Vegetable Gardening

Poster 5

Lesson Notes
Notes for the Educator

Congratulations on obtaining your Water Wise education notes from Rand Water. The following notes explain the concepts displayed in the poster, and include activities that can be done in the classroom.

The pack is aimed particularly at intermediate phase learners, but is suitable for all levels of education. However, the notes can be adapted to various grades by expanding on the content for more advanced groups, or condensing the content for groups that need only the basic concepts.

The facilitator should first determine the group’s needs, desired learning outcomes and the resources available. They can then decide how best to use the poster and notes. The notes include suggested activities that tie in with the outcomes-based curriculum. The content and activities also touch on the critical and development outcomes found in our constitution, in line with the Revised National Curriculum Statements.

The poster and notes may also be adapted for the training of gardeners.

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Growing fresh vegetables to eat is one way of keeping healthy. Most vegetables can easily be grown directly from seeds sown in your garden. Such examples are pumpkin, peas, beans, spinach, tomatoes and onions. When planning a vegetable garden, you need to place it in a sunny area of the garden, as most vegetables, herbs and medicinal plants need plenty of sunlight (6 hours a day). There should be a water source close by to allow for easy watering and maintenance.

**Planting and watering**

Healthy vegetables need fertile soil or soil that is fed in order to increase its fertility. The soil provides plants with the nutrients and minerals they need to grow well and produce good crops.
Follow the steps below to prepare your soil for planting.

Before digging the trenches you need to collect garden and kitchen waste for a few weeks, allowing it to decompose in a compost heap until you have collected enough.

1. Dig trenches in the area chosen for your vegetable garden. Each bed should be at most 1m across, with narrow pathways in between. You can then easily reach the plants for picking or to do maintenance, without having to stand on the soil in between the plants.

2. Whilst digging the trench keep the healthy topsoil (first 30 cm of soil) in one heap and the poor sub subsoil (the next 30 cm of soil) in another heap. It is also acceptable to only dig up the first 30 cm of soil.

3. Water the trenches well.

4. Place organic matter such as garden and decomposed kitchen waste into the trench and allow it to sink down for a few days. This will enrich the soil.

5. Place the healthy soil (top soil) back into the trench on top of the organic matter.

6. Use the poor subsoil to make the paths around your beds.

Help conserve water by grouping vegetables, herbs and flowers in terms of their water needs and water them accordingly.

Topsoil is the upper portion of soil. It differs in thickness depending on the location. It is usually darker in colour when compared to the deeper subsoil. This is because of its organic richness.
Mulch

Mulch is found in nature: think of the blanket of leaves and twigs under a thicket of trees. Like a blanket retains heat, so mulch helps soil to retain moisture. It should be placed around plants to help the soil retain water for the plant, taking care to keep it a couple of centimetres or so away from plants stems to avoid stem rot.

There are two kinds of mulch - organic and inorganic:

**Organic mulches** include compost, pine needles, bark or wood chips, straw, autumn leaves, shredded newspaper and grass cuttings (sprinkle thinly to avoid clumping). Organic mulch decomposes over time, thereby enriching the soil’s organic content. The activities of the earthworms and microbial organisms in the soil mix these nutrients into the soil, and help enrich and aerate the soil.

**Inorganic mulches** are materials that do not break down, but help the soil retain moisture. Examples are plastic sheeting, gravel, pebbles and stones. Using inorganic mulches often creates a build up of heat in the soil, so is best used with plants that are adapted to heat. Plastic sheeting can be used to sterilise soil in a vegetable garden if there have been outbreaks of fungi, nematodes or other pests. Plastic sheeting can also be useful while germinating seedlings as the increase in heat aids germination. The plastic must be removed immediately once seeds have germinated.

Can you think of examples of mulch types that you have seen in gardens or parks?

- Pebbles
- Bark chips
- Nut shells
- Leaves
Reduces evaporation in your garden by up to 70%.
Inhibits the growth of weeds and enriches the soil naturally.
Controls the soil’s temperature according to the seasons, preventing extremes.

Before applying mulch, dig over the ground lightly to improve ventilation. When mulching beds with newly planted seeds it is best to use dry veld grass clippings or straw, which are thinner than other types of mulch.

Seeds need light and oxygen to germinate and importantly need to be kept moist. The dry veld grass clippings (a layer of 5 mm thick) allows light to penetrate through the mulch to the seed. The mulch layer is also thin enough to allow the seedling to push its way through to sunlight.

**Germination**

Germination is the process whereby a plant grows from a seed after a period of dormancy. Germination is the sprouting of a seedling from a seed, when the first greenery becomes visible (cotyledons). The next leaves to follow are the first true leaves.

