



Frequently Asked Questions

In Rubber Agronomy



Compiled by Dr. Priyani Seneviratne

A Centennial Publication

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Dr.(Mrs.) P.Seneviratne



Rubber Research Institute of Sri Lanka
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Dr.(Mrs.) P.Seneviratne

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Preface

"Frequently asked questions" is a unique booklet. The layout is specially designed to be reader friendly and it is the only question and answer type publication that RRISL has published so far in the field of rubber agronomy. Also it is published as an activity to celebrate 100 years of Rubber Research and Development in Sri Lanka.

Each question and the answer for it is written by an eminent scientist attached to the RRISL. Similar questions may have been answered by them many times during their career which made them to categorize them as "Frequently asked questions".

The book will serve not only as a reference guide but also as a very good source of information about cultivation of rubber. Theoretical background for most of the RRISL recommendations are given which reflect the thorough knowledge and the experience of the contributors.

A deep debt of gratitude goes to each of the contributors whose names are listed in the end of the book. Tireless efforts of Mrs. G. A. S. Wijesekara, Mrs. D. E. Jayawardane and Mrs. A. de Almeida in the compilation of this booklet are acknowledged. The contribution and the guidance extended by the Director, Dr. A. Nugawela and the Deputy Director Dr. C. K. Jayasinghe are greatly appreciated.

Dr. (Mrs.) P. Seneviratne

Head, Plant Science Department.

Actg. Head, Genetics and Plant Science Department.

23.06.2010

1. What is the scientific name of the rubber plant?

Hevea brasiliensis (Willd ex A.Juss.) Muell Arg.

2. What is the correct classification of rubber?

Kingdom	-	Plantae
Phylum	-	Tracheophyta
Class	-	Angiospermae
Sub Class	-	Dicotyledon
Group	-	Arachichlamydea
Order	-	Geraniales
Family	-	Euphorbiaceae
Genus	-	<i>Hevea</i>
Species	-	<i>brasiliensis</i>

Source: Sinnott & Wilson (1955) Botany
Principles and Problems (325 – 473)

3. What are the other species in the genus *Hevea*?

In the genus *Hevea* there are 11 species, some of which are *H. nitida*, *H. guianensis*, *H. benthamiana*, *H. pauciflora*, *H. camporum*, *H. spruciana*, *H. rigidifolia* and *H. microphylla*.

4. What is the native country of rubber?

Brazil in South America.

5. When was the rubber plant introduced to Sri Lanka?

In 1876.

6. Where is the world first Rubber Research Institute situated?

In Sri Lanka.



7. Where is the Rubber Research Institute situated in Sri Lanka?

In Dartonfield Estate in Agalawatta of Kalutara District.

8. What is the favorable temperature for the growth of rubber tree?

Between $23^{\circ} - 28^{\circ} \text{C}$ and temperature should not fall below 20°C for a continues period of more than a few weeks.

9. What are the other climatic conditions needed for optimum growth of the rubber tree?

High relative humidity favors crop growth. The duration and intensity of sunshine also have a significant influence on the growth of rubber tree.

10. What are the soil types suitable for rubber plantations?

Many soils of different origin as well as morphological characteristics with desirable physical properties can support rubber plantations.

11. What are the desirable physical properties of soil for growth of rubber?

Soil depth up to 100 cm, well drained, aerated, good soil structure, good water holding capacity, soil texture with 35% clay and 30-50% sand.

12. What are the major rubber growing districts in Sri Lanka?

Kegalle, Kalutara, Ratnapura, Galle and Moneragala.

13. When did the research activities on natural rubber first started in Sri Lanka?

In 1909.

14. What is the required physiography for rubber plantations?

Within 10° of the equator and at altitudes of less than 500 m from mean sea level.



15. What is the ideal annual rainfall for rubber?

Within 1650 – 3000 mm, uniformly distributed.

16. Define the term “Clone”

Any organism whose genetic information is identical to that of the mother organism from which it was created.

17. What are the activities that take place during hand pollination?

Artificially inoculating the pollen collected from selected trees to female flowers of selected trees, label the pods and collect the seeds at maturity.

18. What are the advantages of planting with genetically improved planting material?

- Characteristics are known hence return on investments could be predicted.
- High yield.
- Fast growth rate.
- Resistant to foliar diseases,
- High timber volume.
- Resistance to tapping panel dryness (brown bast) and wind resistance etc., are incorporated in these material.

