G4.1 Practical gardening techniques

The previous section talked about trickier crops, making choices for the kitchen and best varieties. This section looks at techniques for developing school growing further, but each is still easy to achieve. They include additional forms of soil care and saving seeds from best performing plants. There are also ideas for getting the most from your space and attracting even more wildlife. As before, for every topic there is an Activity suitable for pupils and the community (numbers 53-65). See the DVD.

G4.2 Composting in different ways

There are many ways to make compost for using to improve soil and feed crops. The simplest method was explained in B5.7, showing how to use garden waste, vegetable peelings and some paper products in heaps and bins. This section goes further to explain other methods schools can use to recycle degradable waste. A53 explains one of these in detail (how to set up and use a wormery).

Trench composting

How: dig a trench 20-30cm deep and wide in a vegetable patch in autumn. Spread waste at the bottom and backfill with soil. The waste will decompose over winter ready for crops, eg beans.

What to compost: the same as for composting in a heap/bin. See B5.7 for a list of ingredients.

Benefits: gain localised (or whole plot) soil improvement, and without moving compost as it's made 'in situ'.

Disadvantages: hard work to dig and backfill trenches. May encourage foxes or cats to dig bare soil.

Trench composting works well in schools.

Worm composting ('vermiculture')

How: put waste in a self-contained 'wormery' where worms and micro-organisms create worm compost.

What to compost: mostly vegetable peelings from the kitchen, shredded paper, etc. See A53 for a full list and how to get worms started.

Benefits:

- A wormery can be set up indoors or out. Worms will work year round if kept at 12-25°C. They slow down and huddle together if colder and may try to escape if hotter. Keep out of direct sunlight in summer and put in a shed or insulate in winter.
- Worm compost has a high nutrient content, making it ideal for feeding the soil. It's too rich to use by itself for growing seedlings, but useful in potting mix recipes (A38) or digging into soil around planting holes. Also use for 'top-dressing' large containers, such as fruit trees. To do this, replace the top 5cm of potting mix and replace with worm compost annually.
- Worm liquid that runs off from a wormery through a tap at the bottom is a useful liquid fertiliser for established plants. See S4.5 about when to use additional feeds.

Wormery at Four Dwellings High School, producing lovely worm compost and useful liquid run off.

Disadvantages: can't compost tougher garden waste and some other materials. A wormery needs correct and continual maintenance to thrive and can be expensive to buy, but you can make your own at low cost. See A53 for options and how to avoid problems.

In-vessel composting

Example in-vessel system, here the A500 Rocket® Composter.

How: add waste to an enclosed drum in self contained unit. The drum usually rotates and is sometimes heated. These professional installations sometimes require power and an indoor location.

What to compost: cooked and uncooked kitchen waste, as well as some garden waste and high carbon material such as paper, cardboard and/or sawdust, depending on model.

Benefits:

- Suits collaboration with school caterers by allowing composting of cooked kitchen waste and other materials.
- Compost is produced quickly in a relatively compact, but large capacity unit.
- Can compost cooked kitchen waste that would go putrid or attract rats in other composting systems, ie bins/heaps, trenches and wormeries.

Disadvantages: some are large and expensive units, though an increasing range of products and lease arrangements are available. Need to obtain source of high carbon material.

Bokashi bins

Bokashi bin: the 'kitchen composter'.

How: put waste in an airtight container indoors and sprinkle with specially bought 'Bokashi bran' activator made from 'effective microbes' that ferment waste anaerobically (without air). Transfer the 'treated' waste a month later to a normal compost bin/heap to finish composting.

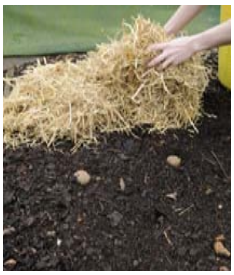
What to compost: kitchen waste, including meat, fish and dairy products.

Benefits: can compost cooked kitchen waste that would go putrid or attract rats in other composting systems, eg bins/heaps.

Disadvantages: ongoing cost of buying activator. Small capacity.

Health & Safety	Waste and compost is safe to handle if usual hygiene rules are followed, eg wear gloves if needed, keep cuts covered, wash hands after handling and keep tetanus vaccinations up to date. Ensure adult supervision. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A38 Making potting mixes A53 Using wormeries
Further information	B5.7 Making compost S4.2 Using compost S4.5 Using additional feeds Home composting and Master Composter network www.homecomposting.org.uk Example wormery supplier www.wigglywigglers.co.uk Example Bokashi supplier www.bokashibucket.co.uk Example in vessel suppliers www.quickcompost.co.uk and www.smartsoil.co.uk See also the Food for Life Partnership compost in schools resource available free from www.gardenorganic.org.uk/schools

G4.3 Gardening without digging



Digging over a vegetable patch is a tradition for many gardeners, but digging isn't always necessary or convenient, especially in schools. No-dig gardening replaces this annual turn-over of topsoil in favour of laying a blanket of soil improver over the soil surface. This section explains how this works. A54 applies the no-dig technique for growing potatoes.

How no-dig works

Rather than digging in organic matter, such as compost and well-rotted manure, these soil improvers are laid on the soil surface as a mulch. Worms and other soil organisms then 'dig' the soil for you, dragging down organic matter as they do for leaves on a forest floor. The soil structure and fertility is improved and crops are sown and planted through the mulch.

Over time, no-dig gardening creates crumbly and nutritious topsoil with ample air and drainage channels. No-dig gardening will work in most instances, though there are some 'terms and conditions' (see table below).

Top tip

How much organic matter?

No-dig gardening doesn't require any more organic matter than when digging. Apply at normal rates, as follows.

- Compost - one wheelbarrowful per 5m^2 of soil per year.
- Well-rotted manure - one wheelbarrowful per 10m^2 of soil per year.

See A9 for details about soil improvement.

Terms and conditions of no-dig

Compacted soil	No-dig doesn't work as well, or as quickly, if your soil is very compacted, eg from building work, foot traffic, or from a 'soil pan' where an impermeable layer of compacted soil has developed after years of cultivating at the same depth, usually 20-30cm deep. In these circumstances it's better to dig deeply and then start no-dig gardening, especially on heavier soils.
Looking after soil	Once no-dig is started, keep soil compaction to a minimum to avoid damage to soil, eg compressing drainage channels. You can avoid walking on the soil by using a bed system with pathways (see B4.5 for details).
Uncultivated soil	No-dig areas need a couple of seasons to get going and develop a crumbly soil structure in a new growing space. It helps to start with transplanting young plants rather than sowing direct. Robust crops are particularly good, such as cabbage and cucumber families. Potatoes are also useful early crops.
Stony soils	No-dig mulching will save you digging awkward stony soils and eventually create a topsoil with fewer stones. (Stones may shuffle to the surface again after heavy frosts.)

