Chapter 8

TRAINING AND PRUNING IN TOMATO AND CUCURBITS UNDER OPEN FIELD CONDITIONS

Objectives

After studying this chapter, the students will be able to understand:

- Importance of training and pruning in tomato and cucurbits
- Different methods of training in tomato and cucurbits

Introduction

Tomato and cucurbitaceous vegetables have trailing growth habit and therefore, require support for better growth and development. Now question arises in your mind that why these plants do not grow better without any support? The answer to this question is if these plants are not staked properly then (1) plants and fruits come in direct contact with soil and water which may spoil the quality of the produce. (2)There is overcrowding of branches which make plants devoid of proper aeration and sunlight. (3)There is increase in humidity in the surroundings of the plants which in association with high temperature renders plant more vulnerable to the incidence of diseases and insect-pests. These explanations will definitely make you understand the importance of training in these crops.

Training Methods

Tomato

There are a wide range of training or support systems employed in the cultivation of tomato. These include

1. Growing tomatoes without support on the ground,
2. Growing them without support on the ground with the plastic mulch
3. Growing them by providing support with cages, stakes, or trellises.

Main reasons for staking or supporting tomato plants

- To keep shoots and fruits away from the ground. It results in reducing losses due to fruit rot and also from sunburn when fruits are not protected by foliage.
- It is easy to spray the well supported plants for the control of insects and diseases
- Harvesting of fruits is much easier than those sprawling on the ground.

Methods of training tomato: There are three popular methods of supporting tomato plants which are mentioned as under:

1. Staking
2. Trellising
3. Caging

Before elaborating these training methods, it is essential to make you understand about another very important operation in tomato which is known as pruning.

Pruning tomato plants: Pruning is the removal of small shoots where each leaf joins the stem. It is important to prune tomato plants (suckered) to reduce the number of branches. This makes plants more suitable for the selected method of staking or support. Plant type also determines the amount of pruning. Based on growth habit, tomato varieties are divided into two main groups:

1. **Determinate growth:** The varieties with determinate growth habit are also known as self-topping varieties. They have short to medium vine length. Plants bear heavy branches and do not grow indefinitely. Such varieties are early and have a short but concentrated production season. These plants are staked or caged but are not adapted to trellising. Determinate varieties are not heavily pruned, regardless of the support system because most of the fruits are produced on the branches.
2. **Indeterminate growth**: Such varieties go on putting growth until and unless any biotic (attack of disease, insects) or abiotic (cold, or lack of water and nutrient supply) stress encountered which may kill the plants. Such varieties are heavily pruned when trellised, moderately pruned when staked, and lightly pruned when caged.

Pruning of side branches
Source: www.theinnovationdiaries.com

Method of pruning: Properly pruned plants produce early and larger fruits than non-pruned plants of the same variety. It is important to remove shoots when they are less than 4 inches long to avoid injury to the plant. The removal of larger sucker results in more wastage of plant energy and also results in larger wound. For pruning, remove a sucker by holding it between your thumb and second finger and twist it to the side until it breaks. This should be done early in the morning when plants are turgid or hard *i.e.* not wilted from the

day's sun and heat. Do not cut suckers with a knife because there is danger of spread of viral diseases. It is important to decide about the method of training before planting tomato plants in the field. Plants for trellising are planted closer than those plants to be staked or caged. Plants for caging are planted at larger spacing than those for staking.

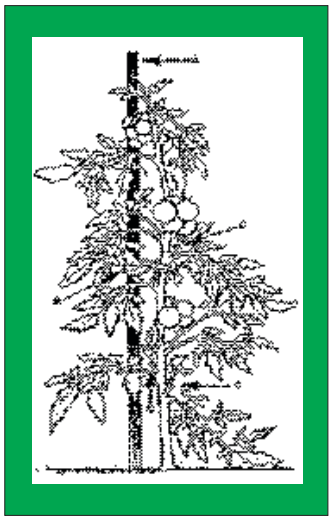
Methods of growing tomato

1. **Sprawl System of growing tomatoes:** It is also known as "Ground Culture". It refers to the idea of growing tomatoes without any form of physical support. It allows the vines of the plant to crawl over the ground. This method results in lower costs than other methods. Various forms of the sprawl system of growing tomatoes are still employed by commercial tomato growers in some areas which include cultivation on bare ground, on plastic mulch and on local mulch.

