter in your field?
- What symptoms of pest attack and diseases have you seen on your onions?
- Which prevention measure do you know to avoid pest and disease attacks?
- Which organic treatment against pest and diseases do you know?

### **Practical exercise** (2 hours)

#### **How to observe the onion field and the onion plant to detect pest attack and diseases?**

The facilitator discusses with the participant how the field should be visited to monitor pest and diseases. Then, he discusses with them how single plant should be observed, which aspects should be looked at. An observation format could be developed by the group.

#### **Practical observation of the field in subgroups**

Each subgroups of 4-5 participants will observe one or two plants taking into consideration the criteria identified in the previous exercise. Parts of sick plants and insects can be collected. Insects can be collected and placed in bottle. The groups summarize their observations on a flip chart and try to formulate recommendations.

#### **Presentation by the subgroups in plenum and discussion**

The findings of each subgroup are presented and discussed. At the end of the discussion, the main pests and diseases found in the field should have been identified and possibilities for prevention or treatments discussed.

#### **Summary**

The facilitator summarizes the main findings of the group works and discussions. He presents other important pests and diseases that may affect onions.

In the next weeks, the groups may be doing scouting on their own and will be using the insect bottle to keep the insects and present to the Agricultural officers on the days they visit the groups. The knowledge got from the demonstration plot will be

used by the trainees in their fields at household level.

A diary on pests and diseases and control mechanisms can be written to share the experience with peers.

## E. Content

### General pest and disease management practices

Onions are not attacked by so many pests and diseases as other horticultural crops. This is because of their smell which repels some of the pests and disease vectors. It is however not completely immune to attack. It is recommended that control starts even before the pests or disease symptoms are seen. Prevention measures should also be put in place. In principle, the following practices will greatly reduce pest and disease incidences in the field.

- a. **Crop rotation** – this breaks the pest lifecycle.
- b. **Early planting** – your crop escapes by the time pest/disease incidences rise, you are harvesting.
- c. **Use of resistant varieties** – they resist damage even when the crop is attacked (see Table 1 to identify which variety is resistant to which diseases).
- d. **Weed control** – weeds affect crop vigor which is related to damage. Weaker crops are more damaged (see previous chapter).
- e. **Scouting** – To spot pests/diseases early and control them in time.
- f. **Correct identification** of pest or disease to use the right control strategy.
- g. When irrigating, do not wet the leaves. Otherwise, it will help fungal diseases to develop.
- i. **Mulching**– reduces contact of soil and the plant parts.
- j. Remove affected plant parts

### Common onion pests and their control




Onion thrips, onion fly, onion crickets and cutworms are the most common pests that attack onion plants.


Onion thrips  
(Thrips tabaci)





- The onion thrips attack an extensive range of crops, including cereals and broadleaved crops.
- They are tiny (1 mm in length), slender and very mobile insects.
- Adult thrips: These are pale yellow to brown
- Immature thrips: They are whitish to pale yellow.



<p>Signs, symptoms and damages</p> 	<ul style="list-style-type: none"> <li>• Slower plants growth in severe infections</li> <li>• Distortion of leaves and bulbs</li> <li>• Pierce the upper surface of the leaves and suck on the plant sap on the development leaves, deep inside the plant resulting into white and silvery patches on the leaves</li> <li>• Reduction in yield.</li> </ul>
<p>Prevention and treatments</p>	<ul style="list-style-type: none"> <li>• Remove weeds. Thrips build up on them.</li> <li>• Remove heavily infested plants.</li> <li>• Crop rotation</li> <li>• Timely planting</li> <li>• Spray with organic pests or cypermethrin</li> </ul>
<p>Onion fly (<i>Delia antiqua</i>)</p> 	<ul style="list-style-type: none"> <li>• The most damaging stage of this pest is the larva, called the onion maggot.</li> <li>• Onion maggots are adapted to cool, wet weather, so usually they are less of a problem during hot dry periods.</li> <li>• They prefer soils heavy in organic matter.</li> <li>• The onion maggot attacks plants related to onion such as leeks, shallots and garlic.</li> </ul>
<p>Signs, symptoms and damages</p>  <p><b>Figure 4 The maggots in the onion plants as a result of the onion flies.</b></p>	<p>The onion maggot is white-cream in colour and it damages onions by:</p> <ul style="list-style-type: none"> <li>• Eating the lateral roots system and boring into the base of the stem.</li> <li>• Attacked leaves wilt and turn bluish, with the plants becoming shriveled and later wilting.</li> </ul>

