KENYA AGRICULTURAL AND LIVESTOCK RESEARCH ORGANIZATION

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FACTSHEET FOR TECHNOLOGY INNOVATORS WORKING WITH SMALL HOLDER FARMERS IN KENYA

TOMATO

INTRODUCTION

Tomato is one of the most widely cultivated vegetable crops in Kenya. In western Kenya, it is mostly grown for home consumption in the backyard of homesteads (kitchen gardens) though commercial production is being done by some farmers.

Tomato is consumed in diverse ways, raw or cooked, in many dishes, sauces, salad and drinks. Tomato yields in smallholder cropping systems in the region are generally far below the potential of the crop. There are several reasons for low yields. Among these are low quality seeds, non-availability of inputs, sub-optimum crop husbandry and a large number of pests and diseases. Varieties include Money Maker, Elgon Ndume, Marmande and Rio Grande for Fresh market. Cal-j, determinate, M-82, Roma VF and Bush tomato are good for processing.

SITE SELECTION

Altitude range

Tomato require altitudes of 0 – 2000 masl.

Soil type and conditions

Deep, well-drained fertile loams soil rich in organic matter. It requires a pH: 5.0 – 7.0, Zn, Mn and Fe become deficient and below 4.5, producing sour fruits. Tomato nutrient requirements include N, P, K, Mg, Ca, S, Mn, Mo, Zn, Bo, Cu, and Fe.

Temperature range

The temperatures should be 18 – 29 °C.

Rainfall

Rainfall of 600 mm is essential during production period.

LAND PREPARATION

Steps during land preparation

1. Prepare the main field 1-2 weeks before transplanting
2. Plough and harrow to appropriate tilth
3. Apply manure and basic fertilizer according to soil analysis results and recommendations.

PLANTING

Direct planting can be done, or seedlings can be raised in a nursery by:

- Constructing raised or sunken nursery beds at 1 m width by desired length.
- Incorporate 5 kg of well-decomposed compost or manure/m^2 into the seedbed
- Sterilize the nursery bed with hot water treatment, burning, solarization or application of appropriate pesticide.
- Sow seeds in the furrows 20cm spaced at 2.5cm and cover lightly with soil
- Mulch and water regularly until the seedlings emerge
- After emergence of seedlings remove the mulch from the beds and construct a raised shade (about 1 m).
- Apply adequate water regularly to sustain good, healthy growth of the seedlings
- Keep the nursery weed-free and scout for pests and diseases.

TRANSPLANTING

- Water the nursery to saturation point 12 hours before transplanting.

- Transplant seedlings at 3-4 weeks in the nursery. Transplanting should be done either in the early morning or late in the evening.
- Make furrows or planting holes depending on the spacing of the specific variety e.g. 100 cm x 50 cm; 75 cm x 50 cm; 70 cm x 45 cm; 60 cm x 45 cm.
- Wider spacing of 100 cm x 50 cm is good.
- Target plant population density 37,000 to 9,300 plants per ha.

SOIL AND WATER CONSERVATION MEASURES

- Irrigate regularly especially during critical periods like nursery, flower setting and fruit development and during dry spell.
- Irrigate early in the morning to avoid late blight disease.
- Reduce watering at the end of crop maturity.
- Regular watering reduces blossom end rot, ensures uniform fruit development, prevents fruit splitting, reduces the risk of sun scorch, enhances fruit growth, and increases the size and number of fruits.

SOIL FERTILITY REQUIREMENTS AND MANAGEMENT

Apply required nutrients based on results of soil test analysis and on plant nutrient requirements.

Apply top-dressing fertilizer such as CAN in 2 splits at 100kg per ha (5g or ½ teaspoonful per plant) and 200kg per ha at 4 and 8 weeks, respectively, after transplanting.

