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African Organic Agriculture Training Manual

A Resource Manual for Trainers

ORGANIC ONION PRODUCTION

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Responsible authors:
Irene Kadzere, Florentine Meinshausen,
Paul van den Berge and Gilles Weidmann (all FiBL)

Illustrator: Deogratius Okudi (Uganda)

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The manual is intended for use by trainers of farmers or other trainers on organic vegetable production with a particular focus on cabbage.

Comments and recommendations for improvement to this version are welcome.

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The manual was produced by the Research Institute of Organic Agriculture FiBL for the Knowledge Centre for Organic Agriculture in Africa implemented by the German Corporation for International Cooperation GmbH (GIZ) and supported by the German Ministry for Economic Cooperation and Development (BMZ).

KCOA
Knowledge Centre for Organic Agriculture in Africa

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CONTENTS

3 ORGANIC ONION PRODUCTION

SET OF TRANSPARENCIES

How to use this Manual

This manual is intended for use by trainers of trainers and trainers of farmers on organic agriculture. The manual highlights approaches to organic onion production. It has been developed with the understanding that farmers live in various contexts that may require unique adaptations of these guidelines by the trainers.

Users may require other references of the Africa Organic Agriculture Training Manual for more guidelines (all available at www.organic-africa.net), e.g.

- Module on definition and benefits of organic agriculture.
- Module on soil fertility management.
- Module on pest, disease and weed management.
- Module on the principles and methods of organic vegetable production.

Learning targets for farmers with a focus on bulb producing onions

- Recognise that organic onion production can make a significant contribution to the income of small-scale producers, particularly in peri-urban areas where domestic demand for vegetables is steadily increasing.
- Recognise that successful organic onion production requires good quality seeds and appropriate varieties, good soil fertility management using well-prepared compost and other locally available and adapted materials and techniques, intensive crop management and provision of good quality water for irrigation, good irrigation practices combined with water harvesting and conservation techniques.
- Understand the importance of the 3-step approach in organic onion production as far as plant health is concerned.
- Understand the importance of diversification through mixed cropping and crop rotations for better plant health, soil health and weed management.

1. Introduction and general information on onion production

Onion is a very important vegetable across Africa. It belongs to the allium family. Other vegetables in the allium family include garlic, leeks, shallots, chives and others. They are known for their strong, pungent flavour, and garlic has the strongest flavour of all. They are popular for their bulbs, although the leaves are also important for leeks, chives and onions. They are a good source of vitamin B1. The allium family species grow best during the cool periods of the year.

Onions (*Allium cepa* L.) are one of the most popular alliaceous plants. People grow onions for either bulbs or scallions (the green tops from the bunching onion types). When grown for bulbs, onions take a long time to mature, up to about 9 months from sowing. This Training manual focuses on bulbing onion.

The bulb shape of onions depends on the variety, but is also influenced by other factors such as soil type and planting depth. Plant vigour can affect the size of the bulb, with larger, more vigorous plants producing larger bulbs, but this also depends on the variety. Plant spacing can affect both the size and shape of onion bulbs. Early planting can result in larger bulbs as the plants will have a longer growing period. Organic onion production follows the four principles of organic agriculture as defined and described by IFOAM.

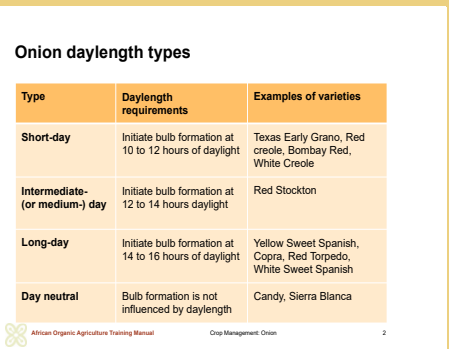
1.1 General production requirements for bulb onions

Depending on the climate, growers can grow onions all year round, but onions tend to do well in temperate climates and are sensitive to day length and temperature.

1.1.1 Temperature

Onion, a cool-season crop, is tolerant to frost especially during early growth. Onion is regarded as a biennial plant, i.e. it takes two years for the onion plants to flower and produce seed successfully. Onions grow best at temperatures between 13 and 24°C. At the seedling stage, the optimum temperature range is between 20 and 25°C. The bulb crop should be planted early in the cool season.

DAYLENGTH TYPES



Onion daylength types

Type	Daylength requirements	Examples of varieties
Short-day	Initiate bulb formation at 10 to 12 hours of daylight	Texas Early Grano, Red creole, Bombay Red, White Creole
Intermediate- (or medium-) day	Initiate bulb formation at 12 to 14 hours daylight	Red Stockton
Long-day	Initiate bulb formation at 14 to 16 hours of daylight	Yellow Sweet Spanish, Copra, Red Torpedo, White Sweet Spanish
Day neutral	Bulb formation is not influenced by daylength	Candy, Sierra Blanca

1.1.2 Daylength

Onion is known to be a day length sensitive crop. Longer days and higher temperatures induce bulb production, while shorter days and lower temperatures induce bolting (or flowering). Bolting is undesirable in onions intended for bulbs as it causes the bulbs to split and be of poorer quality. Long day varieties of onion require up to 16 hours of sunlight to ripen successfully. In the tropics only short day or day neutral onion varieties can form good bulbs.

It is important that growers are aware of these requirements so that they can select varieties that will grow best under their particular conditions.

1.1.3 Water

The onion root system is shallow. Onions at the bulbing stage need a substantial amount of water, but excessive moisture must be avoided during the growing season. Frequent light watering throughout the growing season is, therefore, recommended.

Onions are susceptible to leaf diseases that thrive in wet conditions. Where possible, growers should avoid overhead irrigation to reduce leaf wetness, which encourages the spread of foliar diseases. Also, watering during the morning hours helps the leaves to dry quickly during the day and reduces the risk of prolonged leaf wetness.

As water is scarce in most areas, growers can conserve moisture by applying a light mulch to onion fields or plots. Mulch also helps to suppress some weeds. However, it is recommended that the mulch be removed when the onions start to form bulbs to avoid interference with bulb enlargement and maturation.

1.1.4 Soils

Alliums grow best in fertile, well-drained, silty or sandy soils, or in soils that do not easily become crusted. Heavy soils interfere with bulb growth and can result in flattened bulbs instead of rounded ones, although this characteristic also depends on variety. On heavy soils, growers can reduce the problem by applying plenty of organic matter to make them ideal for onion production.

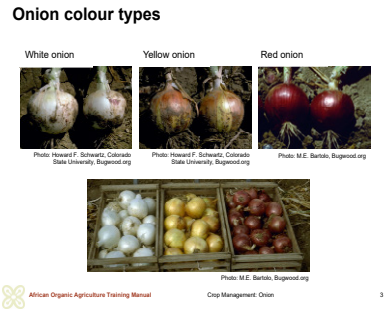
Sharing of experiences on onion production

Ask the participants, how they grow onions and which types they grow most. Further possible questions are:

- What experiences have you made with onion production under conventional and organic management?
- What are your experiences on post-harvest management and marketing of the onions?
- Have you met any challenges with this crop?
- How have you managed the challenges?
- Why do you (still) grow this crop?

Note down the answers on a board or other suitable platforms. You may have a look at the answers after having presented information on organic onion production and clarify whether organic production is an option for the farmers.

ONION COLOUR TYPES



The optimum soil pH for good onion production is between 6 and 7, but on organic soils (such as peat soils) onions can grow well at lower pH conditions.

Soils with heavy weed infestations should be avoided as onions compete poorly with weeds.

1.2 Variety selection: factors to consider for bulb onions

As in conventional production, organic farmers are encouraged to consider the following characteristics when selecting onion varieties:

- Prevailing climatic conditions (day length and temperatures). There are short-day onion varieties that can be grown in areas with short winter days and will begin to form bulbs when day length reaches 10 to 12 hours or more.
- Bulb size
- Shape (flat, round, conical)
- Taste (sweet or hot)
- Skin colour according to market preference (white, yellow, red, brown)
- Tolerance or resistance to major diseases such as Pink Root Rot – this attribute is important as one of the lines of organic disease prevention.

White onion varieties

These varieties are known for their firm flesh and can be used raw or cooked. Their flavour is mild, semi-sweet or sharp. The flesh consists of many layers of thin white rings.

Yellow onion varieties

Yellow onions are the most widely grown and the most flavourful. They have an off-white or pale yellow flesh colour and are usually sweet in taste. The bulb is covered by a golden skin. They are good for cooking and can also be eaten raw. They include varieties such as Texas grano and others.

Red onion varieties

These onion varieties have red flesh. Such a colour profile makes them important for adding colour to dishes such as salads, although some people may find their flavour rather strong.

2. Soil fertility requirements and fertilisation

Soil fertility management in organic onion production is underpinned by the four principles of organic farming, with the ultimate aim of ensuring that all soil functions, such as physical conditions, can optimally support and nourish crops/plants while maintaining satisfactory levels of biological activity.

There are several ways in which farmers can determine the fertility of their soil. They can observe and infer some of the characteristics of their soils by sight (soil characteristics such as colour and presence/absence of organic matter, plant vigour and health, etc.), smell and touch. A soil that emits little or no odour is considered biologically inactive and unfertile, while the presence of a foul odour indicates a poorly aerated soil with low biological activity. A well aerated soil has an earthy smell, like the smell of the forest floor where leaf litter decomposition is good. Farmers can also tell the fertility of their soil by touching it, with a hard soil indicating compaction and low fertility. A crumbly soil indicates good fertility.

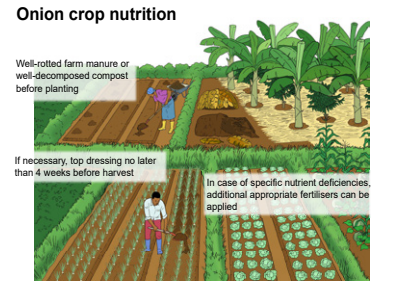
2.1 Nutrient requirements and sources

Onions prefer light soils but need high levels of organic matter. Nitrogen requirements of onion are rather low, and the plants can take up nitrogen over a long period. The nutrient requirements for a crop yield of 350 dt per hectare are 130 kg N, 30 kg P_2O_5, 90 kg K_2O and 10 kg MgO (5 kg Mg).

On fertile soils, the nitrogen requirements of onions can be met by the supply from soil organic matter. Additional fertilisation of the crop is only necessary on light and poor soils or when onions are harvested for fresh consumption.

Average onion yields range from less than 20 tonnes per hectare to more than 30 tonnes per hectare, depending on the nutrients and water available to the plants and other factors. In most cases, and depending on the condition of the soil, the application of 40 to 80 kg of nitrogen from an organic source such as well-rotted farm or livestock manure, or well-decomposed compost, is sufficient for onions. Ideally, the manure or compost is applied to the previous crop in rotation with the onion. A rate of 25 to 40 tonnes per hectare of manure is recommended to obtain a high yield of onion bulbs.

CROP NUTRITION



An adequate supply of phosphorus promotes good growth and yield. Onions need a good supply of potassium for proper ripening and storage.

Once onions have been transplanted with sufficient good quality compost, they do not require much additional nutrition as they are considered to be low feeders. All nitrogen requirements are ideally met before the bulbs are planted (transplanted), i.e. pre-plant through organic nutrient sources.

If the crop requires additional nitrogen, growers should ensure that the final nitrogen application is made no later than 4 weeks before harvest to avoid delays in maturity and the formation of double centres in the bulbs. Onions can be severely stunted when grown in nitrogen deficient soils.

Excessive nitrogen must be avoided as it leads to lush growth which can result in the following disadvantages:

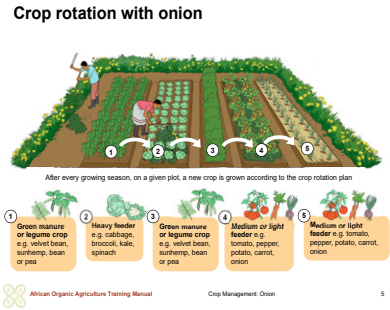
- Increased susceptibility to pests and diseases
- Susceptibility to freezing or chilling injury
- Bolting of the plants
- Poor storage of bulbs after harvest

Besides potassium, phosphorus is also important in onion production, and so are boron, sulphur, magnesium and zinc. Good composts can provide adequate amounts of these nutrients. However, where deficiencies are severe, organic growers can use other sources of these nutrients that are approved for organic production to supplement manure or compost sources. It is important to remember that all phosphorus must be applied before planting.

