

Protected Crop Growing

A GUIDE FOR HOME
AND MARKET GARDENERS



AGRICULTURE AND FOOD DEVELOPMENT AUTHORITY

A Short Guide for Edible Protected Crop Production

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Introduction

There is no better feeling than eating something you have grown yourself. This is especially true for crops like tomatoes which require constant care to get them from seed to plate. There can be a great feeling of accomplishment. This guide is designed to give people the confidence to have a go at growing themselves. If you only have a sunny window you can try mixed leaves or strawberries in a pot. If you have a greenhouse we hope we can answer some of your questions or encourage you to try a few plants of something new this summer.

The best advice is to grow what you like to eat and if you are a beginner, it is sometimes best to start small and build as you go – And always remember to enjoy yourself!

Tomatoes



Tomatoes are tender perennial plants which are treated as annuals and cropped in one season after which the plants are discarded or killed off by frost.

A great range of tomato fruit types are now available from seed suppliers with fruits ranging from Cherry, Plum, to over-sized Beefsteak cultivars. They come in many shapes from traditional round, to oblong or elongated and the colour range includes red, yellow and purple. Seed catalogues list many varieties from the traditional Heirloom cultivars to the modern F1 Hybrid Cultivars. F1 hybrids tend to be heavier croppers and have stronger disease resistance.

Grown from seeds in a propagator, or from plants purchased in the garden centre, different types of tomato suit different methods of use. Cooked or raw, chopped or sliced, whole or halved, the selection of available types in the garden greenhouse will give a great variety of options to try.

Types of plant

Tomato plants are grown as either: Vine (indeterminate) plants or Bush (determinate) plants. It is important to know which type you have as the method of supporting the plants is different.

Vine plants are produced on a single stem with all side-shoots removed and supported by twisting the new growth clockwise around a string (tied at the base of the plant and secured on a strong overhead wire). This keeps the fruit clean and the plant off the ground where it would otherwise lie on the soil surface. Fruits develop on trusses that grow at intervals on the main stem. Vine plants are more suited to indoor production.

Bush plants are not trained and all shoots are allowed to grow. Flowers appear at the end of each stem and develop in to fruits. They are generally shorter season plants and are often used outdoors in the ground or in containers or baskets where they are allowed to trail over the edge. In the Irish climate, tomatoes will generally require some form of protection, such as a greenhouse or polythene tunnel or cloche to produce successful crops. If cropping outside consider planting bush types in containers or hanging baskets in a bright sheltered corner. If planting directly into the soil it may be best to plant through black plastic mulch.

Site and soil

Outdoors:

To avoid a build-up of soil borne disease, fresh soil is recommended in each new season. Any fertile, well-drained soil is suitable, if plenty of organic matter has been incorporated in the top 30cm. If necessary, before planting add a general-purpose fertiliser at a rate of 100g per sq m or pelleted poultry manure at 150g per sq m. Consider using a cloche to protect small plants early in the season. Try not to plant your tomatoes in the same area as potatoes as they are from the same family and are prone to similar diseases.

In Greenhouse:

If growing in the border soil, old soil will need to be replaced at the beginning of each new crop to avoid build up of soil borne diseases. Tomatoes grow best in high organic matter soils, so digging some good compost into the soil before hand would be beneficial. In general tomato plants are Phosphorus hungry, especially at the start. The ph of your soil

should be between within the range from 6.5 to 7 for best growth. At a pH below 5.5, plant growth will be affected.

Growing in containers, in good quality compost or in specially produced grow bags will cut out the chore of moving soil. Three plants per standard grow bag would be suitable. The compost in the grow-bags will contain enough nutrients to carry the crop for 2 - 3 weeks after planting but will need continuous liquid feeding to top up levels as the plant grows and develops fruit. The pH of the growing medium will already be adjusted so no extra lime will be needed (Use Tomato feed mixes according to manufacturers directions).

Getting Started

Do not be tempted to sow seeds too early in the year. Poor light conditions will lead to weak seedlings and spindly growth and your plants may be ready to plant before weather conditions are suitable. Sowing in early April will give you a plant ready to plant out in late May. Loosely fill a 10cm pot with fine 'seed and potting' compost. Slightly firm the compost to 1 cm below lip of the pot. Water up carefully with clean water using a fine rose on the watering can. Sprinkle about 10 seeds per pot onto the moist compost surface. Cover lightly with a layer of fine compost and water in with a fine rose to avoid disturbing the seeds. Warm conditions (15-25°C) are needed for germination. Use a heated propagator for best results. The enclosed atmosphere will maintain a high humidity during germination. When seedlings emerge, transfer to a bright greenhouse or sunny windowsill. After germination, seedlings should be grown on at 21-24°C. When the seedlings are large enough to handle, prick out into individual 10cm pots. When handling the seedling, hold plant by the seed-leaf not by the stem. This avoids damage to the stem which could result in loss of the plant. Feed with **balanced liquid fertilizer** (according to manufacturer's directions) after 2-3 weeks or if growth appears discoloured.

Purchasing Plants

Where a small number of plants from a range of varieties are required, purchasing plants from the garden centre or garden shop is an option. Select healthy plants that are not wilting and are free of disease. Check around the plant and the underside of the leaves for signs of pests. Choose varieties and the number of plants required for space available in the garden or greenhouse.

