



Food and Agriculture Organization  
of the United Nations

# Ginger farming guide



(GCP/RAS/296/JPN)



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**Food and Agriculture Organization of the United Nations**  
**Bangkok, 2019**

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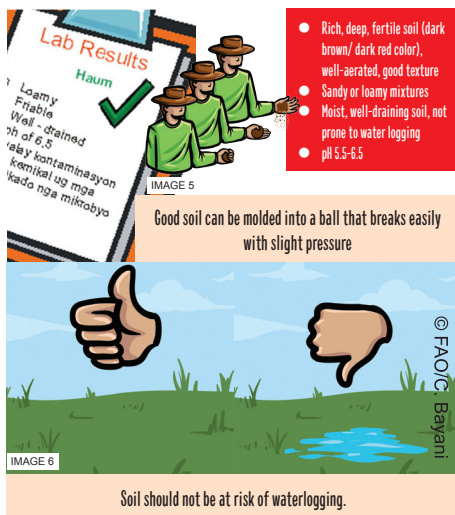
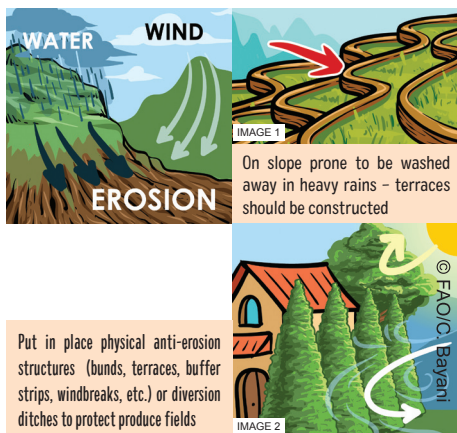
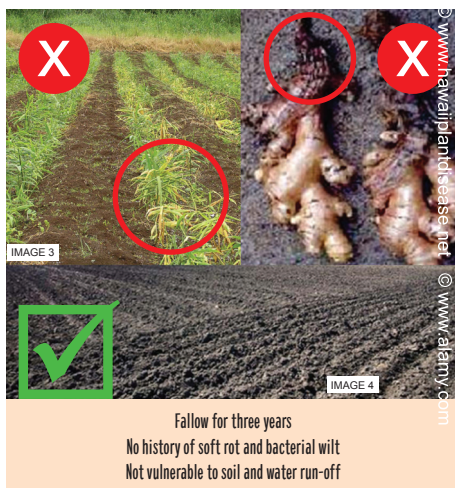
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# Site selection and management

- Choose sites that have no history of pest and diseases, especially soft rot and bacterial wilt.
- Fallow the land for at least three years before being sown with ginger.
- Make sure the area will not be contaminated by other farms on higher ground, whether by soil or water run-off.
- Make sure site is suitable. Conduct soil testing and analysis. Check for contaminants that may affect ginger cultivation.
- Do not locate ginger plots near livestock operations or areas where animal waste can contaminate them.
- Prepare a property layout map or farm plan.
- Check for hazards (physical, chemical, and biological). Identify risks. Formulate hazard control procedures.



# Planting materials

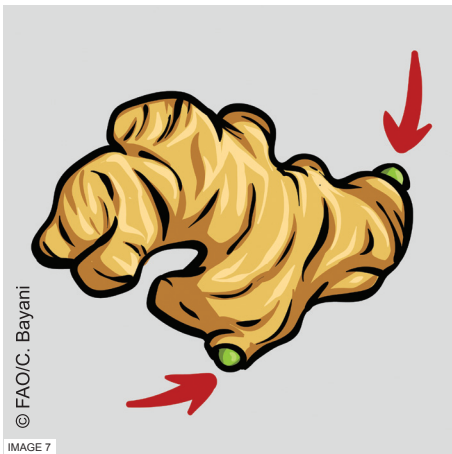
- Plant only mature, clean, and disease-free rhizomes, with two to three buds each.
- Keep records of planting materials indicating variety and source/s.
- Treat rhizomes with Trichoderma or other bio-agents to reduce risk of infection.
- Record all seed treatment (products) applied together with the pests and diseases targeted.
- Store seed rhizomes in a clean and dry place.



