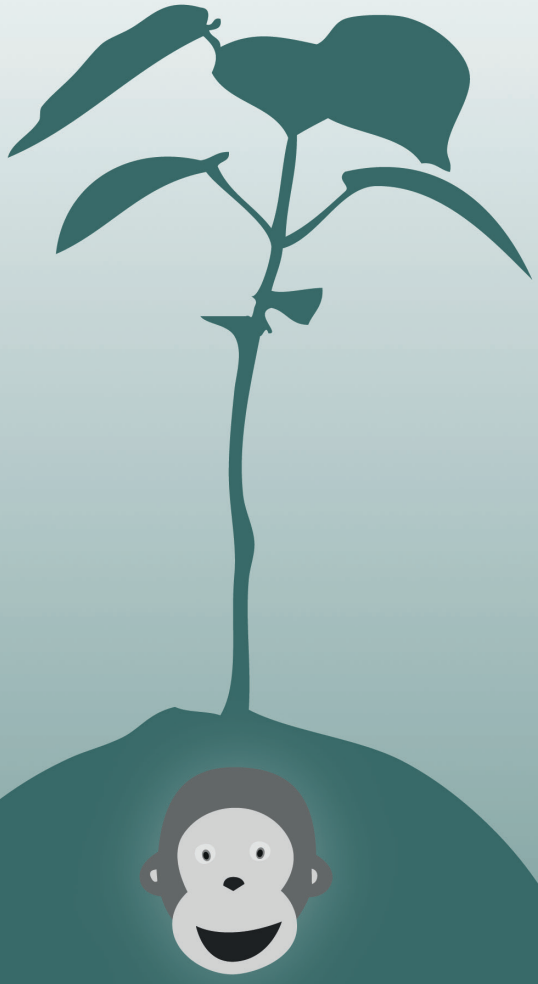


URBAN WORLD ACTIVITY

GROW A LOW-WATER VEGETABLE GARDEN

Jane Goodall's roots&shoots

WATER SAVING AND IRRIGATION: GROW A LOW-WATER VEGETABLE GARDEN

In the xeriscaping activity available on the Roots & Shoots website (direct link: goo.gl/zLK5Mp) we learned about gardening using as little water as possible. This activity focuses on the way that water is used in farming and gardening across the world, and provides information on how you and your students can set up a school garden that grows vegetables using relatively little water.

IN THIS ACTIVITY YOU AND YOUR STUDENTS WILL:

- Learn about the different irrigation techniques used in farming and gardening across the world.
- Learn about different vegetables and the differing amounts of water that they need to grow well.
- Learn about the specific low-water irrigation and water saving techniques that are suitable for a small vegetable garden in Abu Dhabi.
- Plant and care for a low-water vegetable garden (long-term project).

OBJECTIVES

Carrying out this activity will help students realise that different types of vegetable require different amounts of water to grow; that this water can be provided in different ways; and that different vegetable/irrigation combinations are suitable to different parts of the world. By showing the students the different gardening methods in use across the world and considering the climate in Abu Dhabi they can (with your help) draw conclusions about the best methods to use in a vegetable garden of their own. Finally, we do not just want talk, but action! Put what you have learned into practice and build a low water vegetable garden at your school!

WHAT DO I NEED TO MAKE IT WORK?

The learning stages of this activity can all be done in the classroom with minimal resources such as pens and large sheets of paper for making a wall planner. Access to the internet will be vital for background reading provided in links below. The practical part of the activity involves planting and caring for a low-water vegetable garden and will require access to a suitable outside area to build the garden and gardening tools (trowels, spades, gloves etc.). Irrigation may require access to an outdoor tap or water butt.

WHAT THINGS WILL MY STUDENTS CREATE?

- A wall planner for the classroom showing when gardening tasks need to be done throughout the year.
- A map of your vegetable plot for each season.
- A low-water vegetable garden.

LEARNING ABOUT IRRIGATION

To start with we will look at different types of irrigation in use across the world, and see which ones are suitable for your low-water vegetable garden.

WHAT IS IRRIGATION?