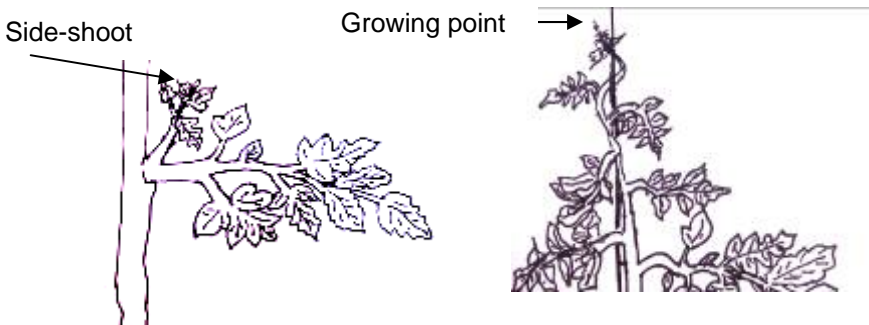
Planting

Plant out, into grow-bags or soil, after roots have filled the pot, the first flower buds appear and any frost is finished. Remove the pot and plant deep enough to support the plant allowing the soil or compost to cover a few inches of the stem above original compost level. For bush plants in containers or baskets, use a good quality potting compost, plant up indoors and grow on there for a couple of weeks before placing outdoors in a sheltered spot near a south-facing wall. Allow the plants to 'harden off' by placing them outside during the day and protecting them indoors on cold nights. Place outside when plants have toughened up. Tumbling cherry varieties perform well and give lots of small sweet fruit if regular feeding with a 'high potash' tomato feed takes place (according to manufacturers' instructions). Large pots in a sheltered spot planted up with dwarf bush types and fresh sweet basil are a great combination.

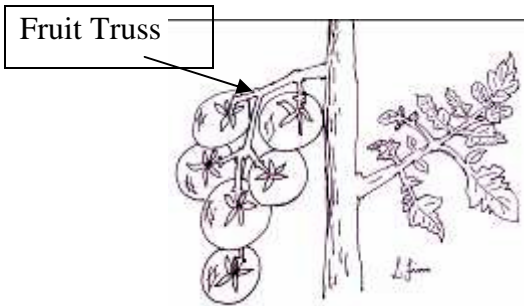
Growing-on

Outdoor: Bush tomatoes: cover with fleece or cloches, and support if needed.

Indoor: Train vine tomatoes, twisting clockwise around support string (or strong bamboo cane) removing side-shoots which develop in the axils between the leaves and the main stem. Rub out the side-shoots with your thumb while they are still small. Be careful not to rub out the growing tip as it needs to continue to grow to produce the main stem.



Flower/Fruit trusses appear on the main stem but not in the leaf axils. No more than 6-8 trusses can be relied upon to ripen in short cold greenhouse season before autumn frosts, so when enough trusses have set fruit, pinch out the terminal shoot, leaving two leaves above the final truss.



Ventilate the greenhouse well during the day in warm weather to cool the crop. Good ventilation is also important to assist in reducing the humidity inside, which can create conditions suited to diseases like botrytis (See note below). If you decide to remove old leaves it is advisable to do this early in the day so the wound has time to heal and dry before nightfall. This can help reduce the risk of botrytis infection.

Watering and feeding

Water all types well every day, especially container plants, including a **high Potash liquid fertiliser** (mix according to manufacturers' directions) to top up nutrient levels. Tomatoes benefit from high levels of Potash, which encourages good fruit formation and enhances flavour and colour. Irregular watering can lead to Blossom-end-rot or cracking of the ripening fruit (See notes under 'Pests, Diseases and Disorders'). Watering is the most common cause of nutrient disorders. Under watering can mean that salts are not flushed out and the salinity of the growing media increases, reducing the availability of some nutrients. Over watering results in the leaching of nutrients and poor aeration.

Harvesting

Leaving fruits to ripen on the vine, will allow them to develop full colour and flavour. At the end of the season, pick remaining green fruits and leave them in a warm place to ripen or use extra green fruit to make chutney.

Sweet Peppers



Sweet peppers are tender plants which will require protection of a glasshouse or tunnel to produce successful crops in the Irish climate. In very mild areas it may be possible to get some small fruit maturing later in the summer if grown in containers in a bright sheltered spot in the garden.

Sweet peppers are available in a range of varieties. Shapes range from the traditional Bell, to the long tapered fruits. Sweet peppers are usually green and then mature to red, yellow, orange or purple depending on variety.

Sowing seeds

As for tomatoes but maintain temperatures in the range from 21 to 25 °C.

Where a small number of plants from a range of varieties are required, purchasing plants from the garden centre or garden shop is an option. Select healthy plants that are not wilting and are free of disease. Check around the plant and the underside of the leaves for signs of pests. Choose varieties and the number of plants required for space available in the greenhouse.

In The Greenhouse

Soil as for tomatoes or in containers / grow-bags

Planting

Plant out, into grow-bags or containers, in the greenhouse after roots have filled the pot. Remove the pot and plant at the same level as the compost in the starter pot.

Growing-on/ training

A 90cm cane will be sufficient support as pepper plants grown in unheated greenhouses will required little training and may be allowed to develop as a bush reaching 60 – 80cm in the growing season.

Liquid Feeding

Sweet peppers are not as hungry as Tomatoes and will not require as much feeding to maintain nutrient levels. A high potash feed will encourage fruit development and intensify flavour and colour. Feed at about half the strength of feed one would use for tomatoes or limit feeding to once per week (Use Tomato feed mixes according to manufacturers directions).

Fruit-set

The first flower or 'King fruit' must be removed as it will take too much energy from the plant before it puts on sufficient vegetative growth. Remove any deformed young fruits to help maintain plant vigor. A strong sturdy plant will produce better quality fruit. Reducing the number of fruits will encourage larger, fleshier fruits to develop. High temperatures will stimulate vegetative growth and temperatures below 12° C will result in poor fruit set and misshapen fruit. Some form of heating may be required during spells of dull cold weather. In prolonged periods of very strong sunshine high temperatures above 35°C in the greenhouse will interfere with fruit-set. Shading and good ventilation can help.

