

preparation #1

Sowing times

Wheat is divided into spring and winter wheat, meaning spring wheat which grows relatively fast and is sown at the start of Spring (usually March) once soil is over 8°C and winter wheat which is sown at the beginning of winter, between late September and the end of November. Winter wheat needs a period after initial growth with consistent temperatures under 7°C in order for it to "vernalise" and become fertile. Both winter and spring sown wheat in an average year will be ready for harvesting in late July to August. If harvested in a traditional manner the crop will be cut and bundled into sheaves and then these stacked into stooks to dry in the open for three to four weeks. The crop will then be ready to be threshed and winnowed at the beginning of September.

Choosing and obtaining seed wheat

Do not use seed wheat without knowing the variety or mix of varieties and how it has been cleaned and stored. You can plant modern wheat varieties but you should be aware these are bred to need and benefit from heavy application of fertilizer and use of herbicides and pesticides. Older varieties pre-1950s and traditional "landraces" (genetically diverse mixes traditionally planted by an area's farmers) are generally more rugged and resistant to a variety of problems.

Planting of a "landrace" or possibly a mix of older varieties can produce a crop which keeps out weeds better and is less susceptible to disease with a more consistent crop year on year. Planting a mix of varieties together can also produce a heavier crop than planting the same seed unmixed though you should try to check that all varieties in a mix have the same or close growth cycle, i.e. days to harvesting. A mixed variety sowing will not produce a harvest with new crosses between varieties since wheat in our climate is self fertilising with very few rare cross fertilization. If you have sufficient space to plant both a mix and separate sowings of exactly equal amounts of grain this could be an interesting experiment. You can contact Brockwell Bake (<http://www.brockwell-bake.org.uk/> atty.area3@gmail.com 07852863952) for advice and possibly for seed, but please do so as long before you plan to sow as possible.

Sowing site

Your sowing site can be a normal bed or a raised bed. For spring sowing a raised bed should mean the soil will warm up approximately a week earlier. Your site should be as little over-shadowed as possible both for rain and sun. Some shelter from wind can however be an advantage.

preparation #2

Choosing soil and soil depth

One of the main problems for wheat growing is “lodging” which means when the crop topples over when the ears become heavy, usually as a result of wind and/or rain in conjunction with weak straw and/or loose anchoring in the ground. Particularly because of this for either old or modern varieties its not good to grow on pure garden centre type potting compost. A good quality medium heavy topsoil would be preferable or topsoil with some compost.

Old and traditional landrace varieties are generally much taller but on the other hand their roots are generally longer and ripe ears lighter than modern varieties. For non-modern varieties no fresh organic matter or manure should be applied otherwise they will get too tall and the risk of lodging will be increased. However a bed that has had manure or compost applied a year before for a past crop is good. Wheat is normally grown in a three or four year rotation with other crops.

Wheat can grow in quite shallow top soil but on the other hand roots can be as long as 46cm. Particularly if growing in a container to avoid drying out a depth of at least 25cm is recommended.

Soil preparation

Ideally the bed for your wheat sowing should be worked into a good tilth ready for sowing. If your bed is at regular ground level, for spring sowing, traditionally this would mean digging over with spade before winter, re digging and breaking up with fork a week to two before sowing, if necessary re digging immediately before sowing and then raking into a fairly good surface tilth. Treatment for a raised bed could be similar but probably less digging will be necessary as less likelihood that soil has become compacted.

Avoid sowing your wheat in a bed that either has perennial weeds or which you think or know has a heavy load of weed seed in its soil.

Traditionally a wheat crop would be rotated with the next year being a bean or other nitrogen fixing crop followed by another crop which could be potatoes, brassicas or roots; so any bed that happens to already match this rotation would be very good.

Equipment needed for wheat sowing

Depending on method of sowing either a dibber or a hoe (see sheet 7), rake, labels, label marker pens, ruler or tape measure, string, sticks, plastic cups, weighing scales.

preparation #3

Planning you sowing session

The key objectives of your sowing session should be to meet the requirements of sowing a viable crop, to allow your class to do as much as possible of the sowing work themselves and to create a sense of ownership, involvement and interest in the crop, at a class, team and individual level.

