Stems

CELTUCE
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CELERIAC
Apiaceae,
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var. rapaceum
p.120

CARDOON
Asteraceae,
Cynara cardunculus
p.138

JERUSALEM ARTICHOKE
Asteraceae,
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Asteraceae,
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p.139

ANGELICA
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Angelica archangelica
p.144

SELF-BLANCHING CELERY

CELERY
Apiaceae,
Apium graveolens
var. dulce
p.119

CAPION RANGED RIGHT

CAPION RANGED RIGHT

CHINESE CABBAGE
Brassicaceae, Brassica rapa
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POTATO
Solanaceae, Solanum tuberosum
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RHUBARB
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SWISS CHARD (SEAKALE BEET)
Chenopodiaceae,
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p.129

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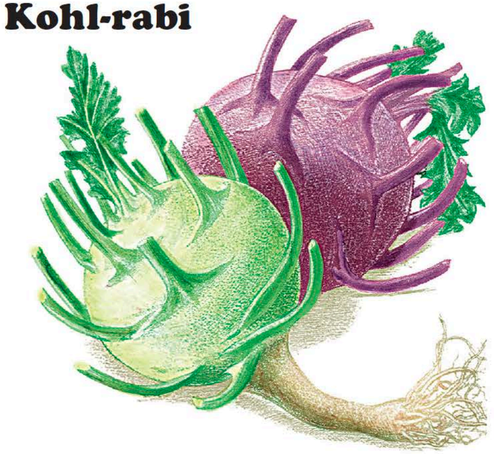
Kohl-rabi



This strange looking plant is merely a cabbage in which all the nutrients are stored in a swollen stem instead of in tight-packed leaves.

Soil and climate
Kohl-rabi likes the same conditions as other *brassica* but is even more dependent on moist soil; drought makes them hard and woody.

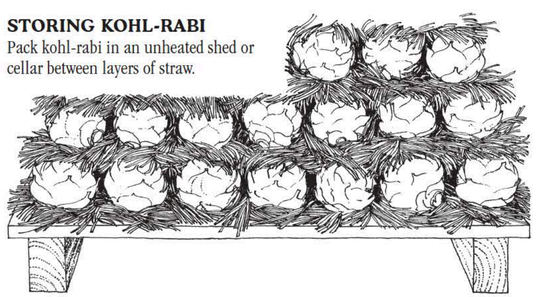
Propagation
It is better not to transplant kohl-rabi, but to sow the seed out where the plants will grow. Sow thinly in two or three successional sowings between April and June.

Care while growing
Thin the plants you want to eat in the summer to 6 inches (15 cm) apart – deep bed method 4 inches (10 cm). Those you want to store through the winter thin to 10 inches (25 cm).

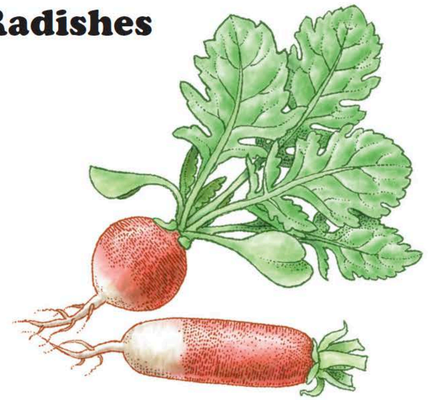
Pests and diseases
Kohl-rabi can suffer from the pests and diseases that afflict cabbages (*see* Cabbages).

Harvesting and storing
Pick the plants very young and tender – about 2½ inches (6 cm) across – and eat them raw or cooked. Store them, as shown below.

STORING KOHL-RABI
Pack kohl-rabi in an unheated shed or cellar between layers of straw.



Radishes



SUMMER RADISHES
Radishes grow in three to four weeks, are rich in iron and vitamin C and are excellent for adding bite and crispness to salads. They are good for growing in odd vacant corners, and they do well in window boxes as well. Winter radishes are larger and can be black, white, red, or red and white.

Soil and climate
Radishes like good rich damp soil and a cool moist climate. Since they grow fast and are eaten quickly it does not matter if they are grown in beds not reserved for *Brassicaceae* for they don't have time to develop diseases. In hot countries they can be grown only as a winter crop. In temperate climates they can be grown in spring, summer, and autumn.

Soil treatment
Like most *Brassicaceae* they don't like acid soil, so you should lime if it seems necessary.

Propagation
Just sprinkle the large black seeds thinly in shallow drills and cover them, or else broadcast and rake in. Sow very few at a time, but sow often – even once a fortnight – so you have fresh tender radishes whenever you want them. The seeds will keep for five years, so don't throw them away. If you want early radishes, you can sprinkle them among other crops that you are forcing in a hot-bed, or in a deep bed covered with transparent plastic or glass. In the deep bed (*see p.* 46) sow 1 inch (2.5 cm) apart in each direction.

Pests and diseases
FLEA BEETLE These pests are the only hazard. If heavy rain does not wash them away, give them a good hosing.

Harvesting
Just pull, wash and eat. If you have too many, pull them out anyway. Don't let them grow up hard and woody, or go to seed. If you can't eat them, feed them to the rabbits.

WINTER RADISHES
Sow white radishes between late spring and midsummer; others towards the end of summer. They will all be ready for harvest at the end of autumn. Dig and store white ones in peat*. Leave the others in the ground until required during the winter.

Seakale

Seakale is a perennial whose young shoots should preferably be harvested in spring, but if you so wish it can be forced for eating fresh in winter.

