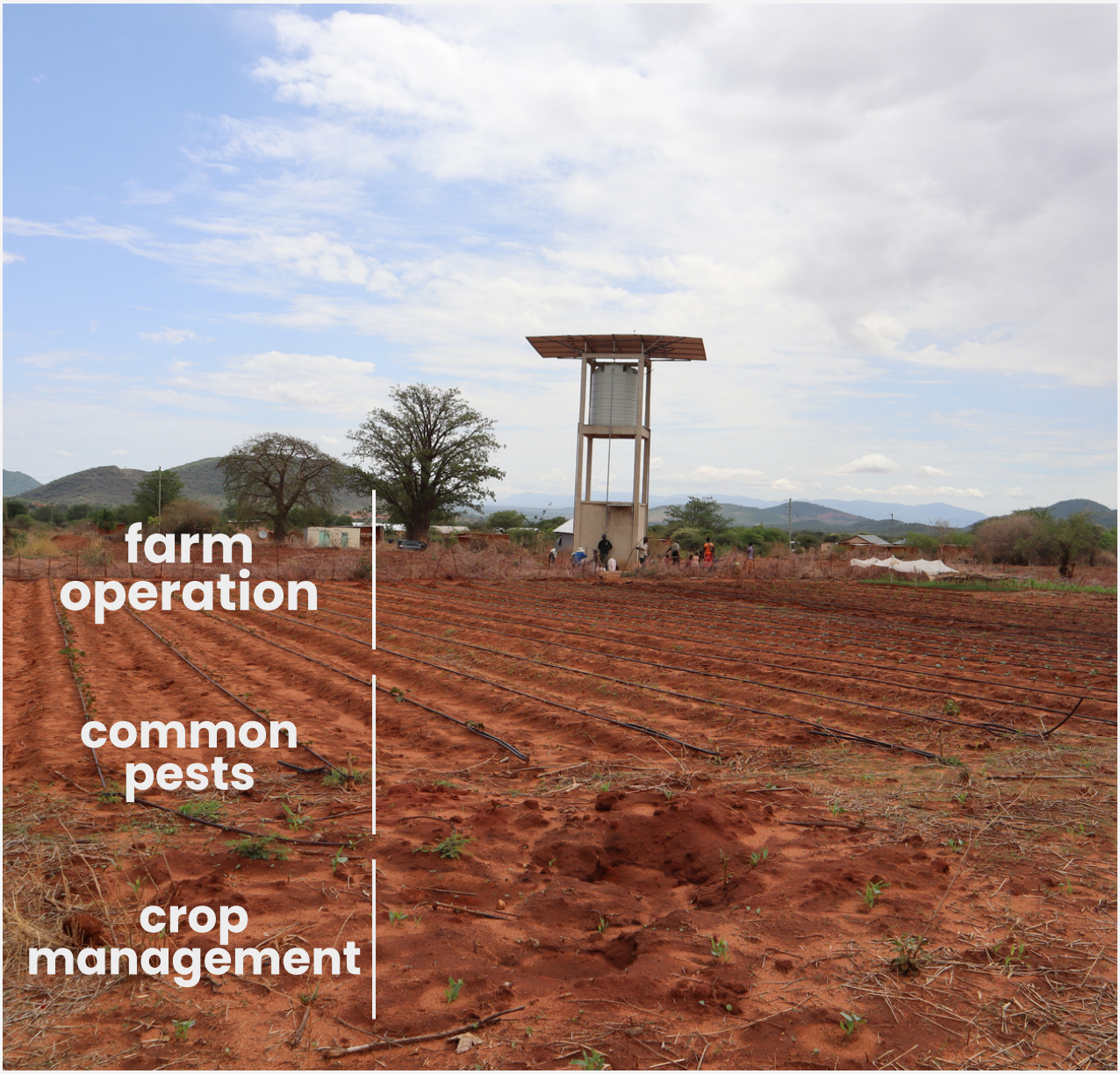
GUIDEBOOK

VEGETABLE PRODUCTION



guide book for drip irrigation demo plot management in Dodoma region, Tanzania.

CultivAid
Knowledge based Development

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farm operation

Crop management

FARM OPERATION

AGRI - TECHNICS

simple technics that can increase yield

field preparation and soil cultivation

increases quality of the soil:

- reduces amounts of insects and weeds.
- Helps incorporation of the manure and the soil in the farm.
- Improve soil aeration.

Land preparation - breaking of all soil hard pans.

- plowing: break up the soil to different directions, to remove big chunks of soil.
- warning- if the plot in slope it is not recommended to cultivate deeply

Fencing- protects the plot from animals and wind.

- Strong wind can destruct crops, and spread pests and diseases.

beds preparation - done after land cultivation.

- the soil of the bed should be brake to small particles, to improve the water mobility and soil aeration.
- Bed size is differentiated according to types of crop, season and the soil type.
- all plant debris of the last season should be removed.
- the beds should fit the irrigation system.

AGRI - TECHNICS

simple technics that can increase yield

Seed sowing

In order for the seed to germinate, it needs to be planted in the soil.

- for each crop, the depth of sowing is different, and determined by the size of the seed.
- there are different methods for sowing -

<u>the main two sowing methods :</u>

Direct sowing

seeds are sown directly to the beds in the farm.

- mostly used for crops with high chances of germination or cheap seeds.
- examples for crops we direct sow: okra, carrots, maize, watermelon.

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Nursery sowing

sowing of the seeds in a special area, for preparation of seedlings.

- the nursery promise good conditions for germination: water supply, shadow, weed control, pest protection.
- This method used mostly for hybrid seeds of sensitive crops.

<u>types of nurseries:</u>

local nursey: seeds are sown near the farm, in protected and shadowed area.

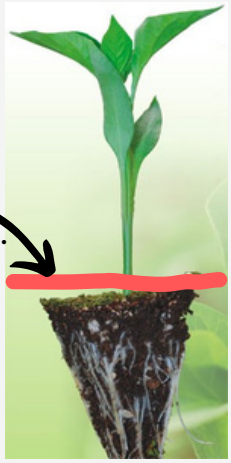
- cultivate the soil so it will be light.
- prepare small fence and shadow.
- sow according to the specific instructions of the crop.
- maintain the soil moist at all time!

commercial nursery: protected growing structure, using technology to create optimal conditions for germination and high quality seedlings in trays.

