

A watercolor illustration of a plant stem. The stem is a vibrant red color and runs vertically down the right side of the page. At the top, there is a cluster of purple flowers with green centers. Further down, a large, green, palmately lobed leaf is attached to the stem. The leaf has several distinct lobes and prominent veins. The background is plain white.

PLANTATION MANUAL

ERI FOODPLANTS

MEGHALAYA STATE RURAL
LIVELIHOODS SOCIETY

in convergence with

DEPARTMENT OF SERICULTURE, RIBHOI

Plantation Manual, 2023

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PLANTATION MANUAL

FOODPLANTS FOR ERI SILKWORM



DEPARTMENT OF SERICULTURE, RIBHOI | MSRLS





acknowledgements

This book is dedicated to Shri Shantanu Sharma, in whose tenure this book was begun, and whose support was vital to exploring new directions to textile projects. This book is also dedicated to Shri Ramakrishna Chitturi (CEO, MSRLS), Shri Ronald Kynta (COO, MSRLS) and Shri Shanlang Lyngdob (COO- I, MSRLS), without whose support, the completion of this book wouldn't have been possible.

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ABOUT THIS BOOK

Ri-Bhoi district, in Meghalaya, is rich in a number of sericigenous insects, and its host plants. Eri, Muga, Tasar and Mulberry silkworms are found in this area. But only Eri and Muga are the two prominent commercially exploited silkworms, out of which, production of Eri is the highest.

Over the years, several schemes from several bodies have reached producers of Eri in the district. Ri-Bhoi's District Sericulture Office, along with the Central Silk Board, Ministry of Textiles, Government of India, has been actively working in Ri-Bhoi and has helped in implementing various schemes and supportive packages to farmers, SHGs and various NGOs falling under the area.

Meghalaya State Rural Livelihood Society (MSRLS) is the state implementing agency of National Rural Livelihood Mission (NRLM). MSRLS focusses on collective action based on self-help and mutual cooperation, building linkages with financial institutions, skill development bodies and knowledge-centric institutions with income generation in mind.

This book is prepared as part of the Eri Value Chain Project, under Convergence Activities, Livelihood Sector of MSRLS with Department of Sericulture, Ri-Bhoi in 2022.



INTRODUCTION

Eri silkworm is polyphagous in nature, i.e., feeding on the leaves of varieties of host plants. In this book, we will look at those foodplants that are feasible to grow in Ri-Bhoi.

The ideal soil is slightly acidic with a pH anywhere between 5.1-5.9. Other conditions are that the soil should be rich, black and loamy with lime and silt, making it suitable for the host plants to flourish.

In Ri-Bhoi, Meghalaya, there are four main host plants that grow well owing to the weather and soil conditions. These are:

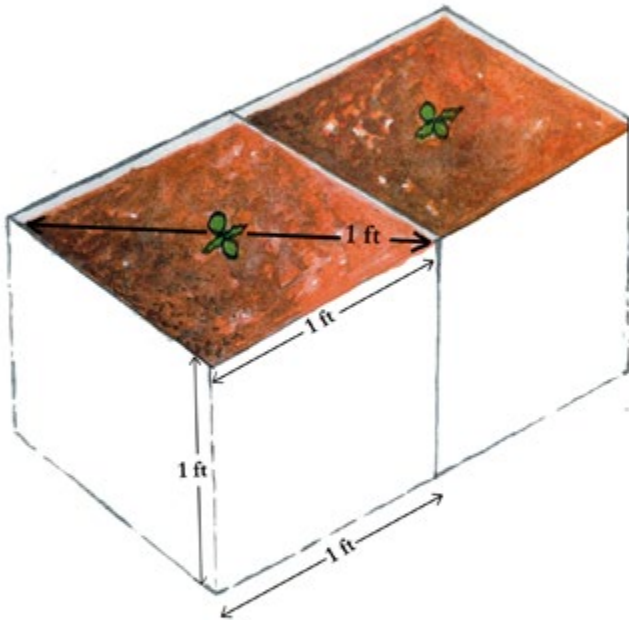
- Castor
- Kesseru
- Payam
- Tapioca

The leaves of castor are considered as the primary foodplants. Kesseru, payam and Tapioca are considered as secondary foodplants.

We shall look at each of these plants in more detail.

CASTOR

Castor seeds are easily sown directly into prepared pits of 1 feet length, breadth and depth each, with a mixture of manure and soil. The soil has to be rich in nutrients



Sowing is usually done during March to April (Monsoon Season) after land tillage. At this time, four to five seeds are sown separately into a single pit at a distance of 4-5 cms.

Fresh soil, is added to the base of each plant and weed infestation is regularly maintained. Soil, rich in nutrients, yield more quality of leaves.

**SOWING:
MARCH to
APRIL**



Regular watering is done and after the plants attain a certain height of about **2-3 feet**, the tip or apical portion is cut off to reduce height and yield quality leaves



Good quality of seeds harvested during February to March are selected based on sizes, colour and succulent matter content (cotyledon) in the seed. This is observed by breaking the seed cover (testa) revealing the nature of the matter.

