HOT PEPPERS

BASIC PRODUCTION PRACTICES TECHINICAL BROCHURE

SNV

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BASIC PRACTICES FOR CROP PRODUCTION

1 Plot and surroundings evaluation: 50-45 days before transplanting (dbt): with the farmer

- Water source: quality, quantity, distance from source to plot.
- Plot agronomic history: insects, nematodes, water logging, etc.
- Cattle and domestic animals: crop damage, soil compaction.
- Soil and water analysis: nutrition program design.
- Neighboring crops: source of potential insects pests and diseases.
- Local weeds in plot: plan strategy to manage them.

1.1. Plot and surroundings cleaning (20-10 dbt).

1.2. Host weeds elimination at 10 m around the plot.

1.3. Wind breaks in place on time.

2 Land preparation (45-30 dbt)

Main activity to reduce weed population, improve soil fertility by plowing under plant debris and increasing organic matter and water holding capacity, interrupt insect life cycles and expose disease causing organism.

The yield increase in a crop that has had a good land preparation and one that is planted in a regular or poor prepared land is significant.

Plowing: to break up soil and incorporate air spaces into the ground. Deepest possible (30-40 cms).

Harrowing: to break large soil clods and to yield the proper soil structure to seed/ or transplant the crop. Avoid excess of harrowing since very fine soil-finish (powder) means that original soil structure is lost.

Apply Broad Bed Making (BBM) and ensure drainage for the rainy season and furrow irrigation.

Liming: When the soil pH is below 5.5, lime the soil to improve soil chemical conditions to increase nutrients uptake by the root system. Follow your extension agent's recommendation. In some countries, 1,000 kg/ha (0.1 kg/m2) of agricultural limestone are applied per year in order to slowly increase pH and keep sound pH stable.

High/broad beds to improve crop performance

Liming high/broad beds to improve soil pH and nutrients availability for a better crop performance

Good land preparation, including raised beds/ridges, are an integral part of the irrigation system as the drainage component. Provisions have to be made in order to facilitate the drainage of the excess water from the root zone, since plants need air to develop successfully.

High beds drainage after a rain. Good drainage, good air content in the soil for the crop roots.

3 Varieties

- Proper variety selection: Use recommended and registered varieties by the national agricultural services (Ministry of Agriculture & Natural Resources, Variety Registry Book).
  - Use seeds free from diseases, virus, insects and weeds (certified seed).
  - Use seeds with good germination percentage (above 90%).
  - In Ethiopia, as mentioned by Dr. A. Zeleke and Dr. Eshetu Derso, the main pepper groups are:
    - Chili (mitmita)
    - Green pepper (Karia)
    - Hot pepper [red-ripen pods, (berbere) types]

Varieties: some hybrid hot pepper cultivars registered by different companies.

Variety (t/ha)	Registered by	Yield	Year of release
Serenade	Hazera	60 - 70	2011
Sahem	Syngenta	-	2013
Virgo	Bekker	60	
Saidah	Syngenta	-	2013
Capsi	Vibha Seeds Ethiopia	6.0-6.5	2011
Spicy	Vibha Seeds Ethiopia	5.0-5.5	2011
SCH 925	Vibha Seeds Ethiopia	6.0-6.5	2011
SCH 942	Vibha Seeds Ethiopia	6.0-6.5	2011

Variety	Maturity (days)	Yield (q/ha)	Area of adaptation (m.a.s.l.)	Remarks	Year of release
Mareko Fana	110-130	15-20	1400-1900	High acceptance for local use, brown pod color	1984
Melka Awaze	100-110	25-28	1000-2200	Tolerance to soil-borne diseases, early maturing	2007
Melka Shote	110-120	20-30	1000-2200	Tolerance to soil-borne diseases	2007
Melka Zala	130-150	15-25	1400-1900	Tolerance to soil-borne diseases	2004
Melka Dima	120-140	13-20	1400-1900	Processing type, high oleo resin content	2004
Melka Eshet	100-120	15-20	1400-1900	Processing type, high oleo resin content	2004
OdaHaro	139	11-12.5	1400-2200	Resistance to bacterial leaf spot, fungal leaf disease, Phytophtora (root disease), virus	2005

4 Plant population, spacing, and spatial arrangements

Plant density depends on the season of the year, growing habit of the variety, and external factors affecting crop growing. Depending on these factors planting 40,000 to 48,000 plants per hectare is possible.

Good plant population using drip irrigation

In Ethiopia, good bed spacing is 0.60 m. to 0.70

m., planting one line of plants per bed every 30-40 cms The lowest population is for furrow irrigation.