Summary table of no-dig and digging

	No-dig gardening	Digging
Good points	• Far less work as it's mainly mulching; useful if resources are limited in schools. • Doesn't disrupt worms and other beneficial soil organisms. • Protects soil structure. • Stops dormant weed seeds coming to the soil surface.	• Good exercise in small doses. • Breaks up compacted soils and soil 'pans' underneath. • Exposes soil pests to predators. • Clears weedy ground and green manures more quickly than using no-dig mulches.
Bad points	• Only works when compacted soil is first loosened by digging deeply. • Takes longer to improve poor soils. • Doesn't expose soil pests to predators. • Soil may take longer to warm up under mulches, causing frost damage.	• Hard work and may cause back problems. • Dug soil quickly loses moisture. • Harms earthworms and other creatures. • Soil can only be dug when not too wet or dry. • Dormant weed seeds come to the surface.

Using green manures in no-dig gardening

Green manures are plants grown to stop nutrients leaching from bare soil and to improve soil structure. See G4.4 and A55 for details. Green manures are usually dug into soil before the space can be used by another crop, but use the following methods instead in no-dig gardening.

- Hoe off the foliage of annual green manures, such as mustard, and leave on the surface as a mulch or remove for composting.
- Cover perennial green manures, such as grazing rye, with a light-excluding mulch as you would for clearing weedy grass, eg use layers of overlapping cardboard or newspaper. See A14 for techniques. Plant new crops through the mulch or wait for plants to die off.

Food Growing Instruction Cards. Further information with top six green manures.

Health & Safety	Take regular breaks when moving heavy mulch materials. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A9 Testing soil and improving fertility A14 Clearing weeds and grass A26 Digging A54 Growing potatoes without digging A55 Growing green manures
Further information	B4.5 Growing in raised beds B5.8 Digging G4.4 Using green manures

G4.4 Using green manures

Green manures are plants grown between crops to improve soil. They are not eaten, but dug in when young, preferably before flowering. In no-dig gardening, green manures are hoed off and left as mulch or killed with a light excluding layer such as cardboard. This section describes the benefits of using green manures and when/how to grow them. A55 has step by step instructions.

Benefits of using green manures

Improve soil fertility	Clover and other 'legume' green manures absorb nitrogen from the air and fix it in nodules on their roots. This nitrogen is released when green manures are dug in/left cut and becomes a fertiliser for subsequent crops.
Prevent nutrient loss	Stop plant nutrients leaching from bare soil, eg in winter rains. The nutrients are returned to the soil when green manure is dug in/left cut.
Improve soil structure	Ground cover protects soil from damage by heavy wind or rain. The roots also break up heavy soil, improving drainage, and hold together free draining lighter soils.
Suppress weeds	Most green manures are quick to establish and smother weed seedlings that would otherwise rapidly take over bare soil.
Help control pests	Keeping soil covered provides safe cover for beneficial wildlife, such as beetles, frogs and other natural predators.
Stimulate soil biological activity	Micro-organisms in soil rapidly colonise green manure foliage dug into the soil. Increased biological activity makes a good soil.
Loosen the soil	Deep rooting green manures help loosen and aerate soil deep down, eg Hungarian grazing rye. They also bring nutrients to the surface that would otherwise be too deep for most vegetables to reach.
Look good	Soil covered with lush green growth looks better, and more impressive than bare soil, especially in winter.

Deep rooting Hungarian grazing rye helps loosen the soil. It also suppresses weeds and stops nutrients leaching over winter.

Legume green manures, such as winter tares, improve soil fertility by 'fixing' nitrogen that subsequent crops use.

Soft clover foliage can be dug in a few weeks before the soil is needed for the next crop of edible plants.

When to sow and incorporate green manures

1. Before crops are planted in spring, eg sow winter hardy green manures in autumn, incorporate during late spring and then plant a crop, such as runner beans.
2. After crops are harvested in summer, eg sow a quick growing green manure such as mustard in gaps between other crops.
3. Around tall growing and widely spaced crops, eg a low growing green manure such as small-leaved white clover sown around sweetcorn or Brussels sprouts.
4. On bare areas of soil, eg new beds awaiting cultivation or areas 'resting' without crops for several months, especially over winter.

Top tip

When to incorporate

Dig in green manures (or lay as mulch) four weeks before the soil is needed for an edible crop and/or before green manure plants flower (whichever is sooner). See A55 for dig and no-dig techniques.

Choosing green manures

A range of suitable species are available, eg from www.organiccatalogue.com. These selections reliably improve soil, but don't become invasive. Choose your green manure based on the following information. More details are on the Food Growing Instruction Cards.

Green manure	Plant family	Sowing time	Growing period	Preferred soil	Adds nitrogen
Crimson clover	Legume	Mar - Aug	8-12 weeks	Lighter	Yes
Red clover	Legume	Mar - Aug	12-72 weeks	Good loam	Yes
Field beans	Legume	Sept - Nov	From 20 weeks	Heavy	Yes
Hungarian grazing rye	Miscellaneous	Aug - Oct	From 24 weeks	Most, especially heavy	No
Mustard	Brassica	Mar - Sept	4-8 weeks	Fertile	No
Phacelia	Miscellaneous	Mar - Sept	4-12 weeks	Most	No
Winter tares	Legume	Mar - May July - Sept	8-12 weeks or overwinter	Avoid acid/dry	Yes

Top tip

Fitting green manures in with your crop rotation

Some green manures belong to the same families as vegetables, eg mustard is part of the brassica family, so grow these during or after others of that group, such as cabbage, cauliflower, etc. Clover is part of the legume family, so follow on from peas, beans, etc. Others don't belong to the usual vegetable families, so can grow anywhere, eg phacelia, Hungarian grazing rye, etc. See S3.2 for principles of crop rotation.

Health & Safety	Wash hands after handling seeds and soil. Take regular breaks if digging. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A26 Digging A55 Growing green manures
Further information	S3.2 Planning crop rotation G4.3 Gardening without digging Step by Step: Green Manure www.gardenorganic.org.uk/publications/guides.php

G4.5 Saving your own seed

Saving seed is an exciting and money saving way to complete the growing cycle. It lets you preserve your favourite fruit or vegetable varieties to grow again next year or swap with other schools or gardening groups. This section outlines the principles of saving your own seed and how you can help protect heritage varieties. A56 gives seed saving instructions for major crops.

Why save seed

Fruit and vegetables are prolific seed producers. They do this in a variety of ways that offer great opportunities for wider learning, eg plant biology and genetics, seed dispersal, pollination, etc. The following are particularly interesting crops to find out about.

- Lettuce and radish grow over a metre tall if left to flower instead of harvesting.
- Carrots grow two metres high with dinner plate size flower heads in their second year.

Saving seed is equally important for preserving successful and unique varieties. There is also the chance to develop new strains by selecting for particular characteristics such as early maturity or pest resistance. Everyone can have a go and swap seeds at local events, such as those the Seedy Sunday organisation can help you plan (www.seedysunday.org).

Broccoli buds open to reveal yellow flowers.

