

TOMATO PRODUCTION GUIDE



MINISTRY OF
FOOD & AGRICULTURE
REPUBLIC OF GHANA



REPUBLIC OF GHANA

TOMATO PRODUCTION GUIDE

This production guide was developed to complement existing Information, Education and Communication (IEC) materials available on the Agronomy of selected commodities under the “Planting for Food and Jobs” campaign. It is designed for use by Agricultural Extension Agents and other farmers who can equally use to train their colleague farmers.

© 2020

ACKNOWLEDGEMENT

The Directorate of Agricultural Extension Services (DAES) would like to acknowledge the untiring effort and interest of staff, all Regional Directors and Regional Extension Officers who contributed directly or indirectly to the development and printing of this production guide.

The Directorate would also like to thank colleagues and experts from other Directorates of the Ministry of Food and Agriculture who contributed to the review and editing of the draft production guide. They include:

Dr. Solomon Gyan,	DCS, MoFA
Theophilus Osei Owusu,	Former Ag. Director, DAES
Michael Owusu,	DCS, MoFA
Paul Siameh,	Director, DAES, MoFA
Paulina Addy,	WIAD, MoFA
Emmanuel A. Odame,	Dep. Director, DAES, MoFA
Esther Agyekum,	DCS, MoFA
Collins Oppong,	DAES, MoFA
Daniel Ninson,	DCS, MoFA
Kwesi Abaka-Quansah,	DAES, MoFA
Hannah Serwaa Nuamah,	PPRSD, MoFA
John Lovelace Kpodoviah,	DAES, MoFA
Prosper Akpablah,	DAES, MoFA
Portia Tandoh,	DAES, MoFA

The Directorate is also grateful to the Modernizing Agriculture in Ghana (MAG) for the provision of financial support towards the development and printing of this production guide. Finally, the DAES acknowledges the Council for Scientific and Industrial Research (CSIR) and International Institute of Tropical Agriculture (IITA) for taking some extracts from their documents.

Permission for commercial production should be sought from the Director, Directorate of Agricultural Extension Services (DAES), P. O. BOX M37 Ministries Accra, Ghana.

Shorts extracts of this publication may be reproduced in any non-advertising, non-profit-making context provided that the source is acknowledged

TABLE OF CONTENT

CONTENT		PAGE NO.
1.0 INTRODUCTION	-	1
2.0 GROWING REQUIREMENTS	-	2
3.0 SITE SELECTION	-	2
4.0 SEED/VARIETAL SELECTION	-	3
4.1 Nursery Establishment	-	3
5.0 LAND PREPARATION	-	4
5.1 Nursery Management	-	5
6.0 FERTILIZER APPLICATION	-	7
7.0 WEED CONTROL/MANAGEMENT	-	7
8.0 PESTS AND DISEASES MANAGEMENT	-	8
9.0 HARVESTING	-	19
9.1 YIELD	-	20
9.2 MARKETING	-	20

1.0 INTRODUCTION

Botanical name: *Lycopersicon esculentum*/*Solanum lycopersicum*

Tomato (*Solanum lycopersicum* L.) is the most important fruit vegetable in Ghana and a good source of Vitamins A and C and other minerals for improved nutrition. The seeds also contain about 24% oil and this is extracted for use as salad oil and in the manufacture of margarine. It is also an important cash crop for most farmers.



Typical tomato farm

2.0 GROWING REQUIREMENT

Ensure that site selected must have a well distributed rainfall of between 300-600mm.

Optimal temperatures for growing tomato are between 22°C and 28°C during the day and between 18°C and 22°C at night. Relative humidity of between 60 - 80% is most suitable. Select well drained soil on a gentle slope. They are very sensitive to water logged soils and prefer a soil pH of between 6.0 -7.0. Below a pH of 6.0 add rock phosphate, poultry manure or lime. Above pH7.0 seek professional guidance in amending your soil pH. Hot dry spells followed by heavy rains cause the mature fruits to crack.

3.0 SITE SELECTION

- Select easily assessable sites close to a permanent water source of good quality. Always make provision for supplementary irrigation.
- Ensure the soils are well-drained and fertile
- Choose areas that allow adequate sunshine required for optimal plant growth
- Select flat and gently sloping land to prevent run-off.