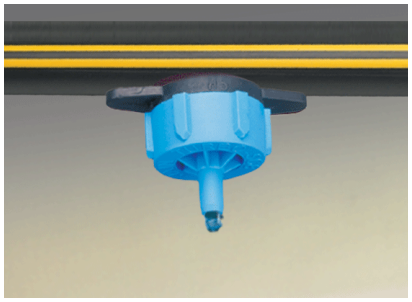
Irrigation is the addition of water to the soil. It is used to help grow crops, maintain landscapes, and revegetate disturbed soils in dry areas and during periods of poor rainfall.

Properly setting up your irrigation is vital to creating a low water vegetable garden, so spend some time with your class on this section to help them understand the issues.

IRRIGATION ACROSS THE WORLD

First, you and your students should look into some of the different irrigation methods used in farming around the world. As you introduce these, ask the students to think about where in the world they might be used, and if they are appropriate for use in Abu Dhabi. Here are some types to look at:

Level Basin Flood Irrigation. Licensed under Public domain via Wikimedia Commons



Drip irrigation – a dripper in action by Jisl [CC-BY-SA-3.0 (http://creativecommons.org/licenses/by-sa/3.0) via Wikimedia Commons

Sprinkler irrigation equipment. Licensed under Creative Commons Attribution-Share Alike 3.0 via Wikimedia Commons

- **Flood Irrigation:** Where crops are in a flood plain the fields can be flooded in a controlled way to provide water to the crops. Flood irrigation can be very wasteful due to problems like run-off (where the water literally runs off the area you are trying to irrigate) and evaporation (especially in hot regions), but requires very little special equipment so it is cheap and easy. As a result, it is used in a lot of less developed areas of the world. Flood irrigation is also required to grow certain crops, like many species of rice (learn about paddy fields on Wikipedia: goo.gl/TP8rC9).

- **Sprinkler, spray or overhead irrigation:** Water is sprayed from a central gun to water its surrounding area. As you can imagine, this method is affected greatly by evaporation, although this can be minimised by choosing the time of day that spraying takes place. This type of irrigation is often required for closely spaced crops covering a wide area like grasses and grains.
- **Drip Irrigation:** Pipes or hoses are set up with drip valves to drip water where it is needed for the plants. This can be a very efficient way of watering plants as it reduces evaporation and run-off, but can be expensive to set up in a large area. It is most effective for the kinds of crops that are planted in reasonably well spaced rows, like a lot of the vegetables grown in a vegetable patch or greenhouse. Its is not suitable for closely spaced crops which cover a wide area (like grasses and grains). A variant of drip irrigation is underground irrigation which can be used to provide water directly to the roots of plants, saving a lot of losses through evaporation. More detail for each of these irrigation types is listed on wikipedia: goo.gl/X2b9on

APPLYING THIS KNOWLEDGE TO YOUR VEGETABLE PATCH

The large scale irrigation methods mentioned above (and others that you discover in your research) may not at first seem applicable to a small vegetable patch. But you should ask your students to think about the small-scale equivalents. E.g. you can compare flooding your veg patch using a hose or water bucket to flood irrigation, careful watering using a watering can with a sprinkler cap to overhead irrigation, and there is a section on small-scale DIY drip irrigation in the text below. Which of these methods use the least water? Which ones seem wasteful in the Abu Dhabi climate? Which do your students think would work best in your own vegetable patch? If you already have a vegetable patch or garden, why not try out each of these methods and measure how much water each one uses?

WHAT HAVE WE LEARNED SO FAR?

These are the key points your students should have learned from looking at irrigation:

- Drip irrigation is the most water efficient way of watering a small vegetable garden in Abu Dhabi.
- Knowing this helps you narrow down the crop choice for your garden – we need to look for plants we can grow in rows or clumps, and avoid grasses and grains that cover a wide area and need overhead irrigation.

CHOOSING WHAT TO GROW

Next, we need to choose what plants to grow in our new vegetable garden.

We've already decided that we want to grow things that can use drip irrigation, but what are the best plants to choose? Here are some guidelines to consider when choosing:

- **Avoid plants with big, broad leaves**. The bigger the leaves the more water the plant will lose in hot weather, so the more you will need to provide.
- **Avoid plants that take up a lot of space** but don't produce a lot of usable produce.

  For example, you should avoid crops like lettuce, broccoli and cauliflower.

- **Choose plants that have deeper, more extensive roots.** Soil near the surface dries out quickly, so plants with shallow roots need watering more often, with more water lost through evaporation.