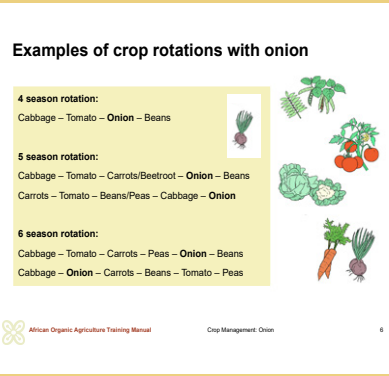
For optimum production, potassium should be split when other sources (other than compost or manure) are used. Up to 50 % of the potassium can be applied before planting, with the remainder applied as one or two splits during growth. Those farmers who use plastic mulches for weed control will find it difficult to apply any 'fertiliser' or nutrient sources after planting. In this case, unless other innovative techniques are available, farmers are better off applying all nutrients before planting.

For large-scale commercial production, it is advisable for farmers to have their soils tested at a laboratory before planting so that they can base their soil fertility and nutrient management options on the soil test results.

CROP ROTATION



CROP ROTATION EXAMPLES



2.2 Rotations in onion production

The basic rule that crops of the same family should not be grown together, or in close succession also applies to onions. Onions should not be grown close to another allium crops. The best practice is for the farmer to plant another allium crop on the same plot as onions only after 3 to 4 seasons. This is especially important if soil-borne pests and diseases are a problem. Onions can be rotated with crops such as brassicas, potatoes, pulses, carrots and others. For example, a farmer can grow cabbages before onions, or potatoes after an onion crop.

Onion grows well with high levels of fertiliser, so it is important that good levels of fertiliser are applied to onion fields/plots before transplanting if the previous crop in the rotation has not received high levels of good quality fertiliser or compost, or leaves behind larger amounts of nutrients.

Farmers are encouraged to include a green manure legume crop in the rotation to replenish soil fertility. Deep-rooted crops should also be included in rotations as they help to break up the hard pans and make the soil more suitable for other crops.

2.3 Intercropping onions with other crops

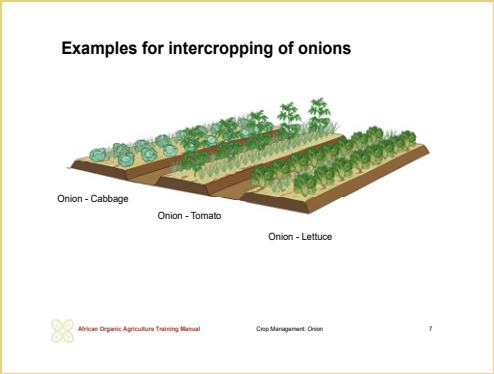
Some reports indicate that onions can grow relatively well with brassicas such as broccoli and cabbage, beets, carrots, lettuce, tomatoes and several others. Onion, however, is said to grow poorly when grown next to peas and beans.

3 Raising onion seedlings

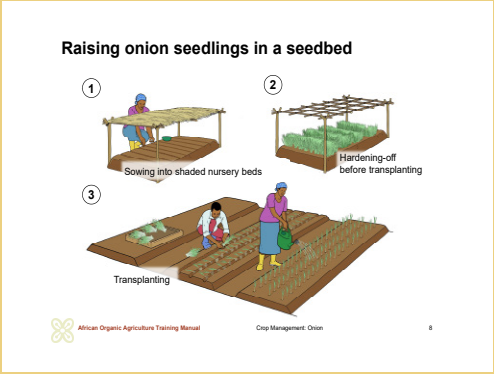
Onions can be direct sown or transplanted. Transplanting is more common and allows growers to select the desired plants and control field spacing more easily. Transplanting also avoids or limits weed competition in early growth provided the seedlings are transplanted to a weed-free field.

Besides seedlings, onions can also be grown from sets (see section 4.2.1 for the definition of sets), but buying sets can be very expensive. However, the advantage is that onions grown from sets mature earlier than those grown from seedlings. Early maturity can help farmers to access window markets when pric-

INTERCROPPING



SEEDLINGS FROM SEEDBEDS



es are more favourable. On the other hand, one of the main disadvantages of onions grown from sets is that the bulbs have a short storage life.

3.1 Seed quantities and sowing

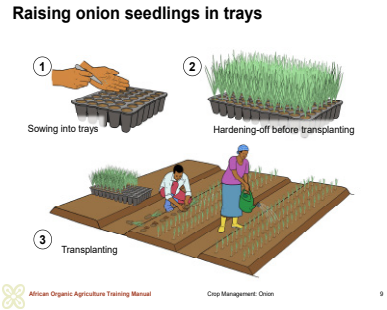
Onion seeds are small. One gram of onion seed can contain between 300 and 400 seeds. Between 4 and 6 kg of seed can produce enough onion seedlings to plant a hectare. The seeds have a hard seed coat and may require pre-sowing treatment to improve germination. Growers can soak the seeds in warm (lukewarm) water for several hours before sowing to soften the seed coat, allowing the seeds to absorb water more quickly and germinate more quickly. Done correctly, this will result in more uniform germination and seedling emergence. Soaking the seeds for too long (more than 12 to 24 hours) or soaking the seeds in water that is too hot can result in seed damage and poor germination. Onion seeds usually take between 7 and 10 days to germinate. The seeds germinate best at temperatures of 18 to 24 °C. Warm soils promote earlier germination, while cold soils can delay germination by up to two weeks. For optimum germination, growers are encouraged to use seed less than one year old.

3.2 Methods of raising onion seedlings

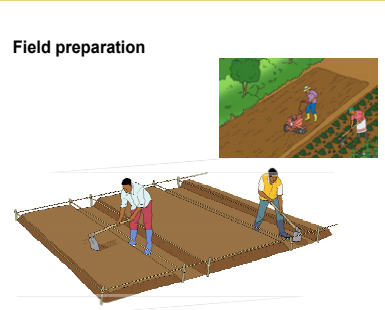
Onion seedlings can be raised in seedbeds or in containers. For seedbeds, a site where no alliums have been grown for the past 3 to 4 years should be selected to minimise the risks of soil-borne diseases. If this risk is high, then farmers are encouraged to solarise or steam the soil intended for seedbed in order to control the diseases.

Depending on the drainage characteristics of the soil, onion seedlings can be raised in flat or raised seedbeds. In susceptible areas, raised seedbeds are preferable to avoid any potential impacts of poor drainage following heavy rains, or in sites where the water table is high enough to cause drainage problems. Beds of 0.2 to 0.3 m high and measuring about 0.6 m wide and 3 m long are prepared, but the sizes can vary depending on the target quantities of seedlings to be raised. The beds should be about 0.7 m apart. A fine tilth is required for sowing the onion seed. Seed sowing should be done in lines spaced at 5 to 7 cm apart and the sow-

SEEDLINGS FROM TRAYS



FIELD PREPARATION



ing depth should be about 2.5 cm. Sowing at shallower depts, like 1 cm, can lead to faster emergence provided that good management is applied to avoid drying of surface soil and seed damage by pests.

To raise enough seedlings to plant a hectare, a farmer needs 3.5 to 4 kg of seed (this means about 35 to 40 grams of seed to raise seedlings for a 100 m^2 plot). However, as onion seed viability period is very short, sometime farmers increase the seeding rate up to 8 kg/ha, but this results in higher production costs. It is recommended that farmers carry out a simple germination test to test the viability of their seed so as to come up with a good estimate of the amount of seed required for their seed lot.

About soil solarisation
Solar power, harnessed by plastic sheets, can be used to increase soil temperatures to levels which are lethal for soil-borne plant pathogens. It is said to be an environmentally friendly way to control soil pests and pathogens. The method is more suitable in warmer climates. In the process, the pests or pathogens are either completely destroyed or weakened to levels that render them incapable of significant plant attack.

3.2.1 Raising seedlings in trays or other containers

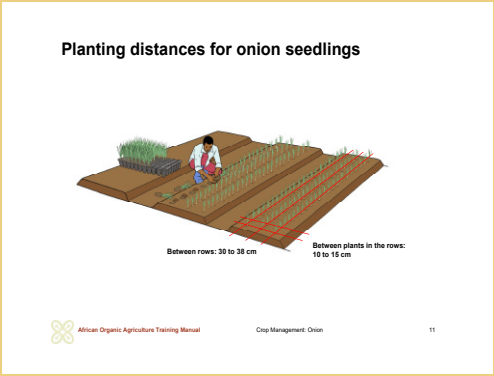
Onion seedlings can be raised in seedling trays for ease of transportation at transplanting time, especially if the fields are far away from the nursery site. The choice of trays depends on many factors such as availability, costs, storing space, and others.

4 Field establishment and management

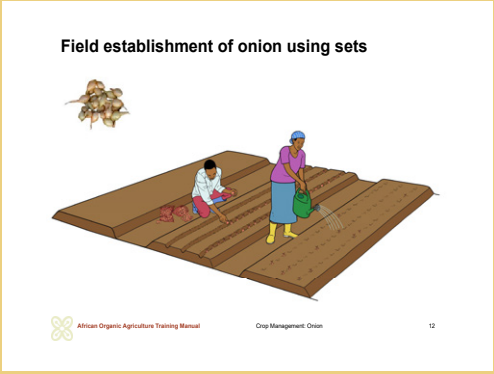
4.1 Field preparation

For field preparation, the soil should be prepared in a way to eliminate debris and soil clods. Directly sown onions require a well-settled and fine seedbed. On silt-rich soils, a too fine seedbeed should be avoided to avoid silting.

PLANTING DISTANCES



PLANTING OF ONION SETS



A slightly deeper soil preparation is required for onion sets than for seed onions, as the planting material must be placed in the soil up to the shoulders.

In most commercial areas, beds 0.9 to 1.0 m wide are common, and 2 to 6 rows are seeded or planted on the bed. If two rows, they may be two-line (twin) rows with plants staggered to achieve proper spacing and high population density.

4.2 Spacing and timing of transplanting/planting onions

The onion seedlings are transplanted after about 6 to 8 weeks from the time of emergence. At this stage, the seedlings will have grown to about 8 to 12 cm high, or have attained the thickness of a thin pencil. For optimum growth, an in-row spacing of 10 to 15 cm between plants and inter-row spacing of 30 to 38 cm between rows is recommended.

4.2.1 Using sets as planting material

Raising onions from seed is an economical way of growing this important crop. However, most onion varieties take long, up to 6 months, before they are fully grown and ready for harvest. Farmers can reduce this long growing period by growing onions from sets. The onion sets are raised during the previous season, i.e. before the expected planting. They are small immature onion bulbs. To raise the sets, farmers grow onions from seed at high densities, but prevent the bulbs from growing large by harvesting them prematurely. The small bulbs are then cured, saved and planted later to grow into full mature bulbs.

To raise mature bulbs from the sets, farmers plant the sets in prepared beds with a well-firmed surface and containing adequate organic matter. The sets are planted in rows of 30 cm apart with an in-row bulb spacing of 10 to 15 cm. If farmers are growing the sets to raise spring onions, rather than bulbs, they can space the sets as close as 2.5 cm apart. If larger bulbs are preferred by the farmers, the spacing can be bigger. The newly planted sets need to be covered by soil to encourage quick sprouting, but the tip of the set should remain visible (uncovered) or else they result in onion plants with long necks that fail to mature properly. Farmers should take care to plant sets which are disease free and have not already started to sprout.

ONIONS ON RIDGES

Growing onions in double rows on ridges

Photo: FiBL

African Organic Agriculture Training Manual Crop Management: Onion 13

DIRECT SEEDING

Field establishment of onion using direct seeding

Manual sowing

Hand-pushed sower

Tractor driven sowing machine

African Organic Agriculture Training Manual Crop Management: Onion 14

4.3 Considerations for spacing

The plant spacing in onion can be modified to suit or fit the prevailing crop rotation practices. For example, on farms where planting ridges are used for growing other crops such as potatoes and carrots, it may make sense for farmers to grow onions in double rows with a 40 to 75 cm distance between the ridges. This way, the system will be compatible with other crops and reduces the need for preparing the ridges frequently, but can lead to significant yield reductions due to too wide spacing if 75 cm spacing between ridges is used to accommodate certain machinery types. On the other hand, double row planting can also make mechanical weeding more difficult.