Trichoderma from the Department of Agriculture



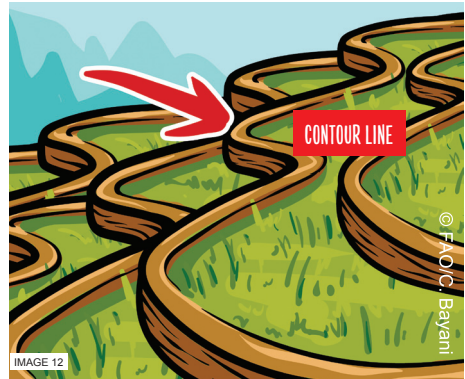
Mixing ratio: 16 litres of water per  
5 to 7 75-gram packs of trichoderma



Disease-free good quality planting material

# Land preparation and farm establishment

- Plow the land twice and then harrow to make soil loose, friable, and pulverized
- Layout the field along the contour line.
- Construct drainage where necessary to prevent water run-off.
- Minimize risk of soft rot infection. Apply bio-agents, such as Trichoderma (100 packs per hectare 75 grams per pack), four to six weeks before planting. Record the location, date, product, application rate and method, and operator name.
- Apply fully decomposed organic fertilizer (3-5 tons/hectare) in your farm. Keep record of application.
- Follow correct planting density depending on slope of land and soil type. Record date of planting, planting density, and variety.



Drainage and raised bed to prevent water stagnation.



# Soil management

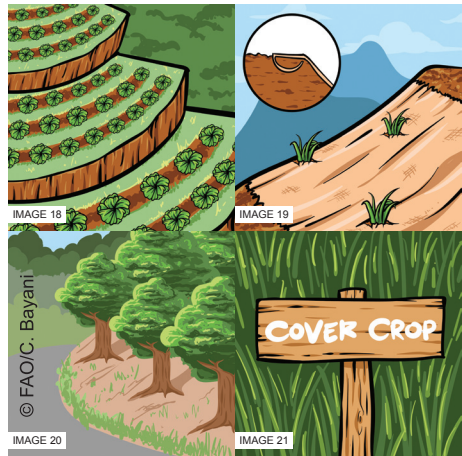
- Employ cultivation practices that minimize soil compaction.

- Reduce tillage. Avoid overworking the soil.
- Use sharp and correctly-adjusted tools to till the soil.
- Apply organic mulches, or protective covers.
- Use crop rotations to improve soil structure.



- Employ cultivation practices that minimize soil erosion.

- Cultivate rows across the slope.
- Construct terraces on slopes prone to being washed away by heavy rains.
- Use mulching mat or organic protective covers to hold vegetation on slopes.
- Plant trees and bushes on farm border.
- Establish permanent grass or vegetation cover on areas that are not cropped



# Farm maintenance/pest and disease management

- Do not allow water stagnation in the field.
- Observe regular weed management.
- Apply disease-free mulching materials, whenever feasible and viable, to help suppress weeds, improve moisture retention, and add organic content to the land.
- Observe and implement farm hygiene and sanitation.



IMAGE 22

Uproot and destroy infected rhizomes.

- Prevent soil contamination. Wash soil off of farm equipment and brush off soil particles from shoes.
- Avoid working in the fields when plants are wet to minimize bacterial spread from diseased plants to healthy ones..
- Sanitize tools, especially if used in handling infected plants, raw manure, and the like.
- Keep animals away from the ginger plots.



IMAGE 23

IMAGE 24



IMAGE 25

Perform regular hand weeding.  
Apply mulching.

Use of herbicides – last resort.  
Follow safety instructions.



IMAGE 26

- Do not allow water to stagnate.
- Maintain cleanliness of the farm. Inspect for rats and rodents, including possible breeding places of mosquitoes and other pests.
- Use only well-composted organic fertilizer or manure.
- Use only disease-free mulching materials.

- Uproot and destroy immediately infected rhizomes and plant parts.

- When symptoms appear, collect, bag and destroy, or pile, diseased material away from farms.
- Cull piles should be placed away from production fields and waterways. If possible, cover with a plastic tarp to speed up microbial decomposition and minimize pathogen spores from escaping.

- Implement integrated pest management system.



© Ministry of Agriculture/India



IMAGE 27



# Fertilizer and nutrient management

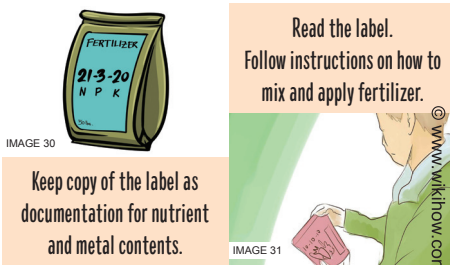
- Use appropriate type and quantity of fertilizer, based on soil analysis and recommendations provided by technically competent authorities.



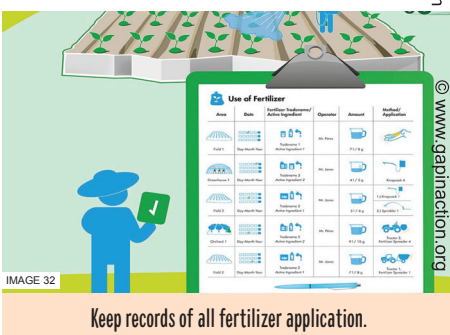
- Record all fertilizer applications per field or ginger plot.

Have soil analyzed.  
Consult technician to know what fertilizer and quantity is recommended for your ginger plot.

