Fair Planet

Cabbage

Production Guidelines

FAIR PLANET TECHNICAL ASSISTANCE PLAN – FDOV14ET01

Production Guidelines for Cabbage in dry season

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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.

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. Access to such seeds allows 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, BASF-Nunhems and Bayer.

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 a training program in Ethiopia in frame of the FDOV14ET01, implemented in collaboration with Haramaya University, the Regional Offices of Agriculture in Butajira, Dire Dawa, Harari and Haramaya, the Ethiopian Ministry of Agriculture, Fair Planet's Seed Partners, KKL-JNF, Netafim, Alterra from Wageningen University and the Netherlands Enterprise Agency.

We would like to thank all the experts and volunteers who contributed to these Cabbage Production Guidelines

Choosing a suitable plot and crop rotation

Cabbage has a significance role in crop rotation due to its ability to disinfect the soil from fungal remains. Through its roots system, the cabbage releases phytochemical, and by crashing its leaves at the end of the season into the soil, the cabbage residues can help in reducing fungal remains.

Cabbage thrives in heavy soils, but can grow on light and sandy soils as well. Choose a plot which have not been used for any brassica crop (see below) in the last 3 growing cycles. Soil should be well drained (a light slope is recommended), clean from weeds and other remains and fully exposed to sunlight.

Cabbage is a crop for cool, moist weather. Hot and dry weather might prevent head formation.

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: Cabbage, Cauliflower, Broccoli and Kale, belong to the same plant family (Brassica Oleracea Var.)

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 the same crop.
- 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 crops between the four fields, maintaining the same total area of each crop.
- If crop total areas are not equal, consult with your local expert.

c) Groups of plants that can be rotated:

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 Cabbage, Cauliflower, Broccoli or Kale, for at least two years.

Why?

- The land can become “tired" and less fertile. planting the same type of crop planted in the same area will drain the land of the same nutrient.
- Certain pests and diseases can reach levels that are hard to control when the same type of crop is repeatedly grown.
- Land can be more susceptible to the forces of erosion if the same type of crop is repeatedly grown.

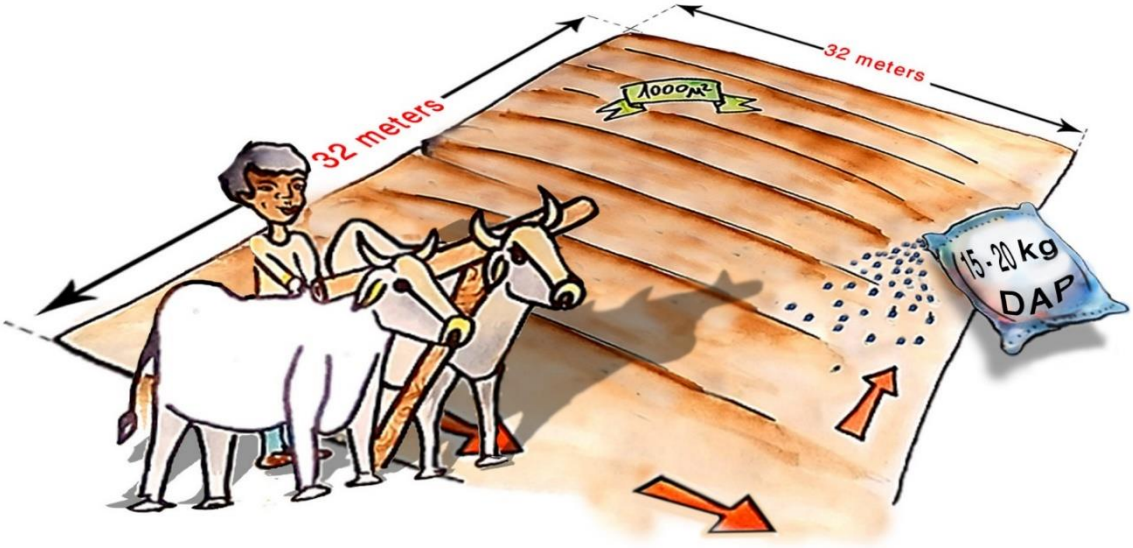
e) Make sure that no broad leaf herbicides (such as 2,4-D) were used on this plot for at least two years.

