

Part 10

Plant reproduction

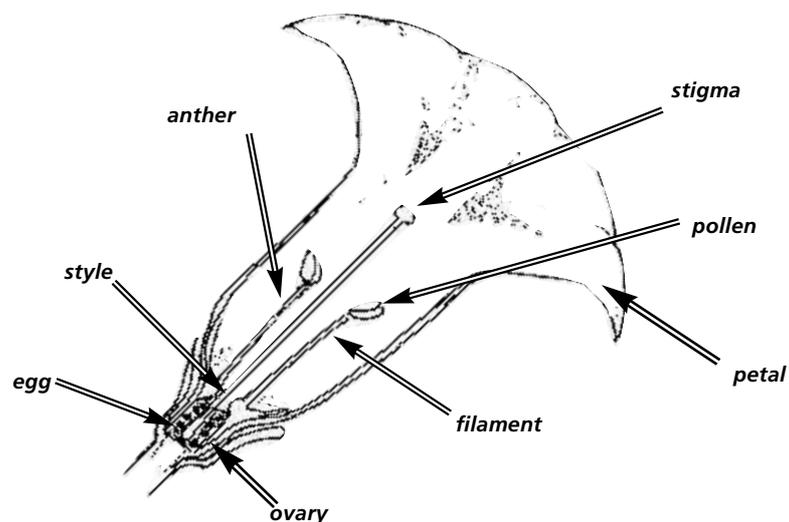
worksheet 10.1

Growing plants from seeds

Most living things reproduce themselves before they die. When a living organism reproduces, it produces other living organisms that are similar to itself. Most plants reproduce themselves by producing seeds. Seeds develop from flowers. Flowers are the sexual organs of plants. The reason that plants produce flowers is to reproduce themselves. The diagram below shows a flower which has been cut in half so that you can see the different parts.

The male organ is called the stamen. The stamen consists of the anthers and the filaments. The anthers produce pollen grains which are the male reproductive cells of plants like the sperm of animals.

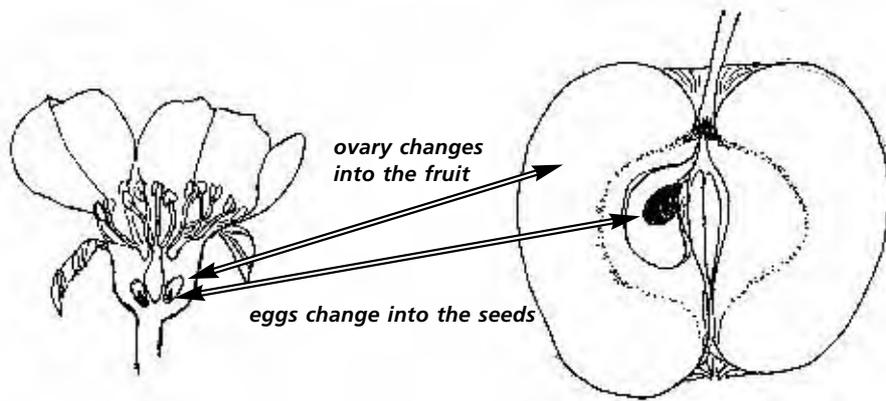
The female organ is called the pistil. The pistil consists of the stigma, the style and the ovary. In the ovary are one or more eggs or ovules which are the female reproductive cells of plants.



Pollen is carried from the anther to the stigma by wind or insects. Insect-pollinated flowers attract insects by producing a sweet substance called nectar, a strong smell and large coloured petals. Most fruit and vegetables are insect-pollinated.

Wind-pollinated flowers do not have to attract insects so they are usually small and green and do not produce nectar, a strong scent or bright petals. The anthers usually hang out of the flowers so that the pollen can be carried by the wind. The stigmas also hang out of the flowers and are usually hairy or feathery to trap the pollen carried by the wind. All grasses and cereals such as rice, wheat and maize, are pollinated by wind.

When a pollen grain lands on the stigma, it grows down the style until it reaches the ovary and then fertilises an egg. The ovary then changes into the fruit and the eggs change into the seeds.



When seeds begin to grow into new plants, we say that they germinate. Seeds need air, water and the right amount of heat to germinate well. After the seeds germinate, we call them seedlings. Seedlings need light to grow.

The top few centimetres of the soil in which you plant seeds dry out quickly. Cover the soil with a mulch of dry grass or leaves. The mulch will keep the soil wet and help to keep the soil warm in winter and cool in summer. Open the mulch once the seeds germinate so that the seedlings can get light.