19. List the factors that should be considered in choosing clones from the recommended list for your estate.

It is difficult to produce an ideal rubber clone possessing all the favorable characters. Therefore what can be done is to select clones to suit the following conditions.

- Elevation,
- Rainfall,
- Current clonal composition.

20. Briefly discuss the objectives in the Rubber breeding and selection programme.

To produce clones with increased productivity which have other desirable secondary characters such as disease resistance, good latex properties and high timber volume etc.

21. When was budgrafting for rubber invented?

In 1917 by Van Helten, a dutch horticulturist in Java.

22. How should the vigorous seedlings be selected?

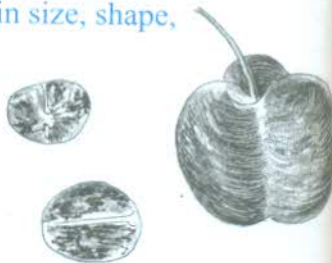
After sowing the seeds on a germination bed, harvesting only early germinators (less than 50% of the seeds sown).

23. Are the rubber seeds of different clones different morphologically?

Rubber seeds of different clones differ in size, shape, weight and colour.

24. What is the viable period of rubber seeds?

Up to 14-21 days from seed fall.



25. How is a germination bed made for rubber seeds?

It is about 5 cm thick and 1m wide layer of pure river sand.
About 1,000 seeds can be sown in 1 m² of germination bed.

26. What are the important conditions in a germination bed?

Shady place, pure sand, well moist and free from insects and rodents.

27. Why is it important to select rubber seeds by using a germination bed?

It is the only available method to select vigorous growing seedlings. Early germinates give rise to vigorous plants.

28. How long does a seedling take to become buddable?

For seedlings grown in poly bags for young budding, it takes about 3-4 months to bud graft.

29. What is the minimum diameter of a seedling required to be grafted in young budding technique?

6 mm (pencil thickness) measured at 1cm above the base of the plant.

30. What should be the age of bud sticks to be used for young budding?

About 6-8 weeks after pollarding.

31. What is the correct way to remove bud patches?

With the use of a very sharp knife or a NT cutter, the bud should be removed with a piece of wood. Then the piece of wood should be removed without bending the bud patch.

32. What type of polythene should be used for young budding?

Transparent, gauge 150 polythene, 1" width strips cut lengthwise.



33. How long should the polythene wrapping be kept for the grafted bud to heal?

About 3 weeks.

34. What criterion can be used to determine the graft success?

If the colour of the bud remains green the graft is a success.

35. What is the procedure to prune the stock plant after bud grafting?

Three weeks after grafting, the polythene is removed and the grafted bud is examined after another 10 days. If the bud patch is live stock plant can be pruned.

36. What is the correct method of pruning the stock plant?

Stock plant is pruned 6" above the upper end of the grafted bud to an angle of 45° sloping to the opposite side of bud patch.



37. Can the failures of the first graft be grafted again on the reverse side?

Yes, while making sure that the plant does not get ring barked.

38. What is the ideal weather condition for bud grafting?

When it is not too dry or wet. The best time during the day is morning and after noon, avoiding hot noon hours.

39. What is the reason to limit the life span of budwood nursery plants to 10 years?

The plants in the budwood nursery gradually gain mature characteristic and therefore plants more than 10 years of age provide inferior quality bud patches.

40. Why is it important to pollard budwood nurseries every year?

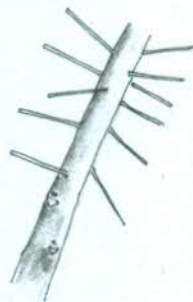
The trees reverse the aging process every time they are pollarded close to the base. Therefore, in order to retain the juvenile characteristics the trees are pollarded close to the base every year.

41. What can be done to increase the number of bud patches in a bud stick?

By cutting leaf blades of a few lower leaves of the stick about 2-3 weeks prior to harvesting the buds.

42. Can budwood be transported?

Green bud sticks cannot be transported successfully.



