



Fair Planet

Fair planet identification guide

Cabbage pests and diseases in Ethiopia



Table of Contents

About Fair Planet and project partners	4
General Pest Management Information	5
Identification guide for Cabbage Pests	10
Caterpillars - <i>Helicoverpa Armigera</i> / <i>Hellula rogatalis</i> / <i>Plutella xylostella</i>	10
Aphidoidea / Aphids	12
Thrips / <i>Ponticulothrips diospyrosi</i>	14
Identification guide for Cabbage Diseases	16
Rhizoctonia / <i>Rhizoctonia solani</i>	16
Black leaf spot / <i>Alternaria brassicae</i>	18
Downey Mildew / <i>Peronospora parasitica</i>	20
Black rot / <i>Xanthomonas campestris</i>	22
Erwiana / <i>Erwiana</i>	24
Identification guide for Cabbage Viruses	26
TuMV - Turnip mosaic virus	26
BWYV - Beet western yellows virus	26
Cracking	28
Identification guide for Physiological Disorders	28
Cracking	28
The Five Golden Rules for safe use of Crop Protection Products	29
Personal Notes	30

General Notes:

The identification guidelines included in this document provide information on the main cabbage 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.

Disclaimer

These guidelines are intended to be used as an identification tool 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.



Fair Planet

About Fair Planet and project partners

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 and RVO - the Netherlands Enterprise Agency. The second one is in collaboration with Tikkun Olam Ventures (TOV), the Jewish Distribution Committee (JDC) and TechnoServe Ethiopia.

We would like to thank all the people (experts and volunteers) who contributed to this edition of the Fair planet's identification guide for Cabbage pests and diseases.





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:

- Cabbage Pests
- Cabbage Diseases

Fair Planet's guidelines for plant protection in Ethiopia

We endorse using robust, high quality varieties, resistant to multiple pathogens. We therefore recommend reducing 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 chemical application, 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.
 - 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.
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Principles for field monitoring of pests

- 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 Cabbage Pests

Caterpillars - *Helicoverpa Armigera* / *Hellula rogatalis* / *Plutella xylostella*

Description	Brown or green, relatively large, caterpillar (1.5-5 cm at maturity)
Affected parts	Outer part of the leaves.
Identification	<ul style="list-style-type: none"> - The caterpillars start eating the outer layer of the underneath of the leaf, creating "transparences windows" - Holes and cuts in the leaves, 2-10 Cm. - High populations will result in bigger holes in all parts of the leaves.
Remarks	<ul style="list-style-type: none"> - These insects have many hosts, therefore, always check the surrounding plants for them. - When the cabbage is young, damage might cause decrease in productivity and slow development. - When the cabbage matures, loss in production is due to unmarketable heads.
Additional information	- Caterpillars move relatively fast, check the fields in the area for potential invaders.
Spray adjustments	<ul style="list-style-type: none"> - Use contact or systemic pesticides - Use high volume of water to ensure entrance of the drop inside the plant's leaves.
Chemicals you can use (active ingredients)	<ul style="list-style-type: none"> - Chlorantraniliprole (28) - Cypermethrin (3A) - Profenofose (1B) - Emamectin benzoate (6) - Indoxacarb (22) - Spinosad (5)





Aphidoidea / Aphids

Description	Small green/black/white aphid, found on leaves
Affected parts	Leaves
Identification	<ul style="list-style-type: none"> - Relatively fast moving, they are found mainly on the underside of leaves. - Usually causing folding and “humps” on the leaf (visible only when using a magnifying glass) - Some species can fly.
Remarks	<ul style="list-style-type: none"> - Eggs are laid on the underside of leaves. - The aphids feed on the plant and produce “honeydew” that serves as a growth medium for fungi, thus attracting secondary disease unless effectively treated. - Aphids cause the leaf to curl and curve, also to become yellowish/white and lose its green color (due to sucking). - Aphids hide within the cabbage head, causing direct damage to the markable crop. Therefore, scout closely to identify aphids when damage is still on the outer leaves.
Additional information	<ul style="list-style-type: none"> - Ants and ladybug-like beetles on plants indicate the presence of aphids, check with a magnifying glass. - Look at the underside of leaves and shake the plant to see if aphids fly away from the leaf.
Spray adjustments	<ul style="list-style-type: none"> - Control using fast acting pesticides. - Spray with high volume. - When damage is high, and aphids located within the plant head, use both contact and systemic pesticide .
Chemicals you can use (active ingredients)	<ul style="list-style-type: none"> - Alpha-Cypermethrin (3A) - Profenofose (1B) - Acetameprid / Thiamethoxam (4A)





