Fair Planet

Crop Production Guidelines

Onion

FAIR PLANET TECHNICAL ASSISTANCE PLAN – FDOV14ET01

Production Guidelines for Onion in the dry and rainy seasons

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General Note:

The production guidelines described in this document are general guidelines only. Weather conditions, such as rain, cloud coverage and wind, might have a major effect on actual water demand. Soil conditions might affect actual fertilizer needs.

Pests and diseases should be monitored periodically and treated using the relevant chemicals, according to chemical's label and safety data sheet.

For more details - contact your local vegetable specialist.

Disclaimer:

This document is intended to be used as general guidelines only, and Fair Planet is not in any way liable for any decisions and or actions resulting from their use.

The information contained in these guidelines may contain technical inaccuracies or typographical errors. We reserve the right to make changes and improvements to any information contained in these guidelines.

We would like to thank all the experts and volunteers who contributed to this edition of Onion Production Guideline

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About Fair Planet

Fair Planet is a non-profit organization. Our goal is to enable smallholder farmers to increase their productivity and income, through access to high quality vegetable seeds suitable for their needs and agronomic knowledge. Access to high quality seeds will allow local smallholder farmers to produce and sell significant yields with gradual changes in their farming practices. To realize this goal, Fair Planet partnered with the world's leading seed companies: Syngenta, Limagrain-Hazera, Enza Zaden, East-West Seed, Bayer, BASF and Sakata - for more info visit us at: www.fairplanetseeds.org.

In each agro-climatic region we perform variety trials to identify vegetable varieties best suited for local farmers' needs and together with our partners, provide these farmers with access to affordable seeds along with agro-technical training and extension visits.

Fair Planet operates two training programs in Ethiopia: The first one is in frame of the FDOV14ET01, implemented together with Haramaya University, Regional Offices of Agriculture, Ministry of Agriculture, Dire Dawa multipurpose Farmers' Union, Fair Planet's Seed partners, JoyTech Plc., KKL-JNF, Netafim, Alterra from Wageningen University & RVO - the Netherlands Enterprise Agency. The Second one is in collaboration with Tikkun Olam Ventures (TOV), the Jewish Distribution Committee (JDC) and TechnoServe Ethiopia.

Choosing a suitable plot and crop rotation

Background:

Onion is considered as a low intensity crop that can be grown in a wide range of soil types and climate conditions. In general, there are two stages in onion production – raising seedlings and open field production (post transplanting).

General recommendations:

- **Soil**: choose a fertile and well drainable soil. Onion can be grown in a wide range of soils (from heavy to sandy) but light soil is preferable due to its drainability. The plot should be clear of weeds and other remains and fully exposed to sun light.
- **Crop rotation**: do not grow onion on plots used for allium crops (garlic, onion, and leek) in the past 3 years. Soil diseases and lack of nutrients may damage the crop.
- **Slope**: a light slop is recommended, especially during the rainy season, to allow good drainage.
- **Variety**: choosing a suitable variety is important. Consult your local expert in order to choose a suitable variety according to:
  1) Day length – short day and long day varieties have different requirements.
  2) Season – dry and rainy seasons as well as different temperature levels, call for different varieties.
  3) Growing cycle length (sowing to curing) - early varieties typically yield less, but have a shorter production time.
  4) Size of bulb – different varieties have different bulb size. Adjust your planting distance accordingly.

Production cycle:

- 40-60 days in seed beds
- 65-80 days in the field
- 20-30 days storing and drying

} 4-6 Months

Crop rotation:

a) What is crop rotation?

Crop rotation refers to the practice of growing different types of crops (or none at all) in the same area over a sequence of seasons. Crops from the same plant family should not be grown on the same plot in consecutive years.

For example: Onion, Garlic and leek, belong to the same plant family (*Allium)*

b) Types of crop rotation:
   - One field rotation – growing a single crop with 1-2 year rest
   - Two fields rotation – alternating between two crops in two fields.
   - Three (and up) fields rotation – growing a different crop in each field every year, for three to four years before repeating.

Example (four fields rotation):

Year	Field 1	Field 2	Field 3	Field 4
1	Cabbage	Tomato	Maize	Onion
2	Tomato	Maize	Onion	Cabbage
3	Teff	Onion	Cabbage	Tomato
4	Onion	Cabbage	Tomato	Maize
5	Cabbage	Tomato	Maize	Onion

- Rotate the crops within fields, maintaining the total area of each crop.
- If crop areas are not equal, consult your local expert.

c) Groups of plants that we can rotate:

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Cucurbits	Brassicas	Solanaceae	Leaf & Root	Cereals	Legumes	Alliums
Cucumber	Cabbage	Tomato	Beetroot	Corn	Beans	Onion
Squash	Kale	Pepper	Spinach	Teff	Peas	Garlic
Pumpkin	Cauliflower	Potato	Carrot	Wheat	Soybean	Leak
Melon	Radish		Lettuce	Barley		
Watermelon						

d) Choose a plot that was **not used** for Onion, Garlic or Leek for at least two years.

Why?

- The soil can become “tired" and less fertile, because the same type of crop planted repeatedly in the same area keeps draining the land of the same nutrient.
- Certain pests can reach levels that are hard to control when they learn that the field always has the same type of crop.
- Soil can be more susceptible to the forces of erosion if the same type of crop is planted repeatedly.

Preparing seedlings

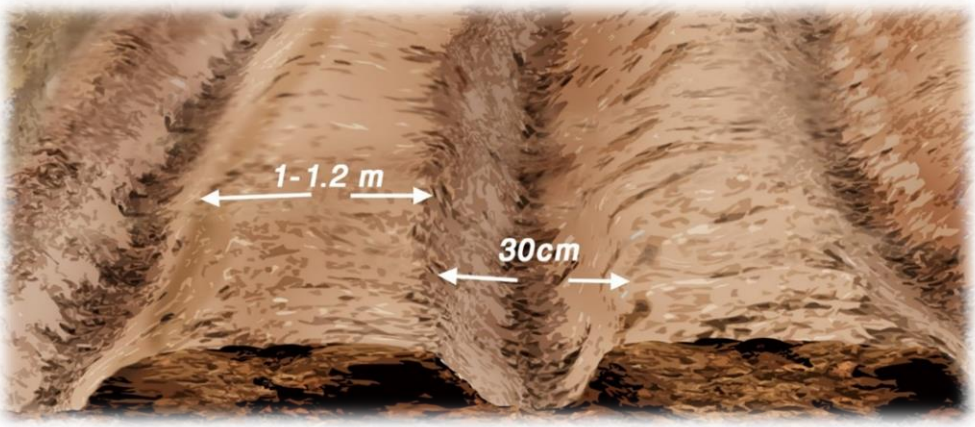
Onion seedlings should be prepared in seed bed, and safely transplanted into the growing beds.