43. How many buds can be harvested from one budwood plant?

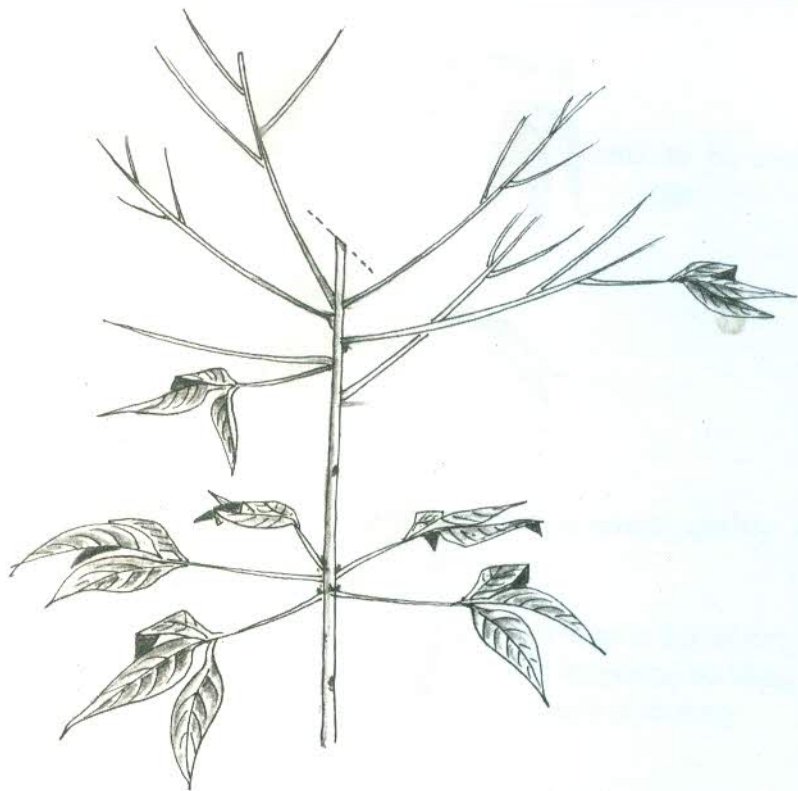
The number of buds that can be harvested depends on the age and the number of bud sticks in the plants. Average figure is 50 buds per plant.

In a yard of brown budwood, about 10-20 buds are available depending on the clone. In green bud sticks of about 6-8 weeks age about 3-4 scale buds are present and 3-4 auxillary buds can also be made available by cutting leaves about 3/2 weeks in advance.

44. Should a budwood nursery be fertilized?

Yes,

The fertilizer mixture and method of application is same as for field plants. Quantity per plant is also similar for 1 and 2 year old plants. But from the 3rd year, only the quantity recommended for 2year old field plants should be applied. Application time should be soon after pollarding the tree.





45. What are the reasons for young budding plants to be superior to bare root budded stumps?

1. Undisturbed root system
2. Production time is 8 months
3. Relatively low cost
4. Worker friendly
5. High establishment rate
6. Uniform growth

46. What are the general characteristics of a good quality budded plant?

Age of the plant should be less than a year at 2-3 whorl stage and should have been produced by young budding technique. The stem should grow straight with long internodes.

47. Is there any alternative method for conventional bud grafting for propagation of *Hevea*?

No. Although tissue culture techniques, rooted cuttings and layering are alternative methods for conventional propagation for many species, these methods cannot be used for mass propagation of clonal *Hevea*.

48. What are the main planting seasons for rubber in Sri Lanka?

South West and North East in the wet zone. North East in the intermediate zone.

49. What is the planting density for rubber?

515-520 trees per hectare.

50. What are the spacing systems recommended to plant rubber?

Depending on the terrain and also whether intercrops are planted, one of the following systems can be adopted.

4.3 m x 4.5 m

3.5 m x 5.5 m

2.5 m x 7.75 m

2.4m x 12m

3x3x18m (double row system) } (for intercropping)

51. What is "Deep Planting"?

When the bud grafted union is placed about 10-15 cm below the ground level at planting, it is called "Deep Planting".