The key constraints will be the resources you have available (planting site, quality of soil, teaching personnel and assistants etc.), the time available with your class or gardening club to complete the sowing and the age and abilities of your group.

The key to fulfilling the full potential of the sowing session is to access your resources and your class' capabilities and plan ahead accordingly.

- Preparing the ground: if your class is not old enough to do so or you will not have enough time in class or there is not physically enough room on your sowing site for your class, as a whole, to be involved in preparing the ground then do this before the class for them. Do not end with half of the class period, the kids watching a bunch of adults doing all this work for them.
- Planning the sowing: before the class carefully plan with the available sowing space and available seed (more than one variety?) what drills or line of holes you are going to sow into and how it may be possible to divide up you class so that teams and/or individuals can assume ownership of a particular row or set of dibbled holes (see "sowing methods" sheet 7). If necessary draw yourself a map of how the sowings will be positioned and possibly mark out where rows will go on the site before the sowing session.
- Measuring, weighing and counting: as a minimum your children should put the seed into the ground for themselves. If they are old enough and there is enough time you can also involve them in dividing up you seed to go into different rows. If they can't help with this then you can either divide up seed into labelled plastic cups before or during the class.
- Plan to complete sowing: try to avoid any risk of the planned sowing being unfinished by the end of the class session. Its probably better to have preparation tasks done before the class session, complete actual placing of seed in the ground with your class, with time to explain things, rather than add extra tasks for the children to do.

preparation #4



Checking germination - sprouting without soil

If you have any doubts about the fertility of the wheat you are going to sow it is best to do a fertility test by sprouting (chitting) it without soil. This can in any case be interesting to show your class either before or at the same time as your main sowing.

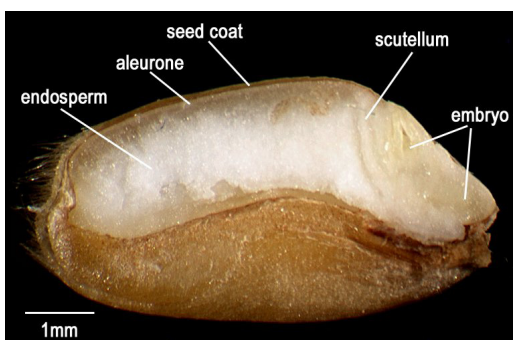
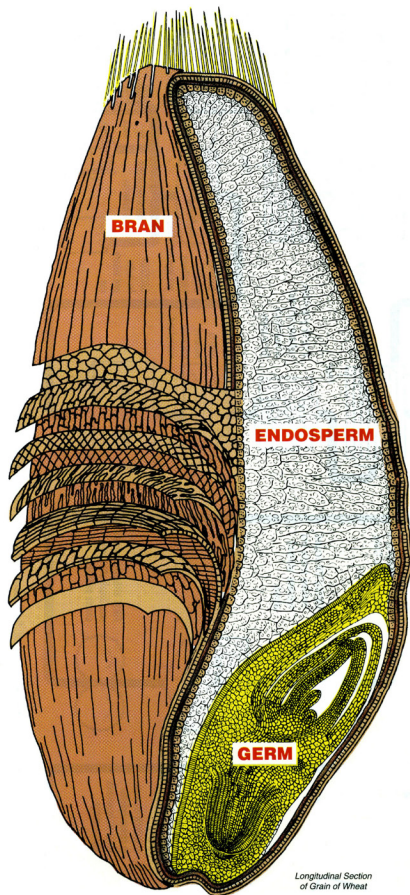
1. Soak a small handful of your wheat over night.
2. Prepare a clean empty large pickle jar by piercing holes in its lid.
3. Empty you soaked seeds into the jar and up end it till drained.
4. Place jar with wheat in a warm position such as near (but not on) a radiator.
5. Get your class to start and keep a daily record for a week of what happens next. This could include taking a few seeds out each day and getting your class to make drawings, maybe with the help of magnifying glasses. You can accompany this by explaining the internal structure of the wheat grain before germination (see "inside the Grain" sheet 4).
6. At two day intervals refill the jar with water, swish around and then drain.
7. After three days take out at least one hundred grains at random and get your class to count how many have germinated. Anything below 75% is not good, 100% or very near is typical of good seed grain.
8. You probably can end this experiment after a week. You can plant out the wheat if you want to.