Soil and climate
Seakale likes a rich deep well-manured loamy soil and a cool damp climate. Don't try to grow it anywhere hot and arid.

Soil treatment
Dig deeply – at least two spits – and incorporate plenty of rich manure into the soil.

Propagation
Seakale can be started from root cuttings, called thongs, or from seed. The former method is preferable, because plants started from root cuttings begin to yield the second year, a year earlier than seedlings. However it is said that a new race should be raised from seed from time to time. Get your thongs from a seed merchant or a fellow gardener. They are just bits of root about 4 inches (10 cm) long. Plant them 6 inches (15 cm) deep and 30 inches (75 cm) from each other in late winter – deep bed 15 inches (38 cm) apart. If you plant from seed, sow in shallow drills in March.

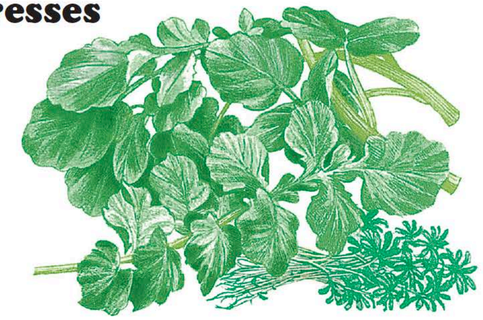
Care while growing
If you sow seed, thin to 4 inches (10 cm) apart and transplant to 30 inches (75 cm) apart the following spring.

Keep well weeded. You cannot eat green seakale because it is bitter. Therefore the plants must be blanched – that is deprived of light completely so that they go quite white. You can do this by covering them *in situ* with buckets, boxes, or upturned flowerpots with the drainage holes blocked up. If you want fresh seakale during the winter you can force its growth. Either spread hot manure over the blanching covers so as to provide heat, or take the roots from their outdoor bed in the autumn and plant them in loam in a hot-bed, or warmed frame, or even in a warmed cellar. Keep your seakale warm – the soil should be 55 to 60°F (13–16°C) – and dark, and you will get a good winter crop.

Pests and diseases
Small seedlings are occasionally attacked by flea beetle (*see* Turnips); otherwise they are not prone to attack.

Harvesting
Cut shoots when they are about a foot (30 cm) high in spring, unless you have forced the plants for a winter harvest. Like all perennials that are harvested for food, seakale must be treated with respect. After you have taken your just dues let it grow up into the sunshine, green and strong, and build itself up for next year.

Cresses



WATERCRESS
If your garden has a corner which is persistently damp, watercress is the ideal crop. It has the distinctive hot flavour of the *Brassicaceae*.

Soil and climate
It does best in cool climates, but will grow perfectly well in a warm one, especially if it is standing in cold flowing water.

Propagation
It is possible to create a bed, next to a flowing stream. Flood the bed by admitting water from the stream after sowing the watercress. You can grow it from seed, either planting the seed in the wet mud just above the water or sowing it indoors, in potting compost, in earthenware pots which should be kept in a tray into which water flows constantly. You can bring it to maturity like this or else plant it out in a stream or damp bed. Another method is to buy really fresh commercial watercress from the greengrocers, put it in a plastic bag with some water, take it home and plant it.

Care while growing
Pinch out the top shoots to make the plants bushy. If a plant flowers, cut it right back.

Pests and diseases
Never grow watercress in water to which sheep or cattle have access. If you do, you might just get liver fluke.

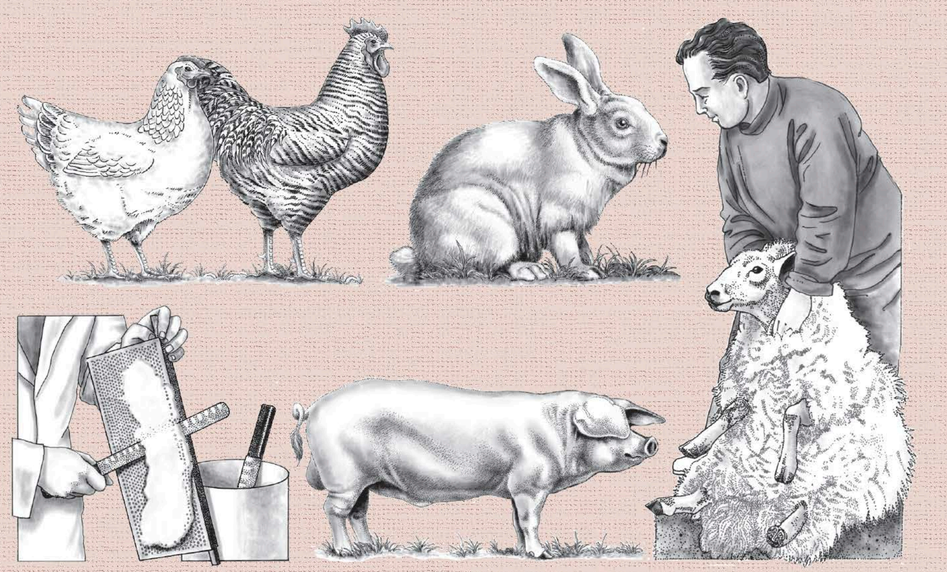
Harvesting
Pick out side shoots. The more you pick, the more grow.

CRESS
Like mustard (*see p.* 151), cress is eaten in the seedling stage, although if you are growing them together remember that cress takes a few days longer than mustard to germinate. Grow it on damp sacking or a damp peat* bed. Sow it thickly throughout spring and summer.