52. What is the main reason for yield variation among the trees of a given clone?

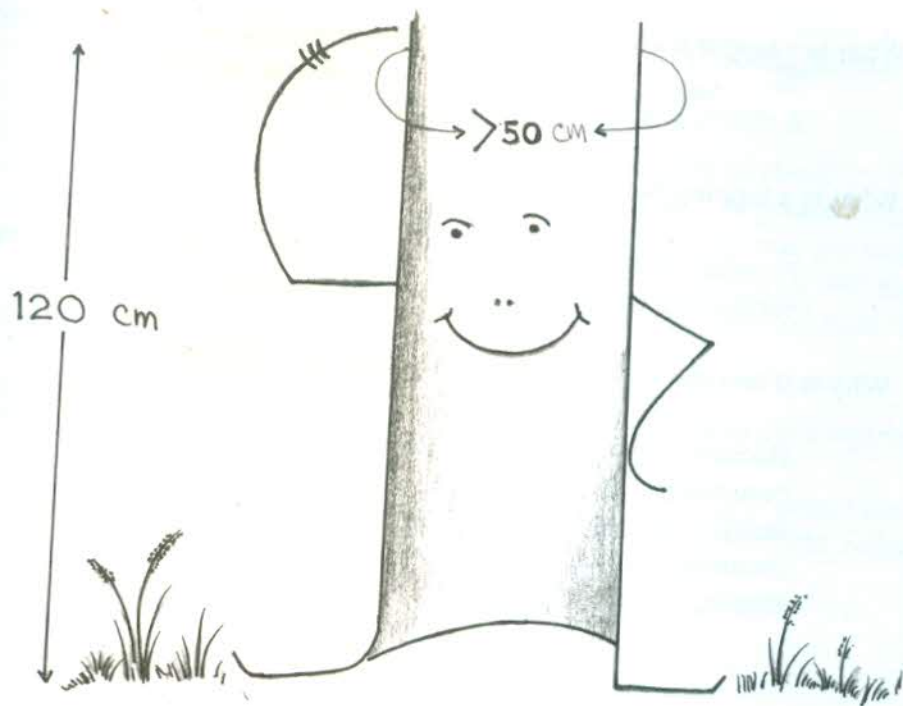
Clonal trees are propagated by bud grafting which is only a partial vegetative propagation method.

53. What would be the growth rate of rubber trees and the immature period of a clearing?

Annual girth increment of 10 cm at a height of 120 cm from the union and therefore the immature period is about 5 years.

54. How do you identify a tappable tree?

When the girth of the tree at 120 cm from the highest point of the stock-scion union is 50 cm or more, such a tree is considered as a tappable tree.



55. What is a tappable clearing?

A clearing with over 60% of tappable trees.

56. What is a tapping block?

Number of trees allocated to a harvester per day. The number varies with terrain of land and tapping intensity.

57. Why is it recommended to commence tapping at a height of 120 cm?

Because it will provide adequate time for bark renewal after completion of virgin bark. Also, considering the average height of tappers, 120 cm is a convenient height for commencing tapping as well as to maintain good quality tapping.

58. Why is the tapping angle recommended to be 30° to the horizontal and tapping direction from high left to low right?

The latex vessels are inclined at an angle of about 2° – 7° to the vertical in an anti-clockwise direction. A greater number of latex vessels are therefore cut open when cuts are made to a slope from high left to low right. The angle of 30° from the horizontal helps smooth and continuous flow of latex without spillage.

59. What are the reasons for shaving 0.125 cm of bark at each tapping?

To minimize bark consumption and to open latex vessels by removing the latex plug. Thicker shavings would reduce the economic life span of the rubber tree.

60. Why is it necessary to tap each base panel for 6 years?

At least 12 years should be given for bark renewal to achieve the potential yield from the renewed barks.

61. Why is S/2 d2 tapping system is recommended for normal tapping?

Tapping half spiral of the tree in alternate days ensures minimum disturbances to the physiological functions of the tree in most of rubber clones.

62. Why should tapping be commenced early in the morning?

The turgor pressure in the latex vessels is highest in the morning, hence the latex flow rate is high. Therefore tapping should be done early in the morning to obtain high yields.

63. Why should the depth of tapping be up to 1 mm from the cambium?

The majority of active latex vessels are concentrated in tissues closer to the vascular cambium. In order to obtain maximum yield, tapping should be undertaken very close to the cambium but without injuring the cambium cells.

64. Why is the maximum recovery tapping days/month restricted for six?

Both the tapping blocks of a harvester are tapped during recovery tapping. This is similar to daily tapping which results in stress that could lead to Tapping Panel Dryness.

Recovery tapping leads to high frequency tapping than that of the system used. To prevent adverse effect of this to the rubber tree recovery tapping is restricted to six per month



65. Why does pre-coagulation take place in unclean and wet collecting cups?

Unclean and wet conditions help the bacteria to grow, and this process release acids which cause pre-coagulation.

66. What are the reasons for recommending a 45° angle for an upper cut?

The tapping cut of upper panels face downwards and hence a 45° angle is recommended in order to make sure that the latex will not drip along the trunk leading to wastage.

67. Give possible reasons for tapping panel dryness.

Over exploitation,
Inadequate fertilizer,
Wounding during tapping,
Tapping on wet panels,
Water logging,
Physiological disorders.

