Bees 'n Beans Instructions

Using broad beans and 'rat-tailed' radishes to look at pollination happening around your school. This project is part of a UK study looking at pollination in gardens and other green spaces in towns. The project is co-ordinated by the University of Sussex.

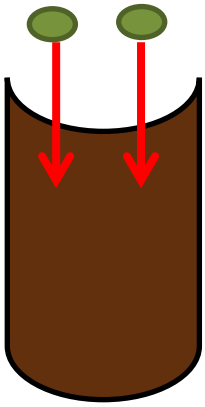
Broad Beans are mostly pollinated by bumblebees.

Radishes are mostly pollinated by hoverflies, and smaller bees.

Initial set up practical sessions are needed, plus 10 minutes twice each week, to pollinate the hand-pollinated plants. Sessions for recording results are also needed. The seeds, pots and instructions are in the field kit provided.

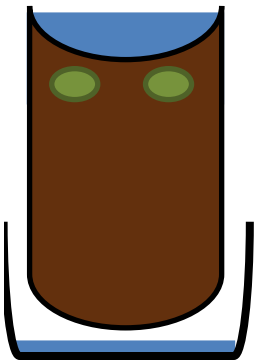
Stage One – Planting Up (per pot)

Broad Beans



1) Fill 5 black plastic pots with soil*, leaving a 1 cm space at the top.

2) Push 2 beans into the soil, about 4cm deep and fill soil* back in.



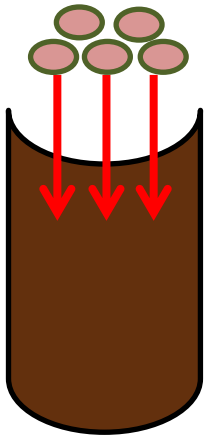
3) Water well, put in a tray to retain water.

4) Keep warm and well lit, somewhere sheltered, preferably inside

5) Keep the soil* moist.

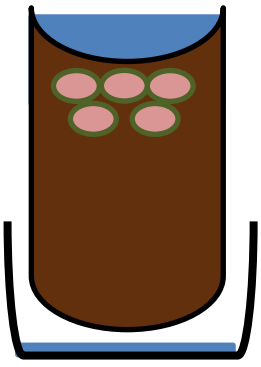
*(*soil or compost can be used)*

'Rat-tailed' radishes



1) Fill 5 black plastic pots with soil*, leaving a 1 cm space at the top.

2) Push 5 radish seeds into the soil*, about 1cm deep and 2 cm apart. Fill soil* back in.



3) Water well, put in a tray to retain water.

4) Keep warm and well lit, somewhere sheltered preferably inside.

5) Keep the soil* moist. Plants will sprout in a week.

Remember: The soil* will need topping up over the experiment as it gets compacted.

STAGE TWO – REDUCING NUMBERS AND MOVING OUTSIDE

Broad beans

After about a month, the bean plants should be about 5cm high. If there are two plants growing in a pot, one needs to be gently removed so there is **one** plant per pot.

When the plants are over 10cm high (like those in the picture on the left – note that size can vary quite a bit) they can be moved outside. Try to avoid frosts. Continue to grow the plants somewhere sheltered until flower buds start to form.

Water twice a week, unless it is hot and plants start to wilt – if so water more, but treat all plants at the same time.

Broad beans are susceptible to slug and snail attack. Ideally, keep the plants in a shallow tray, which can be filled with water. This stops the plants drying out, and acts as a moat against slugs. If possible, check for slugs or snails, in and under the pots before watering.

'Rat-tailed' radishes

The radish plants will start growing quickly. When the young plants are about 5cm high, gently remove any extra plants so that there is **one** plant per pot.

When the plants are over 10cm high (like those in the picture on the left), and have hairy leaves, they can be moved outside.

Continue to grow the plants somewhere fairly sheltered until a flower spike forms.

This will be a thick stem that grows from the middle of the leaves and will be where the flowers form.

