



Government of Vanuatu

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Central School






Home School Package

Year : 10



Ministry of Education and Training / Ministère de l'Éducation et de la Formation
Republic of Vanuatu / République du Vanuatu

LESSON PLAN

 <p>Teacher</p>	<p>Name : John. E Subject : Agriculture</p>
 <p>Date And Week</p>	<p>1st June – 5th June Week : 3</p>
 <p></p>	<p>Topic : The Coconut Palm (sub-strand : coconut palm, coconut leaf, coconut flower and coconut seed.) Lesson number : 1 (Period 1-6)</p>
 <p>Learning outcomes</p>	<p>Having successfully completed this topic, the students should be able to name the main parts of a :</p> <ol style="list-style-type: none">1. Coconut palm2. Coconut leaf3. Coconut flower (male & female)4. Coconut seed
 <p>Introduction</p>	<p>Common Name: Coconut Scientific Name: Cocos nucifera Origin: uncertain: either northwestern Central America or Indo-Pacific region</p> <p>The coconut palm is widely distributed throughout the tropics. The palm is a monocot similar to bamboo and grasses. It has no branches, no lateral growth and no tap roots. The palm provides food and a refreshing drink. Coconut oil is extracted from its white flesh.</p>



Catch phrase for the lesson

Name the main parts of a :

1. Coconut palm
2. Coconut leaf
3. Coconut flower (male & female)
4. Coconut seed



Learners notes

Summary Notes

Nutritional value :

1. The flesh is a good source of Vitamins B and C. (It contains fats, iron and a little amount of protein and calcium).
2. An energy food (mature coconut - it contains a lot of fat)
3. A protective food (green nuts - contain large amounts of some of the vitamins and minerals that are necessary for good health)

Coconut palm :

The characteristics of the palm :

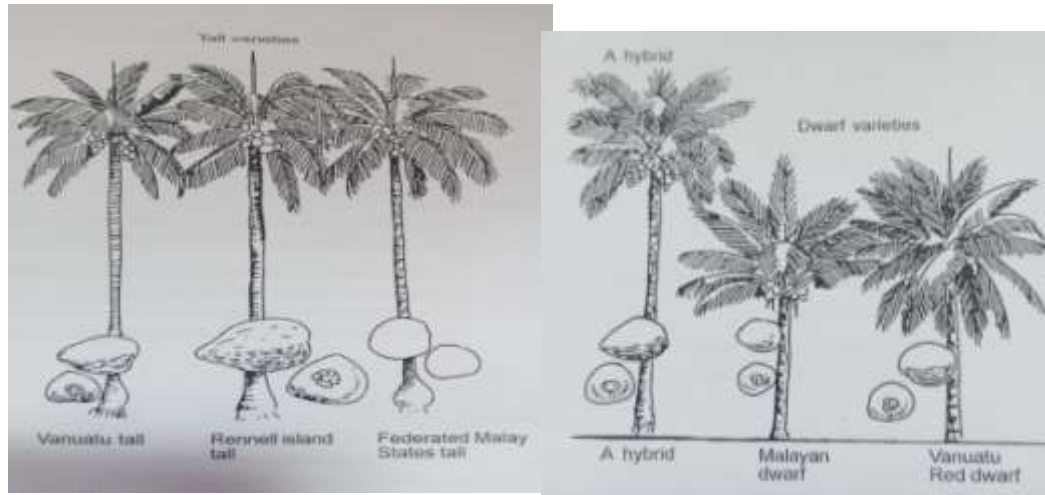
1. has solid unbranched trunk
2. crowned by fan-shape bipinnate leaves
3. It has bole which form from the base of the trunk

In Vanuatu the trunks form medium size boles. This provides a firm grip to the soil.

There are mainly two main types of coconut palms_:

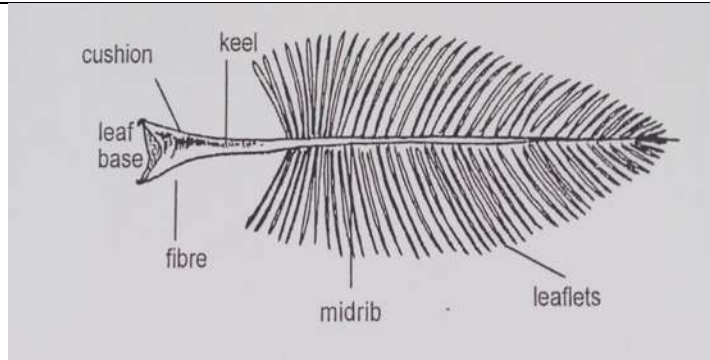
1. tall palms
2. dwarf palms.

The tall palm might be over 25 metres when fully mature.



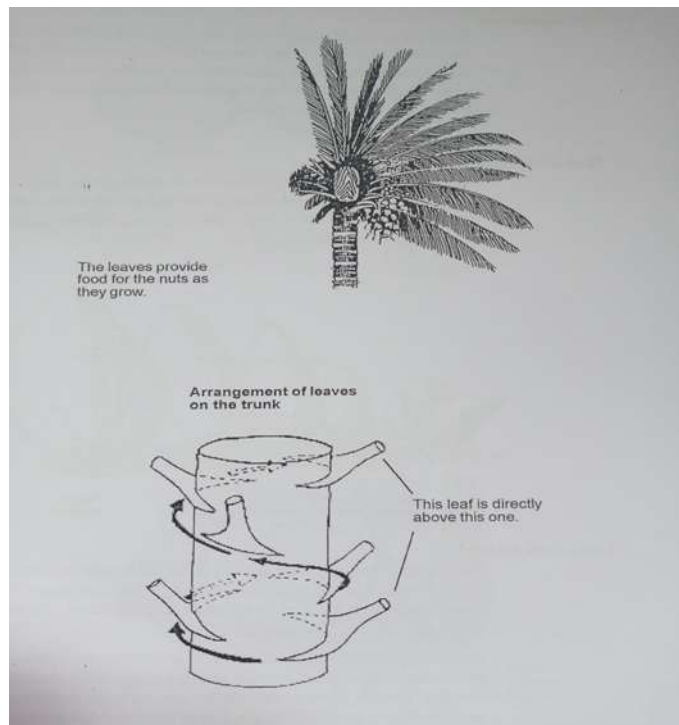
Coconut leaf:

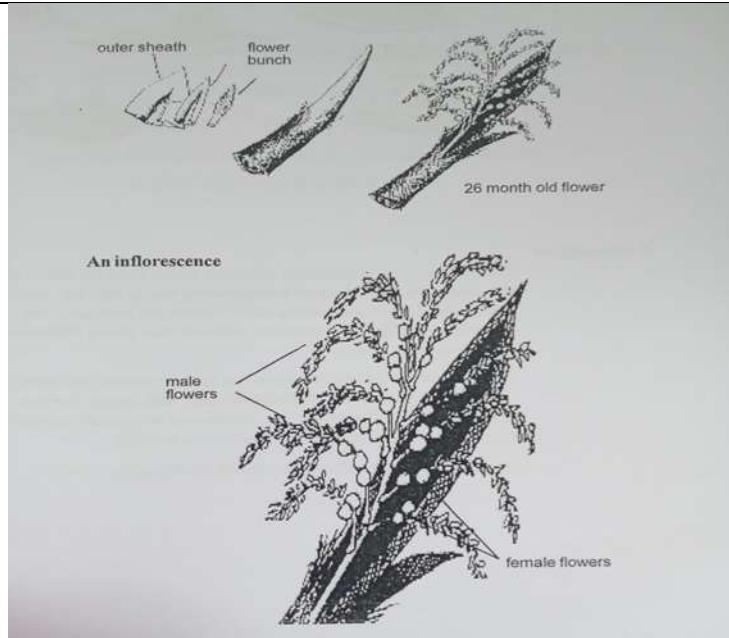
1. 13 or 14 leaves on a coconut palm. There may be more in some dwarf varieties (24 leaves in the Malayan dwarf).
 2. New leaf emerges made every month and it stays on the palm for three years.
 3. 3 or 5 meters in length.
- The first leaves of a seedling appear as entire leaves as they are fused together. When more and more are formed they tend to split into leaflets. Each leaf consists of a large number of leaflets arranged on each side of the midrib.
 - There may be over 200 leaflets on one leaf. The leaves are spirally arranged in groups of five.
 - Number of leaves on a palm gives an indication of the number of nuts the plants can produce. (Palms with many leaves will produce many nuts)
 - Age of Palm = number of leaf scars on the trunk divided by number of leaves on the palm



Coconut flower:

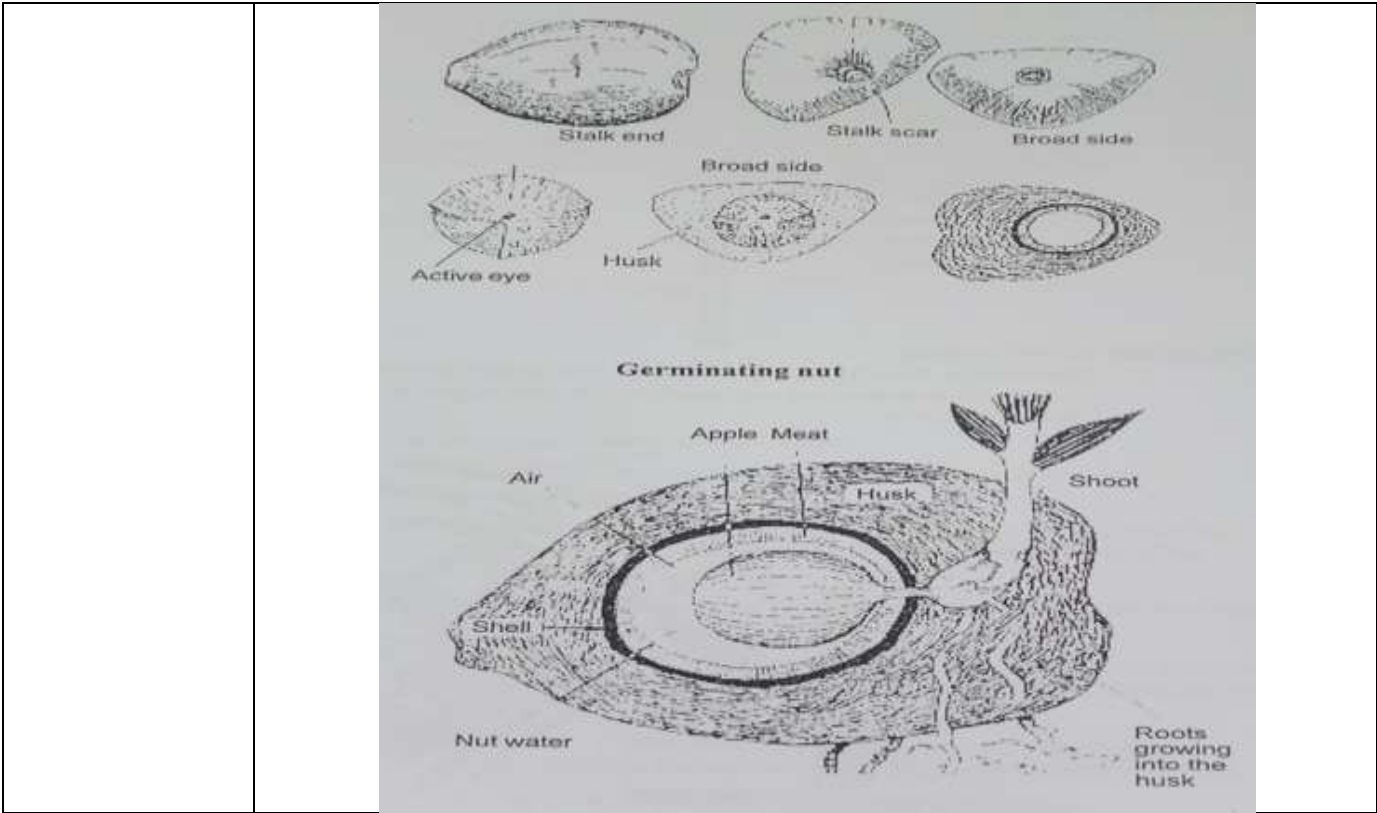
- The inflorescence in coconuts is **monoecious**. It contains both the **male and female** flowers on the same palm, it is **borne singly** in the **axil** of each leaf of a palm, and has numerous side branches (sometimes as many as 40).
- **Female flowers** are situated at the base of each branch of the inflorescence (less than five female flowers on each branch).
- **Male flowers** are much more numerous. They are small and are distributed above the female flowers.