68. Why intensification is introduced to trees towards the end of the tapping cycle?

Tapping is intensified to maintain economical yields and to get as much crop as possible before uprooting. Intensification should be gradual and generally done during the last six years.

69. What is the scheme of Intensification?

19th – 21st year of tapping (first 3 years of intensification)

$S/2 \ d2\downarrow + S/4 \ d2\uparrow$ - (3 years)

22nd and 23rd year of tapping (4th and 5th year of intensification)

$2 \times S/2 \ d2\downarrow\uparrow$ - (2 years)

24th year of tapping (final year of intensification)

$4 \times S/2 \ d2\downarrow\uparrow$ - (1 year)

70. Why is it important for the tapping knife to be very sharp and of high quality steel?

When tapped with blunt knives the latex vessels get crushed preventing smooth flow of latex. Quality steel is essential for maintaining sharpness.

71. Why "CUT" (Controlled Upward Tapping) has been introduced?

1. To prolong the tapping cycle
2. To allow more time for bark renewal in base panels.

72. What is the commonly used yield stimulant in rubber plantations?

Ethephon (2-Chloroethylphosphonic acid).

73. How does Ethephon stimulate the tree for high yields?

Ethephon gives ethylene by reacting with water.

Ethylene converts stored carbohydrate (starch) into sugar (sucrose) the precursor of isoprene molecule which enhances rubber (polyisoprene) production.

This increases turgor pressure within latex vessels.

Also, ethylene delays plugging of vessels.

74. What is the stimulation system recommended for "CUT" tapping system?

Monthly application of 5% Ethephon.

75. Why has the S/2 d3 tapping system with stimulation been introduced?

To overcome the shortage of latex harvesters while minimizing the bark consumption and cost of production.

76. What is the reason for applying 2.5% Ethephon in the virgin bark with d3 tapping?

2.5% Ethephon is recommended to obtain potential yields without over stimulating of the tree. .

77. What is the stimulation frequency for S/2 d3 tapping system?

2.5 cm band of stimulant just above the entire length of cut applied 4/5 times per year.

78. What are the precautions to be taken in a new planting to minimize the incidence of tapping panel dryness?

- a. Avoid planting in shallow and water logged areas.
- b. Use high quality planting material.
- c. Adopt recommended agro-management practices.
- d. Use recommended tapping systems.

79. What is the recommended tapping method for TPD affected trees?

Rest for about 6 months and re open the same cut. If there is no yield in that panel, S/4 upward cut should be introduced in the upper panel in the opposite side of the dry panel. These trees should neither be stimulated or double tapped.

80. What is the main objective of using rain guards?

To minimize the crop loss due to rain interference

81. What are the other advantages in fixing rain guards?

The recommended tapping frequency can be maintained without adopting double tapping. Further, the income levels of rubber growers and latex harvesters are increased. Stimulation can be undertaken efficiently.



82. What is the effective life span of a rain guard?

One year.

83. What is meant by the rubber based intercropping systems?

Growing of other crops with rubber.

84. How can an income be generated during the immature phase of rubber?

By introducing a suitable intercrop.

85. What is the recommended planting distance for introducing intercrops during immature phase of rubber?

Within row spacing 2.5 m and 7.75 m in between rows.

86. What are the recommended long term intercrops that can be grown without compromising the rubber density?

Coffee and Cocoa

87. What are the recommended long term intercrops that can be grown with reduced density of rubber?

Tea, Cinnamon and Pepper .

88. Why is it important that Cardamom, Vanilla and Rattan should be introduced during the mature phase of rubber?

These crops need some shade for establishment and growth.

89. What should be the minimum distance between a rubber tree and the intercrop for optimum growth of rubber trees?

At least 8' (2.5 m) from rubber tree to the intercrop.

90. What is the fertilizer recommendation for rubber based farming systems?

The fertilizer recommendations for rubber and intercrops (component crops) need to be adopted.

91. Can timber crops like Mahogani, Alstonia and Jak be grown in rubber lands?

These timber species can be planted along the boundary leaving a 3m gap to rubber trees. A 4.5m distance should be maintained between timber trees.

92. What criteria should be taken in to consideration when selecting an intercrop for rubber?

An intercrop which grows best in the area with socio-economic compatibility.

93. What are the advantages of planting rubber at a 2.5 m x 7.75 m distance?

- Intercropping can be practiced.
- Easy for soil conservation practices to be adopted.
- Less walking distance for latex harvesters.