Saving heritage

Gardeners have saved seed for centuries. A huge number of varieties have built up, but many have been lost over time. These include heritage/heirloom varieties passed down through families and gardening estates. These plants are connected with the past, uniting gardeners across generations. There are also ex-commercial varieties lost when seed companies merge or cannot afford to register varieties for sale in the European Union.

Seed saving helps protect local biodiversity and social history. Help further by joining Garden Organic's Heritage Seed Library. This is a unique living plant collection with over 800 (nearly) forgotten varieties. The Library is more like a 'gene building society' than a 'gene bank', as members can grow plants from these precious genetic resources. Visit www.gardenorganic.org.uk or call 02476 303 517 to join.

Damson Wood Infant School saving seed from an old pea variety from the Heritage Seed Library.

Isolation method to keep different varieties from cross pollinating, here lettuce with 'hats' made from horticultural fleece.

Increased plant spacing to accommodate mature radish plants flowering. Other crops may need space two years running.

Carrot plants flowering in their second year. They are 'biennial', so flower and set seed over two seasons.

Easy seed saving principles

Different types of fruit and vegetables need different methods to save seed successfully. These are summarised in five seed saving groups that the Food Growing Instruction Cards list next to each crop (see next page). See also A56 for seed saving details for major crops, split into easier and trickier groups. The golden rule is to only save seed from healthy plants to get the best results. The following explains two further guiding principles.

Plan your growing space

You need to allow space and time for growing habits of mature crops going to seed, such as radish plants that need 45cm between each other. Fortunately radish plants flower and produce seed within one season (annual). Other crops demand space for two growing seasons, such as Brussels sprout, as they flower in their second year (biennial). Biennials need slotting into a longer crop rotation or transplanting in the autumn after sowing or the following spring.

Preserving 'varietal purity'

Use particular techniques if you want your plants produced from saved seed to be near identical to their parents, with the same growth habit, fruit size, etc. First you need a vigilant eye to save pure seed, as well as a ruthless streak. You need to remove stray plants that deviate too much from the known variety, eg those with odd-coloured flowers and different shaped fruit or roots. Growing in groups accommodates these losses and helps maintain varieties, eg three to six plants of the same variety for tomatoes and squashes; minimum 20 (ideally more) plants for most other crops including onions and Brassica family.

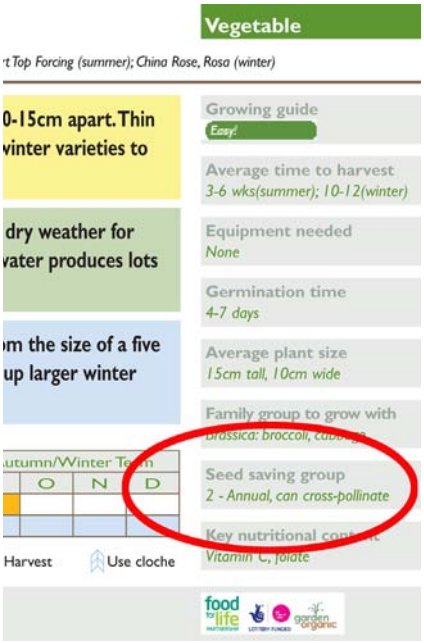
You may also need to 'isolate' plants to keep seeds pure by preventing cross-pollination (producing a mix). Cross-pollination can happen between different varieties of the same crop, as well as between different crops in the same family, if the same species. For example, courgettes 'Genovese' and 'Goldy' can cross-pollinate. Isolate by distance or use barriers that cover plants during flowering, eg cages or 'hats' of horticultural fleece to keep stray pollen away from receptive flowers. Also consider crops growing in neighbouring plots as these may impact on the purity of your saved seeds. See A56 for examples of crops that cross and techniques for maintaining purity.

Notes:

- *F1 hybrid plants are altogether more awkward to save seed from. They don't come 'true' and are best avoided for school seed saving unless breeding new varieties.*
- *The alternative to preserving 'varietal purity' is deliberately cross-pollinating to create new and potentially better plants.*

Five easy seed saving groups (as used on the Food Growing Instruction Cards)

Group 1: Annual, self-pollinating	Plants grow from seed, flower and produce seed in one year. They don't 'cross' (produce a mix) with similar plants.
Group 2: Annual, can cross-pollinate	Plants grow from seed, flower and produce seed in one year, but they can cross with similar plants and may produce a mix.
Group 3: Annual, needs isolation	Plants grow from seed, flower and produce seed in one year, but can cross with similar plants and are likely to produce a mix. Isolate from others by distance or barriers to maintain variety.
Group 4: Biennial, needs isolation	Plants grow from seed one year and flower the next. Most will cross with similar plants nearby. Isolate from others by distance or barriers to maintain variety.
Group 5: Specialist or not-applicable	Plants need expert techniques or are 'propagated' (multiplied) by non-seed methods (cuttings, division, and tubers).



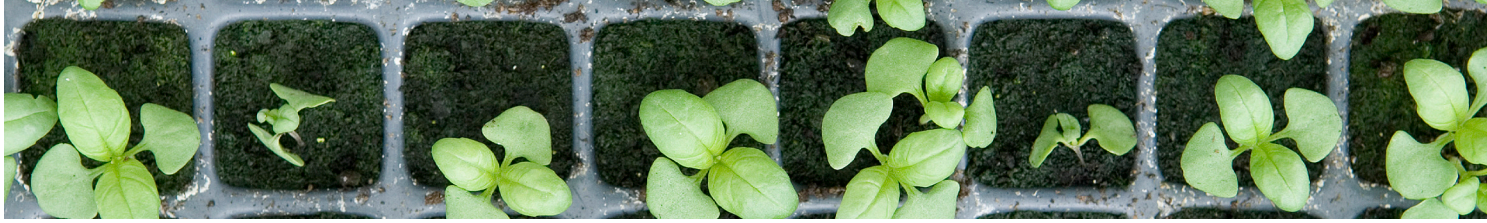
Best storage conditions

Some seeds remain viable longer than others in storage, but the following steps help get the best out of most crops.

1. Store just the seeds, so clean after collection. Wash to remove flesh and gel, eg for squashes and tomatoes, and/or use sieves to remove debris from seeds such as bits of seed pod, eg for peas and brassicas.
2. Lower the moisture content of the seeds by drying them naturally in a warm room, but out of direct sunlight.
3. Store seeds in an airtight container such as a Kilner jar and leave in a cool dry place, ideally in a fridge.
4. Improve germination by keeping the container at room temperature for a few days before sowing to let seeds acclimatise and reabsorb moisture gradually.

Cleaning dried seed head, here carrot.

Health & Safety	Be careful when handling seed, washing hands afterwards. Ensure adult supervision. Wear dust mask and goggles if required when cleaning seed, eg dust from lettuce seeds and 'spines' from carrot seeds can irritate. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A18 Sowing seed A56 Saving seed crop by crop
Further information	Seed Saving Guidelines by Garden Organic's Heritage Seed Library. www.gardenorganic.org.uk/hsl 'Back Garden Seed Saving: Keeping Our Vegetable Heritage Alive' by Sue Stickland. ISBN 1899233156 Seedy Sunday, the UK's biggest community seed swap www.seedysunday.org



G4.6 Germinating difficult seeds

Sowing seeds is fun and rewarding. The basic techniques were introduced in A18, so this section goes further by explaining techniques for seeds that need special conditions to overcome natural mechanisms that inhibit germination. A57 gives instructions for making your own heated propagator.