Prevention treatments	<ul style="list-style-type: none"> <li>• Where manure is used, it should have broken down properly before it is used to cut of attraction to the onion fly.</li> <li>• Avoid planting in soil with high undecomposed organic matter. This attracts adults to lay eggs in soil</li> <li>• Powdered hot pepper or powdered ginger placed around the stems helps when the onion fly population is moderate.</li> <li>• Practice rotation with crops not related to onions, do not plant in fields affected with crops in the same family</li> <li>• Neem-based products have a deterrent effect on the adult flies</li> </ul>
<b>Onion crickets</b> 	
<b>Figure 5 Onion crickets on the plant</b>	
Signs, symptoms and damages	<ul style="list-style-type: none"> <li>• They cause serious damage to the crop particularly at the beginning of the season, both in the nursery bed and after transplanting in the main field.</li> <li>• They cut and feed on the seedlings killing them instantly.</li> </ul>
Prevention treatments	<ul style="list-style-type: none"> <li>• Field hygiene by timely weeding especially immediately after transplanting</li> </ul>

<p>Cutworms (<i>Agrotis ipsilon</i>)</p> 	<ul style="list-style-type: none"> <li>• Cutworms are dangerous insects in onion farming.</li> <li>• They are caterpillars that live in the soil, and eat the stems of young seedlings and transplants of all garden crops. The seedlings or transplants may be entirely eaten, or may be felled like tiny trees at soil level, in most cases, overnight. A heavy or uncontrolled cutworm problem can kill entire crops.</li> </ul>
<p>Signs, symptoms and damages</p>  <p><b>Figure 6 Cutworm damage on the plant.</b></p>	<ul style="list-style-type: none"> <li>• Young larva feeds on tender foliage and grown up larva cuts the stem at collar region.</li> <li>• Moths appear after dusk, mate and lay eggs on ventral surface of leaves or moist soil. Freshly ploughed fields are preferred for oviposition. A female lays 300 to 450 eggs in 10 to 15 clusters. Eggs are globular in shape, ribbed and whitish in colour. Tiny caterpillars feed gregariously on foliage for a few days and then enter into soil.</li> <li>• Caterpillars are nocturnal in habit and hide during day in cracks and crevices in soil or under debris around plants. At night they come out, cut seedlings near ground level and eat tender parts. Damage is more pronounced in low-lying waterlogged areas. Full-grown caterpillars enter soil and pupate in earthen cocoons. Egg, caterpillar and pupal stages last for 2 to 13, 10 to 30 and 10 to 30 days, respectively. Total life cycle is 30 to 68 days.</li> </ul>
<p>Prevention treatments</p>	<ul style="list-style-type: none"> <li>• Field hygiene as the cutworms tend to hide among debris in the field</li> <li>• Spray with organic pesticides</li> <li>• Proper timing of planting to avoid water stress in the early stages of crop growth as this leads to more extensive activity by the pest and damage to the crops.</li> <li>• Maintain weed-free plots</li> </ul>

## Helpful insects




Some insects (and other organisms) can help to control harmful pests. Some examples of natural predators:

- Ladybird beetle controls whitefly.
- Green lacewings control aphids and whitefly.
- Hover flies (Syrphidae) control aphid eggs.
- Trichogramma wasps control codling moth.
- *Bacillus thuringiensis* against Army worm.

## Common onion diseases and their control


A variety of diseases and disorders affect onions and related crops. Most of the diseases are caused by Fungi or Bacteria, while disorders are caused by environmental and nutritional imbalances.

Accurate disease diagnosis is an important step of an Integrated Pest and Disease Management (IPDM) program. Here below is a number of diseases that are common in onions in Uganda.