Harvesting

Start picking fruit when they are green and the skin is smooth and shiny. Allowing fruit to ripen-up to red, yellow, orange or purple will slow down development of new fruit. Grow some plants to allow the fruit to mature and keep picking green fruits from other plants to ensure a continuous supply over the summer. Cut the fruit from the plant using a knife or secateurs to leave a clean wound. Do not tear the fruit from the plant as it will cause damage which leaves the plant exposed to disease.

Chili Peppers



Chili peppers are tender plants which will require protection of a glasshouse or polythene tunnel to produce successful crops in the Irish climate. In very mild areas it may be possible to get some fruit maturing later in the summer if grown in containers in a bright sheltered spot in the garden.

Chili peppers are available in a range of sizes, colour and strength of hot flavour depending on variety.

Sowing seeds

As for tomatoes but maintain temperatures in the range from 21 to 25 °C. Where a small number of plants from a range of varieties are required, purchasing plants from the garden centre or garden shop is an option. Check that plants are disease and pest free.

Planting

Plant out, into grow-bags or containers, in the greenhouse after roots have filled the pot. Remove the pot and plant at the same level as the compost in the starter pot.

Growing-on/ training

A 90cm cane will be sufficient support as chilli plants grown in unheated greenhouses will require little support, tying in to the cane for extra support.

Liquid Feeding

Chilli peppers are not as hungry as Tomatoes and will not require as much feeding to maintain nutrient levels. A high potash feed will encourage fruit development and intensify flavour and colour. Feed at about half the strength of feed one would use for tomatoes or limit feeding to once per week (Use Tomato feed mixes according to manufacturers directions).

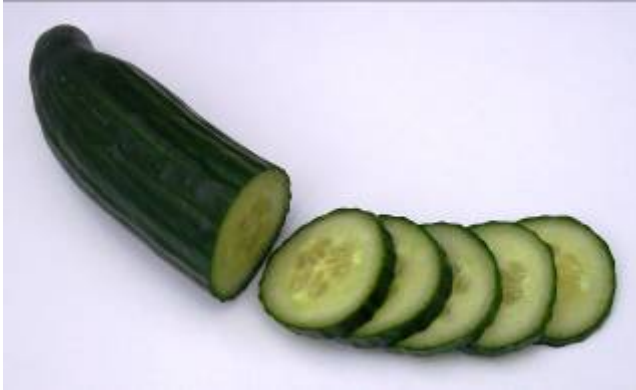
Fruit-set

A strong sturdy plant will produce better quality fruit. Reducing the number of fruits will encourage larger, fleshier fruits to develop. High temperatures will stimulate vegetative growth. Temperatures below 12° C will result in poor fruit set and misshapen fruit. Some form of heating may be required during spells of dull cold weather. In prolonged periods of very strong sunshine high temperatures above 35°C in the greenhouse will interfere with fruit-set. Shading and good ventilation can help. These plants require high light levels to produce fruits with intense flavours.

Harvesting

The fruits are generally smaller than the related sweet peppers. Start picking fruit when they are green and the skin is smooth and shiny. Allow some fruits to mature and turn red. Cut the fruit from the plant using a knife or secateurs to leave a clean wound. Do not tear the fruit from the plant as it will cause damage which leaves the plant exposed to disease.

Cucumbers



Cucumbers are available in a number of different types but the two most commonly grown in Ireland are the Glasshouse grown - slicing cucumber (English Cucumber) and the outdoor grown - ridge cucumber.

There used to be a difficulty with older varieties of glasshouse grown cucumbers in that if they were pollinated and set seeds, they became very bitter and were not pleasant to eat. To get over this problem the male flowers had to be removed by hand before pollination took place. The female flowers are identified by the swelling at the base of the flower which develops into the fruit. This swelling is not present in the male flower.

Newer hybrids are now available in which the flowers are all female and so the plants will not set seed and the taste of the fruit formed will be pleasant. The fruit on these plants are smooth skinned and they will not require peeling. Glasshouse F1 Hybrids are grown as vine plants and must be trained up a string attached to an overhead crop wire to support the plant and allows the fruit to hang down and grow straight.

Outdoor ridge Varieties can be allowed to trail along the ground. They produce both male and female flowers. The female flowers must be pollinated by pollen from the male flowers for cucumbers to develop. This will happen naturally, outdoors, with the help of insects. Do not remove any

flowers from ridge cucumbers. If the plants are grown under the protection of a cloche or frame these must be opened up during the day to allow insects have access to the flowers.

The plants are grown on a mounded ridge to help avoid waterlogged conditions which would tend to encourage root rots. Space required per plant will be about 2.5 m².

Site and soil

Outdoors

As for tomatoes

In Greenhouse

As for tomatoes in border soil or in containers / grow bags.

Sowing seeds

Sowing in early April will give you a plant ready to plant out in late May. Loosely fill a 10cm pot with fine 'seed and potting' compost. Slightly firm the compost to 1 cm below lip of the pot. Water up carefully with clean water using a fine rose on the watering can. Make a hole in the compost and drop in one seed per pot about 1.5cm deep and cover with compost and water in with a fine rose to avoid disturbing the seeds. Warm conditions (20-25°C) are needed for germination and seedlings should emerge within 8 – 10 days. Use a heated propagator for best results. The enclosed atmosphere will maintain a high humidity during germination. When seedlings emerge, transfer to a bright greenhouse or sunny windowsill. After germination, seedlings should be grown on at 20-24°C. Feed with balanced liquid fertilizer (according to manufacturer's directions) after 2-3 weeks or if growth appears discoloured.