Coconut seed

1. 20 to 30 cm long (1 to 2kg in weight)
2. Attached at the stalk end of the plant
3. Some nuts are round but most of them has 3 sides
4. Inside the fibrous coat (husk) the shell is divided into 3 parts by small ridges.
5. The eye found at the broader side is bigger and is known as the **active or germinating eye. It is at this point that germination starts.**



Exercises

Copy the main points in their exercise books



References

Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 7-11 & 13



Date And Week

8th June – 12th June

Week : 4



Topic : The Coconut Palm (sub-strand : Pollination, Nut Development, Selection of Seed Nuts.)

Lesson number : 2 (Period 1-6)



Learning outcomes

Having successfully completed this topic, the students should be able to :

1. Describe the process of pollination and nut-development in a coconut
2. Select good seed nuts, by recognising the characteristics of a good parent tree, by describing seednut collection techniques, and by knowing which nuts to discard.



Catch phrase for the lesson

The process of pollination and the criteria of a good parent tree for selecting best seed nuts.



Learners notes

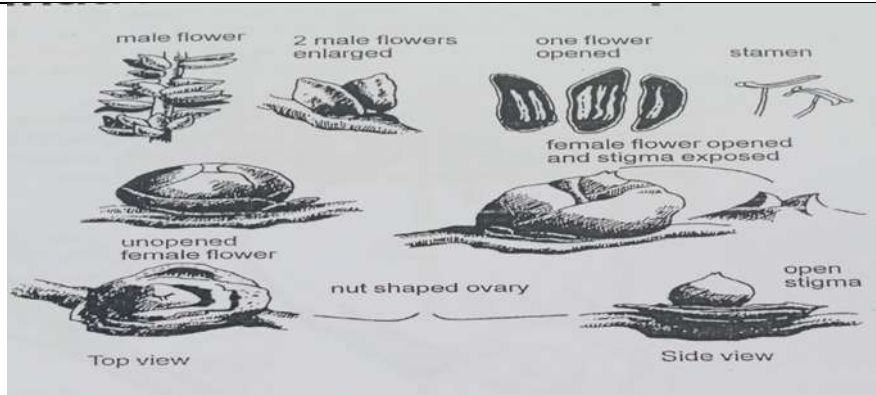
Summary Notes

Pollination :

- Pollination is the transference of pollen grains from the anther to the stigma.
- Tall varieties are **halagamous**, which is they are cross-pollinated (because their male flowers are receptive).
- Dwarf varieties are **automatous**, that is they are self-pollinated (because in dwarf varieties the male and female flowers usually mature at the same time).

Pollination is normally carried out by:

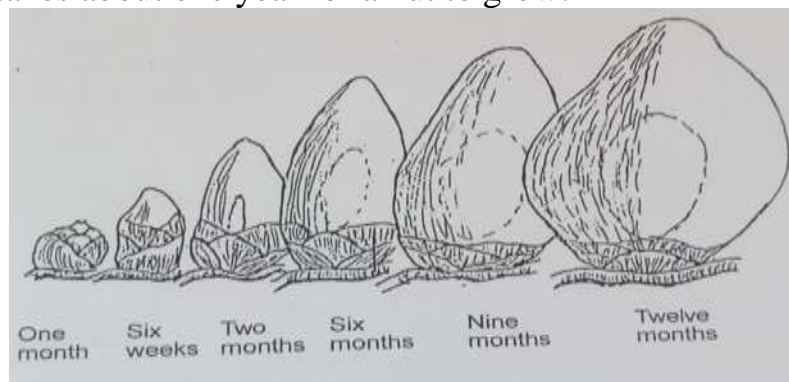
1. Insects
2. Wind
3. Bees
4. Wasps
5. beetles



Fertilisation:

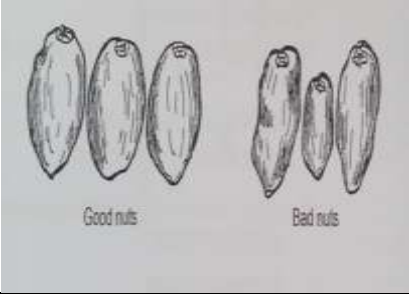


When the pollen is transferred to the stigma, the pollen produces a tube which grows down into the ovary. The nucleus of the pollen moves down through the pollen tube to meet the nucleus of the ovary. There both nuclei fuse together to form the zygote. This process is known as fertilization.



Nut Development: After fertilization the ovary of the female flower grows into a nut. The young nut first grows in length and later grows wider. It takes about one year for a nut to grow.