a) Choosing the plot:

- Choose a plot clear of plants remains, herbicides and other objects.
- Soil should be flat, even shaped and plowed to form an airy structure.
- Do not use soil which has been used for onion production in the last 3 years.

b) Making the beds:

- Fertilize the soil with 50 gr/m^2 NPS, mix the fertilizer into the top soil.
- For 1 Kg of seeds, use 20 beds, 5m long each.
- Bed width should be 1-1.2m. Bed length is flexible according to the amount of seeds intended to be sown, a 5m length is recommended.
- Plow the beds 20 cm deep, leaving a pass way of 30 cm between them.
- Level the soil before sowing.



Note:

- Population density should be 650,000 – 700,000 plants per Hectare.
- There are 250-300 thousand onion seeds in 1 Kg.
- Germination rate can vary, but should be between 60-80%.

c) Sowing:

- Sowing should be done in dry soil.
- Using a stick, mark 2cm deep lines across the beds, 10 cm apart.
- Place the seeds inside the lines, make sure to sow them 1 cm deep, with about 2cm between seeds.
- Cover the seeds with light soil. do not cover more than twice as the size of the seed!

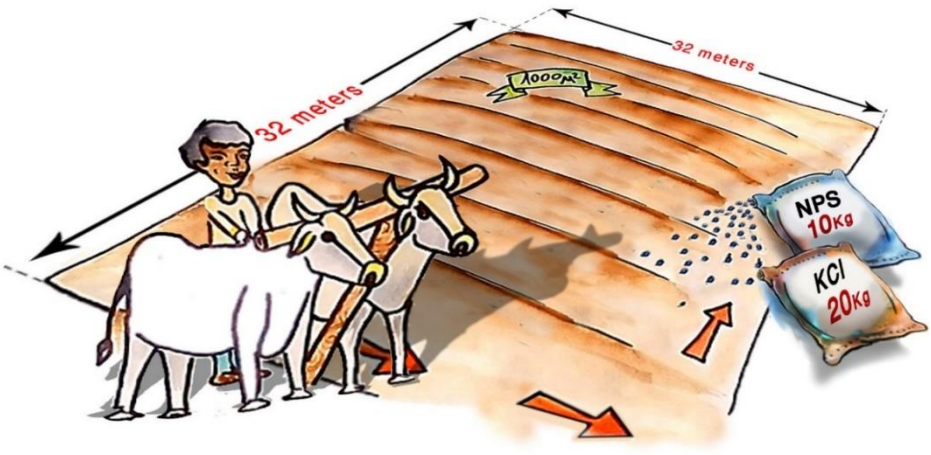
d) Covering and irrigating:
   - Cover the seed beds with dry leaves or stew, make sure not to cover them with green leaves which might have pests on them.
   - Irrigate the beds with a water can, make sure all parts of the bed receive enough water.

e) After sowing
   - Continue irrigating every day, irrigate in the morning and make sure the soil is always moist.
   - Check for germination, usually 10 days after sowing.
   - When seedlings start to germinate, uncover the seedlings from the shading.
   - Check for pests regularly - Thrips and fungal disease may occur in young seedlings.

Why?
- Paths between beds are important for technical aspects: weeding, spraying, irrigating, and will allow draining in during the rainy season.
- Distance between seeds will determine the density between seedlings when they grow. Therefore, do not sow them too densely. High density will increase pest population and competition

Preparing the field

a) Field preparation should begin 2-3 weeks before transplanting (right after sowing)
b) Base fertilization and plowing:
   i) Before plowing, apply up to 100Kg DAP or NPS per Hectare (10 kg per 1000m^2) and 200Kg KCl per Hectare (20 kg per 1000m^2).
   ii) First, apply the fertilizer to the field and then plow the land at least twice, in 2-4 day intervals. (If using a tractor, spread the fertilizer after plowing, before bed preparation, making the fertilize available for the roots of the onion)
   iii) Plowing should be done in two directions - horizontally and vertically.
c) After plowing break clods and big soil lumps to make a flat, uniform textured soil.



Note:
- DAP or NPS base fertilization are important for providing Phosphorus (P) to the young plants.

Preparing beds and furrows

Size of the Beds:

The size of the beds should be determined according to the variety and the desired bulb size. 30-40 cm width and 5-6 m length beds are suitable for most onion varieties for the Ethiopian market.

Furrows:

In the **rainy season,** dig the furrows 30 cm deep (50 cm for the main furrows), to allow rain water to wash away from the field and beds.

In the **dry season**, dig the furrows 10-20 cm deep thus minimizing water usage. Make sure all plants receive sufficient water in every irrigation. If plant roots are dry, deepen the furrows.

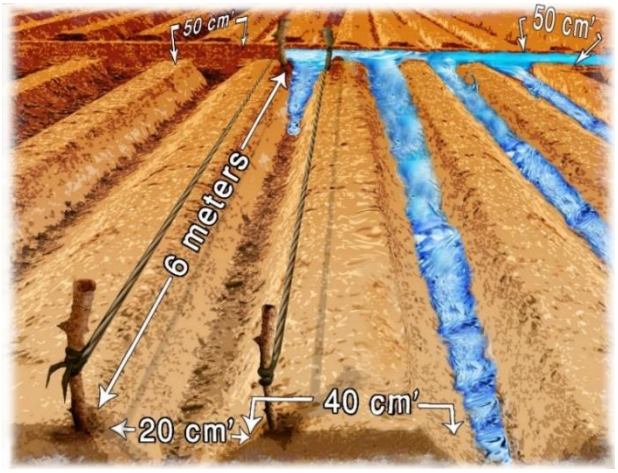
Bed spacing (example):

a) For 0.5 M spacing, prepare measuring sticks (Chikal): 30cm and 20cm long (Adjust stick length if you need different spacing).
b) Mark distances of 30-40cm for beds and 20cm for furrows on both sides of the field.
c) Using a rope, mark the furrows and beds as shown in the figure.
d) Using a shovel, pile the soil from the furrows onto the beds.
e) Level the soil on the beds.
f) Furrows should be 10-20cm deeper than the beds (depending on the soil type and the water source).
g) Dig the main furrows every 6 meters. Main furrows should be 50cm wide.
h) Irrigate the field 3 days before transplanting – allowing it to keep moisture in the transplanting day.