Why some seeds are difficult to germinate

Seeds have evolved to germinate when certain environmental conditions are met. These natural controls stop seeds germinating when the plant wouldn't grow well, such as the middle of summer in dry soil. The seed remains 'dormant' instead.

These mechanisms make fascinating links between the school garden and curriculum work. You can find out what conditions seeds need and ways of controlling germination. An example is light, where seed must be sown on the soil surface, eg for marjoram and the attractant flower *Lobelia*. The most usual inhibiting factors are moisture, temperature, and wearing down the hardened seed coat. Each is discussed below.

Pupils at St Peters School sowing in moist soil after waiting for warm enough weather in spring.

Practical methods for better germination

Moisture

Too little	Germination will fail unless water enters through the seed coat. Some crops are especially sensitive, such as carrots. Check often and water enough so moisture soaks down to the sowing depth, eg 1cm. If sowing in dry soil, water and/or add a thin layer of damp leafmould before sowing, then cover with dry soil to help retain moisture.
Too much	Avoid waterlogging. This rots seeds and squeezes out air needed for germination. Water gently to stop seeds being washed away, especially after sowing; use a fine 'rose-end' on watering cans and hoses. Ideally sow when the soil is already moist from rain or watering an hour beforehand.
Avoid 'caps'	Caps are impermeable layers of compacted soil that may form after rain or watering, especially on clay and silt soils. This can stop water reaching seeds and block emerging shoots. Help avoid this by sowing in a crumbly soil surface ('tilth'). Develop this by adding sieved compost into the top centimetre or so of soil (on top of normal soil improvement).

Temperature

Most seeds have an optimum soil/compost temperature for their enzymes to trigger germination. Germination usually stops when too cold – the reason why many seeds are stored in a fridge. Equally, too much heat can stop germination, such as lettuce seeds that usually fail to germinate when sown in high summer temperatures.

For outdoor sowing, keep to the recommended month on seed packets as a guide when temperatures will be suitable. Seeds remain dormant (and may rot) if sown too early. You can also use a thermometer to check soil temperature. Above all, learn local conditions, eg schools in southern England can start sowing earlier than schools in the colder North. The final way is raising soil temperatures, indoors or out, for seeds that will respond. See boxes.

Sowing seeds in warmer places
Warm up soil using plastic sheets and cloches that trap the sun's energy (see G4.9).
Sow indoors on a windowsill or in a greenhouse or polytunnel. Use an unheated propagator for extra insulation.
Use a heated propagator for speediest results. Most use soil warming cables to thermostatically control the temperature, letting you reliably germinate more temperature sensitive crops, such as cucumbers that need a consistent 20°C.

Sowing seeds in cooler places
Some seeds need a cold period to break dormancy. These include most stone fruits such as cherry and many ornamentals that attract natural predators, eg barberry. Use 'cold-moist stratification'. Soak first in water for 48 hours and then store in sealed plastic bags in a fridge (0-5°C). The average time before sowing is 12 weeks. You can also sow in pots in autumn and leave outdoors over winter, buried in beds of sand or loose soil, eg sweet violet (edible flower).

Wearing down the hardened seed coat

This is called 'scarification', eg abrading the seed coat by rubbing seeds with sandpaper to let in water and speed up germination. This is most useful for the 'legume' family, including peas, beans and attractant flower lupin. Use also for bay and seakale. Soaking seeds in tepid water works similarly by softening the seed coat before sowing, eg for seed-sprouts and okra. Soak for a couple of hours or longer if larger seeds. However, these techniques are not essential in all cases. Seeds will still germinate without treatment, just slower and/or in lower numbers.

Health & Safety	Be careful when handling seed, compost and soil, washing hands afterwards. Ensure appropriate adult supervision. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A18 Sowing seed A57 Building a heated propagator
Further information	'Propagating Plants' by Alan Toogood, Royal Horticultural Society. ISBN 1405315253 'Plant Propagation' by Oliver N. Menhinick, Peter Brown and Andrea Callf. ISBN 0954355008

G4.7 Increasing plant stocks

Increasing your number of plants is very satisfying. These methods of 'propagation' are easy to learn and produce quick results to help fill a school garden and to sell or swap. Sowing seeds is the main method explained in A18, but this section looks at 'vegetative' propagation. These techniques use free plant material from your existing plants. A44 and A58 explain two methods in detail with example crops.

What is 'vegetative propagation'?

Vegetative propagation uses plant roots and shoots as a starting point for new plants. It's most useful when a particular plant doesn't grow well (or at all) from seed, such as rosemary that takes a long time to germinate. Rosemary is far quicker from rooting 'cuttings' (see next page for explanation).

Vegetative techniques also produce new plants that are genetically identical to their parents, a 'clone'. This is useful for preserving a favourite plant variety, such as a nice tasting blackcurrant, unlike plants grown from seed that are slightly different from their parents due to sexual reproduction mixing up genes. The latter is an advantage of course if trying to produce new varieties. See seed saving in G4.5.

Getting started

All vegetative propagation starts with material from your chosen plants. You may need to buy or request donation of the first, eg one rosemary bush to produce a dozen bushes ready for a low herb hedge. This is cheaper than buying new plants from a garden centre or nursery. Learning to propagate successfully also helps plan what plants you can sell or swap at community events. See section G2.3 for other commercial hints.

Top tip

Planning your needs

Have a plan for what to do with propagated plants when they succeed. Know what plants are needed in the next 12-24 months, such as 50 herb bushes the following summer.

Produce extra plants for selling or swapping; sage pictured.

Produce plants for low herb hedges; lavender pictured.

Plan ahead when plants are needed for a new project, eg new herb spiral.

Most useful methods of vegetative propagation

Soft or semi-ripe stem tip cuttings, eg herbs	Short lengths of young shoots are inserted into pots of compost during the growing season. The shoot base produces roots after a few weeks and the upper half starts to grow. New plants are potted on individually. See A58 for technique.	
Hardwood cuttings, eg fruit bushes	Lengths of mature brown wood are inserted into soil or pots, usually in autumn. The base produces roots and the top starts growing. New plants are transplanted 6-12 months later. See A58 for technique.	
Division, eg flowering plants, globe artichoke	Established plants are dug up and the outer sections of the 'rootball' split into smaller sections by pulling apart or cutting, usually in autumn or spring. Each section produces a new plant that can be replanted into soil or pots. See A44 for technique.	
Grafting, eg fruit trees such as apple	A length of shoot ('scion') is secured onto the roots of another compatible plant ('rootstock'). This preserves a variety and imports characteristics of the roots, eg known vigour to control tree size. This is mainly a commercial technique. See details in S3.4.	