2. **Staking:** The standard method of one plant per stake is the most time-consuming training procedure because it requires constant pruning and tying. However, it requires the least space per plant and is the least expensive. Wooden or metal stakes 1.5-2.0 m long are required for indeterminate varieties and 1-1.25m long for determinate varieties. Wooden stakes should be at least 2.5-3.0 cm square. On the other hand, metal stakes can be of smaller diameter and have longer life as they can be used for many years. Sections of concrete reinforce rods (rebar) make excellent tomato stakes. Raise plants at a spacing of 60-90 cm between rows and 30-45 cm between plants to plant.

Procedure of staking:

Single-Stake Support: The wooden or metal stakes are submerged 30-45 cm in the ground and left about 150 cm above ground. Set stake 60-90 cm apart, 60cm deep, in rows 90-120 cm apart. Seedlings should be planted about 15-20 cm above the bottom end of each stake. Train only two or three fruit-producing branches of indeterminate plants by removing all other suckers. A popular method is to select the main stem, the sucker that develops immediately below the first flowering cluster (a very strong sucker), and one other sucker below that. Pruning is a continuous operation since side shoots or suckers grow out rapidly. If side shoots are allowed to develop, the plant will soon be sprawling in many directions, defeating the purpose of staking. The main stem should be tied loosely to the stake with soft, thick twine by first tying it to the stake and then looping it loosely around the plant. If the twine is too tight, it may incise into the stem as the plant grows. Tie individual branches to the stake with soft string.

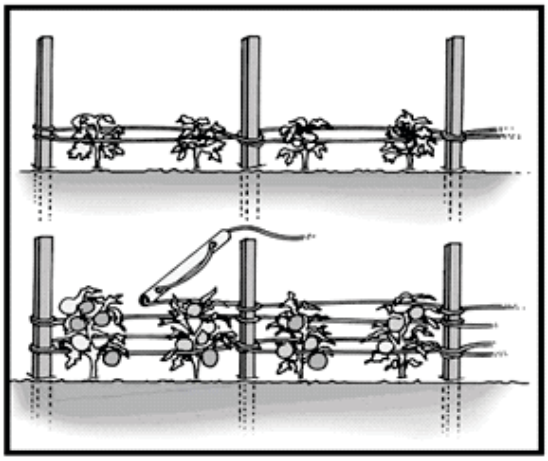


Single branch staking

Single stakes are easy to set up, but they are not wind resistant. It is necessary to prune the vines heavily to keep them trained to the single stake. A simple wooden stake is an adequate support, if the plant is pruned properly and tied up to it as long as it is pounded deeply into the ground. Pruning axillary shoots reduces excessive foliage and thus reduces disease incidence and also causes fruit to ripen earlier. This system has the advantage of being inexpensive.

Trellising: It is used only for indeterminate varieties. The plants are grown at a spacing of 90 cm between rows and 30cm apart in the row. The plants are trained by retaining the main stem only (Single branch training), or occasionally on double branch *i.e.* main stem and one strong sucker (the sucker originating just below the first flower cluster). It is important to remove all other suckers as they develop. Different methods of trellising are as under:

1. Double wire trellis: The double wire trellis is a blend of staking and caging. It is less expensive than individual caging and less time consuming than staking. The double wire trellis can be erected by submerging either 1.5-1.8 m high metal poles or square wooden/bamboo poles in the ground about 5-6 m apart.



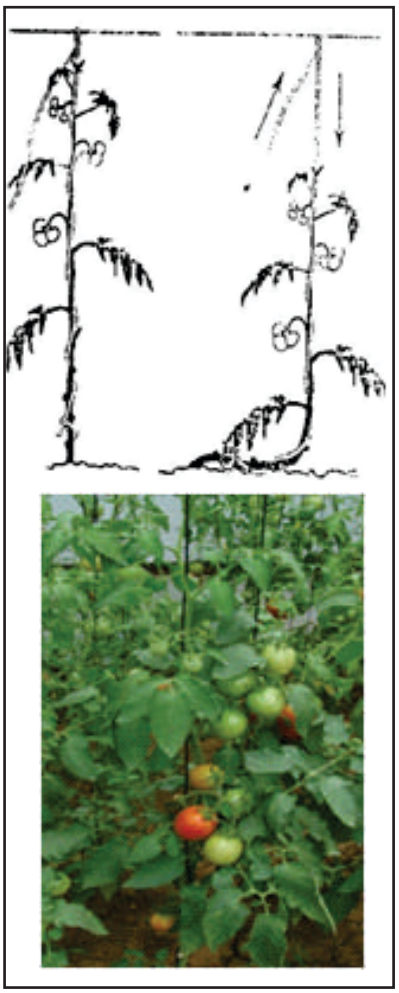
Double-wire trellising
Source: www.extension.org

The end posts should be fixed firmly with support wires. Next, a twine wire is run from one pole around the other pole and back to the starting pole. This makes two parallel wires, tightly placed about 10cm apart. The first set of wire is placed about 60-90 cm above the ground level. The next 3-4 sets of wire are erected tightly at 45-50 cm apart till the top of the posts. Plants are allowed to grow up between these sets of wire.