- Avoid fields previously planted or intercropped with solanaceous crops (e.g. tomato, pepper, garden eggs, cassava, potato) for the past two cropping seasons.
- Rotate tomato with unrelated crops e.g. rice, maize, sorghum, millet, onion, garlic, cowpea, groundnut and cotton. This will help reduce pest and disease incidence.
- Avoid areas with rocks and many trees. Rocks and trees can impede movement of farm implements and make land preparation and crop establishment difficult.

4.0 SEED/VARIETAL SELECTION:

Select improved seeds (early maturing, resistance to common tomato diseases etc.) from dealer source and other Institutions such as CSIR-Crops Research Institute, Ministry of Food and Agriculture etc.

Examples of Recommended and Improved Varieties

- Roma VFN,
- Pectomech VF,
- Tropimech, Rio
- Grande,
- Jaguar,
- Lindo,
- Titao Derma,
- Ada Cocoa.

4.1 Nursery establishment

- Nurse 300-450g of tomato seeds to produce enough seedlings per hectare (30,000-35000 plants per ha) for planting.
- Treat with recommended seed dressing (NB: seeds from certified sources are pre-treated).
- Do a germination test before nursery to avoid wasting resources (eg. Seeds, time etc.) (sow seeds when > 80%)
- Raise tomato seedlings in seed trays or boxes or seed beds.
- Raise all seedlings under protected structures such as simple net houses or net tunnels before they reach the hardening stage.
- The nursery should be located in a flat area that is secure and accessible, to allow close

monitoring.

- Apply 10g/15L knapsack of 19-19-19 (NPK) (10 days) after germination
- Boost seedlings with Mono Ammonium Phosphate (MAP) at 10g/15L Knapsack after 14 days
- Thoroughly water the seedlings about 12 hours before transplanting to the field.

5.0 LAND PREPARATION

A thorough land preparation is important in enhancing early crop establishment and adequate weed control.

- Clear the vegetation - fell trees and remove the stumps where necessary.
- Do spot burning when the debris is thick after slashing.
- Plough and harrow across the slope to a fine tilth (double plough if necessary).
- Incorporate well decomposed poultry manure at the rate of 20-30ton/ha at land at land preparation may be beneficial to plant growth and development.
- In the absence of poultry manure, apply cow dung or other animal droppings at a rate of 30-40ton/ha.

NB! This should be ploughed in 4-5weeks before planting (spot or row application can also be done).

- Prepare ridges or bed across the contours on which seedlings may be transplanted.
- Depending on the onset of rain land preparation should be done as follows,
 - Southern Ghana-March-April (Major season), August (Minor season) and September- October for Irrigated sites
 - Northern Ghana- July (Rainy season) or Sept-October (irrigated sites)

5.1 Nursery management

(a) Prepare the seed bed

- Demarcate a suitable location and clear the land
- sterilize the soil by burning dry grass on the cleared land
- work out the soil to a fine tilt and raise a bed of 1x5x 0.5m and get the bed ready for seeding.

Seeds can be sown on seed beds or in seed trays or seed boxes. Prepare seed beds at 1.2m wide and at any convenient length and then level beds. Sow seeds in drills 10cm apart. Cover beds with well dried non seeded grass or palm fronds. After emergence remove dry grass and provide shade over the bed.



Tomato at the nursery

(a) Transplanting

Transplanting of seedlings should be done 3-4 weeks after emergence on the field at 5-leaf stage. Planting should be done preferably early in the morning or late in the afternoon to increase chances of survival.. One week before transplanting, harden seedlings by decreasing shade until at least 1 day full exposure to sunlight and/or reducing irrigation. Use a spacing of 60cm x 50cm (dry season/determinate/semi-determinate growth habit) and 100cm x 50cm (rainy season/Indeterminate growth habit)

(b) Staking & Caging

Staking helps raise the developing tomato fruit off the ground while caging lets the plants hold itself upright.