ROUTINE CROP MANAGEMENT PRACTICES

Weed management

- Timely weeding should be practiced.
- Weeding is done through hoeing, mulching or use of herbicides.
- Do shallow cultivation not too close to the plant in order to prevent damage of the plants.

Staking

- Stake if necessary depending on the varieties.
- Guide plant along the trellising string or wire.
- Put a 2m stick firmly in the ground for each tomato plant and tie the stems loosely as the plant grows or
- Put a stout pole in the ground at every 4m and 2 wires running one at 2m and another at 0.15m above the ground.
- Tie a strong string between the two wires behind each tomato plant.
- Twist the plants carefully around the strings as they grow.
- Start staking about two weeks after transplanting.

Pruning

Remove the lower leaves

How to prune tomatoes

- Prune to leave 1 to 2 main stems and pinch out the lateral as they grow every week.
- Pruning is done by removing the lower mature leaves and checking for the presence of pests and diseases.
- Pruning creates microclimate that improves air circulation within the canopy which reduces foliar diseases, facilitates harvesting and spraying.
- Pruning leads to earlier maturity and encourages fruits to increase in size.

DISEASE AND PEST MANAGEMENT

Pests include;Tuta absoluta, African bollworm (Helicoverpa armigera), Red Spider mite (Tetranychus cinnabarinu, T. lomardin and T. telaryus), Whitefly (Bemisia tabaci), and Root-knot nematode (Meloidogyne spp).

Tuta absoluta

Burnt leaves with irregular mines that have black deposits (frass).

Black cracks on the stem and holes on the fruit surface leading to tunnels in the fruit.

Control of Tuta absoluta

- Plant clean seedlings free from all stages of the moth.
- Rotate with non-host crops such as maize, beans and cabbages.

- Remove and destroy wild host plants such as Sodom apple around the farm.
- Remove and burn all infected crop residues.
- Remove infested leaves before the caterpillar inside pupates and becomes an egg-laying adult.
- Burying deep 50-100 cm infested fruits and foliage.
- Clean all equipment used in transportation of tomatoes such as boxes, crates and trucks using soap and water.
- Use black sticky traps-24 pcs per acre, placed 15-20 cm above the ground.
- Use screen vents in roofs and on the sides of the greenhouse to reduce insect pest migration.
- Use of *Bacillus thuringiensis* controls outbreaks.
- Use sex pheromone traps on the males, thus reducing the populations due to reduced fertilization of the females.
- Pheromone lures can be used for monitoring and mass trapping.
- Spray using spinetoram (Radiant 120 SC(R)) at the rate of 18-30ml per 20 L of water.
- Spray using Chlorantraniliprol (Corragen 20 SC (R)) at the rate of 2ml per 20 L of water.

African bollworm

- Adult moth is dull yellow to brown.
- The female moth is attracted to flowers where it lays between 750-1000 eggs.
- Eggs are tiny round and brownish and laid near or on flowers or small fruits.
- Eggs hatch after 2 to 4 days.
- Larvae have alternating light and dark colored stripes on either side of the body.
- The larval life lasts about 3 weeks.
- The pupa is shiny brown. Pupal period lasts 10 to 14 days.

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Others

Red Spider mite

White fly

Root-knot nematode

DISEASE MANAGEMENT

Major diseases include:Damping off, bacterial wilt (*Pseudomonas scalanacearum*), Late blight (*Phytophthorainfestans*) and blossom end rot (BER).

Damping off

Caused by several pathogens namely, *Pythium* spp*Fusarium*spp and *Rhizoctoniasolani.*

Control of Damping off

- Use certified disease-free seed.
- Seed treatment with fungicide e.g. Apron Star®.
- Avoid siting seedbed near tomato field.
- Avoid excessive fertilization using nitrogen compounds.
- Solarization of seedbed.
- Thin seedlings in nursery bed to allow for good air circulation.
- Proper watering in nurseries

Bacterial wilt

- Caused by Pseudomonas solanacearum. The disease causes wilt of tomatoes. It is seed-borne in tomatoes.
- Bacterial wilt effects the whole plant.
- Symptom first appear on the youngest leaves and a rapid wilt of the whole plant occurs.
- Adventitious roots appear on the infected stem.The vascular bundles will be yellowish brown in the initial stages of the disease.

