COCONUT – FAQ's

SEASONS

Which season is suitable for coconut planting in Tamil Nadu? June –July & December - January

2. Which season is suitable for coconut planting in Karnataka? May – June

3. Which season is suitable for coconut planting in Kerala?

Main Season – May Under irrigated Condition -April Low lying area – September

4. Why Yield of coconut is is usually better in summer than during rainy seasons?

Unlike in the annual crops the primordial initiation of the female flowers of coconut takes place 6-7 months before opening the spathe. Thus the nut that is harvested during summer was the result of primordial initiation of the female flowers which occurred during the favorable rainy season, while those nuts produced during rainy season was initiated during the summer months. Hence usually summer harvest is better

CLIMATE

5. What is the ideal temperature for coconut planting?

A mean annual temperature of 27^{0} C is best for vigorous growth and good yield. The yield reduces when mean temperature falls below 21^{0} C. High temperature may cause the developing inflorescences to dry up, and limit production during those months in the year.

6. What is the requirement of rainfall for coconut planting?

A total of 1000 mm is sufficient, if it is evenly distributed throughout the year. However, rainfall upto 3000 mm is also ideal for coconut cultivation if the distribution varies to certain extent and drainage of the soil is good. (Kerala: A well distributed rainfall of 1300 - 2300 mm per annum is preferred). Even in dry interior area with a low annual rainfall of 500 to 800 mm, it is possible to grow coconut where sub-soil moisture is adequate at the depression of rolling lands and near valleys or adjacent to tanks.

7.

VARIETIES/ HYBRIDS

8. What are the characteristics of dwarf variety?

- The dwarf coconut is small in stature (5-7 m) and commences bearing earlier than the tall variety
- Dwarf coconut palms flower as early as the third year after planting and come to regular bearing in the ninth year.
- The average life span is 40-50 years.
- Dwarf or short variety which producing green, orange and yellow nuts.
- Susceptible to drought.
- Nuts are small in size and ovoid or round in shape
- Nut weighs about 3 oz (85 gm) with 65 per cent oil content

9. What are the characteristics of Hybrid?

- Hybrids are the intervarietal crosses between the two morphological forms of coconut.
- They exhibit earliness in flowering, increased nut yield, higher copra production and give better quality copra and oil as compared to the parents.
- Hybrids are produced in two ways, with tall as female parent and dwarf as male parent (Tall x Dwarf) or dwarf as female parent and tall as male parent (Dwarf x Tall).
- Besides intervarietal hybrids like Tall x Tall and Dwarf x Dwarf are also produced.

10. What are all the tall varieties suitable for Tamil Nadu?

- 1. West Coast Tall
- 2. Chandrakalpa or Lakshadweep ordinary (LCT)
- **3.** VPM 3 (Andaman Ordinary)
- 4. East coast tall
- 5. Aliyar Nagar 1
- 6. Kera Chandra (Philippines Ordinary)

11. What are the tall varieties suitable for Kerala?

- 1. West coast tall
- 2. Chandrakalpa or Lakshadweep ordinary (LCT)
- 3. Philippines Ordinary (Kerachandra)
- **4.** VPM 3 (Andaman Ordinary)

5. Kera Sagara (Seychelles)

12. What are the tall varieties suitable for Karnataka?

- 1. West Coast Tall
- 2. Tiptur Tall (TPT)
- 3. Chandrakalpa or Lakshadweep ordinary (LCT)
- **4.** VPM 3 (Andaman Ordinary)
- 5. Kera Chandra (Philippines Ordinary)

13. Which dwarf varieties are suitable for Tamil Nadu?

- **1.** Chowghat Orange Dwarf (COD)
- 2. Chowghat Green Dwarf (CGD)

14. Which dwarf varieties are suitable for Kerala?

- **1.** Chowghat Orange Dwarf (COD)
- **2.** Chowghat Green Dwarf (CGD)

15. Which dwarf varieties are suitable for Karnataka?

1. Chowghat Orange Dwarf (COD)

16. Which hybrid varieties are suitable for Tamil Nadu?

- **1.** Kerasankara (WCT x COD)
- 2. Chandrasankara (COD x WCT)
- **3.** Kerasoubhagya (WCT x SSAT)
- 4. VHC 1(ECT x MGD)
- **5.** VHC 2(ECT x MYD)
- **6.** VHC 3(ECT x MOD)

17. Which hybrid varieties are suitable for Kerala?

- **1.** Kerasankara (WCT x COD)
- 2. Chandrasankara (COD x WCT)
- **3.** Chandralaksha (LCT x COD)
- **4.** Keraganga (WCT x GBGD)
- 5. Lakshaganga (LCT x GBGD)
- 6. Anandaganga (ADOT x GBGD)
- 7. Kerasree (WCT x MYD)
- 8. Kerasoubhagya (WCT x SSAT)