LAND CRESS
Also known as American cress, this is a relatively hardy salad plant, which should be pulled after about seven weeks of growth. Sow successionally through the summer for several months' salad supply. Sow ½ inch (1.5 cm) apart and later thin to about 6 inches (15 cm) between plants. Find a fairly shady site which will not dry out, and protect the crop under glass as the weather becomes colder.

CHAPTER THREE

Food from Animals



NEW DESIGN

"People say to us sometimes 'why do you have cross-breeds and mixed-up strains in your animals and poultry?' … For us the all-round animal [is one that is] not too highly specialized, not too developed away from the wild creature, not too finicky and highly strung, not too productive.

People come and stay with us and sometimes express horror at me when I kill an animal. 'How could you do it?' I always ask them what they had for dinner the day before, and if they say 'meat' I know I can treat their scruples with contempt. I do not like killing animals; but having decided, after a great deal of thought, that it is right to kill animals, I do it without worrying myself about it [and] aiming at least for a professional standard in paunching and plucking and cleaning and butchering, and at doing the thing in a workmanlike manner. To connive at the killing of animals while being too lily-livered to kill them yourself is despicable. We could not have eggs unless we kept birds, and if we did not kill off the surplus birds we would very soon be overrun."

John Seymour *'Fat of the Land'* 1976

A ton of fairly good hay is equivalent to:

¾ ton of very good hay
4 tons of kale or other greens
5 tons of mangolds
3 tons of fodder beet

Production ration

Now to give "maintenance plus one gallon" the winter's ration should increase to: 45 cwt (2,285 kg) for a Friesian and 33 cwt (1,675 kg) for a Jersey. The daily ration therefore goes up to 27 lb (13 kg) hay or its equivalent for a Friesian and 20 lb (9 kg) for a Jersey.

Now you can reckon that if you feed 3½ lb (1.5 kg) of a mixed "concentrate" ration for each gallon (4.5 litres) that the cow produces over the first gallon, that will do. And the concentrate could be:

2 parts barley (rolled)
1 part oats (rolled)
1 part beans (broken or kibbled)

Cows kept naturally on organically farmed pastures and hay are unlikely to suffer from mineral deficiencies, but if you ever did get "grass-staggers" or hypo-magnasemia, or any other diseases that your vet told you were due to mineral deficiency, then you would have to add the missing element either to the diet of the cows or to the land. Seaweed meal is an excellent source of all minerals. You can just dump some seaweed on your pasture from time to time, and allow the cows to nibble it and lick it. They will not suffer from mineral deficiency if they do this.

All this means that if, in an average winter situation, you feed your cows, say 30 lb (13.5 kg) of kale or other greens a day and 12 lb (5.5 kg) of hay for her maintenance plus one gallon, and, say, 3½ lb (1.5 kg) of the above suggested "concentrate" for her production ration for every gallon over the first, you will not go far wrong. But use what food you've got. Use common sense and watch the milk bucket. If the milk goes down, feed more and you should be all right.

Summer feeding

In the summer, if you have plenty of good grass, grass alone should give maintenance plus up to 4 gallons (18 litres). A cow yielding over this would have to have 3½ lb (1.5 kg) concentrate per gallon over 4 gallons, but I hope you wouldn't try to keep such a cow. You don't want a ridiculous lot of milk, and very high yielders need a vet in almost constant attendance and have to be cared for like invalids. But grass varies enormously in value, and, if you suddenly find her milk yield dropping off, give her a little concentrate (even a pound or two) and see what happens.

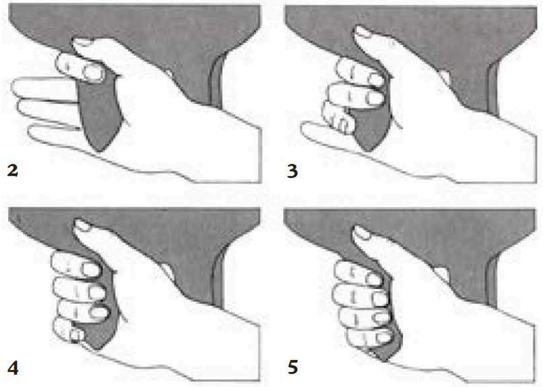
Stockmanship is a matter of constant keen observation and common sense. Look at your animals: learn what the "bloom of health" means. Watch their condition. Are they getting fatter or thinner? Watch their milk yield; watch how hungry they seem to be. The "stockman's eye" may not be given to everyone, but it can usually be acquired.

Milking

Milk your cow twice a day, ideally at 12-hour intervals. Wash the cow's udder and teats in warmish water. Thoroughly wash your own hands. Then dry well with a towel. The more you massage the udder in doing so, the better. Clean the rear end of the cow generally, so that no dung or dirt will fall into your pail. Give the cow something tasty to eat. Sit down beside her on a stool and grasp the two front teats in your hands. Or, if you are an absolute beginner, grasp one teat with one hand. Common sense will tell you how hard to squeeze. Next, keep holding on with your thumb and finger, and squeeze the teat successively bringing in your other fingers, so as to expel the milk downwards out of the teat. Release the teat and repeat the operation (*see below*). It sounds easy, but actually it is difficult, and it takes a week to learn to milk.

OLD STYLE ILLUSTRATIONS

MILKING A COW
Sit down on the right side of the cow(**1**), grip the bucket at an angle between your knees, and grasp the two front teats in your hands. To milk, squeeze high up the top of the teat with the thumb and forefinger (**2**) to stop the milk from going back up to the "bag", as farmers call the udder. Then, bringing in your second (**3**), third (**4**) and little fingers (**5**), squeeze progressively downwards to expel the milk. If you can, practise on a dummy teat to get the necessary rhythmic motion. It is also much better to begin on an old cow who is used to being milked and who won't mind if you fumble.



