

Reaping Gold From Soil



See how happily these children maintain their vegetable garden. Don't you think their minds also blossom and yield when each plant blossoms and yields?

Do you maintain the vegetable garden in your school this way?

Does it yield well always?

A pumpkin vine that sprouted on its own in the backyard of the kitchen, was ready to spread. I made a furrow around it, manured and watered it. It grew well, but yielded only two or three pumpkins.



Did you listen to what Babu said? Why, do you think, the plant did not produce more fruits?

Nurturing alone is not enough to get more yield. There are other factors to be considered too.

- Fertile soil
- Favourable climate
- Quality seeds and planting materials

Seed quality...

A single plant yields plenty of seeds. Are all seeds suitable for farming? Why, do you think, the pumpkin that grew in the kitchen yard did not produce much? Do you realise that all seeds may not have the same quality?



What are the factors to be considered while selecting seeds from a plant?

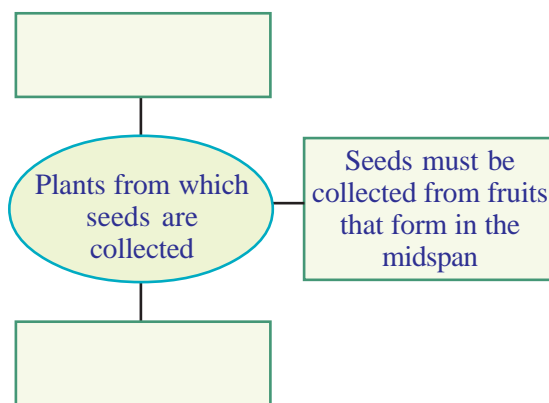
Observe these pictures. Note the differences.

- Which has more yield?
- Can seeds be collected from a diseased plant?
- Have you noticed that fruits are formed in a plant at different stages of its life? Which stage is suitable for collecting seeds - the first formed, mid formed or those formed at the end of its growing stage?



Try to write down the qualities essential for a plant from which seeds are collected.

There may be many crops cultivated in your locality. Observe how any two or three varieties of seeds are collected and stored and note it down in your science diary.



Sowing and sprouting

It is easy to select good quality seeds from plants like lady's finger and pea. How will you select quality seeds from plants that have smaller seeds than the above?

In the case of brinjal, good seedlings are transplanted after sowing and sprouting seeds.

Can you find more examples for seedlings that are transplanted and seedlings that are not? Classify them and write down in the science diary.

Stem cutting

Aren't you familiar with plants that germinate from seeds and those that sprout from other parts?

The formation of seedlings from seeds is by sexual reproduction. The formation of new plantlets from parts like root, stem and leaf is called vegetative propagation.

Tapioca and sweet potato are cultivated by planting stem cuttings. Find out more examples for plants formed through sexual reproduction and vegetative propagation.

Sexual reproduction	Vegetative propagation

Is a new guava plant produced usually by planting its stem cutting?

What is the method to produce a new plant with all the qualities of the parent plant?

What will happen if we plant after sprouting roots on the branches of the parent plant?

Try these activities.

Layering

- Select a branch of the plant from which sapling is to be produced. The branch must be pencil thick. The branches from the main stem are better. Peel off one centimetre of bark from the stem in a circular shape.



- Cover the peeled off part with a slightly moistened mixture of coconut fibre, soil and sawdust.
- Cover it with a polythene sheet. Tie both ends with jute twine. Wet it with enough water to retain moisture.

- Numerous roots will sprout within two months. Cut the branch and plant it in a pot, till it is ready to be transplanted in the soil.

Take care to plant the sapling in a suitable place.



Layering is effective in plants like jasmine (*pichi, mulla*), rose, hibiscus, cashew and sapota. Layering is also done on branches that grow close to the soil, by bending the middle of the branch into the soil.