<p>Purple blotch (caused by <i>Alternaria porri</i>)</p> 	<ul style="list-style-type: none"> <li>• Purple blotch attacks onion, garlic, leek and other <i>Allium</i> crops.</li> <li>• The fungus requires rain or persistent dew for reproduction. It can grow through a wide temperature range of 6 to 33.8°C. Optimum temperature of fungal growth is 25°C.</li> </ul>
<p>Signs, symptoms and damages</p>  	<ul style="list-style-type: none"> <li>• small white sunken spots developed on the leaves. These enlarge and under moist condition turn purple with a yellowish border and are covered with a sooty deposit of spores, after 3-4 weeks the leaves turn yellow and collapse.</li> <li>• Bulbs may be attacked, mainly at the neck. This can be seen as a yellow to reddish watery rot.</li> </ul> <p><b>Figure 7</b></p> <p><b>Purple leaf blotch infection in an onion plant</b></p>
<p>Prevention and treatments</p>	<ul style="list-style-type: none"> <li>• A good timing of sowing or transplanting can minimise purple blotch attack by <i>A. porri</i>, depending on the local environmental conditions.</li> <li>• Varieties with waxy foliage are generally more resistant than those with glossy leaves.</li> <li>• Increased ploughing between seasons may reduce the disease.</li> <li>• Crop rotation</li> <li>• Increased spacing between plants also may reduce disease development.</li> <li>• Other good practices include seed treatment, removal of crop debris and planting in well-drained soil.</li> <li>• sprays every seven days with a fungicide when signs of infection appear. Spray with Mancozeb or Dithane M45. (not recommended in agroecological production).</li> </ul>


<p>Downy mildew (caused by <i>Peronospora destructor</i>)</p>	<ul style="list-style-type: none"> <li>• The fungus survives in seeds, bulbs, sets, and on plant debris.</li> <li>• Spores are carried long distances by air currents.</li> <li>• The fungus can infect onion, Welsh onion, Egyptian onion, garlic, shallot, leek and possibly some other species of <i>Allium</i>.</li> </ul>
<p>Signs, symptoms and damage</p> <div data-bbox="188 539 627 869" data-label="Image"> </div> <div data-bbox="188 913 627 1243" data-label="Image"> </div> <p><b>Figure 8 Downy mildew infection in onion plant</b></p>	<ul style="list-style-type: none"> <li>• It attacks young plants, appearing as white specks, usually confined to the oldest leaves of young plants.</li> <li>• Lesions form near tips of old leaves (elongated yellowish patches)</li> <li>• Leaves die back and this extends to younger leaves</li> <li>• A greyish white mould develops rapidly in cool damp weather and progresses down the sheath, and plants eventually fall over and dry up.</li> <li>• Optimum temperatures for fungal growth are between 13 and 20°C.</li> <li>• Because of the temperature requirements of the fungus, the disease is more serious in higher cooler areas.</li> </ul>
<p>Prevention and treatments</p>	<ul style="list-style-type: none"> <li>• Use clean propagules</li> <li>• Use resistant varieties</li> <li>• Rotate at least 3-years free of onions or other <i>Allium</i> species (e.g. garlic).</li> <li>• Wider spacing of plants help reducing humidity and downy mildew.</li> <li>• Preventative treatments with rock powder can reduce the attack of this disease.</li> <li>• spray every seven days with a fungicide when signs of infection appear using mancozeb or Dithane M45 (not recommended in agroecological production).</li> </ul>