Clearing Land

Unless your holding is big and you plan to farm a proportion of it on the "dog and walking stick" principle, one of your first priorities will be to see if you can gain any extra usable land by clearing overgrown wood and bush land. Such land is worth clearing as long as it is not on a ridiculously steep slope, or irretrievably boggy or covered in boulders. Clearing land is hard but rewarding work, although it can be extremely expensive and time consuming.

Send in the pigs and goats

Your pig is your best pioneer. If you concentrate pigs in bush land they will clear it for you with no effort on your part at all. They won't, of course, remove trees, but all brambles, gorse, and undergrowth generally will yield to their snouts and they will manure the land at the same time. If there are any stubborn areas of thicket, try throwing some corn into them and the pigs will soon root them out.

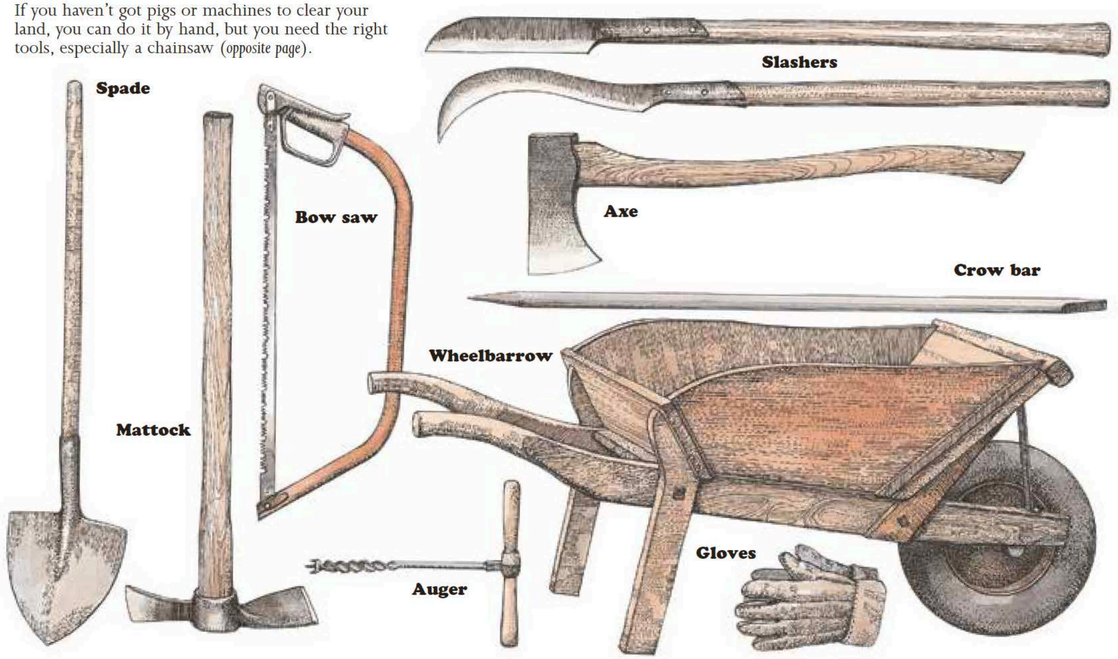
Goats will kill small trees, and big ones too if they are concentrated, by barking them, and they will prevent trees from coming back. They will not, of course, get the trees out, any more than pigs will. You will have to do that.

Clearing woodland

It is essential to have a petrol-driven chainsaw for this work (of course you could hire a mechanical excavator, which is another consideration of cost against time, plus the back-breaking "slashing" of usable timber when the wood is green). A chainsaw is a lethal, noisy monster and you'll have to learn to use this with great care. Courses in chainsaw safety are available and you should ask your supplier about this. First cut off all light branches that are no good for firewood, then cut logs from timber that might serve as good firewood (this includes sections of large roots when the stumps are pulled out). Take all this away to your woodstore for cutting up and splitting later. You can then get a few helpers – kids often love this job – to take all the brashings (small branches) to make a bonfire. Make this in a corner somewhere where the flames will do no harm and you can then leave it for a couple of months until a cold dry winter day makes a good bonfire party.

If you leave the tree stumps reasonably high, say at about 2 or 3 feet (50 cm–1 m) this will make it much easier to lever them out. A good digger driver can clear a big area in a day at a reasonable cost. Have the stumps piled up in a corner for burning a few months later when they have dried out. It is cheaper to haul stumps out with a tree-jack or monkey-winch. You might hire or borrow one of these, or buy one if you had a lot of land to clear, but they cost in the hundreds. There are many varieties of them. Alternatively, you can dig stumps out with spade and mattock, but this is very laborious.

HAND TOOLS
If you haven't got pigs or machines to clear your land, you can do it by hand, but you need the right tools, especially a chainsaw *(opposite page)*.



A more accessible method is sodium chlorate, which is a common weed killer, much used by terrorists for the manufacture of their infernal machines. If you drill holes in the stump and fill them with sodium chlorate, put some cover over the holes to stop the rain from getting in, and wait a month, you will find that the stump has become highly inflammable. Build a small fire on the stump and it will burn right away. A more organic option might be filling the holes with sugar, buttermilk, or dried milk powder to encourage decomposition.

