

An Introduction to Growing Tomatoes

(Lycopersicon esculentum)

Although, strictly speaking, the tomato is a 'berry' fruit, it is mainly used as either a salad vegetable or as an ingredient in cooked savoury dishes. Tomatoes come in many forms and colours, from the typical tomato shape to plum-shaped, and from 'cherry' tomatoes and up to the large multilocular 'beefsteak' varieties. Colours vary from the typical red to golden and to purple-brown.

There are two main types of tomatoes, the 'determinate' and 'indeterminate'. Determinate tomatoes grow to a 'determined' height and are typified by the 'bush' tomato. Indeterminate tomatoes are those which continue growing in height, typified by the 'vine tomatoes'. Both types require similar growing conditions and can be grown in the open ground during the summer months or under glass, with heating as required, throughout the year. The amateur grower may raise plants from seed, or from young plants bought-in from nurseries and garden centres in late Spring. Commercial growers often buy-in young plants from specialist propagators. In the UK the majority of commercially grown tomatoes are raised hydroponically whilst those in continental Europe are still largely grown in open beds in the glasshouse using fruiting varieties grafted onto disease-resistant rootstocks.

Seed Sowing, Pricking out, Growing on

Seeds of tomatoes are either F1 Hybrid or open-pollinated or 'heritage' varieties. The F1 varieties are produced from seed obtained by crossing between two specially selected parents under carefully controlled conditions. This is more labour intensive and results in the higher cost and fewer seed per packet of these varieties. However, F1 hybrids usually grow more vigorously and give greater yields, as well as other advantages, than open-pollinated varieties. F1 varieties cannot be grown from seed saved from the tomatoes produced by these plants as they will not grow true to type. They have to be grown each year from seed obtained by cross-pollinating the selected parents. However, don't decry the non-F1 hybrid varieties for many make up in flavour what they lack in yield. Growing from seed is easy, and the advantage of growing from seed, apart from greater cost saving, is that the grower can choose which particular varieties they prefer, rather than the limited choice of ready-grown plants, and can time the sowing to suit their individual requirements.

Allow 8-10 weeks from sowing seed to planting out in final growing position. If growing under heated glass, tomatoes can be planted at any time. If growing under unheated glass they can be planted in their final growing position from about the third week in April. If grown outside they shouldn't be planted out until the danger of night frost has passed, from late May to early June. Calculate back from the intended planting date to obtain the optimal sowing date. Sowing too early and keeping the plants in their pots longer than necessary will result in them becoming pot-bound. This will cause the plants to take longer to settle in, when they are eventually planted in their final position and may cause restricted root growth.

Seed should be sown on the surface of moist compost and covered with a thin covering of vermiculite or sifted compost, then watered, usually with a solution of copper-based fungicide, to minimise the likelihood of 'Damping-Off'. Alternatively the seed may be sown singly in small modules to minimise root damage when pricking out or potting up. Germination is best carried out at 18°C – 21°C, though germination will occur at lower temperatures, but more slowly. Keep the seedlings in full light to avoid 'stretching', but not hot sun. As soon as large enough to handle, prick the seedlings out into 3½" (9cm.) pots of John Innes No.1 potting compost or multipurpose compost. Hold them by a seed leaf and plant them deeply so that the seed leaves are almost touching the surface of the compost. Water them in and keep the pots in full light, but again not direct hot sun.

The young plants will grow away quickly once they are established in their pots and care must be taken to avoid overcrowding. As soon as the leaves of adjacent plants begin to touch, the pots must be spaced further apart to avoid the plants stretching and becoming 'leggy'. Lightly brushing over the growing tips twice daily with the hand is also said to help minimise 'legginess'. If the timing of sowing was right, the plants will just be showing the first flowering truss by the planting time.

Planting out and subsequent culture

There are a number of methods of growing tomatoes. The one historically most used was direct planting in the soil, either outdoors or in the greenhouse beds. This method is still used for outdoor growing, and to a large extent in continental Europe under protective glass. The problem with this method is that the repeated growing of tomatoes in the same ground can lead to a build up of pests and diseases and the ground becoming 'tomato-sick'. To some extent this was avoided, either by sterilising the soil by chemical means, or by using live steam, between crops. The other alternative was to dig out the soil and replace it with fresh, a fairly Herculean task even for the amateur. This led to the development of disease-resistant strains of tomato which were then used as a rootstock upon which the chosen variety of tomato was grafted. This method is still successfully used today, especially in mainland Europe. In fact, there has been a slight re-introduction of this method in Britain with a number of companies offering ready-grafted young plants for the amateur market. However, there is such a limited choice of varieties and the plants are so highly priced, that it is difficult to foresee a major 'take-up' of this method by the amateur grower other than as a 'curiosity'.