**Nematodes**

Plants sometimes become infested with diseases or are eaten by pests. Healthy plants resist diseases and recover from damage better than weak plants. Help to keep your plants strong and healthy by developing fertile soil. You can do this by regularly watering, weeding, mulching and feeding your soil (compost and fertiliser).

The nematode or roundworm is either beneficial or detrimental to a gardener’s cause:
- Predatory nematodes kill garden pests like cutworms
- Pest nematodes like root knot attack the plants.

Nematodes exist in soils naturally, and in some fertile soils the topsoil is estimated to contain billions of nematodes per acre. A high population of pest nematodes decreases the fertility of the soil and reduces crop yields. Nematodes penetrate root tips and cause swelling and distortions. These are easily recognizable on carrots where you find forked roots and lumps on the root system.
Mulching your garden assists in the prevention of nematodes; other techniques are crop rotation and companion planting and the planting of marigolds. The nematodes mistake the marigolds for a host crop and enter the roots as larvae. They are unable to induce giant cell formation, however, which is necessary to increase food intake in order for the larvae to develop into females. The nematodes then remain at the larvae stage or as males and then die out as they draw to the end of their lifespan. Beans are highly susceptible to nematode infestations.

**SOIL TYPES**

Healthy soil is needed to grow healthy vegetables. To make your soil healthy you first need to know what type of soil you are working with.

Loamy soil is healthy soil. It consists of a mix of clay particles and sand particles. It is also full of organic matter and micro-organisms, which are little creatures that keep soil healthy. Micro-organisms and earthworms assist in breaking down and mixing in organic matter, thereby releasing nutrients for the plants and keeping pest infections to a minimum. Loamy soil allows air to circulate and it holds water well.

Clay soil is very sticky and holds water for long periods. If roots remain waterlogged for an extended period the plant can die.

Sandy soil does not hold water well. Water filters through too quickly for plants to absorb a sufficient amount.

Clay and sandy soil are not unhealthy soils. Most vegetables and plants grow better in loamy soil.
**Identifying your soil type**
By conducting a simple soil test, you can easily see what kind of soil you're dealing with. You may want to repeat this test with soil from different areas of your garden.

1. Fill a jar about 1/3 full with topsoil and add water until the jar is almost full.
2. Screw on the lid and shake the mixture vigorously, until all the clumps of soil have dissolved.
3. Now set the jar on a windowsill and watch as the larger particles begin to sink to the bottom.
4. In a minute or two the sand portion of the soil will have settled to the bottom of the jar. Mark the level of sand on the side of the jar.
5. Leave the jar undisturbed for few hours. The finer silt particles will slowly settle onto the sand. You will find the layers are slightly different in colour, representing different types of particles.
6. Leave the jar overnight. The next layer above the silt will be clay. Mark the thickness of that layer. On top of the clay there will be a layer of organic matter. Some of this organic matter still may be floating.

**ACTIVITY**

Samples can be taken using a soil tube, soil auger, or a garden spade. Scrape off all surface vegetation or litter before taking the sample. Dig down 15 cm and then take the sample, about 2 cups full. Remove large pebbles and pieces of plants.

**Notes**
A triangle can be used to determine the textural name of a soil by actually measuring the percentage of sand, silt, and clay found in the soil. After the percentages of silt and clay are determined, these amounts can be plotted on the textural triangle. To do this, project lines inward from the point on each side of the triangle that represents the percentage of that particular type of soil. The line drawn from the silt side of the triangle is placed parallel to the sand side of the triangle. The line projected from the clay line runs parallel to the silt line. The location of the point at which these two lines intersect indicates the name of the soil. By determining your soil type, you are then able to make your soil healthier by adding either clay, silt or loam to your soil, thereby adjusting the percentages and changing your soil type. All soils are not unhealthy, different vegetables prefer different types of soils.

Soil organisms
Soil organisms include the bacteria and fungi, protozoa and nematodes, mites, springtails, earthworms and other tiny creatures found in healthy soil. These organisms are essential for plant growth. They help convert organic matter and soil minerals into the vitamins, hormones, disease-suppressing compounds and nutrients that plants need to grow. As a gardener, your job is to create the ideal conditions for soil organisms to do their work. This means providing them with an abundant source of food (the carbohydrates found in organic matter), oxygen (present in a well-aerated soil), and water. Vegetables thrive in properly cultivated and well-drained soil.

