

# Crop choice and crop rotations

## Practical Guide



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**Success with horticultural crops depends on you choosing the right crops for your soils and geographical area and changing the plots or beds in which you grow them each year.**

### The right crops for you

Growing crop species and varieties that suit your site and soil means that you are more likely to get reliably good yields of quality crops that suffer from fewer pests and diseases. If you are new to an area or new to growing your own produce, then your gardening neighbours and local growers may be able to tell you what crops grow well locally. Take the time and trouble to learn which crop varieties are likely to do best too. Books which deal specifically with fruit and vegetable growing in Scotland are likely to be useful. Seed catalogues are another good source of information, since they usually provide details about the degree of resistance which different varieties have to a range of named pests and diseases. For example, it is possible to obtain potato varieties with partial or total resistance to blight, and carrots with partial resistance to carrot fly attack. Be very careful to make



sure, when choosing varieties, that flavour remains high up your priority list though. Some modern crop varieties look beautiful and have good resistance to pests and diseases but have very little flavour and have a tendency to produce a uniform stand of produce which all ripens at once, rather than over a period of weeks, which might suit you better. Often the older, more traditional varieties taste best, but in some cases, you may have to accept greater crop losses due to pests and diseases if you want to grow them.

If you wish to maximise income from your holding, you should concentrate on growing the most profitable crops (e.g. leafy salads, heritage variety salad potatoes, carrots, beetroot, sprouting broccoli, courgettes and squash). The crops that will be most profitable for you might differ depending on your site, soil and on competition from other local growers. If you wish to concentrate on feeding just your family, friends and neighbours, then you'll probably enjoy experimenting with a wider range of crop types. In both cases, you'll generally find that you want to grow crops from several plant families, which makes it easier to design a crop rotation.



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## What is crop rotation

Crop rotation is the practice whereby crops from different plant families are grown on different areas on the plot, polytunnel, field, farm or holding each year, so that no single area of land is used to grow the same crop for long (usually not more than one year, although cereals or grass are often grown for several years in a row). Rotation has long been recognised in many civilizations as an important means of helping growers achieve and maintain reliably good yields of quality crops.

## Why bother with crop rotation

Crop rotations bring a number of important benefits to any horticultural crop production unit, regardless of size. They:

- are an effective way to help prevent and control soil-borne pests and diseases;
- provide useful opportunities to prevent and control weeds;
- can help build and enhance soil health;
- exploit soil nutrients at different depths, due to different crops having different types of rooting systems;
- help balance nutrient use with replenishment;
- allow labour costs to be spread and reduce financial risk, and
- are essential to ensure compliance with organic standards (if you are certified organic).

## The main vegetable plant families

It is important to know the main vegetable plant families and the crops in them, so that you can separate crops in the right way and choose a rotation that works for you. Sometimes it is obvious which plant family your crops belong to, but this is not always the case. Members of the salad family can be particularly hard to pin down! (Box 1) The main vegetable plant families are shown on the next page.

### Box 1: The importance of identifying crop families

*Your efforts at designing and running a crop rotation will be in vain if you inadvertently plant or sow a crop from the wrong family amidst another family. The most common mistakes are made with the brassica family, which contains so many useful crops. Most people will recognise the well-known ones such as cabbage, broccoli, turnip, brussels sprouts and cauliflower, but many of the salad varieties grown (which might look rather like members of the lettuce family) are actually brassicas and it is important to keep them separate from the "lettuce year" in the rotation. Similarly, if you decide to grow a green manure mixture containing several species, this should not contain brassicas if you have brassicas in your rotation (which most vegetable growers do). It is particularly important to rotate brassica crops properly, since they are susceptible to a number of important soil-borne pests and disease. The most common brassica salad species are listed below.*

Salad brassicas		
Radish Pakchoi Tatsoi	Rocket Mustard	Mizuna Mibuna

*If you grow leafy salad mixtures, these will often contain members of both the brassica and lettuce families. If this is the case, you should only grow such mixtures in the brassica part of the rotation, since it is usually less of a worry to grow lettuces twice in a rotation than to grow brassicas twice in a rotation.*

Don't forget that it sometimes works to include herbs and soft and bush fruit crops in your rotations, although many of these are perennial crops rather than annuals, so they tend to be in the ground for longer. Herbs come from many plant families. It is best to check which ones if you plan to grow herbs within a rotation. Some fall into the same families as commonly grown vegetables (e.g. chives belong to the onion (*Alliaceae*) family and dill and fennel belong to the carrot (*Umbelliferae*) family).