  Squash, pumpkins, parsnips and sweet potatoes all have deep root systems. Squash also produces a lot of edible produce in a relatively small space.

- **Choose plants that have a short growing season**. Even if they need more water while they are growing, they can still work out more water efficient over the course of the year. Plants with a short season can also be grown twice a year, in spring/early summer and then again in late summer/autumn – this avoids growing in the mid summer when water losses are highest.

  Plants like tomatoes, peppers and aubergines fit this bill.

- **Choose plants that are already adapted to the hot climate.** Although not vegetables, a lot of herbs such as oregano, thyme and sage are great in dry climates. goo.gl/JfXfjb
- **Where possible, choose dwarf varieties.** Dwarf plants are smaller. This means you can plant them closer together, reducing the area you need to water. They are also shorter, which provides better shade cover for the soil, reducing evaporation.

  In Abu Dhabi, aubergine, courgette, onions and potatoes thrive in the springtime. The wintertime is fantastic for growing cucumber, pumpkin, capsicum and chilies. Tomatoes and herbs can grow year round but are not too fond of the harsh sun so choose the right spot!

OTHER IMPORTANT WATER SAVING IDEAS FOR VEGETABLE GARDENS

As well as making sure that your irrigation system is efficient and you've chosen the right plants, there are also some other important ways of saving water that you should introduce to your students. These are discussed briefly below, and here are some useful links for background information – just type the short link into your web browser's address bar to access the resource:

- goo.gl/0g0bhV – Water Conservation in an arid vegetable garden
- goo.gl/Rbpb3t – Details on mulching and drip irrigation
- goo.gl/uCZ5W5 – Advice for saving water in your vegetable garden

Take a look at the following water saving methods. You will need to incorporate these ideas into your garden plan.

- **Soil preparation:** Prepare your garden's soil by adding lots of rich, organic compost that will help trap moisture and encourage deep root formation in plants. Maybe you could think about setting up a compost bin to make your own compost over time. Here's how to make a compost bin of your own: goo.gl/xeb7HN
- **Mulching** is covering the top soil with a layer that holds in moisture. This can be organic matter like straw or compost, or is can be a man made plastic sheet or fabric. Further detail can be found here: goo.gl/biyo2w

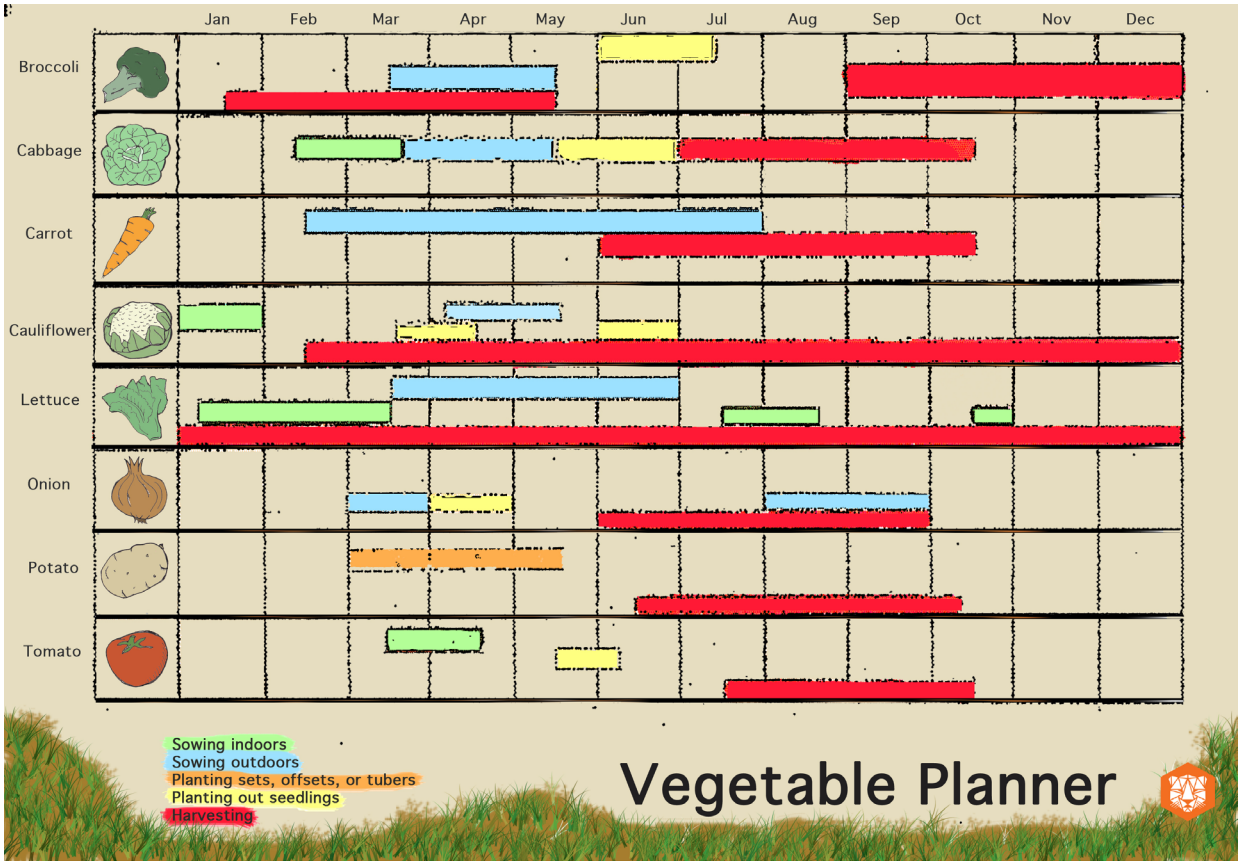
Mulching Image: Marion Phillips [CC-BY-SA-2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