Selection Of Nuts: It is highly advisable to get your seeds for planting at CIRAD on Santo. **Good seed nuts will produce about 2 tons of copra per hectare per year.** When selecting nuts for planting it is very important to look for the following characteristics:

- Big nuts
- Even shape
- Nuts containing enough (or a large amount) of water
- Nuts that come from high-yielding palms

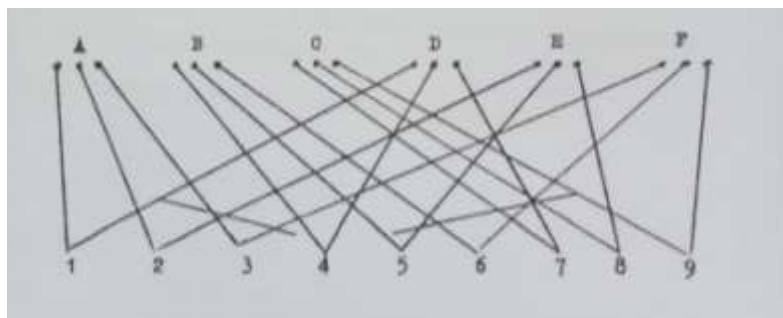
	
 Exercises	Copy the main points in their exercise books
 References	Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 12-15

 Date And Week	15 June – 19th June Week : 5
	Topic : The Coconut Palm (sub-strand : Plant Breeding At CIRAD, Nut Selection AT CIRAD, Breeding At CIRAD, Techniques Of Breeding (1st Method & 2 nd Method.) Lesson number : 3 (Period 1-6)

 <p>Learning outcomes</p>	<p>Having successfully completed this topic, the students should be able to :</p> <ol style="list-style-type: none"> 1. Describe the work of the plant breeders at CIRAD, mentioning the techniques of collection, breeding and selection that are being employed, and the characteristics for which breeders are aiming.
	<p>Catch phrase for the lesson</p> <p>Coconut palm can be undertake research and experimental in Vanuatu.</p>
 <p>Learners notes</p>	<p>Summary Notes</p> <p>Plant Breeding At CIRAD : C.I.R.A.D. (Centre de Coopération Internationale en Recherches Agronomiques pour le Développement)</p> <p>The aim of the plant breeders is to get a good selection of nuts which will:</p> <ul style="list-style-type: none"> •increase the yield of copra per hectare •increase the resistance to diseases and pests. <p>There is a large collection of coconut palms available at CIRAD</p> <ul style="list-style-type: none"> •10 different tall varieties •13 different dwarf varieties <ul style="list-style-type: none"> • The breeders have a large collection of germplasm which is used for producing high yielding and pest and disease resistant plants. • Pollen grains are imported from the Philippines and the IRHO in the Ivory Coast. The Ivory Coast IRHO is the biggest coconut research centre in the world. Pollen can be freeze-dried and vacuum stored. The viability of the pollen is 2 to 3 months. <p>Nut Selection At CIRAD: Selection provides breeders with the best materials. The aim is to improve plant materials by selecting those with desirable characteristics.</p>

One method of breeding

A to F are different varieties of coconuts. They are intercrossed and the best quality obtained from 1 to 9 is selected. This method provides the breeder with the best selection of nuts for planting.



Breeding At CIRAD :

- Tall plants are crossed with dwarf varieties. Tall varieties are known as the local tall (**Grande Vanuatu in French**). The palms are tall, mostly green in colour and produce small numbers of big nuts.
- Dwarf varieties are known as the Dwarf (**Nain Rouge Vanuatu in French**). The palms are dwarf, mostly red in colour and produce large number of small nuts.
- The hybrid obtained is known as **NRVGT**. It is a medium sized palm, reddish green in colour and produces lots of big nuts.

Local Dwarf

Nain Rouge Vanuatu (French)

NRV

Local Tall

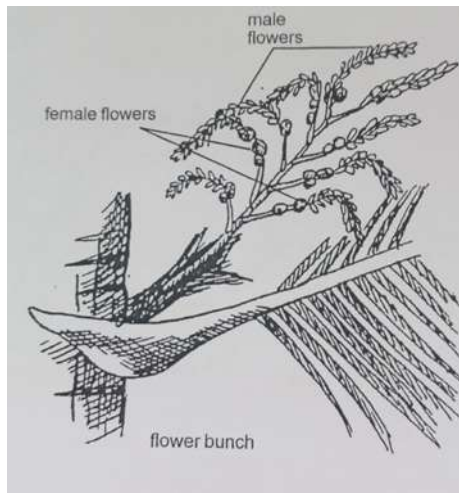
Grande Vanuatu (French)