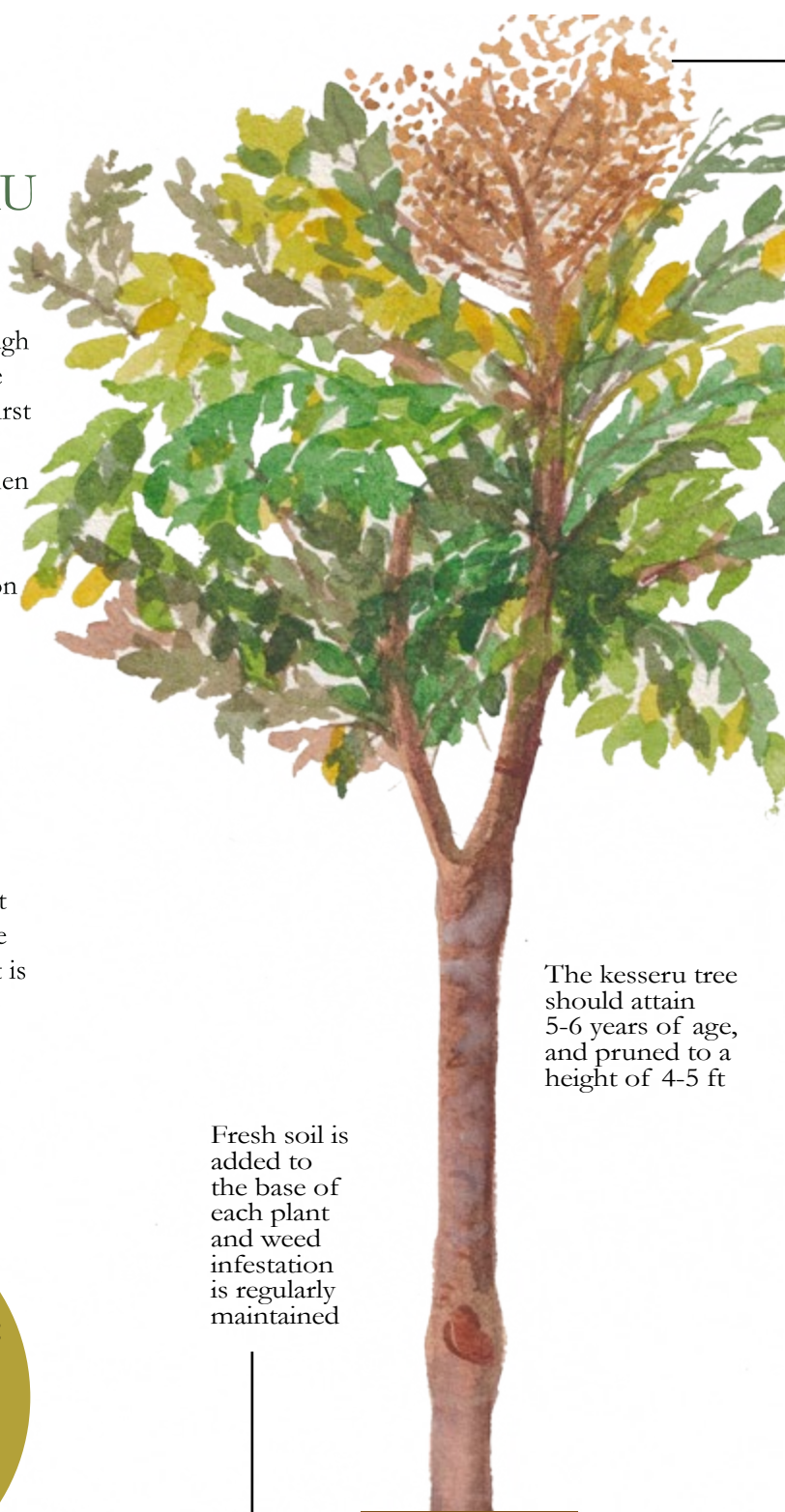
KESSERU

Kesseru is propagated through nursery technique where seeds are first sown on nursery beds. Seeds are then collected during February- March and are selected on the basis of healthy inflorescence, colour and size.

The skins of the seeds are washed off, and only the seeds that settle at the bottom of the vessel (in which it is washed) are selected.

Fresh soil is added to the base of each plant and weed infestation is regularly maintained

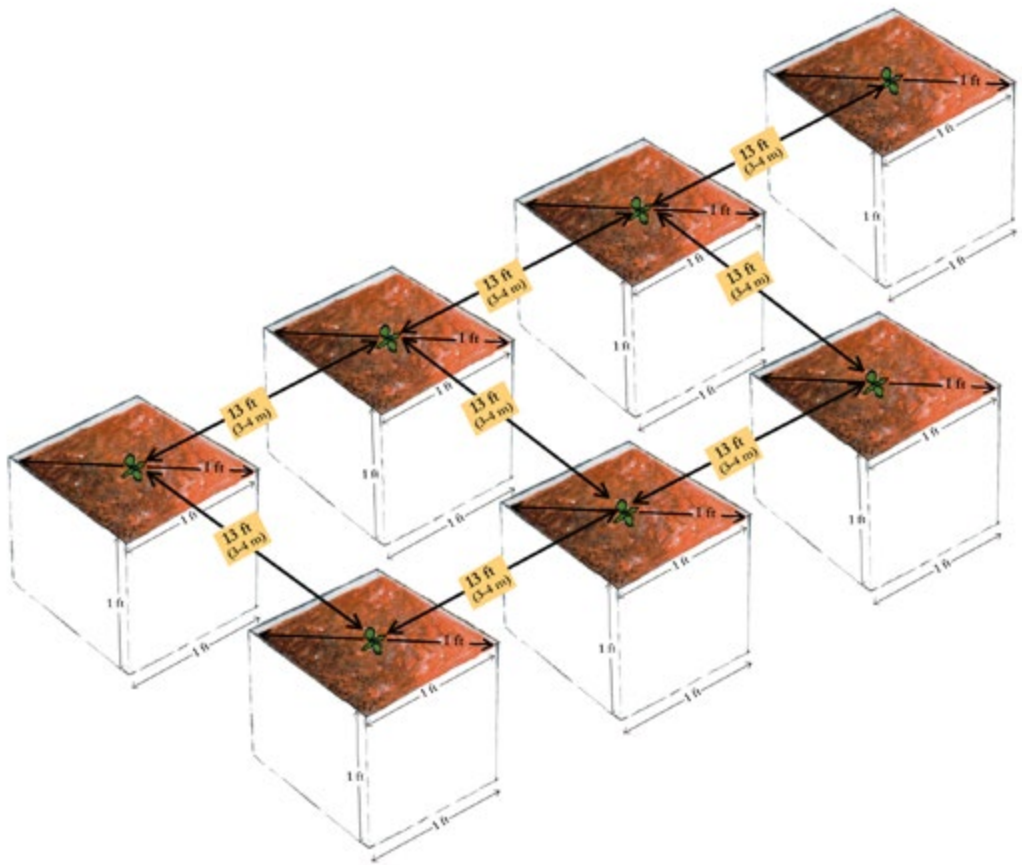
The kesseru tree should attain 5-6 years of age, and pruned to a height of 4-5 ft