4.4 Considerations for the method of onion planting

The question on whether to use direct seeding (or direct sowing), seedling transplants, or onion sets for raising onions depends on many factors.

Nursery: In direct seeding, there is no need for establishing a nursery. When seedlings are used, a nursery has to be prepared, unless if farmers buy seedlings, or practice direct seeding. When onions are grown from sets, there is no need for establishing a nursery at the beginning of the season. Smaller bulb sets are easier planted than larger ones.

Costs: In direct seeding, the costs of raising a nursery are avoided. Seeds are cheaper to buy compared to sets and seedlings.

Germination phase: In direct seeding, the germination phase is long and it is more difficult to control the germination conditions. In contrary, the germination phase in the nursery can be hastened by modifying the conditions such as temperature and humidity. Sets do not need a germination phase, except for raising the sets for seed during the previous season.

Transmission of diseases with planting material: Seed borne diseases can be transmitted through the use of seed, however when farmers use good quality seed this risk can be avoided or reduced. If seedlings are raised in an infected soil or sowing medium they can carryover the infection to the field. Fungal diseases (root and basal rot) and bacterial diseases are often transmitted with planting material such as sets. However, if the sets are clean to begin with, disease transmission will be low or negligible.

GROWING SYSTEM CONSIDERATIONS 1/2

Comparison of the planting types (1/2)

	Direct seeding	Planting from seedlings	Raising from sets
Nursery	• No need for establishing a nursery	• Nursery required, unless seedlings are bought	• No nursery required
Costs	• No nursery costs	• Higher costs for seedlings than for seeds and sets	• Sets more expensive to buy than seeds
Germination phase	• Long germination phase; germination conditions difficult to control	• Shortening of the germination phase possible by modifying the conditions such as temperature	• No germination phase
Transmission risk of diseases with planting material	• Transmission of seed borne diseases possible (use of good quality seed)	• Transmission of seed borne diseases possible (use of good quality seed)	• Transmission of fungal diseases (root and basal rot) and bacterial diseases common • Low or negligible disease • If the sets are clean to begin with, disease transmission will be low or negligible

African Organic Agriculture Training Manual Crop Management: Onion 15

GROWING SYSTEM CONSIDERATIONS 2/2

Comparison of the planting types (2/2)

	Direct seeding	Planting from seedlings	Raising from sets
Growing period	• Very long growing period	• Long growing period of up to 6 months	• Shortest growing period of 60 to 80 days
Competition by weeds	• Young plants can be outcompeted by weeds	• Seedlings can be outcompeted by weeds	• Sets are larger and can withstand weed competition better.
Weeding requirements	• High weeding requirements	• Weeding of small seedlings is tedious	• Easier weeding as larger spouting stalks are produced
Uniformity of plants and bulbs	• High risk of non-uniformity due to irregular germination	• More uniform plants and tubers as spacing and planting depth can be controlled more easily	• More uniform plants can be attained, however this depends on the uniformity of the sets at planting
Shelf life of bulbs	• Longer shelf life due to stronger skins	• Longer shelf life than onions raised from sets	• Poorer skin strength and shelf life

African Organic Agriculture Training Manual Crop Management: Onion 16

Growing period: Direct seeding has the longest growing period of the three methods. Seedlings have a long growing period of up to 6 months – longer than when onion sets are used. Sets provide a good head start by skipping the seedling stages. Onions grown from sets are ready for harvest earlier (within 60 to 80 days of planting), or even earlier if grown for spring onions.

Competition by weeds: Direct seeded plants can easily be outcompeted by weeds. Also seedlings can be outcompeted by weeds, but weed control is easier than in direct seeded onions. Sets are larger and can withstand weed competition better.

Uniformity of plants and bulbs: In direct seeding there is a high risk of non-uniformity to the plants due to irregular germination. Seedlings result in more uniform plants and tubers as the spacing and planting depth can be controlled more easily. With sets more uniform plants can be attained, however this depends on the uniformity of the sets at planting.

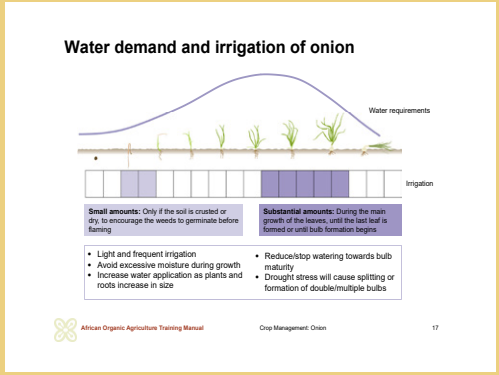
Shelf life of bulbs: The mature onions grown from seeds have a longer shelf life due to stronger skins. Bulbs from seedlings have a longer shelf life than onions raised from sets. Sets have a poorer skin strength and shelf life compared to onions raised from direct seeding and seedlings.

4.5 Top dressing after transplanting

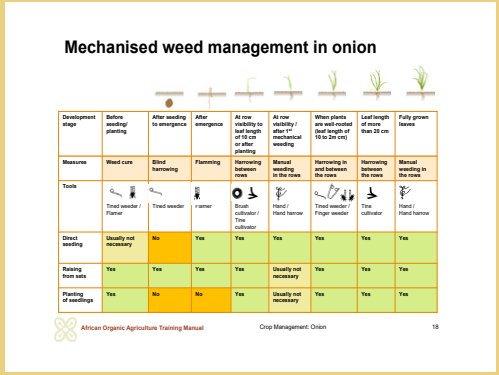
If inadequate nutrients were applied at the time of planting or pre-planting, in about 4 weeks from transplanting (when the base starts to swell), a 'top dressing' of well-composted manure should be applied once per month. Such post-planting applications are possible if plastic mulches have not been used for weed control in the onion fields.

Onions have a low root density and the roots lack root hairs. Nutrients should, therefore, be in ready availability to facilitate uptake by the roots.

WATER DEMAND AND IRRIGATION



WEED MANAGEMENT



4.6 Water demand and irrigation

A sufficient water supply is necessary for reliable onion yields. The possibility of irrigation is therefore an advantage. However, before any irrigation is carried out, the increase in yield due to watering should be weighed up against the risk of downy mildew infestation.

Wherever possible, it is important to keep the soil moist through irrigation from the time of transplanting. The water requirement is highest between the 8-leaf stage and bulb formation. Watering is no longer advisable after the leaves have fallen over. Onion plants are particularly sensitive to a lack of water during bulb formation. The daily evaporation rate of bulb onion is 5 to 8 mm. Irrigation frequency should be reduced gradually to encourage the bulbs to firm up towards maturity.

Wet leaves in the early morning and evening prolong the infection phase with downy mildew. Irrigation should, therefore, take place in the second half of the morning.

Once bulbs start to ripen, weeds should be allowed to grow so that they will take up nutrients and moisture and help in the onion ripening process.

5 Weed management

Onions have a shallow root system and are slow growing. Their leaves grow upright. They are, therefore, poor competitors with weeds as already highlighted before. As onions grow over a long period, they are likely to be affected by several flushes of weeds.

It is important for farmers to start with and plant into a weed free field. As much as possible, fields with problematic weeds like nutsedge should be avoided for onion production. Crops grown in rotation with onion should be well-weeded to avoid carryover weeds when onions are being planted or transplanted. Farmers are encouraged to remove weeds before they set seed.

A green manure crop can be planted before transplanting onion into the field in order to suppress weeds. Deep ploughing of fields infested with nutsedge prior to planting can help to reduce weed problems, but this can lead to soil degradation. Planting beds must be prepared well in advance and irrigated towards planting time to stimulate weed growth. These weeds must then be destroyed

through a shallow cultivation before transplanting the onions.

Farmers can solarise their fields to control weeds prior to planting. The solarisation will also control some important soil-borne diseases such as pink root, and soil pests.

Once the set bulbs have sprouted, or when the transplanted seedlings are large enough, a layer of grass mulch measuring 5 to 10 cm thick can be applied to help smoother off weeds.

6. Disease and pest management in the field

In general, alliums do not suffer from many major pests and diseases when compared to leafy vegetables. One of the main reasons is that onions, and other alliums, emit scents or smells that can irritate and repel certain pests. However, there are a few potential problems with the stem and bulb nematodes and thrips, and diseases like anthracnose and downy mildew.

In organic farming, farmers are encouraged to apply the three step approach to pest and disease management.

The first step includes ensuring good crop growing conditions, limiting disease introduction and spreading and strengthening the plants to help them withstand diseases better.

In a second step, pest and disease spread should be limited through field and crop hygiene. Good crop husbandry and field hygiene practices are part of the steps to control pests and diseases in onions like in many other plants. With proper management and a good crop rotation plan, the key pests and diseases will cause fewer problems. Crop rotations of at least 3 to 4 years on the same plot between onions and other members of the Allium family like garlic, leeks and chives are recommended. If land is not limiting, it is even better to plant a different Allium crop than onion after the 3 to 4 years in the rotation.

A proper orientation of onion rows and spacing also reduces disease incidences by maximising air movement during growth. With good ventilation of the plants in the fields, the onion leaves dry up quicker after wetting through irrigation or a rainfall event. Diseases thrive in moist or damp conditions, but good ventilation makes the conditions less favourable for pathogen growth. On the other hand, if bulbs are wet for too long, then bulb rot disease may become a problem.

YELLOW NUTSEDGE WEED

Weed management in onion

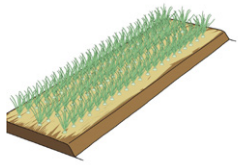
Yellow nutsedge weed – one of the most important weeds in onion production

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

African Organic Agriculture Training Manual Crop Management: Onion 19

MULCHING AND COVER CROPPING

Mulching and cover cropping in onion crops

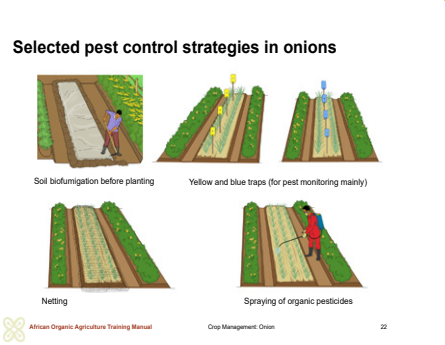


Covering the soil surface with dry mulch. The dry mulch can be replaced by suitable short cover crop where this is possible.

African Organic Agriculture Training Manual Crop Management: Onion 20

THREE STEP APPROACH

PEST CONTROL STRATEGIES



Diseases are easily transferrable to onion fields through different ways, e.g. contaminated farm tools and implements, transplanting contaminated seedlings or sets, using contaminated containers and protective clothing, using contaminated manures or mulches, etc.

Weakened and damaged plants or bulbs are more prone to attack by diseases. Care should be taken to avoid damage to the bulbs during harvest and handling or packaging. Some diseases are carried over from the field into storage. Hence, farmers need to take care and minimise such disease carryovers, and disease development during storage. If properly cured (dried) after harvest and kept in well ventilated structures, alliums can store well after harvest provided the storage facilities are clean and other conditions are ideal.

In a third step, pests and diseases are controlled with direct measures when they occur.

Details on these steps can be found in the separate module on pest and disease management of the African Organic Agriculture Training Manual.

6.1 Selected fungal diseases of onion and suggested control measures

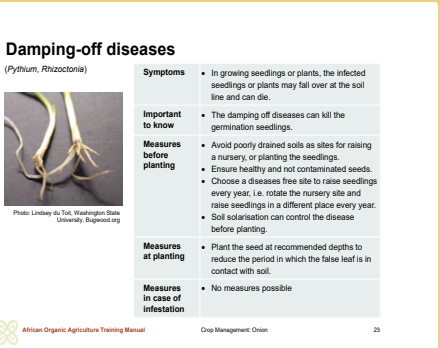
Damping-off diseases *(Pythium, Rhizoctonia)*

Cold and wet soils favour the development of these damping off diseases. Farmers growing their crop in poorly drained fields are likely to experience this problem. The damping off diseases can kill the germination seedlings. In growing seedlings or plants, the infected seedlings or plants may fall over at the soil line and can die.