AGRI - TECHNICS

simple technics that can increase yield

Seedlings transplanting



- irrigate the beds before transplanting.
- it's better to transplant in the afternoon, when the sun is not strong.
- the depth and spacing is different between each crop.
- mark holes for transplanting, it should cover only the roots, not more.
- after placing the seedling, cover with soil and press it.
- irrigate right after transplanting and keep the soil moist.

Mulching

covering the soil at the root zone, in order to support plant development:

- conserve moisture of the soil and reduce water logging.
- Reduce soil erosion.
- Reduce weed germination.
- reduce flocculation of soil temperature.

preparation of mulching:

- cut grass or small woods into small pieces and spread it equally along the bed.
- the mulching can remain for all the plant stages.

AGRI - TECHNICS

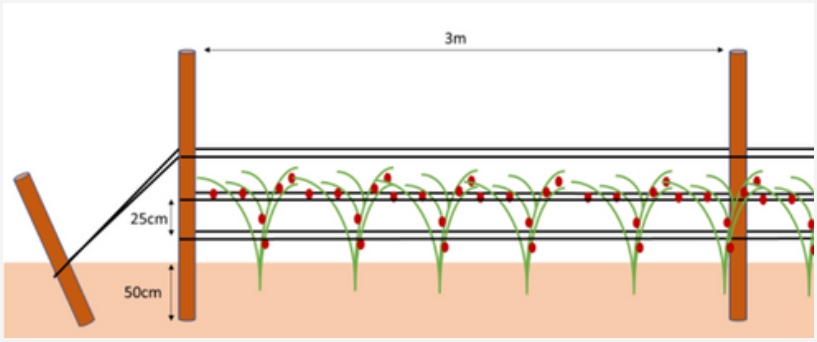
simple technics that can increase yield

Staking

creating support for the plant in order to increase production and simplify farm activities.

crops that can benefit from staking: Tomato, Pepper, Africans Eggplant, Cucumber.

- staking should start at first flowering stage.
- use wood poles, 1.5-2 m long.
- plant the poles 50 cm deep in the ground, and not more than 3 m apart.
- Stretch ropes from both side of the pole, and keep the main stem in between.
- keep a gap of 20-30 cm between lines of wires.



Pruning

selective cutting away of plant parts, allowing room for new growth and protecting from damage.

- in crops that have staking - prune leaves which touching the ground, but leave at least 3 branches.
- during the season - remove dead or highly infected leaves and fruits.
- the tools used for pruning should be clean and sanitized in order to reduces transfer of diseases from one plant to another.
- Be carful - **DO NOT OVER PRUN!** the plant needs enough leaves for growth.
- Try to remove as little leaves as possible in areas where there are growing fruits.

Harvest

- find buyers before the crops reaching ripening stage.
- harvest at low temperature as possible and at dry condition.
- do not harvest when it is raining!
- store the yield in a cool and dry place , avoid direct sunlight.

IRRIGATION

irrigation timing and amounts are determined by the **amount of moisture** in the soil at a root zone.

- root depth in most vegetables is 10-30 cm.
- Plant appearance is NOT an accurate method of determining soil moisture content.

Feel methods - for assessment of soil moisture content

Soil Ball Method:

1. Dig a hole and remove a handful of soil from 15-30 cm deep.
2. Squeeze the soil into a ball.
3. 'bounce' the ball in the palm of your hand
4. If it remains in a stable shape - the soil is moist enough.
   If it crumbles - it needs more irrigation.

Finger measurement:

1. along the day, press your finger deep next to the plant.
2. monitor the changes of moister, to better know the soil characteristics.

Looks of the soil:

1. moist soil tend to become darker, learn the ideal color of your soil.
2. with drip irrigation: the soil is well irrigated when there is unified wet line along the bed

when to irrigate?

- if possible - it's better to irrigate early in the morning.
- the soil needs to be moist at all times, but not too wet.
  - check if your soil needs irrigation every second day or even twice a day.
- After transplanting/sowing - irrigate well and keep the soil moist at all time.

seed that germinate and got dry - is DEAD.

- **don't over irrigate -** too much water will get the plant rot.

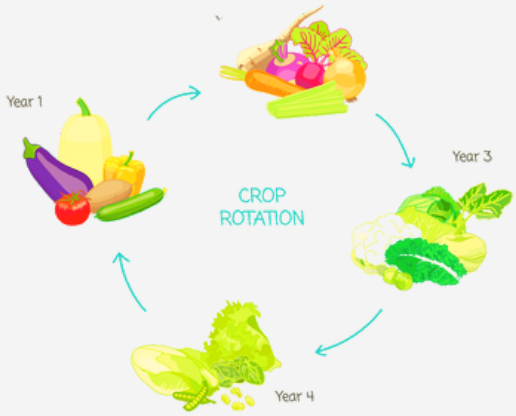
how much to irrigate?

know the needs of your crop!

- different crops needs different of water.
- **plant stage** affect the amount of water the plant needs. plant with more leaves consume more water.

GUIDELINES FOR PREVENTION OF PESTS AND DISEASES

Prevention is the most efficient & cheapest way to control pests and maximize your yield



Crop rotation

planting different crops on the same plot

- Do not grow crops from the same family for at least one year.
- crop rotation improve soil health, optimize nutrients in the soil, and combat pest and weed pressure.

keep it Clean:

- Clean the tools every once in a while, and between crops.
- keep your field clean from plant derbies.
- Dispose infected plants or parts (leaves/ fruits).
  try not to break and spread the fruit body to avoid the spread of the disease.
- Always move from younger crop to older one.

Reduce free water on leaves / stem base.

Seeds

- get seeds/seedling from a known and clean place.
- Choose tolerant/resistant crops verity.

know the optimal spacing for transplanting

- High plant density increase the risk for diseases and pests.

Monitoring of pests and disease

early treatment can reduce the use in chemicals and minimize the damage.

SAFE CHEMICAL APPLICATION

Pesticide is a poison by definition- use it with great care!

- **use only when needed (after monitoring and identifying the pest)**

Unnecessary and exaggerated use bring to an unstable environment and to development of resistance.

- **follow instructions on the label**

Choosing pesticide: Targeted to the pest identified, Approved to use in the crop, Brakes the chance for resistance.