- Keep labels detailing major nutrient content for all fertilizers used on the ginger plot.

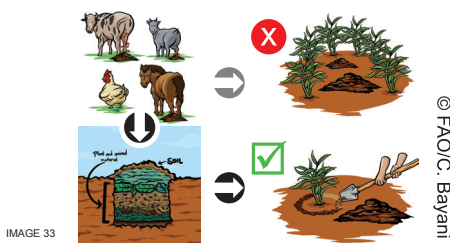


- Keep labels detailing chemical content, including heavy metals, for all inorganic fertilizers used on the ginger plot.



- Ensure that facilities for storage, mixing and loading of fertilizer and for composting of organic material are located and constructed and maintained in a manner to minimize the risk of contamination to production sites and water sources.

- Conduct food safety and environmental risk assessment on organic fertilizer use. Keep records of the risk assessment.



Use only treated and dried manure.

© FAO/C. Bayani

# Agrochemicals and chemicals

Read the label especially mixing and application instructions before use.



IMAGE 34

© FAO/E. Idrovo  
IMAGE 35



IMAGE 36

- ☒ Calibrate, handle, clean and maintain properly all equipment for chemical application
- ☒ Never mix chemicals

© FAO/E. Idrovo  
IMAGE 37



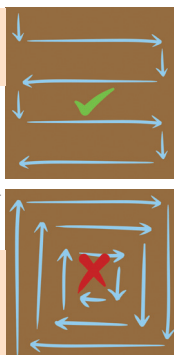
- ☒ Use personal protective equipment when applying pesticides
- ☒ Know what to do in case of accidents and poisoning

Plan an application route. Stay out of freshly treated areas.

© FAO/E. Idrovo  
IMAGE 38



Always direct the spray downwind of the operator. Spraying into the wind will result in operator contamination.



- Use only government approved pesticides for ginger.
- Purchase chemicals from registered and licensed suppliers.
- Use only the recommended dosage.
- Calibrate spray equipment – pumps and nozzles – for accuracy. Check frequently for malfunction.
- Never mix or load pesticides near a drinking water well, pond, stream, ditch, or other water sources.
- Train properly persons handling or applying pesticides. Keep training records.
- Sprayers must carry a supply of clean water with them. This is for cleaning items (e.g. gloves and nozzles) and rinsing small spills at the application site.
- Pesticide sprayers must wear the appropriate protective gear.
- Sprayers must plan an application route that avoids passing through spray or vapor drift.

- Record pesticide applications, stating pest to be controlled, date of application, quantity used, method of application, and pre-harvest intervals.

- Observe the pre-harvest interval and re-entry periods.

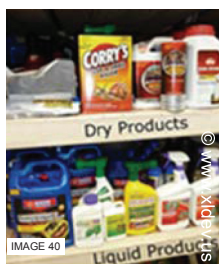
- Wash equipment and spraying clothes after every use. Dispose washing water away from the field to avoid contaminating produce.

- Dispose surplus chemicals away from the field to avoid contaminating produce. Ensure that surplus chemicals do not pose health threat to households.

- Do not reuse empty chemical containers. Collect in a secure place and dispose according to ordinances and regulations.



- ☑ For your safety, observe Re-entry Interval (REI)
- ☑ People should not perform any labor in the treated areas without appropriate PPE



- ☑ Never store pesticides in containers that once held food, drink, or medicine
- ☑ Store pesticide product in a way that will eliminate cross contamination



- ☑ Do not reuse empty chemical containers
- ☑ Protect your life and your family, dispose properly empty chemical containers

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Store pesticides away from food, fresh produce, and the reach of children.



Low cost, effective and safe storage for pesticides



- Pesticide storage facilities should be: (i) clearly identified; (ii) well ventilated; (iii) securely closed to prevent unauthorized entry clearly identified; and (iv) with floors that facilitate cleaning up of spills.
- Store pesticides in their original containers. Make sure labels are intact.
- Do not store pesticides with food, animal feed, seeds, fertilizers, packaging material, water or other material, to avoid contamination.
- Store liquids and solid formulations separately, and away from dry substances.
- Keep an inventory of all pesticides. Follow the 'first in first out' principle.
- Securely close containers to avoid spillage.
- Do not transport pesticides with food for human or animal consumption.

# Workers' welfare, health, and safety

- Inform workers about the terms and conditions of their employment. Wages must be as per labour laws.
- Do not employ children.
- Working hours should not be detrimental to the physical and mental health of the workers.
- All workers should be trained, especially on health and safety, good agricultural practices, hygiene, and first aid.
- All farm vehicles, equipment and tools, including electrical and mechanical devices, are adequately guarded, maintained, and inspected on a regular basis, for potential hazards to users.
- Follow safe manual handling practices to minimize the risk of injury from lifting heavy objects, excessive twisting, and reaching movements.
- Potential hazards are clearly identified by warning signs.
- First aid kit is available. Emergency procedures are known to all workers.