Suggested control measures are:

- Avoid poorly drained soils as sites for raising a nursery, or planting the seedlings.
- Ensure that seeds are healthy and not contaminated.
- Choose a disease-free site to raise seedlings every year, i.e. rotate the nursery site and raise seedlings in a different place every year
- Soil solarisation (using a 250 gauge polythene for about 10 days) can control the disease before planting.
- Plant the seed at recommended depths to reduce the period in which the false leaf is in contact with soil during seedling emergence.

DAMPING-OFF DISEASES



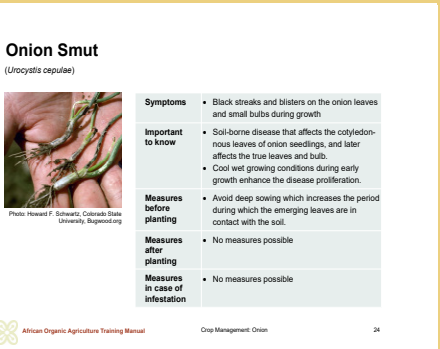
Damping-off diseases

(*Pythium, Rhizoctonia*)

Photo: Lindsey du Toit, Washington State University, Bugwood.org

Symptoms	• In growing seedlings or plants, the infected seedlings or plants may fall over at the soil line and can die.
Important to know	• The damping off diseases can kill the germination seedlings.
Measures before planting	• Avoid poorly drained soils as sites for raising a nursery, or planting the seedlings. • Ensure healthy and not contaminated seeds. • Choose a diseases free site to raise seedlings every year, i.e. rotate the nursery site and raise seedlings in a different place every year. • Soil solarisation can control the disease before planting.
Measures at planting	• Plant the seed at recommended depths to reduce the period in which the false leaf is in contact with soil.
Measures in case of infestation	• No measures possible

ONION SMUT



Onion Smut

(*Urocystis cepulae*)

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

Symptoms	• Black streaks and blisters on the onion leaves and small bulbs during growth
Important to know	• Soil-borne disease that affects the cotyledonous leaves of onion seedlings, and later affects the true leaves and bulb. • Cool wet growing conditions during early growth enhance the disease proliferation.
Measures before planting	• Avoid deep sowing which increases the period during which the emerging leaves are in contact with the soil.
Measures after planting	• No measures possible
Measures in case of infestation	• No measures possible

Onion Smut *(Urocystis cepulae)*

This is another soilborne disease that affects the cotyledonous leaves of onion seedlings, and later affects the true leaves and bulbs. The smut manifests as black streaks and blisters on the onion leaves and small bulbs during growth. On cotyledonous leaves, the disease is worsened by deep seed sowing which increases the period during which the emerging leaves are in contact with the soil. Cool wet growing conditions during early growth also enhance the disease proliferation.

Suggested control measures:

- Avoid planting into disease-infested soil or in fields with infected plant residues.
- Sow clean seed or plant clean onion sets.
- Transplant seedlings instead of direct sowing in areas with high disease risks.
- Sow the onion seed at recommended depths. Avoid deep sowing to reduce the period in which the false leaf is in contact with soil during emergence.
- Practice good crop rotations (however, the spores can remain viable in the soil for many years and rotations might not be effective).
- Raising seedlings in disease free soil and media will help the plants to avoid the disease.

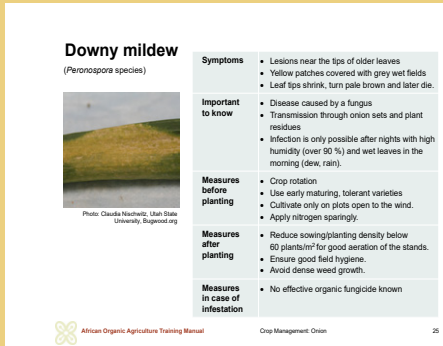
Downy mildew *(Peronospora species)*

This disease is an airborne type and is favoured by cool (below 22 °C) and humid atmospheric conditions. Although it may not be very common, downy mildew can cause rapid devastation to an onion field if conditions are favourable. Initially, a purple-grey, velvety growth occurs on the leaves. The leaves rapidly turn to a pale green colour. These leaves turn yellow, collapse and die. Lesions can form on the pale green-yellow leaves and worsen the situation by providing entry points to other diseases such as purple blotch or bacteria.

Suggested control measures:

- Sow/Plant resistant onion varieties.
- If selecting own seed or sets, ensure to collect these from disease-free plants.
- Sow/Plant healthy seed or sets.
- Avoid infected fields or fields with infected plant residues – remove and destroy any onion plant residues or volunteer crops.

DOWNY MILDEW



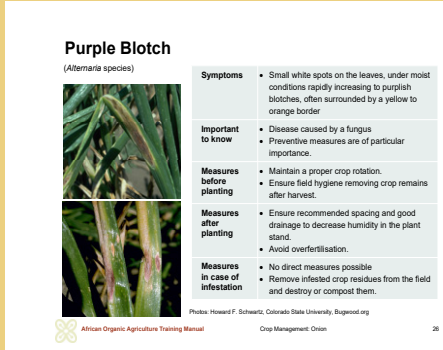
Downy mildew
(*Peronospora* species)

Photo: Claudia Nischwitz, Utah State University, Bugwood.org

Symptoms	• Lesions near the tips of older leaves • Yellow patches covered with grey wet fields • Leaf tips shrink, turn pale brown and later die.
Important to know	• Disease caused by a fungus • Transmission through onion sets and plant residues • Infection is only possible after nights with high humidity (over 90 %) and wet leaves in the morning (dew, rain).
Measures before planting	• Crop rotation • Use early maturing, tolerant varieties • Cultivate only on plots open to the wind. • Apply nitrogen sparingly.
Measures after planting	• Reduce sowing/planting density below 60 plants/m² for good aeration of the stands. • Ensure good field hygiene. • Avoid dense weed growth.
Measures in case of infestation	• No effective organic fungicide known

African Organic Agriculture Training Manual Crop Management: Onion 25

PURPLE BLOTCH



Purple Blotch
(*Alternaria* species)

Photos: Howard F. Schwartz, Colorado State University, Bugwood.org

Symptoms	• Small white spots on the leaves, under moist conditions rapidly increasing to purplish blotches, often surrounded by a yellow to orange border
Important to know	• Disease caused by a fungus • Preventive measures are of particular importance.
Measures before planting	• Maintain a proper crop rotation. • Ensure field hygiene removing crop remains after harvest.
Measures after planting	• Ensure recommended spacing and good drainage to decrease humidity in the plant stand. • Avoid overfertilisation.
Measures in case of infestation	• No direct measures possible • Remove infested crop residues from the field and destroy or compost them.

African Organic Agriculture Training Manual Crop Management: Onion 26

› Practice good plant spacing and row orientation to promote good ventilation for the growing plants.
› Avoid extended periods of leaf wetting, e.g. through overhead irrigation.
› Irrigate the onions when the risk of extended leaf wetting is low, e.g. overhead irrigation during the evening.
› Practice good crop rotations to minimise disease perpetuation – avoid planting onions on the same field in cycles of less than 3 years.
› With early-maturing varieties, harvest maturity can be reached before the onion foliage has been completely destroyed by the disease when cultivated via seedlings and under good growing conditions.
› Good weed management helps to improve field ventilation.

Purple Blotch *(Alternaria species)*

Allium crops are susceptible to the Purple Blotch disease. The disease has a long temperature range for growth from 6 to about 33 °C. Temperatures around 25 °C are most favourable for disease development. It affects leaves and may also affect the neck part of bulbs.

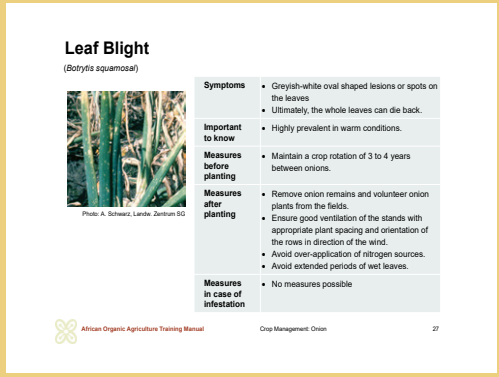
The disease begins as tiny spots on the leaves, exhibiting a sunken appearance. As it develops, the spots grow larger, especially under favourable temperature and moist conditions. The enlarged spots turn to a purple colour and surrounded by a yellowish colour on the edges. Often, the spots become covered with black sooty spores. Eventually, in a few weeks the leaves turn to a yellow colour and then collapse. When the bulb neck is attacked, the disease manifests as a watery yellow to reddish rot.

The fungus is transmitted on infested dead plant material, in the soil or from nearby infested crops. Preventive measures are of particular importance, as no organic treatment measures are known to date.

Suggested control measures:

› Selecting suitable varieties which resist the disease is one of the initial lines of managing the disease. Varieties which have a glossy leaf appearance are more susceptible while those with a waxy appearance are more resistant.
› Onion seed treatment with hot water can help to kill some spores.
› Where it is possible, farmers can plan to sow and grow the onions during periods when the risk of disease attack is low.

LEAF BLIGHT



Leaf Blight

(*Botrytis squamosal*)

Photo: A. Schwarz, Landw. Zentrum SG

Symptoms	• Greyish-white oval shaped lesions or spots on the leaves • Ultimately, the whole leaves can die back.
Important to know	• Highly prevalent in warm conditions.
Measures before planting	• Maintain a crop rotation of 3 to 4 years between onions.
Measures after planting	• Remove onion remains and volunteer onion plants from the fields. • Ensure good ventilation of the stands with appropriate plant spacing and orientation of the rows in direction of the wind. • Avoid over-application of nitrogen sources. • Avoid extended periods of wet leaves.
Measures in case of infestation	• No measures possible

- The crop should be planted in well drained soils, and over watering and water logging in the field should be avoided.
- Wetting of leaves should be avoided where possible. Prolonged periods of wet leaves and moist conditions favour disease development.
- Suitable plant spacing in the field improves ventilation of the plants. In high risk areas, increased spacing should be considerd, but this may encourage development of larger bulbs.
- In case of infestation crop residues should be removed from the field and destroyed or composted properly.

Leaf Blight *(Botrytis squamosal)*

Botrytis is a fungal disease that causes blight in onions. Infected onions which are not removed from the field can facilitate the disease to overwinter in the field and cause infections to subsequent crop. The disease starts as greyish-white oval shaped lesions or spots noticeable on the leaves. The spots centres may be sunken and exhibit a straw colour. Often, the spots are surrounded by a distinctive silvery-white 'halo' (spot) characterised by uneven margins. The onion leaf tips may dieback when the disease infection is severe. The whole leaf can ultimately die back. The disease is highly prevalent in warm conditions of around (16 to 28 °C).

Suggested control measures:

- Good field and plant hygiene are important in managing the disease. Onion remains and volunteer onion plants should be removed from the fields.
- Proper crop rotations should be ensured. Onions should be planted on the same field in cycles of 3 to 4 years only.
- Recommended plant spacing and orientation of the rows in direction of the wind ensure good ventilation among plants.
- Over-application of nitrogen sources should be avoided as this causes lush vegetative growth.
- Wetting of the leaves for extended periods should be avoided as this promotes disease growth and development.

White Rot *(Sclerotium cepivorum)*

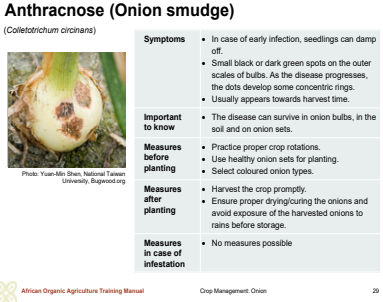
The onion white rot is one of the most devastating diseases, particularly in the non-red varieties. It can survive in the soil for up to 20 years, or on infected onion bulbs as black masses (sclerotia of the fungus, 0.2 to 0.5 mm large, black spots visible to the eye) or on sets with ability to germinate and progress into disease once conditions become favourable (optimal temperatures ranging from 15 to 20 °C and wet conditions favourable). The disease also attacks other allium species such as chives and garlic.

Affected onion leaves become yellow, their tips die back, and the whole leaves collapse, eventually. Farmers might observe white mould fluffs on the bulbs or onion roots often containing the sclerotia. White mould can affect patches of onions in the field. The infection from the field can be carried into storage.