Store Bought Plants

Where a small number of plants are required, purchasing plants from the garden centre or garden shop is an option. Select healthy plants that are not wilting and are free from disease. Check around the plant and the underside of the leaves for signs of pests.

Planting

Outdoors: Only use varieties suitable for outdoor conditions. Firstly ensure the plants have been acclimatised to outside conditions by hardening off plants from the warm indoor atmosphere, placing them outside during the

day and protecting at night until they have toughened up and will be able to withstand the colder outside temperatures.

Indoors: Use suitable indoor varieties. Plant out into grow-bags (2 plants per bag) or into soil, after roots have filled the pot. Remove the pot and plant so that the top of the root-ball is about level with the soil or compost.

Watering and feeding

Water plants well every day. Feed with a balanced feed at least once per week. Good levels of nitrogen and potash will contribute to vigorous plants which will produce many fruit. (Use fertiliser according to manufacturer's guidelines).

Training

Ridge/outdoor types can be left to trail on the ground or trained over a trellis. These plants can produce too much leaf at the expense of fruit so when the plant has produced 5 or 6 sets of leaves on the main stem pinch out the growing tip. This will encourage side shoots and therefore fruit. Train the side shoots over the ground or up a trellis

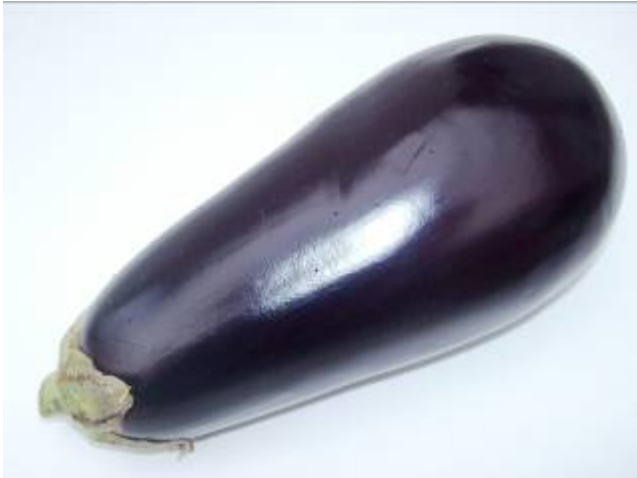
Indoor vine plants

Training/Pruning: To allow a strong root system to develop remove all side branches, flowers and tendrils on the first 100cm of the plant twisting the main stem clockwise around the support string. Pinch out any subsequent lateral shoots at the first leaf. Remove the growing point of the main stem when a couple of leaves have developed above the overhead crop wire. Two side branches near the top of the plant are allowed to grow downward. The growing point of each lateral is removed when about 30cm from the ground. Fruits develop at the node of each leaf. The main stem is generally more productive than the two lateral shoots. Plants may set more than one fruit per node but these should be thinned to one to ensure better quality.

Harvesting

Cucumbers are ready to harvest when they are green, shiny and cylindrical in shape. If they are still pointed and not filled out at the end they are not quite ready. Fruit should be used fresh, for best flavor. Store in the chilling cabinet in the fridge

Aubergines



Aubergines (Eggplants) are tender plants from the tropics which are best suited to production in a greenhouse in the Irish climate. F1 hybrid black varieties are most commonly grown but these egg shaped fruits are also available in Yellow, white or purple. In the greenhouse these plants perform well if grown in conjunction with tomatoes.

Sowing seeds:

As for tomatoes but maintain temperatures in the range from 21 to 25 °C.

Where a small number of plants from a range of varieties are required, purchasing plants from the garden centre or garden shop is an option. Select healthy plants that are not wilting and are free of disease. Check around the plant and the underside of the leaves for signs of pests. Choose varieties and the number of plants required for space available in the greenhouse.

Where a small number of plants are required, purchasing plants from the garden centre or garden shop is an option. Select healthy plants that are not wilting and are free of disease. Check around the plant and the underside of the leaves for signs of pests. Choose varieties and the number of plants required for space available in the greenhouse.

Planting

Plant out into grow-bags or soil, after roots have filled the pot, the first flower buds appear and any frost is finished. Remove the pot and plant deep enough to support the plant allowing the soil or compost to cover a few inches of the stem above original compost level.

Growing-on A bushy easy to manage plant will be achieved by pinching out the growing tip when the plants are about 20cm high. Even though these plants will not produce very tall growth, support the plants on a string as you would for tomatoes or tie in to a strong cane. A second pinch may be useful when the new growth reaches 40cm. This type of plant will produce many small fruits unless fruits are thinned to 1 or 2 per stem.

Watering and feeding

Water plants well every day, include a high Potash liquid fertiliser (mix according to manufacturers' directions) once per week to top up available nutrient levels. Aubergines benefit from high levels of Potash, which encourages good fruit formation and enhances flavour but because the plants are slower growing than tomatoes they will require less overall feed. Apply weaker feed solutions or feed less often. Irregular watering can lead to Blossom-end-rot. This crop has a tendency to attract a lot of Aphids. If growing Aubergines inspect regularly for aphids (Greenfly) and treat when populations are low.