- **Do not use sprayer under strong winds or rain**

it can harm people and livestock.

- **Do not spray next to children and other people**

insecticides can cause cancer, damage to fertility, and even death!

personal safety

Protect your self and your loved ones!

- cover all the body with appropriate protection:

MASK, GOGGLES, OVER COAT, GLOVES, BOOTS

- Ware safety **from preparing of the mixture to application.**
- **Wash** your body and clothes after using.
- Do not eat, drink or smoke during application.
- **lock** the chemicals away from children and food.
- **Mark** containers used for measuring and mixing – do not use them for other purposes.

Prevent pest resistant! Rotate!

- **Monitor** - Use pesticide only when needed.
- Always work with the label instruction.
- Don't re-use ineffective pesticides.
- Don't use same active ingredient for more than 3-4 times a season.
- Check the expiry date of the chemical.

Aphids
Thrips
Mites
Nematodes
Grasshoppers, Crickets, Locust
Beetles & Weevils
termites
diseases
beneficial insects

COMMON PESTS

APHIDS / WHITEFLIES

identification:

- Very common
- small (1.5-3mm), pear-shaped
- Comes in many colors
- feed in groups
- Will appear in the bottom of the newer leaves
- Most are wingless , the adults have wings
- excrete a sugary, sticky liquid called honeydew, on leaves and branches
- Ants on the crop are often a sign for aphids
- Prefers warm conditions

direct damage:

phloem sucking - Cause leaf rolling and curling , or malformed flowers and fruits.
Heavily attacked leaves can turn yellow and eventually wilt.

indirect damage:

- Viruses vectors:
  - African cassacve mosaic virus,
  - Tomato yellow leaf curl virus (TYLCV)
  - Barley yellow dwarf virus
- Sooty mold (a fungal growth) can grow on the honeydew - turning leaves and branches black

Main crops infected:

- Extremely polyphagous

Optional treatment:

- Tolerant variety

insecticide - High tolerance to insecticides

THRIPS

identification:

- Very small. Up to 1.5 mm long
- Carried with the wind
- Cryptic (inside flowers, under leaf folds)

direct damage:

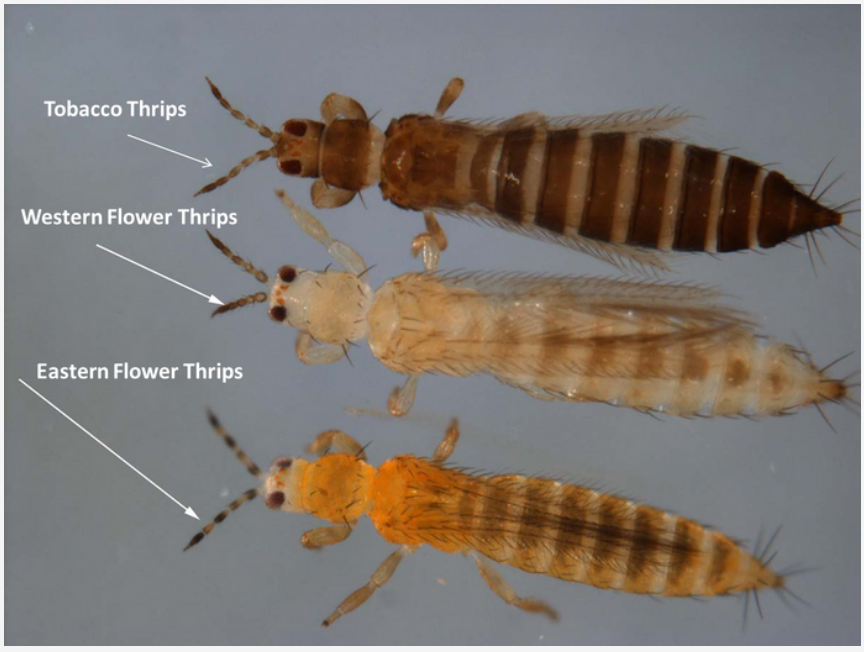
- deformed leaves nd fruits

indirect damage:

- Vector of virus : Tomato Spotted Wilting Virus (TSWV)
- Cryptic (can be found in flowers)

Main crops infected:
onion, tomato, pepper, African eggplant, Watermelon

Optional treatment: insecticide



MITES

identification:

- Four pairs of legs
- Small size – sometimes can be hardly seen
- No wings
- not insect - the treatment is different (Do NOT use insecticide)
- Very susceptible to moister
- Do not fly- carried in the wind

direct damage: Bronze-colored leaf and stems

Main crops infected:
Tomato, Onion, African Eggplant, Pepper.

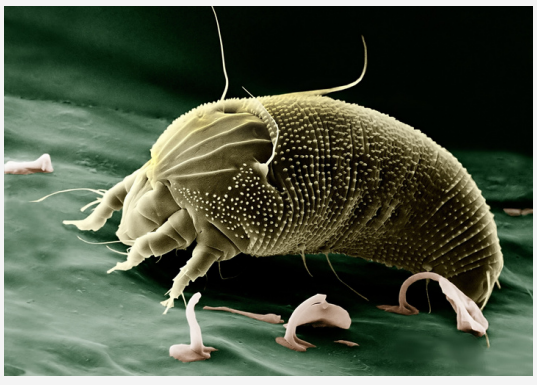
Optional treatment:

Prevention:

- Clean tools - can return to the crop from equipment in the field (pipes, nets, wires)
- keeping the field well irrigated and fertilized will reduce mites population
- spraying water with some soap or oil

Treatment:

- Good to use oils like nemozide.
- spraying Sulfur is affective



NEMATODES

identification:

- Microscopic roundworm
- live in soils- Mainly root parasites
- Very hard to detect
- Have ability to spread in and between fields
- Excessive water in soil enhance the population
- Infection is usually patch-like

direct damage:

- stunt plant, sufferers from lack of water and nutrients

indirect damage:

- Secondary disease infection can be prompted due to the penetration.

Main crops infected: .
effects a wide verity of crops.
for some crops there are resilient verities.