Note:

- Bed's and furrow's width may vary depending on the expected yield. Wide beds will generate bigger onion heads means more yield.
- Furrow adjustments will control irrigation – giving more, or less water to the plant, depending on environmental conditions and others (soil, Temp. Etc.)

Onion beds and furrows preparation



Why?

- The size and spacing between the furrows allow efficient use of the water by the plant roots.
- Spaces between the plants are important to enable each plant to get good exposure to the sun
- Spaces are also important to avoid transfer of diseases from plant to plant.

Transplanting

General recommendation for plant population and density:

a) How to determine plant population?

The density of the plants will directly affect productivity (size/weight of the onion's bulb). As a general guideline, it is recommended that the plants fill the rows (bulbs touching each other when matured).

b) How to determine distance between the plants:

- Market demand: the size of the bulb should be determined according to the market demand (usually 5-7.5 cm).
- In ideal conditions, the bulbs will fill the rows, and stop growing when touching the neighboring bulb.

Double row planting:

In furrow irrigation it is recommended to plant in **double rows**, each row is located on the edge of the bed.

- 5 cm from the bed's edges.
- 20 cm between the two rows.

Transplanting steps:

a) Collect the seedlings from the seed beds. Transplanting should be done when plants developed 5-10 cm roots and three real leaves.

b) When collecting the seedlings be careful not to damage the roots. Pull the roots genteelly with their original soil.

c) Never keep the seedling in the sun. It is recommended to collect them into buckets that will keep moisture around the root system at all times.

d) Plant all the seedlings on two sides of the bed, slightly above the water line, about two thirds of the height from the bottom of the furrow.

e) While transplanting, the soil must be moist but not too wet.

f) Transplant only in the late afternoon. Do not plant in hot weather.

g) Plant only the root plug. **Stem and leaves should not touch the soil.**

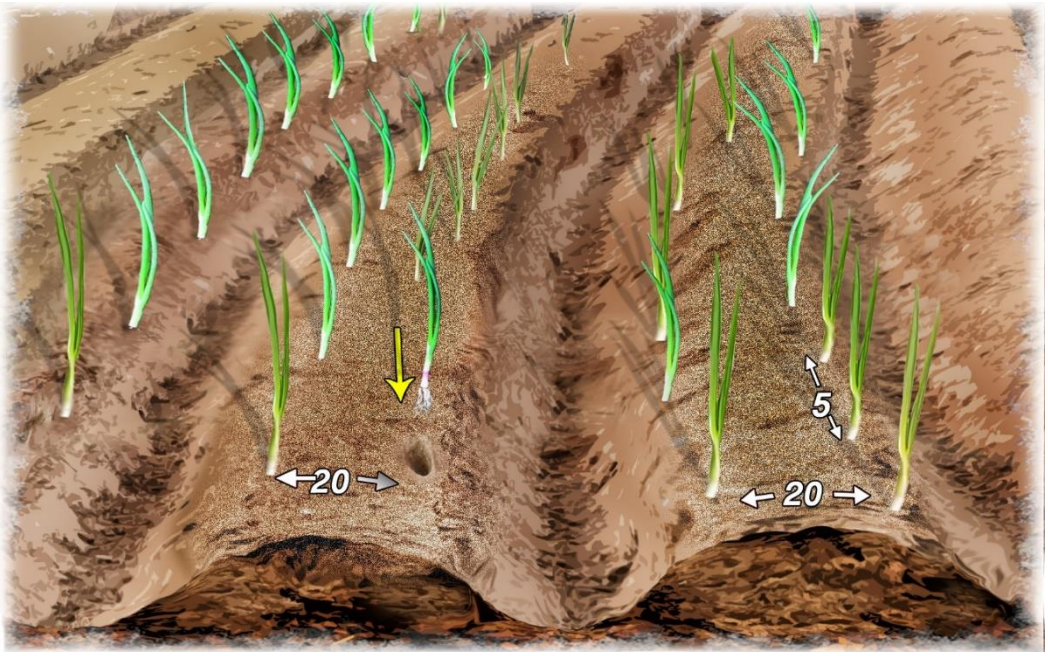
If pests are present, it is recommended to spray the seedlings a day **before** transplanting.

Take care not to plant too deep

Why?

- The roots should be in the soil and the leaves should be outside the soil.
- Do not cover the leaves with soil, as it can cause diseases and rotting of the plant.

Example for transplanting distances



Why?

- The seedling roots are small and placing them slightly above the water line will enable them to reach the water.
- Do not plant too low, since direct contact with water will damage the plant and may cause diseases and rotting.
- Do not plant too high, since the small roots will not reach the water.

Press the soil around the

Why?

- The roots should be in the soil and the leaves should be outside the soil.
- Do not cover the leaves with soil, as it can cause diseases and rotting of the plant.

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Field management - Irrigation

a) Immediately after transplanting, irrigate the plot.
b) Supplement irrigation using water cans, to make sure each plant receives enough water.
c) Repeat the irrigation with the water cans once a day, for 3 days.
d) After 3 days, start irrigating in furrows and manage the field according to table 1 below.
e) It is important to allow the soil to dry between irrigations.

Field irrigation in week 5-6, Water reaches to the root zone

Important Notes - Water management:

- Onions grow best in drained soil, irrigate at intervals that nearly dry the soil, but do not allow the soil to dry completely.
- Furrow's size (width and depth) will determine the amount of water that the onions receives. Therefore, consider the type of soil (its water holding capacity), and the climate condition in order to adjust the irrigation intervals.