Don't forget that clearance is not the only option. It is perfectly possible to renovate old woodland by judicious felling and replanting. You can then leave the old stumps to rot in situ. When the timber is more mature the wood will make an ideal holding ground for pigs or poultry. Or consider if it would not be better to replant old woodland as new woodland and farm it as forest.

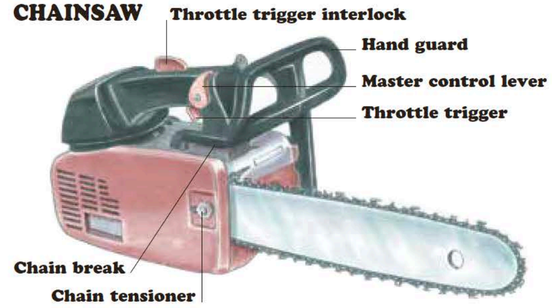
Gorse, broom, and brambles

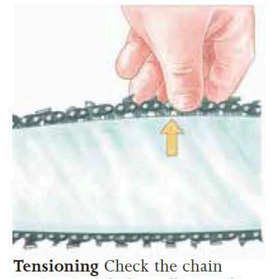
Areas covered with gorse, broom, and brambles can be cleared very effectively with a bow saw and a sharp scythe. Make sure you have a good pair of leather gloves and you can remove gorse fairly quickly with a small bow saw. A chainsaw is noisy and will quickly blunt when cutting gorse near to the ground (which is what you want to do). Your scythe will easily cut brambles if it is sharp and you always pull away from the roots. Cutting thorny brambles from a distance with a scythe is very effective: use a pitch fork to pile them up in a heap for burning. Once you have cleared an area, you may need to pass over it with your scythe once or twice every year for a few years after to keep down the prickly shoots that are re-emerging.

Removing rocks

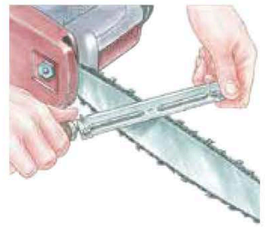
Rocks can be very obstructive, particularly on boulder-clay or glacial till in which boulders have been left by the retreating ice in a completely random fashion. Again, a mechanical excavator can deal with these if they are not too big, hauling them out and dozing them to the side of the field. You can lift quite large rocks, of several tons or more, with levers. Dig down around the rock, establish a secure fulcrum at one side of it – a railway steeper will do, or another rock – insert a long beam of wood or a steel girder (a length of railway line is ideal) and raise that side of the rock a few inches. Now pack small rocks under the big rock, let the latter subside, and apply your lever to the other side. Do the same there. Continue to work your way round the rock, raising it again and again the few inches made possible by your lever and packing small stones under it each time you have gained a bit. You will eventually work your rock to a point above the surface of the surrounding ground. Once you have got a boulder out you may be able to roll it to the side of the field, again using levers. If it is too big for this, you can try lighting a big fire under it, heating it right through, and then throwing cold water on it. This should crack it.

CHAINSAW



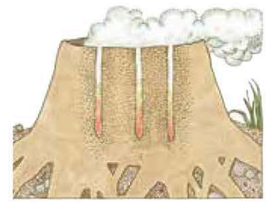


Tensioning Check the chain tension is right by pulling with your thumb, and make sure the chain lubrication is filled up and working properly.



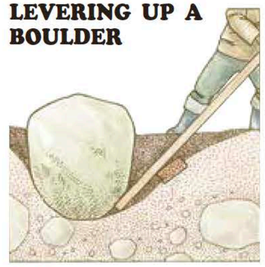
Sharpening With a file holder leave the chain on the bar and lock it with the hand guard. Always file from inside to outside with the cutter in a horizontal fashion.

BURNING A STUMP



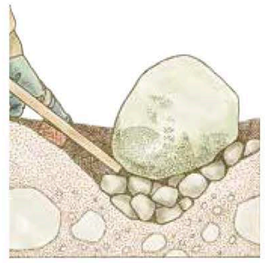
Drilling holes in the stump is a slow but effective way to remove it. For faster results build a fire on top.

LEVERING UP A BOULDER



1 Use a rock or a chunk of wood as a fulcrum. Work a lever down beside the boulder.

2 Raise the boulder as far as possible. Prop up with stones. Take lever and fulcrum to the other side.



3 Repeat the process over and over, gaining a few inches each time. Once the boulder is out, roll or lever it off your field.

IMAGES AND TEXT MOVED SLIGHTLY IN THESE 2 COLUMNS

Bottling

Glass jars for bottling must have airtight tops, capable of supporting a vacuum, and arranged so that no metal comes into contact with the contents of the jar. If you examine the common "Kilner" jar, or any of its rivals, you will find quite a cunning arrangement ensuring that the above requirements are met. A rubber ring compressed by a metal screw-cap forms an airtight seal, and only the glass disc inside the screw cap comes into contact with the jar's contents. Kilner and other proprietary jars need the metal parts smearing with vaseline to prevent them from rusting, both when in use and when stored away. Keep the rubber rings in the dark, for light perishes rubber.

To bottle you also need a container in which jars can be boiled. If you buy one it should have a false bottom, so that the jars are not too close to the source of heat. Alternatively, put a piece of board in the bottom, or else just a folded towel. When bottling fruit pack the jars as tightly as you can; tapping the base of the jar on the table helps to settle the fruit, and drives air bubbles out.

BOTTLING FRUIT

Cold water bath method

Put the fruit into jars of cold brine or syrup and put the jars in cold water. Take an hour to bring water to 130°F (54°C), then another half hour to raise it to the temperature given on the chart below.