Optional treatment:
<u>prevention:</u>

- Be cautious when importing soil from different plots, clean tools, uproot entire plants after season and destroy plant derbies.
- Grow Brassica (mustard, rocket, broccoli, cauliflower etc…) and plow the derbies to the soil - the best is the flowering of mustard)

<u>Treatment:</u>

- When heavily infected – it is better to uproot the infected plot
- leave dry for the follow season if possible and only then to re-use the soil.
- chemical application: **Nematicides are not useful during the season!** only before season if needed.

GRASSHOPPERS, CRICKETS, LOCUST

identification:

- Nymphs are similar to adults without wing
- Causes major damage when swarming

direct damage:
Chewing leaves, stems, fruits, upper roots

Optional treatment:

- manual killing
- remove weeds from the plots surroundings
- insecticide

BEETLES AND WEEVILS

identification:

- Hard and usually compact body
- Forewings
- Larva – only 3 pairs of true legs
- Head is always distinct, usually darker

direct damage:

- Chewing abilities make this order very harmful post-harvest pest

Optional treatment:

- manual killing
- remove weeds and plant residues from the plot surroundings
- insecticide, neem oil

TERMITES

identification:

- Live in a colony
- Build mounds

damage:

- Usually don't attack vegetables.
- come as a secondary pest (after an initial damage by fungus or a beetle) and pernitrate decaying roots and plant tissues.

Optional treatment:

- keep the soil moist! termites move in dry soil.

FUNGAL DISEASES

identification:

- Most common disease
- Can be prevented and treated
- Some of the life cycle are visible
- distributed with rain and wind




Optional treatment:

<u>prevention:</u>

- some varieties of hybrid seeds have resistance/tolerance to some diseases. *consult the input company or expert.*
- Crop rotation
- clean and resistant seeds
- Dispose carefully damaged plants (try not to break and spread the fruit body)
- Well drained soil
- ventilated foliage

<u>Treatment:</u>

- fungicides (after identifying the type of fungi)

VIRAL & BACTERIAL DISEASES

- Can not be seen with naked eye.
- Look for unusual growth patterns, yellowing and distortions.
- viruses transfer to the plant by some insects.
- A bacteria usually invades into the plant through cuts it the plant.

There is no treatment after infection. <u>the only solution in prevention:</u>

- use resistance seeds if possible.
- Prevent vector insects.
- Dispose every suspicious plant.
- Clean your tools, hands and field.
- Crop rotation.
- Reduce free water on leaves.

read the page: ***guidelines for prevention of pests an diseases*** *on page 7*

BENEFICIAL INSECTS

Not every insect is a pest…

On the contrary –
there are **many insects that are <u>important</u> for healthy field.**

for example:

- <u>parasite wasps</u> reduce pest population.
- <u>lady bird</u> is an efficient insect predator.
- <u>bees and lacewings</u> contribute to crop pollination.

Lady bird beetle

parasite wasp

honey bee

lacewings

CROP MANAGMENT

Tomato
Onion
African eggplant
Pepper
Carrot
Watermelon
Maize
Cabbage & Greens

TOMATO

Family: Solanaceae
growing period: 120-150 days

Planting spacing:
bed width: 0.6 m
Bed High: 0.3 m
drip line per bed: 1
rows per bed: 1
gap between plants: 0.6 m

Transplanting/sowing:

- seedlings. should be at least 4-6 weeks old before transplanting in fields.

Irrigation:

- Daily irrigation is crucial after transplanting for the first 10 days.
- Frequency of irrigation can vary from twice a week early in the season to daily during fruit set.

Agri-technics:

- *Staking*

- Keep 2.5-3 m between poles, and a gap of 20-30 cm between lines of wires (floors).
- The poles should be fixed 50 cm deep into the ground.
- Stretch the ropes so it will go from both side of the pole, and the main stem in between.

- *pruning*

- fruit that is not good for selling must be removed, and sooner the better! it will focus the energy on good and new fruits.

- *Harvest*

- 8-10 weeks from sowing.
- At least once a week.
- Be careful not to put too many tomatoes in one container.
- Don't put rotten tomatoes with good tomatoes - prevent disease transmission.

plant stages and fertigation:

the amount in the chart is for **10 plants per week.**
it is recommended to split the amount to 3 application per week and apply after irrigation:

FERTILIZE	g/week/10plants		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	10.2		
establishment (1 weeks)		1.60	1.20
vegetative growth (4 weeks)		6.00	8.70
fruit set (5 weeks)		7.70	10.50
harvest (18 weeks)		19.10	25.80

TOMATO Main pests

APIDS / WHITEFLIES

see page 10

Main damage: stunting and leaf curl, virus
treatment: Tolerant variety, insecticide


THRIPS

see page 11

Main damage: virus, leaf curl
treatment: insecticide


TUTA ABSULUTA

A significant pest. green caterpillars, found inside leaves & fruits.
Main damage: very harmful to leaf and fruit
treatment: pheromone traps. insecticide. remove damaged fruits.


MITES

see page 12

Main damage: Bronze-colored leaf and stems
treatment: Do NOT use insecticide, spray water with some soap or oil, nemozide and sulfur.


LEAF MINER

Main damage: tunnels inside the leaves - not harmful to the fruit
treatment: insecticide, only if most of the leaves are damaged!


NEMATODES

see page 13

Main damage: damage to the roots - lack of water to the plant
treatment: only after the season


TOMATO

Main diseases

read page 16

FUNGAL DISEASES

BLOSSOM END-ROT

not a disease!
treatment: Avoid water stress, stop urea fertilizer, remove damaged fruits.


EARLY BLIGHT

description: brown circle spots on old leaves. could damage also stamp and fruits
treatment: stacking, suitable fungicide


LATE BLIGHT

description: green-black/brown spots on leaves and fruit.
treatment: stacking, suitable fungicide


POWDERY MILDEW

description: Attacks leaves - Drying and narcotic spots
treatment: stacking, suitable fungicide


ANTHRACNOSE

description: Attacks mainly ripe fruit.
treatment: stacking, suitable fungicide, sodium bicarbonate, or baking soda.


BACTERIAL AND VIRAL DISEASES





for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)
on rainy season: spray preventive fungicide after every heavy rain

ONION

Family: Amaryllidaceae
growing period: 110-180 days
- 35-40 days in the nursery
- 75-100 days in the field

Planting spacing:
bed width: 0.65 m Bed High: 0.15 m
drip line per bed: 2 rows per bed: 4
gap between rows: 0.14 m
gap inside the row: 0.05 m

Agri-technics:
- *Weeding*

- 10 days after sowing/transplanting, start routine weeding.