<p>Yellow dwarf (spread by <i>Myzus persicae</i>)</p>	<ul style="list-style-type: none"> <li>• Onion yellow dwarf virus is a potyvirus that has a narrow host range (onions, garlic, shallots and a few ornamental Alliums).</li> <li>• It survives in bulbs and sets, and therefore can be transmitted during vegetative reproduction.</li> <li>• The green peach aphid, <i>Myzus persicae</i>, as well as other aphids, spreads the virus from plant to plant in a nonpersistent manner.</li> <li>• The virus can also survive in volunteer onions.</li> <li>• Although the virus is not spread to the seed, seed from infected plants is of poor quality.</li> </ul>
<p>Signs, symptoms and damages</p>  <p><b>Figure 9 Yellow dwarf infection in onion plants with crinkled leaves.</b></p>	<ul style="list-style-type: none"> <li>• The first symptom of onion yellow dwarf in young onions is the appearance of yellow streaks at the bases of the first true leaves.</li> <li>• After this initial symptom, all developing leaves show symptoms ranging from yellow streaks to complete yellowing of the leaves.</li> <li>• Leaves are sometimes crinkled and flattened and tend to fall over; bulb size is reduced.</li> <li>• In combination with other viruses, this virus probably contributes to Garlic Mosaic symptoms.</li> </ul>
<p>Prevention and treatments</p>	<ul style="list-style-type: none"> <li>• Timely planting, improved field hygiene and sanitation</li> <li>• Use true onion seed (rather than sets) and use virus-free planting stock. In garlic, indexing for the virus and meristem tip culture eliminates the virus.</li> <li>• Remove infected plants.</li> <li>• No pesticides control this disease. Controlling aphids also does not prevent the disease because they retain the virus for a very short period of time and quickly transmit the virus as they move through the crop in search of preferred hosts.</li> </ul>

## Storage diseases of onion

When storing onion improperly, major diseases like neck rot, soft rot, Brown rot and Black mold can destroy the harvest.

<p>Neck rot</p> <p>(caused by the fungus <i>Botrytis allii</i>)</p>	<ul style="list-style-type: none"> <li>Neck rot symptoms usually appear in storage; however, it may start immediately before harvest.</li> </ul>
<p>Signs, symptoms and damages</p>  <p><b>Figure 10 Neck rot disease of onion.</b></p>	<ul style="list-style-type: none"> <li>When infected bulbs have been in store for several weeks, tissue becomes greyish and a grey mold may also develop</li> </ul>
<p>Prevention, control</p>	<ul style="list-style-type: none"> <li>Use healthy seeds</li> <li>Dry the onions properly</li> <li>Leave at least 4 cm stem length at neck during topping</li> </ul>
<p>Soft rot disease</p> <p>(caused by <i>Erwinia carotovora</i>)</p>	<ul style="list-style-type: none"> <li>develops near the neck and these leaves can be easily pulled off the onion</li> </ul>



<p>Signs, symptoms and damages</p>  <p><b>Figure 11 Soft rot in onion</b> (Source: Omafra)</p>	<ul style="list-style-type: none"> <li>• Symptoms can range from a spongy, water-soaked scales to complete bulb breakdown</li> <li>• Severe discoloration with soft rotting and water soaking of one or more of the inner fleshy scales.</li> <li>• Foul odour may ooze from the bulb when squeezed</li> </ul>
<p>Prevention, control</p>	<ul style="list-style-type: none"> <li>• Reduce, if applying, doses of nitrogenous fertilizers.</li> <li>• Proper drying: Onion tops should be allowed to mature well before harvesting.</li> <li>• Take care during harvesting and packing to avoid bruising.</li> <li>• Storage places should be well ventilated to avoid accumulation of moisture on the surfaces of bulbs.</li> <li>• Onions should be stored at 0°C and a relative humidity (RH) of 65-70%.</li> </ul>
<p>Brown rot</p> <p>(caused by <i>Erwinia carotovora</i>)</p>	<ul style="list-style-type: none"> <li>• develops near the neck and these leaves can be easily pulled off the onion</li> </ul>
<p>Signs, symptoms and damages</p>  <p><b>Figure 11 Brown rot in onion</b></p>	<ul style="list-style-type: none"> <li>• Dark brown discoloration on bulb scale</li> <li>• Rotting starts from inner scales and spreads to outer scales</li> <li>• Bulbs seems to be healthy, but when pressed, white ooze comes from the neck.</li> </ul>
<p>Prevention, control</p>	<ul style="list-style-type: none"> <li>• Proper drying and leave at least 4 cm stem length at neck during topping</li> </ul>

# 7

## Onion Harvesting and drying

When: 17-20 weeks

### A. Learning objectives

At the end of the training, the participant will:

- be able to identify signs of maturity and ripening in the onion crop
- know when to harvest onions
- know the different methods and practices of harvesting and drying onions

### B. Duration

2-3 hours

### C. Learning aids

- Tarpaulins
- Containers/wooden boxes
- Demonstration garden

### D. Activities and exercises

**Look back at what has happened since the last meeting.** (10-20 minutes)

- **In the participant fields:** Take a few minutes to ask participants what they have been able to apply at home since the last session and with what results. Allow participants to share their experiences with each other, highlight their successes and ask questions if they have any.
- **In the demonstration field:** Also take a few minutes to observe with the participants what has happened in the demonstration field since the last session. What has changed, how have the plants grown?