Table 1 - Recommended schedule for irrigation, fertilization and field management

Week (from planting)	NPS (Kg / 1000 m^2 / week)	KCl (Potash) (Kg / 1000 m^2 / week)	UREA (Kg / 1000 m^2 / week)	Activities in the field
1	10*	20*	2.5	Irrigate to capacity to ensure seedlings receive sufficient amount of water
2			2.5	
3			3	
4			5	
5			5	Double the nitrogen application when the plants start onion formation
6			8	
7			8	Boost the Nitrogen application for maximum yield
8			10	
9			(8)	Stop fertilize when the onion reach the required size
(10)			(8)	Cure onions when 50% fall over is reached
(11)				Excess of irrigation and fertilizers might delay the harvest
Total		**20**	**44-60**	

Daily activities in the field:

- Irrigation: irrigate every 5-7 days, depending on soil and environmental condition.
- Look for pests and diseases and spray according to need.
- Check chemical treatment efficiency 3 days after spraying.
- Remove weeds.
- Keep the beds and furrows in proper condition.
- Cultivate the soil before irrigating, to improve irrigation efficiency.

Important notes:

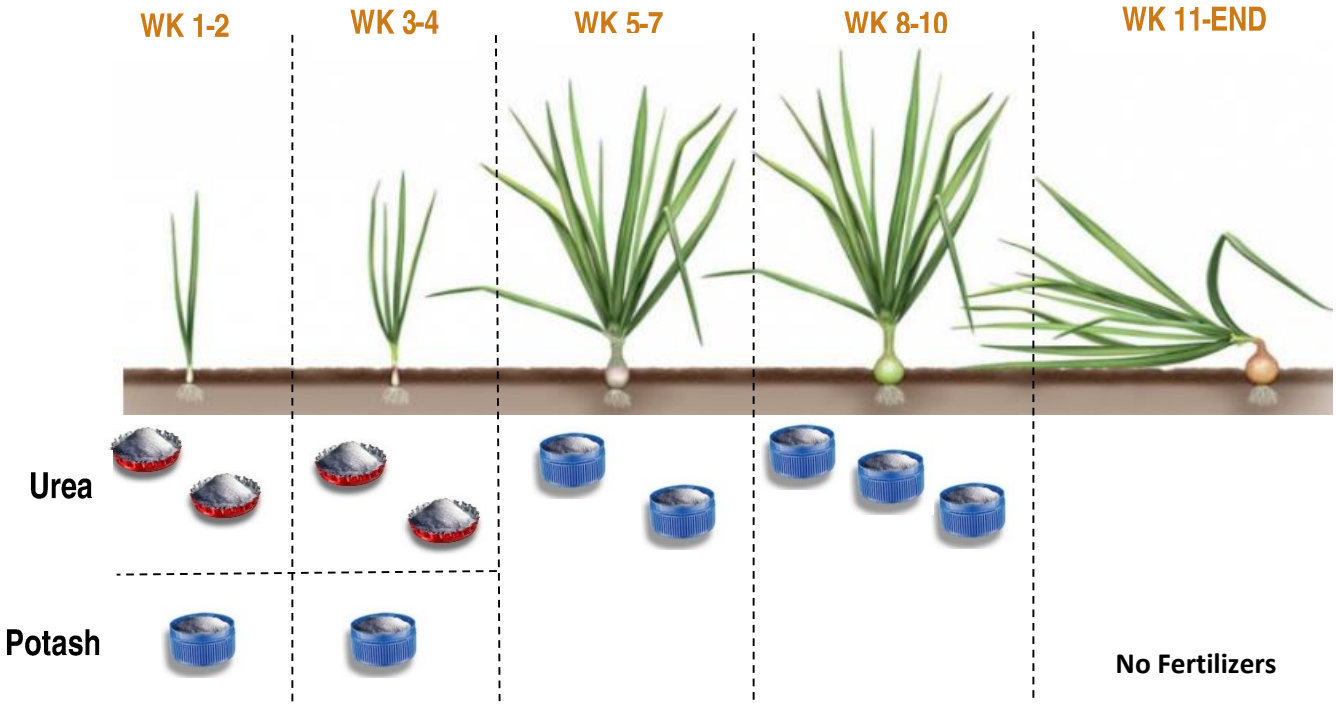
1. Potassium chloride and NPS should be given as base dressing before the season.
2. KCl may cause the soil to become salty and the risk increases when using it repeatedly in the same plot (risk of long-term soil salinity). To reduce salinity risk, KCl can be given in 4 weekly applications of 5 Kg each.
3. Using Potassium Chloride (KCl) combined with Urea, especially in cold weather, may cause yellowing and burns (scorches) of leaves. The yellowing symptoms may resemble fertilizers' deficiencies.
4. For Potassium application it is recommended to use Potassium Nitrate (KNO_3) that does not bare the risk of long term salinity since it does not contain Chloride (Cl). When using KNO_3, reduce 13% of the amount of Urea applied.

Using Fertilizers

a) Apply Urea and Potash according to the schedule in table 1 above.
b) Irrigate the plot immediately after fertilizing.
c) Stop fertilizing 2-3 weeks before onions are fully cured (usually 60-75 days after planting, depends on the variety and conditions)
d) It is important to know your variety characters, and its growing speed.
e) Fertilizer amount will directly affect the size/weight of the onion, therefore, adjust your application accordingly.

In case you cannot use table 1 for applying the needed fertilizers per week, add each fertilizer (Urea and Potash) as described below for single bed application. If risk of soil salinity is low, potash can be given as base dressing.

Single bed application:



*** Recommendations for one bed per week**

Important notes:

- Table 1 provides general recommendations. Adjusting the fertilizers applications along the season is highly important. Soil types, varieties, previous crops grown in the plot and the desired outcome are factors that should be considered to optimize your result.
- Check for Deficiency/Excess of fertilizers frequently to identify possible problems (see illustrating photos).

Fertilizer application

a) Place the fertilizers on the middle of the bed, between the two lines of plant (see illustration in the next page). **Make sure that fertilizers do not come in direct contact with any part of the plant.**

b) Irrigate immediately after fertilizing.

Why?

- Fertilizers should be applied between every two lines of plants.
- After seedling setting (week 3 and on), fertilizers can be applied in the furrows, as the onions' roots will be long enough to absorb the fertilizers from the furrow.
- Direct contact of the fertilizers with plant parts can cause damage.
- Irrigating is needed to dissolve the fertilizers and make them accessible to plant roots.