- *Harvest*

- at least 75% leaves dropped and the stamp is got soften (press it).
- pull the onion, cut the roots and the leaves.
- Post-harvest: Drying and storage for 3-4 weeks, in shadowed, dry and ventilated place.

sowing:
- Amount of seeds for 100 m: 45 gr.
- timing: about 2 months before the rainy season ends, to avoid rotting
- sow the seeds in local nursery: plow the soil 20cm deep, level the soil, sow in dry soil in 2cm deep lines, 10cm apart.
- create shading to the nursery.

Transplanting:
- seedlings are ready to transplant when the pencell-wide thick and developed three real leaves (after 35-40 days).
- before transplanting- cut the roots 2cm long and the leaves to 5cm long.

Irrigation:
- For local nursery: 2 times a day. keep the soil moist at all time.
- after transplanting, until bulb formation is starts: only when the soil is dry.
- In bulb formation stage: irrigate more.
- stop irrigation after the bulb are at desired size. In rainy season big bulbs can rot easily.

plant stages and fertigation:

the amount in the chart is for **1 METER BED (80 plants) per week.**

it is recommended to split the amount to 3 application per week and apply after irrigation:

FERTILIZER	g/week/1 METER bed		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	7.25		
establishment (3 weeks)		1.8	3
vegetative growth (5 weeks)		2.2	2
bulb development (5 weeks)		3.1	2
maturation (leaf drop)		0.0	0.0

- Onion reacts strongly to fertilization.
- It is recommended to **apply compost** during field preparation.

ONION

Main pests

THRIPS

see page 11

can be found hiding in the lower part of leaves
Main damage: wilting and yellowing, viruses.
treatment: insecticide, Repeat after seven days, with alternative chemical.

MITES

see page 12

Main damage: small spots on the upper surface of leaves, can become bronzed and turn brown. can also damage the bulb.
treatment: Do NOT use insecticide, spray water with some soap or oil, nemozide and sulfur.

LEAF MINER

Main damage: tunnels inside the leaves - not harmful to the fruit
treatment: insecticide, only if most of the leaves are damaged!

ONION Main diseases

read page 16

FUNGAL DISEASES

POWDERY MILDEW

description: Attacks leaves and Stem. Drying and narcotic spots, white powdery appearance.
Prevention: suitable systemic fungicide.


PURPLE BLOTCH

description: purple to brown infection, usually with white center.
Prevention: Spray fungicide immediately when infection appears.


STEMPHYLIUM LEAF BLIGHT

description: yellow to brown blight of the leaves, usually no damage to the bulb
Prevention: suitable fungicide (for Downey mildew)


IRIS YELLOW SPOT DISEASE

description: narcotic spots with green center.
Prevention: virus transfers with thrips - treat the vector.


DOWNEY MILDEW

description: Yellowish spots on the leaves that expand along the leave.
Prevention: Suitable systemic fungicide


BOTRYTIS LEAF BLIGHT

description: white dots on leaves, affects the size of the yield.
Prevention: Suitable fungicide


for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)
on rainy season: spray preventive fungicide after every heavy rain

AFRICAN EGGPLANT

Family: Solanaceae
growing period: 145-180 days

- 12 weeks from sowing to first harvest.

Planting spacing:
bed width: 0.6 m
Bed High: 0.3 m
drip line per bed: 1
rows per bed: 1
gap between plants: 0.6 m

Transplanting/sowing:

- seedlings. should be at least 3-4 weeks old before transplanting.

Agri-technics:

- *Staking*

- Hold the plant together by a horizontal wire on both sides of the plant, to help reduce diseases and make Easier crop management.

- *Pruning*

- remove leaves about 10cm above the ground.
- fruit that is not good for selling must be removed, and sooner the better! it will focus the energy on good and new fruits.

- *Harvest*

- Harvest before the fruit is changing color.
- can be done 1-2 times a week.
- The fruit should be eaten within one week after harvesting.

Irrigation:

- After transplanting: Daily irrigation is crucial .
- during the season irrigate Frequently, especially during fruiting stage.
- can tolerant dry conditions, but it will reduce yield.

plant stages and fertigation:

the amount in the chart is for **10 plants per week.**
it is recommended to split the amount to 3 application per week and apply after irrigation:

AFRICAN EGGPLANT FERTILIZER	g/week/10 plants		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	2.8		
all season		15.4	10.5

AFRICAN EGGPLANT

Main pests

MITES main pest

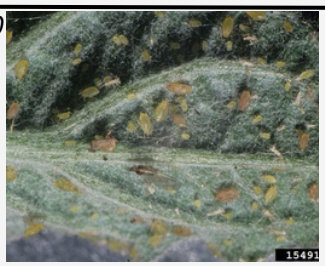
see page 12

Main damage: webbing on the lower surfaces of leaves, yellow & stippling Bronze-colored leaf.
treatment: Do NOT use insecticide, spray water with some soap or oil, nemozide and sulfur.

APIDS / WHITEFLIES

see page 10

Main damage: necrotic spots on leaves, virus, fungi
treatment: spray water and oils, insecticide only when infestation is very high.



THRIPS

see page 11

Main damage: leaf curl, virus
treatment: insecticide

NEMATODES

see page 13

Main damage: damage to the roots - lack of water to the plant
treatment: only after the season

AFRICAN EGGPLANT

Main diseases

read page 16

FUNGAL DISEASES

POWDERY MILDEW

description: White, powdery spots on leaves, shoots, flowers and fruit. yellow, twisted leaves.
Prevention: Suitable fungicide

CERCOSPORA LEAF SPOT

description: small circular chlorotic spots on lower leaves with dark brown centers
Prevention: Suitable fungicide

PHOMOPSIS FRUIT ROT

description: Circular brown spots with lighter centers on fruits, infested leaves may turn yellow
Prevention: Destroy infected plant material, spray Suitable fungicide

PHYTOPHTHORA BLIGHT

description: Wilting plants, brown discoloration on roots, brown lesions on stem at soil line
Prevention: avoid excessive overhead irrigation

for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)
on rainy season: spray preventive fungicide after every heavy rain

PEPPERE Hot and Sweet

Family: Solanaceae

growing period: 120-150 days

Planting spacing:

bed width: 0.6 m

Bed High: 0.3 m

drip line per bed: 1

rows per bed: 1

gap between plants: 0.3 m

Transplanting:

- seedlings. should be at least 6-8 weeks old.
- cover only the roots with, not more. the stem is sensitive to moister comes from the soil.
- if seedlings have flowers, it is recommended to remove them, to give the plant more energy to establish itself.