X

GTNRVGT

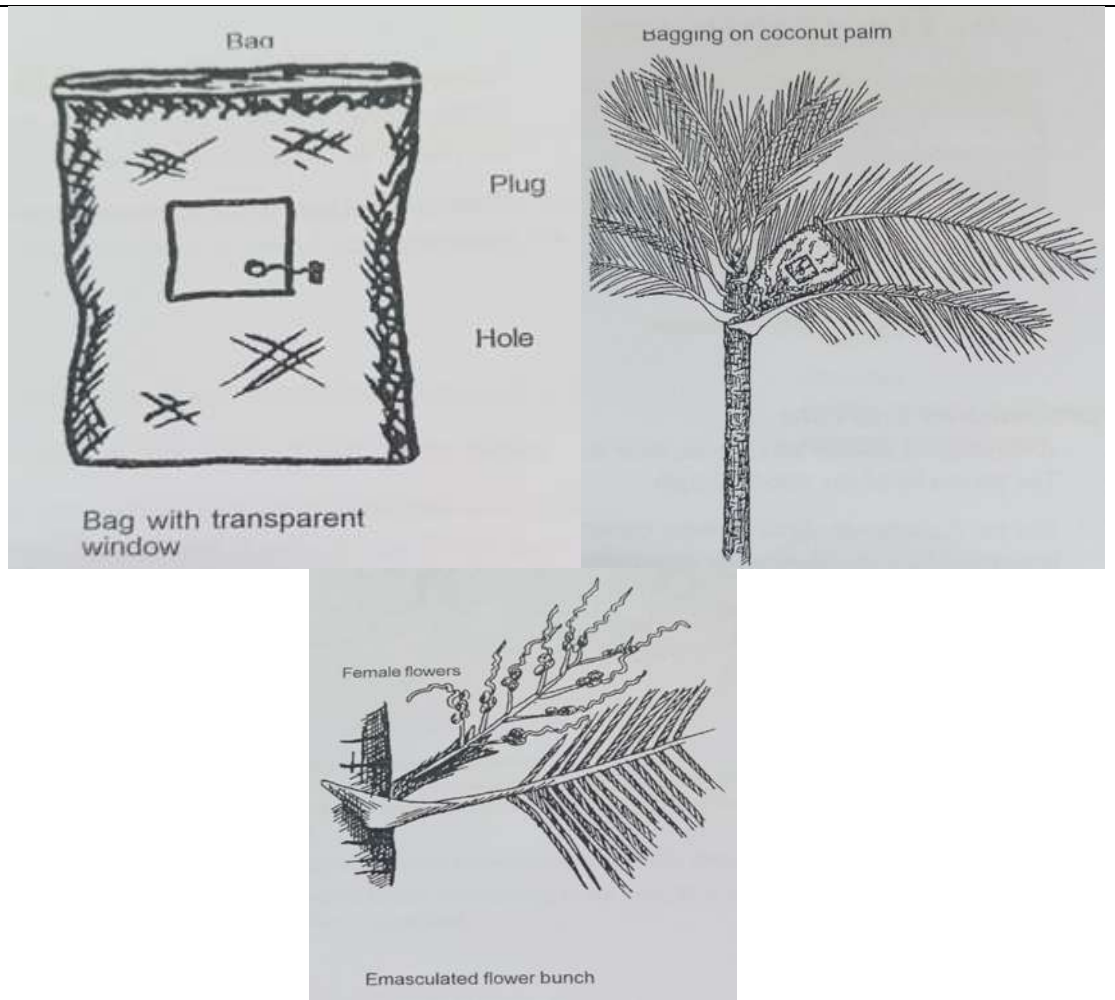
Techniques of breeding:

Breeding is done by hand pollination. The pollen grains are carried in a small container and are transferred to the stigma of the female flower manually.



1st Method : Breeding is done in the following steps:

1. The flowers are emasculated, that is all the male flowers are removed from the bunch.
2. The bunch with the female flowers is placed into a tarpaulin bag. The opening of the bag is securely attached at the base of the flower stalk.
3. Some insecticide powder is placed at the base of the flower stalk in order to keep insects away from the female flowers.
4. The pollen is mixed with some talcum powder and put in a plastic bottle. The talcum powder facilitates dispersal of pollen inside the bag.
5. When ready to pollinate, the pollen from the plastic bottle is pumped onto the female flowers through a small hole in the bag.
6. The bag is left on the palm until fertilisation occurs.
7. Fertilisation is confirmed when small drops of water appear on the flower. This is visible through the transparent part of the bag. Bagging on coconut palm.



2nd Method: Sometimes a seed garden with assisted pollination is set up. The flowers of the mother plant are emasculated. Pollination is done every day with the plastic bottle containing pollen grains. This is a very expensive method which needs a lot of people and lots of care.








Exercises

. Copy the main points in their exercise books



Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 16-17

References

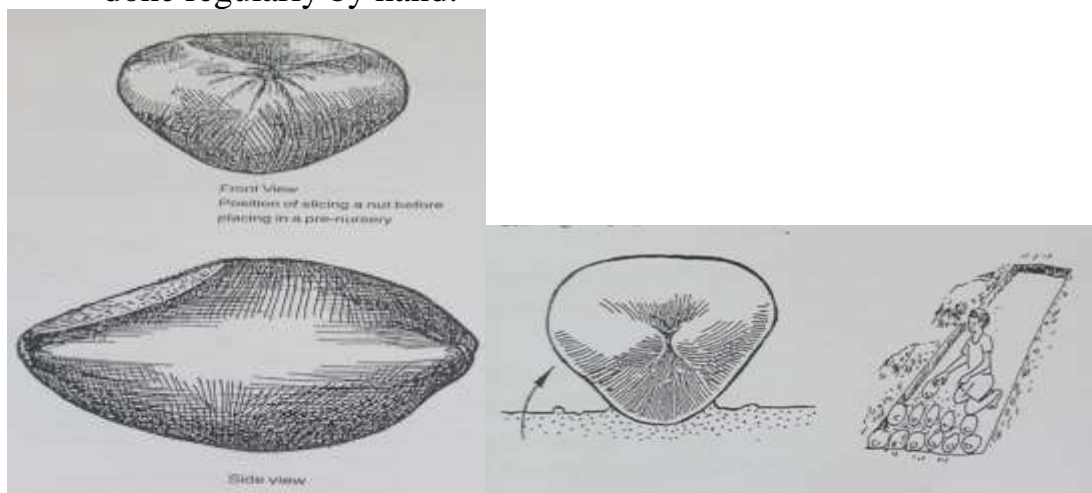
 <p>Date And Week</p>	<p>22nd June – 26th June</p> <p>Week : 6</p>
	<p>Topic : The Coconut Palm (sub-strand : The Pre-nursery)</p> <p>Lesson number : 4 (Period 1-6)</p>
 <p>Learning outcomes</p>	<p>Having successfully completed this topic, the students should be able to :</p> <ul style="list-style-type: none"> • Demonstrate a knowledge of the recommended procedure to be followed when planting coconut in a pre-nursery, and of the maintenance of the pre-nursery.
	<p>Catch phrase for the lesson</p> <p>The importance of pre-nursery and their procedure and maintenance.</p>
	<p>Summary Notes</p> <p>The Pre-Nursery :</p> <ul style="list-style-type: none"> • Seed nuts are first raised in a pre-nursery in order to identify the fast germinating ones. <p>It is extremely important to identify the early germinating seeds as they will produce:</p>