Step 1 - Using a stick, create 5-10 cm deep slots on the side of the bed between the plants

Step 2 – Apply fertilizers into the slot

Step 3 - Cover the fertilizers with soil

Step 4 - Irrigate immediately after fertilizing

Symptoms of Nutrient deficiencies in Onion

Source – Haifa Chemicals, YARA, Seminis

Lack of Nitrogen (N)

Nitrogen (N) deficiency:
Deficiencies result in stunted plants with pale green to yellow leaves that dieback from the tips. Also, the foliage tends to be erect and the bulbs are smaller than normal and mature earlier. Excess nitrogen causes rapid plant growth and delays maturity. The bulbs tend to be softer and more susceptible to storage rots.

Lack of Phosphorus (P)

Phosphorus (P) deficiency: Deficiencies result in slow growth, delayed maturity and a high percentage of thick necked bulbs at harvest. Leaves become a dull green color and dieback from the tips without the yellowing associated with nitrogen and potassium deficiencies.

Lack of Potash (K)

Potassium (K) deficiency:
Deficiencies result in the foliage initially becoming darker green and the tips of the older leaves begin to wilt, especially on the upper surface. Eventually the leaves droop and take on a satiny progressing to paper-like appearance and develop chlorosis similar to that caused by nitrogen deficiencies.

Monitoring pests and diseases

a) Monitor the plants daily, checking bulbs and leaves.
b) Consult with your Kebele Development Agents and the experts from your Woreda Office of Agriculture about pest or disease symptoms you observe in your field.
c) It is strongly recommended approaching the experts with a sample of the infected plant.

Safe spraying for Pest control

a) Safety guidelines

i) Do not inhale the pesticides.

ii) Cover your mouth and nose with a professional spraying mask.

iii) Wear long sleeved shirt, long trousers, shoes, and cover your head and neck.

iv) Wear gloves also when preparing the chemicals.

v) Make sure other people are not present in the field while the field is being sprayed and 2-3 days after spraying (according the chemical label).

Why?

- Most pesticides are toxic to humans.
- The person who sprays should protect himself.
- Other people should not be present in the field while the field is being sprayed, and during 2-3 days after spraying (according to chemical label).

b) Correct spraying

i. Make sure you spray from above, from the sides, from beneath and inside the plant, to get full plant coverage (full shower).

ii. Apply the amount recommended by the manufacturer on the chemical's label.

iii. Last spray before harvest- check the Label's instruction for Harvest Interval.

Why?

- Some chemicals are toxic to humans even after 7 days!
- Always follow the instruction on the chemical label.

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Harvest and Storage

When onions are dropping their leaves, it means they reached maturity and are ready for collection. When 50% of the field has dropped spontanuaslly, drop the rest of the onions manually and let them dry. When leaves are dry, pull the onions and let them cure in a cool dry place.

Example of 100% fall over at week 9-10

Usualy onions will completly dry in 15-30 days. Cut all the remaining leaves prior to storing in a cool dry place. Avoid the onions touching the ground.
In long term storage post harvest diseases might occur. Check your onions frequentlly and remove all damaged onions.
After harvest, onions should be stored in a cool shaded space. Do not cover the onions with plastic, to allow ventilation. Storage of onions in suitable conditions can prolong their shelf life. These conditions may allow you to store onions in good quality for months.

Why?

Covering the fruits will speed ripening, shorten shelf life and damage the crop quality.

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Identification guide

Onion pests and diseases in Ethiopia

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General Notes:

The identification guidelines included in this document provide information on the main onion pests and diseases that are prevalent in the Fair Planet project sites in Ethiopia.

Weather conditions (such as temperature, rain, cloud coverage and wind) and soil type might have a major effect on the development and spread of plant pests and diseases, and should be taken into account when considering applications of chemicals.

Pests and diseases should be monitored periodically and treated using the relevant chemicals, according to the chemical's label and the chemical's safety data sheet.

For more details and for information on other plant pests and diseases – contact your local vegetable specialist or plant protection expert.

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General Pest Management Information

What's in the guide?

Introduction

- Fair planet`s guidelines for plant protection in Ethiopia.
- Procedures for chemical application
- Principles for monitoring pests and diseases in the field

A Pocket Guide for identification of:

- Onion Pests
- Onion Diseases

Fair Planet`s guidelines for plant protection in Ethiopia

We use robust varieties, resistant to certain diseases and viruses. We therefore endeavor to reduce interventions and the use of chemicals for the following reasons:

- The danger of pests developing resistance to chemicals.
- The costs of materials and labor, and harm to the environment.
- Upsetting the natural biological balance in the field.

- Whenever we spray poisonous chemicals we affect the general biological balance in the field, including essential pollinators and a range of insects and natural enemies.

We therefore endeavor to take several measures that may reduce/prevent the establishment of pests and plant diseases in our fields.

Three basic rules for correct control of pests

1. Prevention
   - Regular irrigation and fertilization promote the development of healthy, vigorous plants.
   - Good airflow along the row, by trellising and proper spacing reduces accumulation of moisture on the plants, which is a major cause of the development of fungal diseases and infection of neighboring plants.
   - Clearing the field of weeds that provide habitat for pests will reduce infestations.
2. Sanitation
   - Plants, branches and infested fruits must immediately be removed from the field, preferably to be burned at a far-away, controlled site.
   - Prevent entry to rows of infected plants.
   - If a certain variety is affected; a specific worker should preferably be assigned to maintain that variety. This worker should not enter other rows on the same day.
3. Elimination
   - When a certain pest or disease has been identified, we shall try to find out:
     i. The source. Identify the specific pest and characterize whether it affects a certain variety.
     ii. Find out whether the whole field is affected, or whether the problem is localized. Is just one or are many plants affected?
   - We will try to deal with the problem by the means available to the average farmer. We do not use expensive methods that are not available to the average farmer.
   - Specificity: we apply a chemical spray that suits the specific source(s) of the problem and try to treat the entire field uniformly, but perhaps a little more where the pest or disease was first observed.
   - Change of materials: to avoid pests developing resistance to chemicals by repeated use of the same material, sprays with different active ingredients should be rotated on a weekly basis.

General comment: According to the characteristics of the pest and the potential damage it may cause, you have to decide whether to act at a low threshold, or wait and decide to treat only later, in case of increasing severity.