18. Which hybrid varieties are suitable for Karnataka?

- **1.** Kerasankara (WCT x COD)
- **2.** Chandrasankara (COD x WCT)
- **3.** Chandralaksha (LCT x COD)
- **4.** Kerasoubhagya (WCT x SSAT)

19. What are characteristics or features for west coast tall variety?

- Other Name: Ordinary or Common Tall Variety
- Soil: WCT palm grows in all type of soil, especially grow well in littoral sand as well as in the interior and is somewhat tolerant to moisture stress in the soil
- Time take for bearing: 6 to 7 years
- Average Yield: 80 nuts / palm / year
- Copra content: 176 gram/ nut, the range between 135 and 200 gram
- Oil content: 68 per cent
- Special Features:
 - It is recommended for large scale cultivation in coastal regions of Tamil Nadu, Kerala, Karnataka, Gujarat, Bihar, Madhya Pradesh, Lakshadweep, Orissa and Tripura.
 - The tree also yields, on tapping, good quantity and quality of coconut juice or toddy which can be fermented or converted into jaggery or sugar.
 - ✤ It can prefer for both edible purpose and soap manufacture.

20. What are the characteristics or features for east coast tall variety?

- Soil: Well drained deep sandy loam, alluvial and red loamy soils are ideal
- Time take for bearing: 6 to 8 years
- Average Yield: 70 nuts / palm / year
- Copra content: 125 gram / nut, the range between 100 and 140 gram
- Oil Content: 64 per cent
- Special Features:
 - It is recommended for large scale cultivation in coastal regions of Tamil Nadu, Andhra Pradesh, Bihar, Pondicherry, Orissa, Madhya Pradesh, Andamans and West Bengal.
 - The nuts are smaller than West Coast Tall

21. Specify the characteristics of Chandrakalpa or Lakshadweep ordinary (LCD) tall variety.

- Soil: The palm grows in all types of soil and it can withstand moisture stress
- Time take for bearing: 5 to 6 years
- Average Yield: 100 nuts / palm / year
- Copra content: 176 gram / nuts
- Oil content: 72 per cent
- Special Features:
 - This cultivar was released by CPCRI, Kasaragod during 1985 under the name 'Chandrakalpa' for large scale cultivation in the state of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra.

22. Mention the characteristics of Philippines ordinary or Kerachandra tall variety.

- Soil: The palm grows in all types of soil.
- Time take for bearing: 5 years
- Average Yield: 110 nuts / palm / year
- Copra Content: 198 gram / nut
- Oil Content: 66 per cent
- Special Features:
 - This cultivar was released by CPCRI as a 'National Variety' during 1995 for commercial cultivation in all states.

23. What are the characteristics for VPM 3 tall variety?

- Time take for bearing: 5 to 6 years
- Average Yield: 92 nuts / palm / year
- Copra content: 176 gram / nut
- Oil content: 70 per cent
- Special Features:
 - Drought tolerant suitable for Rainfed and Irrigated condition
 - Selection from Andaman Ordinary
 - High copra content

This cultivar was released by Coconut Research Station, Veppankulam, Tamil Nadu, during 1994 for commercial cultivation in the states of Tamil Nadu, Kerala, Andamans, Andhra Pradesh, Bihar, Assam, Orissa, Madhya Pradesh, Pondicherry, Tripura and West Bengal

24. What are the characteristics for Aliyar Nagar 1 tall variety?

- Time take for bearing: 5 years
- Average Yield: 126 nuts / palm / year
- Copra content: 131 gram / nut
- Oil content: 66.5 per cent
- Special Features:
 - Drought tolerant suitable for Rainfed and Irrigated condition
 - Selection from Arasampatti Tall (Dharmapuri Dist)
 - One year earlier flowering compared to WCT, ECT and VPM 3
 - ✤ Moderately tolerant to major coconut pests.
 - This cultivar released by Coconut Research Station, Aliyar nagar, Tamil Nadu during 2002 for commercial cultivation in the states of Tamil Nadu and Pudhucherry.

25. Mention characteristics for Tiptur tall variety?

- Time take for bearing: 6 to 7 years
- Average Yield: 86 nuts / palm / year
- Copra content: 178 gram / nut
- Oil content: 68 per cent
- Special Features:

This is popular cultivar of Karnataka State.

26. Mention characteristics for kera sagara or Seychelles tall variety?

- Time take for bearing: 6 to 7 years
- Average Yield: 99 nuts / palm / year
- Copra content: 203 gram / nut
- Oil content: 68 per cent
- Special Features:

This cultivar released by Kerala Agricultural University in 1995. This is popular cultivar of Kerala State.

27. Which Tall variety produce high yield?

In Tall variety, Aliyar Nagar 1 produce 126 nuts/ palm / year when compare to other variety. As fallows Philippines ordinary and Chandrakalpa average yield is 110 nuts/ palm/ year and 100 nuts/ palm / year.