As the plants grow, they are further directed to the next set of wires and are allowed to climb there. Some pruning is necessary to keep side shoots from sprawling away from the trellis.

Plants are spaced at least 30 cm apart and are pruned to 2 or 3 stems. This trellis should last several years. The lowest set of wires should be high enough to take up weeding operations and to prepare the soil under the trellis for the next season crop. It is best to rotate tomatoes with another trellised crop, such as cucumbers, to avoid the build-up of soil insects and diseases.

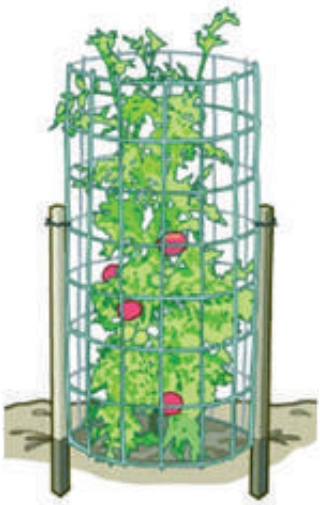
2. Tree or Head system: Similar to double wire trellis, build a trellis (fence) by fixing 2-2.2 m high metal poles or square wooden/bamboo poles in the ground about 5-6 m apart. The tops of the posts should be about 6 feet above the soil surface. Stretch a heavy wire or a piece of barbed wire between the tops of the two posts. Extend a polypropylene twine along the base of the row and tie it with both end of the poles. Use same polypropylene twine to train the plant by putting knot of the one end of it with the base twine and the other end to the top wire. Barbed wire prevents twine from slipping as the top wire droop down with the weight of the plants. As plants grow, wrap them around the twine for support, or use the plastic clips that greenhouse tomato growers use. For trellising two stems per plant, use a separate cord for each stem. Trellising produces ripe fruit earlier than other methods of support.



Head System

Caging: Tomato plants supported by cages made from concrete reinforcing wire require considerably less labour than either staked or trellised tomatoes because there is no

tying and only limited pruning. A 5-foot length of 10-guage support wire 6-inch openings makes a cage of about an 18-inch diameter. Make cages at least 5 feet in height for indeterminate varieties. Small cages are best for determinate varieties. Using heavy bolt cutters, remove the sections of the bottom horizontal wire, leaving wire legs to stick into the ground.



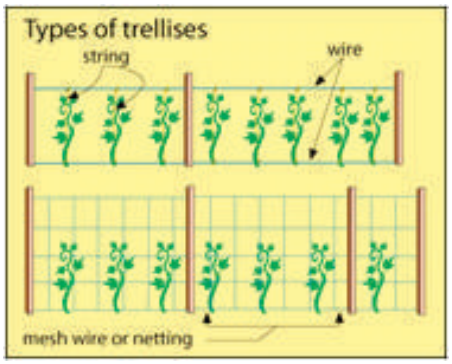
Caging-Source: www.veggiegardener.com

Set tomato plants 90 cm apart in the row and place a cage over each plant. Push legs into the ground for fixing the cage. Protect early plants from cold and wind by wrapping the bottom 18 inches of each cage with clear plastic sheet. Black plastic mulch, in combination with caging and a clear plastic wrap, promotes early blooming.

Caged plants generally are pruned to four or five main fruiting branches. As plants grow, keep turning ends of the branches back into the cages. Caged plants may not produce ripe tomatoes as early as staked or trellised plants, but they produce more tomatoes that are less likely to crack or sunburn.

Training Methods Used in Cucurbits

Trellising: Trellises can be made from a wide variety of materials. They generally consist of two vertical supports with a mesh suspended between them to provide support for climbing plants. Metal or wooden stakes should be pounded into the ground deeply enough that the trellis does not tilt due to strong wind.



In cucurbits, efforts are required to train the vine to its support by a netting composed of strings or wires. This can be done by twining the stems and tendrils through the net as the plant grows, which usually requires about three or four twists during the whole growth period of the plant.