Top three rules for increasing your stock

1. **Choose healthy plants.** Avoid problems by only propagating from strong growing plants free from pests and diseases. Carefully inspect plants coming into the garden from outside sources.
2. **Use the right tools for the job.** Use clean, sharp tools to avoid spreading infection and ensure a crisp cut for minimal damage to plant tissues. Clean and sharpen tools before use as needed, ideally disinfect between plants with an organic product such as 'Citrox' available from www.organiccatalogue.com.
3. **Provide the right conditions**. Look up the best propagation method for each plant to get the right preparation and soil treatment, together with aftercare such as a humid environment. See A44 and A58 for ideas. See what works best for you, linking studies to the curriculum. A heated propagator and a cold frame can be useful.

Health & Safety	Be especially careful when using sharp tools such as knives and secateurs. Store tools safely. Follow Manual Handling guidelines (SG1.3) if lifting heavy trays of young plants and large bags of compost. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A18 Sowing seed A44 Dividing plants A57 Building a heated propagator A58 Taking cuttings
Further information	G2.3 Displaying and selling G4.5 Saving your own seed 'Propagating Plants' by Alan Toogood, Royal Horticultural Society. ISBN 1405315253

G4.8 Making full use of space

Space in a garden is often at a premium. There are so many crops you could grow and plenty of mouths to feed, especially in school with pupils, parents and caterers wanting to take part. Making full use of space is very important, but simple with a few horticultural and imaginative techniques. This section describes these methods. A59 takes this further with 'square-foot' gardening.

Two guiding principles

1 *Grow all year round* — Have a plan, so you know what crops are following each other. See S3.3 about harvesting each term for lots of ideas, including staggering harvest times with 'succession' sowing, as well as what to grow in winter and spring to have more seasonal produce to eat and cook with.

2 *Fill your space* — Don't leave bare soil when one crop has been harvested and the next isn't due for a few months. Sow quick maturing crops such as radish or lettuce instead, or put in a few attractant plants (S4.8) or a green manure in gaps (G4.4).

Practical ideas

Use vertical spaces

- Hanging baskets, pictured right at Haworth Primary School, growing tomatoes.
- Simple upright supports, eg runner beans, flowering attractant plants such as sweet peas, etc.
- Walls and fences for trained fruit tree forms, eg 'espalier'. See G4.10 for how this works.

Use roof space — Green roofs, eg on top of sheds and school buildings. CHECK structural suitability and design details with professional builders as the weight of soil and access need careful attention. Since roofs may have limited access, they're often best suited to growing attractant plants.

Credit: Amelio Ancaya, Living Roofs, Inc.

Plant raising with modules — Get an earlier crop by sowing crops in pots/trays for transplanting into soil when plants are older. See A22 for technique. This lets another productive crop use an area of soil until needed by the transplants. This is rather than sowing the next crop direct and 'wasting' soil while seedlings grow.

Planting holes prepared for small growing fruit bushes at Crich Junior School. See A36 for planting instructions.

Polytunnels at Eastwood Comprehensive School where all available space is used, still leaving space for safe access.

Raised bed at Abbey Road Primary School, transplanting and sowing quick maturing crops between slower growing ones.

More practical ideas

Underplanting	Use space around the base of taller plants, eg low growing pumpkins around sweetcorn.
Reduce spacing	Grow dwarfing varieties close together (see www.organiccatalogue.com for suggestions), or plant full size varieties closer than recommended and harvest young, eg carrots.
Interplanting	Sow quick maturing crops between slower growing ones, eg radish and lettuce between rows of Brussels sprouts.
Protected cropping	Use space earlier and later in the year by warming up soil, eg use cloches and plastic sheeting. See G4.9 for techniques.
Use bed system	Arrange growing space into beds so you can tend them all the way round without treading on and compacting the soil. About 1.2m wide by 1.8m long is usual size. By avoiding compaction, plants grow better and can be planted closer, so you'll get an equal yield per square metre of soil than in non-bed growing, despite using up space for paths. See B4.5 for more details about growing in beds.
Position paths carefully	Keep paths as narrow as possible to maximise growing room, but wide enough for safe access for people with different mobility needs and wheelbarrows.
'Key hole' gardening	Make paths the shape of a key hole and surround by easy-access growing space. Essentially, a more space efficient bed system.

Health & Safety	Follow usual garden hygiene guidelines, eg keep cuts covered, wash hands, keep tetanus vaccinations up to date. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A22 Transplanting young plants A59 Setting up a square-foot garden
Further information	B4.5 Growing in raised beds S3.3 Harvesting each term S3.4 Planting fruit S4.8 Choosing attractant plants G4.4 Using green manures G4.9 Using protected cropping G4.10 Pruning and training fruit Poster - Using space well

G4.9 Using protected cropping

This section builds on techniques in S3.3 for harvesting seasonal produce every term, including good planning, early/late varieties, succession sowing, early/continuous picking and storing produce. The next step is 'protected cropping' to extend the season, especially in spring and autumn. A60 adds to this by showing you how to make a cloche to shelter crops from harsh weather.

How protected cropping works

Protected cropping buffers plants from cold weather by trapping heat under an insulating cover of plastic, glass or lightweight fabric. Covers also deflect excess rain and strong winds. This protection creates a microclimate where seeds can germinate and plants grow well. However, these plants are dependent on you for water, as well as for controlling pests and diseases that can also thrive in these protected conditions. Close monitoring is essential, together with ventilation to stop plants over-heating.

Simple cold frame for seedlings at Damson Wood Infant School.

Removing protection

Protected cropping is usually temporary, removed once weather warms up. Before removing protection, it's worth acclimatising plants to cooler conditions by 'hardening' them off gradually. Growth can otherwise be damaged or stunted. The trick is to gradually increase exposure to harsher conditions, eg removing horticultural fleece during daytime and replacing at night; opening lids wider on cold frames and rolling up the sides of cloches. Do this for a couple of weeks before removing covers entirely.

Crops that benefit from protected cropping

Early planted spring crops (from Feb/March)	Beetroot, broad bean, carrot, early potato, lettuce, pea, radish, spinach, summer cabbage, turnip.
Cold sensitive crops sown/ transplanted near time of last spring frost	Asparagus pea, aubergine, pepper, tomato, courgette, pumpkin, runner bean, French bean, okra, sweetcorn.
Late planted autumn crops (Sept-Dec)	Carrot, winter salads, pea.
Crops ripening in autumn	French bean, melon, runner bean, tomato.

Special note

Covering soil with plastic can warm up soil and keep it drier so you can sow or plant crops earlier. Lay and weigh down the plastic for three or four weeks before you want to use the soil.

Main types and uses of protected cropping

Fabric crop cover

A lightweight blanket over plants is the simplest protection, such as horticultural fleece. This lets through air, water and light, but prevents damage to plants by spring frosts, such as on emerging potato shoots and flowers on peach trees. Fleece can also prolong autumn harvest of cold sensitive crops such as runner beans. Old net curtains make a good alternative.