28. Which Tall variety has high copra content in nut?

In tall variety, West coast tall, Philippines ordinary and Kera sagara have a copra content nearly 200 gram/nuts.

29. Which type of tall varieties has high oil content?

VPM - 3 oil content - 70 per cent and Chandrakalpa or LCT oil content - 72 per cent

30. What are the tall varieties released in Tamil Nadu?

Aliyar Nagar 1. This cultivar released by Coconut Research Station, Aliyar nagar, Tamil Nadu during 2002 for commercial cultivation in the states of Tamil Nadu and Pudhucherry.

VPM – 3 - This cultivar was released by Coconut Research Station, Veppankulam, Tamil Nadu, during 1994 for commercial cultivation in the states of Tamil Nadu, Kerala, Andamans, Andhra Pradesh, Bihar, Assam, Orissa, Madhya Pradesh, Pondicherry, Tripura and West Bengal

31. What are the tall varieties released in Kerala?

- Chandrakalpa or LCT This cultivar was released by CPCRI, Kasaragod during 1985 under the name 'Chandrakalpa' for large scale cultivation in the state of Kerala, Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra.
- Philippines ordinary (Kerachandra) This cultivar was released by CPCRI as a 'National Variety' during 1995 for commercial cultivation in all states.
- **3.** Kera sagara This cultivar released by Kerala Agricultural University in 1995. This is popular cultivar of Kerala State.

32. What are the characteristics for Chowghat orange dwarf variety?

- Time take for bearing: 3 to 4 years
- Average Yield: 65 nuts / palm / year
- Copra content: 150 gram / nut
- Oil content: 66 per cent
- Special Features:

- This cultivar is known as 'Gowrigathram' or 'Chenthangu' and 'Kenthali' in Kerala and Karnataka respectively.
- The palm has a thin stem with closely arranged leaf scars, a small compact crown with characteristic orange colour on leaf petioles, inflorescences and nuts.
- This cultivar was released by CPCRI in 1991 for large scale cultivation in the states of Kerala, Karnataka and Tamil Nadu.
- High wind areas and drought-prone regions should be avoided. If planted in high wind-prone regions, good shelterbelts should be provided to minimise the damage due to winds.

33. What are the characteristics for Chowghat green dwarf variety?

- Time take for bearing: 3 to 4 years
- Average Yield: 66 nuts / palm / year
- Copra content: 60 gram / nut
- Oil content: 66 per cent
- Special Features:
 - The leaf petioles, leaves and nuts are dark green in colour. The nuts have the characteristic 'beak' when fully mature.
 - Root wilt disease tolerant variety

34. What are the characteristics for Kerasankara hybrid variety?

- Selection from: West Coast Tall x Chowghat Orange Dwarf
- Time take for bearing: 4 years
- Average Yield: 108 nuts / palm / year
- Copra content: 187 gram / nut
- Oil content: 68 per cent
- Special Features:
 - This variety released by CPCRI, Kerala in 1991, for large scale cultivation in Kerala, Karnataka and Tamil Nadu.
 - This hybrid palms are precocious and exhibit higher productivity than the parents.

Recommended for general cultivation both under rainfed and irrigated conditions.

35. What are the characteristics for Chandrasankara hybrid variety?

- Selection from: Chowghat Orange Dwarf x West Coast Tall
- Time take for bearing: 3 to 4 years
- Average Yield: 116 nuts / palm / year
- Copra content: 215 gram / nut
- Oil content: 68 per cent
- Special Features:
 - This hybrid released by CPCRI, Kerala in 1991, for large scale cultivation in Kerala, Tamil Nadu and Karnataka.
 - This hybrid can be easily identified in the nursery as the seedlings exhibit vigorous growth with bronze coloured petioles.
 - Chandrasankara are recommended for ideal situations and where good management practices are adopted.
 - Chandrasankara is markedly superior to that of WCT in root (wilt) affected areas, cultivation of Chandrasankara is preferred in such areas

36. What are the characteristics for Chandralaksha hybrid variety?

- Selection from: Lakshadweep Ordinary x Chowghat Orange Dwarf
- Time take for bearing: 4 to 5years
- Average Yield: 109 nuts / palm / year
- Copra content: 195 gram / nut
- Oil content: 69 per cent
- Special Features:
 - This hybrid released by CPCRI, Kerala in 1985, for large scale cultivation in Kerala and Karnataka.
 - This hybrid performs better in moisture stress situation.

37. What are the characteristics for Keraganga hybrid variety?

- Selection from: West Coast Tall x Gangabondam Green Dwarf
- Time take for bearing: 4 to 5years
- Average Yield: 100 nuts / palm / year

- Copra content: 201 gram / nut
- Oil content: 69 per cent
- Special Features:
 - This hybrid released by Kerala Agricultural University in 1988 for commercial cultivation in Kerala.
 - Recommended for general cultivation both under rainfed and irrigated conditions.