In an attempt to avoid the build up of pathogens in the soil and avoid the need for sterilisation or soil replacement, tomatoes were grown in large pots, but then the 'ring-culture' method was introduced and enjoyed widespread popularity in the 1950's and '60's. This method replaced both open-bed growing and growing in plant-pots, and consists of an open-ended cylinder of 'whalehide' (roofing felt), about 11" in diameter and of similar depth, filled with the planting soil or compost, which is stood on a sunken bed of washed ashes or gravel (about 6" (15cm.) deep). The plant was placed in the sterile compost and fed regularly with liquid feed, but the main source of water for the plant was supplied to the ashes or gravel. Thus the plant's root system was subdivided into feeding roots in the 'ring' and water absorbing roots growing out of the base and penetrating the the gravel. At the end of the growing season, both the ring and the compost contents were lifted from the gravel and disposed of, while the gravel was left in place for the next crop.

Soon after came the advent of the 'growbag', a long polythene 'sausage' filled with ready-made peat-based compost tailored for tomato growing. This was both labour saving and less messy, so it rapidly caught on and is still in widespread use today by the amateur, though less so by the major commercial growers. However, the move away from peat-based composts has led to the use of more peat substitutes, such as composted green domestic waste. Despite claims that these materials are an acceptable substitute for peat, they often fall far short, both in their moisture retentive properties and in their nutrient retention capacity and should be avoided until an industry-proven acceptable alternative is available. Commercial growers shun the current alternatives for the reasons given, but they are still being promoted for the amateur market.

The next development was the hydroponically grown system, pioneered by the Stockbridge Horticultural Research Station in Yorkshire. This consists of growing the tomato plants in blocks of rockwool supplied with nutrients and water by a drip fertigation system. This system was rapidly adopted by northern growers, while southern producers continued with the use of growbags for some while longer, before eventually moving over to the hydroponic system. The huge glasshouse complex of 'Thanet Earth' (Essex) exclusively raises its year-round tomato crop by this hydroponic method. However, the need for constant monitoring of the nutrient solution together with the associated pumps and irrigation system usually puts this method

beyond the reach of the vast majority of amateur growers.

Consequently, the growbag system is probably the most widely used among amateur growers and the smaller commercial growers. The cost of growbags has to be reckoned into the economics of growing tomatoes by this method, and care should be taken to ensure that a good quality growbag is used. The cheaper offers from supermarkets and garden centres often have a lower compost capacity, together with dubious compost quality. A growbag should normally contain 33-35 litres of compost and have sufficient fertiliser content to feed the newly planted tomatoes for 4-5 weeks before additional feed is required. A formulation to make up home-made growbags is given later.

Planting-out

Two, or at the most three, tomato plants should be planted per growbag. Shake and bash the growbag to break up the compost that has become settled while in storage and make some small slits about an inch long on the underside to allow for drainage. Place the bags in their final position and cut the required number of holes in the upper side to allow planting; there are usually guide lines printed on the bag to assist in positioning the holes. Cut a further two holes to allow two 9cm plant pots to be sunk into the bag through which watering will take place, without washing compost from around the plant roots.

The plants will be between 7-9 inches tall, have dark green healthy leaves, and the first flower truss will have formed with a couple of buds showing the yellow colour of the flower. The original seed leaves will still be present on a well-cared for plant. The plant should be planted slightly deeper than the level it was at in the pot, up to the level of the first seed leaves. The extra depth will provide for additional roots to grow from the buried stem and add to the 'feeding power' of the plant. The plants may be grown up a cane, or up a string that is wound round the stem as it grows. The cane or the string should be attached to a cross-wire stretched between the ends of the greenhouse. An initial good watering should be given after planting to settle the roots in, but then no additional water should be given for a week. This will encourage the plant to send out new root growth in a search for water.