Activity 10.1



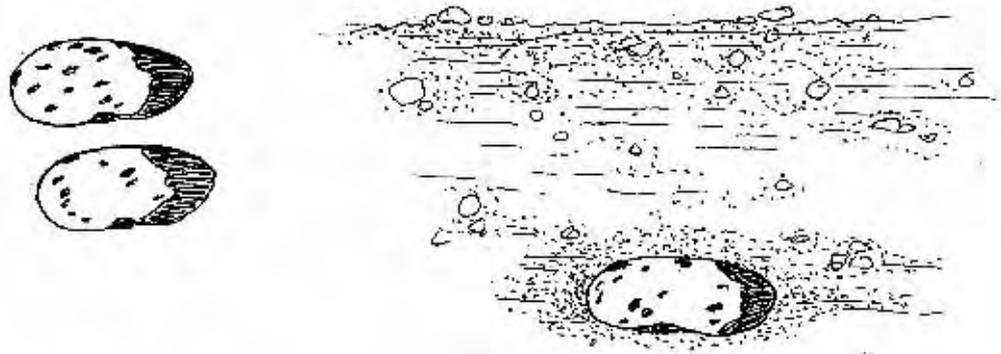
Individual work

Growing trees from seeds

You will need

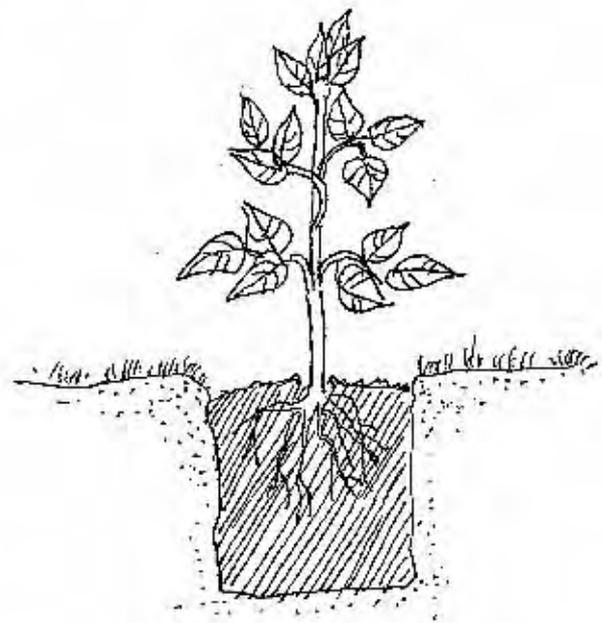
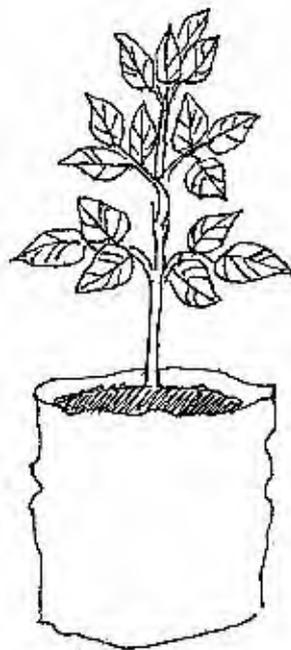
magnifying glass if you have one, potting soil, strong plastic packet at least 20 cm long, tree seeds

1. Walk around the school grounds and look for flowers. Pick six different flowers and take them back to the classroom.
2. By comparison with the drawing of the half-flower on the previous page, draw and label each of the six flowers.
3. Identify and note whether it is wind- or insect-pollinated.
4. You are going to grow a tree seed at home for planting in the school garden. Follow the steps below:
 - a) Tree seedlings will survive better if you plant them into containers such as strong plastic packets. Using containers stops the roots from being disturbed when you transplant the trees to the place where they will permanently grow. Make holes in the bottom of the container with a nail or a piece of wire. The holes let water drain out of the containers so that the seeds do not rot.
 - b) Get some good garden soil and fill the container with it. Knock the container gently on the ground to settle the soil. Then add some more soil.
 - c) Plant three seeds in each container in case some do not germinate. Plant seeds two or three times as deep as the size of the seed.
 - d) Water the seeds and place the container in a warm but shaded place such as a on windowsill or under a tree. Keep the soil in the container moist.



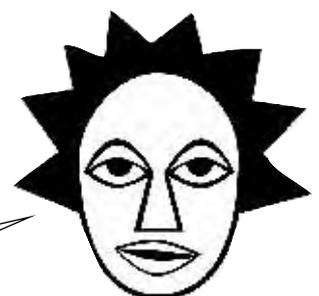
Plant seeds 2-3 times as deep as the size of the seed

- e) When the tree seedlings are the same height as the containers, they are ready for transplanting. If you leave them in the container for longer, the roots start to grow around the inside of the container. Do not transplant trees less than 20 cm high as it is difficult for smaller trees to survive after transplanting.