Chemical application

Before any spray is applied, carefully read the instructions on the label and the accompanying literature.

The following instructions have to be observed and followed:

- Determine the exact amount of chemical (grams or milliliters) required per a given area of this crop. Quantities must be measured exactly, with a measuring cup (milliliters) or balance (grams).
- Fill the sprayer with 5 liters of water, add the required amount of the chemical, mix well and only then fill up the sprayer. **Never deviate from the instructions**.
- Check if other chemicals can be combined.
- Verify the number of spraying rounds allowed per season. **Never exceed the recommendations**.
- Check the latest spraying time before harvest (days before harvest).
- In case of doubt, consult with your local professionals.
- Always wash the sprayer thoroughly before use, to avoid residues from previous sprays.

Using hazardous materials

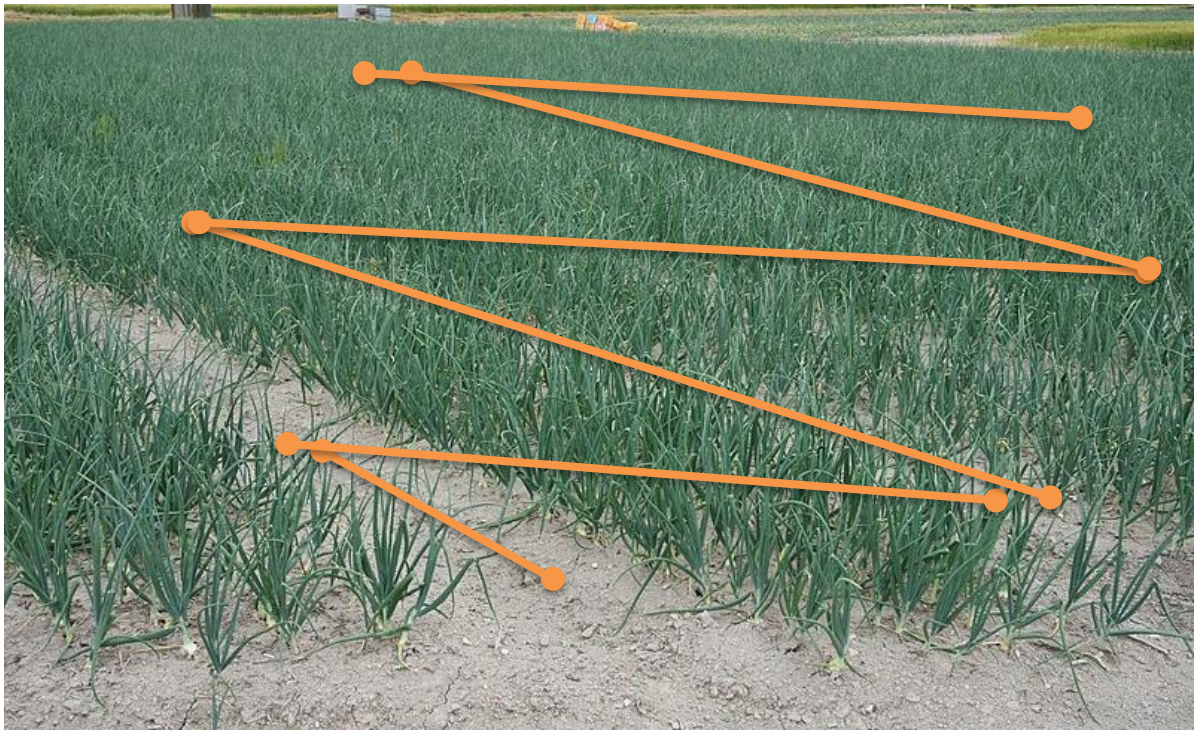
Some chemicals are hazardous to humans, plants and the environment.

All necessary precautions must be observed according to instructions:

- Wash your hands after every contact with chemicals.
- Avoid touching the eyes. In case anything gets into the eye, rinse well for 5 minutes with running water and then get medical attention.
- Do not mix chemicals before consulting instructions.
- Do not use equipment meant for applying chemicals for any other purpose (such as storage or packaging).
- **Safety**: the operator must wear a mask, long sleeved clothes and solid shoes when spraying.
- **Operating hours**: spraying should be done in the early morning or in the afternoon. Do not spray in strong sunlight hours as the spraying may scorch the plants (especially oil-based materials). Also, do not spray when rain is expected or soon afterwards as the moisture on the plants may wash off the chemicals.
- **Spraying the plant**: make sure that all parts of the plant are covered with the spray, including the lower parts and the top of the plant.
- **Cleaning and maintenance**: the spraying equipment is expensive and delicate, and has to be handled accordingly. After every use, all parts must be rinsed thoroughly with clean water. The sprayer should be stored in a closed and locked place.

Principles for monitoring pests and diseases

- What to look for? Look for unusual appearances on plants: different form or color of leaves, spots of various colors on or under the leaves, holes in leaves or fruits, shriveling etc.
- How to search? Sample the field at several locations, not at the margins (see picture below).
- Quantitative assessment: evaluate the extent and spread of the problem.
    1. How extensive and how widespread in the field is the infestation and how many of the plants are affected?
    2. What is the extent of the infestation and what is the amount of the pests or the symptoms?
    3. What is the extent of the damage?



Walk the field and sample at several locations, not at the margins

Identification guide for Onion Pests

Cut Worm / Horn Worm

Description	Black or green caterpillar up to 3 cm in length, highly sensitive to sunlight, feeding in the dark on the stem of the plant.
Affected parts	The base of the plant, near the roots.
Identification	- Damage is near the roots (dig close to the roots and look for the caterpillar) - Thin, torn off leaves may be found near the plants
Remarks	- High potential for damage unless treated - Take care to spray low, near the ground - During daylight the caterpillars hide and are not active - Only very young plants are attacked, during their first weeks in the field
Additional information	- The eggs are white - If young plants are cut and Cutworm is present, it is recommended to spray immediately
Spray adjustments	Use contact or systemic chemicals specific to worms. Spray in early morning, when soil is cool and worms are at the upper soil or on the surface.
Chemicals you can use (active ingredients)	- Profenofos (1B) - Lambda-cyhalothrin (3A) - Deltamethrin (3A)