38. What are the characteristics for Lakshaganga hybrid variety?

- Selection from: Lakshadweep Ordinary x Gangabondam Green Dwarf
- Time take for bearing: 5 years
- Average Yield: 108 nuts / palm / year
- Copra content: 195 gram / nut
- Oil content: 70 per cent
- Special Features:
 - This hybrid released by Kerala Agricultural University in 1987 for large scale cultivation in Kerala.
 - This is another drought tolerant hybrid and grows well even under rainfed condition.

39. What are the characteristics for Anandaganga hybrid variety?

- Selection from: Andaman Ordinary x Gangabondam Green Dwarf
- Time take for bearing: 5years
- Average Yield: 95 nuts / palm / year
- Copra content: 216 gram / nut
- Oil content: 68 per cent
- Special Features:
 - This hybrid released by Kerala Agricultural University in 1999 for large scale cultivation in Kerala.
 - Recommended for general cultivation both under rainfed and irrigated conditions.

40. What are the characteristics for Kerasree hybrid variety?

- Selection from: West Coast Tall x Malayan Yellow Dwarf
- Time take for bearing: 5years
- Average Yield: 130 nuts / palm / year
- Copra content: 216 gram / nut
- Oil content: 66 per cent
- Special Features:
 - This hybrid released by Kerala Agricultural University in 1992 for cultivation in Kerala state.

41. What are the characteristics for Kerasoubhagya hybrid variety?

- Selection from: West Coast Tall x Strait Settlement Apricot Tall
- Time take for bearing: 5years
- Average Yield: 116 nuts / palm / year
- Copra content: 196 gram / nut
- Oil content: 65 per cent
- Special Features:
 - This hybrid released by Kerala Agricultural University in 1993 for large scale cultivation in Kerala, Karnataka and Tamil Nadu.

42. What are the characteristics for VHC 1 hybrid variety?

- Selection from: East Coast Tall x Malayan Green Dwarf
- Time take for bearing: 4 years
- Average Yield: 98 nuts / palm / year
- Copra content: 135 gram / nut
- Oil content: 70 per cent
- Special Features:
 - This hybrid released by Tamil Nadu Agricultural University in 1982 under the name 'Veppankulam Hybrid Combination – 1' (VHC-1) for general cultivation in Tamil Nadu.
 - This bunches have a tendency for buckling which is to be prevented by providing support.

43. What are the characteristics for VHC 2 hybrid variety?

- Selection from: East Coast Tall x Malayan Yellow Dwarf
- Time take for bearing: 4 years
- Average Yield: 107 nuts / palm / year
- Copra content: 152 gram / nut
- Oil content: 69 per cent
- Special Features:
 - This hybrid released by Tamil Nadu Agricultural University in 1987 under the name 'Veppankulam Hybrid Combination – 2' (VHC-2) for general cultivation in Tamil Nadu.

44. What are the characteristics for VHC 1 hybrid variety?

- Selection from: East Coast Tall x Malayan Orange Dwarf
- Time take for bearing: 4 years
- Average Yield: 127 nuts / palm / year
- Copra content: 162 gram / nut
- Oil content: 70 per cent
- Special Features:
 - This hybrid released by Tamil Nadu Agricultural University in 2000 under the name 'Veppankulam Hybrid Combination – 3' (VHC-3) for general cultivation in Tamil Nadu.
 - Drought tolerant.

45. What are all the hybrids released in TNAU, Tamil Nadu?

Reason Hybrids - VHC₁, VHC₂, VHC₃

46. What are all the hybrids released in Kerala?

- 1. Lakshaganga (Lakshadweep Ordinary x Gangabondam)
- 2. Anandaganga (Andaman Ordinary x Gangabondam)
- 3. Keraganga (West Coast Tall x Gangabondam)
- 4. Kerasankara (West Coast Tall x Chowghat Orange Dwarf)
- 5. Chandrasankara (Chowghat Orange Dwarf x West Coast Tall)
- 6. Kerasree (West Coast Tall x Malayan Yellow Dwarf)
- 7. Kerasoubaghya (WCT x SSA)
- 8. Chowghat Green Dwarf x West Coast Tall

9. Chandralaksha (Lakshadweep Ordinary x Chowghat Orange Dwarf)

Tender nut variety: Chowghat Orange Dwarf

47. Which coconut hybrid is highest in oil content in TamilNadu?

Highest oil content hybrid is $VHC_2(70.2\%)$

48. Name the variety which is suitable for drought in TamilNadu?

- VPM3 and ALR (CN) 1
- It is also suitable for rain fed and irrigated condition

49. Which coconut variety / Hybrids gives highest copra yield in TamilNadu?

VHC3 (copra yield -162 g / nut)

50. Which coconut variety / Hybrids gives highest nut yield in TamilNadu?

VHC3 (Nut yield -156 nuts / palm / year)

51. How long a coconut hybrid takes to bear nuts?

It takes 3 - 4 years.