Transplant tree seedlings when they are at least 20 cm tall.

I am going to start a tree nursery at home. I will plant trees along our fence and to give shade in our garden. I will also try sell some of the tree seedlings to my neighbours.

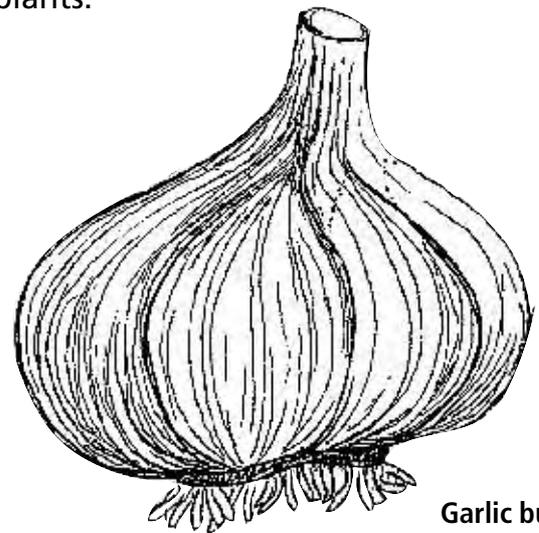


Growing plants from parts of a parent plant

Most flowering plants reproduce themselves by producing seeds. The seeds grow into new plants. Seed production involves sexual reproduction since seeds only form after the fertilisation of an egg. Some plants can also reproduce from special types of stems or roots. This is called vegetative or asexual reproduction. In this worksheet you will learn about some of the methods of vegetative reproduction of plants.

Bulbs

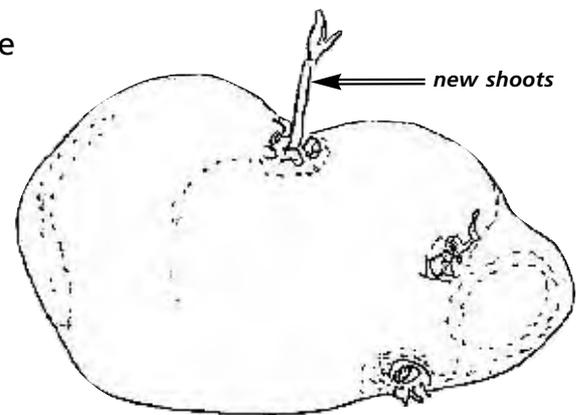
Bulbs are plants that grow leaves and then produce flowers during their growing season. The leaves die down at the end of the growing season and the bulb remains in the soil until the next growing season. They also produce new bulbs around or inside the older bulb. Examples of bulbs are plants in the onion family (onion, garlic, chives, shallots) and plants grown for their beautiful flowers such as lily, hyacinth, iris, daffodil and tulip.