Learners
notes

1. early flowering palms
2. early producing palms
3. high yielding palms








Methods, procedures and care

1. A rectangular shallow pit (1 meter wide and 15cm deep) is dug.
 2. The nut is shaken to check its water content.
 3. A small part of the husk is sliced to facilitate water absorption.
 4. The nuts are placed side by side with the sliced surfaces facing upwards.
 5. They are about two thirds covered with soil.
 6. The bed is thoroughly watered and mulched.
- It is extremely important to keep the bed weed-free, so weeding is done regularly by hand.



Selection of early germinating nuts

- The selections of early germinating nuts are done every week. The seedlings are transferred directly to the nursery.
- Seedlings are transferred to the nursery when their leaves are 15 to 20cm in length.
- The selection should be done within a period of 3 months.
- Seeds that do not germinate within the 3 months should be rejected.

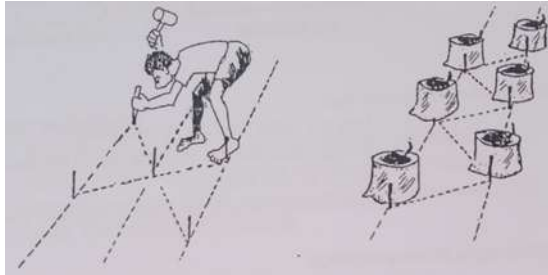
 Exercises	Copy the main points in their exercise books
 References	Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 21-22
 Date And Week	29th June – 3rd July Week : 7
 	Topic : The Coconut Palm (sub-strand : The Nursery.) Lesson number : 5 (Period 1-6)
 Learning outcomes	Having successfully completed this topic, the students should be able to : <ul style="list-style-type: none"> • Demonstrate a knowledge of the recommended procedure to be followed when planting coconuts up from the pre-nursery, and of their maintenance in the nursery.
 	Catch phrase for the lesson The importance of the nursery and the procedure and maintenance.
 	Summary Notes The Nursery: <ul style="list-style-type: none"> • A nursery is important as it facilitates a proper selection of the strongest seedlings. • Seedlings from the pre-nursery are transferred to the nursery.

Learners
notes

- They are placed in polybags in order to avoid transplanting shock later.

Planting in polybags steps:

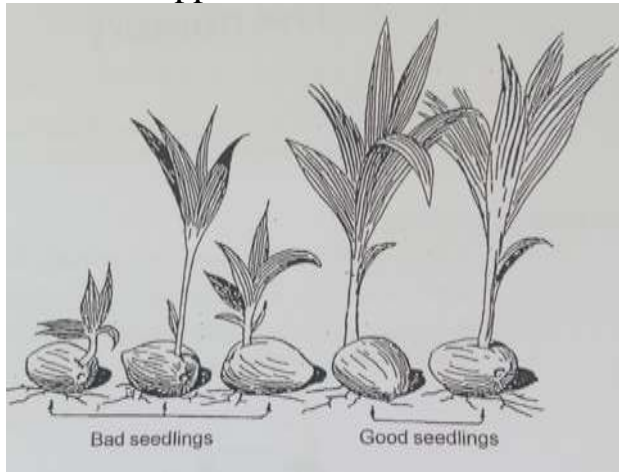
- A polybag is filled with top soil and the seedling is placed in it.
- Some more soil is then added, followed by some water.
- Sometimes a small amount of fertilizer is added around the seedling. (Muriate of Potash and Ammonium Sulphate).



Application of fertilizer to the seedling in the polybag



Prior to the transference of seedlings from the pre-nursery to the polybag nursery,


- A basal dressing is essential. 25 grams of the fertilisers are applied.
- After 3 months another 25 grams are applied as a side dressing.
- Lastly 2 months before transplanting to the field, 50 grams of the same fertilisers are applied.







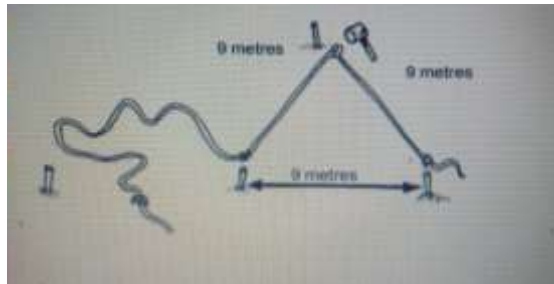
Advantages of using polybags:

- There is a better seedling development.
- The bag containing the seedling can be handled safely.
- There is no root damage.
- Transplanting shock is very small (less than 1%).