The plant population can be increased depending on the irrigation system and the distribution of the plants, thus increasing the yield.

During rainy season, rows are recommended to be apart 0.70 m and plants 30 cms apart (47,620 plants per hectare). At 0.70 m among beds/furrows we have 143 furrows/hectare with a length of 100 m, making up 14,286 m of beds/furrow in a hectare. Planting at 30 – 45 cms between plants, we end up with 47,620 plants/ hectare.

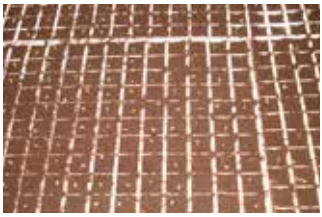
Poor plant population

A spacing stick has to be used to have the precise plant population. The longer the stick, the better. Plant distances are marked on the stick, then, holes for the seedlings are made in the beds at the marked distances.

Illustration on the use of the "spacing stick" to have a good plant population.

The idea is to have a facility that can yield healthy plants for the grower

Nursery on the ground (seed beds)



Seedlings in tray

Seedlings in tray

5 Nursery seeding (45-15 dbt):

5.1 SEED BEDS

Plot location and soil conditioning: Good drainage, sandy loam-loam texture, organic matter present, free of noxious weeds, good water availability (quality and quantity).

Seed Beds preparation: Beds have to be very well formed with a fine structure to improve germination, and at least of 30 cms high. A good soil fungicide is suggested to reduce damping off complex and to increase the amount of healthy seedlings.

Seed quantity: Amount of seed depends on the plant density to be used..

Sowing: Seeds are sown in lines across the beds and at 2-3 cms apart each other (in order to have good-sized final seedlings), soil must have some moisture for the first 3-5 days.

After sowing: beds have to be covered with plastic of local materials to reach and keep a uniform moisture and temperature, and to avoid dry spots on the borders and corners. The cover, if it is plastic, has to be removed in 3-4 days before visible germination occurs and keep a cover of straw or other material that will perform protecting seedlings from heavy precipitations and other adverse factors. Seedling will be ready in 30-35 days, depending on weather conditions.

5.2 Nursery seeding:

Amount of Seed: the amount of seed required is based on the desired final plant population. Take into account the germination percentage of the seed (shown in the package label). Also, add 5% to 10% more seed (5% for hybrids, 10% for varieties) to replant any dead seedling during the first days after field transplanting.

Seedling Tray Selection: Hard plastic trays are preferred, 128 to 200 square cells. Polystyrene trays become more difficult to re-use them and seedlings roots become stuck to cell walls.

Seedling Tray Preparation: Trays should be disinfected before re-use them. Immerse them into chlorinated water at 100 ppm for 20 minutes.

A 200 litres solution can treat at least 300 trays. An alternative disinfection method is to treat the trays in hot water (70°C) for 45 minutes.


Substrate Preparation:

- To provide seedlings with water holding capacity, anchor, drainage, volume, light weight.
- Add 10-12 grams of NPS (19-38-7) or 20-2020 and a fungicide (commonly used) to every 0.50 Kgs of substrate. It helps to protect the root system from early attacks from humidity-lover fungi and some soil insects.
- The fertilizer should be dissolved in water and mixed well.

Trays and Substrate: the substrate should be uniform when filling the trays. It should not be compacted.

Trays/pots: individual management, healthier and cleaner seedlings.

Substrate preparation in a tray nursery.

Substrate preparation in a tray nursery.

Seed planting: holes are made in the middle of the cell. As a rule of thumb, the seed is place at a depth of 2.5 times its length. Seedling uniformity depends on the uniformity of the hole depth and size. A custom made marker should be used to make the holes.

Watering and Preparation: the first watering is the base for the germination uniformity. Water has to be supplied to the seeded trays until drops come through the cell bottom holes in the tray. The trays are then covered/wrapped completely with black plastic and placed under shade. Dark, cool and fresh conditions will improve germination uniformity. Germination of the crop depends on local weather conditions and its own characteristics.

Hot peppers: 4-5 days.

Water management: careful use of water, not too much not too little.

F**ertilization at seedling stage:** be careful, most of the time they don't need it.

Home made tool to have uniform depth during tray seeding.

Uneven hole depth. Lack of uniformity at germination and development.

One seed per cell.




5.3 Germination Chamber:

To have uniform temperature and humidity in the germination process, before emergence (2-3 days).

Check the germination chamber at least 2-3 times per day, when they get closer to the reference germination period.

When first seed germinates, uncover/unwrap the trays and move them to racks for 48 hours, giving time to more seeds to germinate.