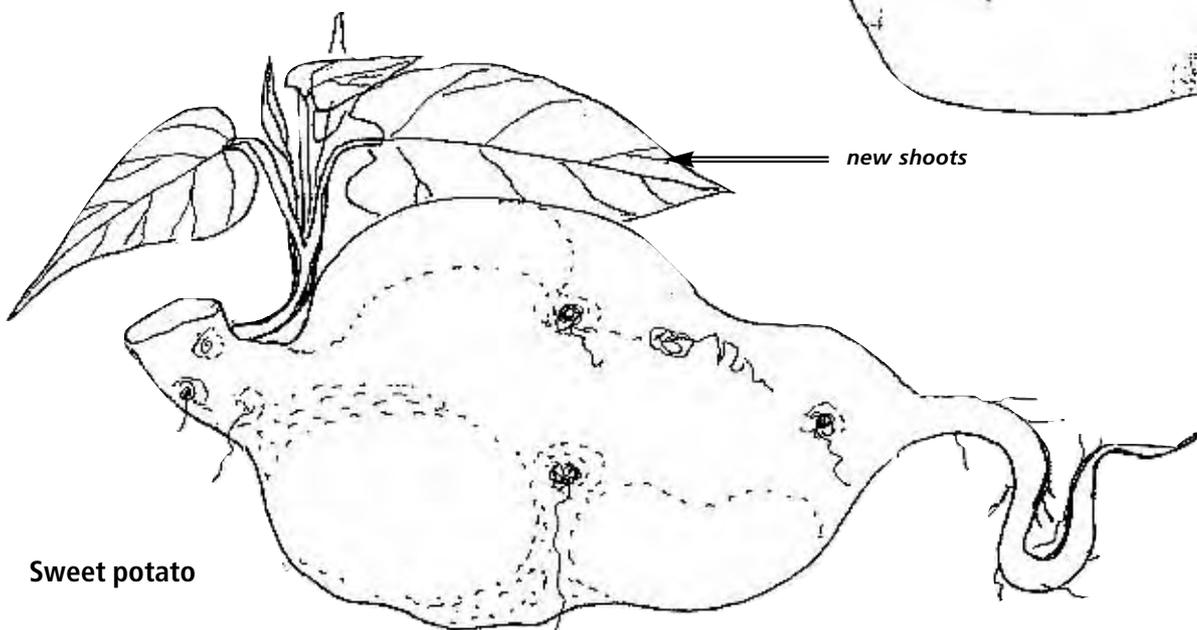
Garlic bulb

Tubers

Tubers are storage stems or roots. Sweet potatoes are an example of a storage root and potatoes are an example of a storage stem. Plants that produce tubers store food to be able to grow again at the start of the next growing season. You can use the tubers to grow new plants.