Harvesting: Fruits are ready when they develop their full colour but harvest before this colour starts to fade and the flesh becomes pithy. Cut cleanly from the plant using a sharp knife or secateurs leaving about 2cm of the stalk on the fruit. Fruit will last for up to 2 weeks in the chilling cabinet of the refrigerator

Growing mixed salad leaves



Mixed leaves

It is possible to grow mixed leaves for use in salads containing blends of Red, Cos, Batavia and Oak Leaf types. The seeds are available in pre-mixed packets so choose the mix you like to use. Don't forget to include some Chard and Rocket in your sowings for better flavour mix. For early season, sow in pots or trays and later in the season sow in rows in garden soil. These salad leaves are suitable for 'Cut and come again' production. You need only cut what you require fresh, on the day you use them.

Oriental mixes containing mustard leaves are good for autumn sowing in the greenhouse and can be harvested right through the winter.

Early season sowings

Fill some 12cm pots with a standard seed and potting mix and firm to 1cm below the top of the pot and water up with watering can fitted with a fine rose. Sprinkle 8 to 10 seeds over the surface of the pot and cover lightly with compost and water up again. Place in warm greenhouse or on a window sill indoors where germination will take place within days. Keep

evenly watered and allow seedlings to grow on until the mix develops true leaves and is ready for the first cut (3 – 4 weeks). Clip with a scissors about 2.5cm above soil level. This will allow the plants to produce more leaves for later harvests.

Main season sowings

Sowing can also be made in the greenhouse soil or in beds outside in the garden when soil temperatures have warmed up, from April to August.

Sprinkle about 50g pelleted poultry manure per m² onto soil and till and lightly rake the soil. Scribe a line into which you sow about 30 seeds per metre run. Lightly cover with compost or soil and water in. Keep evenly watered for best results.

Take first cut when leaves are large enough. It will be possible to take 3 or more cuts from each batch. For continuous cropping sow batches at 3 week intervals.

Pests

The main pests to watch out for are **Aphids** (greenfly and black-fly). Use soft soap or mixtures containing organic fatty acids to reduce the pest.

If **slugs** are a problem in the garden biological control can be achieved using the organic eelworm which parasitizes the slugs in the soil.

Growing lettuce

Lettuce is a cool temperature crop but can be grown all year round in the greenhouse if you choose the correct varieties. Always check the correct sowing time on the packet to ensure success. Some varieties do better in winter and will bolt (go to seed) if sown in the summer and vice-versa. If selecting lettuce for planting between September and late February select a short day variety, for planting from March to August select a long day variety.

There are many different types of lettuce available and suited to different uses. Available types include Lolla Rossa, Oak leaf, Cos, Butterhead and Loose-leaf.

Sowing

Seeds can be sown in cell trays and they can be transplanted into their final position. Sow indoors in the cooler times of the year and outdoors if weather is very hot in the height of summer. Fill cells evenly with good quality seed and potting compost. Sow one seed per cell and very lightly

cover. If using pelleted seeds dib a hole in each cell about 0.5cm deep and drop the pellet in and water well to enable the seed coat to split or break down. Covering is not essential. Keep evenly watered, germination will take place in 4 -5 days. If temperatures rise above 20 degrees move seed trays to a cooler spot.

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Soil preparation

Dig over the soil removing any perennial weed roots and incorporate well rotted compost well in advance of planting. Incorporate 80 - 100 g of pelleted poultry manure or 50 – 60 grams of general garden fertiliser into the soil and rake to provide even bed.

Planting out

Transplant into final position when the seedlings have developed 4-5 true leaves and the roots have grown through the compost. Plant lettuce plants shallowly on the bed surface in rows 20 – 25 cm apart and space 20cm apart in the row. Keep evenly watered. Do not plant lettuce plants deeply as this can cause some rot diseases.

Strawberries

Strawberries can be grown in 2 ways, in the ground or in pots. If planting directly into soil, its best to add bulky organic compost at an approximate rate of 5Kg per m². The pH of the soil should be approx 5.7 -5.9. If you are planting strawberries where tomatoes have previously been grown it may be necessary to flood the area before planting to wash out excessive salts.

Strawberry plants are readily available from garden centers. When planting strawberries be careful to keep the crowns at soil level, not below it. If planting in the soil it may be preferable to lay plastic so the developing fruit is not in contact with the soil. If growing in grown bags and pots it may not be necessary. However try to avoid situations where fruit is lying on wet surfaces as this will cause diseased fruit.

Growing-on/ training

If you are growing plants to produce fruit only, pick off 'runners' as they emerge. Similarly if you are producing runners, pick off flower stems as they emerge. Runners can be cut away for plant propogation once they have formed callus's and roots have begun to grow. They can then be pinned into small pots to allow the root system to develop. The primary and secondary (closest and second closest plants to the mother plant) will produce the best plants.

Liquid Feeding

For good yields feed approximately every 2 weeks. In commercial/ semi commercial systems feeding will be more regular.

Fruit-set

As the flowers develop it may be necessary to open up vents and doorways to allow bees in to pollinate the crop. Otherwise you will get misshapen fruit. In commercial enterprises it will be necessary to introduce artificial hives of bumble bees to ensure fruit quality.

Harvesting

Harvest fruit when the shoulders of the fruit are red. Pinch the stem above the calyx to avoid damaging the fruit while picking.

Pests, Diseases and Disorders

Pests

Whitefly

Seen frequently in glasshouse grown crops, tiny white moth-like insects lay their eggs on the underside of leaves which hatch and develop into larvae which suck sap and can also transmit viral diseases. Feeding larvae also secrete 'honeydew' which attracts nuisance insects like wasps and can lead to the development of sooty moulds. Strict hygiene can keep your greenhouse free of this pest. Completely clean down and remove any plant debris from previous crops during the winter season, including any and all weeds. Thoroughly inspect any plant material brought into the glasshouse paying particular attention to the undersides of leaves. Spraying with soap solution may make life difficult for this pest. If the pest becomes a major problem your local garden centre or garden shop may have some specific control products available. (Follow manufacturers' directions and safety instructions)

Biological option – You can now purchase a predatory wasp, *Encarsia formosa*, from garden centres or over the internet. This wasp lays its eggs in whitefly eggs, thus reducing the numbers of emerging whitefly. You can also use sprays based on organic fatty acids and vegetable oils. They work by smothering the insect. Sticky traps will also help to keep populations low.