Water gently the trays during this period of germinating seeds (up to three times per day) since the substrate should be kept moist.

6 Staking (15 dbt):

Staking is done to produce a healthier crop, fruits free of water and soil borne diseases.

- Set into the soil, a wooden support of about 3-5 cms of diameter, every 1.0-1.5 m along the center of the bed.
- Link the stakes by a plastic twine (other materials) at 15-20 cms high from the soil for the first horizontal twine line, then after, every 20-30 cms up, depending on the plant growth habit.
- Stakes could be local bamboo or eucalyptus stakes, or any other local available material.

Vertical staking for a crop, before the crop is transplanted, to avoid damage to the plants during the staking installation.

Pepper crop with horizontal staking

crop with vertical staking

7 Transplanting (0 DAYS):

It should be done when seedlings have 4 true leaves, about 30 - 40 days after sowing, depending on the weather conditions.

This activity is to ensure designed plant population, uniform and healthy plantings.

Measuring stick: To secure plant desired plant population. The longer the stick is, the field error is reduced.

To ensure designed plant population, uniform and healthy plantings:

- Starter solution: NPS 1-3 kg in 200 lts of water; 200-250 ml per hole (50-75 ml for onion).
- NPS has to be diluted in water (warm water preferred) for 12-24 hours.
- Apply it BEFORE TRANSPLANTING, NOT AFTER.
- Transplant as soon as possible after application.
- Don't take seedling trays to the field.

Application of starter solution

Good root development

Avoid seedlings planted too deep/too shallow, any mismanagement during transplant.

Grade seedlings before transplant

Rough

Seedling planted managementtoo shallow

Small

Medium

Large

Seedlings grading at transplanting

Transplanting steps:

- Starter solution application
- Seedling distribution
- Actual planting

Avoid soil air-bags

8 Irrigation (40-25 dbt):

There are three main irrigation systems:

1. **Furrow**: most common used in Ethiopia, very well known by most farmers. It needs a proper slope design.
2. **Drip**: most water efficient system. It needs more technology and training, but it's worthy because of its yield increases (agronomic and economic). The most suitable for row crops.
3. **Sprinkler**: suitable for high density crops, requires good amount of water.Is not suitable for pepper

TEST: The system has to be tested to confirm its working conditions and perform remedial measures, if necessary.

Proper irrigation system allows to apply water and nutrients in an efficient way.

Spraying of IPM products can be performed in a safer way, since the system has the right slope and raised beds/ridges.

Furrow irrigation

Drip irrigation

Sprinkler irrigation

ROOT PROMOTION:

At transplanting, the field has to be thoroughly wet, (field capacity).

After transplanting, plantlets have to be induced to produce MORE roots by not irrigating for 2-3 days (FORCING).

To make a decision to re initiate irrigation, crop has to be monitored at 10 am everyday to see if there is a light wilting symptom.

When this symptom happens, re initiate irrigation in order to provide the crop the water necessary to allow the plant to take up the nutrients provided in the soil solution (usually, a thorough watering, leaves the soil wet enough to have some soil air micro spaces, so the plant can breaths and take up dissolved nutrients, it is called FIELD CAPACITY).

MOISTURE MANAGEMENT:

Next irrigation will depend on the weather conditions (too hot and sunny: more frequent irrigation. Too cloudy and cool: less frequent).

Under normal conditions, a hectare of land with a vegetable crop will require 60 m3 per day.

The moisture management depends on the type of the soil particles (texture) and the size of those particles (structure).

Silty and clay soil type will retain water longer, whereas sandy soil soils will require more frequent irrigations.

Large to medium soil clods will require more frequent watering than very fine prepared soils.

WATER QUALITY: A good water quality will yield a good quality crop. Physically and chemically safe water should be used. Alkaline water should be avoided, because of salts build up in the soils, if there is not enough rain to wash it down during the rainy season.

9 Fertilisation and crop nutrition:

- Hot Pepper is a high nutrient demanding crop.
- The amount of fertiliser to be applied can be calculated based on the target yield and residual nutrients in the soil.
- Nutrients are up taken by the plant in a soil solution with water.
- In some countries, the Fertilizer Program using furrow irrigation and granular fertilizers, is applied in divided applications/rounds, in order to reduce the nutritional stress the plant may have.
- In Ethiopia, the Ministry of Agriculture and Natural Resources (MoANR) has developed fertilizer recommendations for horticultural crops. Based on formulas, such as NPS

10 Weed management (30 dbt):

The land should be prepared about 30 days before planting, to let weeds germinate and be controlled before transplanting the crop.