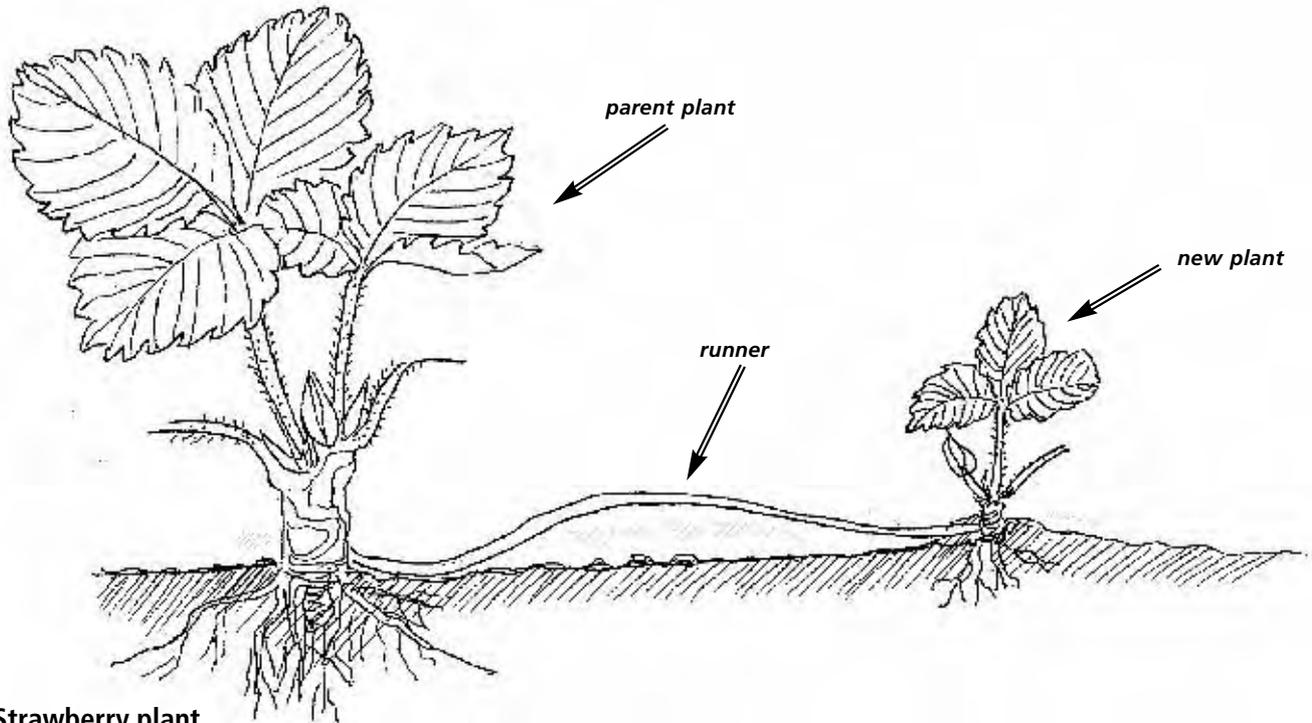
Potato



Sweet potato

Runners

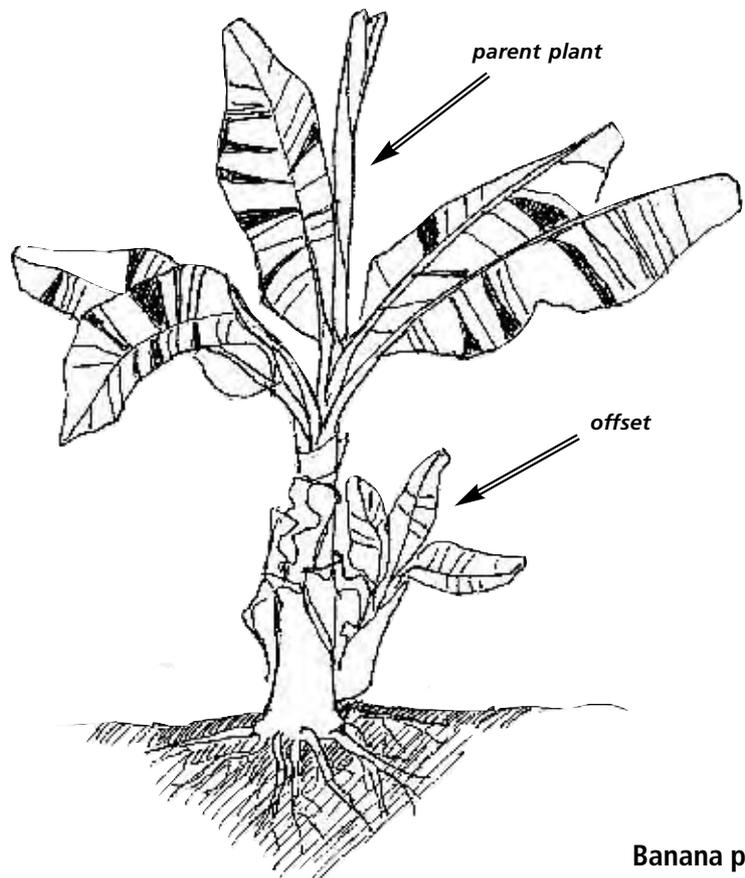
Runners are stems that grow along the ground. Roots and new plants grow along the stem. Examples of plants that produce runners are strawberries and many grasses. You can easily grow new plants from runners by digging up the new plants, cutting them off the runner and planting them.



Strawberry plant

Offsets

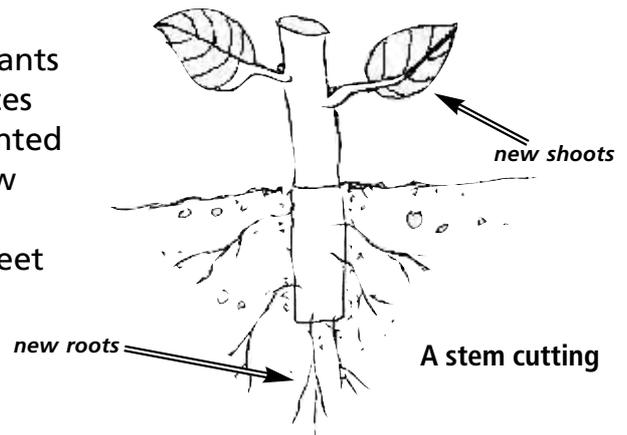
Offsets or suckers are new plants that grow on the stem of the parent plant. The offsets may have their own roots in the soil or be joined to the stem above the soil. To grow plants from offsets, use a knife to cut off the offset close to the main stem. Then plant the offset into a container or straight into the soil. Examples of plants that produce offsets are pineapples, bananas, sisal and dates.



Banana plant

Cuttings

People often take stem cuttings to grow more plants for their gardens or farms. Stem cuttings are pieces of stems from which new plants grow. When planted into the soil, stem cuttings develop roots and new shoots of leaves. Examples of plants that you can grow from stem cuttings are figs, granadillas, sweet potatoes, cassava, kiwi fruit and many different garden plants.



Grafting and budding

Grafting is joining the stems of two different plants so that they grow together as one plant. Budding is joining the stem of one plant with buds from another so that they grow together as one plant.

There are a number of reasons for grafting and budding. The main one is to produce plants which are the same as a parent plant with good characteristics. Grafting and budding are usually done with woody plants, such as fruit and nut trees which cannot easily be grown from cuttings.

If you want good quality, high yielding fruit and nut trees, it is best to buy grafted or budded trees from a nursery.