Let us examine some information related to layering:

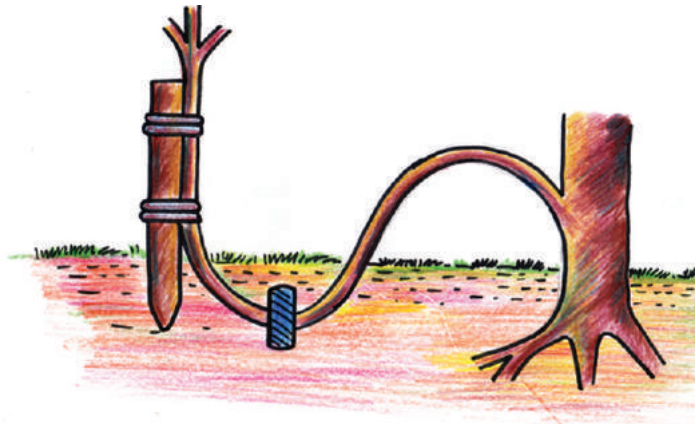
- Most of the plants can be grown this way.
- Plants formed from layering do not have as much life span as plants formed from seed germination. They will be of smaller size too.
- They have qualities of the parent plant.
- If layering is done on diseased plants, new plantlets will also be infected.
- Flowering and fruiting of such plants are faster than those in plants formed from seeds.
- Through this method, we can produce more saplings within a short period.
- Layered plants do not possess the taproot system.
- They require more care.

With the help of the information given above, write down in your science diary the merits and demerits of plantlets produced through layering.

Grafting

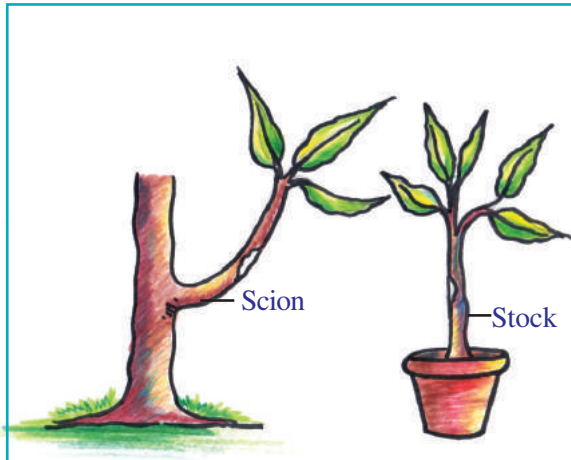
Grafting is another method used to produce superior quality plantlets. This method is practised from ancient times. Superior quality plantlets are produced by joining the stems of two plants of the same species.

The rooted plant selected for grafting is called stock and the branch selected for grafting is called scion.



Branches of mango trees like neelam, malgova etc. can be grafted to the plantlets of indigenous mango trees. Here, the plantlet of the indigenous mango tree is the stock and the branch of malgova is the scion.

Let us try this activity.



Peel off the bark from the facing sides of both the stock and scion in 3 ½ cm length.



Bring the peeled off portions of stock and scion in contact with each other. Wrap them together firmly with a jute twine.



Cover it with a wax cloth or a plastic tape. After one month, cut partially the stock above the covered area and the scion below.



Wait for one more month and cut and detach the part completely. When it attains proper growth, it can be replanted in a more suitable place. Remove any new branches sprouting on the stock.

Graft the branch of any other variety of mango tree on the sapling of an indigenous variety of mango tree and write the procedure in your science diary.

Can you think of any other method by which good quality saplings can be produced?

Budding

In this method, a bud is grafted, instead of grafting a branch to another plant. This method can be used to produce flowers of different colours in the same

plant. Buds of other varieties can be grown on indigenous varieties.

See how budding is done.

- Cut off the bud from a quality plant.
- Make a 'T' shaped cut on the plant on which the bud is to be grafted and leave the bark open.
- Insert the bud into the 'T' shaped cut on the bark.
- Wrap it in such a way that the bud is exposed.
- Cut off the upper part of the stock when the bud attains proper growth.



Try to graft the bud of a red rose plant on to a white rose plant. A bud of a superior rose variety may be grafted to a native rose variety too. Write down the activities sequentially in your science diary.

Now we are familiar with different methods to produce superior varieties of plantlets. Examine the information given in the table below and answer the following questions.

Crop

Variety 1	Variety 2
Long life span	Short life span
Low yield	High yield
Active growth in our soil	Poor growth in our soil
High resistance to disease	Low resistance to disease
Needs less nurturing	Needs more nurturing

- Examine the peculiarities of the two varieties. What are the methods that can be adopted to produce good saplings with the qualities of both the varieties?
- Which variety can be selected as stock and which one as scion?
- What would be the qualities of the plant formed by combining the two varieties?