The ideal temperature for tomato growing is between 21 – 25 deg C. If the temperature falls below 18 deg C growth will slow down and the plant becomes 'chilled'. The leaves of the plant take on a blueish tinge when chilled or become short of water, a sign that the plant is stressed. Equally, the temperature should not exceed 27 deg C. for any length of time as this will damage the plant. Adequate ventilation should be given to prevent too high a temperature building up inside the greenhouse. Feeding with a high potassium fertiliser should start about 3-4 weeks after planting, following the dosage recommended by the fertiliser manufacturer. Two well-known brands are 'Tomorite' and 'Phostrogen', though other 'brands' are available or the grower may make up his own mixture. If excess fertiliser is given, the excess potassium may hinder the uptake of magnesium. This will cause yellowing of the leaves, especially the newer ones at the plant tip. This 'inter-veinal' chlorosis is a sign of shortage of magnesium, which is needed for the production of chlorophyll. This shortage can be overcome by watering the plants with a solution of Magnesium Sulphate (Epsom Salts) (a heaped tablespoon dissolved in a gallon of water)

Pollination

In order for tomato fruits to develop, the flowers need pollinating and fertilising. This requires either wind or insects, so in order to get either insects or air movement into the greenhouse will require ventilation. Top ventilation should be one sixth of the floor area. Thus for a 6x8 greenhouse (48 sq ft floor area) the area of vents should be 8 sq ft. Extra vents are required pro rata for a larger greenhouse, or louvre vents fitted into the side-walls. As a last resort the greenhouse door may be left ajar during hot days, though it may need a screen to exclude pets. Another method of increasing the chances of pollination of the flowers is to tap the supporting cane several times at around midday to get the pollen flying. Commercial growers usually place a bought-in colony of humble bees in each greenhouse. Another method is to use an 'electric

bee' to vibrate each flower truss to ensure that the pollen is sent flying. (An 'electric bee' is also known as a 'vibrator', though not for the same purpose). When a flower has been pollinated and fertilised the petals drop to reveal a tiny round green immature tomato nestling in the green calyx. The flower is then said to have 'set'. The first, lower flower truss is often difficult to 'set' as it is usually too early in the season and too cool for much pollinating insect activity. This is where mechanical agitation of the flower truss is often needed, either by hand or electric bee. An alternative method used in the past has been to use a hormone solution sprayed onto the flower truss. The hormone is giberellin (giberellic acid, GA3) and was sold commercially as Tomatset. This hormone causes the fruit to develop, but without fertile seeds. The technical term for this is parthenogenesis ('virgin birth') and this method was also used to develop seedless grapes, before seedless varieties were developed by hybridisation and subsequent cloning. However, the demand for 'Tomatset' didn't take off successfully as a commercially viable product and has now been withdrawn from sale. Giberellic Acid is available for purchase through the internet.

Side-shoot removal

As the plant grows and develops further flower trusses, it will also send out side shoots from the leaf axils. These side-shoots grow quickly, and as the intention is to grow the plant as an upright cordon having just the one main stem, these shoots should be pinched out early and not allowed to develop, so the vines need to be checked whenever watering.

De-Leafing

Also, as the plant grows it is the younger, newer leaves nearer the top of the plant which are most photosynthetically active as they are nearer the source of light, but they are also metabolically more active. Thus they provide the vast bulk of the photosynthesised sugars which are the plant's energy source. The leaves at the lower level gradually become senescent and are actually consuming energy just to keep themselves lingering on. So, they are negative energy providers in that they consume more than they produce. To combat this, it is preferable to remove these lower leaves at regular intervals by 'de-leafing'. To do this push the base of the leaf stalk (petiole) upwards with the thumb towards the main stem until a faint click is heard, then bend the leaf sharply downwards, when it will break off cleanly at the junction with the main stem. The scar that is left on the stem is actually a layer of corky cells called the abscission layer which will quickly seal itself to prevent ingress of fungal spores which may cause rotting. Cutting the leaves some way away from the stem leaves an open wound which is slow to seal and may become the site for rot and 'die-back' to set in.

The timing for de-leafing is as follows; when the flower truss has 'set' and the young tomatoes are about the size of a marble, then take all the leaves off below that truss. As the next higher truss becomes 'set' and fruit marble-sized, remove the leaves between it and the lower truss. Continue in this fashion as the plant grows and the fruit trusses develop, until there is about only 15-18 inches of leafed stem left at the top of the plant. (you still need some photosynthesis to continue!). For cherry-sized tomatoes you only need wait until the immature fruit is about the size of a small pea, before de-leafing.