52. Name the variety / Hybrid, which is suitable for rain fed and irrigated conditions in Kerala?

Hybrids – Anandaganga, Keraganga & Kerasankara

53. Which hybrid is suitable for the areas affected in root wilt, especially in Kerala?

Chandrasankara

54. Name the hybrid, which is suitable for drought prone areas in Kerala?

Chandralaksha, Lakshaganga and Chandrakalpa

55. Which type of variety is most disease resistant?

Tall varieties are suitable than dwarf & hybrids, especially for large areas

56. Which variety is suitable for tender coconut?

Dwarf varieties (Chowghat Orange Dwarf is mostly cultivated in India)

57. Which coconut hybrid gives highest nut yield in Kerala?

Kerasree (WCT * MYD), nut yield – 130 kg / palm / year.

58. Which coconut hybrid is highest copra yield in Kerala?

Kerasree (28 kg / palm /year)

59. Which coconut hybrid in Kerala gives highest oil content?

Lakshaganga (70%)

60. What will be the average yield of coconut hybrids?

100 nuts / palm / year

61. How long a coconut tall variety takes to bear nuts?

8 - 10 years.

62. How long coconut dwarf varieties takes to bear nuts?

Above 6 years.

63. To obtain one tone of copra how many nuts are required?

Above 6,000 nuts are required to get a tone of copra.

64. I plan to start 5 acres of coconut plantations with hybrid varieties. Which hybrid is better? TXD or DXT?

Both the hybrids are progenies of cross between west coast tall and chawacad dwarf. In TXD tall is the mother. While DXT dwarf s the mother palm. Generally, DXT was found to perform better than TXD. But DXT starts bearing only after 4-5 years compared to 3-4 years for TXD. The average yield of DXT is 120-130 nuts per year with 65-68% oil content compared to 100 nuts and 60-65 grams of oil content for DXT. However this may vary depending upon the climatic conditions and locations.

SOILS

65. Which soil is suitable for coconut cultivation?

Red sandy loam, Laterite and Alluvial soils

66. Which soil is not suitable for coconut cultivation?

Imperfectly drained soil, shallow soils with underlying hard rock, low-lying areas, and heavy clay soils are not suitable for coconut cultivation.

NURSERY MANAGEMENT

Mother Palm Selection

67. How to choose the seed garden for mother palm selection?

• Gardens should have palms with a high proportion of heavy bearers but it should be kept in mind that this must not be from very favourable conditions Garden should be free from the incidence of diseases and not prone to severe attacks of pests. • Trees growing closer to households, cattle shed, compost pits and other favorable conditions should be avoided.

68. How to choose the mother palm based on the nuts?

The palm which gives 100 nuts / palm / annum is suitable for mother palm.

69. How old should be the mother palm?

Middle aged mother palm of 25 to 40 years is suitable.

70. Physical characteristics of mother palm.

- Straight trunk
- Spherical or semi spherical crown
- High rate of leaf (more than 30 fully opened leaves)
- High rate spathe production
- High copra outturn

71. What are the characteristics for good regular bearer of mother palm?

It should produce on an average of one leaf and an inflorescence in its axil every month.

72. Which palms should be avoided while collecting seed nuts?

- Alternate bearers
- Long, thin and pendulous inflorescence stalks.
- Small sized or barren nuts.

73. When seed nuts should be harvested?

- Tamil Nadu and Karnataka February to August
- Kerala December to May.

74. What are the characteristic for good seed nuts?

- Medium sized.
- Round or Oblong in shape
- When tapped by finger, it should produce metallic sound
- Fully ripe (12 months old)

75. Can we sow the seed nuts immediately after plucking from the mother palm?

No, the seed nuts should be stored for a minimum period.

Tall and hybrids are to be air cured for one month followed by sand curing for two months. And for dwarf varieties, the air curing should be lesser than one month followed by sand curing for two months.

76. How to store the seed nuts in sand?

Arrange the seed nuts with the stalk-end up over an 8cm layer of sand in a shed and cover with sand to prevent drying of nut water upto 5 layers of nuts can be arranged one over the other. (This can be done in open space with sufficient shade.)

Nursery Preparation

77. Which soil is best for nursery preparation?

- TamilNadu Coarse soil with good drainage.
- Kerala Light texture soil.
- Karnataka coconut tolerate a wide range of soil conditions. It is particularly grown on the coastal belt on all tropical area where light sandy and sandy loam soil exists which is highly permeable and is assured with sub-soil water at a shallow depth, within easy reach to the roots.

78. Selection of nursery area?

Nursery can be raised in the open space with artificial shade or under adult coconut garden.

79. How much space would be taken for planting 1000 nuts in nursery area?

 120 m^2 areas required to sow 1000 nuts in flat or raised beds whereas larger area of 200 m² would be required to maintain 1000 poly bag coconut seedlings.