Working hours should not be detrimental to the physical and mental health of workers.



First aid kit is available.

- Ensure that there is an adequate supply of safe drinking water at the workplace.
- Produce-handling facilities should be designed to allow for comfortable working positions.
- Smoking and eating should be restricted to designated areas.
- Toilets and hand washing facilities are readily available and are maintained in a hygienic condition.



IMAGE 49

© FAO/C. Bayani



IMAGE 50



# Harvest and postharvest

- Harvest ginger following recommended pre-harvest intervals.
- Harvest ginger at maturity time, according to the quality required by the market or buyer.
- Sort out the inferior from good quality ginger.
- Clean storage areas thoroughly before harvesting and storing produce.
- Clean all harvesting containers. They must be made of non-toxic materials.
- Do not use harvesting containers for storing non-produce items.
- Practice good hygiene and sanitation.
- Do not allow sick workers to harvest or handle produce.
- Do not allow pets, farm and wild animals, to roam in the production and postharvest areas.



IMAGE 51



IMAGE 52



IMAGE 53

- ☑ Water used on ginger pre-harvest and postharvest activities shall be free from harmful contaminants
- ☑ Assessment of the source of water should be done at least annually



IMAGE 54



IMAGE 55

Remove infected ginger to avoid contamination.  
Sort harvest according to quality.

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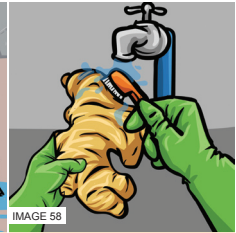
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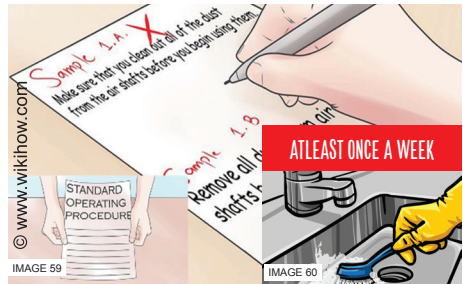
- Use only potable water for post-harvest operations.
- Wash ginger thoroughly. Clean from debris, shoots, and roots.
- Use only approved post-harvest techniques and treatments when storing or packing ginger.
- Record sanitation standard operating procedures (SSOPs) for postharvest treatment.
- Clean and regularly maintain produce-handling facilities and equipment (floors, walls, storage areas, pallets, containers, etc.).
- Do not mix and store waste or reject produce with good quality rhizomes.
- Clean and disinfect waste disposal areas.
- Record cleaning procedures, including the dates when these were actually done.



Postharvest facilities should be cleaned and maintained in hygienic conditions.



Harvested produce must be thoroughly cleaned of soil, debris, and other foreign materials.



Documented sanitation standard operating procedures.



☑ Fence to protect farm from animals.



Observe personal hygiene and sanitation.



# Packaging and transportation

- Transport ginger using clean and odor-free containers and equipment, which are easy to lift and can be thoroughly cleaned.
- Stack produce on pallets to facilitate ventilation, minimize damage, as well as avoid contamination.
- Clean and sanitize vehicles for transporting produce before loading.
- Do not transport ginger with vehicles used for transporting toxic substances, pesticides, or live animals.



Trays and containers should be clean. Stocking/drying of ginger should be such that ginger will not be in contact with ground.



Vehicles for transporting must be clean and not used for transporting toxic substances.

# Leaf symptoms of nutritional disorders in ginger

## Definition of terms

<b>Chlorosis</b>	Loss of green color in the leaf. Affected areas are said to be chlorotic, which may vary in color from yellow to almost white, depending on the disorder involved. Chlorotic areas may also be tinged with other colors, such as red or brown.
<b>Deficiency</b>	Disorder resulting from an insufficient supply of a mineral element essential for healthy growth.
<b>Necrosis</b>	Death of tissue. Usually follows chlorosis, but tissues sometimes become necrotic without first becoming chlorotic.
<b>Pseudostem</b>	The true stem in ginger is a very small structure at the base of the shoot. The main above ground portion is a pseudostem, made up of tightly rolled leaf bases.
<b>Shoot</b>	Above ground portion of the plant consisting of the pseudostem plus leaves.
<b>Toxicity</b>	Disorder resulting from a poisonous excess of some substance in the plant's environment. Some elements that are essential for plant growth are capable of producing toxicities when supplied in excessive amounts.

## Nitrogen deficiency

- Leaves are paler green than normal. May be quite yellow in the case of severe deficiency.
- When very heavy rain occurs shortly after the application of nitrogen, much of the application may be lost by leaching and the leaves will start to turn yellow. In these cases, a further nitrogen application may be made. However, care should be taken not to fertilize excessively with nitrogen as leaf burning and reduced yield may result.