Thrips / Ponticulothrips diospyrosi

Description	Small black flying insect, mainly hiding in flowers
Affected parts	Flowers, leaves and the crown
Identification	<ul style="list-style-type: none"> - 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 - Yellow Thrips indicate that the trips is young, black for mature Thrips. The cycle from egg to adult may last 10-30 days, therefor – spraying may programed according to the color and cycle of the Thrips (10 days and more) - Use magnified glass for specific recognition
Remarks	- Thrips cause damage to the quality of the cabbage's steam. Resulting in increase of productivity.
Additional information	<ul style="list-style-type: none"> - Thrips has many hosts. Therefore, good sanitation is important. Remove potential host plants from the fields, especially pepper and eggplant - Specially active during how seasons
Spray adjustments	- Repeat spray after 10 days
Chemicals you can use (active ingredients)	<ul style="list-style-type: none"> - Chlorantraniliprole (28) - Lambada Cyhalothrin (3A) - Thiamethoxam / Imidacloprid (4A) - Enamectin benzoate / Abamectin (6)





Identification guide for Cabbage Diseases

Rhizoctonia / Rhizoctonia solani

Description	A fungal disease affecting the leaves and stems
Affected parts	Stem and leaves
Identification	<ul style="list-style-type: none"> - Seedlings - Bottom part of the stem of young seedlings will become brown and wilt in their first days at the nursery site. - Older plants - A firm to slimy dark decay of the bases of the outer leaves and heads develops between early head formation and maturity
Remarks	<ul style="list-style-type: none"> - Make sure that water drains after irrigation - Do not grow seedlings in soil which holds high water content
Additional information	<ul style="list-style-type: none"> - The infection occurs mainly when temperature is high. - Reduce irrigation and allow top soil to dry.
Spray adjustments	<ul style="list-style-type: none"> - There is no chemical treatment





Black leaf spot / *Alternaria brassicae*

Description	A fungal disease affecting the leaves
Affected parts	Leaves, stems and the head of the cabbage
Identification	<ul style="list-style-type: none"> - Infection starts as brown necrotic spots surrounded by yellow area. - The brown-black spots will grow and cover the leaf upper part. - The infected part might generate distinctive "rings".
Remarks	<ul style="list-style-type: none"> - The disease develops under conditions of high temperatures and humidity - The disease spreads easily through the air. - Avoid contact. Remove and dispose of infected leaves at a distant place.
Additional information	<ul style="list-style-type: none"> - The infection may look similar to Downey mildew (<i>Peronospora parasitica</i>). The distinguishing characteristic is that in black leaf spot the spots are more concentrated and black-brown, rather they yellowish spread on the entire leaf. - Infection might cause damage to the head.
Spray adjustments	<ul style="list-style-type: none"> - Repeat the treatment every week, rotate chemicals across group. - Use preventive spray program when conditions for the disease development are present
Chemicals you can use (active ingredients)	<ul style="list-style-type: none"> - Boscalid (C2, 11) - Pyraclostrobin (C3, 7) - Difenoconazole (G1) - Tebuconazole (G1) - Iprodione (E3)



Alternaria Rings



Downey Mildew / *Peronospora parasitica*

Description	Fungal disease caused by <i>Peronospora parasitica</i>
Affected parts	Leaves
Identification	<ul style="list-style-type: none"> - Distinguish between upper and lower leaf: <ul style="list-style-type: none"> • Upper side will show brown to yellow spots, spreading all over the leaf (in highly infestation) • Lower side will show grey-white mold, associated with the damage on the upper side. - Do not confuse with <i>Alternaria</i> that shows brown-black spots, while downy mildew covers the leaf with yellowish color.
Remarks	<ul style="list-style-type: none"> - High humidity and low temperatures (8-20°C) are optimal for the development of powdery mildew, especially in rainy conditions
Additional information	<ul style="list-style-type: none"> - If it rains during the growing period, preventive spraying is advised as soon as the rain stops.
Spray adjustments	<ul style="list-style-type: none"> - Use preventive spray program when conditions for the disease development are present. - Repeat the treatment every week, rotate chemicals across groups.
Chemicals you can use (active ingredients)	<ul style="list-style-type: none"> - Mancozeb (M3) (Preventive) - Metalaxyl (4) - Azoxystrobin (C3) - Cymoxanil (27) - Chlorothalonil (5)





Black rot / *Xanthomonas campestris*

Description	Bacterial diseases caused by <i>Xanthomonas campestris</i>
Affected parts	Leaves
Identification	<ul style="list-style-type: none"> - Infection begins at the tip of the leaves, with yellow to brown mold infection - The infection increase further to the center of the leaf, in kind of "V-shape" structure. - It will cause the whole leaf part wilting with yellow and brown color.
Remarks	<ul style="list-style-type: none"> - The Bacteria is favor in humid, hot temperature (25 C), with high content of water at the surface - Bacteria may also be present on contaminated equipment and surfaces (farm machinery, racks, greenhouse structures, tools). - The bacteria are spread primarily by splashing water and wind-driven rain or mists produced during storms.
Additional information	- Avoid touching the leaves, avoid entering the field as possible (especially at the morning, when plants are wet).
Spray adjustments	<ul style="list-style-type: none"> - Use Cooper based fungicides for preventing the bacteria from develop. - If condition are present, rain or high humidity, repeat the cooper treatment every week. - If bacteria has spread, try spraying in higher volume and repeat after every rain.
Chemicals you can use (active ingredients)	- Cooper Hydroxide/Oxychloride (M1)





Erwiana / Erwiana

Description	Bacterial disease
Affected parts	Stems and inside parts of the head
Identification	<ul style="list-style-type: none"> - Begins when head formation is developing - Entrance through wounds and cuts in the plant - Damage is visible under wet conditions - Damage will cause total mold from the inside part, resulting in black mold that "breaks" the cabbage head.
Remarks	<ul style="list-style-type: none"> - Connecting part of the stem and cabbage head will mold - Relevant in wet condition
Additional information	<ul style="list-style-type: none"> - There is no chemical treatment, therefore, ensure derange of the water irrigation and increase irrigation intervals if disease occurs.