Agri-technics:

- *Weeding:* should be done during the entire crop life. Particularly 12-48 days after transplant.
- *Staking:*

- poles should be between 1.2-1.5m long.
- Poles should be planted around 40–50cm deep, and not more than 3m apart.
- start staking at first flowering stage.

- *pruning:* fruit that is not good for selling must be removed, and sooner the better! it will focus the energy on good and new fruits.
- *Harvests:* After 2.5-3 months, weekly. can continue for up to 6-8 months

Irrigation:

- special emphasis should be placed at transplanting (the two weeks that follows) and during the onset of flowering /fruit production, in providing enough water.
- In drought and heat stress, plants lose flowers and buds, which reduces yields.
- sensitive to high wetness.

plant stages and fertigation:

the amount in the chart is for **10 plants per week:**

- split the amount to 3 application per week and fertigate after irrigation

FERTILIZER	g/week/10plants		
	DAP	**UREA**	**KCL**
Base dressing before transplanting	27.4		
establishment (2 weeks)		4.40	4.20
vegetative growth (2 weeks)		4.40	12.60
flowering (4 weeks)		6.30	18.00
fruit set to harvest (10 weeks)		6.90	19.20

PEPPER

Main pests

APHIDS / WHITEFLIES /MEALYBUGS

see page 10

Main damage: leaf curl and wilting, flower drop, virus.
treatment: small population- prune affected leaves. big population- spray insecticide based on soaps or oils.

THRIPS

see page 11

Main damage: Bronzing of leaves, Flower drop, stunting of plant, viruses.
treatment: insecticide

MITES

see page 12

Main damage: Bronze-colored leaf and stems
treatment: Do NOT use insecticide, spray water with some soap or oil, nemozide and sulfur.

NEMATODES

see page 13

Main damage: damage to the roots - lack of water to the plant
treatment: only after the season

BLOSSOM END-ROT

not a disease!
Dark leathery spotting at the end of fruit.
treatment: Avoid water stress, stop urea fertilizer. remove damaged fruits.

PEPPER

Main diseases

read page 16

FUNGAL DISEASES

ANTHRACNOSE

description: Small sunken water soaked lesions on fruit.
treatment: copper based fungicides


EARLY BLIGHT

description: brown circle spots on old leaves. could damage also stamp and fruits.
Prevention: Spray Suitable fungicide, contains chlorothalonil.


LATE BLIGHT

description: green-black/brown spots on leaves and fruit.
Prevention: Suitable fungicide


POWDERY MILDEW

description: White, powdery growth underside the leaves, yellow-brown discoloration.
Prevention: Spray suitable fungicide.


DAMPING-OFF

description: seedlings dying, dark stems near the soil line and roots.
Prevention: treat seeds with fungicide prior to planting, Spray Suitable fungicide

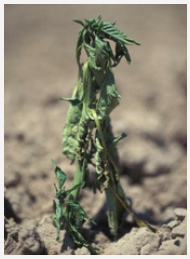

BACTERIAL AND VIRAL DISEASES


Tomato spotted wilt virus


Verticillium Wilt


Bacterial Spot


Mosaic virus


phytophthora blight

for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)
on rainy season: spray preventive fungicide after every heavy rain

CARROT

Family: Apiaceae

growing period: 120-150 days

Planting spacing:

bed width: 0.6 m

Bed High: 0.3 m

drip line per bed: 2

rows per bed: 4

gap between rows: 0.2 m

gap between plants: 0.05 m

sowing:

- direct sowing. sow in moist soil.
- Recommended to mix the seeds with send, for better distribution of the seeds.
- mark straight lines 10-25mm deep and divide the seeds equally along the bed.

Agri-technics:

- *Bed preparation*:

- The soil should be well tilled to at least 30cm depth, and and as level as possible.

- *Weeding*:

- Weeds should not at any p time be allowed to compete with crop.

- *Thinning*:

- should be carried out when the soil is moist, creating 5cm distance between plants.

- *Harvest*:

- The root is the edible part
- Usually when the carrots matured, their base tips appear.
- diameter of 20 mm and more, still young and tender.

Irrigation:

- Carrots require a steady supply of moisture. The soil should never be allowed to dry out.
- after sowing: irrigate lightly immediately, and apply light Irrigation several times a day.
- make sure the top layer of the soil is moist through germination period.
- Water stress during root development causes cracking of the roots.

plant stages and fertigation:

the amount in the chart is for **1 METER bed (80 plants) per periodical application:**

- fertigate after irrigation
- **DO NOT apply Compost** or organic manure, it cause unattractive, hairy roots.

CARROT FERTILIZER	g/application/10plants		
	DAP	**UREA**	**KCL**
Base dressing before transplanting		27.4	
30 days after sowing	11.8		24.0
60 days after sowing	11.8		24.0

CARROT

Main pests

APHIDS - MEALYBUGS

see page 10

Main damage: stunting and leaf curl, mold, virus
treatment: insecticide based on soaps or oils.

BEETLES AND WEEVILS

Main damage: dark grooves in zig-zag on roots, leaves may yellow;
treatment: remove weeds, application of a thick layer of mulch, manual killing

see page 9

NEMATODES

see page 13

Main damage: Forked, distorted or stunted taproots;
treatment: only after the season

Main diseases

read page 16

FUNGAL DISEASES

POWDERY MILDEW

description: Powdery growth on leaves, flowers and bracts. leaves becoming chlorotic.
Prevention: avoid excess fertilization, protective fungicide applications, sulfur application only early in the season

BLACK ROOT ROT

description: dark, irregular lesions in carrots after harvest, stored at high temperatures and humidity.
Prevention: raised beds, preventive fungicide

CERCOSPORA LEAF SPOT

description: Small, necrotic flecks on leaves. cause leaves to wither, curl and die
Prevention: Spray suitable fungicide.

for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)

WATERMELOM

Family: Cucurbitaceae
growing period: 90-120 days.