80. When the seed nuts are sowed in nursery?

Sowing of seed nuts with commencement of the rainy season will reduce the frequency of irrigation required for getting good germination.

Generally seed nuts are harvested during April may and planted in june in the west coast region, whereas sowing is done in October – November in East Coast region.

81. How to prepare the nursery?

- Sunken beds and channels (if, poor drainage use raised beds)
- Beds width 1.5m, and spacing between the beds should be 75 cm.

82. Is any treatment made in nursery bed before sowing nuts?

Yes, the seed beds should be drenched with Chlorpyriphos @0.05% before sowing of seed nuts, in areas having termite problem. To prevent bud rot in seedlings, the nursery can be drenched with 1% Bordeaux mixture, in bud rot endemic areas.

83. What should be the spacing between seed nuts?

- Spacing: 30 * 30 cm
- Depth: 20 25 cm.

84. How to select the seed nuts before planting?

- Select the seed nuts with nut water.
- Discard the seed nuts with rotten kernels.

85. Which season is suitable for coconut nursery planting?

• May – June (after commencement of southwest monsoon)

86. How to plant the seed nuts in the nursery?

It may be planted horizontally or vertically.

87. Why one eye of the coconut is soft compared to the other two?

Usually one eye is soft because it is not lignified like the other two. This is the

germinating eye and is usually located opposite the widest segment of the nut.

88. When is horizontal planting used in nursery?

In delayed planting i.e., when the nut water goes down

89. What is the advantage of vertical planting of seed nuts in the nursery?

- Convenience in transportation.
- Lesser risk of seedling injury.

90. How often should the nursery be irrigated?

Once in two days during summer months.

91. Any protective measures should be taken after sowing of nuts?

The seed beds can be covered with suitable mulch after the cessation of monsoon rain. Coconut leaves, straw or green leaves are used. This is done to conserve moisture and to check weed growth.

Provide protective fencing to the nursery if it is located in open area. Keep the nursery beds free of weeds by periodic weeding. Provide shade to the nursery by raising Sesbania or Leucaena on the sides of beds.

92. Which pest is most often & noticed in the nursery?

Termites (seedling wilt, plastering over the seed nuts)

93. What are all the control measures for termites in nursery?

• Remove the soil upto a depth of 15 cm

• Dust chlordane of 5% can be used

94. How to prevent fungal infection (bud root) in the nursery?

Spray 1% Bordeaux mixture.

95. How to prevent weeds in nursery?

- Hand weeding at 6 months.
- Growing sun hemp 2 times (harvested at flowering stage).

96. How long does the seed nuts take to germinate in the nursery?

It takes 6 - 8 weeks after planting.

97. How to select the seedlings in the nursery?

- Seedlings 9 12 months old.
- Early germinated seedlings (before 5 months)
- 6 to 8 leaves / seedlings
- Collar girth -10 to 12 cm.
- Early splitting of leaves.

98. When the seedlings are ready to harvest?

Seed nuts of tall varieties begin germination within 60-130 days after sowing and seed nuts of dwarf varieties usually germinate 30-95 days after sowing. Generally germination is recorded till the fifth month of sowing and a good seed lot will have 80-90% germination. Seed nuts that do not germinate within 5 months can be removed from the nursery and used for production of copra.

99. Any other fertilizers applied after sowing of seed nuts in nursery?

Chemical fertilizers need not be applied to the seedlings in the nursery since the seedlings are usually nourished by the endosperm. Moreover application of chemical fertilizers can mask the true genetic potential of seedlings.

100. Why poly bag seedling production adopted? What are special characteristics for poly bag seedling nursery?

Poly bag nursery can be adopted for

- Producing more vigorous seedling with better root system.
- Better establishment and early bearing
- Reduced transplanting shock as no root damage
- easier weeding, watering and elimination of unwanted seedlings

101. What is the size for poly bag for adoption of seedlings?

Poly bag size is 60*45 cm for bigger nuts and 45 *45 cm for smaller nuts (500 gauge thickness).

102. When the germinated seedlings are transferred to poly bag?

Inorder to produce poly bag seedlings, the seed nuts are initially sown very closely and allowed to germinate in a pre nursery bed till the sprouts are 8-10 cm long. The germinated seedlings are picked out from the nursery once 80% of the nuts have germinated or 5 months from sowing, whichever is earlier.

103. How the seedlings are planted in poly bag?

The germinated nuts are placed in half filled poly bags with the sprout positioned upwards in the centre of the bag and sufficient potting mixture is added to fill two-third portion and the sides slightly pressed to keep the nut firm.

104. What mixture should be used in poly bag before planting?

- Poly bags of the first size require 13-16 kg of top soil to fill two thirds of the bag. The bottom of the bag is provided with 8-10 holes for draining the excess water.
- The commonly used potting media are top soil mixed with sand in 3:1 ratio or 3:1:1 ratio of top soil, sand and FYM/vermicompost. Red earth, sand and FYM/vermicompost in 1:1:1 ratio can also be used.