Staking in tomato

6.0 FERTILIZER APPLICATION

- Use soil test as a guide to fertilizer application. A guideline to fertilizer application will include: The table below is a general recommendation. For a yield of 40tons/ha tomato requires about 96kg of N, 16kg of P_2O_5 , 144kg of K_2O , 68kg of Ca, 24kg of Mg and 24kg of S. Apply foliar fertilizer to supply adequate amount of boron and manganese to enhance crop quality and yield
- Weekly application of micro-nutrients (Iron, Zinc, Copper, Molybdenum, Boron, Manganese) should be applied to foster better plant development.
- Pre-mix 32kg Nitrogen and 16kg Phosphorus with the well-decomposed poultry manure at the rate of 20-30ton/ha of poultry manure or 30-40ton/ha of cow dung or other animal droppings as basal.

7.0 WEED CONTROL/MANAGEMENT

Timely weed control is necessary for healthy crop growth. This may be achieved by frequent shallow weeding. Application of pre-emergence weedicides 3-4 days before transplanting will enhance weed control.

8.0 PESTS & DISEASES MANAGEMENT

(a) Insect Pests

(i) Aphids - Aphids remove sap from the plant with their piercing-sucking mouthparts.

They multiply quickly so it is important to manage them early before reproduction starts. Many generations can occur in one season. Most potyviruses (the largest group of plant viruses) are transmitted by aphids.

Signs and Symptoms

- Presence of immobile aphids on the underside of leaves, shoots and stems
- Curled, wrinkled or cupped leaves
- Honeydew on infested crop



Aphids on the underside of leaves



Aphids damage

Management

Prevention

- Avoid too much nitrogen which makes plant to be very succulent and attractive to aphids
- Grow repellent plants like onions, garlic and marigold in alternating rows to prevent aphids
- Conserve natural enemies (e.g. ladybird beetles, hoverflies and *Aphidius* sp.) by avoiding spraying broad spectrum insecticides
- Intercrop with resistant species such as onion, garlic and parsley to reduce aphid populations

Monitoring

- Start monitoring from seedling stage, look at lower leaves, stems or growing points for soft bodied insects, found in clusters
- Regularly check for leaf curling and sticky residue on crops at least once a week
- Observe underside of leaves for aphid's presence
- When monitoring crops, sample the most recently expanded leaves (4th or 5th leaf from the growing point) to give an estimated threshold

Control

- Prune leaves showing symptoms (curling, aphid populations on underside)
- Remove and burn infected/infested plants to help reduce aphid populations
- Spray soap solution (Potassium soaps e.g. Alatasamina) (add 10-15 tablespoons of liquid soap in 15L and spray on foliage)
- Spray with botanical extracts e.g. garlic, neem, red chilli pepper or soap (take 50g mix in 2 L of water. Boil for 15 minutes, allow to cool and spray 3 times at 2 weeks' interval)
- There are many predators and parasitoids that can aid in controlling aphid populations. These include lady beetles, syrphid fly larvae, damsel bugs, and tiny wasps.

(ii) Fruit flies

Signs and Symptoms

- Dot-like scars on fruit
- Eggs of fruit fly inside the skin of the fruit
- Larvae (maggots) feeding inside the fruit when cut open
- Check for rotten and fallen fruits
- Presence of adult flies on the field



Adult fruit fly on tomato fruit

Fruit fly maggot inside the

Management

Prevention

- Avoid planting pepper near alternate hosts (mango, citrus, watermelons, tomatoes, eggplants, avocado) to reduce pest populations
- Remove non-harvested pepper and wild melon pumpkins as they will host larvae. Bury 15 to 30 cm deep
- Till the fields top soil (5 to 10cm deep) before planting to expose pupae to the sun, birds, poultry and parasites

Monitoring

- Start monitoring as soon as fruit begins to develop. Inspect plants weekly to look for brownish or yellowish wasp-like flies on plants.
- For early detection, use commercial pheromone traps with trimedlure (TML), or cuelure (CL), or methyl eugenol (ME) attractants (3traps/ km²)

Direct control

- Collect dropped fruits and bury them outside the field at a depth of 60cm with plastic bags
- Use food baits e.g. waste brewers' yeast at 45ml/L of water
- Spray Success Appat (food bait+spinosad (0.24g/l) The spray should contain ½ cup (150ml) of the bait mixed with 5L water. Protection lasts 8 days
- For early detection use commercial pheromone traps with trimedlure, cue lure or methyl eugenol (3 traps/50m²)