## Physiological leaf scorch

- The tips and margins of the leaves are burnt.
- This is caused by too much exposure to the sun and high nitrogen supply.
- Severity can be reduced by shading the plants, raising the humidity by misting, and lowering the supply of nitrogen.



# Potassium deficiency

## From early to mature stages:

- Plants tend to be smaller and darker green than usual.
- If deficiency becomes severe, tips and margins of the lower leaves develop a yellowish-brown marking, and later die.
- Dead tissues become irregular in shape and often show patches of reddish brown color.
- Leaf surfaces are often crinkled and the leaf tips twisted.
- Sometimes, when the plants are well grown before the deficiency appears, the bottom one or two leaves may remain free of symptoms. But the pattern of symptom development is unchanged.
- Ginger tends to remove large amounts of potassium from the soil. Application of well-composted chicken dung can help restore potassium in the soil.



## Phosphorus deficiency

- Affected plants tend to be smaller and darker green in color than healthy plants.
- Smaller and darker green in color than healthy plants.
- As the deficiency becomes more severe, the tips and margins of the leaves at the lower part become chlorotic and eventually die. Chlorotic leaves are pale, yellow, or yellow-white.
- Soils with high phosphorus fixing capacity (e.g., some red soils), high rates of phosphorus application may be necessary, particularly if the soils have not previously received large amounts of phosphatic fertilizer.



IMAGE 70

© Department of Agriculture

# Phosphorus toxicity

- Initial symptoms appear on the lower leaves. The tips and margins of these leaves become chlorotic, and eventually die. The chlorotic areas often contain bright yellow spots or patches, and have a rather diffuse edge.
- Excess phosphorus may adversely affect the growth of ginger, either directly or by immobilizing elements, such as copper, zinc, or iron that form insoluble phosphates in the tissues.
- In previously planted farms, which may have already received high dosage of phosphorus, high rates of phosphorus fertilizer may be unnecessary. In some cases, it can even be detrimental to crop growth.



## Manganese deficiency

- Ginger crops suffering from magnesium deficiency have bright yellow to white chlorosis of the leaves.
- The lower leaves are first ones affected and show the most severe symptoms.
- Symptoms start at the leaf tip and work back towards the leaf base.
- Severely affected leaves may develop irregular water-soaked areas, which later die.
- Dead tissues are usually brown in color.



## Boron toxicity

- The chlorotic area is usually a light color and patches of it are often pure white. After death, the tissue may turn brown.
- Boron toxicity causes chlorosis and eventual death of the margins and tips of the lower leaves.





# Manganese toxicity

- Older leaves become chlorotic at the tips and along the margins. The affected tissue eventually dies.
- Too much manganese can adversely affect the growth of ginger, either directly (manganese toxicity), or by interfering with the iron nutrition of the plant.
- Drainage and soil acidity are the two main factors controlling the availability of manganese to ginger. Under waterlogging conditions, normally insoluble higher oxides of manganese are converted to a soluble form and toxic levels. Good drainage is important in preventing manganese toxicity on soils of high manganese content
- Manganese toxicity can often be corrected by using lime. However, liming also reduces the availability of iron, copper, and zinc. Too much lime can cause deficiencies of other trace elements. The aim should be to use the smallest amount of lime to put the problem under control. Contact your municipal extension officer for the right dosage.



## Calcium deficiency

- The first sign of calcium deficiency is usually the appearance of numerous small, irregular chlorotic spots towards the tips and margins of the upper leaves. These spots coincide with the depressions in the upper surface of the leaf. The tissue in the spots eventually dies and the spots may join together into larger areas of affected tissue. Sometimes the shape of affected leaves becomes irregular.
- Young emerging leaves become seriously affected. In extreme cases, they may shrivel and die before emerging from the pseudostem.
- Roots of affected plants tend to be stunted and brownish in color.



## Sulphur deficiency

- Sulphur deficiency results to chlorosis of the upper leaves.
- The sulphur-deficient leaves are usually paler in color than nitrogen deficient leaves. They may be almost white in the case of severe deficiency.



# Iron deficiency

- First, the tissue between the veins of the upper leaves becomes pale. It then appears as stripes.
- When the disorder becomes worse, the areas between the veins lose their green color. With severely affected plants, upper leaves may be almost white. They may resemble those of sulphur-deficient leaves.
- Iron deficiency results when another excess element is present. Too much manganese or phosphorus can interfere with iron nutrition.
- Iron deficiency may be cured, either by applying sulphur to lower the soil pH, or by spraying iron salt on to the leaves.



# Manganese deficiency

- Main symptoms occur towards the base of the leaf. The chlorosis usually starts at the leaf margin, about half way along the leaf, spreads towards the midrib and the leaf base, forming a chlorotic V-shaped area with its apex towards the leaf base. Small, dying spots usually develop along the veins, within the chlorotic area.
- Liming reduces manganese availability. As such, excessive use of lime may cause a deficiency of manganese.