Why?

- Herbicides, like 2,4-D, have residual effect, which can last for 2 years.
- The residual effect can damage your crop.

Preparing the field

a) Field preparation should begin 2-3 weeks before transplanting.
b) Base fertilization & Plowing:
   i) Before plowing, apply **up to** 150-200 Kg DAP or NPS per Hectare (15-20 kg per 1000m^2).
   ii) First, apply the fertilizer to the field and then plow the land at least twice, in 2-4 days intervals.
   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.



*** DAP can be replaced by NPS (19-38-0-7)**

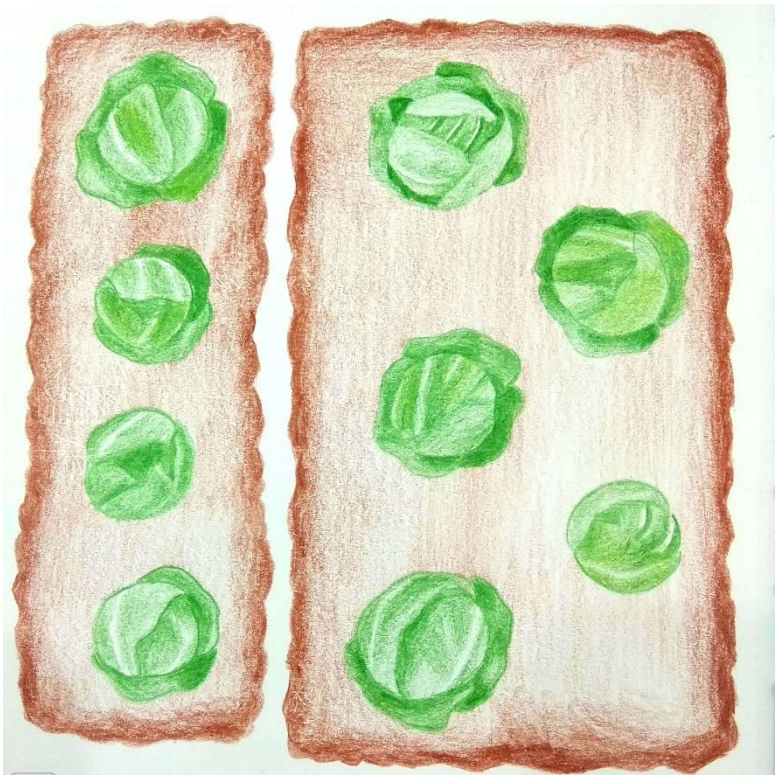
Preparing beds and furrows

a) How to determine plant population:

Recommended plant population in cabbage is between 55,000 – 85,000 plants per Ha. Plant density will directly affect productivity (size and weight of the cabbage head). As a general guideline, it is recommended that the plants will densely fill the row (plants touching each other), leaving a sufficient space between rows for sunlight and air-flow.

The two main planting schemes are:

1. Single row planting (suitable for furrow irrigation):
   - **30** cm between plants (**55,000** plants per Ha)
   - **25** cm between plants (**66,000** plants per Ha) - Recommended
2. Double row planting “Zigzag" (suitable for drip irrigation or rain fed crop):
   - **25** cm between plants (**82,550** plants per Ha)
   - **30** cm between plants (**66,000** plants per Ha)



Important note:

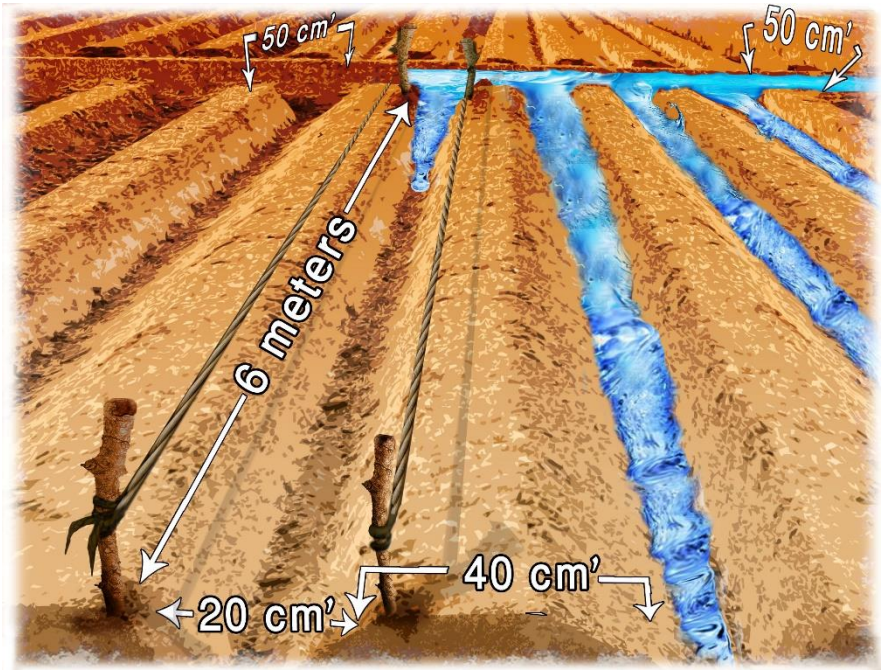
- Double row planting is not recommended for furrow irrigation. It is used for drip irrigation, or in the rainy season - when maintenance of the bed is less important.

b) How to determine correct spacing:
Spacing should be determined according to soil-type and environmental conditions, as well as the variety of the cabbage. Strong varieties need more spacing than compact ones.
Furrows can be 20-30 cm wide. Furrow width will affect the amount of water available for the plant, thus affecting the yield.
Please consult your local expert for the correct spacing for your plot.

Cabbage spacing example

a) For 60 cm spacing, prepare two measuring sticks (Chikal): 40cm and 20cm long (Adjust stick length if you need different spacing).
b) Mark distances of 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 soil type and water source).
g) Dig the main furrows every 6 meters. Main furrows should be 50cm wide.
h) Irrigate the field to full water capacity 3 days before transplanting, to get moist soil during transplanting.