## Main plant families

<p><b>Pea/bean family</b> (<i>Leguminosae</i>)</p> <p>French bean Runner bean Broad bean Pea Clover Lucerne Lupin Trefoil Vetch/tares</p> <p><b>Potato family</b> (<i>Solanaceae</i>)</p> <p>Potato Tomato Aubergine Pepper</p>	<p><b>Beetroot family</b> (<i>Chenopodaceae</i>)</p> <p>Beetroot Spinach Swiss chard Spinach beet</p> <p><b>Lettuce family</b> (<i>Compositae</i>)</p> <p>Chicory Endive Lettuce Salsify</p> <p><b>Grass family</b> (<i>Gramineae</i>)</p> <p>Sweet corn Grazing rye All cereals/grasses</p>	<p><b>Cucumber family</b> (<i>Cucurbitaceae</i>)</p> <p>Cucumber Squash Courgette Marrow Gourd pumpkin</p> <p><b>Carrot family</b> (<i>Umbelliferae</i>)</p> <p>Carrot Celery Parsnip Celeriac Fennel Parsnip</p>	<p><b>Onion family</b> (<i>Alliaceae</i>)</p> <p>Onion Leek Garlic shallot</p> <p><b>Cabbage family</b> (<i>Brassicaceae</i>)</p> <p>Cabbage and kale Broccoli Brussels sprouts Swede and turnip Kohl rabi Cauliflower Radish Oriental brassicas Mustard</p>
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Soft and bush fruits fall into three main families as follows:

- **strawberries, raspberries, tayberries, loganberries, blackberries (the rose family: *Rosaceae*)**
- **currants and gooseberries (the currant and gooseberry family: *Grossulariaceae*)**
- **blueberries and wild blaeberrys (the heath and heather family: *Ericaceae*)**

## How to design your crop rotation

There are rules which will help you design an effective crop rotation. The main ones are:

- **Plants susceptible to the same pests and diseases should be separated by an appropriate time interval. This means that crops within the same plant family should not follow others in the same family;**
- **Vary weed susceptible crops (such as onions and leeks) with weed suppressing crops (such as potatoes);**
- **Crops with different root systems should be included in all rotations, so include those with tap roots (e.g. carrots, parsnips, tomatoes), shallow roots (beetroot and some of the leafy salads) and fibrous roots (sweetcorn, onions, leeks and some of the leafy salads).**
- **Try to include fertility-building crops in your rotation (e.g. those which can fix their own nitrogen, such as peas, beans and even clovers and vetches) if you can afford a season or more in one of your rotation blocks where you don't grow a cash crop).**
- **Try never to leave your soil bare over winter. Ideally this means sowing a fast-establishing ground cover crop after harvest. If this is not possible, try allowing weeds to colonise the soil surface as your crops mature. As a last resort, simply leave the crop residues to lie on the soil surface to protect it over winter. Adding leaves as a mulch or a light dressing (no more than 3 kg/m<sup>2</sup>) of well-rotted compost, FYM or seaweed can also help protect the soil surface.**



## The challenge with crop rotation

The problem for many growers is that they never have sufficient space in a rotation to grow enough of their favourite crops (such as potatoes) and can't think what to grow in some of the other blocks in the rotation. This problem is particularly acute in polytunnels (Box 2). The key to success lies in choosing groups of crops which grow well together to make up each phase in your crop rotation. For most people, this means dividing all the crops they want to grow into four, five or six groups, each representing one year in the rotation. More than six is even better, and three is really too few. Once you have decided on the number of years (or courses) in your rotation, you can divide your growing area up into equal size blocks. You must physically separate each block. That means installing barriers such as paths or fences between them to ensure that soil from each cannot easily mix with soil in the other blocks.