Suggested control measures:

- Practice good rotations of 3 to 5 year cycles.
- Use healthy seed, seedlings or sets.
- Choose well-drained sites and avoid over-irrigation or water-logging.
- Avoid acidic soils, or apply lime to raise the soil pH to optimal levels for onion.
- Use resistant varieties if the disease is prevalent. Red onion types are less susceptible.
- Before planting onions, destroy volunteer alliums and any wild relatives.
- Use good quality, well-decomposed compost and green manures, as these promote the decomposition and reduction of sclerotia in the soil. Note that poorly decomposed plant residues and manures containing white rot can act as diseases sources.
- Avoid over-application of nitrogen fertilisers.
- Clean farm implements thoroughly after field operations.
- Avoid bulb damage in the field or after harvest. Avoid soil compaction and physical damage during field and postharvest operations.
- Discard infected bulbs before storage and ensure that the storage facilities are clean.

ONION SMUDGE

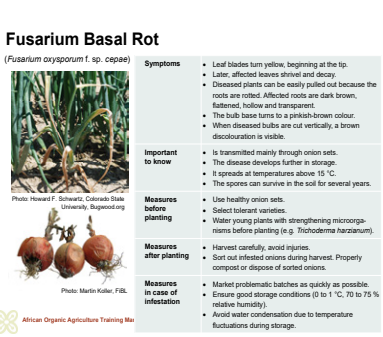

Anthracnose (Onion smudge)
(*Colletotrichum circinans*)

Symptoms	• In case of early infection, seedlings can damp off. • Small black or dark green spots on the outer scales of bulbs. As the disease progresses, the dots develop some concentric rings. • Usually appears towards harvest time.
Important to know	• The disease can survive in onion bulbs, in the soil and on onion sets.
Measures before planting	• Practice proper crop rotations. • Use healthy onion sets for planting. • Select coloured onion types.
Measures after planting	• Harvest the crop promptly. • Ensure proper drying/curing the onions and avoid exposure of the harvested onions to rains before storage.
Measures in case of infestation	• No measures possible

Photo: Yuan-Min Shen, National Taiwan University, Bugwood.org

African Organic Agriculture Training Manual Crop Management: Onion 29

FUSARIUM BASAL ROT


Fusarium Basal Rot
(*Fusarium oxysporum* f. sp. *cepae*)

Symptoms	• Leaf blades turn yellow, beginning at the tip. • Later, affected leaves shrivel and decay. • Diseased plants can be easily pulled out because the roots are rotted. Affected roots are dark brown, flattened, hollow and transparent. • The bulb base turns to a pinkish-brown colour. • When diseased bulbs are cut vertically, a brown discolouration is visible.
Important to know	• Is transmitted mainly through onion sets. • The disease develops further in storage. • It spreads at temperatures above 15 °C. • The spores can survive in the soil for several years.
Measures before planting	• Use healthy onion sets. • Select tolerant varieties. • Water young plants with strengthening microorganisms before planting (e.g. *Trichoderma harzianum*).
Measures after planting	• Harvest carefully, avoid injuries. • Sort out infested onions during harvest. Properly compost or dispose of sorted onions.
Measures in case of infestation	• Market problematic batches as quickly as possible. • Ensure good storage conditions (0 to 1 °C, 70 to 75 % relative humidity). • Avoid water condensation due to temperature fluctuations during storage.

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

Photo: Martin Koller, FiBL

African Organic Agriculture Training Ma

Anthracnose (Onion smudge) *(Colletotrichum circinans)*

Anthracnose, also known as smudge, attacks onions, shallots and leeks. The disease can survives in onion bulbs, in the soil and on onion sets. It thrives in warm (optimum around 24 to about 29 °C) and moist soil conditions. Under these conditions, anthracnose can cause seedling damping off.

The disease manifests as small black or dark green spots on the outer scales of bulbs. As it progresses, the dots develop some concentric rings. The disease usually appears in the field towards harvest time. While infection begins in the field, the disease develops further during storage. Living fleshy plant tissues can also be attacked when infections are heavy and may collapse.

The disease is more severe in white onions compared to the coloured types.

Suggested control measures:

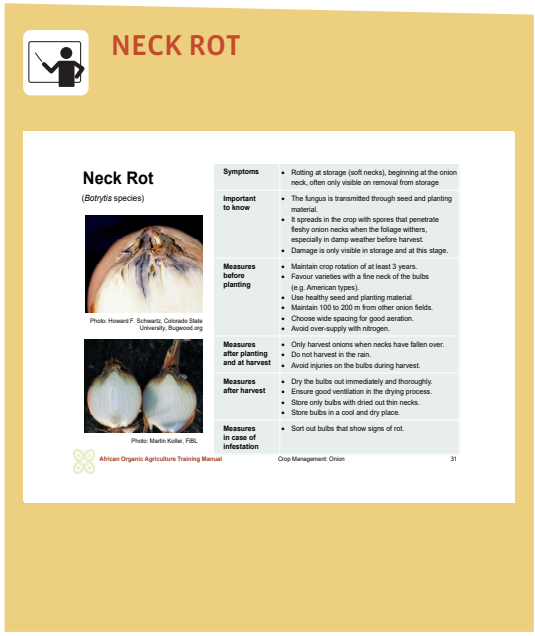
- Avoid using infected onion sets at planting.
- Select suitable (coloured) onion types.
- Practice proper crop rotations.
- Timely harvesting is encouraged.
- Ensure proper drying/curing of the onions, and protect the harvested onions from rains before storage.

Fusarium Basal Rot *(Fusarium oxysporum* f.sp. *cepae)*

Fusarium is one of the rot diseases in onions. It favours soil temperatures above 15 °C and develops optimally at soil temperatures of around 29 °C. The disease spores can survive for long periods in the soil, and the disease is easily spread by infected sets, tubers, and volunteer allium crops.

In early stages, the leaves become yellow and their tips begin to die back. Eventually, the whole plant may collapse as the disease progresses. Diseased plants can be easily pulled out because the roots are rotted. The bulb base turns to a pinkish-brown colour. The fungus manifests as a white coating. Affected roots are dark brown, flattened, hollow and transparent. When diseased bulbs are cut vertically, a brown discolouration is evident. Unlike white rot, fusarium rot does not produce sclerotia.

The fungus survives in any soil moisture that permits crop growth. Infection is facilitated by injuries to root system. Fusarium rot weakens the onion plants and makes infections by other diseases easier. Late infections in the field can be carried over into storage and cause further damage and loss.



Suggested control measures:

- Use tolerant varieties, however some of the tolerant varieties such as Praat Takii have a short shelf-life.
- Use disease-free bulb sets to plant, and discard any diseased seedlings at transplanting. Check for the presence of mycelia (white strands) at the base of the bulb.
- Maintain good crop rotations.
- Seedlings can be treated with strengthening microorganisms such as *Trichoderma* before transplanting.
- Take care to not damage the onion roots during field operations.
- Dry the bulbs properly after harvest.
- Sort and remove any diseased or damaged bulbs before storage.
- If cooling facilities are available, onions should be stored at 0 to 1 °C and 65 to 75 % relative humidity (70 to 75 % RH is optimal).
- Onion batches with potential disease problems should be used or marketed earlier.
- The stored onions must be protected from moisture or rain as this will facilitate spore germination and disease development.

Neck Rot *(Botrytis* species*)*

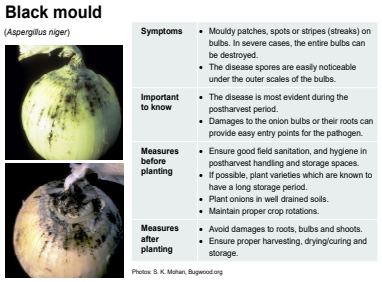
Neck rot is a seed-borne disease. It affects stored onion and other allium crops and can be easily mistaken for other rot diseases. Infections start in the field, especially in humid conditions. Infected onion necks may become soft and rot before harvest. The disease becomes more evident during storage and can occur simultaneously with bacterial decay diseases. As neck rot disease development progresses, some grey mould may form on the bulbs.

Varieties with a fine neck are less susceptible to the disease. Heavy infestation by downy mildew can promote onion neck rot due to thick tubes that do not mature properly. Low risk if foliage matures quickly and dries immediately after harvest.

Suggested control measures:

- Since it is a seed-borne disease, starting with disease-free planting materials (seed and sets) is important.
- Hot water treatment can be used to control the disease before seed sowing.
- In areas where Botrytis is problematic, farmers should use wider spacing (e.g.

BLACK MOULD



Black mould

(Aspergillus niger)

Symptoms	• Mouldy patches, spots or stripes (streaks) on bulbs. In severe cases, the entire bulbs can be destroyed. • The disease spores are easily noticeable under the outer scales of the bulbs.
Important to know	• The disease is most evident during the postharvest period. • Damages to the onion bulbs or their roots can provide easy entry points for the pathogen.
Measures before planting	• Ensure good field sanitation, and hygiene in postharvest handling and storage spaces. • If possible, plant varieties which are known to have a long storage period. • Plant onions in well drained soils. • Maintain proper crop rotations.
Measures after planting	• Avoid damages to roots, bulbs and shoots. • Ensure proper harvesting, drying/curing and storage.

Photos: S. K. Mohan, Bugwood.org

50 cm between rows) to allow good ventilation and avoid moisture build up in the fields. However, larger spacing can result in larger bulb sizes.

- Onion plants that have been infected by downy mildew are more susceptible to Botrytis infection.
- Overhead irrigation promotes leaf wetting and should be avoided where possible.
- If land is not limiting, onion fields should be a minimum distance of 100 m apart as an isoloation strategy.
- Good fertilisation is important. However, when onions receive excessive amounts of nitrogen they become more susceptible to the rot.
- Harvest the onions under dry conditions and avoid bulb damage during and after harvest. After curing, the onion necks should be cut at about 10 cm above the bulb.
- Ensure good onion curing and drying before storage. When the weather is good, the onions can be left in the field for up to 10 days to allow proper curing. In case of unavoidable rainy weather at harvest, farmers should dry the onions in a shed.

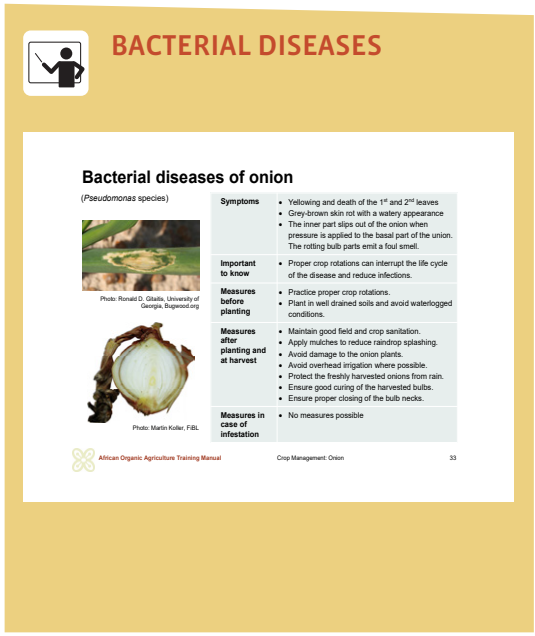
Black mould *(Aspergillus niger)*

The black mold disease attacks onions and other alliums both in the field close to maturity, and in postharvest stages. It is often described as ubiquitous, meaning it can be commonly found in the general environment. Rotting plant materials are an important source of the disease pathogens.

On bulbs, the disease appears as mouldy patches, spots or stripes (streaks). The disease is most evident during the postharvest period. Any damages to the onion bulbs, or their roots, can provide easy entry points for the pathogen. In severe cases, the whole bulb can be destroyed by the disease. When present, the disease spores are easily noticeable when one peels off the outer scales of onion bulbs.

Suggested control measures:

- General field sanitation, and hygiene in postharvest handling and storage spaces can help to prevent the disease.
- If possible, plant varieties which are known to have a long storage period.
- Plant onions in well drained soils.
- Ensure good crop rotations.



› Avoid any form of damage to the onion roots, bulbs and shoots.
› Ensure proper harvesting is carried out, followed by proper drying/curing.
› Ensure proper storage facilities.

Several other fungal diseases can affect onions. Examples include powdery mildew, and rot diseases such as *Penicillium* and *Aspergillus* species.