Companion Planting – There is some evidence that planting marigold plants at the base of tomatoes can help reduce whitefly infestation of tomato plants.

Aphids

Green, Black, Red, woolly or waxy, these sap sucking insects feed on the young growth and under leaves causing distortion and weakening the plants. Aphids can also carry virus diseases. Soap solutions can upset the insects' ability to cling to plant. If the pest becomes a major problem your local garden centre or garden shop may have some specific control

products available. (Follow manufacturers' directions and safety instructions)

Biological option – You can now purchase a parasitic wasp, *Aphidius*, which uses its ovipositor to lay eggs within immature aphids. Ladybirds, particularly their larvae are significant predators of Aphids. Lacewings are also effective in controlling aphids.

Companion Planting – Hoverflies also feed on aphids. To attract them towards your crop plant flowers such as dill, fennel, daises, cornflowers and buckwheat.

Red Spider Mites

These tiny mites, present on the undersides of the leaves, are difficult to spot and may first be seen when the sucking damage they cause shows up on the upper surface of the leaves as yellow speckling. They will weaken the plant by sucking the sap and when present in large population mature mites will create webbing. Good hygiene can keep your greenhouse free of this pest. Completely clean down and remove any plant debris from previous crops during the winter season. Thoroughly inspect any plant material brought into the glasshouse paying particular attention to the undersides of leaves. If the pest becomes a major problem your local garden centre or garden shop may have some specific control products available. (Follow manufacturers' directions and safety instructions). If you have had a problem with Spider mite during the summer make sure to clean down the house thoroughly as this pest likes to over winter in greenhouses.

Biological option – A numbers of predatory mites, *Phytoseiulus spp.* or *Amybecelius spp* are now available and are excellent at controlling RSM populations as long as they are added before the pest population becomes too high. If the pest population is high before adding the predatory mites, treat with a fatty acid oil before introducing the predatory mites.

Sciarid Flies

These small black flies occur frequently when using peat and greenwaste composts. Their larval stage, small clear bodied larvae with shiny black heads feed on fungi in the growing media and will tunnel into the base of the stem of weaker seedlings. The adults can be an annoyance in the greenhouse, but also they can spread disease on their legs around the

house. Their presence can be an indication of over-watering. Sticky traps can help keep the adult numbers down (Yellow Traps).

Biological option – A predatory mite, *Hypoaspis miles* is now available and eats the larvae. It is best to apply this mite on the surface on the growing media rather than in the plant canopy. You can also use a nematode, *Steinernema feltiae* which again attacks the larval stage.

Diseases

Many diseases are spread by water, be that from rain or watering the crop. Careful watering can help reduce diseases spreading. Most diseases also favor humid conditions so try and maintain a good airflow through your crop. A number of the more common diseases encountered under Irish conditions are listed below.

Botrytis (Grey mould)

A furry grey mould which will invade the plant where wounds occur. A humid atmosphere encourages botrytis to develop so good ventilation is important to create air movement and keep foliage dry. High humidity will encourage spores of the disease to develop on the ripening fruits causing 'Ghost Spot' on Tomatoes. Lettuce crops can suffer from this disease, usually in the Spring and early Autumn. Water plants early in the day, to avoid build up of humidity at night-time. If this disease becomes a major problem your local garden centre or garden shop may have some specific control products available. (Follow manufacturers' directions and safety instructions)

Tomato Blight

Tomatoes are in the same family as potatoes and can be affected by the same blight disease. Blight is a bigger problem on older heirloom varieties than on the newer F1 Hybrids. Control humidity in the greenhouse. Practice good hygiene and use a clean water source. Destroy all debris from previous crops. Blight is more likely to be a problem on outdoor tomato crops. To protect the crop, your local garden centre or garden shop may have some specific control products available. (Follow manufacturers' directions and safety instructions)

Damping-off (Rhizoctonia, Phytophthora, Pythium.)

Root rots are a common cause of seedling loss with blackening of roots or stems. Avoid over-watering and ensure soil or growing medium is free draining. Use fresh soil each year to avoid carry-over of these diseases.

Powdery Mildew

Powdery mildew is common on glasshouse crops, especially cucumbers and strawberries. It will appear as a white fluffy growth on the upper surface of leaves. If noticed early remove infected leaves and try to reduce the airflow through the house to prevent its spread. To protect the crop, your local garden centre or garden shop may have some specific control products available. (Follow manufacturers' directions and safety instructions).

Blossom-end-rot

Not technically a disease but a very common problem for home growers. Calcium is required for normal cell growth. When fruit is growing rapidly it may be deprived of calcium when there is a shortage of calcium in the soil, if there is too little moisture available or when plants are waterlogged at the root. If plants are short of calcium a lesion can form at the blossom end of the fruit and as the fruit develops this lesion becomes an enlarged brown rot. This problem can generally be avoided by regular even watering.

Nutrient Deficiencies

The visual symptoms of nutrient deficiencies in tomato and other crops can be similar and confusing. We have tried here to provide you with a list of tell tale signs to look out for

Nitrogen Deficiency

In Tomatoes leaves turn pale green and growth is stunted. Lower leaves become yellow and areas of purple pigmentation will develop. Peppers will have similar symptoms but usually without the purple colouring. With Cucumbers new leaves are smaller than expected and yellow green. In lettuce plants the outer leaves will turn a yellow green colour.