Fleece is best weighted down or stapled to wooden battens and folded over to form more layers for extra protection. With careful handling, it should last at least two seasons.

Cold frame

A permanent frame with glass or plastic covers that are opened for ventilation and temperature control.

Cold frames offer spring vegetables an early start by sheltering seedlings and young transplants. They are ideal for hardening off tender plants such as courgettes after raising in a greenhouse/polytunnel. Later in the year, they can extend the autumn harvest of melons and encourage herbs and salads to produce year-round. Choose from brick, wood, or aluminium frames when buying or making your own cold frame. For winter and spring growing, locate the frame to receive maximum sunlight.

Cloche

Choose individual plant protection, eg clear plastic bottles cut in half. Use models to suit the shape and size of different crops. Alternatively, choose row/bed protection, eg tunnel cloches made by stretching clear polythene over wire hoops pushed into ground at regular intervals. The ends are pegged and the sides lifted for watering and ventilation, as well as hardening off. See A60 for instructions for how to build a tunnel cloche. Try covering only half a row to stagger harvesting times.

Cloches in autumn can extend the harvest of outdoor herbs and hardy salads well into winter. Cloches in spring will warm and dry the soil ready for early sowing and young transplants. Crops such as salad onion, carrot, and cabbage will be ready to harvest four or five weeks earlier than those grown without protection. Strawberry plants can crop from May if covered over in early spring after their winter chilling.

Health & Safety	Be careful when manoeuvring protected cropping structures, eg wire hoops or glass frames. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A60 Making a cloche
Further information	S3.3 Harvesting each term S4.9 Using greenhouses/polytunnels

G4.10 Pruning and training fruit

It's worth pruning fruit trees, canes, bushes and vines to get better crops. This process follows simple rules to cut off selected growth to favour the healthiest and most productive shoots. 'Training' goes a step further to modify the natural shape of a plant for even better fruiting, or to fit a space. This section summarises the principles and A61 has details for major fruit crops.

Principles of pruning

The practice of pruning is to cut off or shorten shoots to stimulate new growth in the right place. This takes advantage of the plant's natural reserve of new shoots waiting to grow and produce fruit. These shoots grow from 'buds', and every leaf has a bud where it attaches to a shoot. Every cut therefore should be above a bud (see A61). The principles of pruning follow three steps outlined below.

Top tip

Getting help

Pruning can be a daunting task for beginners. Many schools invite local experts, including parents and enthusiasts from special interest groups to advise with pruning.

1 Cut off dead and damaged growth to help maintain good plant health. This growth can otherwise die back and/or become infected. Next remove growth that has become diseased, such as canker, cutting back at least 30cm beyond the infection. Use sharp tools cleaned with hot soapy water or organic disinfectant. Always start with this pruning when tackling any woody fruiting plant.

2 Cut off growth that gets in the way of an 'open' branch structure. This open structure is crucial for letting in light to ripen fruit and allowing airflow for preventing diseases, eg gooseberry mildew. Start this pruning when plants are young, eg select four or five evenly spaced branches and remove the remainder. Aim for open 'cup' shaped fruit trees and bushes.

3 Cut off or shorten selected growth to favour shoots that will produce the most fruit. This varies with each type of fruit. An example selection is below. See A61 for full details.

- Gooseberry - shorten leading shoots by half previous season's growth; cut back side shoots to one bud to stimulate more fruiting shoots.
- Blackcurrant - cut quarter of oldest stems to 3cm every year to stimulate new growth.
- Summer raspberry - cut out old fruited canes at soil level and keep new non-fruited canes to fruit next year.
- Apple - shorten leading shoots and cut back side shoots to stimulate more fruiting growth.

Principles of training

Training combines pruning principles with deliberate production of branches to produce 'trained' plant structures. These are not natural plant shapes and are more effort to maintain, but offer three exciting opportunities which all overlap, explained below with a typical example.

Space saving

Main shoots of several fruiting trees and bushes can be trained into narrow columns of growth called 'cordons'. This lets you grow a number of varieties in a small space. Cordons vary in height and may have single, double or even triple stems. A double gooseberry cordon is pictured.

Optimum fruiting

Main shoots of fruiting trees can be trained along wires at near horizontal angles. This stimulates more flower buds and reduces leafy growth, so increasing yield per area compared to natural plant shapes. A series of horizontal tiers is called an 'espalier' and common for apples, while a diagonal branch structure is a 'fan', often used for plums.

Ease of harvesting and care

Main shoots of cane fruit can be trained to separate fruiting and non-fruiting growth, eg tie one year old fruiting blackberry canes in one direction and new, non-fruiting wood in the opposite direction, both on horizontal wires. Fruited canes are then easy to cut off in late summer and new shoots left to fruit for the following year.

Apple archway

A trained apple tree making a beautiful and productive archway into a garden. Trees have upright trunk with short, fruit bearing 'spurs' that are pruned annually to shorten side shoots. This pruning controls vigour, lets in light to developing fruit and encourages more spurs and good air flow, much as for espalier forms (see A61 for technique).

Health & Safety	Be careful when using sharp tools and handling large/sharp stems, ensuring constant adult supervision. Store tools safely. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A61 Pruning and training fruit
Further information	S3.4 Planting fruit 'Pruning and Training' by Christopher Brickell and David Joyce, Royal Horticultural Society. ISBN 1405315261 The Food for Life Partnership fruit resource available free from www.gardenorganic.org.uk/schools

G4.11 Introducing biological control

Pest control in an organic garden relies on attracting natural predators, such as growing flowers to attract hoverflies whose larvae eat aphids. There are also predators that you can introduce into an environment to deal with specific pests, such as a small parasitic wasp to eat greenhouse whitefly. This is known as biological control and this section gives some examples. A62 outlines how to introduce them.

Biological control essentials

The best approach to organic pest and disease control is prevention, eg by growing healthy plants in the right soil/location and using pest barriers. See S4.6 for a summary of managing plant problems. Biological control isn't a substitute for this, but can be an extra defence that, when used correctly, can prevent pests becoming dominant and ruining crops, especially in a greenhouse/polytunnel.

Always some pests	Just like the rest of an organic garden, you'll never remove all pests using natural predators. The aim is to create a balance that keeps problems at tolerable levels. If predators ate all their prey, they would have no remaining food source. It's the same with biological control, so expect some pest damage.
No spraying	It may take time for biological control to have its full effect after introduction, even when perfectly timed. Don't be tempted to use an organic spray if the problem worsens in the short term as this will kill the control before it has a chance to become established.
Right conditions	Biological controls are living creatures that, like pests, have their own preferred living conditions, eg min/max temperature. These are detailed by suppliers. Check you can maintain these conditions for the duration of the crop before introducing expensive controls. Creatures will otherwise not perform well or die.
Cost	Biological control is more expensive than other pest control methods, but is sometimes the only sustainable option. Consider the need for control carefully before investing. See A42 for diagnosing problems.