Alternatively you can do this test in a heated propagator if you have one, either with seeds buried in potting compost or sitting on top of the compost.

With some soil or compost if you want to and have a suitable juicer you can allow to grow on until wheat is about 10 cm tall and harvest with a scissors to make the wheat grass drink the health benefits of which is much promoted by some <http://en.wikipedia.org/wiki/Wheatgrass>

Grow your own wheat

inside the grain



Bran

- Bran is the hard, brownish outer protective skin of the grain. It surrounds the germ and the endosperm, protecting the grain from weather, insects, mold and bacteria.
- The bran consists of 7 layers. The bran layers are a concentrated source of dietary fibre.
- The aleurone is the layer of cells between the bran and the endosperm. It contains a higher proportion of gluten compared to other inner parts of the grain.
- The aleurone layer is a concentrated source of vitamins, minerals and other nutrients.

Endosperm

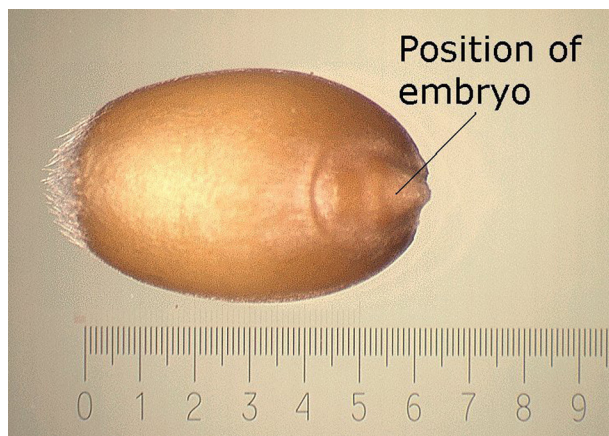
- The endosperm is the inner part of the grain. It supplies food to the growing seedling.
- The main nutrients in the endosperm are protein and carbohydrate. About 50 to 75% of the endosperm is starch. It also contains the gluten storage proteins, gliadin and glutenin, typically 8 to 18%. Relatively few vitamins, minerals, fibre or phytochemicals are found in the endosperm.
- White flour is produced from the endosperm.

Germ

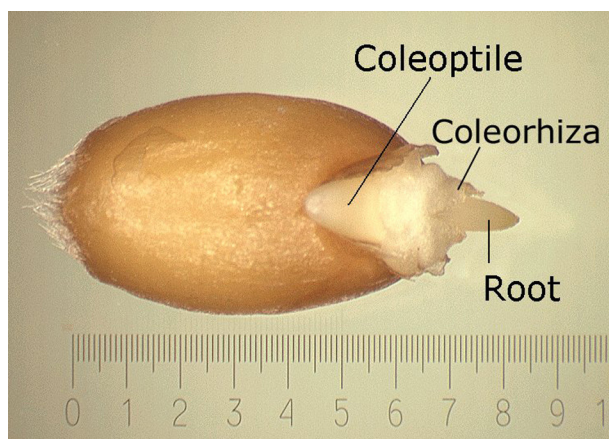
- The germ contains the plant embryo. It typically accounts for about 2 to 3% of the wheat's dry weight.
- Most of the wheat kernel's fat (comprised of essential fatty acids), B vitamins and vitamin E content are found in the germ.