ACTIVITY
Measure the percentage of sand, silt, and clay in your sample
Measure the total amount of sediment in the jar with a ruler
This number represents 100% of the soil sample
Measure the amount of each layer. Divide this layer by the total sample. Take this figure and multiply it by 100 and it will give you the percentage of that sediment in the sample.

Using the percentages from the above calculations and the soil texture triangle below you can identify your soil type and correct imbalances that are found.

The jar should remain murky with plenty floating organic matter, if not you probably need to add organic matter to improve the soil's fertility and structure.

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COMPOST AND MULCH

Increase soil moisture and fertility by covering soil with a layer of mulch to reduce evaporation, and dig in compost. Organic mulches like garden clippings will return nutrients to the soil as they decompose on top of the soil. Legume crops like green beans and peas add organic nitrogen to soil. Earthworms and micro-organisms help break down compost and aerate the soil.

Fertile soil is less susceptible to an outbreak of nematodes.

Compost improves aeration of tight clay soils, whilst building the water and nutrient holding capacity of sandy soils.

How to make compost

To make compost you need to collect your kitchen and garden waste. A compost heap should be placed on a bare patch of soil so that earthworms and other soil organisms have access to it. The heap should also be sheltered from sun and wind to prevent it from drying out. Air is important in the production of compost as it helps organic waste like leaves, shredded branches, grass clippings and vegetable scraps decompose into rich humus.

Make a 15 to 20 cm layer of hard, dry brown material (dry leaves and grass, sticks). This will leave space for air to enter.

The next layer must be 15 to 20 cm thick and contain moist green material (grass clippings, kitchen waste, leaves, wet newspaper).

Continue alternating these layers with what you have available.

This heap can grow to 1.2 m tall and 1.2 m wide.

Once you have completed your layers, cover it with a layer of soil or canvas (covering) to keep heat trapped in the heap. Heat helps break down the compost more quickly.

The heap must not dry out, it must contain moisture. Compost activators are cow, goat and chicken manure and old compost. You must not use pet and human waste, cooked food, coal, disposable nappies or magazines in your compost heap, tins, orange or potato peels.
CROP ROTATION

To prevent attacks by pests and the build up of diseases in the soil, avoid planting the same kinds of vegetables in the same place every year - rather practice rotation planting. Organisms multiply when only one type of plant is grown in large areas, leaving an opportunity for disease infestation.

There are different ways to rotate your crops, namely feeder rotation or sensitive and resistant crop rotation.

**Feeder rotation**

Planting a combination of vegetables, herbs and fruit provides a natural method for effectively controlling parasites without using harmful chemical pesticides. Done correctly, this method increases the yield and improves the taste and aroma of your plants.

Vegetables should be grown in rotation, meaning that the same plant should not be planted in the same bed season after season. This is because some vegetables take a lot of food (nutrients, such as nitrogen) out of the soil (heavy feeders), while others take very little (low feeders). There are some plants that put nutrients into the soil, making it richer (givers).

<table>
<thead>
<tr>
<th>Heavy feeders</th>
<th>Low feeders</th>
<th>Givers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbage</td>
<td>Beetroot</td>
<td>Most types of beans, for example: soya, kidney, pole, broad and lima beans (legumes)</td>
</tr>
<tr>
<td>Green pepper</td>
<td>Carrots</td>
<td>Chickpeas</td>
</tr>
<tr>
<td>Lettuce</td>
<td>Onions</td>
<td></td>
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<tr>
<td>Spinach</td>
<td></td>
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<tr>
<td>Pumpkins</td>
<td></td>
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<tr>
<td>Mealies</td>
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<tr>
<td>Sunflower</td>
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<tr>
<td>Tomato</td>
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</tbody>
</table>

If you keep planting heavy feeders in the same place, you will be taking nutrients out of your soil, causing the soil to become weaker and less fertile. The correct way is to do feeder rotation, which works as follows:

- First grow vegetables which are low feeders;

- When those vegetables are harvested, plant vegetables that are heavy feeders in that soil in the next season;

- Once those are harvested, then plant vegetables that are givers.
Sensitive (S) and resistant (R) crops

Most gardeners follow root crops with leafy crops and non-leguminous with leguminous crops. This system assumes that each different species is susceptible to a different set of pests or diseases. It is not always effective, as some nematodes may still persist in the soil. An alternative method to prevention is to determine the resistance and susceptibility of a plant to the pest and develop a planting program accordingly.

