Grow Pulses 4 Science

Continuing Jeanie Clark's environmental education series in the International Year of Pulses (IYP)2016

How exciting is it to have pulses in your pantry? You can use them for cooking nutritious meals. You can use them for exploring plant science. This article will focus on a developing pulse plant.

Grouping Pulses

We saw in the introductory article (in "*From soils to pulses*" in Otherways issue 147 pp 29-30) that the Earth's biodiversity has produced lots of different pulses. How can they be grouped? This first activity involves an essential science skill – observing and categorizing, or grouping, things.

Our senses are the first tools we have for doing science. In the introductory article, the activity about the shapes of pulses in the pantry, used senses of sight and feel to produce pulse models. Did you name their shapes too? Using my sample in the logo photo above left, my shape groups are (clockwise from top): kidney, oval ball, discus, yo-yo with peak and (in the centre) dimpled ball.

What other groups can be made using sight? The reference sample could be the 12 pulses shown in the IYP brochure* (photo below), or pulses in your pantry or gathered from a shopping trip. Some questions to think about are:

- Is shape the most obvious way to group the pulses in this photo? (Hint: link to colour photo*)
- Are groups by colour and size different?
- What other groups arise using other senses?
- What tools could give greater precision?

* Source: excerpt from FAO IYP promotional poster http://www.fao.org/fileadmin/user_upload/pulses-2016/images/posters/En_IYP_Poster.pdf

There are 12 groups of pulses, of which the main four are: (dried) beans, chick peas, lentils, and (dried) peas. How much variety is there in these? *Pulses Canada's* website has named photo galleries for each of these four groups (from http://www.pulsecanada.com/food-health/what-is-a-pulse). Could you now identify to which groups the IYP photos and pulses in your pantry belong?

Description and groupings are the basis of the scientific identification of things. Visual features are often the key ones: colour, size, and shape. Other features can add complexity and precision.

Consider the groups of pulse seeds in your pantry. Their function is to grow themselves a future! We stop that by using them as food, but not as they are! What we do to them is linked to how their life cycle begins#. Let's experiment!

AIM: To investigate pulse growth from seeds

Water and pulses

Expt. 1 needs: at least a couple of similar sized seeds of each (not 'split') pulses from the pantry,
A shallow container with water.
A ruler

Method: Put half of each type of pulses into the water to soak and leave the other dry.
Leave a few hours at least.
Compare the dry pulses with those soaking for: colour, size, shape and feel.(e.g. in photos below)

Take the pulses out of the water and put them beside the dry ones to observe differences better. Be more precise by using a ruler to measure the longest diameter. For example:

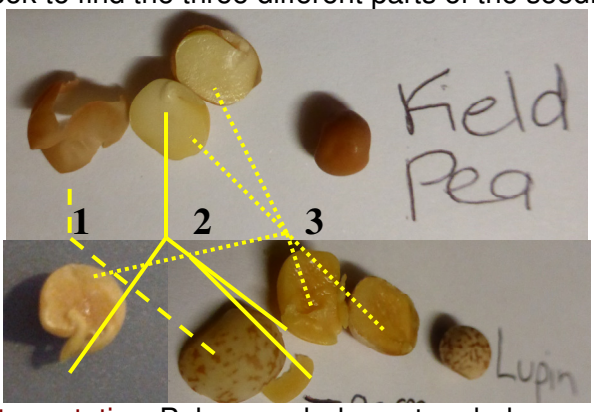
Interpretation: Soaking seeds softens their hard seed coats and swells the seed. So: 1 the seed inside knows the conditions are right to start growing. … and… 2 we will be able to eat them

Looking inside a pulse

Pulses are seeds we eat. They have a hard cover to protect the next generation of seed. The seed gets the message to start growing when the hard outer cover gets wet and softens.

Expt. 2 needs: well-soaked larger pulse seed(s)
A small sharp knife – to be used by someone who can do so safely.
A magnifying glass or digital camera (used for taking close-up photographs).