Phosphorus Deficiency

Growth is poor in Tomatoes and the underside of the new (younger) leaves will start to turn purple or a blue/green colour. However with some varieties the purpling of the stalk of the leaf (petiole) is a trait of the variety. If the deficiency is severe then the upper and lower surface of the leaves will turn purple. If the plant has been exposed to low temperatures it may display similar symptoms. New leaves in Cucumbers will be smaller than expected, but still green in colour. Peppers will keep their green leaf colour but again new leaves will be smaller than expected. In winter grown lettuce, Phosphorus deficiency will result in small stunted plants. In fast growing summer varieties outer leaves can turn yellow and you may notice a browning in the interveinal areas of the leaves and at the leaf edge.

Potassium Deficiency

Potassium is critical for good quality fruit in Tomatoes, Peppers, Cucumbers and Strawberries. The first indication of deficiency is when the edges of the upper leaves begin to turn yellow eventually brown. If there is fruit on the plant you may notice it ripening unevenly, although there are other factors which cause uneven ripening. In Lettuce you may notice the outer leaves turning brown, but reduced plant growth may not be obvious.

Calcium Deficiency

The most obvious sign of calcium deficiency is blossom end rot, a large leathery spot which develops on the bottom of the fruit. Calcium deficiency can also be identified by a browning of the leaves at the base of the leaflets. In some varieties the tips of the leaves turn yellow before any

browning occurs. Blossom end rot can be identified in maturing fruits and if evident you should remove the fruit as it will be inedible. In Lettuce growth will be stunted and you may notice small black/brown spots on the plant.

Magnesium Deficiency

Magnesium deficiency is very common in tomatoes as a result of the large amount of potassium needed for good fruit quality. The areas in the leaf, between the veins will turn yellow, while the veins and leaf edges remain green. This will originate in the middle and bottom of the plant working its way upwards. These symptoms are similar for Peppers and Cucumbers. If

Herb Growing

Plant	Propagation	Where to grow on	Nutrition	Harvest And uses
<p>Sweet Basil A tender annual needing some protection from frost and cold winds</p>	<p>Sow 5 -6 seeds, indoors, in a 13cm pot in good quality potting compost. Do not cover seeds. Keep warm and well watered. Repeat sowings for continuity.</p>	<p>Best indoors, on a window-sill or in a greenhouse in soil or quality compost in a larger pot. Outdoors in container during the Summer in a very sheltered spot when all risk of frost has passed. Protect from slugs and snails</p>	<p>Occasional feeding will encourage leaf development and keep plant active. Use good quality compost or incorporate compost into soil</p>	<p>Pinch out and use young shoots early to encourage bushy plant. Tear up the leaves and add to dishes when serving. Cooking spoils flavour. Perfect with tomatoes. Freezing is the best way to preserve basil.</p>
<p>French Tarragon (Has a more subtle delicate flavour than Russian tarragon) A half hardy perennial it needs protection from frost</p>	<p>Not grown from seed. Divide clumps as growth begins in spring or use 10 – 12cm cuttings, cut below a node and strip lower leaves insert in pot of compost and cover with polythene bag. Keep warm bright place but protect from strong Sunlight.</p>	<p>Protect from frost. Plant out in soil rich in organic matter. Will tolerate some shade in a warm position in the garden. Can also be planted in containers and kept under protection in winter. Foliage dies down over the winter.</p>	<p>Occasional feeding will encourage leaf development and keep plant active. Use good quality compost or incorporate compost into soil.</p>	<p>Harvest leaves as required and will continue to produce leaves up to September. Excess leaves can be dried but flavour is best preserved by freezing in ice cube blocks. Use in soups and sauces and is great with chicken</p>

<p>Coriander Leaf An annual plant grown for its leaves but can also be allowed to flower and develops seed for your spice collection</p>	<p>Choose a good leaf producing variety. Sow 5-6 seeds in a pot and cover lightly with compost indoors early in the season or sow direct in the soil about 1-2cm deep after risk of frost has passed. Use successive sowings, 2 – 3 weeks apart, to give a continuous supply of leaves</p>	<p>Early sowings in pots can be potted on into larger pot inside. Try not to disturb the roots Later sowings are made in the soil or in the containers where plants are to grow on in the garden.</p>	<p>Once established the plants need little attention. A couple of weak feeds will keep leaf growth active.</p>	<p>When using the leaves harvest the whole plant as they will otherwise quickly flower and produce seed heads. Excess leaves can be frozen in ice cubes and later added to Asian dishes. Seed heads if allowed to develop will be useful in spice mixes warmed on a dry pan and ground for use in Asian cooking.</p>
<p>Peppermint A long lasting perennial plant grown for its leaves which are used in seasoning, sauces and for making a refreshing tea</p>	<p>Cannot be grown from seed as it is a hybrid. It is propagated by layering shoots along the ground or by taking tip cuttings in early summer. Place cuttings with 2-4 leaves into quality moistened compost in a pot and covered with a polythene bay to keep humid. Roots develop in about 3 weeks.</p>	<p>Outdoors in a moist but free draining soil rich in organic matter. The plant will tend to spread along the ground and take over large areas of the garden. It is best to use some form of barrier to around the plant to a dept of 15 – 20cm to prevent the plant from taking over. Sink a bottomless bucket into the soil and plant into this.</p>	<p>Applying a well rotted manure or organic fertiliser in the Autumn after harvesting is finished or in the spring before new growth starts is all this vigorous grower will need. Too much nitrogen will encourage rust disease.</p>	<p>Cut as required for seasoning soups, sauces or making teas. Use as a garnish on deserts. To preserve, pick and dry leaves in the shade or to preserve stronger flavour freeze the leaves in water in ice cube trays.</p>