Planting spacing:
bed width: 0.6 m
Bed High: 0.3 m
drip line per bed: 1
rows per bed: 1
gap between plants: 1.0 m

sowing:

- sow 10-25 mm deep.
- sow in moist soil.

Agri-technics:

- *Weeding*:

- essential for high quality fruit.

- *Fruit pruning*

- Remove misshapen or rotten fruit to promote additional and better fruit set.
- To avoid disease spread, do not prune melons when vines are wet.

- *Harvest*:

- Tapping: a dull or hollow sound is an indication of maturity.
- Color: the fruit part resting on the ground becomes a distinct yellow patch.
- Tendril behind each fruit is dried down up to the base.
- harvest at full maturity, fruit typically does not develop after being removed.

Irrigation:

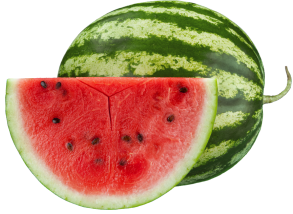
- after sowing: keep the soil moist at all time. But too much water can kill the seeds.
- Vegetative growth: Plants should be watered more heavily at a lower frequency
- Fruit set: irrigation should be frequent and light.
- Ripening and harvesting: Irrigation should be reduced 7 to 10 days prior to harvest.
- Two month after sowing, cant tolerant small amount of water.

plant stages and fertigation:

the amount in the chart is for **1 plant per periodical application:**

WATERMELON FERTILIZER	g/application/1 plant		
	DAP	**UREA**	**KCL**
Base dressing before sowing	28.96		
3 weeks after sowing		8.83	2.10
6 weeks after sowing		8.83	7.50
9 weeks after sowing		8.83	7.20
12 weeks after sowing		9.39	14.40
15 weeks after sowing		0.00	13.50

fertigate after irrigation



WATERMELON Main pests

APIDS / WHITEFLIES / MEALYBUGS

see page 10

Main damage: stunting and leaf curl, yellow leaves, necrotic spots, viruses and mold
treatment: small population: prune affected leaves. big population: insecticide based on soaps or oils.


THRIPS

see page 11

Main damage: virus, curled and silvery leaves
treatment: Avoid planting next to plants with large numbers of thrips, apply suitable insecticide if become problematic.


FRUIT FLY

Main damage: the fly lay eggs inside the fruit and cause rotten and misshaped fruits.
treatment: pheromone traps, insecticide. remove damaged fruit

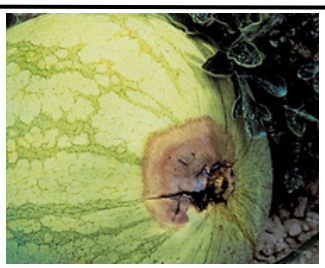

NEMATODES

see page 13

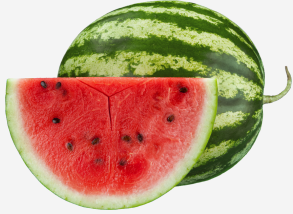
Main damage: damage to the roots - lack of water to the plant
treatment: only after the season


BLOSSOM END-ROT

not a pest!
Symptoms first appear on immature fruits as small light brown spots close to the end of the fruit. As fruit grow, the spots getting bigger and get rot.
treatment: Avoid water stress, stop urea fertilizer. remove damaged fruits.




WATERMELON



Main diseases

read page 16

FUNGAL DISEASES

FUSARIUM WILT

description: Wilting plants, gray-green leaves, turns yellow as the disease progresses.
Prevention: avoid over-irrigation


ANTHRACNOSE

description: dark brown or black spots on leaves with yellow border, long spots with sunken centers on stems and fruit.
Prevention: prune infected leaves and fruit


POWDERY MILDEW

description: Reddish-bronze on older leaves. white powdery patches on leaves.
Prevention: sanitize equipment regularly


DOWNEY MILDEW

description: dark brown spots on leaves, leaves curling.
Prevention: avoid over-irrigation, irrigate from base of the plant, apply suitable fungicide.


CERCOSPORA LEAF SPOT

description: small spots with light to tan brown centers on leaves, may have a dark border and surrounded by a chlorotic area.
Prevention: remove all affected plants.


VIRAL DISEASES

- PRSV, WMV, ZYMV



for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)
on rainy season: spray preventive fungicide after every heavy rain

MAIZE

Family: Poaceae
growing period: 90-150 days

Planting spacing:
bed width: 0.6 m
Bed High: 0.3 m
drip line per bed: 1
rows per bed: 1
gap between plants: 0.15 m

sowing:
- Direct Sowing
- sow in moist soil
- Planting depth: 5 cm deep

Agri-technics:

- *weeding*

- from the growing stage until start of tasseling (flowering) stage.

- *pruning: fruit that is not good for selling must be removed, and sooner the better! it will encourage developing of good and new fruits.*

- *Harvest*

- the fruit is ready after the hair in the end of the cobs is dried and the maize seeds are firm.
- the fruit can be harvest fresh or after drying on the plant.

Irrigation:
- most important after sowing in growing stage and tasseling (flowering) stage.

plant stages and fertigation:

the amount in the chart is for **10 plants per week.**
it is recommended to split the amount to 3 application per week and apply after irrigation:

MAIZE FERTILIZER	g/week/10plants		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	10.4		
establishment (1 weeks)		1.60	1.20
vegetative growth (4 weeks)		6.00	8.70
fruit set (5 weeks)		7.70	10.50
harvest (18 weeks)		19.10	25.80

MAIZE

Main pests

ARMYWORM (AND ANY OTHER BOLLWORM)

Main damage: circular to irregularly shaped holes leaves, usually in rows across the leaf. shallow, dry wounds on fruit. Deep feeding may may destroy maize tassels.
treatment: strong and suitable insecticide

Main diseases

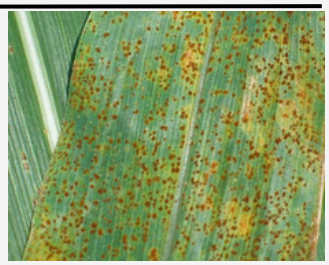
read page 16

FUNGAL DISEASES

LEAF BLIGHT

description: starts with elliptical gray-green long, narrow damage on leaves, that becoming gray with time, particularly under lower leaf surface.
Prevention: crop rotation , resistant varieties, suitable fungicide.