Herbicide use will depend on the type of weeds existing in the plot. The time of application is THE MOST CRITICAL ASPECT and should be taken into consideration.

Always read the label and follow the instructions.

Apply herbicides with enough time in advance following the label (e.g. 15-20 days before transplanting).

Chemical weed control. Herbicide applied three weeks before transplanting.

Manual weed control.

The use of herbicides: No herbicide application (left), one herbicide application (middle), two herbicide applications (right). Effects on Cyperus spp.

Weed management: to use inputs FOR PRODUCING THE CROP, NOT THE WEEDS.

11 Wind breaks planting (40-25 dbt):

Depending on the wind speed and the air temperature, yields can be reduced from 30-40%, due to mechanical damage

High density maize/sorghum barriers can be planted before transplanting the crop.

It is considered that a wind barrier protects 10 times the height it has reached. So, if the barrier is 2 m. tall at crop transplant, it will protect for 20 m. before the next wind break is planted, and so on. The space in-between the wind breaks is for the crop to be protected.

In case there is no time/option to plant live barriers, other material wind breaks can be used: plastic films, recycled/new grain sacks, etc.

Recommended species for fast growing wind breaks: sorghum, maize, elephant grass.

Wind breaks barriers planted with enough time before the crop is transplanted.

Wind breaks barriers well established to protect a crop.

12 Integrated Pest Management (IPM) (20 dbt until crop elimination)

- IPM is the key to have a healthy crop, productive and safe for the consumer.
- Consistent and frequent scouting methodology.
- Recording the monitored findings:

· Insects

· Diseases

· Weeds

· Soil humidity and weather conditions

Strategies:

1. Cultural practices: staking, twining, removing of infected plants, cleaning field of diseased material, etc.
2. Mechanical methods
3. Improve biodiversity
4. Chemical control Using threshold levels

Critical comments on pesticides application:

Use clean water with recommended pH for mixing.

Calibrate sprayers to have the smallest droplets possible.

Follow the mixing procedures and recommended doses.

Select appropriate time of the day for application (early morning or late afternoon).

Perform a good crop coverage application, directed and with the recommended frequency.

Rotate active ingredients from different chemical groups.

Use of the proper personal protection equipment.

Correctly identify the pests.

It is important to spray the right adherent, spreader, sticker.

Pruning: it depends on the growing habit of the variety used. Indeterminate varieties and tall determinate varieties require some kind of pruning to control growth habit and improve quality and size of the fruits.

A pepper crop pruned.

Cleaning field of fallen fruit: to eliminate sources of insects and diseases reproduction/ propagation. Deposit them in a hole of at least 1 m deep and far away from the field

Crop rotation: with crops from different families, it helps to:

- Interrupt the life cycle of some insects and diseases that are limiting factors in the crop production
- Improve soil fertility
- Increase soil microorganisms

Fallen fruits should be discarded properly to avoid increasing problems in the field.

Fallen fruits should be removed from the field.

13 IPM, Mixing of chemicals into the spraying solution:

Use clean water with recommended pH for mixing.

Use pH regulator: agricultural acids, commercial acids.

Mix the chemical products in the recommended order to have a more effective application and/or to avoid any secondary damage to the sprayer and to the crop.

· Wettable powders (WP)

· Wettable/ dispersible granules (WG)

· Concentrate emulsion (CE)

· Concentrate suspension (CS)

· Soluble liquid (SL)

· Granular fertilizers

· Growth regulators

· Adherent/spreader/stickers

POWDERY MILDEW (Leveillula taurica)

Disease symptoms

- Patchy, white, powdery growth, enlarging to cover entire lower leaf surface.
- The upper surface may show patchy yellowish or brownish discoloration.
- Leaf edge of infected leaves may roll upwards.
- Diseased leaves defoliate exposing the fruits to sunburn.
- IPM
- Regular monitoring, especially during warm-wet weather.
- Field sanitation, including removal of volunteer plants and weeds.

- Primary management is by fungicide spraying.
- Apply fungicides to prevent the disease.
- Have a good coverage spraying for effective control.
- Use recommended and registered fungicides

· Kresoxim-methyl 500 g / l

· Trifloxystrobin + Tebuconazole

· Triadimefon 500 g a.i./kg.

PEPPER ROOT ROT (Phytophtora capsici)

Disease symptoms

- Seedlings fail to emerge or die soon after emergence.
- Stems usually have a dark shriveled portion at the soil line.
- Plants at any stage can wilt even if the soil is wet.
- As the disease progresses the whole leaves defoliate or stalks wither and die.
- Taproots and smaller, lateral roots show water-soaked, very dark brown or black discoloration.
- Very few lateral roots remain on the plant.