- **Weed control** is important as weeds (plants you didn't intend on growing and don't want) will steal water from the plants you do want, so you'll end up using too much water overall. Save water and pull up the weeds!
- **Plant in groups**, and 'water smart': try and group your plants together by water need so that you don't end up needlessly watering some of them too much just because their neighbours need water. You can also 'water smart' by watering at just the right amount for the plant's development rather than the same amount each week. For example, many plants need frequent, light watering as they are establishing their root system, but more and less often thereafter. This link will help you see which plants need what and when: goo.gl/zXAqys
- **Collecting water** for use on plants: why not try using water from sources other than the municipal supply, such as collecting rain water in a bin or water butt (goo.gl/hc8hvG), using filtered grey water (goo.gl/gDP57m), collecting water from condensation either from air conditioning units (goo.gl/ldfmeF) or from organic matter (like those water stealing weeds).
- **When should you irrigate?** When it comes to watering, the sun is the biggest problem as it can evaporate the water you are giving your plants very quickly if done at the wrong time of day. With this in mind, ask your students what time of day they think is best to water your vegetables? Why not try some tests, by putting out a small saucer of water at different times of day and seeing which ones evaporate fastest? This should help them to see that early in the morning and later in the afternoon/evening are the best times to irrigate.
- **How much should you irrigate?** How much water does a vegetable plot need? When it comes to watering, there are no hard or fast rules. It's a judgment call that depends on the type of plant, the soil, the weather, the time of year. Ask your students what signs they might see in the soil and plants that show if they need watering or not (dry/wet soil–especially if you dig down a bit, wilting leaves and drooping stems). This site gives some advice on how to know you are overwatering: goo.gl/P7alm7.
- **Remove leaves:** Once your vegetables start to develop, in most cases you can prune the amount of leaves on the plant. Removing leaves means less water loss.
- **Harvest quickly:** Harvest your vegetables as soon as they are ready to eat – this stops them using more water than needed. In a similar vein, if your vegetable plant is an 'annual' (only lasts one year) then remove it from your vegetable patch as soon as its harvest is finished to stop it using water from surrounding plants.

MAKING A VEGETABLE PLOT WALL PLANNER & MAP

Now you have all the background information that you need you can start planning your vegetable garden!