Combining qualities

We have seen so far how plants of the same kind, but with different qualities, are combined together to form good quality sapling. What other methods can be used to produce better seeds?

Examine the pictures and notes given below



West-coast tall

Tall variety

- 20 – 30 metre high
- Yields in 6 – 10 years
- Life span of 80 – 100 years
- Green-coloured coconut

Major varieties: West-coast tall, East coast tall, Lakshadweep ordinary (Lacative ordinary).

Find out the advantages and disadvantages of tall and dwarf varieties and write them down.

What will be the qualities of a new seed produced by combining tall and dwarf varieties (tall × dwarf)?



Chavakkad orange

Dwarf variety

- 8-10 metre high
- Yields in 4 – 5 years
- Life span of 30 – 35 years
- Yellow, orange, brown coloured coconut

Major varieties: Chavakkad orange (chowghat orange), Chavakkad green, Gangabondam.

Hybridisation

Hybridisation is the method of producing new seeds through artificial pollination between plants of the same species but of different characteristics. Seeds formed in this manner may combine advantages, disadvantages and mixed qualities of both the parent plants. Seeds with desired qualities are selected from these.



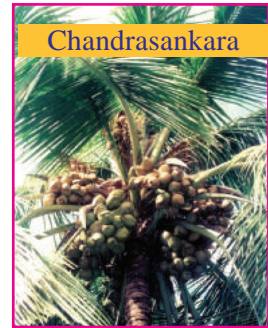
Edubuntu - School Resource - See 'vargasankaranam'

Hybrid variety coconut tree

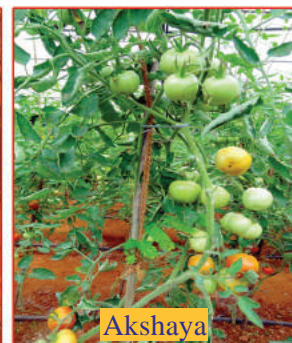
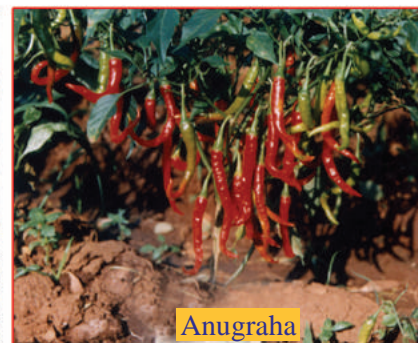
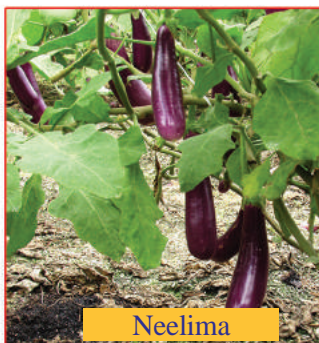
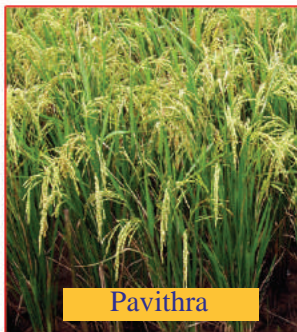
Let us familiarise ourselves with certain hybrid varieties of coconut.

- *Chandralaksha* - Lakshadweep ordinary \times Chavakkad orange (T \times D)
- *Chandrasankara* - Chavakkad orange \times West coast tall (D \times T)
- *Lakshaganga* - Lakshadweep ordinary \times Gangabondam (T \times D)

Good quality seeds of paddy, vegetables etc., have also been developed in this manner. Let us familiarise ourselves with some of these seeds.



Paddy	Pea	Green chilly	Lady's finger	Brinjal	Tomato
Pavithra, Hraswa Annappoorna	Lola, Malika, Bhagya- lakshmi Jyothika	Ujjwala Jwalamukhi Anugraha	Kiran, Arka Anamika Salkeerti	Surya, Swetha Haritha Neelima	Mukthi Anagha Akshaya



Many research activities are being conducted in Kerala to produce such superior varieties of seeds.