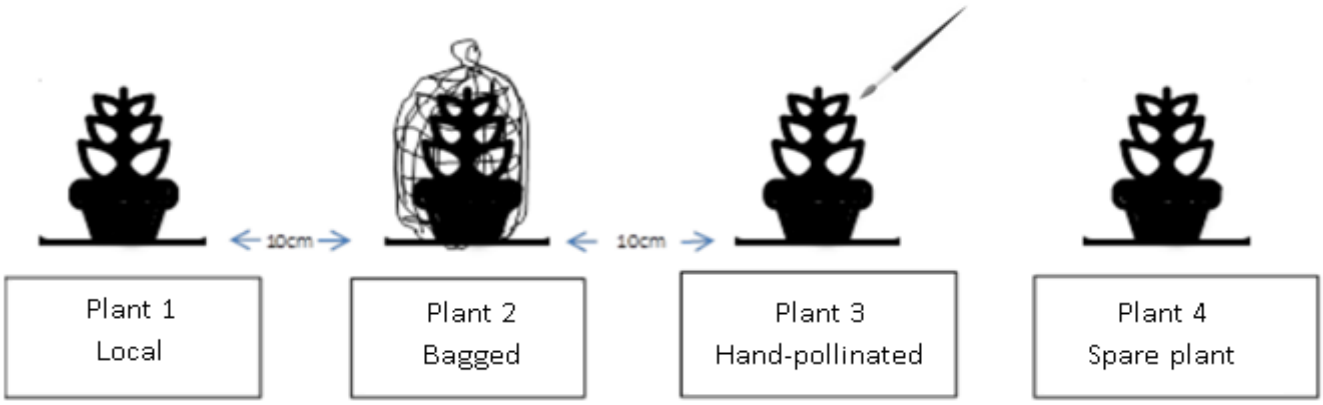
At that point, the flower spike should be tied to a garden cane or stick to support it (take care as the spikes are a bit brittle).

STAGE THREE – FLOWERING AND EXPERIMENT DESIGN

When the flowers start to open on the plants, the experimental stage can start.

The general principle is the same for both types of plant. There are 3 'treatments' that make up one experimental group. The radishes will also need a spare plant, so each group will be 3x mature bean plants, and 4x mature radish plants, under treatments:

1) One plant will be left alone to be pollinated by **local** insects.
2) One plant will be **bagged**, with garden fleece, to keep insect pollinators out.
3) One plant will be **hand-pollinated**, to make sure it has been fully pollinated.



Where to place the plants?

You will need to decide on places on the school ground to place each experimental group; we will provide project packs for each site. These sites should be about 500m apart but can be at the front, back or the sides of the building, or at different ends of a field. The locations need to described, i.e. is it near to playing gardens, fields, conservation area, surrounded by tarmac, etc. See the recording sheet for detail.

Important notes on plant selection

- When picking plants to be used at each experimental sites, the three plants need to be as close to **the same size** / number of stems as possible.

This means that any differences in the results should because of the different pollination received, not by one plant just being bigger or healthier than the others.

- When choosing which of the three plants at each site will have which 'treatment' - this needs to be done **randomly**.

This might not seem hugely important for a few plants, but because this will contribute to a larger study, it is. The easiest way to do this is to number your plants (1 – 3 will do), and use either a random number generator (on a calculator, or using a website like www.random.org) to assign each one to one of the three 'treatments' above.

EXPERIMENTING – BROAD BEANS

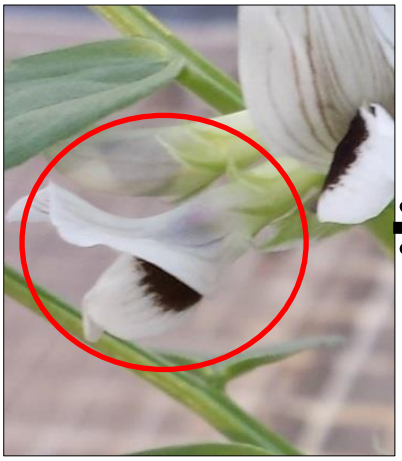
You will need **three** plants that are about the same size, and have the same number of stems. The spare plants can be left to grow somewhere else or disposed of.

Local-pollination plant

Bagged plant

Hand-pollination plant

All of the plants need to be kept watered; twice a week and more frequently if it is hot. The **hand-pollination** needs to be done **twice a week** (can be done at the same time as the watering). The method of hand-pollination is shown below:



Find open flowers. the black part should be visible.

Gently grip the top petals. Gently grip the bottom petals.

Pull gently on bottom petals to open, then let go. Repeat x 5 per flower.

Flowers that go grey/ floppy may be fertilised and **should not** be handled again.

Plants will need to be fed with a commercial tomato / veg feed when beans start to form (follow the instruction on the pack).