Continue training until the vine reaches the top of the netting. Pinch the top stem (terminal end of the stem) tip to prevent continuous upward growth. Tying of the branches at few intervals shall be helpful in training the cucurbits to the net trellis.

Source: extension.missouri.edu

Select a heavy mesh for large fruited and more vigorous crops. The melon growers encounter a problem of premature fruit drop from the vines. To avoid this, make slings to support the developing fruit by using net bags. Tie each end of the net bag to the wire loosely enough to allow the middle portion to form a sling and set the fruit in it. Fruits of pumpkin and ash gourd are too heavy to trellis and should be grown on the ground.

Tree or Head System: Build a trellis (fence) by fixing 2-2.2 m high metal poles or square wooden/bamboo poles in the ground about 5-6 m apart. The tops of the posts should be about 6 feet above the soil surface. Stretch a heavy wire or a piece of barbed wire between the tops of the two posts. Extend a polypropylene twine along the base of the row and tie it with both ends of the poles. Use same polypropylene twine to train the plant by putting knot of the one end of it with the base twine and the other end to the top wire. Barbed wire prevents twine from slipping as the top wire droop down with the weight of the plants.

Tree System

www.tomatoville.com

In this system the vines are trained like dwarf bush. Tree system of trellising is the most suitable method for training cucurbits. In this system, the first four to six lateral runners, as well as leaves are removed that appear up to first 50 cm of the plant height. The main stem of the plant should be attached to the top of the trellis structure with ties. This can lead to continuous horizontal growth. As plants grow, wrap them around the twine for support.

Pergolla System: This system of training is also known as Pendal or Arbour or Umbrella or Bower. Umbrella system of trellising is the other method used for training cucurbits. In this system, the vines are spread over a criss cross net work of wires above the ground supported by pillars (Concrete or stone) or metal poles or square wooden/bamboo poles. Galvanized wires of 5, 8 and 10 gauge thickness and turning buckles are used. Only the best growing shoot from the plant is allowed to grow upright along the stake provided up to the bower height. In this system, two vigorous shoots are selected and allowed to grow in opposite directions on the wires overhead. They serve as primary arms and from these primary arms, secondary shoots emerge.

Umbrella system

These primary and secondary arms form the permanent frame work of the vine. This system gives better exposure of the foliage to the sun and thus results in better quality fruits and higher yield.

Double wire trellis: Similar to tomato, the double wire trellis can be used for staking cucurbits like cucumber, small melon, or small winter squash with fruit weight up to about one kg. The double wire trellis can be erected by submerging either 1.5-1.8 m high metal poles or square wooden/bamboo poles in the ground about 5-6 m apart. The end posts should be fixed firmly with support wires. A twine wire is run from one pole around the other pole and back to the starting pole. This makes two parallel wires, tightly placed about 10cm apart. The first set of wire is placed about 60-90 cm above the ground level. The next 3-4 sets of wire are erected tightly 45-50 cm apart upto the top of the posts. Plants are allowed to grow up between these sets of wires. As the plants grow, they are further directed to the next set of wires and are then allowed to climb. This trellis should last several years. The lowest set of wires should be high enough to take up weeding operations and to prepare the soil under the trellis for the next season crop.

References

1. Edomond JB, Senn TL and Andrews FS. Fundamentals of Horticulture. Mc Graw-Hill Book Co. Inc.
2. Christopher EP. Introductory Horticulture. Mc Graw-Hill Book Co. Inc.

3. http://www.tomatoville.com
4. http://extension.missouri.edu/p/M173
5. http://www.extension.org

Activity 1

Visit some vegetable garden where tomato or cucurbits are growing. Do pruning of unwanted branches and apply any of the training methods in these crops. Keep some of the plants without pruning and training for comparison. Analyse the effect of these operations on quality of fruits and total yield.

Check your progress

Answer the following questions:

1. Why staking is needed in tomato?
2. What do you understand by pruning? Why pruning is essential in tomato?
3. Make a list of different training methods. Explain trellising?
4. Explain tree system and umbrella system of training in cucurbits?

State true or false:

1. Staking results in reducing losses due to fruit rot.
2. Staked plants are difficult to harvest than those sprawling on the ground.
3. Plant type also determine the amount of pruning.
4. Properly pruned plants produce late and smaller fruits than non-pruned plants of the same variety.
5. We train all the fruit-producing branches of indeterminate plants without removing the suckers.