## Boron deficiency

- The two main symptoms are: (1) the spacing between the leaves is reduced towards the top pseudostem; and (2) the upper leaves develop small rough circular, whitish spots, caused by breakdown of the tissue inside the leaf. These spots appear transparent when affected leaves are viewed against the light.
- In the early stages of the deficiency, the plants are darker green and the leaves tend to be thicker and stiffer than usual.
- Apply boron in the smallest amount, just enough to correct the problem. Too much boron is toxic to plants. The range between safe and unsafe is rather narrow. Consult an extension officer for correct dosage and analysis.



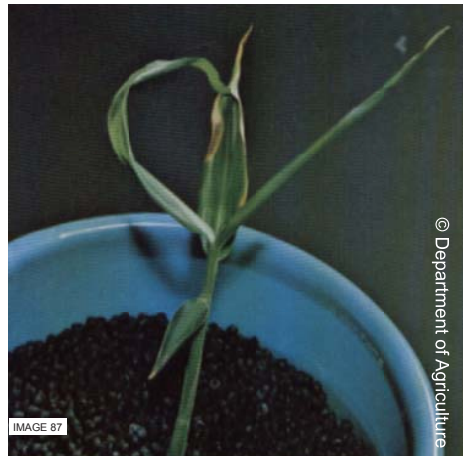
## Zinc deficiency

- Zinc deficiency stunts plant growth. It will shorten the spacing between the upper leaves; broad chlorotic stripes will also develop between the main veins of the leaves.
- Zinc deficiency in ginger is the opposite of boron deficiency. There are no small circular spots on the upper leaves, no leaf stiffening when affected leaves are pulled through the fingers, and there are chlorotic stripes on the upper leaves.
- Compared to iron deficiency, chlorosis in zinc deficiency shows only the major veins remaining green.
- Liming reduces the availability of the soil zinc in plants. Excess lime use may lead to zinc deficiency. However, excess zinc is toxic to plants so the aim should be to apply the smallest amount that will just correct the deficiency.



# Copper deficiency

- Leaves do not unroll fully when the plant is copper deficient. It results in tangled leaf arrangement, where tips of young leaves entangle with older leaves.
- Other symptoms include mottled chlorotic and closer spacing of the leaves on the upper part of the pseudostem.
- Like iron, manganese, and zinc, the availability of copper decreases as the soil acidity increases. Copper deficiency can be brought on by excessive use of lime or phosphorus.
- Copper is not readily lost from the soil by leaching. A single application of copper sulphate may cure
- Too much copper is toxic. Use only when there is evidence of copper deficiency. Apply the smallest amount to correct the deficiency.



## Molybdenum deficiency

- The tips and margins of the younger leaves look bleached among molybdenum-deficient plants. Narrow discolored lines also develop on the leaves.
- In contrast with iron, manganese, zinc, and copper, availability of molybdenum increases with increasing soil pH. Liming ginger soils will reduce the possibility of molybdenum deficiencies affecting crop growth.





# Control measures of common pests and diseases

Pests and diseases may be avoided if farmers follow GAP. It is important that everybody in the village implement GAP.

Most of the diseases of ginger are spread through soil and water contamination. If farmers can prevent pests and diseases from occurring, they will also not need to buy chemicals so they also protect their health and that of their family.

The table below describes the control measures for common pests and diseases of ginger. It should be remembered though that chemical control is the last measure to be considered.

Control measures for common pests and diseases			
Pests and disease	Control measures		
	Cultural	Biological	Chemical
Soft rot	<ul style="list-style-type: none"> <li>– Use of resistant varieties</li> <li>– Crop rotation with corn and other non-host crops.</li> <li>– Plant disease free seed rhizomes.</li> <li>– Use raised beds to reduce risk of water stagnation during rainy season</li> <li>– Soil solarization prior to planting</li> <li>– Use of well composted manure to increase the population of beneficial micro-organism</li> <li>– Treat the rhizomes with hot water at 47° C for 30 minutes.</li> <li>– Proper drainage</li> <li>– Uproot infected plants and destroy it</li> <li>– Mulching with green lagundi at time of planting and after two to three months</li> </ul>	<ul style="list-style-type: none"> <li>– Planting of perennial or seasonal flowering plants (basil, marigold, sunflower etc.) along the border to enhance the population of biocontrol agents for managing pests and diseases</li> <li>– Trichoderma treatment (rhizome and soil) + neem cake. Soil treatment: Drench soil with Trichoderma @ 100 packs (75 gram pack) per hectare. Seed treatment: Mix 5 g of Trichoderma per litre of water per kilogram of rhizome. Dip rhizomes for 15 minutes and air dry for 24 hours under shade before planting.</li> </ul>	<ul style="list-style-type: none"> <li>– Seed treatment with mancozeb (0.25%) by dipping the seed rhizome for 30 minutes</li> <li>– Mancozeb soil treatment</li> </ul>