**PLANTATION:
MARCH to
APRIL or rainy
season**

Inflouescence in
kesseru tree





PLANTATION: KESSERU

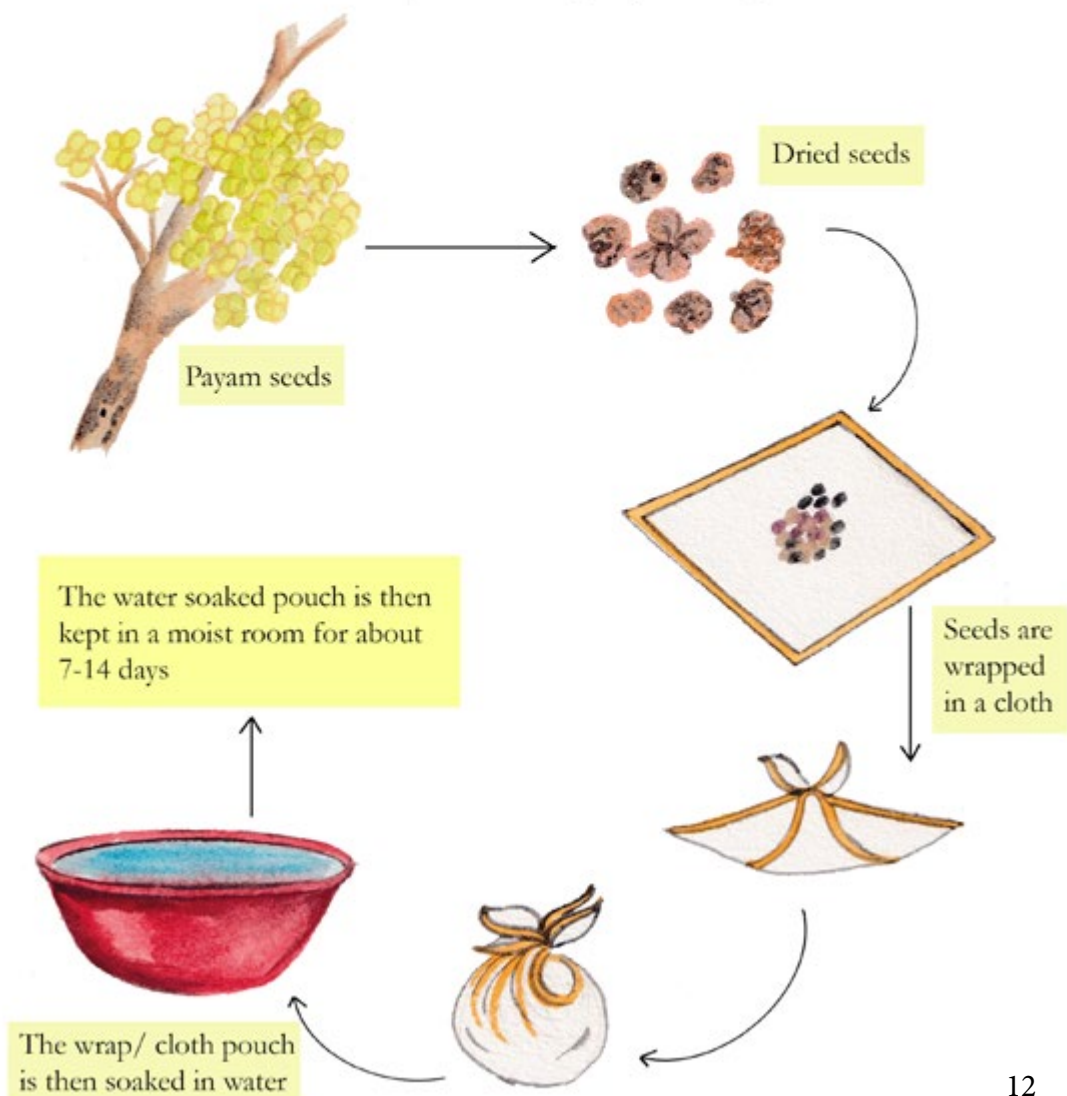
A year old nursery plants, when they reach a height of 1 to 1.5 feet, are then transplanted onto prepared pits of length, width and height of 1 foot each.

The distance between the plants should be about 13 feet (3-4 metres).

PAYAM

Payam's nursery and transplantation is similar to that of kesseru, except that payam seed is difficult to germinate, due to its hard seed coating (pericarp).

In order to soften the coating, the following steps are adopted.