There are no hard and fast rules as to how to group your crops. Outdoors, many growers choose to have potatoes filling an entire rotation block, brassicas (cabbage, cauliflower, broccoli, brussels sprouts etc.) filling another, and then have a mixture of crop species in the other two or more blocks. It is best to mix crops which have similar needs, so it makes sense to grow peas, beans, carrots and beetroot together, since they have either no demand or a low demand for nitrogen (N) and relatively low demand for phosphate (P) and potash (K).

### Box 2: Particular challenges in polytunnels

*Crop rotations are difficult in polytunnels and glasshouses, because the crops which people most want to grow (tomatoes, peppers, aubergines, chillies and early potatoes) all come from the same family! It's for this reason that many people decide not to bother with crop rotations in small spaces. However, it's risky to grow the same crops year after year in any one area of soil and commercial growers generally do not do it. The chances of a serious disease coming in, which might be very difficult to eradicate, are much higher where any crop family is grown repeatedly in the same soil.*

*It is possible to run a crop rotation in even the smallest polytunnel or greenhouse. Use wooden partitions or paths to divide the tunnel into between four and six areas. You can then grow multiple crops of fast-growing species in a single year in the areas not being used for the more common crops such as tomatoes and cucumbers. Try crops such as early broad beans, sugar snap peas, French beans, early courgettes, leafy salads and sweetcorn.*

## Examples of crop rotations

There is no "one-size fits all" crop rotation. The right crop rotation will differ depending on what you want to grow in order to eat/sell and what you can reliably produce depending on your time, expertise and your site and soil. Here are some examples of crop rotations that have been shown to work well.



### Four course rotations for outdoors

Example	Year 1	Year 2	Year 3	Year 4
1	Brassica family	Potato family	Beetroot, peas and beans	Carrots, onions, lettuces
2	Potato family	Brassica family	Peas, beans, carrot, sweetcorn	Leeks, onions, lettuces, courgettes
3	Potato family	Brassica family	Beetroot, lettuces, courgettes	Peas, beans, onions, carrots

### Six course rotations for outdoors

Example	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
4	Brassica family	Potato family	Beetroot, peas and beans	Carrots, onions, lettuces	Grass/ clover ley	Grass/clover ley
5	Potato family	Brassica family	Leeks, onions and sweetcorn	Lettuces, courgettes and beetroot	Peas, beans and carrots	1-year multi-species green manure mixture, including legumes but no brassicas.

Grass clover mixes (or leys) or multi-species, overwintering green manures are sown after the previous crop and allows the soil to rest and recover and nitrogen to be fixed (by the clover or other legume) ready for the next cash crop.

### Four course rotations for indoors (plant crop a first and follow it with crop b<sup>1</sup>)

Example	Year 1	Year 2	Year 3	Year 4	
6	a	Tomatoes	Cucumbers	Peas and beans	brassicas and brassica salads
	b	Lettuce	Spinach		As above
7	a	Early potatoes	Cucumbers and squashes	Brassicas and brassica salads	Sweetcorn
	b	Tomatoes and peppers	Winter lettuce	As above	Spinach

<sup>1</sup>You should be able to get at least two crops each year from every rotation block indoors. In some cases, this means sowing crops and bringing them on elsewhere in modules or pots. Plant them immediately after harvest of the previous crop for cropping as soon as possible.

### Six course rotation for indoors

Example	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
8	a	Early potatoes	Brassicas and brassica salads	Cucumbers and squashes	Peas and beans 2nd (and 3rd?)	Sweetcorn and beetroot	Early carrots
	b	Tomatoes (followed by winter lettuce)	2nd (and 3rd?) crops of above depending on type.	Garlic, spring onions, chives	crops of above depending on type.	Spinach	Multi-species leafy herbs (e.g. basil, coriander, parsley)

For more information: [www.fas.scot](http://www.fas.scot) and "Horticulture – a Handbook for Crofters" (<https://www.crofting.org/enterprise/books-and-cards/horticulture-handbook/>)