105. What is the fertilizer recommendation for poly bag nursery?

Fertilizers can also be applied in poly bags@ 20g ammonium sulphate and 25 g Muriate of potash per bag after 2 months of germination and 45g ammonium sulphate and 45 g Muriate of potash per bag after 4 months of germination. Seedlings should be irrigated after fertilization.

106. How to remove the seedlings from the nursery?

Lift the seedlings with spade, digging rod (kadaparai).

107. Should the roots of the seedling be kept as such during planting?

No, the root should be cut back in order to induce fresh roots.

108. Can we store the seedling after removed from nursery?

It is recommended to plant immediately. But in case of delay, it may be kept in shade under a tree. It may be covered with sand and sprinkled with water at regular intervals.

109. What are all the serious pest and diseases in coconut nursery?

Disease: Bud Rot

Pest: Scale insect, Termite, White grab

110. What is the reason for seedling death in nursery?

It may be bud rot or white grab. If the spindle leaf comes out easily by pulling it is death is caused by bud rot.

111. How to treat Bud rot in nursery?

Spray 1 % Bordeaux mixture over the seedlings.

112. How to control White grub in nursery?

Apply Phorate 10G @15g/ seedling.

113. What are all the climatic requirements for coconut cultivation?

- Equatorial climate with high humidity
- Mean annual temperature -27 ^oC with 5 to 7^oC diurnal variation.
- Rainfall 1300 to 2300 mm / Annum
- Tolerate salinity
- Wide range of P^H 5.0 to 8.0

CULTIVATION PRACTICES

Soil:

114. What is the soil condition for coconut cultivation practices?

Red sandy loam, laterite and alluvial soils are suitable. Select sites with deep (not less than 1.5 m depth) well drained soil heavy, imperfectly drained soil is unsuitable. Avoid shallow soils with underlying hard rock, low-lying areas subject to water stagnation and heavy clayey soils. Soil with a minimum depth of 1.2 m and fairly good water holding capacity is preferred for coconut cultivation. However, in lands, reclaimed by heaping alternate layers of sand and clay, coconut thrives well. Proper supply of moisture either through well distributed rainfall or irrigation and sufficient drainage are essential for coconut. Coconut can be grown in soil with pH of 5.2 - 8.6.

Preparation of Land:

115. How to prepare land for coconut cultivation?

The nature of preparation of land before planting depends upon topography of land, soil type and other environmental factors. The area should be cleaned and planting holes marked out at appropriate places. If the land is slopy, soil conservation methods should be adopted. If the groundwater level is high planting may be taken up in the mounds. On slopes and in areas of undulating terrain, prepare the land by contour terracing or bunding. In low-lying areas and rice fields, form mounds to a height of at least 1 m above water level. In reclaimed kayal areas, planting can be done on the field bunds.

116. What are the field layout systems in coconut plantation?

Although several systems of planting are followed, selection of a suitable system depending on soil, climate, plant type etc. Adoption of improper system results in over lapping of plant parts, competition for water, light, nutrient and unequal distribution of water etc., ultimately results I poor performance.

The systems of layout are Square system, Rectangular system, Triangular system, Hedge system and Contour system. These are all systems are followed in Tamil Nadu, Kerala and Karnataka state.

117. What are all the planting methods in various areas?

- Plains pit method
- Slope –Contour terracing or bunding
- Low-lying areas Mounds at a height of 1m above water level.

Spacing:

118. What is the spacing for coconut planting in main field for Tamil Nadu?

Adopt a spacing of 25' x 25' (7.5 x 7.5 m) with 175 plants/ha is ideal for tall varieties and a spacing of 8.5 x 8.5 m is optimum for hybrids. A spacing of 6.5 x 6.5 m is optimum for dwarf variety. For planting in field border as a single row, adopt 20' spacing between plants.

Particulars	Spacing
Tall varieties	7.5 x 7.5 m (25' x 25')
Dwarf varieties	6.5 x 6.5 m (20' x 20')
Hybrids	8.5 x 8.5 m (26' x 26')

119. What is the spacing for coconut planting in main field for Kerala?

Planting system	Spacing	Approximate number of
	T to b	plants/ha
Triangular	7.6 m	198
Square	7.6 to 9 m (7.6x7.6m, 8x8m, 9x9 m)	170-120

Single hedge	5 m in the rows 9 m between the rows or 6.5m in rows - 9m between rows*	220
Double hedge	5 x 5 m in rows 9 m between pairs of rows or 6.5 to 6.5m in rows - 9m between pairs of rows*	280



120. What is the spacing for coconut planting in main field for Karnataka?

No. of Seedlings	Spacing	Plants/ha
Tall varieties (Southern region & Hilly region)	9 x 9 m	125
Tall varieties (Coastal region)	8.2 x 8.2 m	149
Dwarf and Hybrids (Southern dry region & Hilly region)	7.5 x 7.5 m	178
Dwarf and Hybrids (Coastal region)	7 x 7 m	204