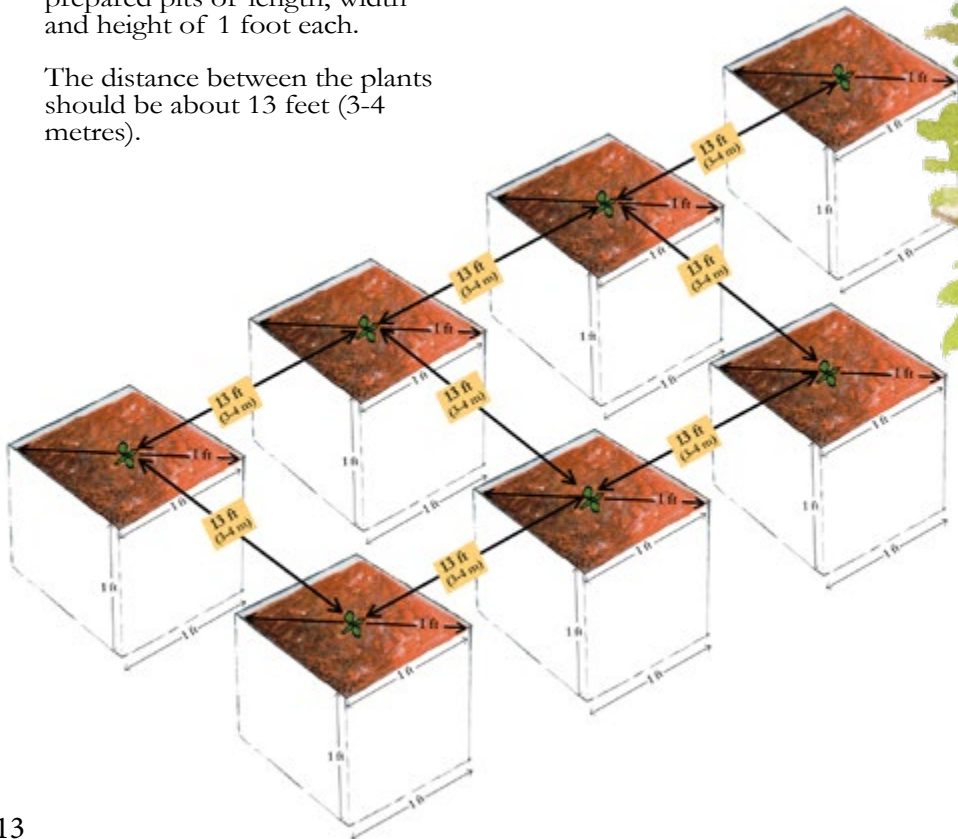
PLANTATION: MARCH to APRIL

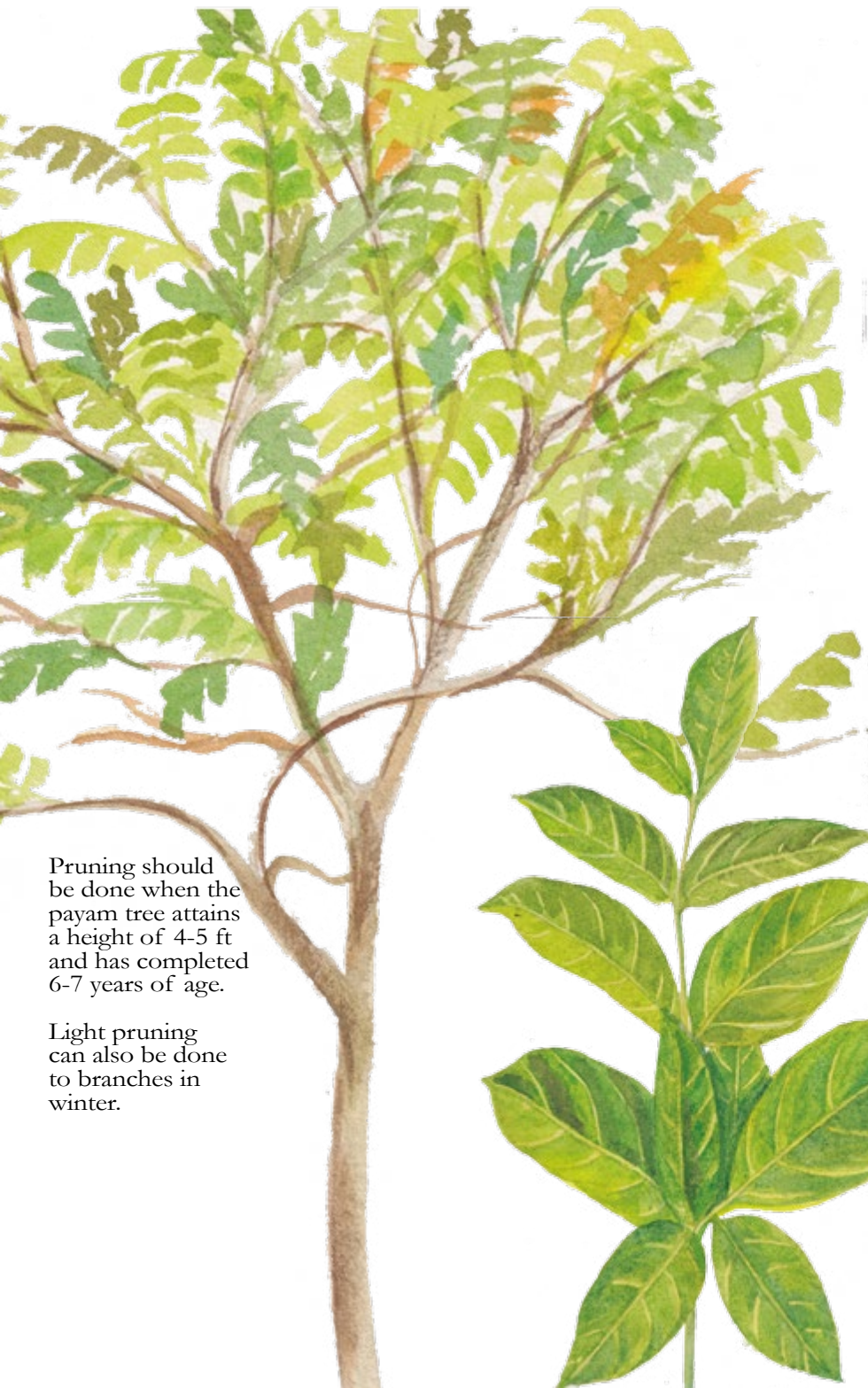
The germinated seeds are then carefully taken and sown into prepared polythene bags

PLANTATION: PAYAM

A year old nursery plants, when they reach a height of 1 to 1.5 feet, are then transplanted onto prepared pits of length, width and height of 1 foot each.

The distance between the plants should be about 13 feet (3-4 metres).