(iii) **Tomato leaf miner (*Tutaabsoluta*)-*Tutaabsoluta*** is a small moth which mines tomato leaves as a caterpillar. The moth is active at night and hides between leaves during the day

Signs and Symptoms

- Look out for eggs on leaves and stem
- Mines (galleries) and droppings on leaves, stems and fruit. Leaf mines are wide and gradually become brown and necrotic
- Fruit mines rot
- Exit holes on surface of fruits
- Adult moths are observed underneath leaves. They are silvery, grey brown and thin



Damage on fruit



Damage on leaf

Management

Prevention

- Use pest-free transplants. Inspect new seedlings carefully before they are transplanted into the field or under shelter
- Seal door frames and window frames with insect-proof netting (with mesh less than 1.6mm)
- Remove and destroy weeds that act as alternative host plants e.g. *Datura*, *Solanum*
- Tools should be cleaned after use in infested fields
- Avoid rotation with, or planting near solanaceous crops such as eggplants, potatoes, tomatoes and capsicum since these crops can be hosts of *Tuta absoluta*. Instead rotate with non-host plants such as maize, beans and cabbages
- Avoid staggered tomato cropping because *Tuta absoluta* moths can fly from an infested crop to previously uninfested crop

Monitoring

- Use Pheromone traps, light traps or sticky traps to detect the pest early
- Remove infested tomato plant materials and destroy by burning or burying in holes more than 50cm deep.

Control

- Remove infested tomato plant materials and destroy by burning or burying in holes more than 50 cm deep. Do not dump infested fruits at farm edges, collection points

or in markets

- Destroy plant residues after harvest by burning or burying
- Inspect harvesting containers, field boxes or carts, packaging material and destroy or disinfect if tomato leafminer is suspected

(iv) Whitefly (*Bemisia tabaci*)—Adults are sucking insects. The body and wings are covered in a powdery waxy secretion, white to slightly yellowish in colour

Signs and Symptoms

- Look for leaves with whitefly groups mainly on the underside of leaves. They usually fly when you shake the plants
- Yellowing, curling, crumpling of leaves and occurs at heavy infestation



Whitefly on underside of leaf

Whitefly damage

Management

Prevention

- Remove tomato residues and volunteer tomatoes and bury or burn
- Transplant shortly after or during the rainy season
- Conserve natural enemies (wasps, ladybirds) by mulching or leaving a natural hedge of flowering plants (e.g. Thiona, Lantana) along the edges to offer them refuge
- Plant repellent crops such as Coriander or Mexican marigold after 3-4 rows of tomato to repel the whiteflies
- Keep the field weed-free throughout the cropping season since weeds act as alternate host and can harbor whitefly-transmitted viruses

Monitoring

- Use yellow sticky traps at about 1 per 5 plants

Control

- Spray Azadirachtin 0.03% (50ml/20L water) 15 days after transplant
- Use hot pepper spray. Put cut pepper in warm water. Soak for 1 day. Dilute in 10L water and add 20 drops of liquid soap before spraying
- Conserve natural enemies. Several wasps, including species in the *Encarsia* and *Eretmocerus* genera which parasitize whiteflies

(b) DISEASES

(i) Damping off: It is a rot that occurs at soil level of the young crop (seedling stage) and it is caused by fungi.

Symptoms

- Wilting, collapse and death of seedlings
- Dark shriveled stems around the base and brown rotten roots



Management

Prevention

- Solarize the soil of nursery beds before planting using clear plastic to sterilize. If the problem persists, consider changing nursery sites
- Clean or disinfect tools (tillers, cutlasses and hoes) using 10% bleach solution or fire to heat
- Sow seeds thinly to ensure aeration. Plant in raised beds to maintain good drainage and avoid over watering
- Remove infected plants as soon as symptoms appear and destroy them away from nursery
- Avoid excessive fertilization at nursery to reduce damping off

Control

- Treat seed with Mancozeb 800g/kg, Folpet 500g/l at 3-4g/kg

(ii)Early blight (*Alternariasolani*): Attacks seedlings at the seedbed stage. High temperatures may favour disease incidence. The leaf blight phase usually begins on the lower, older leaves and progresses up the plant. Infected leaves eventually wither, die, and fall from the plant.