Cabbage beds and furrows preparation

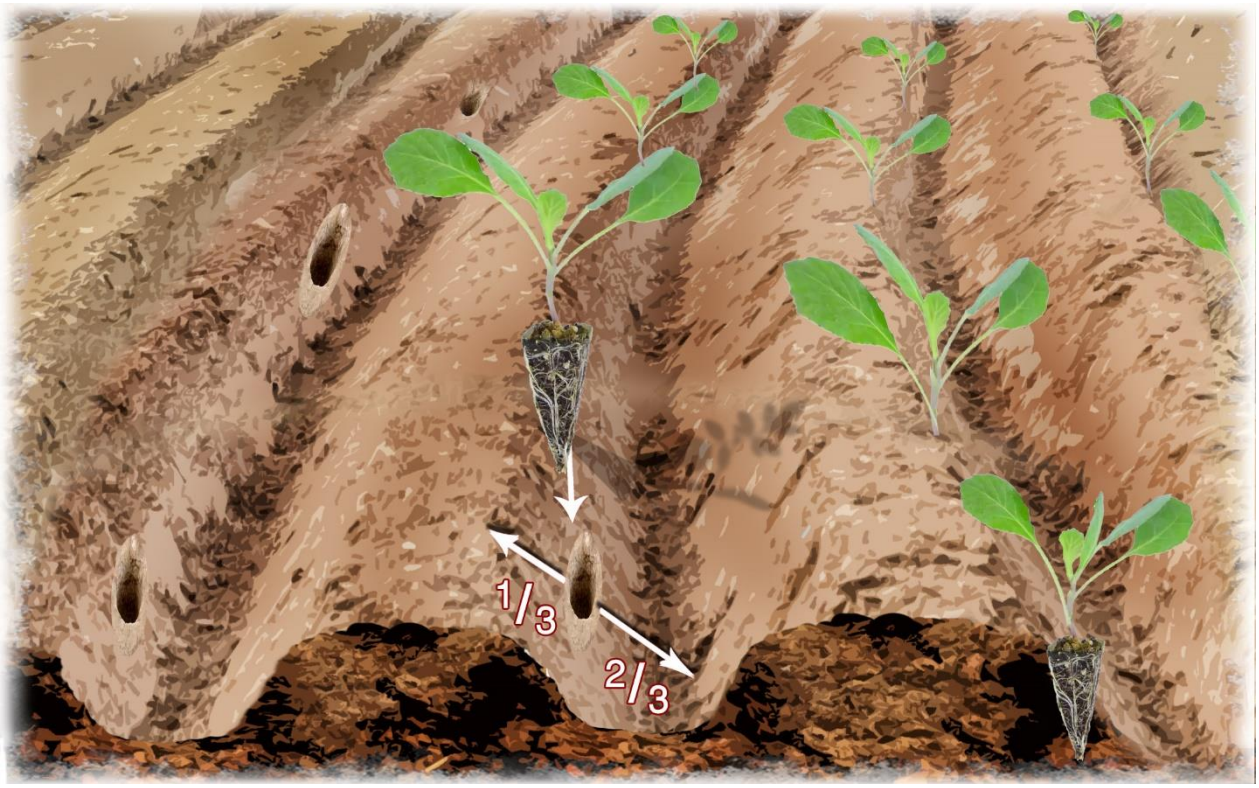


Why?

- 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 sufficient exposure to sunlight.
- Spaces are also important to avoid transfer of diseases from plant to plant.

Transplanting

a) Do not leave the seedlings in direct sun and keep them well irrigated until transplanting them in the field.
b) Before transplanting, prepare small holes to mark the spacing between the plants.
c) Spaces between plants in the row should be 25 – 30 cm. Consult your local experts regarding plant density.
d) Plant all the seedlings on the same side 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.



Why?

- The seedling roots are small and placing them slightly above the water line will allow them to reach the water.
- Planting bellow water level may cause direct contact with the water resulting in diseases and rotting.

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

Take care not to plant too deep.

Why?

- To avoid the plant stem from rotting, the roots should be in the soil and the plant stem should be outside the soil.
- Do not cover the stem with soil: it can cause diseases and rotting of the stem.

h) Press the soil around the seedling

Why?

- Pressing the soil is needed to make sure there is no air trapped around the roots.
- Trapped air causes damage to the roots.

Field management

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.

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

Week (from planting)	Irrigation interval (days)	KCl (Potash) (Kg / 1000 m^2 / week)	UREA (Kg / 1000 m^2 / week)	Activities in the field
1	3-4	6.5	3	Supplement irrigation to ensure seedlings development.
2	3-4	6.5	3	
3	3-4	6.5	3	
4	2-3	6.5	6	Increase nitrogen application when head formation begins.
5	2-3	6.5	6.5	
6	2-3	6.5	6.5	
7	3-4			Stop fertilizing as the head becomes solid.
8				Harvest heads when they are ready (see page 17).

Daily field activities:

- Irrigation intervals depend on soil and environmental conditions. Soil should always be moist.
- Cultivate the soil before irrigating, to improve irrigation efficiency.
- 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.

Important notes:

1. Using Potassium Chloride (KCl) combined with Urea, especially in cold weather, may cause yellowing and burns (scorches) to leaves. The yellowing symptoms may resemble fertilizers' deficiencies.
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).
3. For Potassium application, it is recommended to use Potassium Nitrate (KNO_3), which includes some Nitrogen content and does not bare the risk of long term salinity since it does not contain Chloride (Cl). When using KNO_3, reduce Urea application by 13%.
4. Fertilization will directly affect the size and weight of the cabbage head. Adjust your fertilization application accordingly. Irrigate the plot immediately after fertilizing. Stop fertilizing 2-3 weeks before harvest (cabbage is usually harvested 55-60 days after planting).

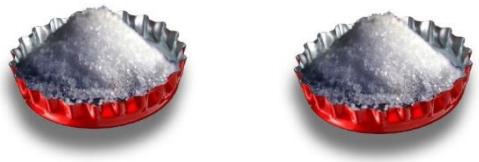
Using Fertilizers

In case you cannot use table 1 for applying the needed fertilizers per week, apply each fertilizer (Urea and Potash) as described below for single plant application (see figures below for more details).

Single plant application:

i. Weeks 1-3 - half a cap of Coca Cola bottle of Urea and a full cap of Potash, per plant.

ii. Weeks 4 to 7 (during head formation) – a full cap of Coca Cola bottle per plant from each fertilizer.