Reduce nematodes:

By planting a susceptible crop followed by a resistant crop and vice versa you are able to starve nematodes of food and their populations will then decline. Onions are more resistant to infestation; therefore they should be planted after beans or spinach which are highly susceptible. Marigolds are helpful in reducing nematode populations. Plant marigolds in rotation and work them into the soil at flowering to help control nematodes. They can also be used to treat infected soils. Marigolds attract nematodes, which become trapped in the marigold’s roots as they are unable to complete their life cycle.

Another method of control is to increase the organic content of the soil with compost and/or well rotted manure. This increased organic content allows bacteria and fungi to survive, and these attack nematodes. Healthy soil leads to healthy plants, which are less susceptible to attach by nematodes.

During winter pests are less active.

Cover a section of moist soil with a clear plastic sheet during hot weather for two weeks. The soil retains an increased amount of heat, thereby sterilising the soil. This is best done whilst preparing your soil for planting.

Some varieties of tomatoes are super sensitive (SS) to nematode infestations.
Companion plants
Companion planting involves growing plants together that complement and assist each other. For example, onions help repel carrot fly, therefore it is beneficial to plant onions and carrots together, both of which are low feeders.

Plants that grow well together are:

<table>
<thead>
<tr>
<th>Plants that do not grow well together are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beetroot</td>
</tr>
<tr>
<td>Carrots</td>
</tr>
<tr>
<td>Cabbage</td>
</tr>
<tr>
<td>Pumpkin</td>
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<tr>
<td>Beans</td>
</tr>
<tr>
<td>Beetroot</td>
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<tr>
<td>Onion</td>
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<tr>
<td>Cabbage</td>
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<tr>
<td>Pumpkin</td>
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</tbody>
</table>

Parsley is a good companion for many plants. Companion plants need not only be for vegetable plantings. Parsley is said to keep aphids away from roses and also enhances the flavour of carrots, tomatoes and broccoli.

Healthy soil = healthy vegetables

ACTIVITY
On paper, design a vegetable garden for your home, according to the advice provided. Remember to take into account access to water and the area you choose in terms of sun and shade. Design your garden using water conservation techniques such as grouping plants according to water usage. Using arrows, indicate your crop rotation plan (use either feeder rotation or sensitive or resistant rotation).

Notes
**GROWING SEEDLINGS**

**Seeding**

1. Fresh seeds are always best to use. If you are buying seeds in a packet check the expiry dates. (Alternatively, collect seeds from ripe, mature fruit or pods found in the garden. Clean away any fruit flesh or dried parts from the seeds.) It is best to use seeds that germinate easily and are large in size, such as beans, pumpkins and maize.

2. Select the appropriate soil mixture for the plant type.

3. Fill the seed trays or plastic containers with the soil mixture and press down until the soil is 1 cm below the edge of the tray/container.

4. Dampen the soil before sowing the seeds.

5. Sow seeds evenly in the tray and then cover with soil and a light layer of mulch. Some seeds can be sown directly onto the soil, for example carrots.

6. Water the seeds gently with a fine rose-head watering can.

7. Label the container and put it inside an inflated clear plastic bag, secured with an elastic band. Place in a warm sheltered spot such as a window sill that has a lot of natural light.

8. When the first true leaves appear the seedlings are ready to be transplanted (see below for method).

**Transplanting**

Moving seedlings is called transplanting, usually from a seedling tray to the ground or a larger container.

1. Seedlings will first develop a pair of cotyledons (rounded leaves) and after that the true leaves will form. Once the true leaves are formed transplanting may take place.

2. Use a pencil to make holes in the compost approximately 4 to 5 cm apart in all directions.

3. Remove the seedlings from their tray, using a knife, by carefully levering under the soil. Lift the seedlings 2/3 at a time. Hold them by their leaves and gently shake them apart.

4. Place each seedling into a hole. Press the compost down gently around the seedlings. Place the seedling into the new holes at the same depth that it was before it was transplanted.

5. Water the seedlings gently with a fine rose-head watering can.
Transplanting a seedling involves digging a hole large enough to fit all the roots in and to allow the stem of the plant to be level with soil surface once the hole is filled in. The seedling needs to watered regularly (every few days) and fed organic fertiliser every 2 to 3 weeks to keep them growing well. Thereafter, water regularly and feed the plants with liquid fertiliser.

**Transplanting a seedling**

1. Loosely sown seed has germinated.

2. Prepare a new tray with compost & make holes using a pencil.

3. Once first time leaves have appeared, remove 2/3 seedlings at a time, lifting them with a knife and gently separating the new seedlings from one another.