## Control measures for common pests and diseases

Pests and disease	Control measures		
	Cultural	Biological	Chemical
	<ul style="list-style-type: none"> <li>– Field sanitation/ phytosanitary measures</li> </ul>	<ul style="list-style-type: none"> <li>– Manure applied should also be treated with Trichoderma; no raw manure</li> </ul>	
Bacterial wilt	<ul style="list-style-type: none"> <li>– Soil solarisation</li> <li>– Planting of disease-free seed rhizomes.</li> <li>– Crop rotation with non-host crops like corn.</li> <li>– Avoid crop rotation with tomato, potato, chilli, and peanut as these plants are hosts for the wilt pathogen</li> <li>– Rhizome treatment with hot water</li> <li>– Proper drainage</li> </ul>		<ul style="list-style-type: none"> <li>– Mancozeb soil treatment</li> </ul>
Rhizome fly	<ul style="list-style-type: none"> <li>– Use of healthy rhizome for planting</li> <li>– Removal and destruction of rotting rhizomes along with the maggots from the field after the harvest of the crop may help to check the breeding of the pest.</li> <li>– Intercropping with corn and other non-host crops can reduce or lessen pest attacks.</li> </ul>	<p>Conserve natural bio-agents such as lady bird beetle, spiders, etc.</p>	
Rhizome scale	<ul style="list-style-type: none"> <li>– Collect and destroy damaged leaves</li> </ul>		
Leaf roller	<ul style="list-style-type: none"> <li>– Intercropping with corn and other non-host crops can reduce or lessen pest attack</li> <li>– Collect and destroy the larvae, egg masses</li> <li>– Do not allow the weed host to grow near the field</li> </ul>	<ul style="list-style-type: none"> <li>– Conserve the natural bio-agents such as lady bird beetle, spiders, etc.</li> </ul>	

## Control measures for common pests and diseases

Pests and Disease	Control measures		
	Cultural	Biological	Chemical
	host to grow near the field		
Nematodes	<ul style="list-style-type: none"> <li>– Intercropping of marigold</li> <li>– Deep ploughing</li> <li>– Solarisation</li> </ul>	<ul style="list-style-type: none"> <li>– Application of neem cake before planting</li> </ul>	
Shoot borer	<ul style="list-style-type: none"> <li>– Use the attractant plant for natural bio-control conservation.</li> <li>– Cut open the shoot and pick out the caterpillar and destroy.</li> <li>– Spray neem oil (0.5%) at fortnightly intervals if found necessary.</li> <li>– Mulching with green lagundi</li> </ul>	<ul style="list-style-type: none"> <li>– Conserve the natural bio-agents such as lady bird beetle, spiders, etc.</li> </ul>	
Leaf spots	<ul style="list-style-type: none"> <li>– Pluck and remove the leaf and/ or uproot the infected plants and destroy it.</li> <li>– Green mulching to reduce soil splashes.</li> <li>– Provide shade 30-40% to minimize the disease</li> </ul>		<ul style="list-style-type: none"> <li>– Bordeaux mixture 1% or mancozeb 0.2%.</li> </ul>
White grub	<ul style="list-style-type: none"> <li>– Uproot infested plants and collect and destroy the larvae.</li> <li>– Use well composted manure</li> <li>– Install light traps immediately after first monsoon showers</li> <li>– Tilling of the soil during land preparation</li> <li>– Solarisation</li> <li>– Mechanical collection and destroying</li> <li>– Leaving the land fallow</li> </ul>		

