Unit 1 Factors Affecting Tomato Production

Tomato is one of the most widely grown vegetables in the world due to its wide variety of uses. Tomato is an important source of Vitamin A and C. This manual presents an overview of good agricultural practices for tomato production. The actual success of the tomato crop will depend on the individual farmer. Not only will hard work be necessary, but attention to all aspects of the production cycle and an organized approach will be needed to guarantee success.

CLIMATE & SOIL REQUIREMENTS
Tomato grows well in temperatures between 68-80 °F. Tomato prefers well-drained soils as the crop is susceptible to water logging. Optimum soil pH is 6.0 – 7.0. This crop is best grown with irrigation but if none is available, the crop will require about 600mm of rain during the life of the crop. Tomato is best grown on level ground but can also be grown on slopes if the proper contouring is done during land preparation. Tomatoes benefit from crop rotation. Avoid planting in fields where a Solanaceous crop has previously been planted. Tomato is a Solanaceous crop (belonging to the Solanacea family), which puts it in the same group as eggplant, peppers and potatoes. All plants in this family share the same pests and diseases.

VARIETIES
Factors to consider:
Fresh market: Fruits are usually red in color and come in different sizes.
Processing: Fruits have an intense red color and have a high solids content.
Cherry: usually small in size (30g) and come in a variety of colors.

Adaptation to season
Most tomato varieties are adapted to dry seasons. Successful wet season production requires a combination of suitable varieties and careful management practices (raised beds, proper nutritional programs, Integrated Pest Management practices, and preventative disease control).
FIELD PREPARATION
Soil sampling should be done once a year to determine the nutritional and pH status of the soil. Soils that are acidic (pH of 5.5 or less) should be limed to bring soil pH to between 6 and 7. Fertilizer efficiency is greatest at this range. It is also useful to calculate the soil’s water retention values (permanent wilting point and field capacity) to help with the design and management of the irrigation program. Calculating these values only needs to be done once unless there is any large change in quantity of organic material in the soil. The soil should be prepared 30 days before the planting takes place. This helps avoid any delays and allows for timely completion of all the other pre-plant tasks. The soil preparation should be done to a depth of at least 30-40cm. The field has to be plowed at least once and then harrowed. When plowing, make sure that all the clumps have been worked out of the soil but do not over-cultivate it as this destroys soil structure. Depending on the type of soil and previous activity on the land, there may be compaction or presence of a hardpan. If this is the case, then the land should be subsoiled first. Raised beds should be made irrespective of the irrigation practices used. Beds have a number of agronomic advantages:

- Good drainage – tomatoes are easily damaged by water logging.
- Good aeration (roots need oxygen – plants absorb 90 percent of their oxygen through the roots).
- Good soil structure to allow proper root growth and development.
- Weeding, scouting, application of pesticides, and harvesting are easier.
- Soil compaction is avoided because people are forced to walk in the rows and not on the beds.

The tomatoes are planted on the top of the beds, which protects them from excess water. Usually, beds are 1 meter wide with furrows of 30-40cm in width. Bed height varies depending on the season; 30cm in dry season and 40 cm in rainy season. Plastic row covers can then be put over the beds for weed control. Mulch is also recommended as an alternative to plastic row covers because it reduces fertilizer leaching and moisture loss in addition to weed control.

PLANTING DENSITY
The desired planting density is 13,333 - 22,220 plants/hectare, although it can rise to 33,000 plants per hectare in indeterminate plants (¾m between rows and 45cm between plants). Density will depend on the variety of tomato grown. Plum tomatoes require the higher densities (18,000 - 22,220 plants/hectare) while the regular salad tomatoes are planted the lower densities (13,333 - 18,000 plants/hectare). The beds
should be about 1.2-1.5 meters from center to center with a plant every 30cm to 50 cm. Depending on planting density, there can be one or two rows of plants per bed. If there are two, the plants should be staggered in a zigzag pattern. We recommend using a straight stick or pole that can be marked at the required planting distances. This will ensure correct planting distances when making the planting holes. Remember, it is the small details that lead to success.

SEEDLING PRODUCTION
When planning seedling production, remember to plant more seeds than the number of plants needed for your planting density. The exact number will depend on percent seed germination and on the number of replants required after transplant. As a guide, an extra 3 percent of hybrid seeds and an extra 10% of non-hybrid seeds should be sufficient. In total, about 250g of seed is required to produce enough seedlings for one hectare. Seedlings can either be produced in trays in a nursery or in field nurseries. Seedlings grown in trays are healthier and more vigorous compared to those grown in beds, which tend to suffer root damage when pulled out of the soil.