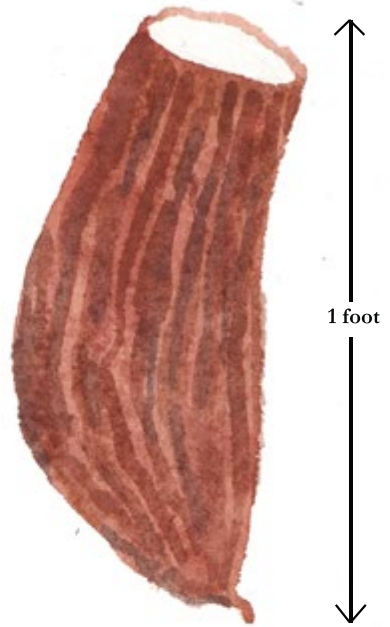


Pruning should be done when the payam tree attains a height of 4-5 ft and has completed 6-7 years of age.

Light pruning can also be done to branches in winter.

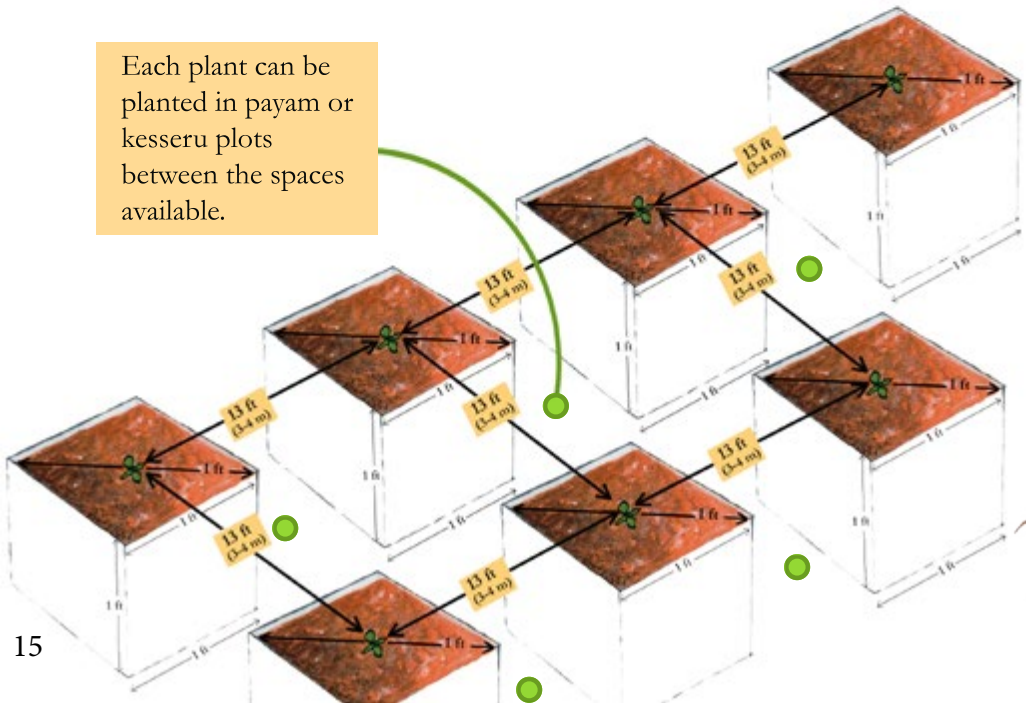
TAPIOCA

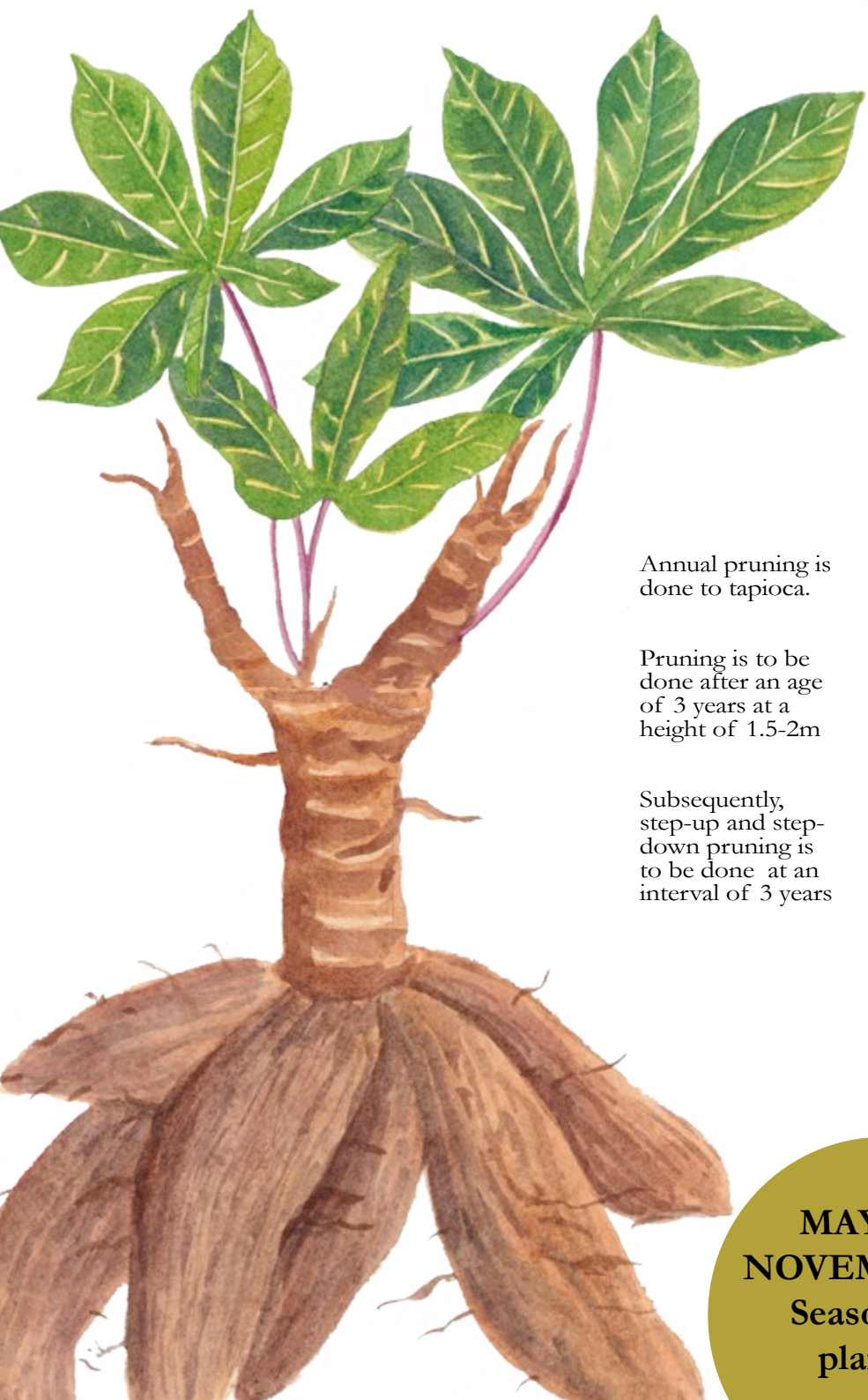
Tapioca is easy to propagate. A year old tapioca stem is cut into pieces of 1 foot length and planted into prepared pits.