## Attributes

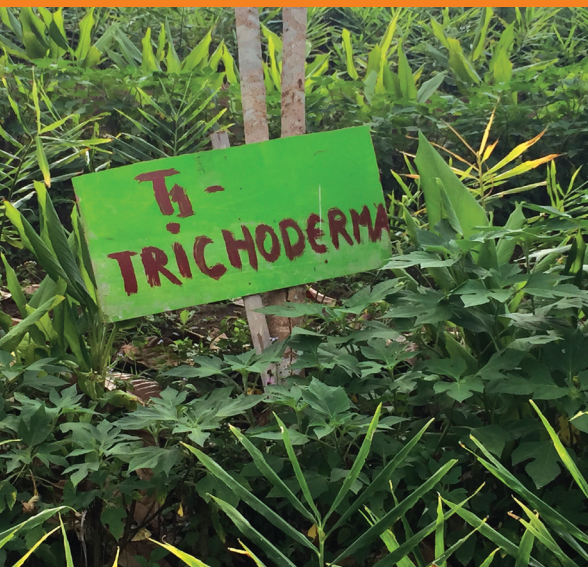
Page	Image	Contributor
1	1	Original image from wikiHow to Prevent Soil Erosion; redrawn by Christopher Bayani
	2	Original image from wikiHow to Conserve Soil; redrawn by Christopher Bayani
	3	1_ginger_bacterial_wilt_field_1.JPG from hawaiiplantdisease.net
	4	image-details-popup.asp from alamy.com
	5	Illustration by Esteban Idrovo
	6	Original image from wikiHow to Care for a Spider Plant; redrawn by Christopher Bayani
2	7	wikiHow to Grow a Ginger Plant
	8-10	Photo by Ivan Idrovo
3	11	FAO, Guidelines "Good Agricultural Practices for Family Agriculture"
	12	wikiHow to Prevent Soil Erosion
	13	<a href="http://agritech.tnau.ac.in/horticulture/horti_spice%20crops_ginger_productiontech.html">http://agritech.tnau.ac.in/horticulture/horti_spice%20crops_ginger_productiontech.html</a>
4	14	Original image from wikiHow to Fix Composted Soil; redrawn by Christopher Bayani
	15	Original image from wikiHow to Prevent Soil Erosion; redrawn by Christopher Bayani
	16	Original image from wikiHow to Fix Compacted Soil; redrawn by Christopher Bayani
	17	Original image from wikiHow to Use Crop Rotation in Gardening; redrawn by Christopher Bayani
	18-20	Original image from wikiHow to Prevent Soil Erosion; redrawn by Christopher Bayani
	21	Original image from wikiHow to Fix Compacted Soil; redrawn by Christopher Bayani
5	22	Photo by P. Latham
	23	Original image from FAO, Guidelines "Good Agricultural Practices for Family Agriculture"; redrawn by Christopher Bayani
	24	Original Illustration by Esteban Idrovo; redrawn by Christopher Bayani
	25	Original image from Good Farming Practices for Coffee; redrawn by Christopher Bayani
	26	Original image from wikiHow to Control Weeds; redrawn by Christopher Bayani
6	27	AESA based IPM Ginger from the Ministry of Agriculture - India
7	28	Original image from wikiHow to Use Commercial Fertilizer; redrawn by Christopher Bayani
	29	Illustration by Esteban Idrovo
	30	Original design from 931905012.gif from soils-fertilizers-and-compost.html Mhscience.weebly.com; redrawn by Christopher Bayani
	31	wikiHow to Use Commercial Fertilizer
	32	<a href="http://www.gapinaction.org/">www.gapinaction.org/</a> <a href="http://www.globalgap.org">www.globalgap.org</a>
	33	Original image from Good Farming Practices for Coffee; redrawn by Christopher Bayani
8	34	Illustration by Cristopher Bayani
	35-38	Illustration by Esteban Idrovo

9	39	Illustration by Esteban Idrovo
	40	6-pesticidestorage_kathleenmoore_ccby20.jpg from shelf.xldev.us
	41	Illustration by Cristopher Bayani
10	42	Original design from ILO WIND Manual; redrawn by Esteban Idrovo – change in colors made.
	43	Original photo from Smallholder Guide for GlobalGAP – Plant Protection Module by GlobalGAP. Redrawn by Esteban Idrovo - sharpened image and contrast; changed bottles in 2nd shelf.
	44	Photo by Ivan Idrovo
11	45	<a href="https://www.aseanbriefing.com/news/wp-content/uploads/2018/01/ASB-Philippine-Labor-Contracts-revised-banner.jpg">https://www.aseanbriefing.com/news/wp-content/uploads/2018/01/ASB-Philippine-Labor-Contracts-revised-banner.jpg</a>
	46-48	Illustration by Cristopher Bayani
12	49-50	Illustration by Cristopher Bayani
13	51-52	Photo by Ivan Idrovo
	53	Illustration by Cristopher Bayani
	54	Illustration by Cristopher Bayani; Photo by Debbie Dominguez
	55	Illustration by Esteban Idrovo
14	56	Illustration by Esteban Idrovo
	57-58	Illustration by Cristopher Bayani
	59	wikiHow to Write a Standard Operating Procedure
	60	Original image from wikiHow to Keep Your Kitchen Clean and Safe; redrawn by Christopher Bayani
	61	Original image from wikiHow to Practice Good Hand Hygiene; redrawn by Christopher Bayani
15	62	<a href="https://www.freshplaza.com/article/157577/China-No-increase-in-ginger-plantings-this-season/">https://www.freshplaza.com/article/157577/China-No-increase-in-ginger-plantings-this-season/</a>
	63-64	Photo by Ivan Idrovo
	65-66	Illustration by Cristopher Bayani
17-30	67-88	Source: Department of Agriculture, University of Queensland, Diagnosis and Corrections of Nutritional Disorders in Ginger, 1975
Front Cover		"Gingerito" illustration by Esteban Idrovo
Back Cover		Photos by Ivan Idrovo and Debbie Dominguez

## Notes

INSIDE BACK COVER





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