Grow your own wheat

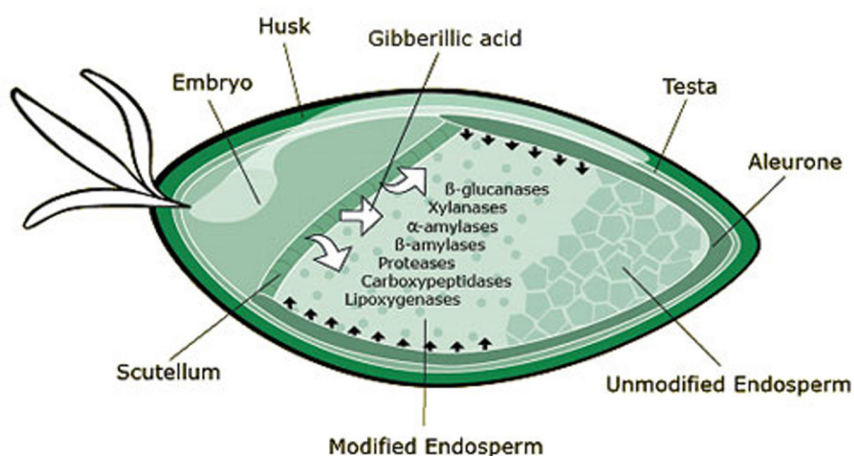
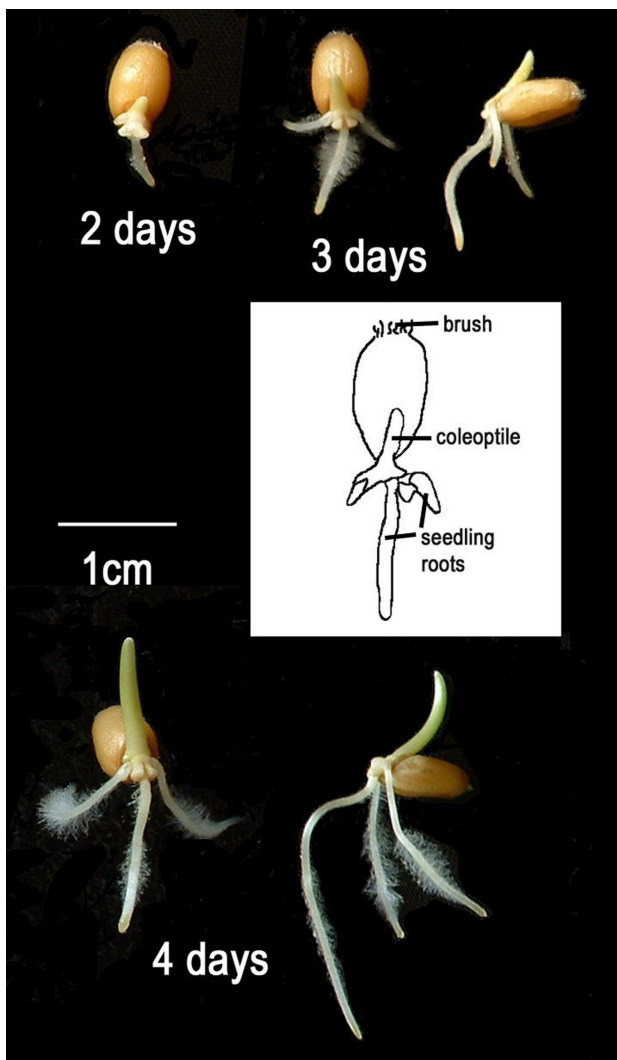
germination



Day one



Day two



As grain moisture level rises to around 45%, β -amylases are activated and other enzymes produced and begin to turn the starch of the endosperm into sugars that are fed by the scutellum to the embryo.

sowing methods



a Vincent Van Gogh study for his "The Sower" painting

Broadcasting

The most traditional method of sowing wheat is simply walking a prepared field throwing out seed as you go. In fact its an extremely skilled job to get an even coverage and even when done well usually a lot of seed is lost to birds and if weeds become a problem they cannot be easily hoed out.