IPM

- Proper diagnosis of the disease causing pathogen.
- Drain the soil water before planting.
- Prepare raised field and seedbed.
- Select less susceptible varieties.
- Use disease free seeds or transplants.
- Avoid planting when the soil is cool.
- Use water sprinklers in seedling preparation.
- Apply light irrigation to avoid overwatering.
- In heavy soil, apply alternative furrow irrigation.
- Apply preventative fungicides in soils with root rot history or poor drainage.
- Use recommended and registered fungicides: Mancozeb 64% + Metalaxyl 8%.
- Most recommended active ingredients like Phosphoric acid and Fluopicolide are not registered.

CUTWORMS (Spodoptera, various Noctuidae)
Damage symptoms

- Damage occur early in the season when the plants are small.
- Clipping off seedling stems or young plants near or just below the soil surface.
- Entire row of plants might be cut off during the night.
- Climbing caterpillars can damage foliage, buds and shoot.

IPM

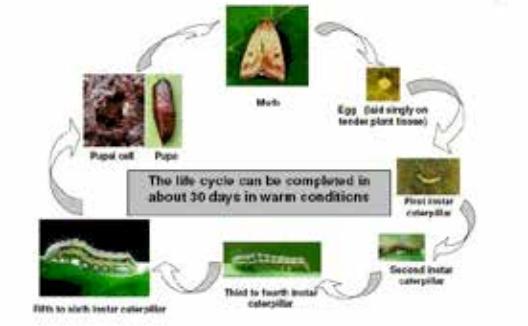
- Regular and consistent field monitoring from seedling emergence stage.
- Monitoring is better late afternoon or in the evening when they are active.
- Use of adequate bait, applied fresh in late afternoon.
- Check the damage early in the morning when it is fresh.
- With the damage symptoms, dig around the plants to a depth of 5 cm to find the cut worms.
- Apply ash around the seedlings.
- Handpicking of larvae late afternoon/evening (early morning).
- Preserve natural predators, parasites and birds that feed on cutworms.
- Remove weeds and plant residues that serve as egg-laying sites and food sources.
- Insecticide spraying is effective if larvae are small (less than 2.5 cm).
- If damages are only on small patches, apply spot treatment.
- Apply contact insecticides late in the day or evening.
- Use recommended and registered insecticides
- Carbaryl 85 % WP, cyfluthrin 0.5 EC and permethrin 1 % WG

BOLLWORM (Helicoverpa armigera)

Damage symptoms

- Severity varies between locations, regions and seasons.

- Caterpillars feed on leaves, buds, growing points, flowers and fruits.
- It bores clean and circular holes through fruits.
- Faeces of feeding caterpillars are placed away from damaged plant parts.
- Holes serve as entry points for secondary infections.



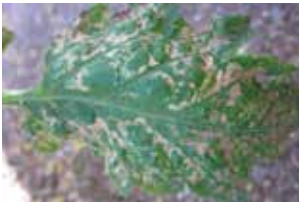
IPM

- Monitoring (field inspection, use of traps, etc).
- Adequate identification/monitoring of different life stages and damage symptoms.
- Monitoring (field inspection, use of pheromone traps, etc).
- Use a trap crop (e.g. African marigold) planted every 8 rows.
- Remove and destroy infected fruit and infested plants after harvest (burn or make compost).
- Plough soil after harvesting to expose pupae to sunlight and natural enemies.
- Conserve natural enemies (Trichogramma pertiosum or T. achaeae, Macrolophus pygmaeus).
- Use recommended and registered chemicals
- Deltamethrin 25 g/l

- Alpha-cymermethrin 100 g/l
- Azadirachtin 0.03%

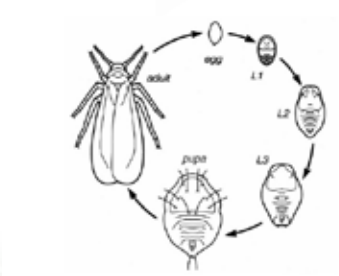
WHITE FLY (Bemisia tabaci , Trialeurodes vaporarorium)

- Damage symptom
- Feed by sucking sap from the leaves of plants
- Characteristic wilting, yellowing, defoliation of leaves
- Secretion of honeydew by the pest encourages sooty mold growth
- Interferes with the photosynthesis and reduce plant vigor