Agricultural Research Institutes

What should be made possible in the agricultural sector?

- High yield
- Quick yield
- Resistance to infections
- Lower nurturing costs
- Availability of quality seeds/planting materials

Priyanka : a new leap in yield

Mannuthi : Priyanka, a new bitter melon variety, is making new leaps in productivity. This variety was developed by the Kerala Agricultural University. It is a seed variety that grows well in the climatic conditions of Kerala.





Tissue Culture

Tissue culture is the process of producing a new generation from a cell or tissue of a plant. Plantlets with all parental qualities can be developed through this technology. This technology is effectively practised in plants like plantain, pepper, cardamom, pineapple etc. The peculiarity of this technology is that hundreds of plantlets with the same qualities of parent plant can be produced from a plant. The video of conducting tissue culture in the laboratory is available. Observe the different steps.



Agricultural Research Institutes function to fulfil these needs. Is there any Agricultural Research Institute in your locality? Have you visited any such institutions?

Some of the Agricultural Research Institutes in our State

- Kerala Agricultural University (KAU) – Mannuthi, Thrissur
- Central Tuber Crops Research Institute (CTCRI) –Sreekaryam, Thiruvananthapuram
- Indian Institute of Spices Research (IISR) – Kozhikode
- Rubber Research Institute of India (RRII) – Kottayam
- Central Plantation Crops Research Institute (CPCRI) – Kasaragode
- Regional Research Centres of Kerala Agricultural University



Kerala Agricultural University



It is through the Krishi Bhavan that seed varieties and planting materials developed by research institutes are brought to farmers. What are the other services that we get from the Krishi Bhavan? Prepare a report after visiting a Krishi Bhavan or collecting the information from the Agriculture Officer.

Plant diversity

We have so far discussed modern methods of preparing quality planting materials. Even if we use quality planting materials, the yield may not be good if the soil is not fertile. Good quality soil ensures the health of a plant.

What is the benefit of depositing plant debris in the field after cultivation?

The nutrients provided by one kind of plant debris is not the same supplied by another. The more diverse the plant debris that decomposes in the soil, the higher the fertility of the soil.

Let us observe some of the methods followed by farmers to ensure maximum diversity in agriculture.



Intercrop-Short term crops cultivated among the main crop in such a way that they do not harm the main crop are called intercrops. They help in maintaining soil fertility.

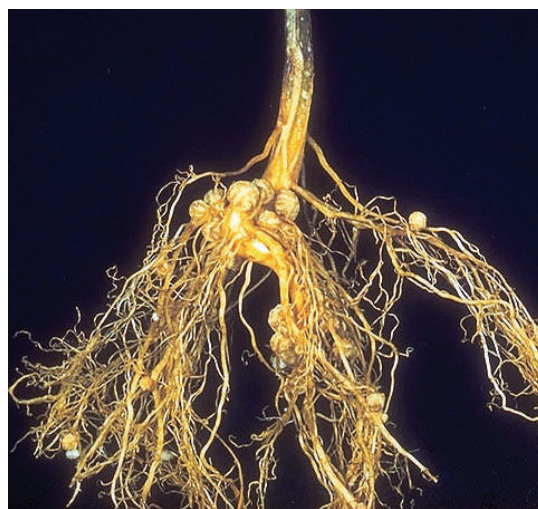
- Which are the intercrops cultivated in coconut fields? Observe and write them down in your science diary.

Crop rotation-Cultivating a different crop instead of the crop cultivated earlier is called crop rotation. Haven't you noticed the cultivation of pea, black gram etc at intervals in paddy fields?

- Does the cultivation of different crops bring about any increase in soil fertility?