Oven method

Fill the jars, not putting any syrup or brine in them yet, and covering them with loose saucers only. Put them in a low oven at 250°F (121°C). Leave them for the time given in the chart, take out and top up with fruit from a spare jar that has undergone the same process, then fill up with boiling brine or syrup, screw on the tops, and leave to cool.

Hot water bath method

If you have no thermometer, and no oven, use the hot water method. Fill packed jars with hot syrup or brine, put the lids on loosely, lower into warm water, bring to the boil, then simmer for the length of time shown on the chart below.

For fruit other than tomatoes, use a syrup of sugar and water if you wish. Water alone will do, and if you pack the fruit tightly you won't need much. But if the fruit is sour, a weak syrup does help.

BOTTLING VEGETABLES

I strongly advise against the bottling of vegetables, but if you insist upon doing it you must heat in a pressure-cooker, as boiling at atmospheric pressure is not enough to make it safe.

Sweet corn can be bottled (although I prefer the oven-drying method I described on p.300). Husk your corn, remove the silk, wash well, and cut the corn off the cob with a knife. If you force the cob on to a nail sticking up from a board at an angle, you will have it steady for slicing. This will leave a little of each grain on the cob, but that's all the better for the pigs. Pack the corn in the jar to within an inch of the top, add half a teaspoonful of salt to each pint of corn, fill up to half an inch from the top with boiling water, put the lid on loosely and heat in a pressure-cooker at 240°F (115°C), at 10 pounds pressure, for an hour. Remove the jars from the cooker and seal.

Salting runner beans

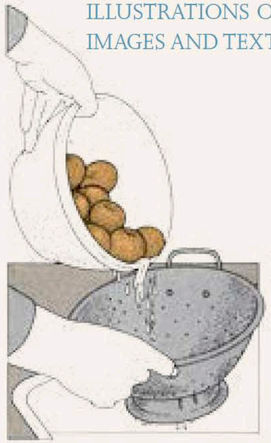
Use a pound (0.5 kg) of salt to 3 pounds (1.4 kg) of beans. Try to get "dairy" salt or block salt; though vacuum salt will do. Put a layer of salt in the bottom of a crock, a layer of stringed and sliced beans (tender young French beans do not need much slicing, whereas runners always do) on top, another layer of salt, and so on. Press down tightly. Add more layers daily. When you have enough, or there are no more, cover the crock with an airtight cover and leave in a cool place. The beans will be drowned in their own brine, so do not remove it. To use, wash some beans in water and then soak them for no more than 2 hours.

Basic method	Cold water bath		Hot water bath		Slow oven	
	Take 90 minutes to bring water from cold to required temperature, then follow instructions given below.		Starting at 100°F (39°C), take 25–30 minutes to reach required temperature of 190°F (88°C). Follow instructions.		Preheat to 250° F (121° C). Leave bottles according to times given below.	
Liquid in bottles	Put cold syrup or water in before processing.		Put hot liquid at 140°F (60°C) in before processing. For tomatoes, liquid is optional.		Add boiling liquid at end of processing.	
Soft fruit Blackberries, raspberries, currants, etc. and apple slices	**Temperature** 165°F (74°C)	**Time** 10 min	**Temperature** 190°F (88°C)	**Time** 2 min	**Temperature** 250°F (121°C)	**Time** 45–55 min
Stone fruit Cherries, plums, etc. **Citrus fruit**	180°F (83°C)	15 min	190°F (88°C)	15 min	Heat oven to 300°F (149°C) and put hot syrup in before processing them.	40–50 min
Tomatoes	190°F (88°C)	30 min	190°F (88°C)	40 min	250°F (121°C)	80–100 min
Purées and tight packs	Allow 5–10 minutes longer than times shown above and raise temperature a little.					

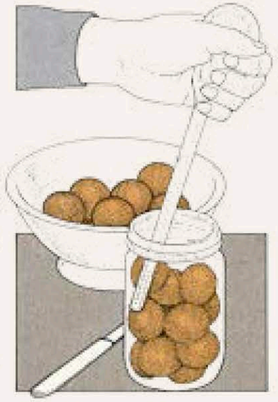
ALL COLOUR ILLUSTRATIONS REPLACED WITH THE OLD STYLE ILLUSTRATIONS ON A TINTED BACKGROUNDS. SOME OF THE IMAGES AND TEXT HAVE BEEN MOVED SLIGHTLY

BOTTLING TOMATOES
Jars of bottled tomatoes on your shelves in winter are a cheering sight. They are easy to bottle and it even improves their flavour.

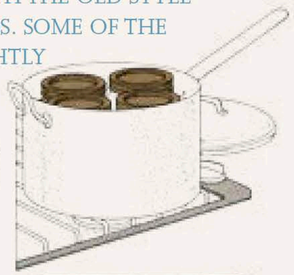
1 Remove the green tomato stalks, and nick the skins with a knife.