EXPERIMENTING – 'RAT-TAILED' RADISHES

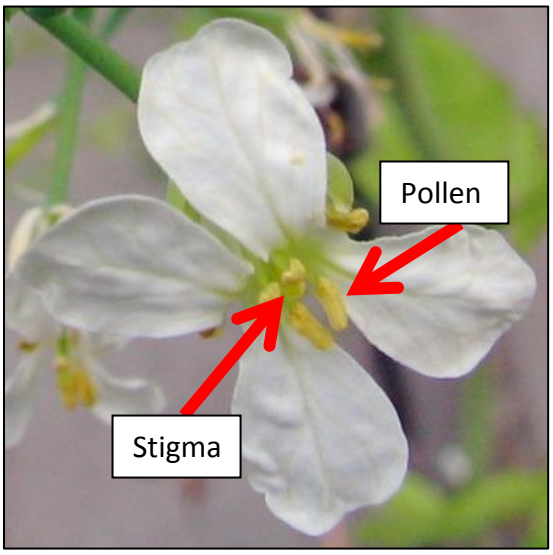
You will need **four** plants that are about the same size, three for treatments and at least one spare plant to provide extra pollen (but a few spares may be helpful).

The radish plants need to be bagged slightly differently to the broad beans. Because the flower spike will get much taller than the rest of the plant, the fleece does not need to cover the pot **at all**, and can be loosely tied around the flower spike **below** the actual flowering bit (see photo of 'Plant 2' to the left).

The top of the fleece may need to be moved up as the plant gets taller / wider.

All of the plants need to be kept watered. This can be done directly into the pots; twice a week and more frequently if it is hot.

The **hand-pollination** needs to be done **twice a week** (can be done at the same time as the watering). The method of hand-pollination is shown below:



1) Using a small paint brush, gather the bright yellow pollen from the **stamen** (male parts) of the flowers on the spare plant (this should come off easily).

2) Brush the collected pollen onto the **stigma** (female part, green and in the centre) of open flowers on the **hand pollination** plant.

Please note that the radish plants may well lose most of their leaves as the project continues – this is normal, as they do not produce many leaves. If leaves snap, leave them attached; only remove parts of the plant that have gone yellow or mouldy.

The radishes are less likely than the beans to suffer from slug damage, but they are a more brittle plant. Later in the summer, caterpillars may start to damage the radishes – these should be obvious, and can be picked off easily.

STAGE FOUR – HARVESTING AND RECORDING

Broad beans

Bean pods should be ready for harvest **16 weeks** after sowing (or a bit later if you are further North). **All** pods from **all three** plants in each experimental group should be harvested at the same time, and recorded on the project recording sheet provided:

- **Number of pods** from each plant
- **Weight of pods** (g) from each plant
- **Number of beans** from each plant
- **Weight of beans** (g) from each plant

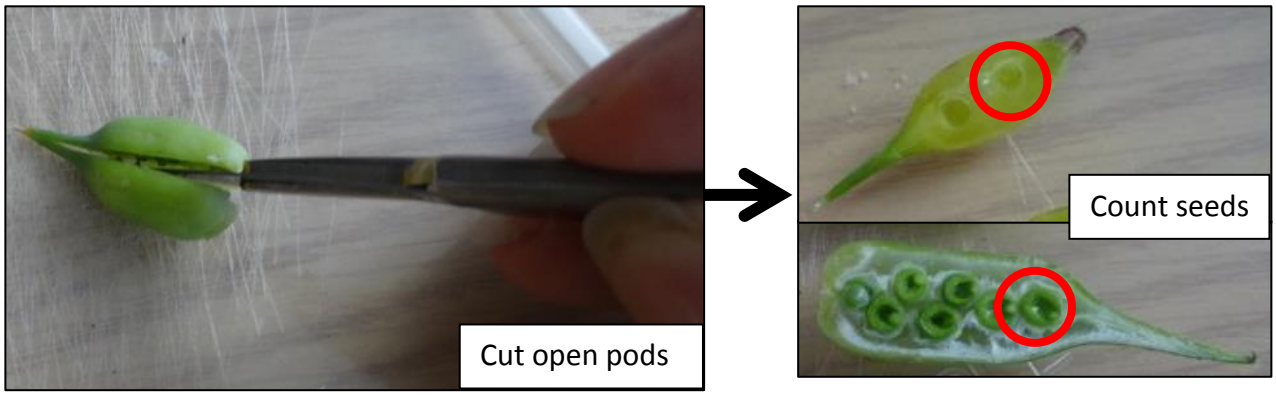
This will allow us to compare the success of each treatment crop, and give a measure of how well the local insect pollinators are doing in helping pollinate the plants.

Radishes

The 'rat tailed' radish seed pods are ready to harvest when they are about the width of a pencil. The first pods may be ready to harvest as little as **10 weeks** after sowing.

Removing the pods will encourage the plant to produce more flowers, so it is important that this is done consistently for all plants at the same time, **including the bagged plant.** Seed pods that are big enough to harvest (pencil width or more) should be taken from **all** plants, **once every two weeks**.