These pits are provided with manure.

Each plant can be planted in payam or kesseru plots between the spaces available.





Annual pruning is done to tapioca.

Pruning is to be done after an age of 3 years at a height of 1.5-2m

Subsequently, step-up and step-down pruning is to be done at an interval of 3 years

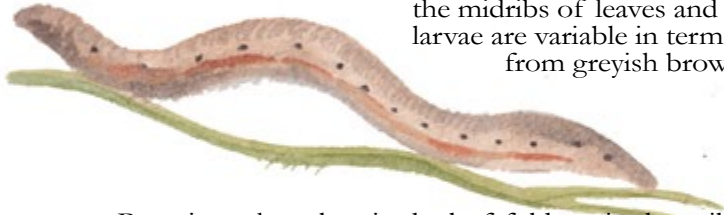
**MAY to
NOVEMBER:**
Seasonal
plant

PESTS, DISEASES AND PREDATORS OF FOODPLANTS

PESTS OF ERI FOODPLANTS

1. Grasslooper

Description: One of the major pests seen in Castor, especially in Warmawsaw, Jirang Block, is **Grass Looper (Achaea Janata)**, or **Niansidho** in Khasi. It is also known as Castor Oil Looper or Semi Looper. It is a leaf-eater and in severe cases, The larvae completely defoliates the plants, leaving behind only the midribs of leaves and stems. The larvae are variable in terms of colour from greyish brown to black.



Occurrence: Pupation takes place in the leaf folds or in the soil. The occurrence is mostly seen in May or June in Ribhoi District.

Control:

- **Bio-pesticides** such as trichoderma and pseudomonas can be used at 15- day intervals. Botanical extracts like Neemastra also help.
- **Cleaning of forest floor or the space where the plantation is** a necessity as the most moths and insects survive, fly and travel upto 2-3 feet with the help of weeds and bushes.

2. Powdery Mildew

Description: White powdery patches appear on the lower surface of the leaves. The corresponding portions on the upper surface develop chlorotic lesions. When severe, the white powdery patches turn to brownish-black; the eaves become yellow, coarse and loose their nutritive value.

Occurrence: This disease is prevalent during winter and rainy seasons, and can occur due to moist



and warm weather.

Control:

- Thinning out existing susceptible plants to **improve airflow**
- Maintaining **adequate spacing as described** between plants
- Keep plants away from walls and fences to ensure good air circulation and help **reduce relative humidity**
- Locating plants in **proper sunlight**
- Cut and removing infected leaves. Spray the plant with **baking soda solution**. For this method, mix 1 tablespoon baking soda and $\frac{1}{2}$ a teaspoon liquid soap in 1 gallon of water. Transfer it into a spray bottle and spray the tops and underside of leaves and any other affected areas.

3. Diseases of the Leaf: Leaf Rust, Leaf Blight and Leaf Curl

Description: Symptoms of **red rust** are circular or oval, orange spots and bumps on the upper surface of infected leaves. The spores within these bumps break free to cover everything with an orange dust.



leaf rust

Younger plants are affected by **leaf blight**, which may be scattered or concentric. Both the surfaces of the leaf turn yellow or brown with concentric brown zones on lower surface of leaf. Dull green round patches soon spread to the base, causing the leaf to rot and hang down.

Leaf curl is caused by a fungus which is characterized by distortion and coloration of leaves.



leaf curl



leaf blight

Occurrence: All these diseases are air borne dispersing by air through water droplets and wind current.

Control:

- Follow wider spacing of plantation or paired row planting system for better air circulation
- Avoid delayed leaf harvest
- Using botanical extracts

4. Tussock Moth

Description: Tussock moth is a major pest in foodplants. These are small moths that are best-known because of their attractive larvae. The name is derived from the hair tufts or tussocks, found on the larvae. Farm owners may develop dermatitis from contact with the cocoons while removing them from the foodplants. Hairs in the cocoons retain their urticating capability for up to a year or longer.



tussock moth

Occurrence: The larvae may be contacted when they drop from host trees or when the moth wanders from the trees in search of a place to spin their cocoons. In some years the larvae become numerous and pose a problem when they leave their host plants to search for suitable site to spin their cocoons.

Control:

- The females are short-winged, but cannot fly. They use weeds to climb on to the foodplants. The best control is to keep checking the foodplants for these and removing them instantly.
- Using bio-pesticides and botanical extracts



tussock moth larvae

Chemical pesticides on foodplants such as DDT, mosquito repellent etc. should be avoided at all costs. This affects the Eri worm feeding on these plants. Sometimes, it even leads to the death of the worm.

PEST MANAGEMENT

There are various kinds of methodologies for pest control.