Biology

- Females can lay 200+ tiny spindle-shaped eggs
- Often laid in semi-circles on the under surface of the leaves
- Eggs usually take 7 days to hatch (10-12 days at 18-24˚C)
- Nymphs crawl a few millimeter and start feeding on the leaf and become sedentary
- Complete the rest of the nymphal life stages that usually takes 14-35 days
- Pupate then, in 9-23 days
- Life cycle is considerably faster at warmer conditions
- Not necessary for adults to mate for egg production



B. tabaci

	16 °C	26 °C
Egg	21.0	6.7
L1	11.8	3.7
L2	9.0	2.9
L3	10.4	3.3
Pupa	18.1	5.7
Total	70.3	22.3

IPM

- Adequate identification/monitoring of different life stages and damage symptoms
- Completely clean the production area at the end of the crop
- Inspect new plant material before introducing · Use resistant varieties where possible.
- Use insecticides selectively
- Alternate classes of insecticides to prolong use and to avoid chemical resistance developing.
- Thorough coverage on leaf surfaces, particularly the undersides of leaves for effective control.
- Target susceptible stages, usually adults and early nymphs
- Soaps and oil sprays can give an effective control
- persistent infestations consider using systemic sprays
- Use recommended and registered chemicals

· Azadirachtin 0.03%

· Lambda-cyhalothrin 50 g/l

· Alpha-cymermethrin 100 g/l

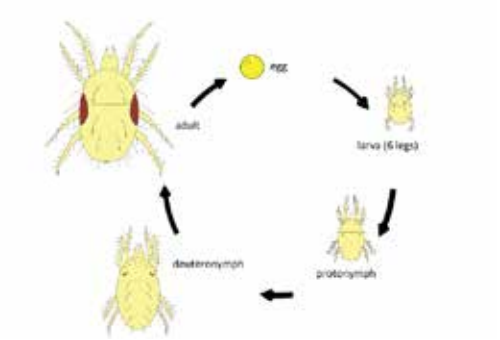
· Thiamethoxam 250g/kg Thiocyclam SP50%

RED SPIDER MITE (Tetranychus urticae)

Damage symptoms

- Larvae, nymphs and adults feed by sucking the contents of the underside of leaves
- High population sizes can cause severe damage to the entire plant
- First the damages show up as a stippling of light dots on the leaves
- Gradually changes to a bronze color, and as the feeding intensifies the leaves turn yellowish and defoliate
- Often, large amounts of webbing cover leaves and twigs and damages can even deteriorated when compounded by water stress
- High mite population can decrease plant growth and production and gradually kill the entire plant Biology
- Undergoes five different life stages
- Egg, larva, first nymphal stage (protonymph), second nymphal stage (deutonymph) and adult

- Eggs are spherical and translucent, like tiny droplets
- Immatures resemble adults except their small sizes
- Adults: have oval body with two red eye spots near the head and four pairs of legs



IPM

- Adequate identification/monitoring of different life stages and damage symptoms · Good hygiene practices/Sanitation
- Removing debris and other plant residues
- Cutting off highly infested plant parts and proper removal
- Use healthy planting materials
- Avoid water stress: correct fertigation
- Use recommended and registered chemicals (these products are not registered for vegetables in Ethiopia)
- Azocyclotin, Bifenazet, Clofentezine,
- Fenbutatinoxide, Flufenoxuron, Hexythiazox, Tetradifon
- Fenpyroximate, Milbermectin, Propargite, Pyribaden, Abamectin, Silwet (trisiloxane ethoxylate)

VIRUS

- Tomato Spotted Wilt Virus (TSWV)
- Disease symptoms
- Small, light brown flecks first appear on leaves.
- Spots later turn brown, followed browning of leaves that die and appear drooped on stems.
- Plant are often stunted, and with the droopy leaves, give one the impression that they are wilted.

- Green fruit show concentric rings of yellow or brown alternating with the background green color, and striking brown rings occur on red-ripe fruit.
- Severe when young plants are infected

Biology

- Many plant species (>1,000) can be hosts for this virus including tomato, pepper, potato, tobacco, lettuce and many other plants.
- It is not transmitted by infected seeds
- Thrips are the only vectors for TSWV and it is acquired at larval stage

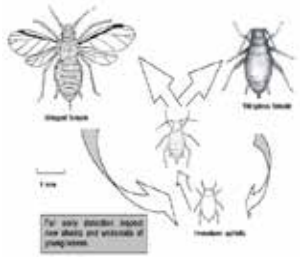

IPM

- Use TSWV resistance varieties
- Proper thrips control or avoidance
- Regulate the planting time to avoid major thrips migration during the early plant growth stage
- Do not plant tomatoes and peppers near TSWV susceptible crops (i.e. peanut, tobacco)
- Uprooting and proper removal of virus infected plants as early as possible
- Effective weed control in and around tomato or pepper fields
- Maintain plant-free border (10m) around the production fields to prevent the spread of TSWV