6.2 Selected bacterial diseases and suggested control measures

Among the bacterial diseases for onion, *Pseudomonas*, *Erwinia*, *Xanthomonas* and *Pectobaterium* species are some of the key ones. They are favoured by wet and warm conditions. The diseases cause a soft rotting near the neck of the bulbs. Affected bulbs have slippery and sour skins. Infections begin in the field and are carried over into storage. An affected bulb appears to be normal. However, its inner part can easily slide when the bulb is squeezed, or when being cut. The soil is the major source of infection. Preventing damage to bulbs can reduce disease infection to the bulbs.

Slippery skin *(Pseudomonas allicolai* pv. *allicola)*

Pseudomonas is a bacterial disease that is known to occur commonly in the soil and other areas of the environment. The pathogens can be spread easily by farm implements, soil on shoes or boots, water, and other mechanisms. Water drops from overhead irrigation or rain water can form significant splashes when they impact with the ground. These splashes can easily carry soil, and if the soil is contaminated, the splashes can spread the pathogens onto plants where they land. Any open sites on the plant can provide pathogen entry into the plant. The bulb necks are open and can provide entry points for the pathogens.

The early symptoms of the disease is yellowing and death of the first and second leaves, as these are closest to the soil. As the bacteria enters into the bulb, it causes a grey-brown skin rot with a watery appearance. The outermost skins or scales and the innermost parts of the bulb remain intact, yet the inner part slips out of the onion when pressure is applied to the basal part of the bulb. The rotting bulb parts emit a foul smell.


THRIPS

Thrips

(*Thrips tabaci* and other species)

Photos: Agroscope

Symptoms	• Silvery-white patches on the leaves due to sucking activity on the epidermis, often with black faecal spots • The adults are slender, coloured from light yellow to brown and winged.
Important to know	• Major pests of onions throughout Africa • Favoured by dry and warm conditions • They survive on host crops and in the soil.
Measures before planting	• Avoid growing onion crops next to each other. • Remove and destroy plant remnants and volunteer onion plants from the field. • Ensure good (and deep) soil preparation as this exposes the adults that are in the soil. • Promote the natural enemies.
Measures after planting	• Weekly check blue traps for appearance. • Remove weeds and keep plants well irrigated. • Crop protection nets can delay the infestation, but may promote downy mildew.
Measures in case of infestation	• Remove heavily infested plant material. • Spray neem extracts on infested plants.

African Organic Agriculture Training Manual Crop Management: Onion 34

Suggested control measures:

- Plant in well drained soils and avoid waterlogged conditions.
- Maintain good field and crop sanitation.
- Apply clean mulches to the onion so as to reduce raindrop splashing.
- Proper rotations can interrupt normal cycle of the disease and reduce infections, but onions planted after maize can exacerbate the situation.
- Avoid any damage to the onion plant at any stage.
- Avoid overhead irrigation where possible.
- Protect the freshly harvested onions from rain.
- Ensure good curing of the harvested bulbs.
- Ensure that onion necks are properly closed during drying before cutting the tops. Avoid cutting the dry tops too close to the bulb.

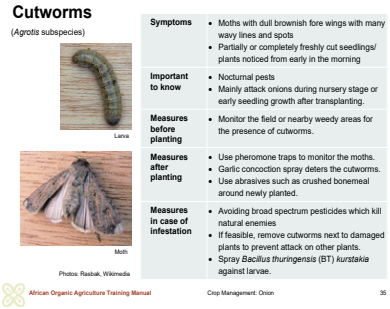
6.3 Selected common pests and suggested control measures

Similarly to disease management, different strategies and measures can be used to prevent, limit and control crop pests. The 3-step approach also applies in pest management. The steps build onto each other. Organic farmers aim to optimise on preventive measures, and those strategies which encourage suitable growing conditions and a surrounding environment that discourages pest proliferation and spreading. The farmers are also encouraged to monitor their crop closely and scout for pests so that direct control measures can be applied timely before severe damage occurs.

Thrips *(Thrips tabaci)*

Thrips are tiny and very mobile insects which can cause severe damage to onions, causing up to 60% loss. Dry warm conditions favour the pest to develop. They have a yellowish or greyish green to dark brown colour and have a short life cycle of around 8 days. They suck sap from onion leaves, particularly in the axils of newly emerging leaves, leaving a spotted appearance on the leaves. As the pests continue to suck out the sap from the plants, the spotted parts turn to pale white blotches or blemishes. Their feeding activity interferes with normal plant growth. Damage by thrips can be easily mistaken with damage by spider mites, however the latter produce darkish waste while trips leave small green waste on the leaves.

CUTWORMS



Attack by thrips can cause both quantitative and quality losses, e.g. seed harvested from thrip infected plants has low viability. The pests can also cause indirect damage by transmitting viruses when they pierce the leaves and suck sap. The pest can survive from one crop to the next as adult stages on the onion or other host plants. They can also survive in the soil and infect the next host crop.

Suggested control measures:

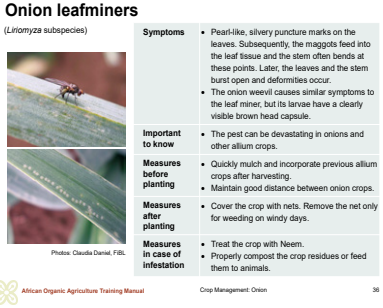
- If land is not limiting, avoid growing onion crops next to each other.
- Remove and destroy any onion plant remnants and volunteer onion plants from the field.
- Good soil preparation before planting can expose the adults that are harboured in the soil and destroy them before the new onion crop is planted.
- Thrips are predated by natural pests such as hoverfly larvae, predatory mites, fungi, and lacewings. Ensure that conditions which promote the multiplication and spread of these natural enemies prevail.
- Practice regular (e.g. weekly) crop scouting to monitor pest levels (e.g. with blue traps). Take the necessary direct action when pest thresholds have been reached for organic onion production.
- Avoid early morning and evening irrigation even though it is good for moisture conservation. Shorter irrigation cycles are recommended, but this may lead to downy mildew and other disease attacks.
- When direct control is needed, farmers can use treatments such as neem sprays. Although pyrethrin and spinosad can be effective, they are also known to kill the natural enemies to the thrips. Soap sprays can be effective. Farmers always need to check if control products are permitted for use in organic, especially if intended for marketing.

Cutworms (*Agrotis* species)

Cutworms are nocturnal pests, meaning that they hide during the day and become active at night. Their adult stages are moths with dull brownish fore wings that have many wavy lines and spots. The hind wings are brown in colour.

Cutworms can attack tender onions during their nursery stage, or during early seedling growth after transplanting. During the night, they wrap themselves around the seedling at the ground level and chew on the stem. Continued chewing causes the seedling to fall, either partially or completely cutting it. Damage is noticed from early in the morning as freshly cut plants.

LEAFMINERS



Onion leafminers

(*Liriomyza* subspecies)

Symptoms	• Pearl-like, silvery puncture marks on the leaves. Subsequently, the maggots feed into the leaf tissue and the stem often bends at these points. Later, the leaves and the stem burst open and deformities occur. • The onion weevil causes similar symptoms to the leaf miner, but its larvae have a clearly visible brown head capsule.
Important to know	• The pest can be devastating in onions and other allium crops.
Measures before planting	• Quickly mulch and incorporate previous allium crops after harvesting. • Maintain good distance between onion crops.
Measures after planting	• Cover the crop with nets. Remove the net only for weeding on windy days.
Measures in case of infestation	• Treat the crop with Neem. • Properly compost the crop residues or feed them to animals.

Photos: Claudia Daniel, FiBL

African Organic Agriculture Training Manual Crop Management: Onion 36

Suggested control measures:

- Monitor the field, or nearby weedy areas to check for the presence of cutworms before planting.
- Use pheromone traps as an early warning system for the pest, or a control mechanism. The traps are installed to catch the male adult moths and monitor the numbers for thresholds. Capturing the males also disrupts their normal mating activity with females.
- Avoiding broad spectrum pesticides which kill natural enemies.
- Practice good pest scouting and apply direct control methods timely.
- Use seedling collars if it is economic.
- Use garlic concoction spray to deter the cutworms.
- Use abrasives such as crushed bonemeal around newly planted seedlings to damage the larvae as they crawl. The bone meals also supply calcium to soils and make the soils less favourable to cutworms.
- If feasible, search for and remove the cutworms next to damaged plants to prevent further attack on remaining plants.
- Spray the field with *Bacillus thuringensis* (BT) *kurstakia* against larvae.

Leafminers (*Liriomyza* subspecies)

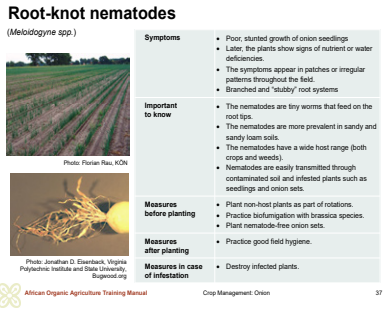
Leafminers can be devastating in onions and other allium crops. The adults lay eggs and emerging maggots feed on the leaves and make tunnel structures in the leaf tissues. The adults are active at temperatures above 13 °C during the day.

At first, some dots arranged in rows appear on the leaves. These depict puncture marks, or entry points of the maggots. The maggots tunnel their way to the bulbs where they pupate. Affected bulbs often burst.

Suggested control measures:

- Crop remnants from onions or other alliums should be destroyed soon after harvest to avoid perpetuation of the pest.
- Maintain good isolation distance between two onion crops.
- When the risk is high, the onion crop can be covered with fleece or netting with a mesh size of less than 0.8 mm). When fleece is used, ensure that it does not have holes. Where possible, for weeding, the netting or fleece should be removed on a windy day, or when day temperatures are less than 13 °C, as the adults are less active under these conditions.

ROOT-KNOT NEMATODES



Root-knot nematodes

(*Meloidogyne spp.*)

Symptoms	• Poor, stunted growth of onion seedlings • Later, the plants show signs of nutrient or water deficiencies. • The symptoms appear in patches or irregular patterns throughout the field. • Branched and "stubby" root systems
Important to know	• The nematodes are tiny worms that feed on the root tips. • The nematodes are more prevalent in sandy and sandy loam soils. • The nematodes have a wide host range (both crops and weeds). • Nematodes are easily transmitted through contaminated soil and infested plants such as seedlings and onion sets.
Measures before planting	• Plant non-host plants as part of rotations. • Practice biofumigation with brassica species. • Plant nematode-free onion sets.
Measures after planting	• Practice good field hygiene.
Measures in case of infestation	• Destroy infected plants.

Photo: Florian Rau, KÖN

Photo: Jonathan D. Eisenback, Virginia Polytechnic Institute and State University, Bugwood.org

African Organic Agriculture Training Manual Crop Management: Onion 37

› If possible, time planting of the onions so that their growth does not coincide with conducive conditions.
› Well composted materials have lower risks of pest carry-over. The compost needs to have gone through a 2 week heating period at 55 °C.
› Neem spray can help to control the pests when they occur.

Root-knot nematodes (*Meloidogyne* spp.)

Root-knot nematodes are plant-parasitic tiny worms that attack plant roots in susceptible crops such as onion. The pest has a full life cycle in 3 to 4 weeks under optimal conditions. The larvae hatch from eggs and in their second stage infect plant roots.

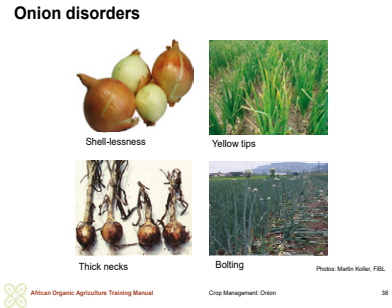
Infested onions show stunted growth after germination or later in crop development. Later, the plants show signs of nutrient or water deficiencies. The symptoms appear in patches or irregular patterns throughout the field. Pulled plants have branched and 'stubby' root systems.

The nematodes are more prevalent in sandy and sandy loam soils. They have a wide host range (both crops and weeds) making control through crop rotations alone difficult. Nematodes are easily transmitted through contaminated soil and infested plants such as seedlings and onion sets.