Activity 10.2



Individual work

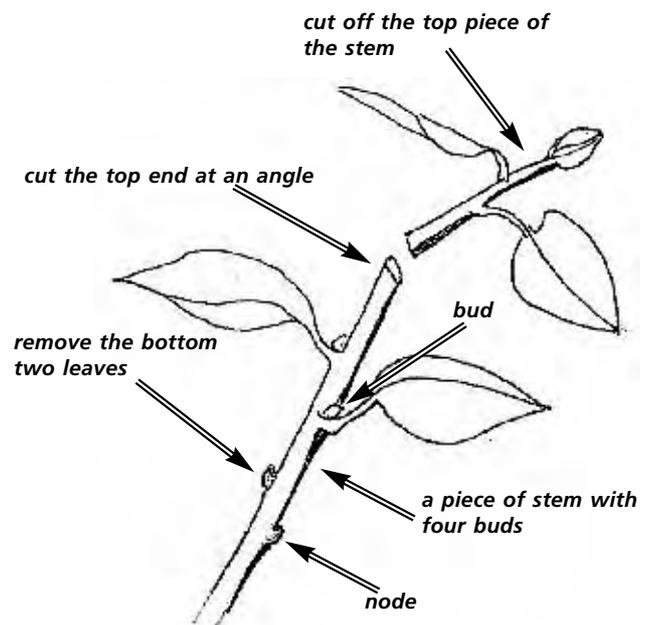
Growing trees from cuttings

You will need:

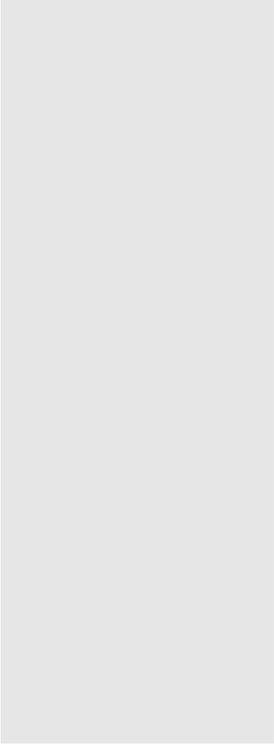
potting soil, strong plastic packet at least 20 cm long, sharp knife or secateurs, tree cuttings

Follow these steps to grow plants from cuttings.

1. Use a sharp knife or secateurs to cut off pieces of stem as thick as a pencil. Choose stems which have buds. The new shoots will grow from these buds.
2. Cut the top pieces of the stems off, so that you are left with pieces that have at least four nodes. A node is a joint in the stem. Buds form at nodes.



Taking a cutting

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3. Cut the top ends at an angle to make them look different from the bottom ends. This will help you to know which end of the stems go into the soil. If you plant the cuttings upside down, they will not grow.
 4. Cut off the bottom two leaves. Cut off some of the top leaves to stop the cutting from losing too much water. Cut off all flowers from the cutting.
 5. Prepare the place where you will plant the cuttings. It is best to plant cuttings in containers as this stops the roots from being disturbed when you transplant the trees to the place where they will permanently grow. Make holes in the bottom of the container with a nail or a piece of wire. The holes let water drain out of the containers so that the seeds do not rot. Get some good garden soil and fill the container with it. Knock the container gently on the ground to settle the soil. Then add some more soil.
 6. Place the cuttings into the soil so that two nodes are above the soil and two nodes are in the soil. Roots will grow from the part of the cuttings that are in the soil. The buds above the soil will grow into new stems. Place the container in the shade and keep the soil wet until the new plants are growing strongly.

Curriculum Links

Outcomes

Technology LO1: Learners are able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.

Assessment

There are 12 different parts to this activity, as learners work through the Technology process. Use the intermediate phase Technology assessment standards for LO1.

worksheet 9.5 Moving in – make sure your chickens are comfortable

Activity 9.7 Equipping your chicken tractor

Group work

The aim of this activity is to get learners to design drinkers, roosts and nesting boxes for the chicken tractor. If you do not yet have these, you can then choose the best ideas to use in the school chicken tractor.

Curriculum links

Outcomes

CO2: Learners work effectively with others as members of a team, group, organisation and community.

Technology LO2: Learners understand and apply relevant technological knowledge ethically and responsibly.

Assessment

This activity gives a good opportunity for assessing CO2: Learners work effectively with others as members of a team, group, organisation and community.

Part 10: Plant reproduction

A school nursery is a good way to raise funds for school projects. We have given tips on keeping a nursery after the activity information.

worksheet 10.1 Growing plants from seeds

There are three main aims of this worksheet:

- to teach the sexual reproduction topic of the Natural Science content curriculum
- to give learners practical skills of growing trees from seeds
- to start to propagate trees for the school food garden
- to build up a supply of plants for a school nursery.

Activity 10.1 Growing trees from seeds

Individual work

You will need

magnifying glasses (if you have)

Each learner will need the following, but probably can provide his/her own: potting soil, strong plastic packet at least 20 cm long, tree seeds

Steps 1-3 involve collecting, drawing, labelling and identifying flowers. This is probably best done at school as learners may need some guidance.

Step 4 involves each learner growing a tree from seed. This is a good activity for learners to do at home. Give a due date 6 weeks away when the seedlings must be brought to school. Keep reminding the learners about their seedlings. Once they are brought to school, and are big enough for transplanting, you can use them for

food forests, windbreaks, living fences, etc. You can give the learners some guidance on what trees to plant, or you can leave it up to them.