**Introduction** (20 minutes)

The trainer will introduce the topic and ask the following questions to stimulate the discussion:

- What are signs of maturity and ripening in the onion crop?
- What is the correct stage of harvesting? When do you harvest your onions?

- What are the common mistakes made by farmers during harvesting of onions?
- Do you dry your onions? How and why?

This can be directly in the field, so that participants can look at sign of maturities directly on the crop. The facilitator can show sign of maturities by cutting the onions.

### **Demonstration** (2 hours)

The participants, together with the facilitator, will harvest the onions. This training should be done at the demonstration sites so that the farmers learn good harvesting practices and replicate in their fields at household levels.

## **E. Content**

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### **Signs of maturity and harvesting of onions**

Onions take 165- 170 days (5 – 6 months) to mature including days in the nursery bed. Maturity signs include:

- Bulb necks become thin
- Leaves bend over/droop
- Leaf bending can be done by the farmer during the last month of maturity (to fasten ripening)
- The tops of the onions turn brown or yellow and fall over

### **Methods and practice of harvesting onion**

Pull the onions early in the morning on a sunny dry day, Shake off excess soil.

Proper harvesting of onions starts with a preparation phase called curing. Curing is a process intended to dry off the necks and outer leaves of bulbs. The main objective is to prolong shelf life by preventing moisture loss and attack by diseases

**Field Curing** - Curing can be done in the field if the maturity and harvesting coincides with dry months. It involves:

- Placing the harvested onions in rows with leaves partially covering the bulbs to prevent sunburn or greening
- The onions are then left in the field until the outer leaves and neck are completely dry and papery. This takes 2 – 3 weeks depending on the environmental condition

Protected Curing is where the drying of onions is done in a protected environment, in a warm, dry and well-ventilated location protected from direct sunlight and rain

### **The process involves the following:**

- Removal of excess soil
- Trimming of foliage leaving 2.5cm of section of stem at neck
- Placing onions in single layer in large flat tray

Onions can also be cured by tying tops of bulbs in bunches and hanging on a horizontal pole in well ventilated shade

## **Drying and storage of onion after harvest**

- Dry in open sided bands or under tree shade on a raised platform that allows air circulation from the bottom of the heap, protected from sunshine to avoid scorching the bulbs
- Delayed drying after harvest can cause rotting
- Store in good houses, well ventilated for further curing.
- Tie bunches by the leaves and hang in an onion store well ventilated cool and dry
- Skin colour should be typical of the cultivar if it is to be stored
- Do not mixed varieties in the same package
- Remove all damaged, diseased and thick necked bulbs during sorting before storage

# 8

## Record keeping

When: 17-20 weeks

### Activity 1: Introduction to record keeping

#### A. Learning objectives

After this session participants will:

- Be aware of the importance of record keeping and be able to record costs and income of the target crop.
- Know how to calculate the gross margin in order to assess the profitability of a crop and find out ways of potential improvements.

#### B. Duration

2-3 hours

#### C. Learning aids

- Flip charts,
- markers,
- calculator.

#### D. Activities and exercises

##### Introduction

The trainer will introduce the topic of the day. He will stimulate the discussion by asking the following questions:

- Do you know how much profit you generate with the target crop the last season?
- Do you know which expenditures are most important in the production?
- Do you know if your costs were higher or lower than your income?