Suggested control measures:

› Plant clean sets which are free from nematodes.
› Practice good field hygiene: clean implements when moving from one field to the next.
› Destroy infected plants.
› Plant non-host plants as part of rotations.
› Practice biofumigation with brassica species which naturally contain the chemical compounds effective against nematodes. The plants are grown until they reach an appropriate stages after which they are cut down, chopped, and incorporated.

DISORDERS



6.4 Selected onion disorders

Onion seedlings can be affected by a number of disorders arising from the following and other causes:

- Adverse soil conditions such as nutrient imbalances, high soil temperatures, extreme soil moisture levels, salinity, unfavorable pH
- Strong winds, hailstorms, and impacts of raindrops on the leaves, and physical impediments.

Disorders can manifest as uneven seedling emergence, plant stunting and general poor growth, leaf tip dieback and physical injury. Phytotoxic products such as herbicides and insecticide can also cause some disorders in onion, but in organic these challenges should be insignificant as herbicides and synthetic insecticides are not permitted. Common nutrient deficiencies include pale or yellow leaves (from nitrogen, phosphorus and manganese deficiencies), and stunted and twisted yellow striped leaves.

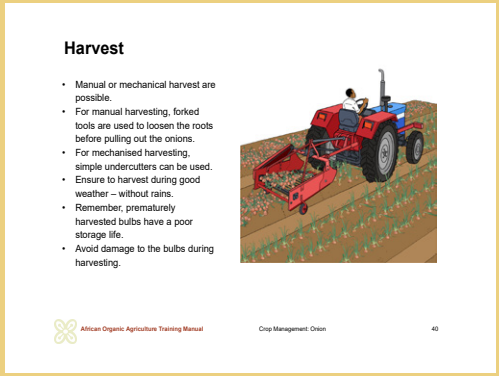
Thick necks result from factors such as late sowing, over-irrigation, over- or late supply of nitrogen, and too wide spacing. Some varieties have a tendency to produce thick necks.

Bolting, the production of a flower stalk prematurely before the bulbs are fully formed, is another disorder that occurs in onions. This can be caused by cool conditions prevailing during the time when the onions are expected to be forming bulbs. Bolting results in split bulbs that have a tougher texture and poor storage quality. The most sensitive stage for bolting is when the onions are at the 8 to 10 leaf stage. Timing of planting is, therefore, very important to avoid cool conditions during the sensitive stage. Farmers can make reference to planting calendars which suit their areas. Further, the farmers' experience in growing onions over the years can be a good guide to the timing of sowing and transplanting.

Some of the disorders can be mistaken for diseases and farmers may waste resources in controlling non-existent diseases. Good record keeping and proper identification are encouraged for a more accurate diagnosis of the problems and how to control them.

DETERMINING MATURITY

HARVESTING



7. Harvesting and postharvest management

7.1 Timing of harvest, drying and curing, and storage

Determining harvest maturity

Time of harvesting depends on the purpose for which the crop was planted. Onions can be harvested starting from when the tops are about 15 cm tall depending on the needs or use, i.e. spring onions or bulb onions. Onions harvested at the green stage do not keep for long and should be marketed or consumed within a few days except if cold storage facilities are available.

Onions meant for bulbs are ready for harvesting between 90 to 150 days after sowing (depending on the variety and the growing conditions), or a week after the tops begin to turn yellow and collapse/lodge. Yellowing and toppling of the foliage is a sign that the crop is reaching maturity. When the leaves start to dry, irrigation should be stopped.

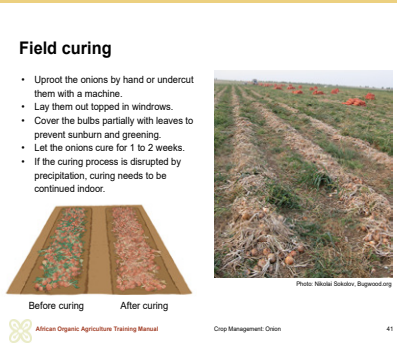
When some of the tops fall over, the onions are ready for immediate consumption. Maturity for storage is reached when at least 75 to 85 % of the tops have dried and fallen over naturally. Alternatively to waiting for the natural collapsing of the leaves, they can be bent over mechanically at the necks and left to dry for 10 to 12 days.

Drying and curing

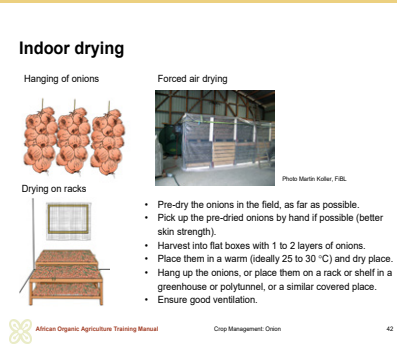
Before harvesting and storage, the onions need to be properly dried and cured. Proper drying of the onions prior to storage is key to their preservation and prevents the development of bacteria and mould. Drying is especially important in wet climates or if the onions have been exposed to extended periods of moisture through the harvesting season. The less moisture is present at the time of storage the longer shelf life.

Drying and curing serves to dry off the necks and the outer leaves of the bulbs. Curing can be done in the field or in a protected environment. Curing in the field is recommended if the climate around onion harvest is hot and dry. For field curing, onions are typically uprooted (undercut) by hand or with a machine, windrowed, topped, and left to dry in the field. The bulbs should be partially covered with leaves to prevent sunburn and greening. Field curing can take 1 to 2 weeks. Precipitation during this time can disrupt the curing process and also leads to disease infection and/or development..

FIELD CURING



INDOOR DRYING



If weather does not permit curing in the field, the onions need to be dried in a protected place on drying racks in single of double layers for further curing under cool dry conditions with good aeration. Improved drying facilities include forced air drying in bulk pallets or wooden crates where the conditions of the air, such as relative humidity and temperature, can be controlled. Although it is a faster and more efficient method, forced air drying requires specialised equipment, power, and operational skills.

Curing is completed when the necks of the bulbs (the place where the leaves meet the bulb) are dry and shrunken. The necks should be closed without large cavities, and feel soft when rubbed between thumb and forefinger. The sheath leaves should have papery quality with a dry touch, and a uniform colour typical of the variety. A dry outer layer of skin protects and maintains onion freshness and quality during storage. To avoid rot during storage, also the last green leaf should be dry.

Before storage, the onion bulbs need to be sorted a first time. Bulbs with thick necks, and bolted, injured, decayed or small onions should be removed.

Storage

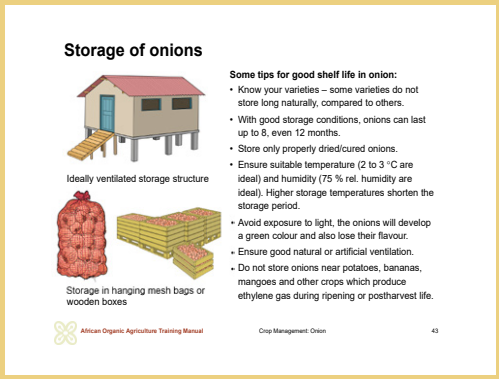
Freshly harvested onions are dormant and will not sprout for a variable period of time (depending on the variety). Proper storage extends the dormant period.

Ideal storage temperature is at 2 to 3 °C. Higher storage temperatures shorten the storage period. Ideal storage humidity is at 75 % relative humidity. For natural storage, a dry place with draughts or good ventilation should be chosen.

Good storable varieties can be stored in machine-cooled storage for 6 to 8 months. Onions store better when not or only roughly cleaned. Wounds shorten the storage life as do temperature fluctuations. Sprouting increases in storage temperatures above 4.4 °C.

Some ventilation is essential to avoid an increase in CO_2 levels and to dissipate heat generated by the onions as they slowly continue to respire. However, too draughty a spot can cause onions to respire more, dry out and lose too much weight. To keep the onions dry and cool, they should be ventilated regularly (20 to 30 hours per week, 4 times 1 hour per day). The air temperature should be below the temperature of the bulbs to prevent condensation. For ventilation, fresh air is let into the storage when the air is colder and less humid outside than inside. If the conditions outside are unfavourable, the valves are closed and the ventilation system recirculates the inside air.

STORAGE



STORAGE DISEASES

As most smallholder farmers do not have the specialised storage facilities, they can hang their onions in a well ventilated cool shed in mesh bags, or keep them on a cool floor. Above temperatures of 25 °C, onions keep well, too. If the temperatures drop significantly below 18 °C, the onions may begin to sprout. The onions, particularly the red fleshed ones, need to be protected from light as this can cause some discolouration and loss of flavour. In white or yellow onions, exposure to light can cause some green colour to develop. Onion should not be stored near potatoes, bananas, mangoes and other crops which produce ethylene gas during ripening or postharvest life. The ethylene gas produced by the potatoes and onions causes either the onion bulbs or potato tubers to sprout in storage.

In case of machine-cooled storage, at removal of onions from storage, the temperature should be increased slowly to approximately 10 to 15 °C with dry, warm air to avoid the formation of moisture condensation.

Pest and disease management in storage

Onions are susceptible to several diseases in storage. Most of the infection starts during the field stage and continues into storage. Preventive measures during growing, harvesting and postharvest handling through good hygiene and other strategies will help to reduce problems during the postharvest life of the onions. Some of the common storage diseases include:

- Fusarium Basal Rot
- Botrytis Neck Rot
- Purple Blotch (Alternaria species)
- White Rot (Sclerotinia species)
- Blue Mold (Penicillium species)
- Soft rot (Rhizopus species)

7.2 Sorting, grading and packaging

Onions should be sorted to remove damaged, diseased, wilted or bolted bulbs before packing or transportation to the market. This can be followed by grading, if the target markets or consumers demand graded bulbs. Some of the important grading criteria for markets include size, colour, and shape. Farmers are encouraged to find out what their markets need so that they deliver bulbs that attract a good price.

SPROUTING AT STORAGE

Farmers can pack the cleaned bulbs into mesh bags and keep them in a well-aerated shed away from the sun pending marketing or storage. The field-cured onions can be carried in mesh bags or rigid containers with smooth internal surfaces such as boxes, cartons or large baskets. Care must be taken to ensure that the harvesting containers are clean and not contaminated with soil or rotting produce from other harvests.

8. Economic considerations in onion production and certification

8.1 Key consideration before embarking on large-scale onion production

Most farmers produce onions for both household consumption, and for sale. Before onion production, it is important that farmers outlay the objectives of their production. This helps them to consider all the requirements which are necessary from production to utilisation. This prior reflection helps the farmer to make advance preparations for a successful process.

Similarly to other Modules in previous series to this Training Manual, the section below lays out some of the key questions which farmers need to ask themselves when thinking about growing onions. The list is not exhaustive, and the farmers are encouraged to add more points for consideration depending on their situation.

Possible questions:

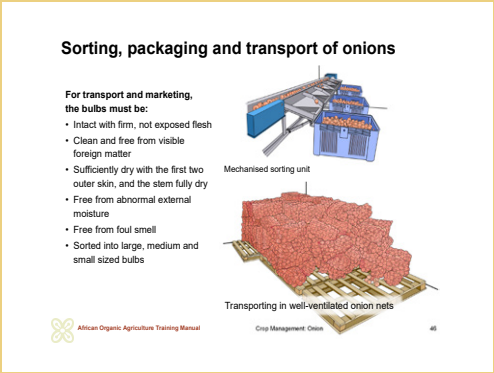
- What is the main driving reason for growing the onions?
- Is there suitable land available for producing organic onions?
- Beside land, are the following inputs also available: good quality planting materials, water, capital, nutrient sources such as good quality compost, equipment and tools (for field, harvesting and postharvest operations), pest and disease management materials, energy, transport, etc.
- Do onions fit well into the existing crop rotation or cropping patterns on the farm?
- Does the farmer have the necessary skills, or need to hire skilled labour for some operations?

Discussion on marketing

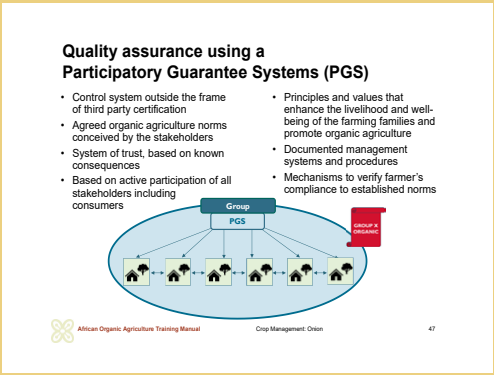
Ask the participants the following questions:

- Do any of the farmers in the area sell their onions as organic? If yes, where do they sell them?
- Discuss the type of certification that they have, if any – whether participatory guarantee system (PGS) or third-party certification. Do the farmers know these different types of certification?
- Do they face any challenges with their organic onions during marketing, e.g. any product returns due to non-compliance?