- **Pheromone traps:** A type of trap that uses pheromones to lure insects using pheromones. The male moths are tricked into thinking that they smell a mate, but when they arrive at the source of the pheromone, they get trapped or stuck on its sticky surface instead.
- **Yellow sticky traps:** Yellow is the colour of plants under stress, and years of evolution have taught insects to head directly to yellowing plants whose defences have weakened. Yellow sticky traps use yellow colour to attract insects towards itself. Once the insect gets closer to the trap, it gets stuck on to the gum. Sometimes, yellow sticky traps are simply pieces of yellow plastic or cardboard covered with a sticky, non-drying glue.
- **Growing trap crops:** Trap crops like marigold, green gram and lantana are grown at the base of the plant, or near the plant.
- **Botanical extracts:** Botanical extracts such as neemastra, brahmastra and agniastra can be made very easily by the farmer herself and can be used as pesticides.
- **Bio-pesticides:** Bio-pesticides such as trichoderma and pseudomonas can be used at 15- day intervals.

The recipe for two botanical extracts are listed in the following pages.

AGNIASTRA

Agniastra is a powerful agent against pests like leaf roller, stem borer, fruit borer & pod borer.

The solution can be prepared in-house by the farmer

Materials required:

- Cow urine
- Crushed leaves of Tobacco: 25 g per litre of cow urine.
- Local green chilli pulp: 25 g per litre of cow urine
- Local garlic pulp: 12.5 g per litre of cow urine
- Crushed neem leaves (with thin stems) or neem seed powder :100 g per litre of cow urine

Usage

- The solution should be sprayed on the infected plants.
- For foliar spray use 3% agniastra with water.
- If the infestation is high then you can use 4% solution.
- For 1 acre, mix 6 to 8 litres of agniastra with 200 litres of water and spray on the plants.



NEEMA STRA

- Take 100 litre water.
- Add 5 litre local cow urine in it.
- Add 5 Kg local cow dung in it.
- Crush 5 Kg of neem leaves & add this neem pulp in this water.
- Let this solution ferment for 24 hours
- Stir this solution twice a day by any stick.
- Filter this by cloth.
- Spray this Neemastra as it is on the plants for sucking pests & mealy bug.



WHY KESSERU AND PAYAM?

To qualify for a scheme or get support for plantation or rearing, the basic criterias are:

- The farmer should have one acre of land with a plantation of kesseru or payam.
- Alternatively, the farmer could have a plantation of 400-450 kesseru or payam plants.
- The farmer should produce 10-15 kg of cocoon per year.



Why is Kesseru and Payam promoted?

Kessar and Payam are perennial plants unlike castor which is seasonal. Presence of Kesseru and payam also indicate regular rearing activities, as they are primarily grown as foodplants for Eri.



Hence, the farmer and rearer should ensure that they plant more saplings of Kesseru and Payam.



MANURE: BERKELEY METHOD

Manuring is an essential requirement, especially in areas where the soil content has a significant amount of stones. Creation of humus, to enhance the top layer of the soil is possible through organic manure.

INGREDIENTS:

Dry Matter: The first step is to collect all forms of dry matter such as dry leaves, hay, dried grass and fallen branches. The more the variety, the better the yield.

The dry material is at the very bottom layer, hence its better if its chunkier for better aeration asnd water management.

Dry chunky matter such as branches, cut into pieces of minimum 2-3 cm should be included.

The dry material should be put through a chaff cutter if possible, before putting it into the compost. Dry chunky matter helps to seep through excess water in the compost.



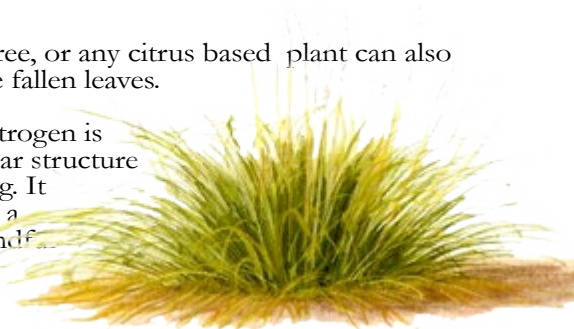
Green Matter: Green matter comprises of green fallen leaves, grasses, weeds removed while farming and agricultural waste.

Water hyacinth is a very good addition as green matter.

The monsoon season and post-monsoon, when we have lots of water available, we can get the maximum yield of green material.

Leaves from lemon tree, or any citrus based plant can also be used, but only the fallen leaves.

A good source of nitrogen is moss, as it has a similar structure to the content in dung. It helps greatly to make a good compost. A handful of moss is enough.



Dung: Variety is important when it comes to the usage of dung.

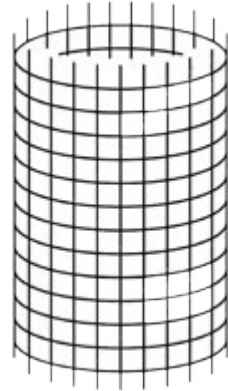
PROPORTION

Dry Matter : Green Matter : Dung = 3 : 2 : 1

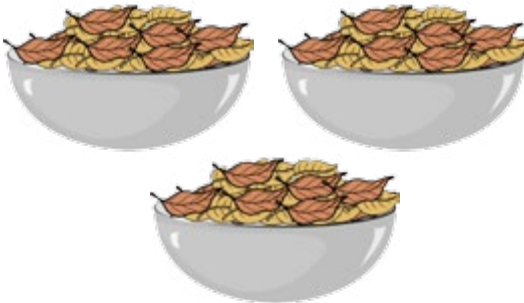
PROCESS:

1. A standing wide-mesh cylinder is used so that the compost stays straight up and we get more air into the compost.

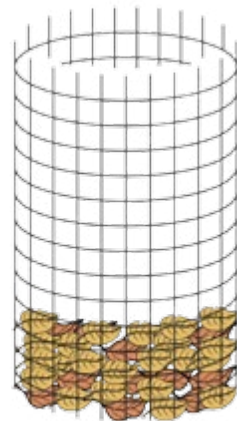
An alternative to the cage is constructing a similar structure from bamboo.