## Practical exercise

1. The facilitator asks the group to list all the expenses and costs (means of production and labour) they had for the target crop during the last crop year (or other crop). Producers are invited to mention them from memory. Do not forget the value of family labour and the costs of paid labour. The facilitator records the costs mentioned by the producers in the table below (on a flip chart).
2. Once the production costs are listed, the facilitator asks the group about the income: What have you done with the harvest product? Did you sell the entire production or only part of it? How much did you earn from the sales? Do you still have a remaining stock, how many bags/kg? The facilitator writes the cash income or the value of the production (in case of no cash value) in the table under part B. Income.
3. The facilitator explains how to compute the gross margin, which is total income minus the total costs. Then he asks the group whether the production of this crop is profitable or not (see if the gross margin is positive or negative).
4. The facilitator asks who wants to try to keep a record for the target crop during this season. The facilitator distributes the above table to the participants. The latter should write down their expenses (materials and labor). At each session, the host farmer could present his data (or in turn). It could serve as starting point for a group discussion on the similarities and differences in the record keeping among the participants. And report on the difficulties faced in filling the table.

**Table for the calculation of the costs and income for a crop**

Name of farmer:		Village/district:	
Date of calculation:			
Time period (season from/to):			
Crop:			
Total field area (ha):			
Total yield (kg):			
	Quantity	Unit cost (Ushs)	Total (Ushs)
<b>A. Production costs (input)</b>			
<b>Materials</b>			
Seed	3 bags	600	1800
Organic fertilizers:			
- Manure			
- Compost			
Mineral fertilizers:			
- NPK			
Pesticides:			
Packaging bags			
<b>Labor (Person-days)</b>			
Soil preparation	2 man days	2000	4000
Manure application			
Planting			
Weeding/ Hilling up 1			
Weeding/ Hilling up 2			
Dehaulming			
Harvesting			
Threshing			
Transport			
<b>Total production costs (a)</b>			
<b>B. Income (output)</b>			
Sales			
Home consumption*			
Remaining (storage)*			
Others*			
<b>Total income (b)</b>			
<b>Gross margin (b - a)</b>			
<b>Profit per acre (Gross margin divided by field area)</b>			

\*Convert in monetary: kg multiplied by market price.

## Activity 2: Gross margin analysis

### A. Learning objectives

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By the end of the training the participants are able to:

- analyze the record keeping and the gross margin, and identify how to improve the profitability of the target crop

### B. Duration

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2-3 hours

### C. Learning aids

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- Flip charts,
- markers,
- calculator

### D. Activities and exercises

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- The host farmer and each participant who recorded his costs and income present them to the group. Before the session, the facilitator can help the producers to copy the table on a flipchart to make it easier to read during the session.
- The facilitator initiates the discussion on the analysis of the results by asking the following questions. What are the reasons for the different figures/results between the producers? What does a positive or negative gross margin mean? What are the factors that influence expenditures and income? If the gross margin is low or negative, which expenditures could be reduced and how? Which price should you sell your products to make a profit?



## Summary of onion growing weekly activity plan

Weeks	Growth stage	Activities	Recommendation
8weeks before transplanting	Nursery bed management  Germination after 5-8days	<ul style="list-style-type: none"> <li>• Prepare the nursery bed</li> <li>• Sowing (4 – 5 weeks before intended transplanting date)</li> <li>• Watering</li> <li>• Raise the shade</li> <li>• Thinning</li> <li>• Pest and disease management and (Hardening)</li> </ul>	<ul style="list-style-type: none"> <li>• Soil sterilization</li> <li>• Fence the nursery bed after sowing</li> <li>• Water twice morning and evening)</li> <li>• Slant the shade west-east to a height of 1m by 1/2m immediately after germination</li> <li>• Reduce watering gradually</li> <li>• Remove the shade</li> </ul>
1	Pencil thick	<ul style="list-style-type: none"> <li>• Transplant and mulch immediately after transplanting.</li> <li>• Take care not to mulch with materials having viable seeds. These will become weeds</li> </ul>	<ul style="list-style-type: none"> <li>• Use clean material for carrying the seedling Sort seedlings and plant uniform size seedlings</li> <li>• Transplant in the evening</li> </ul>
2		<ul style="list-style-type: none"> <li>• Gap fill</li> </ul>	<ul style="list-style-type: none"> <li>• Keep the field free of weeds all the time</li> <li>• Select more vigorous seedlings for faster growth to catch up with those planted earlier.</li> <li>• Do it within a week after transplanting to avoid big differences in growth</li> </ul>
3	The fourth and fifth leaves emerge	<ul style="list-style-type: none"> <li>• First weeding</li> <li>• Monitoring for pests (cutworms and crickets)</li> </ul>	<ul style="list-style-type: none"> <li>• Remove the weeds from the field, taking care not to injure the plants</li> </ul>