APHIDS

Damage symptoms

- Attack growing tips and young tissues
- In high population it can spread to all plant parts sucking the saps and cause leaves to curl
- Continuous feeding cause yellowing, wilting and stunted plants
- It prefer flowers and cause flower drops and deformed fruits
- It can also vector some viruses like Cucumber mosaic virus and potato virus Y



IPM

- Field scouting every week
- Cool and dry conditions can favor severe infestation
- Remove alternate hosts and weeds in the surrounding areas
- Dispose of plant debris at the end of the season
- Crop rotation with non-host plants
- Conserve natural enemies in the field
- It is possible to delay pesticide application before head
- formation, save expenses and conserve natural enemies
- Apply insecticide only if population is high on young
- seedlings (up to 7 leaf stage) or on plants close to harvest
- Allow thorough spraying due to waxy nature of the pest
- Use recommended and registered insecticides
- Deltamethrin 25 g/l
- Alpha-cymermethrin 100 g/l
- Azadirachtin 0.03%
- Lambda-cyhalothrin 50 g/l
- Imidachloprid 200g/l

14 Harvest and post harvest handling:

- Depends on the area's climatological conditions.
- Harvest can start at 75 days after transplanting.
- At cooler conditions can be delayed up to 15 days.
- A standard hot pepper variety can last under harvest from one month (weekly harvests) up to five months, depending on how healthy it reached harvesting date and how careful the harvest is done.
- The final market dictates how the harvest is going to be done. In Ethiopia, hot peppers are harvested green or in drying stage. The drying harvest is done at the "leathery" stage with low moisture content.
- Types of container to harvest and to transport and marketing:
- It should be handled carefully, collecting the fruits in the field according to the market, and transferred to the market crates/sacks.

improve proper handling and equipment

15 Other cultural practices (0 dat):

1. **Roguing virotic plants**: to avoid the virus spreading by vectors. Take diseased plants far away out of the field in a sack.
2. Cleaning field of plant diseased parts: to eliminate sources of insects and diseases reproduction/ propagation.
3. Use of intercropping to repel the pests.
4. Crop rotation: with crops from different families, it helps to:

· Interrupt the life cycle of some insects and diseases that are limiting factors in the crop production.

· Improve soil fertility.

· Increase soil microorganisms.

· Diversify household income.

5. Thermal blanket: The use of this agricultural blanket has the purpose of:

· Protecting the seedlings of heavy populations of thrips, white flies, aphids, sucking insects, adult stages of pests etc.

· Reducing chemical application during the first 3-4 growing weeks of the crop.

· Regulation of temperature during this period.

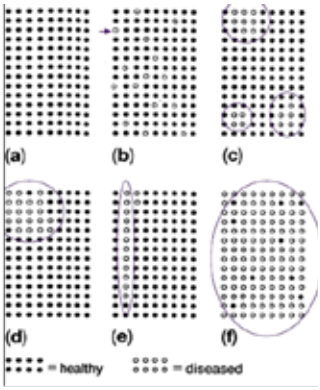
· Since the physical contact with the crop is reduced while the blanket is in place (for 3-4 weeks), a provision for controlling cutworms and crickets has to be applied (soil pests insecticide and/or baits).

16 Crop elimination (right at the end of last harvest):

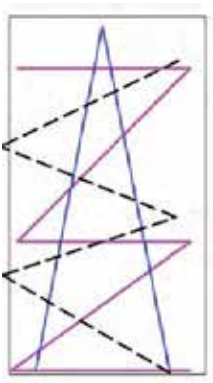
To avoid the presence of plant residues where pests and diseases can overstay and be established in the plot.