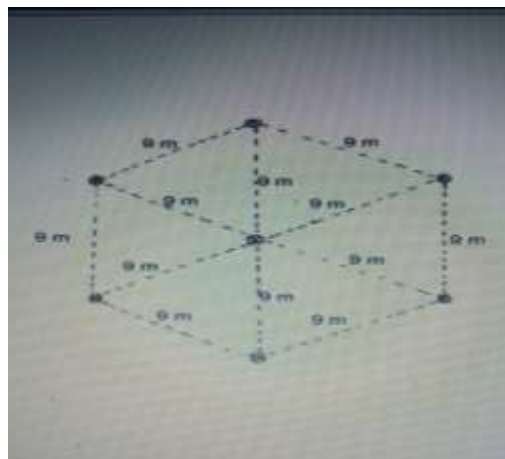
	<p>Disadvantages of using polybags: The heavy weight of the seedling causes a problem for transport.</p> <p>Nursery techniques:</p> <p>Spacing:</p> <ul style="list-style-type: none"> • The seedlings are arranged in a 60cm triangle in a nursery (sometimes 70cm or 80cm). • Bigger spacing is done when the seedlings are to be kept for a longer time in the nursery. • This method of spacing gives a lot of sunlight to the plant and facilitates watering. <p>Duration:</p> <ul style="list-style-type: none"> • A seedling is best kept in a nursery for a period of 6 months. • The dwarf varieties are kept for 10 months • The local tall for 5 to 8 months. • Hybrids are normally kept for 8 months.
 Exercises	Copy the main points in their exercise books
 References	Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 23-24

 Date And Week	6th July – 10th July Week : 8
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	<p>Topic : The Coconut Palm (sub-strand : Planting Out Coconuts.)</p> <p>Lesson number : 6 (Period 1-6)</p>
 <p>Learning outcomes</p>	<p>Demonstrate a knowledge of the recommended procedure to be followed when planing coconuts out in the plantation, both when:</p> <ul style="list-style-type: none"> • coconuts are to be grown alone • coconuts are to be inter-cropped with other crops e.g. cocoa.
	<p>Catch phrase for the lesson</p> <p>Understanding the procedure when planing coconuts out in the plantation.</p>
 <p>Learners notes</p>	<p>Summary Notes</p> <p>Marking Out Procedures :</p> <ol style="list-style-type: none"> 1. a long rope is taken and knots 9 metres apart are tied 2. the rope is then stretched in a north-south direction along one side of the planting area 3. small pegs are fixed into the ground at the positions of the knots 4. to mark the second row the first and third knots are tied on the first two pegs 5. second knot is then pulled sideways and a peg is fixed at the point it reaches <p>This process is continued until the whole plot is marked</p>



- 9 metre triangles is best because it avoids overshade and provides maximum sunlight to the plant.
- The 9 x 9 metres triangle system will give 143 Coconut palms per hectare.



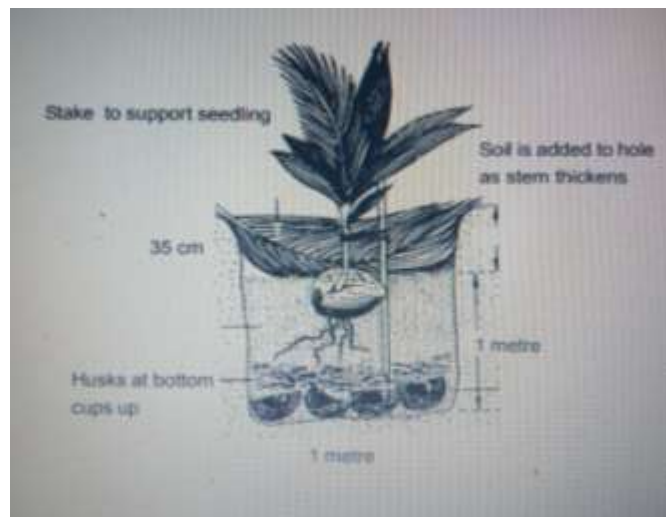
Planting holes – steps 1-6

1. Planting holes are dug at the places previously marked with the pegs.
2. The holes are dug about one metre deep and 60cm diameter.
3. One or two layers of husk, cups up, are placed at the bottom of the holes.
4. The husks contain potassium and putting the cups up holds the potash well
5. Some good soil and mixed fertiliser are then put on the husks.

6. A stake is driven in the hole to hold the seedling straight.

Transplanting steps :

1. The top part of the nut is about 35cm below the surface of the soil
2. Soil is placed around the nut, with care being taken not to cover the collar of the stem
3. Soil is added later as the stem grows in thickness



Planting from polybags – steps 1-5 :

1. The hole is ready
2. The bottom of the polybag is cut off
3. Lowered down the bag and the seedling into the hole
4. The polybag is then pulled up over the leaves
5. The seedling is then watered.





Intercropping

- A shade resistant crop like cocoa may be grown between the rows of coconut palms.
- Extra income for the farmer

Other crops that can be intercropped with young coconut palms are :


1. cassava
2. sweet potatoes
3. banana
4. pineapples
5. maize.





These crops should not be planted too close to the palms (at least 2 metres away) as, if they are, they will take too many plant nutrients from the soil. This will damage the young palms.



Exercises

Copy the main points in their exercise books

 <p>References</p>	<p>Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 25-29</p>
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 <p>Date And Week</p>	<p>13th July – 17th July</p> <p>Week : 9</p>
	<p>Topic : The Coconut Palm (sub-strand : CARE OF THE YOUNG PLANTATION and COCONUT PESTS.)</p> <p>Lesson number : 7 (Period 1-6)</p>
 <p>Learning outcomes</p>	<p>Demonstrate a knowledge of the procedures to be followed when maintaining a plantation, with particular reference to:</p> <ul style="list-style-type: none"> • care of the young plantation • the relative merits of weed control by hand, by cattle, and by machine. <p>Describe the major problems affecting coconut palms growing in Vanuatu, including:</p> <ul style="list-style-type: none"> • foliar decay • helminthosporiose • brontispae beetles • senility
	<p>Catch phrase for the lesson</p> <ul style="list-style-type: none"> • Procedures to be followed when maintaining a plantation in terms of young plantation and weed control. • Problems affecting coconut palms



Learners
notes

Summary Notes

Weeding

1. Ring weeding (3 metre diameter around the palm).
2. Done regularly
3. Using bush knife
4. Discharrowing
5. Slashing
6. Herbicides
7. Cattle (when coconuts are adult)

Cover crops with weeds will provide a useful mulch.