94. What is the suitable spacing for planting rubber in rubber/tea intercropping system for a land less than 1.5 ha?

2.4 m x 12 m

95. What is the suitable spacing for planting rubber in rubber/tea intercropping system for a land greater than 1.5 ha?

(3 m x 3 m) x 18 m

96. Name a suitable floriculture system that could be established with mature rubber?

Anthurium

97. Name a suitable animal integration at any stage of rubber cultivation?

Poultry

98. What is the average amount of carbon fixed in a rubber tree (in biomass) at the end of the 30 year economical life span?

ca. 250 Kg

99. Is the application of Candarson on tapping panels after wintering necessary?

Not at all. Candarson is not a fungicide. It is only a wound dressing. Fungicide application on tapping panels should be done during monsoon season for Phytophthora bark rot. Brunolinum / Ridomil are fungicides and can be used for this purpose. Candarson can be used in physical injuries as a dressing.

100. What are the important factors you should consider when applying fungicides to a rubber nursery ?

- Between 6.30 to 10.30 am.
- When there is no wind.
- When there is no rain.
- When there is no direct sunlight.
- With safety wearing.
- Food/beverages should not be taken while spraying.

101. What are the possible reasons for the increase in cockchafer grub infestation on rubber plantations ?

1. Poor planning of new plantings.
2. Improper removal of decaying branches, logs and root debris.
3. Addition of partially decomposed, organic matter in to planting holes.

102. What are the possible factors causing buckling and yellowing of rubber leaves ?

1. White root disease.
2. Water logging / poor drainage.
3. Ring bark of stem due to mechanical damage.
4. Ring bark of stem due to rodent attack.
5. Cockchafer grub attack.
6. Planting in rocky lands.

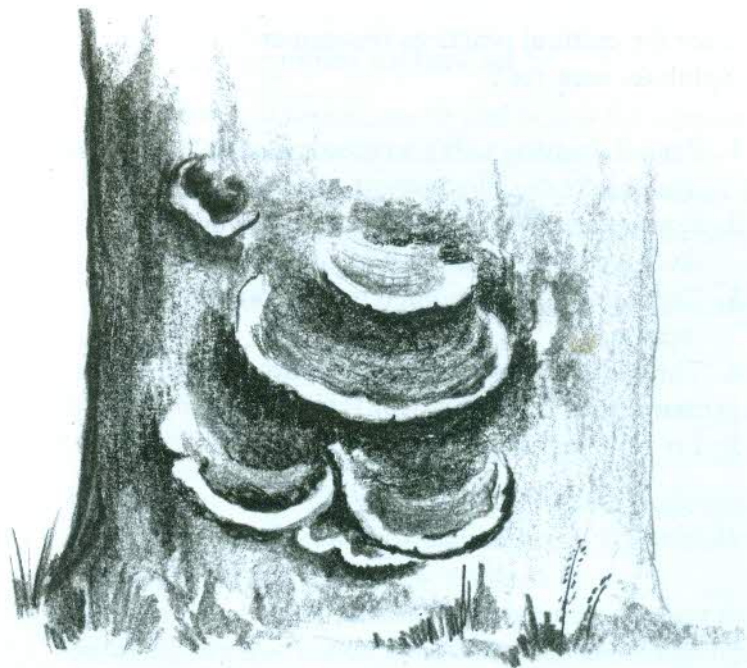
103. What is the recommended fungicide and its concentration to control the patch canker disease (bark cracking disorder) ?

mancozeb (Dithane M 45)
5 g in 1 litre of water

104. How to protect the tapping panel during the rainy season against bark rot?

Virgin panels (Bo-1 and Bo-2 panels) should be protected from infection by an application of a fungicide. Application of Brunolinum planetarium (15 parts of Brunolinum with 85 parts of water) or Ridomil (5 grams in 1 litre of water) should be done on wet days from May to September, on the tapped panels after collection of latex.





105. What are the cultural practices recommended for the management of Phytophthora bark rot ?

1. Pannel dressing using a recommended fungicide during wet weather in the Phytophthora season.
2. Commencement of tapping in virgin bark should be avoided during the period.
3. Trees should be groomed just before the rainy season.
4. Thick weed growth and covers around the plants should be removed.
5. Fix rain guards properly.