Leguminous plants

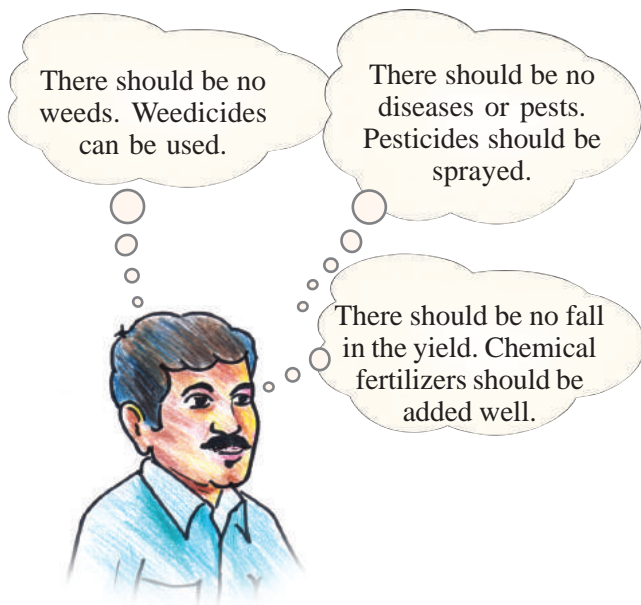
Nitrogen is an essential element for plant growth. Plants cannot absorb atmospheric nitrogen directly, but they absorb the nitrate salts dissolved in water. Some of the bacteria can convert atmospheric nitrogen to nitrate. Rhizobium is one such bacterium. They live in the roots of plants like pea, mimosa (touch-me-not), common terphrosia (kozhinjil), horse gram and black gram and absorb atmospheric nitrogen. When these plants decay, the plant nutrients are added to the soil.



- Observe the roots of leguminous plants. Don't you see nodules on their roots?
- What are the benefits of cultivating leguminous plants?

Crop management

Look at the thoughts of a farmer about improving yield.



Are the decisions of the farmer beneficial? Discuss.

What kind of decisions should the farmer take? Shouldn't we promote the use of fertilizers and pesticides that are not harmful to nature? Examine the information given below.

Biopesticides

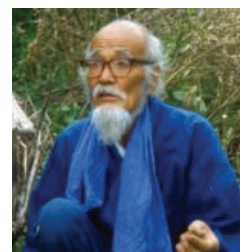
Tobacco decoction : Cut 1 kg tobacco into small pieces. Soak them in 15 litre of water for one day. Filter this and dissolve 100 g scraped bar soap in it by stirring well. Tobacco pesticide is ready. Dilute this by adding double the quantity of water and then spray on plants.

Neem Cake : Adding neem cake, castor cake etc to the soil helps to control worms that attack roots.

Neem oil emulsion: Dissolve 60 g soap in $\frac{1}{2}$ litre water. Mix it with one litre of neem oil and stir well. Dilute it with 10 litre water and spray on plants.

What Fukuoka says

For man's survival we should return to nature. It is man who is destroying forests, the springs and the fertility of the earth. Such environmental destruction should be stopped if all living organisms including man are to be saved. Bio-fertilizers are an elixir to the soil deadened by the use of chemical fertilizers. They catalyse life and retain the fertility of the soil. Our aim should be to make land cultivable rather than a desert.



Masanobu Fukuoka
Researcher in
Organic Farming
Japan

Biofertilizers

- Cow dung
- Poultry droppings
- Green manure
- Goat droppings
- Compost manure
- Bone meal
- Fish manure



Discuss the importance of making it a habit to use biofertilizers and biopesticides. Prepare biopesticides and apply it in the school vegetable garden. Record the method of their preparation, materials used and the mode of application in your science diary. Conduct a seminar on this topic and present your ideas.

Let us conduct an interview

Look at certain excerpts from an interview conducted by Beena with a farmer, for collecting information on agriculture.



How are pests that destroy crops eliminated?

I mainly use tobacco decoction to kill worms that feed on leaves, sap-sucking insects and pests that destroy fruits.



Are there alternate methods for pest control?

Pests can be removed by handpicking. Organisms like calotes, frog and mabuya eat off many pests.



Drip irrigation is one of the methods of irrigation. Will you please explain?

Drip irrigation is the method of dripping water at the plant base at regular intervals.



Do you still have more questions to ask?

After discussing with your friends, prepare a questionnaire to interview a farmer or Agriculture officer. Don't forget to write the information gathered from the interview in your science diary.

Do we cultivate only food crops? Which other crops do we cultivate?