Answers to questions

Check the drawing and labelling of the flowers and whether they have been correctly identified as wind- or insect-pollinated.

Curriculum Links

Core content and knowledge

NS Life and Living

Sexual reproduction is the process by which two individual plants or animals produce another generation of individuals. The next generation's individuals look like the parents but always have slight differences from their parents and from each other.

Outcomes

NS LO2: Learners know, interpret and apply scientific knowledge

Assessment

Assess the flower drawings and labelling. Also assess each learner's tree seedling according to how well they grew and cared for it and the skills they show in plant propagation.

worksheet 10.2 Growing plants from parts of a parent plant

The aims of this worksheet are similar to those of Worksheet 10.1:

- to teach the vegetative reproduction topic of the Natural Science content curriculum
- to give learners practical skills of growing trees from cuttings
- to start to propagate trees for the school food garden
- to build up a supply of plants for a school nursery.

Activity 10.2 Growing trees from cuttings

Each learner will need: potting soil, strong plastic packet at least 20 cm long, sharp knife or secateurs, tree cuttings

This activity involves each learner in growing a tree from a cutting. As with Activity 10.1, this is a good homework activity. Give a due date 6 weeks away when the rooted cuttings must be brought to school. Keep reminding the learners about their cuttings. Once they are brought to school, and are big enough for transplanting, you can use them for food forests, windbreaks, living fences, etc. You can give the learners some guidance on what trees to plant, or you can leave it up to them.

Curriculum Links

Core content and knowledge

NS Life and Living

New plants can grow from parts of a parent plant. This is called vegetative reproduction and does not need seeds. The new plants have all the characteristics of the parent plant.

Outcomes

NS LO2: Learners know, interpret and apply scientific knowledge.

Assessment

Assess each learner's rooted tree cutting seedling according to how well they grew and cared for it and the skills they show in plant propagation.

Tips for starting a nursery

A nursery needs daily care and attention, so you should put it close to water and to your classroom. You need the following conditions for a successful nursery: a source of water, propagation structures, rich soil suitable for raising plants, good quality planting material, control of pests, diseases and weeds and record keeping and labelling. We will look at each of these in turn.

Water

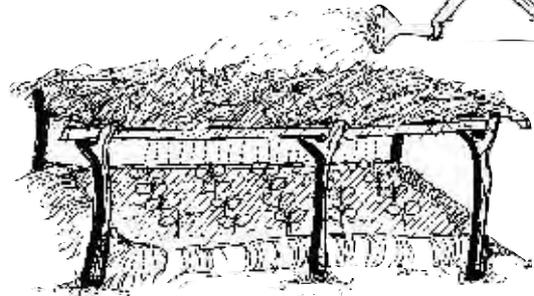
A nursery needs an all-year source of water. The water source should be close to the nursery because you should never allow the soil of nursery plants to dry out. You can use watering cans or hose-pipes to bring water to your nursery. Water early in the morning or late in the afternoon when the sun is not strong. Always water with a fine spray. Hard watering can move seeds and damage seedlings. Shading plants, either in propagation structures or under trees, reduces the amount of water that plants need.



Propagating structures

Propagating structures are built to provide the best conditions for raising plants. A propagating structure should provide:

- stable temperatures, not too hot or too cold
- a controlled flow of air, not too dry or too wet
- controlled light, enough for growth but not enough to burn the plants.

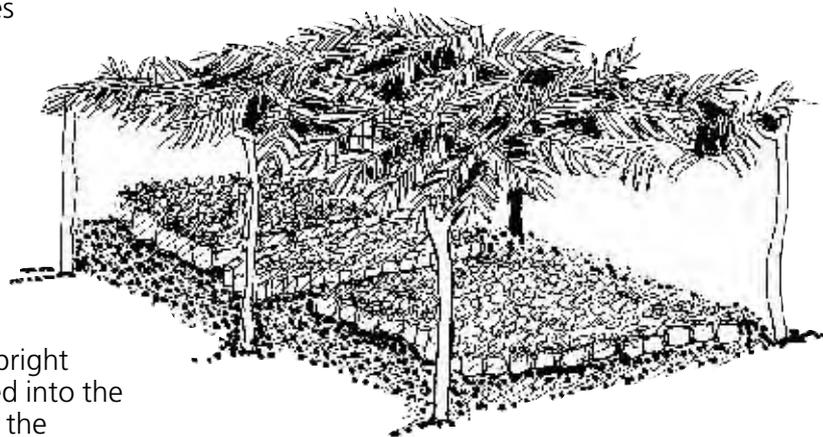


Water with a fine spray through a grass shade to not damage seedlings

It is best to propagate most plants in the shade, and then move them into the sun or remove the shade once they are growing strongly. You will need two types of structures for propagating plants:

- 1 A place where seeds are germinated or cuttings are rooted.
- 2 A place where the newly established plants are stored or grown. You do not need a structure for these plants if you can keep them under trees or vine trellises.