Fertilising

Benefits :

1. For vigorous growth
2. High yields

Best time to apply :- **beginning of the rainy season** (the soil is moist and nutrients by the roots is rapid.)

Steps to apply :

1. drills made around individual palms (not too close to the palm)
2. distance depends on the size of the palm
3. contain adequate amounts of nitrogen, (phosphorus and potassium.)

Potassium Chlorate (Muriate of potash) and Ammonium Sulphate are normally used.

Foliar Decay

- A very serious disease affecting coconuts (probably Viroids cause the disease).
- The disease is spread by an insect called Myndus leffini (The insect is endemic in Vanuatu)
- feeds on coconut, injecting a pathogen in the coconut sap.
- The local tall and Vanuatu dwarf are resistant (The hybrid 'NRVGT' is 100% resistant.)
- The disease causes yellowing of the middle leaves

Helminthosporiose

- A fungal disease caused by *Helminthosporium incurvatum* (*Drechslera incurvata*)
- Affects mostly young palms in the nurseries (overcrowded, heavily intercropped, under fertilised or given excessive shade)

Symptoms :

1. A leaf spot of young palms (spots are at first small, oval and brown.)
2. The spots enlarge and become pale buff in the centre with a broad dark brown margin
3. The edges of leaves become extensively necrotic.

Control

Fungicides can be used for controlling the disease. The controlling measures are :



1. Organil 66 (Procida) - 25 grams in 10 litres of water
2. Dithan M 45 - 25 grams in 10 litres of water
3. Maneb 80% - 25 grams in 10 litres of water
4. Daconil - 25 grams in 10 litres of water


In case of underfertilised palms an application of P and K on a 2 to 3 year old palm reduces the disease by about 40%.





Brontispa



Scientific name of insect: *Brontispa Longissima* Common name of insect: Coconut Leaf Hispa or Coconut Hispine beetle

	<ul style="list-style-type: none"> • Brontispa attacks all palms, but more damaging to young palms in nurseries • Neglected palms are more heavily attacked than those that are carefully looked after. • Adult insects and larvae damage the leaflets of unopened fronds • Adult beetle chew leaves between or inside the tightly folded leaflets. • They graze away the surface in streaks which are typically parallèles to the midrib <p>Symptoms :</p> <ol style="list-style-type: none"> 1. The narrow feeding scars enlarge to form irregular brown blotches as the frond opens. 2. Destruction of young leaves restricts growth for a long time and heavy attack may cause death. <p>Control measures :</p> <ol style="list-style-type: none"> 1. Chemicals which are recommended - Triohiorfon and Lindane 2. Applied to the central spike of the palm. 3. Old palms are controlled by introducing parasites (Tetrastichodes brontispae)
 Exercises	Copy the main points in their exercise books
 References	Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 30-33

 Date And Week	20th July – 24th July Week : 10
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	<p>Topic : The Coconut Palm (sub-strand : Copra and V.C.M.B.)</p> <p>Lesson number : 8 (Period 1-6)</p>
 <p>Learning outcomes</p>	<p>Describe the methods used to produce</p> <ul style="list-style-type: none"> • smoke-dried copra • hot-air dried copra • sun-dried copra and compare the advantages and disadvantages of these three systems. <p>Describe the method by which the price paid to producers for their copra is decided, mentioning in particular the work of</p> <ul style="list-style-type: none"> • the copra graders • the VCMB
	<p>Catch phrase for the lesson</p> <p>Methods used to produce, and methods by which the price to decided.</p>
 <p>Learners notes</p>	<p>Summary Notes</p> <p>Hot air drier</p> <ul style="list-style-type: none"> • The meat is placed in enclosed chambers and heated with hot air. • Coconut husks and shells can be used as fuel. • The hot air drier provides a complete homogenous drying with about 6% humidity. <p>Sun drying</p> <ul style="list-style-type: none"> • The meat of the coconut is placed on mats, drying floors or small platforms and left in the sun. • The copra should be covered at night or when there is rain. • It takes about one week for sundrying copra. <p>Smoke drier</p> <ul style="list-style-type: none"> • There should be as little smoke as possible. It is very difficult to

get an homogenous drying with this method.

Quality of copra

Good quality copra should have the following characteristics:

- should contain less than 7% moisture
- should be brittle and break easily
- small slice should burn with a clear flame (above 0% moisture the copra will not burn).
- should be prepared from mature ungerminated nuts.
- the surface should be clean, smooth and hard
- the testa should be brown and inner surface white or greyish white
- should be free from dust, soil or any foreign matter.





V.C.M.B

- The Vanuatu Commodities Marketing Board was set up under the UNDP/Vanuatu Government joint project in 1980.
- The board started operation on the 5th April 1982.
- Its operation and price stabilisation scheme has been initially funded by the EEC, Stabex Fund through the Ministry of Finance Vanuatu.

The VCMB's main aims are:

- to receive copra offered for export at Vila and Santo.
- Sell copra overseas.
- Control the domestic price payable for copra in Santo and Vila.
- Operate a stabilisation scheme to maintain price at a steady level.
- Maximise returns to the producers.

The board also deals with cocoa and kava.



Copy the main points in their exercise books



References

Agriculture in Vanuatu COCONUTS - Ministry of Education Port Vila Republic of Vanuatu 1997. Pages 34-37



WEEKLY CHECKLIST FOR PARENTS:

Term: 2 Week number 6 -13 Date..... to..... Month:

Subject	Number of lessons	Days	Tick when activity is complete	Parents comment	Signature
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				