Floriculture



Tea plantation



Ornamental plant cultivation

Cotton

Cotton is an important fibre crop cultivated in India. The cotton and the seeds are separated from mature cotton balls. Thread is obtained from cotton. Cotton seed is used as cattle feed. The oil obtained from cotton seeds is used for industrial purposes.



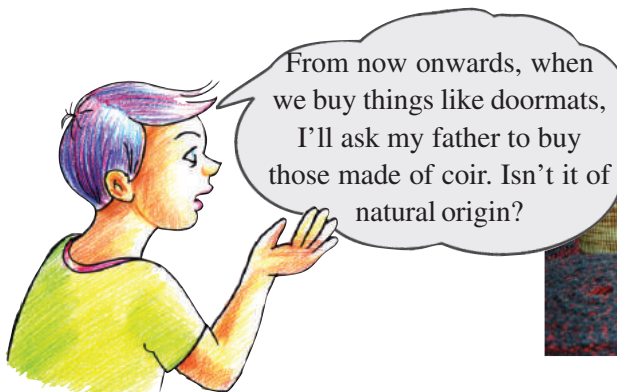
Jute

India is the largest producer of jute in the world. Jute fibre is obtained from the stem of jute plant. Jute sheaves are first soaked in water for retting. They are then beaten to separate the fibres. Sack thread is made of jute fibre.



Coir

Coconut husk is soaked in water. This is beaten to separate fibres. These fibres are woven to make different types of coir products.



Integrated farming



Did you notice the picture?

- How are cattle rearing and paddy cultivation related?
- How are the organic wastes from homes and agricultural fields utilised?
- What can be the use of slurry formed after the production of bio-gas?
- What is the advantage of integrating more than one field of agriculture?

Note the advantage of placing the duck coop above the fish pond. The left over food of the duck will be available to the fish. Moreover, droppings of ducks will promote the growth of aquatic plants. Aquatic plants are food for fish. At the same time, insects, algae, snail and small frogs in the pond will become food for the ducks.



Agriculture and cattle rearing

Agriculture and cattle rearing are integrated farming methods in Kerala that existed traditionally. Cows and buffaloes can be reared along with paddy cultivation. Fodder grass can be cultivated in coconut fields and rubber plantations. The straw obtained from paddy cultivation, the bran obtained from husking paddy grains etc. can be given to cattle as fodder. Goats, ducks, hens etc. can be reared in coconut fields.



Find out other similar possibilities. Write in your science diary how the areas are related to one another. Prepare an agriculture album collecting news reports, pictures etc.



Significant learning outcomes

The learner can

- practice activities like layering, grafting and budding.
- explain how quality seeds can be produced through hybridisation.
- provide suggestions related to crop management.
- explain the importance of organic farming.
- prepare biopesticides.
- identify the ways of agriculture that adversely affect the soil, and suggest remedial measures.
- scientifically nurture vegetable gardens at home and school.
- identify the possibilities of integrated farming.



Let us assess

- Which of the following activities increases the fertility of soil?
 - Repeating the same cultivation.
 - Leaving agricultural remains on soil.
 - Burning agricultural remains after drying
 - Removing agricultural remains and cleaning the land.
- Which of the following statements is true of grafted mango tree?
 - Has greater life span.
 - Requires less nurturing.
 - Yields in a short span of time.
 - Has high disease resistance.
- Formulate inferences based on the table and record your opinion.

Biofertilizer	Chemical fertilizer
Not harmful to soil	Destroys soil composition
Can be prepared at home	Can be prepared only on industrial basis
Less expensive, required in large quantity	Required in less quantity
Mixes slowly with soil	Mixes quickly with soil
Cannot be provided as a specific salt	Can be provided as a specific salt



Extended activities

- How can red flowers be obtained from a hibiscus plant that produces white flowers?
- Visit a nearby plant nursery. Are there plantlets produced through budding, tissue culture etc.? Are there plantlets produced through any other method? Tabulate the information collected.

For more information – *Kayika Pravardhanam Sasyangalil* (Kerala Bhasha Institute), *Krishipadam – R.Heli, Harithakeralam CD, Agriculture Magazines, Mattupavile Krishi* (Kerala Bhasha Institute), *One Straw Revolution* (Fukuoka)