106. What is the curative treatment for bark rot ?

- All the diseased tissues above and below the tapping cut should be removed well into the healthy tissues.
- The resultant wounds having smooth sloping edges should be treated with one of the fungicides, Brunolinum Plantarium 15% or Ridomil (5g per litre).
- Exposed wood should be treated with tar based chemicals to prevent borer infestation.

107. What are the cultural practices recommended for the management of nursery diseases ?

- Use of river sand instead of top soil with organic matter for the establishment of seed germination beds. It prevents the hypocotyl rot in germinating seeds.
- Soil to fill polybags should be without root debris and decaying organic matter. It protects the seedlings from white root disease and Geotrichum.

- Adopt recommended distances in polybag nurseries. It reduces the incidence of diseases caused by *Oidium*, *Phytophthora*, *Corynespora* and *Colletotrichum*.
- Regular weeding of nurseries avoids die-back of plants caused by target leaf spot disease.
- Timely watering during dry weather prevents foot canker and sudden wilt.
- Selection of proper sites for the establishment of nurseries (e.g. site not adjoining to mature plantations) to prevent *Oidium*, *Phytophthora*, *Corynespora* and *Colletotrichum* attacks.

108. What are the reasons for dripping latex continuously from the tapping cut and forming latex pads inside the bark around the tapping cut?

This condition can be caused by *Phytophthora* infections during the wet season. As a remedy, the affected trees should not be tapped and a suitable fungicide should be applied on affected sites. In addition, latex pads formed inside the bark should be removed along with the affected bark tissues. Then a suitable fungicide should be applied on

the bark. Finally, the exposed wood should be protected by applying a wound dressing.

109. How to control mites in a young rubber clearing or in a nursery ?

Mites are naturally controlled by predators such as lady bird beetles and spiders. However, during a severe infestation sulphur dusting or spraying of soluble sulphur can be done.

110. What are management strategies in controlling cockchafer grubs in rubber clearings ?

- (i) Practices such as adding organic matter into the planting holes should be avoided and plantation should be kept clean to eliminate breeding grounds of beetles.
- (ii) Chemicals could be used to treat affected trees as an emergence measure. 'Chlorpyrifos' was found to be the best insecticide. If the problem persists over a long period steps should be taken to fix

light traps in the affected areas to attract and destroy the adult beetles.

111. What is the best time to apply fertilizer for mature rubber?

Within one month after refoliation when the soil is moist.

112. Is there a possibility to enhance growth of under girth plants in a clearing by adding more fertilizer?

Plants are under girth due to several factors. It is advisable to identify the cause and adopt appropriate remedial measures.

113. In the absence of IRP in the market, what is the substitute that can be used.

High grade Eppawela Rock Phosphate (HERP)

114. How do we make R/U/12:14:14 mixture?

To make 100 kg of this formulation mix thoroughly 26 kg of Urea, 24 kg of Muriate of Potash and 50 kg of Rock phosphate

115. What is the best method for fertilizer application?

Fertilizer should be applied at 3-4 points in an area cleared of weeds around the tree base within a radius of 1-4 feet (depending on the age of the plant). Fertilizer should be forked into the top 6" – 9" of soil and covered.

116. Can kieserite be mixed with R/U/ 12:14:14?

Yes. But this mixture cannot be stored.

117. Is Dolomite recommended for mature rubber?

No. kieserite should be used instead.

118. Is fertilizer application necessary for mature rubber?

Yes. Fertilizer should be applied during the first 18 years of tapping. During this period application of N and K fertilizers are essential.

119. Can granule fertilizers be applied to young budding nurseries?

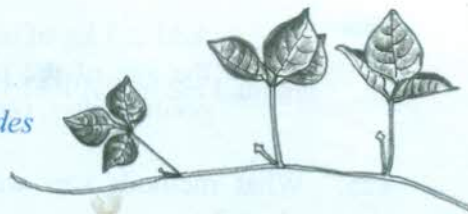
No, only the recommended completely soluble fertilizer mixtures should be used.

120. What is the best cover crop for rubber . How do we propagate it?

Mucuna bracteata, By rooted cuttings.

121. What are the popular cover crops for rubber?

- * *Mucuna bracteata*
- * *Pueraria phaseoloides*
- * *Desmodium ovalifolium*
- * *Calopogonium mucunoides*
- * *Centrosema pubescens*
- * *Mimosa scandens*



122. How do you control soil erosion in a sloping land ?

By constructing stone terraces, drains and establishing a ground cover crop.

123. Is there a substitute for di-ammonium phosphate used in the young budding fertilizer mixture?

Not yet.