TRANSPLANTING
This activity has three steps to it:

- **Marking the planting holes:** It is important to ensure correct planting distances and densities. To achieve this, use a marking stick or tube. Put marks or bits of string along the stick at the required planting distances. These marks will guide the worker making the planting holes.

- **Starter solution:** This solution is a mixture of water and fertilizer (10 kg of DAP in 200 liters of water). 250cc of this solution is placed into each planting hole just before the tomato plant goes in. The value of the starter solution includes:
  
  - Saturating the soil so that it molds around the soil plug of the transplant.
  - Acts as ‘glue’ between the transplant and the soil.
  - Gives uniformity to the moisture in the soil.
  - Gives some early nutrients to the plant.
  - Allows the plant to recuperate quickly from ‘transplant shock’.

  The starter solution can be applied using different methods (cups, buckets, backpack sprayers…) the important thing is to make sure each hole gets some of the solution.

**Planting:** this should be done once the starter solution has been absorbed by the soil, but before the planting hole dries (no later than 5 minute after applying the starter solution). It is very important to avoid air pockets forming around the transplant in the soil. These tend to fill up with water causing severe root problems. Press the soil firmly around the roots to avoid this. Make sure that the soil water content is optimum (field capacity) at planting. For a few days after transplanting, do not irrigate the crop – a slight amount of water stress
will stimulate the plants to produce a more extensive root system. You can start irrigating once the plants start to show signs of wilting at the middle of the day. Five days after transplant, check for establishment and replant where needed.

**PLANT NUTRITION**
Tomato plants can be fertilized with a mixture of organic and inorganic fertilizers. Before beginning any fertilizer program, make sure a soil test is done. The results from the test will be able to tell you what the fertilizer program needs to deliver to make up the difference between what the crop needs for optimal growth and what the soil has available. Fertilizer uptake efficiency by a crop is highly variable and depends on many factors, including fertilizer formulation and placement (surface, incorporated, banded, fertigation), as well as irrigation method and management. Half of the fertilizer should be applied as a base application (during or soon after land preparation) and the remaining at first fruit set. Fertigation is where soluble fertilizers are delivered to the crop using the drip irrigation system. This is a very efficient means of fertilizing a crop and it can lead to large yield gains. The fertilizer is applied in small quantities on a regular basis (can be as frequent as every day) and the quantities and ratios of fertilizers are altered depending on the crop’s needs. This type of fertilization also can reduce negative environmental impact.

**HARVEST**
Extreme care should be taken during harvest, since the effort of raising quality crops can be easily be undone through careless harvest and postharvest practices. **Harvesting will not improve crop quality – it can either preserve it or spoil it.** Tomatoes are usually harvested 2½ to 3 months after harvest, depending on the zone and the time of year. The maturity of the harvested tomatoes will depend on the market demands. Maturity at harvest ranges from fully-developed green fruit, through to red, vine-ripened tomatoes. Supermarkets will often ask for tomatoes that were harvested at the color break stage – that is when the fruit have begun the turn to a pinkish-red. These tomatoes are physiologically mature but are still some time from full ripening. This time can be used to get them to market with minimal damage. The length of harvest will depend on crop type (determinate or indeterminate), crop health and productivity. There can be up to 10 cuts or harvests in one determinate tomato crop if it is a healthy, productive crop. 24 to 30 people are required for each cut per hectare each week. The fruit are placed into buckets or field crates and then sorted in the field. Field selection eliminates the transport of noncommercial tomatoes from the field. All sorting and selecting in the field should be done in the shade and protected from the rain. Apart from physical damage, unnecessary exposure to heat is the biggest factor leading to postharvest losses. In larger operations, tomatoes are taken to refrigerated rooms to take the field heat out of the fruit.

**Key points to harvesting:**
- Have your production and harvest dates planned out before hand
- Communicate regularly with your buyers – there should be no surprises
- Coordinate your harvesting teams and the transporting agents
- Maintain good field supervision of the harvest
POSTHARVEST
Field classification focuses on size, quality and degree of ripeness. Packing into crates or boxes can happen at the same time as classification. The minimum infrastructure needed for a field packing shed is a roof and sorting tables (to keep the fruit off the ground). Workers should be encouraged to work fast, work carefully and take precautions against food safety risks. Packing crates or boxes should not be over-filled and they can be lined with a sponge or any other protective lining – keep them below the height of the container. Transport of the tomatoes should be in covered, ventilated trucks.

Storage
Storage will depend on the maturity stage of the tomatoes. Two key considerations are:

Temperature
Mature, green tomatoes – 54.5 to 59 °F for up to 15 days
Color break tomatoes – 50 to 54.5 °F for 8 to 10 days
Firm, red tomatoes – 45 to 50 °F for 3 to 5 days

Relative humidity
Should be kept between 90-95 percent to prevent water loss and reduction in quality.