<p>Chives A perennial plant related to onions. The chopped foliage is used as flavouring and is best used fresh.</p>	<p>Sow direct in the soil in the garden, from April onwards, where they are to be grown or in pots under protection earlier in the season if required.</p>	<p>Outdoors, in the ground or in containers. Remove the first flowers to allow plants to develop. Flower stalks are tough and are best removed before flowers open to make harvesting the leaves easier. Flower heads can be used in salads for flavour and decoration.</p>	<p>Organic fertiliser can be applied in the spring and worked into the soil. Avoid fresh manures or garden compost that has not broken down completely. Keep the plants well watered.</p>	<p>Cut as required for use as flavouring, adding to dishes when serving for fresh flavour and as a garnish. Chopped leaves go well with cheeses or soured cream as topping for baked potatoes.</p>
<p>Rosemary An evergreen shrub tolerant of mild frost but may be damaged in a severe winter</p>	<p>Semi-hard cuttings taken from June to August rooted in a moist compost in a pot covered with a polythene bag or sown from seed in pots under glass in the spring. As one plant is usually enough to supply a family a single plant purchased in the local garden centre is all that is needed</p>	<p>Plant out from April onwards in a sunny sheltered spot close to a south facing wall or in a container allowing the plants to be moved under protection in severe weather. A free draining soil with added well rotted garden compost/ manure would be suitable.</p>	<p>Plants need little nutrition other than the addition of a small amount organic fertiliser worked into the soil in the spring.</p>	<p>Harvest the soft tips before they become woody. Cutting back will give an increase in softer shoots to use in the kitchen. Excess shoots can be dried or stores in olive oil in screw tight bottles</p>

<p>Parsley is a biennial plant. Curley leaved is good for flavouring and as a garnish but the Italian flat-leaved is preferred by chefs for its flavour</p>	<p>Sow seeds in pots indoors during March and April. Sow outdoors from late April direct in the soil where the plants are grown. Soaking seeds in hot water can help germination.</p>	<p>Plant out or sow into good rich soil with lots of well rooted compost. Avoid replanting parsley in the same ground season after season as this will result in a build up of disease.</p> <p>Parsley can be grown in the greenhouse over the winter from late summer sowings.</p>	<p>Avoid using fresh animal manure. Incorporate an organic fertiliser into the soil before planting. Top up with a suitable organic fertiliser after a heavy harvest to encourage fresh growth.</p>	<p>Harvest leaves as required during the season. Excess can be stored by chopping and freezing in water in ice cube trays.</p> <p>Can also be oven dried at a cool oven setting.</p>
<p>Thyme</p> <p>An evergreen shrub. Also available as a lemon scented type or as a low growing creeping plant</p>	<p>Sow in the greenhouse or on a window-sill from march onwards. All types can also be grown from soft cuttings in late spring. Cuttings 4cm long with leaves stripped from the lower 1.5cm. Insert into pots of moist compost and cover with a polythene bag to maintain humidity. Roots in 5-6 weeks</p>	<p>Plant out in a dry, sunny and free-draining spot. A couple of plants of each type will give plenty of material for use in the kitchen. Incorporate a small amount of an organic fertiliser into the soil at planting. Plants are sensitive to frost and will need protection in cold weather conditions. Use a sandy compost mix if growing in containers.</p>	<p>Small quantities of organic fertiliser worked into the soil in spring should keep the plants active and top up after a heavy harvest.</p> <p>Plant out new plants if frost damage occurs or if the plants are getting too woody as will happen after 3 – 4 years</p>	<p>Harvest shoots at any time as required. Main harvest in mid summer will require cutting the plants back to about 10cm above the soil to keep plants from getting woody. Excess material can be frozen in ice cube trays or dried.</p>

<p>Sage A grey/green soft sub-shrub with a strong savoury flavour.</p>	<p>Sow seed under glass in March and plant out in May or root cuttings in the summer. As the plants produce foliage in abundance, one or two plants is generally enough per household.</p>	<p>Plant in a warm sunny position in a dry sheltered corner of the garden. Sage is hardy but in severe winters will need some protection around the base of the plant such as using straw and fleece netting.</p>	<p>Incorporate well rotted manure into the soil before planting and top up by working organic manure into the soil each spring.</p>	<p>Pick young leaves from soft shoots as required. In spring it is best to cut the shoots back to 10cm long to encourage fresh soft growth. Excess leaves can be dried in the shade and store in the dark in airtight containers</p>
<p>Fennel Perennial plant used as a fresh seasoning in sauces, vegetables and salads using the leaves. Seeds are used with some fish stocks and in pickling or as flavouring in bread</p>	<p>Sow in pots inside on a window-sill in march or outside from April onwards where the plants are to grow covering with a thin layer of soil. Pots can be planted into their final position in May. They flower in their second year</p>	<p>Choose a position in full sun with good drainage. Dig in plenty of well rotted manure deep into the soil. The plants are large and will need a lot of space. They can reach up to 2m in height and will need to be supported if not well sheltered from wind</p>	<p>This plant benefits from plenty of rich compost dug deep into the soil and will need to be topped up by adding some organic fertiliser worked into the soil in the spring to encourage fresh growth</p>	<p>Harvest the soft leaves as required to add to salads and sauces. The seed-heads should be collected once they turn brown and hung upside down to dry and later shaken onto sheet of paper to remove the seeds. Collect and store seeds in a dry airtight container</p>