Drilling

Drilling is the most common modern method and on a farm and is done with a drill behind a tractor (first invented by Jethro Tull in 1731) which places the seed in controlled amounts at a set depth in rows. Manually can be done by hoeing out a furrow, placing seed, evenly spread, into this and then raking in. Sowing in lines allows for some weeds to be removed by hoeing.

Dibbling

Dibbling was used historically when seed wheat was scarce or when a farmer wanted to bulk up a limited or new but small seed supply as fast as possible. Suitable depth and spaced holes were made by the farmer with a dibber and the farmers wife and children came along after placing two or three seeds in each hole. The method lends itself to a school situation as individual children either singly or in groups can take responsibility for sowing in individual holes.

Grow your own wheat

sowing by dibbling

Equipment needed: dibber(s), rake, labels, label marking pen, ruler or tape measure.

Wheat tillers, this means it can send up more than one stem with an ear on it. Each extra stem from the central one is called a tiller. Part of the reason why sowing by “dibbling” can maximise the crop from a comparatively small quantity of seed is that it allows more room for tillering.

However the correct spacing varies according to whether one is sowing spring or winter wheat, winter wheat has more time to tiller therefore needs more space. Different varieties also tiller to differing extent (consult your seed provider).



You can quite easily make a dibber by sharpening to a blunt point a broom handle. You might even like to make a tool with two dibbers, hand made or not, strapped together at the correct distance. Cross bar could be put at right place to stop dibbers going into ground too far.

Soak overnight before sowing: this helps with germination but is not required unless ground is very dry. Alternatively if ground is dry water it after sowing.

Depth: correct depth for planting wheat is 4cm. This is the depth that a wild grass in the right situation would use its hulls to burrow itself down into the ground. Since we have bred the hulls off wheat grain it helps to give it a hand to get down to this correct depth.

Spacing: for spring sown wheat make holes at 15cm in both directions. For winter sown wheat space holes 15cm apart in one direction and 25cm in the other.

Whether for winter or spring sown wheat get your sowing teams to place two seeds in each hole. If there is any doubt about the fertility of your seed or you are sowing late make it three seeds per hole.

Labelling: You can label each hole with the names of the team members who sowed that hole.

If you have more than one variety of wheat don't forget to label these also.

Recording: Of course your class may well be going to keep a diary of your wheat crop's progress. But even if they aren't please make sure to record the date and quantity of each variety that you have sown.

sowing by drilling

Equipment needed: suitable hoe to create a furrow 4cm deep, rake, labels, label marking pen, ruler or tape measure, plastic cups, weighing scales, string, sticks.

Careful measuring out of the ground and weighing out of the grain is the key to successfully sowing in drills.

Soak overnight before sowing: this helps with germination but is not strictly required unless ground is very dry. Alternatively if ground is dry, water it immediately after sowing.

Rate of sowing: this can be between 15g to 35g per square metre depending on the fertility of your grain and whether you are sowing late. 25g per square metre is a good standard.

Create a grid with the string and sticks dividing up your ground into 1 square metre boxes.

Create 3 furrows across each box, 4cm deep. Weigh into plastic cups portions of 25g (more or less depending on fertility and timing) of grain to each cup, one for each square metre you are sowing.