Identification guide for Cabbage Viruses

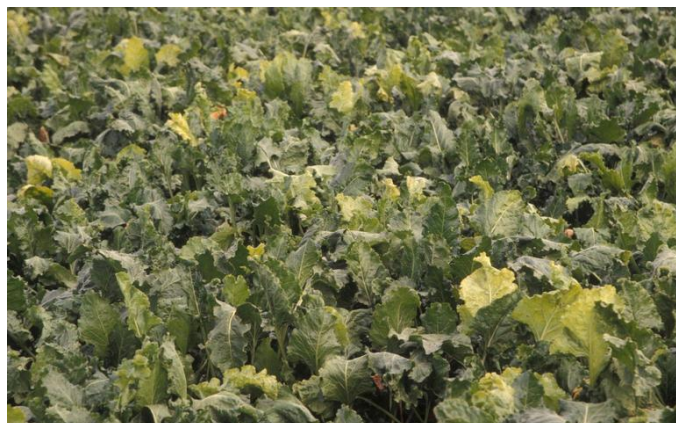
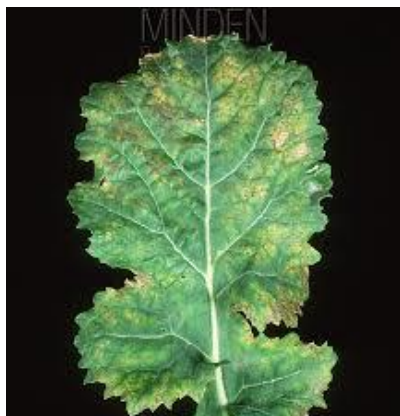
TuMV - Turnip mosaic virus

Symptoms - Severe mosaic symptoms commonly occur in leaves of infected plants. It also causes chlorotic (yellow) ringspots in young leaves. In older leaves, these ringspots develop into yellow or brownish spots surrounded by circular or irregular necrotic (dead) rings. Necrotic streaks, flecks and patches may also occur and plants can be deformed and stunted.



BWYV - Beet western yellows virus

Symptoms - The virus causes reddening of lower leaves and plant stunting, resulting in reduced yield. Its symptoms are easily confused with those of nutritional imbalance, herbicide spray damage, waterlogging or other stress factors. In cabbage, BWYV also induces tip burn in internal leaves, particularly during storage.



Control

- Plant healthy seedlings.
- Control aphid populations.
- Destroy old crops once finished, old plants are potential sources of infection.
- Avoid planting brassica crops sequentially in close proximity.
- Sow non-host barrier crops (i.e. – cereals).
- Rotate brassica crops with non-host crops (i.e. - tomato, celery).
- Manipulate planting dates to avoid exposing vulnerable young plants at times of year when peak aphid populations develop.
- Remove weeds and volunteer crop that might harbor aphids and virus.
- Remove plants with virus symptoms from the field as soon as identified.

Identification guide for Physiological Disorders

Cracking

Description	Cracking of the head (or splitting)
Affected parts	Cabbage head
Identification	<ul style="list-style-type: none"> - During head formation, the head might crack and become unmarketable. This can happen due over fertilizing or an unsuitable variety.
Remarks	<ul style="list-style-type: none"> - This is the main reason to stop fertilizing cabbage 2-3 weeks before harvesting. - Under hot weather conditions, when the cabbage is developing fast, it is recommended to reduce irrigation and fertilization to slow head development and avoid cracking. - Consider using a different variety in future production.



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.

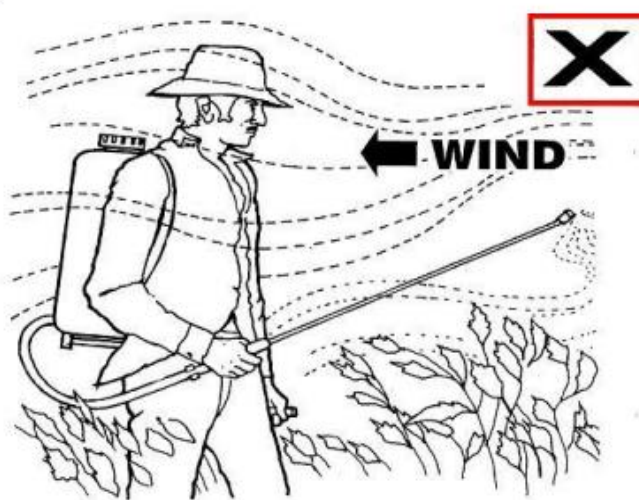
- a) Check spraying equipment before use; any leaks must be repaired before use.



- 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