Method: (Feel the outside of a dry pulse – without soaking it can't be split open with the knife)
Split open a soaked seed along its dividing line.
Look for a small bumpy raised bit on one half. (If not visible, repeat using a seed soaked longer.)
To look closely inside, use the magnifying glass, or take digi photos (from several directions to really pick it up) and view enlarged on a screen.
Pull the seed coat off one half to look closely at it.
Look to find the three different parts of the seed.



Interpretation Pulse seeds have two halves and grow two baby leaves (bumpy bits), '*cotyledons,* ' within the seed. This means they belong to a group of '*dicotyledon*' plants. (*Monocotyledons* cannot be split into two halves, and only grow one cotyledon in its seed.) Both seed groups have three main easy-to-see parts (labelled above):
1 the outer coat (testa),
2 the embryo, from which the cotyledon begins
3 the food storage which the cotyledons consume … or if they are used for food, we do!
A simple diagram shows this structure at http://www2.york.psu.edu/~sg3/ist311/games/team3/. (# This webpage has a 'Plant Life Cycle' #.)

Growth inside the seed case

How can we see what goes on inside the pulse?
Expt. 2b extends Expt 2 method, Repeat Expt 2, with more seeds left for different soaking times and/or length of time after soaking until split open.
Record these different time conditions, with what the seed inside looks like when split open.
Some discoveries that may be made are:

- How much wet time is needed for the seed coat to become easy to open?
- How much wet time is needed for the embryo to become visibly growing?
- How long after soaking does it take for the embryo to use up all its food storage?

Interpretation Pulses, as seeds, respond to water by growing a 'baby plant' inside the seed, using food stored in there for their first growth stage.

Growing outside the seed case (sprouting)

Have you ever sprouted mung beans or something else? What happens to the seed?
Expt. 3 needs: at least 20 big pulse seeds
A container with at least one open or porous side
Up to 8 days of observations
Rinsing water.
Sharp knife to open seed cases
Magnifier or digi camera to see inside better.
Ruler
Basic Method*:
Wash the container and pulses
Soak pulses in container overnight
Rinse twice daily
Open a seed at least after each rinsing, and
Record, as time from start - changes to the seed
* For soaking needs of different seeds see- http://greenharvest.com.au/SproutingAndMicrogreens/SproutsGrowingInformation.html , for the basic method- http://www.simplebites.net/how-to-grow-sprouts-at-home/ , for detailed method with steps in images https://sproutpeople.org/growing-sprouts/sprouting-instructions/growing-mung-bean-sprouts/ (a website with lots of details about sprouting for food), and for food cautions see- https://rawevolution.wordpress.com/2011/11/01/what-not-to-sprout/ .
Interpretation Pulses are designed to grow a new plant. Once rain falls, and softens the hard seed case, the embryo starts growing inside using up the food stored there, from which it gains the strength to push outside the seed case and grow as a sprout, … which ceases, when we eat it!

Growing Roots

What about pulse seeds growing roots?
Expt.4 needs Arizona State University's virtual experiment (which may also be done in reality). https://askabiologist.asu.edu/experiments/vpocketseeds
Method Choose "enter the experiment". There are 10 different (row) conditions (A1 – D2) by which pea sprout and root growth can be compared over 10 days. Selecting a condition and then choosing the 'animate' button, shows its series of growth photos. These can be measured on-line.
Interpretation Hidden in the soil, roots grow down, searching for food to grow sprout into pulse plant.

Growing pulse plants

How quickly does a pulse plant grow? What changes are in its life cycle#? Time to sow seed!
Expt. 5 needs: a few pulse seeds/groups to grow
Pot-plants (or garden) for plants to grow in
Longer time – up to months
Soil, water and access to sunlight.
Ruler
Basic Method:
Plant the seeds in the pot-plant
Nurture it with watering (no floods, no droughts!)
Record, as time from start – growth changes
Interpretation Pulse sprouts grow into pulse plants with stems, leaves, flowers, seeds. ……..