Important notes:

- Adjusting the fertilizer amount along the season is highly important. The differences in soil types, varieties, plot history, and the desired outcome should be accounted for in order to optimize the results.
- Check your crop frequently for deficiency / excess of fertilizers in order to identify problems (see illustrating images below).
- Table 1 provides general recommendations. It is highly recommended to consult with your expert and adjust your application program.

Fertilizer application

a) Place the fertilizers on the side of the bed, between plants, at least 10 cm away from the stem (see illustration below).
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 in the middle between every two plants.
- Direct contact of the fertilizer with plant parts can cause burning damage.
- Irrigation is needed to dissolve the fertilizers and make them accessible to the 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 fertilizer into the slot

Step 3 - Cover the fertilizer with soil

Step 4 - Irrigate immediately after fertilizing

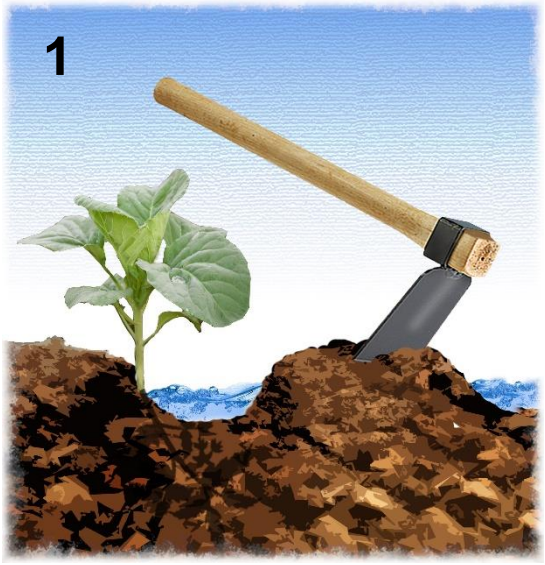
Bed Shifting

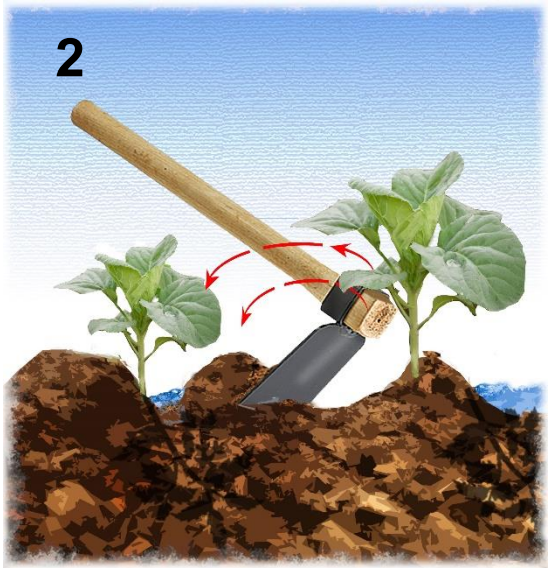
About 3-4 weeks after transplanting, when the plants have been fully established, you should shift the furrows away from the plants. The new furrows should be between the rows (see illustration below).
Carefully move about half of the soil from each bed to fill the existing furrow, creating a new furrow in the middle between the rows.

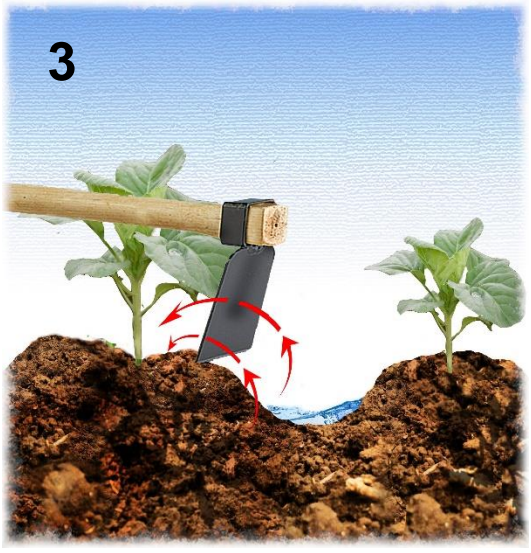
Be careful not to damage the roots of the plants while doing the work. Usually, the size of the roots is similar to the size of the plant.