Seeds will vary in how developed they are within the pods (as shown in the pictures). They should be easy to count by cutting open the pods with a sharp knife, as follows:



One the recording sheet provided, please note:

- The **date** of each harvest.
- The **number of pods** harvested per plant.
- The **number of seeds** harvested per plant.

Data from both plant types can be posted back on the recording sheet (please keep copies if you do), emailed, or can be inputted into an online form that will be made available later in the year.

OTHER OBSERVATIONS

The **recording sheet** provided has space to record other observations of insect activity on the plants during the experiment:

1) Robbing (broad beans only).

Shorter-tongued bees are known to bite into the base of bean flowers to access the nectar, leaving distinctive holes (circled in red). These bees have difficulty pollinating the broad bean flowers properly, so if these robbing holes are present, it can indicate that those bees are present on your site.

Please record:

- **If** flowers have been robbed
- **Date** of the first robbing observation

2) Flower visitors (both broad beans and 'rat tailed' radishes)

There is space on the form to record any insect visitors that you see on the plants.

There is no specific time you need to do this, just when you are able to, or when hand-pollinating. We have not provided a specific identification guide with the project documents, but there are many available resources online for identification if you would like to have a go. (http://www.nhm.ac.uk/nature-online/life/insects-spiders/identification-guides-and-keys is a good place to start)

Please record:

- Type of insect (bumblebee, honeybee, hoverfly, etc).
- **If you can**, record the species of any bumblebees seen.

DO NOT WORRY if you are not able to identify specific species

3) Reasons for loss (both broad beans and rat tailed radishes)

If you suffer failures of the experiments, please can you record why this was? Slug damage, wind damage, plants drying out, fungus problems and so on, or any other reason. This will help me to find out what works best in this project.

CONTACT DETAILS AND OTHER RESOURCES

The project website is www.ljbees.org.uk, the specific Schools' section is www.ljbees.org.uk/Schools, and downloads are here www.ljbees.org.uk/Downloads.

I am happy to provide uncropped versions of any of the images used in these instructions, but as these are quite large (~5mb in many cases) I have not put them on the website yet – but do email me if you would like a specific image.

The downloads page will have freely downloadable copies of:

- The Instructions sheets, for both the Schools and Public versions of Bees 'n Beans; in .doc and .pdf format.
- The recording sheets, in .doc and .pdf format.
- Frequently Asked Questions and tips for different stages of the project.
- A guide to pest control, in .doc and .pdf format.
- A small pollinator ID guide.

Data summaries will be sent back to participant schools after collation and analysis by the project team. Exact details of what data will be shared will be agreed by the project team with schools on an individual basis.

If you have any further questions, anything is unclear, or you have a problem with experiment, please contact me by email or phone:

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RISK ASSESSMENT

Risks to individuals

Risk	Assessment	Precautions
Injury to hands due to manual handing of seeds and soil.	Low	Good hand hygiene – washing with soap and water after handling seeds and soil.
		Cover cuts in skin – use of gardening or other gloves.
Injury to eyes due to manual handing of seeds and soil.	Low	Use of eye protectors if compost is very fine.
Injury to eyes due to plant growing equipment.	Low	Cover ends of supporting sticks with something obvious (such as a yoghurt pot) to reduce impact likelihood and risk.
Irritation to skin from handling plants.	Low	Staff to assess on one-to-one basis if extra precautions are needed for vulnerable participants (e.g. with eczema).
Cutting injury due to use of scissors / knives.	Medium	Cutting out of fleece for bagging plants should be done under supervision.
		Use of sharp knives to cut open radish seeds should be done under supervision, or by a supervising adult.
Stinging injury from insects.	Low	Emphasis of the need not to disturb foraging **bees** or **wasps** present on the plants. **Hoverflies** cannot sting and present no threat of injury.
Allergic response to eating any of the plant products.	Low	Staff to assess on one-to-one basis if extra precautions are needed.

Risks to the project

Risk	Assessment	Precautions
Non arrival of field kit	Low	Participants will be told when kits have been dispatched – so non-arrival can be notified to the project team and replacement sent.
Loss of seeds (non-germination, rotting, vermin eating seeds)	Medium	Notify the project team and replacement/s will be sent.
Loss of plants	Medium	An advice sheet is available on the web site on how to minimise attack by slugs and snails.
		Wind damage can be minimised by supporting plants and not planting in particularly windy areas.
		Recording form contains a section for recording reasons for loss of plants.
Loss of data	Medium	Please keep back-up copies of all data recorded, in separate places.
		Project team will back up data to digital storage immediately if received on paper; and retain paper copies.