2. Once 3 parts dry chunky matter is put inside the cage, spread it out using a shovel.



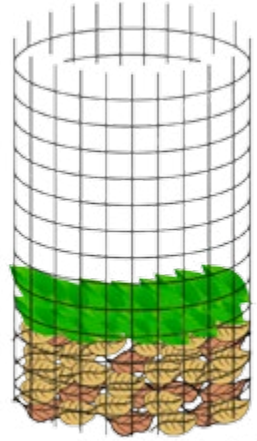
3 portions



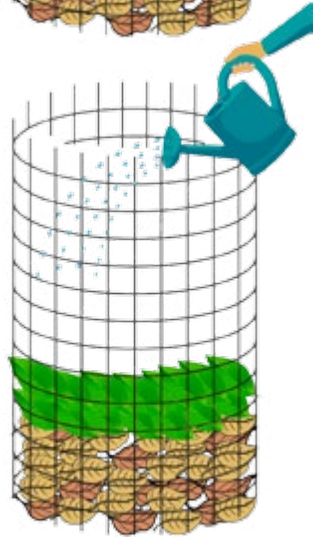
3. Put 2 parts green matter into this, and spread.



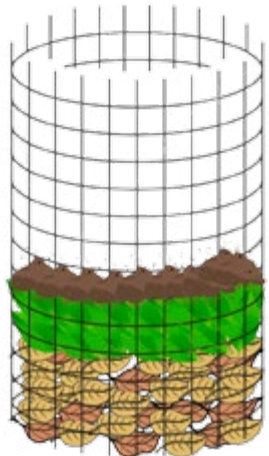
2 portions



4. Sprinkle water on top of the layers. Never pour water directly from a bucket.



5. Now put 1 part dung on it, and sprinkle jaggery and moss on top.



6. Repeat the layers, till you reach the top. Once done, you have to turn it.

FEW THINGS TO KEEP IN MIND:

1. The more the variety in each component, that is, dry matter, green matter, and dung, the better the yield of the compost.
2. Never take neem or eucalyptus to be a part of the compost.
3. One should always avoid plucking leaves from trees for the compost, and instead, use fallen leaves, weeds and agricultural waste. This is to avoid deforestation.
4. Cow feed, or whatever goes into cow feed, is excellent compost material.
5. Bamboo leaves are good compost material.
6. Amount of water used at every stage should be enough to dampen the materials, but not so much that water leaks out from the cage.
7. During the rainy season, sprinkling water may not be necessary, or required very less.
8. If you do not have or wish to use jaggery, take 4-5 sugarcanes, cut them into tiny pieces, soak it in 15-20 litres of water for about 24 hours. Use the water the next day.
9. The compost has to be turned inside out on the 4th, 6th, 8th, 10th, 12th, 14th, 16th and 18th day (the last day), ie, a total of 8 times. Moisten the compost at each turning, if required.

The indication that the compost has to be turned is that the compost has to be more than 70 degree Celsius. In short, the compost should give out more heat than is tolerable by one's hand.
10. High temperature, above 65 degrees, is required to cure all the weed seeds, to sterilize any diseases.



**NOTES
FROM
A TRAINING
(may 2023)**

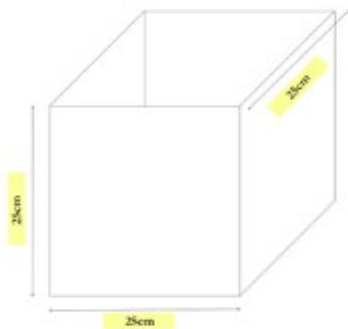
NOTES FROM A TRAINING

FOR CASTOR

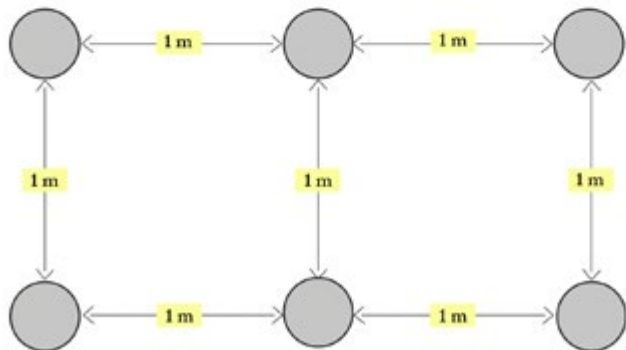
- Number of plants per acre: 4000
- Quantity of castor seeds per acre: 2 kg
- Pit size: 25 * 25 * 25 cm

1 acre: 4047 sq. metre

1 acre: 24 dang



- Distance: 1m by 1m (pit to pit, row to row)



- Number of seeds per pit: 2



- Number of harvests per year: 4
- Leaf yield per year: 4800 kg (4.8 MT)
- Requirement of leaves per DFL: 12 kg

As an example, for 400 DFL, 4800 kgs of leaves are required.

This yields a total of 32 kg of cocoons, which yields Rs. 24,000 (sold at Rs.750/kg)

Additionally, a yield of 200 kg of pupa gives an income of Rs. 80,000 (sold at Rs.400/kg)

Cumulative yield (pupa and cocoon): Rs.1,04,000

Cost of plantation (labour), rearing (labour) and disinfectant: Rs. 44,000

Net profit: Rs.60,000 per annum





Mawlong, Umling



Step 1: Explaining the concept theoretically



Step 2: Taking measurements of a metre to mark the place for the pits



Step 3: Dig to create the pit for the seeds.
The pit should have a little loose soil



Step 3: The pit is 25cm in length, breadth and height.



Step 4: Adding a little compost or cowdung



Step 4: The compost should be dry and loose



Step 5: Mixing the compost with the loose soil.



Step 6: Placing both the seeds with a little distance in the pit



Step 7: Sprinkling water over the pit



Step 8: Part of the completely sown field







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