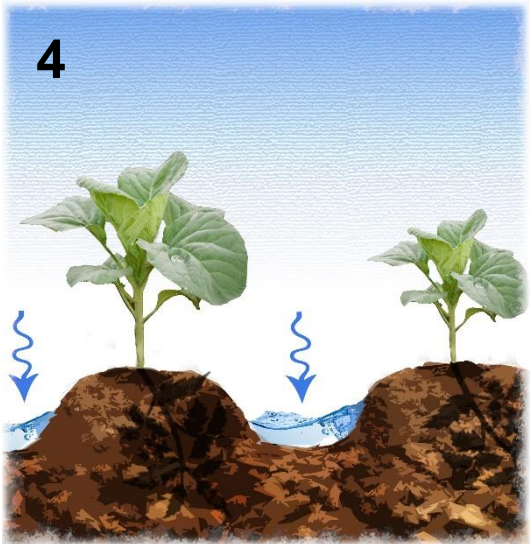
WHY?

- Shifting the furrows is needed to avoid direct contact of the water with the plant.
- Direct contact with water damages the roots, stems, leaves and fruits.
- For double row planting there is no need for bed shifting.









Symptoms of nutrient deficiencies in Cabbage

Lack of Nitrogen (N)

Nitrogen (N) deficiency:

Spindly yellow plants and leaves, occasionally with a pink tint. A nitrogen deficiency will cause stunted growth.

Lack of Phosphorus (P)

Phosphorus (P) deficiency:

Older leaves become dull purple. Head size is small.

Source – Haifa Chemicals

Lack of Potash (K)

Potassium (K) deficiency:

Severe marginal burning of older leaves and inward curling of leaf margins.

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 when spraying and 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) For the timing of the last spray before harvest, check the Label.

Why?

- Pests and diseases are developing on both sides of the leaves and inside the plant.
- Chemicals should reach all plant parts.
- Some chemicals are toxic to humans even after 7 days!
- Always follow the instruction on the chemical label.

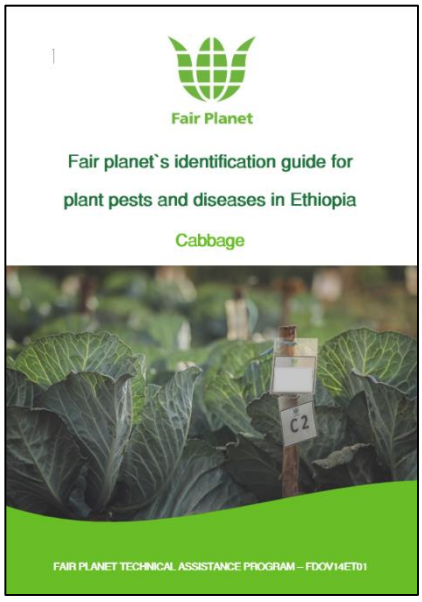
Pest Management

a) Monitor the plants daily, checking leaves and stems, in particular on the inner part of the leaves when head formation begins.

b) Consult with your Keeble Development Agents and the experts from your woreda Office of Agriculture about pest or disease symptoms you observe in your field.

c) We strongly recommend approaching the experts with a sample of the infected plant (leaves, stems or entire plant).

d) Some common pests and diseases are described in our Pest Identification Guide available from your local experts and the Fair Planet team.



Harvest and Storage

When cabbage heads are folding into a solid uniform shape, check their readiness for harvest. The head should be collected when the sprout (internal white part inside the head) reaches 1/2 - 2/3 of the size of the head.

Collect 2-3 heads from different locations in the field, and check sprout lentgh by cuting them in half.

Sprout

Late harvest may result in cracking of the head.

Why?

- Cabbage cracking is mainly a problem in early maturing varieties.
- The rapid growth associated with rain, high temperatures and high fertility can cause cracking.
- Proper irrigation may help to prevent cracking.

After harvest, heads should be stored in a cool, dry place, away from direct sunlight. To allow ventilation, do not cover the heads with plastic. Suitable storage conditions will help maintain heads' quality.

Why?

Covering the heads with plastic will increase humidity and can cause post-harvest diseases that will reduce crop quality.

We wish you Success!

Fair Planet Ethiopia