Leaf Miner

Description	Tiny fly (2.5 mm.) with yellow spots on a black backside. The fly lays its eggs into the leaf tissue. The larva is yellowish and can be found in the tunnels.
Affected parts	Leaves
Identification	- White tunnels on the leaf. - The larva is very lazy (it will hardly move when touched). - The leaf miner makes **tunnels along the leaf**
Remarks	- The female fly feeds on the leaf tissue and lays its eggs in it.
Additional information	- **Important**: The leaf miner is a relatively slow developing pest, causing only limited damage
Spray adjustments	Only if damage is apparent over a large part of the field, control measures should be applied.
Chemicals you can use (active ingredients)	- Chlorantraniliprole (28) - Abamectin (6) - Deltamethrin (3A)

Thrips (Thrips Tabaci, Western flower Thrips and others)

Description	Small black or yellow flying insect, mainly hiding in-between leaves
Affected parts	Leaves
Identification	- The damage is caused by Thrips sucking out the plant fluids, causing wilting and yellowing. It also serves as the main vector of some viruses (Iris Yellow Spot Virus) of Onion. - Thrips can be found hiding between the leaves by separating the leaves, scouting closely around the lower part of the leaves. - Yellow Thrips indicate young, black - mature Thrips. The cycle from egg to adult may last 10-30 days, therefore – spraying should be scheduled according to the color and cycle of the Thrips (10 days and more). - Symptoms consist of yellowing, folding and extreme distortion of leaves as well as spots.
Remarks	- Thrips cause damage in large populations. Spray only when Thrips count is high.
Additional information	- Thrips has many hosts. Therefore, good sanitation is important. Remove potential host plants from the field and neighboring areas, especially pepper and eggplant, but not only. - Monitor Thrips population frequently between the new emerging leaves of the onion.
Spray adjustments	- Use high volume of water. - Use oily substance to increase surface attachment. - Repeat after seven days, with alternative pesticide.
Chemicals you can use (active ingredients)	- Chlorantraniliprole (28) - Cypermethrin (3A) - Imidacloprid (4A) - Profenofose (1B) - Emamectin benzoate (6) - Spinosad (5)

Identification guide for Onion Diseases

Stemphylium leaf Blight - Stemphylium vesicarium

Description	A fungal disease affecting the leaves
Affected parts	Leaves
Identification	Initial infections on the leaves and leaf sheaths are small, light yellow to brown, and water-soaked. As the lesions expand, they coalesce, causing extensive blighting of the leaves. Typically, lesions are found in higher numbers on the side of leaves facing the prevailing wind. The centers of lesions turn brown to tan, then dark olive brown, and finally black as the fungus sporulates.
Remarks	This fungus normally invades dead and dying onion tissues. However, severe damage can occur on healthy leaves during warm weather when leaves are wet for more than 24 hours. Infection is usually limited to leaves, and does not extend down to the scales of the bulb.
Additional information	For prevention, use chemicals that controls Downey mildew.
Spray adjustments	Chemical control with fungicides is effective in reducing disease except when weather conditions favor the fungus. Long-term rotation with unrelated crops may reduce losses. Also, good field drainage and reduced plant density may lessen disease severity.
Chemicals you can use (active ingredients)	- Chlorothalonil (M5) - Cymoxanil(27) - Azoxystrobin (11) - Difenoconazole (3)

Purple Bloch / Alternaria porri

Description	A fungal disease affecting the leaves
Affected parts	Leaves
Identification	- The indication for Purple Bloch is the 'purple eye-like' symptoms occurring when severe infection develops. - Older leaves tend to be more susceptible. - Symptoms begin as water-soaked lesions that usually have a white center. - Edges of lesions become brown to purple and the leaf turns yellow bellow and above the lesion.
Remarks	- The disease develops under conditions of moderate temperatures and high moisture. - Disease is more likely to be present during rainy season. - The pathogen is airborne, thus the disease spreads easily. - Avoid contact. Remove and dispose of infected leaves at a distant place.
Additional information	- Don't confuse with downy mildew. Purple Bloch will turn brown-purple colored, while downy mildew stays whitish.
Spray adjustments	- Spray immediately when infection appears. After fungi established, it will spread quickly and cause irreversible damage to the plants. - When environmental conditions are suitable for the disease to develop, mostly in rainy season, use **prevention measures** and spray every 7-14 days, according to rain frequency.
Chemicals you can use (active ingredients)	- Mancozeb and Cooper compounds (1M) – Preventive - Azoxystrobin (11) – at low infestation - Chlorothalonil (5M) - Cymoxanil (27) - Iprodione (2) - Tebuconazole / Propiconazole(3)



Downey Mildew / Peronospora destructor

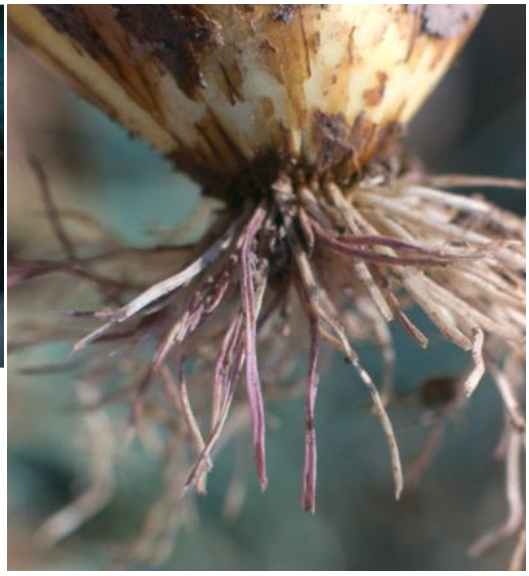
Description	A fungal disease affecting the leaves
Affected parts	Leaves
Identification	- Yellowish spots on the leaves - White to yellow lesions will expend and spread along the entire leaves. - The lesions progress to a pale yellow followed by brown necrosis resulting in collapse of the leaf tissue. - Infections usually begin in small patches and progress rapidly throughout the field.
Remarks	- Treatment fungicide should be applied immediately
Additional information	- Do not confused with Purple Bloch! Downy mildew has yellow to white lesions, while Purple Bloch turns purple when savor. - The Downey mildew usually starts in several locations in the field, when conditions are relatively high humid or rainy, disease will spread vastly and create kind of "white islands" of centers inside the field. - **IMPORTANT!** Do not delay treatment as both these diseases spread swiftly and can cause serious damage to the field
Spray adjustments	- Start with preventive program, every 10-14 days - Spray all the field and scout for fungi symptoms every day - When disease present , treat immediately with systemic fungicide, rotating chemical group every 5-10 days
Chemicals you can use (active ingredients)	- Mancozeb and Cooper compounds (1M) – Preventive - Chlorothalonil (5) – Preventive - Azoxystrobin / Pyraclostrobin (11) – low infestation - Metalaxyl (4) - Cymoxanil (27) - Boscalid + Pyraclostrobin (7+11)