Shade houses are the most common propagating structures used for school nurseries. You can build a shade house from upright wooden or metal poles, cross supports of wood, bamboo or cane and a cover of thatch grass, reeds, palm leaves or shade cloth. The upright poles can be concreted into the ground to strengthen the structure. If you use wooden poles, protect them against termites by painting them with creosote. The cover must not be too thick. Light must still pass through it.



A simple shade house made from wood poles, bamboo and palm leaves

Shade cloth is made of woven plastic thread, similar to orange bags. It can be woven tightly or loosely, to let through different amounts of light. Shade cloth is light, long-lasting and easy to work with. You can use shade cloth on the top and sides of a shade house or you can hang it between supports such as growing trees or buildings.

Propagating soil

There are many different mixes for filling the containers in which you propagate plants. The mix should have the characteristics below:

- It must be firm enough to hold the plants upright.
- It must not let all the water move straight through it, but it must not hold so much water that there is no air in the soil.
- It must be free of weed seeds, pests and diseases.
- It must contain plant nutrients.

Whatever type of soil you have, it will improve if you add compost. For filling containers, it is better to use compost rather than organic matter that has not broken down. If the organic matter in a container is not well rotted, it may burn the leaves as it breaks down.

To germinate seeds and root cuttings, a good propagating mixture has equal parts of washed river sand and sieved compost.

Planting material

The plants that you raise will be as good as the planting material that you use. If you plant seeds or cuttings that come from weak or diseased plants, your new plants will also be weak or diseased.

Most important when choosing any type of planting material is the quality of the plant from which you take the planting material. If, for example, you take a cutting from a grape plant that produces small sour fruit, then the new grape plant will also produce small sour fruit. If you take a cutting from a grape plant that produces large sweet fruit, then, with proper care, the new plant will also produce large sweet fruit.

Controlling diseases, pests and weeds

You may lose large numbers of your plants if they are attacked by pests and diseases. If you do not control weeds, your nursery plants will not grow well because they have to compete with the weeds for plant food, water and light. The control of pests, diseases and weeds is very important in a nursery. See Part 8 of the worksheets section for details of pest and disease control methods.

Record keeping and labelling

Financial records

Financial records show the money you spend and the money you earn. Use these records to work out whether you made a profit or a loss, how to reduce your costs, which type of plants gave you the most profit and so on.

Table 10.1 is a financial record. Write down anything that you buy for the nursery under Expenditure. Write down anything that you sell from the nursery under Income. You can write the Expenditure on the left-hand page and the Income on the right-hand page, as shown in the table, or you can write the Expenditure in the front of your money record book and the Income at the back of the book.

When you complete a page, total the amounts on that page and write the total at the top of the next page. In this way you can easily find the total of all the pages you complete.

Plants which you take from the nursery for planting on your own land, should be written down under Income because you do not pay for them.

Columns can be made on the Income and Expenditure pages so that you can easily get the totals for the different expenses and sources of income.

Keep the receipts of everything you buy in a file, and use them to complete the Expenditure page every week or every month. Give out a receipt from a receipt book every time you sell plants. You can buy special receipt books that have carbon paper for making a copy of each receipt you write. Use your copies to complete the Income page.

Profit or loss

To find out whether you made a profit, subtract the total expenditure from the total income. If the income is greater than the expenditure, you made a profit. If the expenditure is greater than the income, you made a loss.

Table 10.1 An example of an income and expenditure record

Expenditure									Income					
Date	Item	Diesel for pump	Seeds	Containers	Tools and equipment	Building materials	Other	Total	Date	Item (reference number)	Seedlings	Established plants	Other	Total
1/3/06	Balance carried forward							429.73	1/3/06	Balance carried forward				1239.78
7/3	1 kg onion seeds		129.75					29.75	12/3	1 tomato tray	4.00			4.00
15/3	secateurs				52.78			52.78	24/3	2 fig		12.00		12.00
2/4	15 m shade cloth					60.00		60.00	3/4	2 wild olive		10.00		10.00
2/4	1000 20 cm containers		102.00					102.00	3/4	1 granadilla		6.00		56.00
8/4	Watering can				35.00			35.00	4/4	2 keurboom		14.00		24.00