Symptoms

Dark brown to black circular or angular spots on leaflets with concentric zones

Black or brown sunken lesions on fruits

Presence of lesions with chlorotic margins on leaves



Damage on leaf

Management

Prevention

- Rotate tomato with cereals (e.g. maize) or legumes (cowpea or groundnut) every two seasons. Observe good agricultural practice
- Disinfect hands and tools with detergent or household bleach after working on the infected plants
- Practice staking and mulching to prevent the fruit from touching the soil and to improve aeration.

Control

- Remove and destroy crop debris after harvest and solanaceous weeds that may act as hosts
- Remove and burn infected plant detected early
- Carry diseased materials to be destroyed away in a closed container to prevent spread of the disease
- Apply Mancozeb at a rate of 24-32g/ 15 L knapsack

(iii) Fusarium wilt : The fungus lives indefinitely in the soil and is spread in irrigation water. It is very susceptible to changes in temperature and soil moisture. The optimum temperature for disease development is 24 -27°C. The wilt does not occur in dry soil, but it is serious in poorly drained fields.

Signs and Symptom

- Yellowing, and wilting of leaves and stems, often only affecting one side of the plant
- Wilted leaves which dry up and turn brown
- Uproot and cut the stem lengthwise, internal dark brown to dark-red discoloration can be seen when the fungus is present
- There may also be damage on the root system



Damage field

Internal dark brown colouration

Management

Prevention

- Avoid planting on land with history of wilt disease
 - Rotate nursery site each season and maintain good drainage
 - Destroy plant debris immediately after harvest by burning
 - Solarize soil using plastic sheets 6-8 weeks before planting
 - Practice long crop rotation- 6 years with non-solanaceous plants (e.g. cereals and grains maize, millet) after 3 seasons
- Disinfect farm tools with 10% bleach solution after working in infested areas

Control

- Rogue out and destroy plants that show early symptoms of the disease and destroy by burning
- Monitor field weekly for symptoms of wilt soon after transplanting

(iv) Nematodes (Root-Knot Nematodes)

Signs and Symptoms

- Wilted and yellowing of plants
- Stunted growth and zones of poor growth on the farm soon after transplanting
- Uproot affected plants to examine the root system and check for galls and swellings



Management

Prevention

- Do not transfer nematodes into a clean area when transplanting by reducing movement of soil particles after use
- Expose ploughed land 2-3 weeks before transplanting, this may help to reduce nematode numbers
- Farm tools (e.g. cutlasses) should be washed of soil particles after use
- Control weeds and volunteer crops or solanaceous plants
- Rotate for 2 years with non-host crops: sorghum, millet. Broccoli or cauliflower
- Plant marigolds (e.g. *Tagetes patula*) on fields for two months after harvest, plough into soil before transplanting seedlings

Control

- Rogue and burn affected plants with typical nematode symptoms at early stages of plant growth
- Applications of poultry manure or cow dung at a rate of 5t/ha can boost crop vigour and reduce nematode infestations on the crop
- Nematicides (chemicals) used in controlling nematodes are generally poisonous and expensive. Avoid recommending chemical control with Nematicides. Encourage use of

9.0 HARVESTING

- Tomatoes ripen in **60-85 days** from the time seedlings are set out depending on the variety. When the fruits begin to turn red, check the plants every day and pick those that are fully red and firm, but not hard. Fruits
- Harvest at breaker or fully-ripened firm stage depending on market segment

requirement.

- Observe strict hygiene during harvesting operations.
- Harvest carefully to avoid damaging the produce.
- Keep produce under shade or in a cool environment immediately after harvest to remove field-heat.
- Sort and pack stackable wooden crates lined with foam or dry straw.
- Never placed tomatoes on the sun to ripen, they may rot before they arrive.

9.1 Yield

Yield varies greatly with cultivar and adherence to Good Agricultural Practices. Yields of up to 35-40 tons/ha are achievable.

9.2 Marketing

The fruit should be firm and free from blemishes or any damage before marketing. Fruits are harvested at mature green stage or full ripe but firm stage depending on market demand and distance. Tomatoes can be marketed in raw state or processed into paste and put in a sealed container.