- **Create a wall planner** to help visualise when things will happen in your garden. Seed packets usually have advice on when to sow and when to harvest each type of vegetable. Don't forget that many plants are best started off in small pots indoors and transplanted out to your garden when they are a bit larger, so you need to factor in this time. You can plot this information on a chart like this:



Above is an example of a wall planner suitable for the UK as a guide to how to make one and may not apply to Abu Dhabi – talk to your local garden centre for advice. Taken from photobucket (goo.gl/iQpBiW)

- **A map of your vegetable plot** is also important. Use a simple grid the same shape as your vegetable plot and divide it up into areas then you can write in each sub area which vegetables you are going to plant at each time of year. To make it more visual, use a different colour for each season or cut out pictures of the vegetable to stick in each are. Here is some further advice in planning your vegetable plot: goo.gl/WQeN4q

GET PLANTING YOUR VEGETABLE GARDEN

That's the plan made, time to get planting!

Here is a step by step guide of the steps you will need to take to get planting your vegetables.

1. **Seeding the vegetable**s: Most seeds are best grown in pots or trays inside first where they can be easily cared for as the start to grow. Each seed packet should have instructions for this stage. Once seedlings are at the right size (according to packet) they can then be planted out in your plot.
2. **Prepare the ground:** While your seeds are germinating inside, you will need to prepare the soil for the plants outside. To do this you will need to remove any weeds and 'dig over' the soil. This loosens the soil making it easier to plant in and easier for plants to grow. You should also mix in compost if you have some at this point to make sure that ground has the right nutrients and help increase water retention (see the section on soil preparation, above).
3. **Planting and irrigating:** Plant out your seedlings according to your plan. Remember to try and group by water usage. At the same time set up any irrigation you have decided to use such as a DIY drip irrigation (see below).
4. **Don't forget to mulch!** Covering the bare soil around your plants will dramatically reduce water use.
5. **Care for your plants.** Keep a check on moisture levels in the soil so you water only when needed. Keep removing weeds and set up wind breaks if necessary.
6. **Get ready for the harvest time** for each plant. Why not plan some recipes in advance?

DIY DRIP IRRIGATION

Drip irrigation doesn't have to be complicated! Here is a great method you can try whether you are planning a whole vegetable plot or just some indoor pots for growing veg: goo.gl/ThUJAe. It involves simply making holes in a plastic container and burying it in the soil leaving the opening showing so you can top up the water when needed. Fantastic simple irrigation!

KEEP US UP TO DATE

Remember to take lots of photos of your vegetable garden as it develops, and keep us up to date! Just send us an email with details (and some pictures) to MrH@rootsnshoots.ae and let us know what you have been up to, and we'll feature it on the website!

TAKING IT FURTHER

Want turn your vegetable garden into an enterprise? Why not set up a market stall and sell some of your produce so that you can fund continued work in your garden? And if that is not exciting enough for you why not work with a couple of other local schools and have a vegetable competition and judge which school grows the best low water veg?

OUT IN THE WIDER WORLD...

Outside of the scope for a school garden, there are other ways to grow vegetables using relatively little water. Have a look at what one company in the UK is doing to grow vegetables in a 'closed loop' aquaponics system – it's amazing! goo.gl/IB8WrU

WANT TO HELP IMPROVE THIS ACTIVITY?

This activity is a living document! Please help us by editing this activity to make it as good as possible. You can edit it by using this short link (just type it into your web browser's address bar): goo.gl/gwK32o – full instructions are provided. Any edits that can make this resource easier to use in the classroom or more applicable to life in Abu Dhabi are very welcome, so please follow the link and make your contribution!

ACKNOWLEDGMENTS

Many thanks to John Kentish for his contributions to this activity and the provision of invaluable gardening advice.

APPENDIX – LINKS TO OTHER PROGRAMMES

LINKS TO ABU DHABI EDUCATION COUNCIL (ADEC) CURRICULUM STRANDS:

- **Living World** – this activity is about growing vegetables using minimal water, meaning ground water is preserved and energy use and desalination minimised, with positive effects for the living world.

LINKS TO ENVIRONMENT AGENCY – ABU DHABI (EAD) PROGRAMMES:

KEY AREAS

- Direct link to **Water** – this activity is all about reducing water use.
- Indirect link to **Air** – reducing water use means less energy used in water treatment and desalination, so less air pollution.
- Indirect link to **Climate Change** – reducing water use means less energy used in water treatment and desalination, so fewer emissions and less impact on the climate.

CURRENT ENVIRONMENT (HABITATS):

- Direct link to **Ground Water** – this activity is all about reducing water use.
- Indirect link to **Marine** – reducing water use means less desalination and hence less discharge of high salt content brine into the marine environment.