Important: Monitoring and timing

Biological control relies on close monitoring of plants to correctly identify the problem and then choosing the right control (see table on the next page). You must monitor plants for the right level of infestation to apply control, ie adding a small number of predators to a huge pest infestation won't work as the predators will not breed fast enough to have any impact. Instead, introduce control when the pest is building up, but before it becomes too dominant.

Note: if an infestation becomes too bad before control can be introduced, eg an important plant covered in whitefly, you can first spray with an organic pesticide, such as those based on natural vegetable oils. See www.organiccatalogue.com. The spray will kill enough of the pest to reduce populations to a level where biological control can be introduced. However, this tactic should be a last resort.

Main biological pest controls – mostly indoor use

*This list is not exhaustive. See **www.organiccatalogue.com** for full selection.*

Aphids

Control: *Aphidius* is a slender black insect about 2mm long that lays single eggs into immature aphids like greenfly and blackfly, killing them as the new *Aphidius* develops. A single female can lay 100 eggs in a lifetime.

Applying: Remove the cap from the tube of *Aphidius* and hang in the greenhouse/polytunnel. A temperature of 18°C is required for at least two hours a day. Generally available April to October.

Aphidius
Credit: David Cappaert, Michigan State University, Bugwood.org

Mealybugs

Control: Australian ladybirds, *Cryptolaemus*, attack mealybugs. Beetles are very mobile so cover the plant with enviromesh for a few days to contain. They are strong fliers so also cover vents and windows.

Applying: Have life cycle of several months, so one pack of *Cryptolaemus* is usually sufficient for an average greenhouse/polytunnel. Maintain a minimum daytime temperature of 20°C and good levels of sunlight. Generally available all year round.

Cryptolaemus
Credit: Jeffrey W. Lotz, Florida Department of Agriculture and Consumer Services, Bugwood.org

Greenhouse whitefly

Control: *Encarsia* is a tiny parasitic wasp that lays eggs in young whitefly, turning them black.

Applying: Remove the cap from the tube of *Encarsia* and hang in the greenhouse/polytunnel. Introduce as soon as possible after the first adult whitefly are seen. Best used on low-medium infestations, giving protection over a long period. Maintain a minimum night temperature of 16°C; daytime 20°C. Generally available from May.

Encarsia
Credit: David Cappaert, Michigan State University, Bugwood.org

Sciarid fly

Control: Adults and larvae of *Hypoaspis* feed on sciarid fly larvae, a small white grub that lives in the top few millimetres of compost, attacking rooted cuttings and seedlings. Adult sciarid flies are 3-4mm long and black, gathering on the soil/pot surface where compost is warm/moist.

Applying: Use mainly in a greenhouse/polytunnel. One treatment of 10,000 predators remains active for four or five months. Usually available all year.

Sciarid fly

Red spider mite

Control: A tiny predatory mite, *Phytoseiulus*, which feeds on the red spider mite.

Applying: Use mainly in a greenhouse/polytunnel. Maintain a minimum night temperature of 16°C and 20°C daytime, but below 30°C. Generally available April to October.

Phytoseiulus

Main biological pest controls – can be used indoors and out

Caterpillars/larvae

Control: Microscopic nematode, *Steinernema carpocapsae*, feeds on different caterpillars/larvae.

Applying: Spray solution direct onto pest. Usually supplied with three applications, stored in the fridge and used at five to seven day intervals to ensure all hatchings are killed. Timing varies, eg spray cabbage white caterpillars on brassicas around July; gooseberry sawfly larvae from late spring; codling moth caterpillars during late September and October.

Slugs

Control: Microscopic nematodes, *Phasmarhabditis hermaphrodita*, kill slugs; mainly young and small slugs under the soil rather than big slugs on the surface. Nematodes do not control snails and are not as effective for use in very heavy clay soil.

Applying: Mix with water and apply with watering can when slugs are active for up to six weeks protection. Best applied three weeks before vulnerable crops are planted. For optimum performance, ensure soil is moist and soil temperature between 10°C and 25°C. Usually supplied from April until September, often two deliveries six weeks apart.

Vine weevil larvae

Credit: Peggy Greb, USDA Agricultural Research Service, Bugwood.org

Control: Microscopic nematode, *Steinernema kraussei*, seeks out and kills vine weevil larvae. This does not control adult weevils. Make sure larvae are present before using.

Applying: Mix with water and apply with a watering can to pots. Can also apply to open ground. Apply March to May or July to October. In the period between, only adult weevils are present, laying their eggs, which hatch into larvae in late summer and autumn. High infestations may need two applications. Autumn use is often the most effective since the larvae are younger and have not caused significant damage to plants.

Health & Safety	Be careful handling biological control, following supplier's instructions for applying and managing. Ensure adult supervision when spraying. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A42 Diagnosing plant problems A62 Planning biological control
Further information	S4.6 Managing plant problems The Organic Gardening Catalogue www.organiccatalogue.com Scarletts Plant Care www.ladybirdplantcare.co.uk Defenders www.defenders.co.uk Nemasys www.nemasysinfo.com

G4.12 Using wild flowers

Wild flowers help create a healthy organic garden for growing food. They provide food and shelter for beneficial insects that eat pests and pollinate plants. Wild flowers are endlessly fascinating and able to grow in the smallest patch or windowbox, or expand to fill larger spaces and even meadows. This section suggests some useful plants for different sites. A64 looks at how to start growing and maintaining wild flowers.

The essentials

Wild flowers are a diverse group of plants. They can grow by themselves or among more delicate grass species, although do need special care to do well and look attractive. Wild flowers are usually best on poorer soils and compete badly against other plants in fertile soils. Choose your wild flowers based on which species will suit your site, particularly soil type. See table for examples. See A64 for details of how to start a new area for wild flowers or plant into grass, plus maintenance tips for established wild flowers.

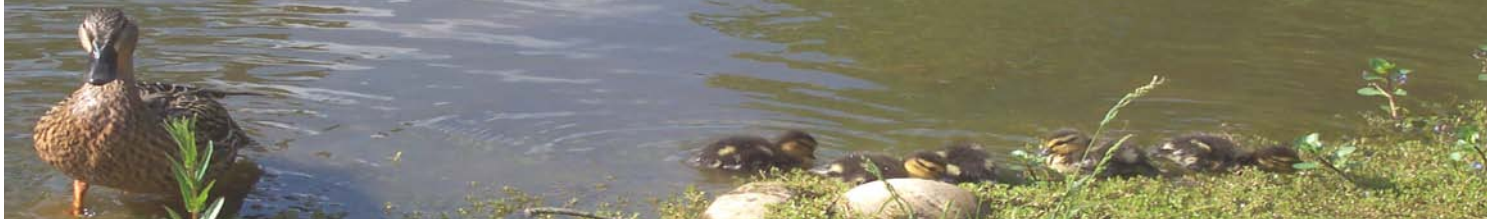
Pupils at Coppice Farm Primary School planting and studying wild flowers.