Powdery Mildew / Leveillula taurica (Oidiopsis sicula)

Description	Fungal foliage disease
Affected parts	Leaves and Stem, occasionally fruits
Identification	- Circular to "cloud shape" chlorotic lesions 5-20 mm (0.2-0.8 in.) in diameter develop on older leaves and rarely on younger leaves prior to bulb initiation. - Sporulation gives lesions a gray to white powdery appearance. Chlorosis and eventually necrosis may develop around areas of sporulation. - Lesions may coalesce to cover large areas of the leaf surface. - This disease appears to be most common on varieties with glossy leaves, which are associated with thin cuticular waxes.
Remarks	- Leveillula Taurica has wide spectrum of hosts plants. - Therefore, it is highly recommend to rotate crops through sowing cycle
Additional information	- Disease is not common on onion, as much as on tomatoes and peppers.
Spray adjustment	- Start with preventive program, every 10-14 days - Spray all the field and scout for fungi symptoms every day - When disease present , treat immediately with systemic fungicide, rotating chemical group every 3-5 days
Chemicals you can use (active ingredients)	- Azoxystrobin (11) - Cyproconazole or Tebuconazole (3) - Sulfur based fungicide

Pink Root / Phoma Terrestris

Description	Soil fungal disease
Affected parts	Effecting root, resulting in wilting and undeveloped plant
Identification	- The name "Pink root" defines this disease in exact way. Roots will become pink and wilt, resulting in mod kind of structure. - First sings will be shown by small plants, few leaves and unhealthy development compared to the neighboring healthy plants. - Those signs will indicate that the field has been effected by the fungal disease.
Remarks	- Disease will not show in the above soil plant part, only in the soil. - Above the soil parts, will result in weak leaves, colorless, and eventually wilt.
Additional information	- Due to the difficult identification, it is recommended to scout for the disease every week, by pulling 1-3 onion from several location of the field, to check the roots. - Rotate crops over sowing cycles. Disease will naturally decrease when using non host crops.
Spray adjustments	- There is no chemical treatment for the disease, therefore, use tolerant varieties and rotate crops over seasons. - Wait 3-5 years before growing onions again on the same plot.



The Five Golden Rules for safe use of Crop Protection Products

1. **Exercise caution at all times**
    a) Always keep products under lock and key, out of the reach of children and animals.
    b) Handle and transport products with caution. Transport crop protection products separately from foodstuff or animals.
    c) Always triple rinse emptied product containers and dispose by following local best practice.
    d) Wear a hat and do not spray during the hottest part of the day.
    e) Carry an adequate supply of drinking water to avoid dehydration. Always wash before drinking.

2. **Read and understand the product label.**

The product label contains important information on product features and on risks relating to product use, together with correct measures to take in the case of an emergency.

    a) Always follow the label instructions for use (crops, targets application rates and water volumes per unit area).
    b) If you cannot understand the label, then have it read and explained to you.
    c) Understand the meaning of the pictograms if used.
    d) Read the emergency procedures.
    e) Check that the product has not expired.
    f) Check when purchasing products that the WHO hazard classification color coding band and select the least hazardous.

3. **Practice good personal hygiene**
    a) Always have clean water available when working with chemicals.
    b) Wash any chemical splashes immediately from skin or eyes.
    c) Do not eat, smoke or drink whilst handling, working with or applying crop protection chemicals.
    d) Always wash yourself and clothes after working with chemicals.
    e) Wash spray clothes separately from the domestic washing.
    f) Do not work with chemicals if you feel unwell before you start.

4. **Take care of and maintain application equipment.**

a) Check spraying equipment before use; any leaks must be repaired before use.

b) Check the nozzle is working correctly, clean or replace if necessary.

c) Spraying equipment should be calibrated at least once a season depending on the amount of use.

d) Wash spraying equipment after use and store securely away from children, animals and feed.

e) Always avoid operator exposure to any spray drift; walk up-wind from the nozzle.

f) Do not spray in windy conditions.

5. **Wear appropriate protective clothing and equipment (PPE)**

a) Follow the label pictograms for PPE requirements for both mixing and spraying.

b) Different products and application methods sometimes require different PPE.

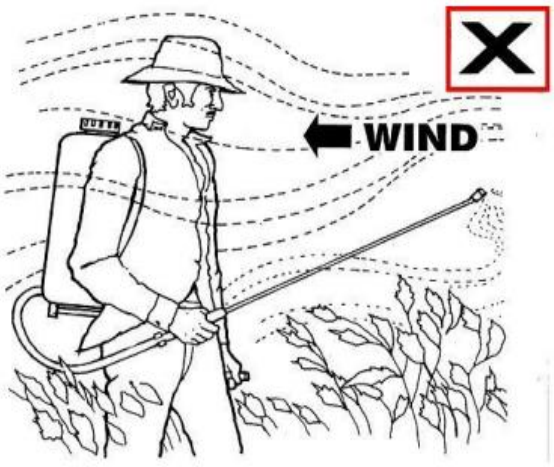
c) The minimum requirement is long sleeved shirt, long trousers and non-absorbent footwear when spraying with nozzle at less than waist height. The use of a wide brimmed hat will give protection from both the sun and potential spray drift.

d) When mixing liquids, eye and hand protection are also required. A dust mask is required when mixing powder formulations.

e) Wash gloves before removal to avoid potential contamination.

Application quality: Never spray against the wind direction

Wind may move drops onto operator. The higher the nozzle, the closer the nozzle is to operator, the finer the spray..... so exposure risks increase.



We wish you Success!

Fair Planet Ethiopia