SORTING, PACKAGING AND TRANSPORT



PARTICIPATORY GUARANTEE SYSTEMS (PGS)



› What onion quantities does the household require for household consumption?
› If for selling, is there a good demand for the organic onions, and where, and during which times of the year?
› Will organic production require additional work and lead to labour bottlenecks?
› What potential risks can emerge – e.g. labour bottlenecks for weeding, pests and diseases and how to deal with these?

For marketing, the following are important too among other considerations:
› Which markets are targeted? How to get niche markets?
› Are any additional investments necessary on the farm to ensure that the onions can be marketed as organic without any contamination?
› Type of certification required to sell the onions as certified organic, availability of certifiers, regulations and standards and ability to observe all required expectations by the certification standard.
› Competitiveness and sustainability of the enterprise.
› Are there other considerations to suit the farmer's situation?

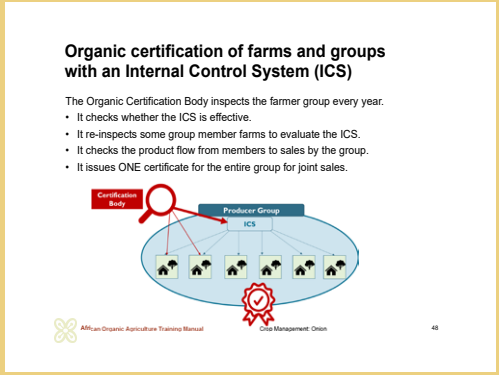
For further insights into the economic considerations, the reader can refer to the General Vegetable Training Manual at www.organic-africa.net.

8.2 Organic certification

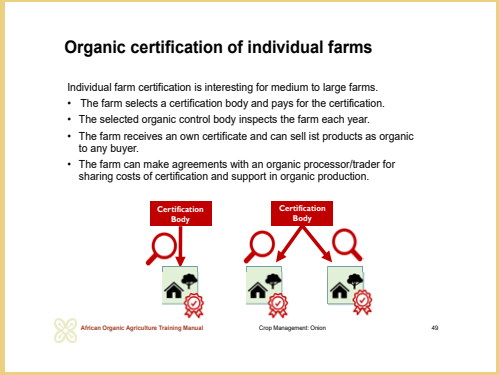
The following section describes some organic certification considerations as discussed already in previous Modules of the Training Manual. Organic certification checks compliance with organic standards to ensure that everyone in the organic supply chain adheres to the organic production principles and practices.

To be certified as organic, the farm must be inspected by a representative of a certifying organisation or body, and assessed against an organic standard or regulation. After this, products can be labelled and sold as 'organic products'. Certification of organic products is compulsory in all countries. For example, to sell in organic shops in Tanzania, the shops may expect to see the certification according to the East African organic standard or other recognised standards as a proof of organic practices. To export any products as 'organic' to Europe or the

INTERNAL CONTROL SYSTEM (ICS)



INDIVIDUAL FARM CERTIFICATION



US, farmers and traders will need to have third party certification by an accredited organic certification body recognised for certification of the import countries' organic regulations.

There are specific rules for organic production which must be met for being certified organic. However, the specific requirements may vary in different national or international organic standards. Therefore, interested farmers should consult the national organic movement or organic certification body operating within the region or country for further guidance.

There are three main types of certification relevant to organic farmers.

a) **Participatory certification through a Participatory Guarantee System (PGS):** This certification scheme is mainly relevant for the local or domestic market. According to IFOAM, Participatory Guarantee Systems are locally focused quality assurance systems. They certify producers based on active participation of stakeholders and are built on a foundation of trust, social networks and knowledge exchange. The details of methodology and process may vary, but the key elements and features of PGS systems remain consistent worldwide. With PGS, the responsibilities for implementing sustainable agriculture practices are shared by the community. PGS enhances transparency and shared decision-making processes and prioritises a solidarity approach to organic certification.

b) **Third party certification** conducted by an independent (third party) organic certifier, also called certification body **for a producer group with an Internal Control System (ICS)** and joint marketing. This scheme is relevant for some domestic markets, but mostly for export markets. Export of organic onions and other fresh produce is usually better handled by bigger operators who have the certification expertise, cooling facilities and can organise efficient logistics to ensure quick delivery to the distant export markets. Small farmers can work with such export companies as organic outgrower suppliers and be certified as a group. Some specific standards (e.g. the new EU organic regulation) require farmers to be organised as a legal entity to be certified as a group. In either case, the export company can help to manage the certification and marketing of the products and work with farmers to adhere to stipulated regulations based on agreements between company and farmers.

c) **External certification of single farms:** In difference to certification of groups of farms with an Internal Control System, single-farm certification involves

COMPARISON OF GROUP AND INDIVIDUAL CERTIFICATION

Comparison of certification of groups with ICS and certification of individual farms

Aspect	Single Farm Certification	Group Certification with ICS
Scope	Individual, medium to large farm	Group of small farms
Inspection	Full external inspection of entire farm	External inspection of a sample of farms, internal inspections by ICS
Responsibility	Farmer	Group management via ICS
Costs	Basically borne entirely by the individual farmer	Shared by the group
Record-keeping	Maintained by the farmer	Managed by ICS with farmer's records
Corrective actions	Handled by the farmer	Managed and enforced by ICS
Risk	Limited to the farm	Shared risk, but ICS helps manage

certifying one individual farm. The farm owner or operator is solely responsible for ensuring compliance with organic standards, and certification applies only to his or her specific operations. In single-farm certification there is no ICS. The individual farmer is responsible for managing all aspects of compliance with organic standards. External inspectors from the certifying body visit the farm annually for inspections. The farm can market its products independently.

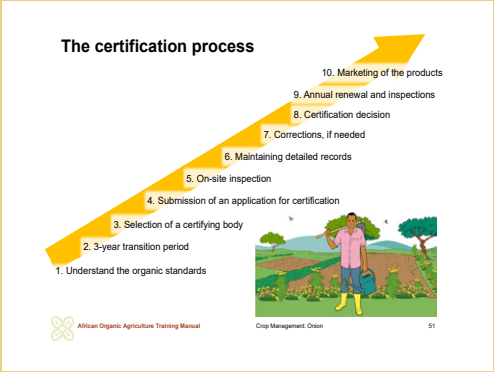
Every year, the certifying body inspects the entire farm, checking for compliance with organic standards, reviewing records, and evaluating all production areas. Records include detailed information of organic practices, inputs, sales, and compliance actions. The certifier verifies all aspects of the operation. The individual farmer bears full responsibility for ensuring that their farm complies with organic regulations. They directly interact with the certifier. If a non-compliance issue is found, the farmer must correct it and may face re-inspection or additional follow-up from the certifying body.

The cost of certification is typically higher for single farms because they must bear all the fees for inspections, application, and renewal on their own. Certification costs include application fees, inspection fees, and renewal fees. Additional costs may apply if further corrective actions or re-inspections are necessary.

Single-farm certification typically focuses on selling organic produce directly to national or international retailers or organic brands. Certification of single farms is common for farms with larger or more diverse operations. Farms of more than 5 hectares or with a turnover of more than 25.000 Euros per year must be inspected and certified as a single farm and cannot be part of a group certification.

In summary, single-farm certification is simpler in structure but costlier and more labour-intensive for the individual farmer, while group certification with ICS offers cost-sharing and internal management benefits, particularly for smallholders, but requires strong organisation and internal monitoring. Under the new EU Organic Regulation, individual farm certification will increase in many countries. In order to reduce certification costs, farms can conclude commercial agreements with exporters, for example, whereby the exporter pays part of the certification costs in return for certain delivery commitments.

CERTIFICATION PROCESS

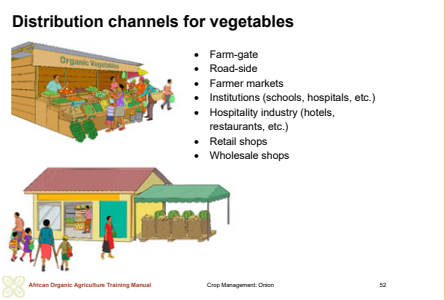


Process of organic agriculture certification for single farms

The process of organic agriculture certification for single farms is a structured procedure with key steps and specific requirements involved.

1. **Understanding the organic standards:** Before beginning the certification process, the farmer should familiarise him-/herself with the organic standards set by the country or certifying body. These standards define what is required in terms of soil management (use of organic fertilisers, crop rotation, etc.), pest and weed control (use of biological methods, no synthetic chemicals), use of seeds and inputs (only approved organic inputs allowed), and livestock management (organic feed, outdoor access, no antibiotics).
2. **3-year transition period:** Most organic certification systems require a transition period of 3 years from conventional farming to organic farming. This period is crucial for soil health and compliance. During this period, the use of synthetic pesticides, fertilisers, and GMO seeds must be avoided. During this time, the farmer will need to implement organic practices but will not yet be certified organic. However, crops planted at least one year after the first certification can be sold as 'organic in conversion'.
3. **Selection of a certifying body:** The farmer chooses a government-approved or otherwise accredited certifying agency in the country or region. The agency will guide the farmer through the certification process and conduct inspections. It's important to research and choose a certifier that aligns with the market goals and geographic area of the farm.
4. **Submission of an application for certification:** For the application, detailed information about the farm must be provided, including maps, field history, types of crops, and management practices. The farmer should outline how he or she plans to comply with organic standards, such as: fertiliser sources, pest and disease control strategies, seed sources, and record-keeping practices.
5. **On-site inspection:** After submission of the application, the certifier will schedule an inspection of the farm. The inspector will review the production practices, soil management, water use, pest control, and any inputs use. He will furthermore check for potential contamination risks from neighbouring conventional farms or environmental factors, and inspect storage and processing facilities, if applicable.
6. **Maintaining detailed records:** The farmer must keep accurate records of everything related to the farm's organic practices, including: input records

MARKETING CHANNELS



(fertilisers, seeds, pesticides), farm activity logs (crop rotations, planting and harvesting dates), and sales and product tracking (traceability from field to market).

7. **Corrections, if needed:** After the inspection, the certifier might request corrective actions if they find areas of non-compliance. The farmer will need to address these and provide evidence of correction within a specified time frame.
8. **Certification decision:** Once the inspector submits their report, the certifying body will review it and decide. If the farm meets all the organic standards, the farm will receive organic certification. If the requirements are not met, the farmer may need to make further changes and undergo another inspection.
9. **Annual renewal and inspections:** Organic certification is not a one-time process. The farmer will need to renew it annually, which includes submitting updated farm plans and undergoing annual inspections. The certifier may carry out unannounced inspections to ensure ongoing compliance
10. **Marketing of the products:** Certified farmers can label their products with the organic certification logo or label. This can help to access premium markets and consumers willing to pay a higher price for organic produce.

For further details on certification, the reader can refer to Module 7 on Marketing and Trade at www.organic-africa.net

8.3 Distribution channels for organic onions

The following list provides possible channels through which farmers can sell their organic onions, similarly to other vegetables as highlighted in Module 7 on Marketing and Trade at www.organic-africa.net.
These include:

- Farm-gate
- Road-side
- Farmer markets
- Institutions (schools, hospitals, etc.),
- Hospitality industry (hotels, restaurants, etc.)
- Retail shops
- Wholesale shops

9. Recommended further reading

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FAO Irrigation Manual – Planning, Development, Monitoring and Evaluation of Irrigated Agriculture with Farmer Participation. 2002. Developed by Savva, A.P. and Frenken, K. Volume II Module 7. Food and Agriculture Organization of the United Nations (FAO) Sub-Regional Office for East and Southern Africa (SAFR), Harare.

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Organic Onion Farming: Cultivating Quality Produce Sustainably. https://organic.adidevgroup.com/organic-onion-farming

Organic Onion Growing Information and Tips. Agri Farming website https://www.agrifarming.in/organic-onion-growing-information#google_vignette

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The African Organic Agriculture Training Manual Modules on Crop Management. www.organic-africa.net