4	Vegetative growth	<ul style="list-style-type: none"> <li>Monitoring for pests and diseases (cutworms, aphids, bacterial wilt)</li> </ul>	<ul style="list-style-type: none"> <li>Spray with organic pesticides/ Pyrethroid and dimethoate derivatives</li> <li>Fungicides (mancozeb, dithane M45) • Phyto sanitation</li> </ul>
5	Vegetative growth continues	<ul style="list-style-type: none"> <li>Second weeding</li> <li>Monitoring for pests and diseases (mole crickets, downy mildew, onion thrips))</li> <li>Do earthing-up</li> </ul>	<ul style="list-style-type: none"> <li>Phyto sanitation</li> <li>Reduce movement in the field</li> </ul>
6	Bulbing starts	<ul style="list-style-type: none"> <li>Monitoring for pests and diseases (mole crickets, downy mildew, onion thrips)</li> <li>Do earthing-up</li> </ul>	<ul style="list-style-type: none"> <li>Spray with dimethoate</li> <li>Phyto sanitation</li> <li>Minimize movements in the garden</li> <li>Start constructing a store for curing</li> </ul>
7	Bulbing continues	<ul style="list-style-type: none"> <li>Weeding continues</li> <li>Monitoring for pests and diseases (mole crickets, downy mildew, onion thrips))</li> <li>Earthing-up continues</li> </ul>	<ul style="list-style-type: none"> <li>Minimize movements in the garden</li> </ul>
8	Bulb expansions increase in size	<ul style="list-style-type: none"> <li>Field monitoring to check for exposed bulbs</li> <li>Earthing-up exposed bulbs</li> </ul>	<ul style="list-style-type: none"> <li>Reduce movement in the field</li> <li>Phytosanitation</li> <li>Avoid foreigners from accessing the field</li> </ul>

9	Bulb expansion continues	<ul style="list-style-type: none"> <li>Weeding continues</li> <li>Monitoring for pests and diseases (mole crickets, downy mildew, onion thrips))</li> <li>Earthing-up for exposed tubers continues</li> </ul>	<ul style="list-style-type: none"> <li>Guard against thieves</li> <li>Avoid movements in the garden</li> <li>Phyto sanitation</li> </ul>
10	Physiological maturity signs appear (10% maturity)	<ul style="list-style-type: none"> <li>Field monitoring for exposed bulbs</li> <li>Earthing-up for exposed tubers continues</li> </ul>	<ul style="list-style-type: none"> <li>Guard against intruders (thieves)</li> <li>Reduce movement in the field phyto sanitation</li> <li>Organize the items used during harvesting and drying</li> </ul>
11	Physiological maturity signs intensify (50% maturity)	<ul style="list-style-type: none"> <li>Field monitoring for theft</li> </ul>	<ul style="list-style-type: none"> <li>Bend the leaves to fasten maturity</li> </ul>
12	Maturity continues (70%)	<ul style="list-style-type: none"> <li>Start selective harvest incase bending wasn't done</li> </ul>	<ul style="list-style-type: none"> <li>Guard against theft</li> </ul>
13	Maturity continues (70%)	<ul style="list-style-type: none"> <li>Start selective harvest incase bending wasn't done</li> </ul>	<ul style="list-style-type: none"> <li>Guard against theft</li> </ul>
14	Harvesting	<ul style="list-style-type: none"> <li>Lifting the bulbs</li> </ul>	<ul style="list-style-type: none"> <li>Take care to avoid bulb injury</li> </ul>
15	Post-harvest handling	<ul style="list-style-type: none"> <li>Drying/ Curing</li> <li>storage</li> </ul>	<ul style="list-style-type: none"> <li>Cure under shade</li> <li>Well ventilated stores</li> </ul>