3 Drain and cover with cold water. Don't leave them very long or they will soon go soggy.

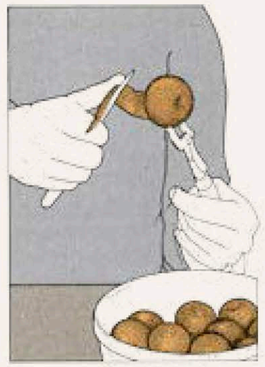


5 Pack tomatoes in jars very tightly. Push large fruit into place with the handle of a wooden spoon.



7 Put jars in a pan of water, or stand on newspaper in the oven. Now cook.

2 Put the tomatoes in a bowl and pour over boiling water. Leave until the skins have loosened.

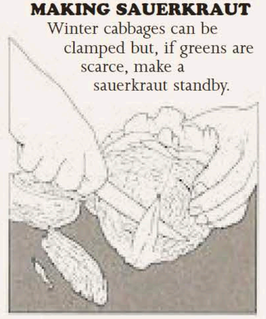


4 Peel off the skins carefully so that the tomatoes retain their shape and do not lose any juice. Make up a brine by mixing half an ounce (14 g) of salt to a quart (1 litre) of water.

6 If sterilizing in water, fill the jars with brine, cover with sealing discs, and screw lids on loosely; if in the oven, add brine afterwards.

8 When cool, try lifting the bottle by the disc only. The vacuum should hold.

MAKING SAUERKRAUT
Winter cabbages can be clamped but, if greens are scarce, make a sauerkraut standby.



1 Shred hard white cabbage hearts finely, and estimate ½ ounce (14 g) salt for each 1 pound (0.5 kg) of cabbage.

2 Pack layers of shredded cabbage into a stone crock or wooden tub; sprinkle salt between the layers.

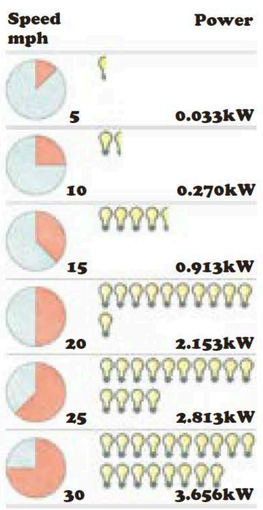
3 Spread one big cabbage leaf across the top, put a cloth over it, and cover that with a plate.

4 Weigh the plate down and leave in a warm place. In 3 weeks put the cabbage in jars and sterilize.

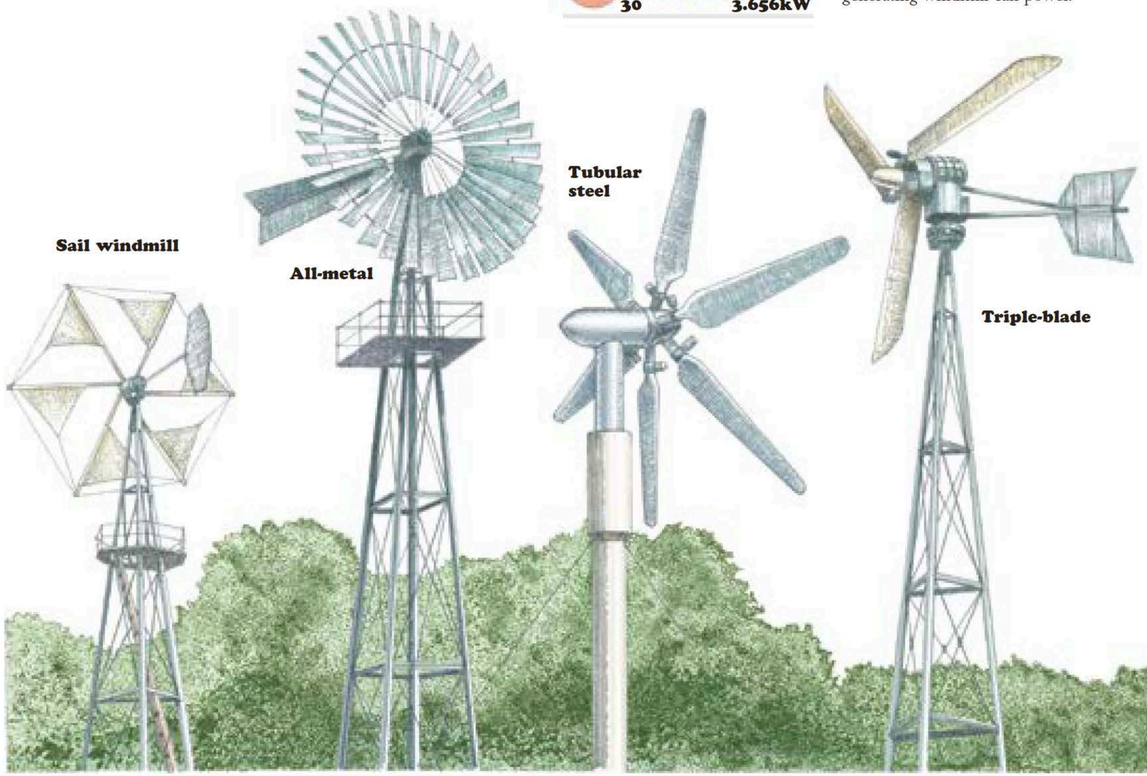
Power from the Wind

The common factory-built steel pumping windmill, seen by the thousand in all lands where water has to be pumped up from deep boreholes, is one of the most effective devices ever conceived by humans. Many an old steel "wind pump" has been turning away, for 30 or 40 years, never failing in its job. Such machines will pump water comfortably from 1,000 feet (300 m) and work in very little wind at all. The tail-vane is arranged on a pivot so that the windmill can turn itself sideways to the wind in a storm.

Wind power has followed the same trend as water power in that low-powered but high-speed devices are now wanted for driving dynamos to produce electricity. But the wind, of course, is completely unpredictable, and so you must either accept that you cannot use a machine in calm weather, or in severe gales, or you must be able to store electricity, and that is very expensive. However, if you can use the power when it is available – say, for grinding corn, or store it, as heat, for example – the total wind energy available over a period of time tends to be fairly constant.