Watering

Tomatoes are vigorous growers, with an appetite and a thirst to match, so in addition to a regular feeding regime it is essential that a regular and adequate watering regime is also followed. Irregular watering causes the condition known as 'blossom-end rot'. The bottom of the tomato furthest away from the stalk (the distal end) collapses and turns black and rotten. This is not a disease but a condition caused by lack of calcium, which in turn was caused by insufficient and, or irregular watering. The calcium is needed for the formation of calcium pectate which is the 'glue' that sticks plant cells together. A shortage of this and the plant cells collapse. This shortage of calcium is also responsible for a condition known as 'bitter pit' in apples. Additional calcium may be provided by watering the plant with a solution of calcium nitrate or adding some nitro chalk fertiliser to the compost before planting. Soil based composts usually have sufficient

calcium present but peat-based composts, such as those in growbags contain far fewer nutrients. As a guide to the watering needs of a tomato plant, check out the previous day's weather and adjust the water supplied accordingly. For a 3-4ft high plant, if the previous day's weather was hot and sunny then about 2 pints of water per plant will be required. If the weather was dull and cool, then only about one pint of water per plant will be required. But, don't leave out that watering of one pint and think 2 pints the following day will make up for it, as it is the irregular supply of water as well as the shortage of water that brings on the calcium deficiency and the subsequent 'blossom-end rot'.

Stopping & Ripening

Depending upon the height of the greenhouse and whether you are able (and willing) to heat the greenhouse towards the end of the season, then it is usual to 'stop' the plant after about 5 trusses have set. This consists simply of pinching out the top growing point of the plant to prevent further flower trusses being formed. This is usually about the end of August or early September. For tomatoes grown outdoors it is usual to stop them earlier in August, allowing no more than 4 trusses to set. It is warmth rather than light that ripens tomatoes, so ensure that the greenhouse isn't left open at night time towards the end of the season in order to retain the warmth in the greenhouse for as long as possible. When picking tomatoes break the tomato off from the truss at the 'knuckle' situated about 1/2" from the calyx so that the calyx is left on the tomato. This is a 'must' if tomatoes are to be exhibited in a show.

Tomatoes that aren't fully ripe will ripen on a warm window sill indoors or can be ripened by placing in a fruit bowl with other fruit, particularly bananas. This is because ripening fruit gives off ethylene gas during the ripening process and it is this which will hasten the ripening process of tomatoes. Never put tomatoes in the refrigerator; tomatoes should be kept above 10deg C (most refrigerators are at 5 deg C) Below 10 deg C the flavour of tomatoes is spoiled, giving that acid metallic taste. When buying tomatoes it is better to do so twice a week and keep them at room temperature than buy just once a week and keep them in the fridge to last longer. In any event most tomatoes when bought are still not fully ripe, so are best kept for a couple of days in the fruit bowl at room temperature to ripen and develop their full sweet flavour.

Finally, there is occasionally a phenomenon which occurs that might alarm the first-time grower. After a hot sunny day followed by a cool evening the leaves of tomatoes may be seen to be dripping water. This is because during the day the plant is pumping water up the stem and is transpiring actively through the stomata on the underside of the leaves. These stomata close up as the light levels fall and darkness arrives, so the water vapour that would normally pass through them cannot escape. Meanwhile there is a time lag while the plant is still pumping water up from the roots, but it cannot escape through the stomata. This causes a build up of pressure within the leaf, and as the temperature is cool the water cannot vaporise. To relieve this pressure, the leaf leaks water through special cells at the leaf tips (a sort of gland). This process is called 'guttation' and is perfectly natural and normal and no cause for alarm.

Make your Own Growbags

Prepare the growbag from 800 gauge polythene sheeting, so that it forms a tube approximately 42-48" (105-122cm) long by 15" (38cm) diameter when empty. Polythene which is white on one side and black on the other can be purchased for the purpose. The black side forms the inside of the tube, as black on the outside may absorb too much heat. A stapler can be used to fasten the edges and ends. This will hold about a bushel* of compost.

To every 4 bushels (144litres) of coarsely milled peat thoroughly mix in the following:

- 1.5lb (680g) Magnesian Limestone
- 2 oz. (57g) Ureaform or Nitroform
- 4 oz. (114g) Nitrate of Potash
- 8 oz. (227g) Single Superphosphate of Lime
- 2 oz. (57g) Sulphate of Potash
- 2 oz. (57g) Fritted Trace Elements

This will make a potash-rich compost for growing tomatoes and other fruiting plants. After 5-6 weeks from initial planting give a weak liquid feed of soluble tomato fertiliser every time watered, or as directed by the manufacturer's instructions if using a proprietary feed.

Staple the seam lengthways and staple closed one end, then fill with compost before closing the other end. Place seam side down in growing position before cutting out planting holes; the seam shouldn't be watertight as it is needed to provide some drainage. If the growbag still doesn't drain sufficiently then make a series of holes along the lower part of the sides.

*A bushel is an old volumetric measurement. It is the volume contained by a box of internal dimensions 22"x10"x10" or 2200 cubic inches. This is equivalent to approximately 8 Imperial gallons or 36 litres.