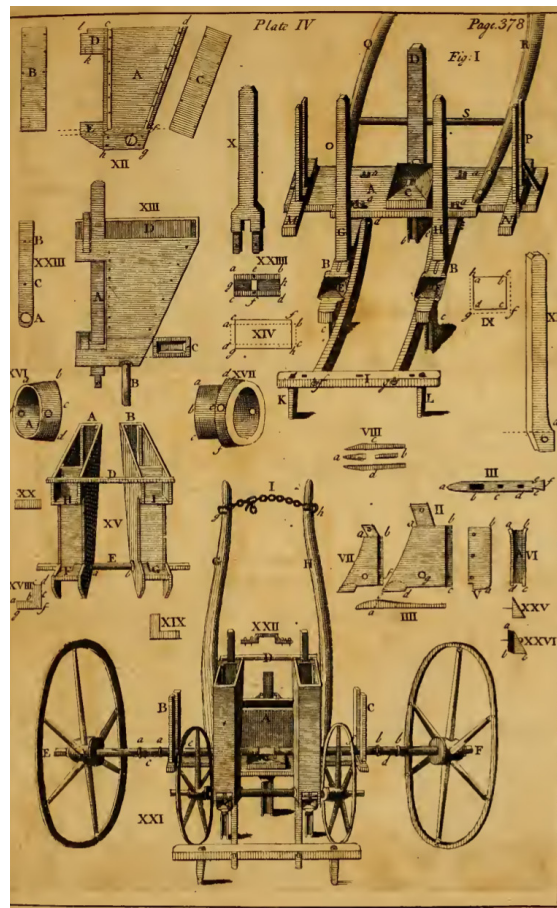
Divide you class into teams where there is enough sowing to be done and get each team to attempt to spread their cup of grain as evenly as possible in the three furrows inside their square metre box. They may want to divide the contents of their cup into three equal piles before they put it into the furrows.

When seed has been put into furrows use rake to fill the furrows in with soil.

Labelling: You can label each square with the names of the team members who sowed that square.

If you have more than one variety of wheat don't forget to label these also.

Recording: Of course your class may well be going to keep a diary of your wheat crop's progress. But even if they aren't please make sure to record the date and quantity of each variety that you have sown.



Jethro Tull's 1731 seed drill, the first

Grow your own wheat

sowing in the classroom

As an interesting exercise for your class at the same time as you sow outdoors why not sow some wheat in the classroom in pop bottles? This way your class can see the roots grow as well as the wheat plant growing above ground. This experiment is maybe best done with a modern wheat variety, as when fully grown there will be slightly less chance of bottle and wheat toppling over.

Equipment needed: 2 litre transparent plastic pop bottles, topsoil, gravel, wheat

Preparing the bottles

Remove the labels and clean, cut off the top of the bottles so that they start when already at their maximum width, drill five or six largish holes in the bottom of each bottle, fill 5 cm of the bottom of bottle with coarse gravel if available. Now fill the bottles with top soil or compost or a mix of soil and compost till there is 5cm left free at top.

Sowing

Now place around ten soaked wheat grains in a circle near to the outer edge of the top of the soil. Place a 2cm layer of your soil on the top of the wheat. Water and place on a tray in a sunny position in the classroom.

How many bottles?

You might want to have five bottles, after about a month you could use a couple to demonstrate what happens if you place one in a dark cupboard and stop watering another.

Two others you could have your class empty at three week intervals, clean soil off plant roots and measure, weigh and maybe draw images of the root structure at 3 weeks and 6 weeks.

keeping wheat diaries

If your class is at a suitable age why not get them to keep a wheat diary (or diaries)? A diary could contain drawings, photos, words and measurements.

Soiless sowing (germination test)

Follow the instructions on sheet 4. Get your class to record, measure and draw the progress of the grain germinating daily for a week. At intervals record the number of grains germinated by selecting 100 at random and then counting how many of these have germinated and how many not.

Bottle planting in the classroom

You may want to record daily for first week. Root and wheat plant above ground can both be measured. If you empty some bottles at 3 week intervals, individual plants can be washed and then weighed.

Your crop outdoors

Similarly crop can be measured, leaves counted, the different stages of growth (see diagram on sheet 12) noted at regular weekly intervals. A log of the weekly weather could be added to these records.

Grow your own wheat

wheat growth stages

Spring wheat	Establishment (0)		Tillering		Head development		Flowering (2)	Yield Formation (3)	Ripening (4)
	15-20 days	10-20 days	early (1a)	late (1c)					
Winter wheat	10-15 days	15-25 days	(1b)	40-50 days	15-20 days	30-35 days	10-15 days		

(1b) Winter dormancy up to 90 + days