Suggested wild flowers for different conditions

See A9 for soil assessment

Sandy soil	Birdsfoot trefoil, black knapweed, bladder campion, common sorrel, common toadflax, hoary plantain, lady's bedstraw, musk mallow, selfheal, viper's bugloss, wild carrot, etc.
Clay/wet soil	Betony, birdsfoot trefoil, black knapweed, common sorrel, lady's bedstraw, meadow buttercup, pepper-saxifrage, ragged robin, ribwort plantain, selfheal, wild red clover, etc.
Chalky/ lime soil	Birdsfoot trefoil, black knapweed, dropwort, field scabious, greater knapweed, lady's bedstraw, rough hawkbit, salad burnet, selfheal, small scabious, wild basil, wild carrot, etc.
Acid soil (slightly)	Betony, birdsfoot trefoil, black knapweed, bulbous buttercup, common sorrel, devil's bit scabious, lady's bedstraw, lesser stitchwort, pignut, selfheal, wood sage, etc.
Hedgerows/ verges	Agrimony, betony, black knapweed, foxglove, garlic mustard, hedge bedstraw, red campion, ribwort plantain, selfheal, white campion, wild basil, wood avens, etc.

Health & Safety	Be careful when handling soil, washing hands afterwards. Ensure adult supervision. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A9 Testing soil and improving fertility A63 Growing wild flowers
Further information	Really Wild Flowers www.reallywildflowers.co.uk Organic Gardening Catalogue www.organiccatalogue.com



G4.13 Planning a wildlife pond

Ponds attract a terrific range of wildlife for pest control to help with organic food growing. These predators live in and around water, feeding, sheltering, and breeding. Likely visitors are frogs and birds that eat slugs and insects, plus an array of other diners. This section explains how to make the most of a wildlife pond. A64 has construction and maintenance instructions.

Before starting

Installing a pond greatly benefits the local ecosystem, but needs careful planning to avoid problems. The first is safety, especially for children, but paramount for any garden visitor. See Top tips for ideas. Next there is space the pond uses up where crops could yield produce. Fortunately even small ponds 1m^2 will tempt wildlife, while larger 2-3m^2 ponds attract a greater diversity. Quite often ponds can be located away from prime growing space.

Top tips

Pond safety

Design with safety in mind, checking with the school Health and Safety officer. Try the following.

- Position ponds appropriately for the site, eg obvious, out of the way, restricted access, etc.
- Install a metal grid over the water surface. This can be tricky in wildlife ponds with less distinct and shallower edges.
- Put up chain-link or picket fence barriers. These needn't be unsightly. Try painting them green to blend in.
- Try pond alternatives, such as a boggy patch and bowls of clean water. They still offer wildlife a pit-stop for drinking and bathing.

Laying pond liner for a new pond. See A64 for step by step construction.

Removing excess blanket weed. See A64 for how to limit such algal growth.

A lovely pond acting as a hub of school garden wildlife for pest control.

Simple ponds in schools help organic food growing by attracting natural pest predators.

Features of a wildlife pond

Simple	Use straightforward, easy to make shapes such as a circle or kidney, not elaborate waterfalls with several levels and pumps. You'll find the shape of your wildlife pond is soon obscured as marginal plants blend in with surrounding habitats.
Shallow	Design a very gradual slope up to 30cm deep. Most wildlife congregates in this shallower water for easy access in and out of the pond, not least hedgehogs and birds. Shallow water also offers most dissolved oxygen for good feeding and breeding, such as for tadpoles. A deeper pond up to 60cm is usually better for larger ponds with fish and deeper water plants.
Diverse edges	Create sheltered nesting and hunting sites for wildlife around the pond edges. Let marginal plants spread into adjacent boggy soil (see A64 for suggestions and percentage cover, etc). Also add log piles, stones, etc. Even muddy edges are useful, especially for dragonfly eggs. Aim for as few 'sharp' edges as possible to anchor your pond into its surroundings. Allow clear access on at least one side for maintenance.
Diverse surroundings	Extend your pond edges into surrounding habitats. This allows seamless wildlife travel around your plot and areas beyond. Try flowering plants, hedgerows, compost heaps, and even crops and green manures. These 'corridors' needn't use up lots of space, just 'direct' pond wildlife, such as amphibians. These spend a lot of time on land, but need safe travel when returning to water to avoid birds, such as blackbirds and thrushes, swooping down to eat them mid-way.
Clean water	Support the best mix of wildlife by having 'clean' water. This usually establishes naturally over time, but may be disrupted by sudden changes in plant and animal populations, as well as excess tap or flood water. Aim for reasonably clear water. A hint of murkiness will provide some cover for insects while small amounts of algae and weed are useful habitats. Your main adversary though is excess algal growth, especially blanket weed. See A64 for control tips.

Health & Safety	Be very careful around areas of open water in school, ensuring appropriate protection by netting, barriers and/or metal grids and adult supervision at all times. Check with school site manager and local authority Health & Safety officer if unsure. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A64 Creating a wildlife pond
Further information	S4.7 Creating habitats for wildlife Pond Conservation www.pondconservation.org.uk 'The Wildlife Pond Handbook: A Practical Guide to Creating and Maintaining Your Own Wetland for Wildlife' by Louise Bardsley. ISBN 1843301113

G4.14 Managing power

Using power in your garden gives extra opportunities for growing food, not least heating for winter crops. However, there is a financial and environmental impact. This section shows how to reduce energy use, as well as ways schools can generate their own renewable sources of electricity. A65 looks at conserving heat energy for cooking in an insulated 'hay box'.

When power is useful in a school garden

Heating in greenhouses/ polytunnels (S4.9)	Lets you grow winter crops more reliably and protect frost sensitive plants. Reduce heating by setting heaters to keep structures just above frost level. This suits most crops. Also insulate structures with bubble plastic and try dividing up larger structures and only heating a section.
Watering systems (S4.10)	Lets you automate and control watering systems using electric powered systems/timers. Reduce the use of powered systems by setting them correctly, eg on/off times. Also minimise need for watering, eg mulching soil to conserve moisture.
Heated propagators (A57)	Lets you raise seedlings and plant cuttings at higher temperatures than surroundings. Install on windowsills or in a greenhouse/polytunnel. Reduce energy use by keeping on lowest heat setting necessary. Use a thermostat and turn off when not in use.

Generating power

Case Study

St Gregory and St Patrick's Catholic Community School

As explained by the school's eco-coordinator and growing champion, Margaret Messenger, they have several methods for generating power, most recently installing geo-thermal heating in their new classroom (pictured). They also have a wind turbine that feeds energy into the school and excess to the national grid, as well as a solar panel that heats the water used by caterers in the kitchen.

Health & Safety	Consult a professional electrician and manufacturer before installing power systems. *See also Health and Safety Guidelines (Section SG1.2)*
Activities on DVD	A65 Making a hay box
Further information	Eco-Schools www.eco-schools.org.uk Energy Saving Trust www.energysavingtrust.org.uk UK Energy Saving www.uk-energy-saving.com