Control of bacterial wilt

- Practice crop rotation, with non-susceptible crop.
- Tomatoes should not follow *Solanaceous* crops like potatoes and capsicums.
- Produce transplants in pathogen-free soil.
- Remove and burn infected plants as soon as possible to check the spread of the diseases.

- Plant resistant tomato cultivars.

Late blight

Blossom end rot

Physiological disorder due to calcium deficiency

HARVESTING

Tomato is mature between 2½–3 months after transplanting depending on the variety and environmental conditions.

Four maturity stages are recognized for tomatoes, i.e. breaker, light red, turning and pink:

Tomato ripening stages

Harvest index	Characteristics	Use
Breaker	10% of the fruits break colour from green to pink or red	Fruits are harvested to send to distant markets
Light red	60-90% of pink or red colour	Fruits are picked for the local market
Turning	10-30% of pink or red colour	Fruits are consumed or used for canning and processing
Pink	30-60% of pink or red colour	Frits are consumed or used for canning and processing

Harvest is done at different stages depending on the market requirement and distance to the market. Harvesting should be done early in the morning or late in the evening since this is when the plant is turgid.

Harvesting is done by hand by twisting and turning until the fruits, snap off the vine. It should preferably be done early in the morning when temperatures are cool.

Put the harvested fruits into holding containers (plastic buckets) in a cool place e.g. in a shade.

Tomato will produce 25-100 tons per ha with proper management.

Tomato Maturity stage

POST-HARVEST HANDLING

Storage

Tomatoes are placed into plastic or wooden crates in the field until they are transported to the market.

Transportation

Transportation from farm to the market should be done early in the morning when temperatures are cool and care should be taken to avoid damaging the tomatoes.

Transportation is done by pick-ups, Lorries and motorbikes.

Packaging

- Sorting is done before packaging to remove rotten, damaged, cracked and diseased fruits Sorting limits spread of infection to healthy fruits during post-harvest handling
- After sorting then fruits are graded on the basis of color, size and stage of maturity / degree of ripening.
- Tomatoes are then packed in environmentally friendly canvass bags 1-1.5kg for sale at retail level.
- Other retail units include plastic containers 2-5kg, traditional baskets 2-5kg and heaps 3-5 fruits.

Processing

Tomato is processed into tomato sauce, juice.

Juice

Tomato Source

MARKETS

Prices are better in some markets. Consider markets offering better prices.

The producer needs to focus on agribusiness and commercially oriented production (for instance gross margin analysis including marketing channels and production costs - to derive mark-up).

SokoYetu - Twiga Foods Marketplace, Revolutionizing African Retail

https://www.mkulimayoung.com/market

KAMIS is the source of market data (prices and volumes) in the Kenyan region AMIS

Kilimo Call Centre 0800 724 891

Sauti Trade and Market Information Platform Dial *384*35#

National Agricultural Commodities Market Information (NAFIS) http://www.nafis.go.ke/category/market-info/

Taimbahttps://taimba.co.ke/254-709-790-000

REFERENCES

- https://www.jica.go.jp/project/english/kenya/015/materials/c8h0vm0000f7o8cj-att/materials_26.pdf
- https://www.greenlife.co.ke/tomato-farming-for-beginners/
- https://infonet-biovision.org/PlantHealth/Crops/Tomato
- https://kalro.org/sites/default/files/Tomato_production_manual.pdf
- https://www.kalro.org/divisions/crops/tomato/

CONTACTS

Kwa maelezo zaidi wasiliana na:KALRO HRI Kandara, Kibos, Matuga na KALRO Kisii.