HOW MUCH POWER?
The main problem in harnessing wind is that it carries very little power when it blows lightly, but offers an embarrassing surfeit in a gale. The power of wind is proportional to its velocity cubed: in other words, if the wind speed doubles, its power potential rises eight-fold. This means that a fairly large windmill is needed if useful amounts of power are to be extracted from a light breeze, and that the windmill must be protected from storm damage by having a hinged tail-vane which can swing the wind-rotor out of the wind. Or it can have removable sails or blades which can be made to twist into a "feathered" position where they act as air brakes to slow the rotor. The diagram shows how many 100-watt lightbulbs a 15-feet (4.5-m) diameter electricity-generating windmill can power.



This is a variation on a Mediterranean sail windmill. Used for irrigation water pumping by market-gardeners on Crete, it is readily improvised.

This typical all-metal windmill is used for pumping water. A swinging tail-vane turns it out of the wind in a storm. You might be able to renovate an old one.

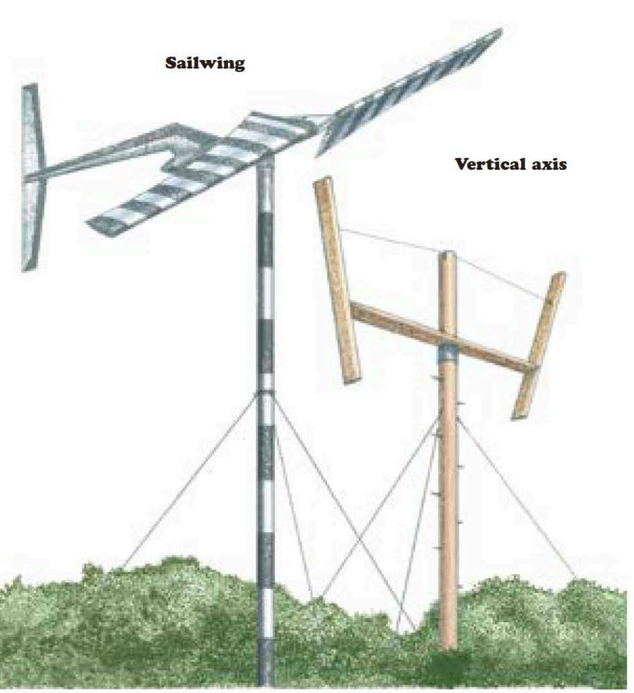
A water-pumping windmill in which the rotor runs in the lee of the tubular steel tower; weights at the blade roots swing them into a feathered position in gales.

This windmill needs only three aerodynamically profiled blades. The machine trickle-charges a bank of batteries to supply low-powered appliances.

To be self-sufficient in electricity

Wind power is hard to win and store, so you should always use wind-generated electricity sparingly. Never use it for heating appliances. In order to exploit wind power you must have an average wind speed of at least 9 mph (14 km/h), with no lengthy periods of low winds; even so you will need battery storage to cover up to 20 consecutive days of calm. Apart from an electricity-generating windmill, you need a voltage regulator and a cut-out to prevent the battery from overcharging. Total battery storage capacity needs to be 20 x average current needed in amps (watts ÷ volts) x average usage time in hours per day, measured in amp hours. Standard domestic electric appliances requiring 220 volts a.c. can be driven from a bank of 12 volt (d.c.) batteries by an electronic invertor. Alternatively, low-voltage appliances may be used directly. A typical 2 kW, commercially manufactured windmill will often generate at 110 volts d.c. to charge a bank of low-voltage batteries, wired in series. You might get 5,000 kW-hr annually from a 2 kW windmill. One kW is equal to one unit of electricity.

REMOVED PART OF ILLUSTRATION →



This is the simple and cheap sailwing, developed at Princeton University, USA. A fabric sleeve is stretched between the two edges of the "wings."

Reading University, England, developed this vertical axis windmill. Aerofoil blades are spring-loaded and fold outwards to prevent over-speeding.

Generate your own electricity

The typical electricity-generating windmill is available in kit form or as a do-it-yourself design. The aluminium or fibreglass blades are pivoted from the hub: centrifugal force works on the balance weights and overcomes a set of springs attached to the hub shaft, so the blades feather automatically if the rotor overspeeds.

A toothed rubber belt drives a car alternator to produce up to 750 watts. Power is transmitted down the inside of the tower, either through a conducting slip ring and brush, or by a cable which can be released when it is twisted, thus providing a breakable connection. Similar arrangements might be improvised though they might suffer in reliability.

ROTOR TYPES
Here are a selection of rotor blades running on electrical generators, pumps, and even a Dutch-style millstone – ideal for the self-supporter. Locally constructed and operated windmills have been highly successful in many rural communities in Denmark as it happens. Sadly, incentives for small-scale windpower are few.

Rotor type	Typical load	rpm	Hp	Torque
Propeller (lift) double and triple	electrical generator	high	0.42	low
Darrieus (lift)	electrical generator	high	0.40	low
Cyclogiro (lift)	electrical generator or pump	moderate	0.45	moderate
Chalk multiblade (lift)	electrical generator or pump	moderate	0.35	moderate
Sailwing (lift)	electrical generator or pump	moderate	0.35	moderate
Fan-type (drag)	electrical generator or pump	low	0.30	high
Savonius (drag)	pump	low	0.15	high
Dutch-type (drag)	pump or millstone	low	0.17	high