124. What are the things we can do to improve and maintain fertility in the soil?

Add 2-3 kg of organic manure to planting holes. Depending on the age of the plant apply 2-5 kg of straw, green manure, poultry litter, cow dung or compost.

125. What methods can we adopt to control weeds around the rubber plants?

1. Mulching
2. Application of "power mat"
3. Application of a cocktail of round-up and diuron
4. Manual weeding

126. Annually in how many applications do we have to apply the recommended quantity of Dolomite during the immature period.?

In one application.

127. What is DPNR?

Deproteinised natural rubber.

128. What is used in commercial production of DPNR in Sri Lanka?

Papain.

129. How do we measure percentage DRC of latex in the field?

Using the metrolac which is a special hydrometer.

130. Name the valuable sugar-alcohol present in latex?

Quebrachitol.

Resource Persons

Genetics and Plant Breeding Department

K K Liyanage - BSc Agric (SL) - *Assistant Geneticist and Plant Breeder*

K B A Karunasekera - *Development Officer*

K W Rupatunga - *Experimental Officer*

I D M J Sarath Kumara - *Experimental Officer*

L S Kariyawasam - *Experimental Officer*

T M S K Gunasekera - *Experimental Officer*

H P Peiris, - Dip. Agric (Kundasale) - *Experimental Officer*

Mrs A K Gamage - BSc (SL) - *Experimental Officer*

Plant Science Department

P Seneviratne - BSc (SL), PhD (Bath) - *Head of Department*

A M W K Senevirathna - BSc (SL), MSc (SL), PhD (Wales) - *Botanist*

N M C Nayanakantha - BSc (SL), MSc (India) - *Botanist*

Mrs D S A Nakandala - BSc Agric (SL) - *Asst. Botanist*

K A G B Amaratunga - *Asst. Botanist*

T U K Silva - BSc Agric (SL) - *Asst. Botanist*

R P Karunasena - *Experimental Officer*

Mrs G A S Wijesekera - *Experimental Officer*
Mrs R K Samarasekera - *Experimental Officer*
M K P Perera - BSc (SL) - *Experimental Officer*
W D M N de Alwis - BSc (SL) - *Experimental Officer*
D L N de Zoysa - *Experimental Officer*
P D Pathirana - BSc (SL) - *Experimental Officer*
P K W Karunathilake - Dip. Agric (Ratnapura) - *Experimental Officer*

Plant Pathology and Microbiology Department

Miss W P K Silva - BSc (SL), MSc (SL), MPhil (Aust.), PhD (SL) - *Head of Department*
Mrs T H P S Fernando - BSc (SL), MPhil (SL) - *Assistant Plant Pathologist*
E B Fernando - *Experimental Officer*
Mrs B I Tennakoon - Dip. Agric (Kundasale) - *Experimental Officer*
Mrs E A D D Siriwardene - BSc (SL) - *Experimental Officer*
S C P Wijayarathne - NDT Agric (Hardy) - *Experimental Officer*
Mrs N Jayawardene - Dip. Agric. (Bibile)
S R D P C Peiris - BSc (SL) - *Experimental Officer*
E A D N Nishantha - Dip. Agric. (Ratnapura) - *Experimental Officer*

Soils and Plant Nutrition Department

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R S Dharmakeerthi, BSc Agric (SL), MSc (SL), PhD (Canada) - *Soils Chemist (Principal Research Officer)*

Mrs R P Hettiarachchi - BSc (SL), MPhil (SL) - *Assistant Soils Chemist*

H D S P Perera - BSc (SL), MSc (SL) - *Experimental Officer*

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P Karunadasa - BSc (SL), MSc (SL), M I Biol. (SL) - *Experimental Officer*

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Biochemistry and Physiology Department

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D Ramawickrema - *Experimental Officer*

P D J Rodrigo - *Experimental Officer*

Adaptive Research Unit

S M M Iqbal, BSc Agric. (SL), MPhil (SL), PhD (Essex) - *Agronomist*

W A D D S Wettasinghe - *Research Assistant (Adaptive Research)*

Mrs E S Munasinghe, BSc Agric (SL) - *Research Assistant*

Mrs B M D C Balasooriya, BSc Agric (SL) - *Research Assistant*



Rubber Research Institute of Sri Lanka
Dartonfield
Agalawatte

Tel:- 034-2247426
2247383
2248459

Fax:- 034-2247427
e-mail:- dirrri@slt.net.lk

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