COMMON RUST



description: brown pustules on leaves, release powdery red\brown spores. can affect also tassels and ears.
Prevention: resistant verity, suitable fungicides

HEAD SMUT

description: green-silvery white tumor-like wounds, produce powdery dark powder. common on ears, tassels, shoots or leaves.
Prevention: resistant verity, suitable fungicides

PENICILLIUM / TRICHODERMA / FUSARIUM / ASPERGILLUS EAR ROT

description: Plants wilting and leaves changing color to light green, internal stalk tissue breaks down and has a red discoloration, black fungal at internodes, and a red-pink mold at the tips of the ear
Prevention: fertilization and irrigation can help reduce disease, control insects.

for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)

CABBAGE

Family: Brassicaceae
growing period: 100-150 days

Planting spacing:
bed width: 0.6 m
Bed High: 0.2 m
drip line per bed: 1
rows per bed: 2
gap between rows: 0.3 m
gap between plants: 0.3 m

Transplanting/sowing:

- usually seedlings.
  can be also direct sowing.
- The young plants are easily damaged by heavy rain and wind
- irrigate well immediately after transplanting

Agri-technics:

- *weeding*: Important at the first stages of the plant, until the formation of heads.

- weeding around the plot reduce chewing insects, which can damage the head formation.

- *pruning*: fruit that is not good for selling must be removed, and sooner the better! it will encourage developing of good and new fruits.
- *Harvest*: Be sure that heads are well formed and firm to the touch.

- cut stems close to the ground, near the base of the head.

Irrigation:

- relatively drought tolerant crop.
- Daily irrigation is crucial after transplanting for the first 10 days, and during head development.
- regular irrigation will ensure rapid growth and evenness of maturity.

plant stages and fertigation:

the amount in the chart is for **10 plants per week.**
it is recommended to split the amount to 3 application per week
and apply after irrigation:

CABBAGE FERTILIZE	g/week/10plants		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	7.3		
Establishment (6 weeks)		2.100	2.3
mid season (3 weeks)		8.300	7.9
production		1.900	1.8

GREENS FERTILIZE	g/week/10plants		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	5.5		
establishment (2 weeks)		1.40	1.90
weeks 3-4		2.80	3.80
weeks 5-6		5.50	7.50
weeks 7-8		1.40	2.10

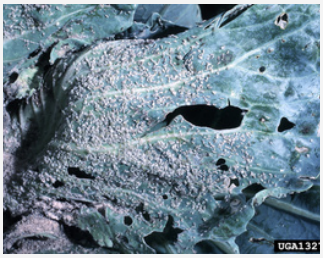
CABBAGE & GREENS

Main pests

APIDS / WHITEFLIES

see page 10

Main damage: stunting and leaf curl, virus
treatment: small population: prune affected leaves. big population: insecticide based on soaps or oils.



CABBAGE WORMS

Main damage: holes in leaves, extensive damage.
treatment: selective insecticide, mainly after head formation.

CUTWORMS

Main damage: damage the stem, damaging in young seedlings. irregular holes. the worm usually active at night and hide during the day in the soil.
treatment: hand-pick worms after dark, suitable insecticides.

FLEA BEETLES

see page 14

Main damage: Small holes, especially on young plants and seedlings
treatment: thick layer of mulch, neem-oil, suitable insecticides in intervals of one week.

DIAMONDBACK MOTH CATERPILLAR

Main damage: small holes on the underside of the leaf or large, irregularly shaped holes on leaf undersides, leaving the upper surface intact.
treatment: insecticide is only necessary if there is damage to growing tips of the plants

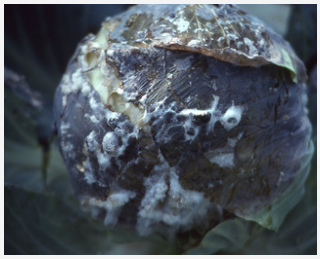
CABBAGE & GREENS

Main diseases read page 16

FUNGAL DISEASES

WHITE MOLD

description: Irregular, necrotic gray spots on leaves, white-gray on stems.
treatment: Rotate crop to cereals, control weeds, suitable fungicides.




LEAF BLIGHT

description: V-shaped dry burn on leaf margin, pointed tip towards the main vein.
Prevention: fertilizers according to plan, suitable fungicides.


LEAF SPOT

description: Small dark spots which turn brown-gray, may have a purple-black margin.
Prevention: rotate crops, suitable fungicides.

BACTERIAL AND VIRAL DISEASES

BLACK ROT

description: Irregularly shaped yellow areas along leaf margins which expand and create a "V-shaped" lesion.


BACTERIAL SOFT ROT

description: large rotted areas which is liquid underneath, usually crack and exude slimy dark liquid.

Prevention: good sanitation, rotate crops, plant resistant varieties**.**

for all diseases: Dispose carefully damaged plants (try not to break and spread the fruit body)
on rainy season: spray preventive fungicide after every heavy rain

OKRA

Family: Malvaceae
growing period: 3 month and more

Planting spacing:
bed width: 0.6 m
Bed High: 0.2 m
drip line per bed: 1
rows per bed: 1
gap between plants: 0.4 m

sowing:
- direct sowing.
- sow in moist soil
- Sow about 1.5 cm deep.

Irrigation:
- high water requirements
- Critical times for irrigation:
  - at emergence
  - from flowering to fruit production.

Agri-technics:

- *weeding*

- weed control is important throughout the season.

- *Harvest*

- cut the fruit and leave small stalk (less then 1 cm), to keep it fresh
- Okra is harvested over a long period .
- Harvest every 2-3 days.
- sell the product within a day or less.

pest management:
- okra is relatively tolerance to pests but can be source of insect pests for other crops in the farm.

plant stages and fertigation:

the amount in the chart is for **10 plants per week.**
it is recommended to split the amount to 3 application per week and apply after irrigation:

OKRA FERTILIZE	g/week/10plants		
stage	**DAP**	**UREA**	**KCl**
Base dressing before transplanting	2.3		
establishment (1 week)		0.5	0.4
vegetative growth (6 weeks)		1.9	2.5
Harvests (up to 4 month)		6.2	7.9