4. Place each seedling in the new holes which are evenly spaced.

5. Finally, press the soil down gently around each seedling and water.

Transplanting in the late afternoon allows the newly transplanted seedlings to settle in before it gets too hot the following day.
Irrigation

You can save rainwater to use during dry months in your garden. You can collect large amounts of rainwater from your gutters with a rain barrel instead of allowing the water to run down your driveway into a storm drain.

Sprinklers are not the most Water Wise way to water vegetables. Drip irrigation delivers water directly to the roots and prevents loss by evaporation and damage to leaves and stems caused by spray from sprinklers. Drip irrigation is the most water efficient form of irrigation. This type of irrigation can reduce the chances of powdery mildew occurring.

Making your own irrigation system

Pierce holes 2 cm apart into the bottom half of a 2 litre plastic bottle.
Bury the bottle half way into the ground (the holes must be below the surface). The depth that the bottle is buried to depends on the type of plant being irrigated.
Fill the bottle with water and leave the cap off. The bottle will release water directly to the roots of the vegetables.
**ACTIVITY**

When it rains, observe the path the water follows in your garden. If the water is flowing out of your garden (down the drive way) try diverting it back into your garden. You can do this by using a channel. A channel can be used to slow the flow of the water, reducing erosion. The channel can be vegetated or a dry river bed, which can also assist in cleansing the water. This is specific for your ornamental garden and not necessarily for your vegetable garden.

**hint**

Water less if the weather is cool and overcast. Make a shade cloth from green and orange vegetable bags sewn together to put over the vegetable garden when it is hot and dry, to keep the plants cool and minimise evaporation.

**Vegetable water usage**

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
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</thead>
<tbody>
<tr>
<td>Lettuce</td>
<td>Parsley</td>
<td>Bay trees</td>
</tr>
<tr>
<td>Celery</td>
<td>Potato</td>
<td>Cabbage</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Onion</td>
<td>Cauliflower/Broccoli</td>
</tr>
</tbody>
</table>

**VEGETABLES AND GOOD HEALTH**

HIV/AIDS is one of the biggest challenges facing South Africa. One of the best ways of reducing the effects of the virus is with good nutrition and good mental health. Gardening for the kitchen can foster physical health and have therapeutic benefits for mental and social well-being.
Growing your own vegetables limits your exposure to pesticides and is usually cheaper. Another health benefit is that it increases your mental and general well being. Working in your garden is also a great way to exercise outdoors. By having vegetables within reach and readily available for picking, you’ll be more inclined to eat more vegetables and thereby meet your daily intake requirements for a healthy lifestyle.

Sources of vitamins

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Vegetable</th>
</tr>
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<tbody>
<tr>
<td>Vitamin A</td>
<td>Asparagus</td>
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<tr>
<td></td>
<td>Broccoli</td>
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<tr>
<td></td>
<td>Carrots Peas</td>
</tr>
<tr>
<td></td>
<td>Avocado</td>
</tr>
<tr>
<td>Vitamin B</td>
<td>Peas</td>
</tr>
<tr>
<td></td>
<td>Carrots</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>Corn</td>
</tr>
<tr>
<td></td>
<td>Green peppers</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Mushroom</td>
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<tr>
<td>Vitamin K</td>
<td>Brussels</td>
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<td></td>
<td>Spinach</td>
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<td></td>
<td>Kale</td>
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African potato (*Hypoxis*)

The African potato plant has a long history of medicinal use in Africa. In South Africa studies are being done to determine its effectiveness as an immune booster in primary health care. It is supposed to increase the body’s natural resistance to disease, and to help recovery from illnesses ranging from the common cold to cancer and (inconclusively) HIV/Aids. It is easily recognisable by its bright yellow-star shaped flowers and strap-like leaves. Herbalists often prescribe the *Hypoxis* plant to patients for a variety of ailments. Remember to always consult your doctor or herbalist before trying any new home remedies, herbs or plants.
WATER WISE VEGETABLE GARDENING TIPS:

Keep pathways narrow.

Avoid walking in the beds as this compacts the soil.

Add compost regularly to the beds to help the soil retain water.

Keep the beds flat to prevent water running away from the plants.

Group plants according to their water needs to conserve water. Most herbs need less water than vegetables; therefore they should be planted in their own bed.

Cucumbers and tomatoes need a lot of water; plant them together or in a container. Planting in a container allows you to control the amount of water used.

Always keep the beds well mulched. A 5mm layer of dry veld grass clippings or straw is good mulch for seedlings.

Water in the late afternoon, to ensure minimal water loss through evaporation.
For information and ideas on Water Wise gardening call the Rand Water customer service centre on 0860 10 10 60, or visit the home and garden section of their website at www.randwater.co.za