17 Record keeping:

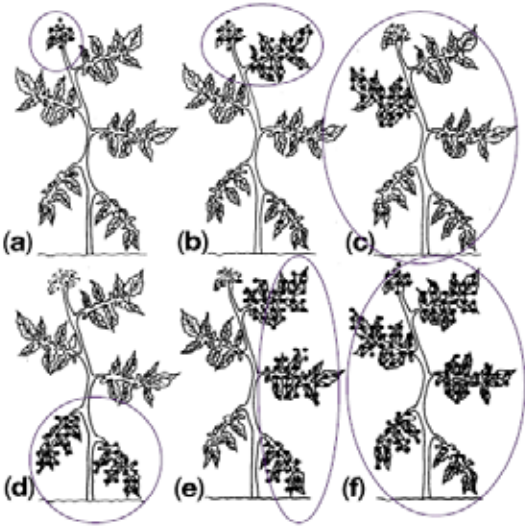
- A logbook should be kept on hand to record every activity related to the crop growing.
- Dates of conducting the different fields operations.
- Number of labourers/ labour days.
- Costs of operations: machinery and equipment activities, etc.
- Results of crop scouting and control measures taken (insects, diseases, weeds, irrigation).
- Monitoring and evaluating: production activities and their result in the crop: inputs use and their effects on the crop.
- Field visits of development agents and other
- professionals and their advices given.



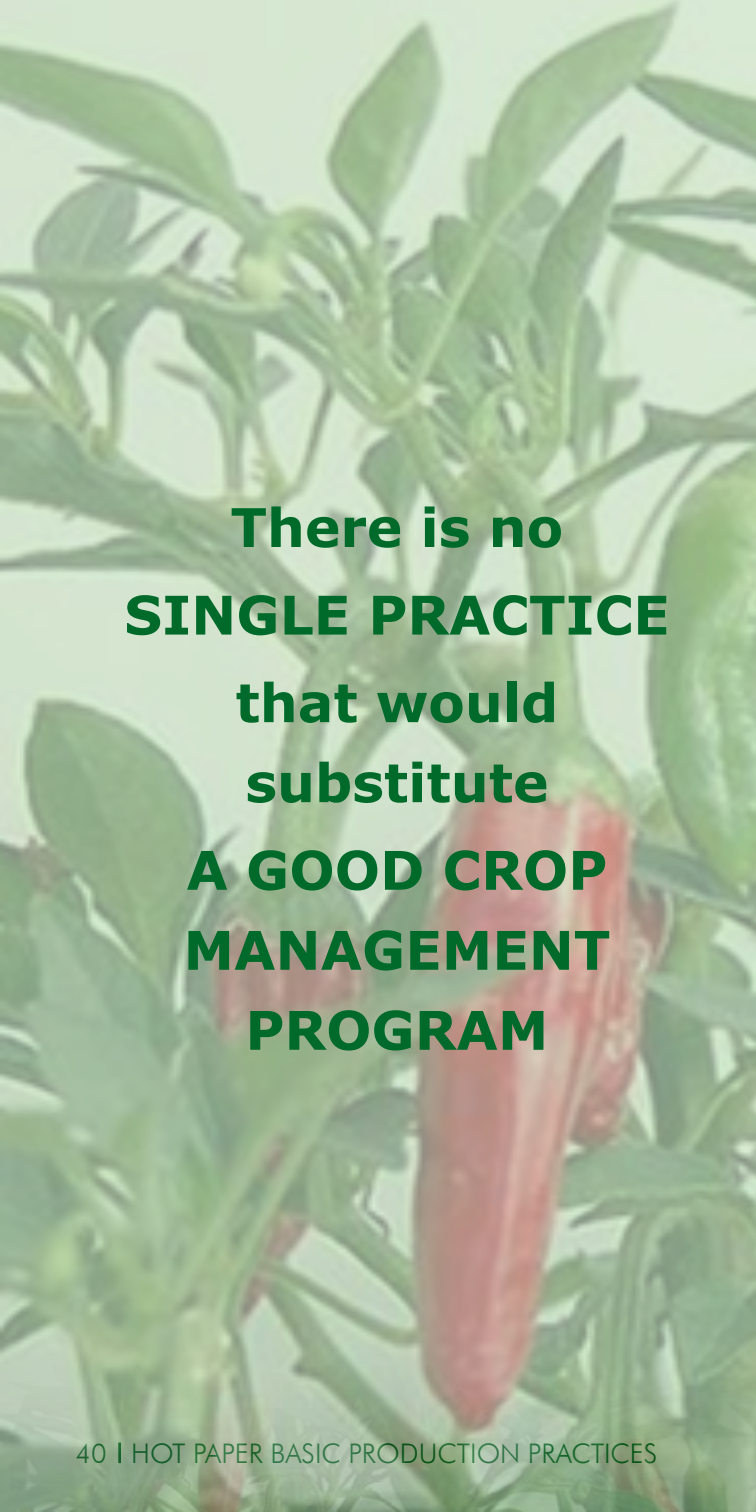
Example of SCOUTING a Field



Examples of scouting patterns



Example of SCOUTING plants



There is no SINGLE PRACTICE that would substitute A GOOD CROP MANAGEMENT PROGRAM