Planting:

121. What is the size of the pit for planting for Tamil Nadu?

Tamil Nadu – 3 * 3 * 3 feet (for all soils)

122. What is the size of the pit for planting for Kerala?

- Kerala:
 - 1. Loamy soils with low water table -1 * 1 * 1 m
 - 2. Laterite soils with underlying rock 1.2 * 1.2 * 1.2 m
 - 3. Sandy soil 0.75 * 0.75 * 0.75 m

123. What is the size of the pit for planting for Karnataka?

Karnataka – Pit size - 1 m cube (3.3. ft)

124. How to prepare the pits before coconut planting?

Fill the pits with Kolingi (Tephrosia purpurea) and allow it to decompose for six months.

125. What mixtures should be used in the pits before planting?

- FYM, red earth and sand mixed in equal proportions upto 60cm (2 feet) in the pits.
- Application of neem cake in the pits before planting prevents attack of insects and ants.
- Put 1 to 2 kg of common salt in the pits to control termites and conserve moisture.

126. What can be done to conserve soil moisture in the pits?

Burry two layers of husk with concave surface facing upwards

While planting coconut seedlings, one leaf of Agave sp. is planted in the pit to retain the soil moisture and control termites.

127. What are all the preventive measures that to be taken before and after planting the seedlings?

Apply Carbaryl 10% dust in the pits before planting or on the husk to prevent termite attack.

128. How the young palms protected from environment?

For the first two years from planting, irrigate @ 45 litres of water per seedling, once in 4 days, during dry summer months. Provide adequate shade to the transplanted seedlings. Also provide staking so that winds may not uproot the young seedlings. Provision of proper drainage is also equally important in areas subject to water logging. If planting is taken up in littoral and soil, application of 0.15 m³ of red earth is recommended.

The pits should be cleared of weeds periodically. Soil washed down by the rains and covering the collar of the seedlings should also be removed. The pits should be widened every year before the application of manure. The pits should be gradually filled as the seedlings grow. The palms should be frequently examined for any insect or fungal attack and necessary remedial measures should be taken up promptly.

129. How to irrigate young seedlings?

Irrigate @ 45 litres of water per seedling, once in 4 days for the first two years.

130. In coconut field, what is the interspacing followed for inter cropping cultivation?

Coconut seedlings are planted 7.5 m to 9.0 m apart and hence the wider interspace can offer opportunities for raising other crops, either annuals as intercrop or perennials as mixed crop as a source of additional income to the growers.

131. How to adopt inter crops in coconut field?

While such inter or mixed-cropping system is adopted, about 2 m all round the basin of the palm should be left un-cropped and kept free from weeds for regular manuring and cultural operations to the main crop.

132. What are all the crops that can be grown as inter / mixed crops in coconut fields of TamilNadu?

(i) Annuals: Groundnut, bhendi, turmeric, tapioca, sweet potato, sirukizhangu, elephant foot yam, ginger, pineapple

(ii) Biennials: Banana. Varieties Poovan and Monthan are suitable.

(iii)Perennials: Cocoa*, pepper* (Panniyur 1 or Panniyur 2 or Panniyur 5 or Karimunda), nutmeg* and vanilla*

*Suitable areas in Pollachi tract of western region and Kanyakumari district. For vanilla, use disease free planting material and maintain high vigilance to maintain a disease free crop. In all cases, separate application of adequate fertilizers and manures to the individual crop is essential.

133. What are all the crops can be grown as intercrops / mixed crops in coconut field in Kerala?

The following crops are recommended as intercrops.

- Cereals: Rice, maize
- Legumes and pulses: Groundnut, horse gram, cowpea Tubers: Tapioca, sweet potato, yams, colocasia
- Spices and condiments: Ginger, turmeric, chilly, pepper, nutmeg, cinnamon, clove
- Fruit plants: Banana, pineapple, papaya. (Banana variety Palayankodan is recommended in the reclaimed soils of Kuttanad. Three suckers per clump have to be retained).
- Beverage crop: Cocoa
- Fodder grasses: Hybrid Napier, guinea grass –KAU

134. What are all the crops can be grown as inter crops in coconut field in Karnataka?

The common annual intercrops that could be grown during the pre-bearing or early stage of growth of the palms are: dry land paddy, millets, groundnut, cowpea, chillies, wheat, potato, tuber crops and rhizomatous crops. In older plantations, mostly root and stem tuber crops such as elephant foot yam, cassava, colocasia, greater and lesser yams, sweet potato, ginger and turmeric are grown. Among these elephant foot yam is found to be the best and most profitable among the intercrops followed by ginger, cassava, turmeric, French bean fodder grass (Hybrid Napier, Guinea grass and *Styloesanthes gracilis*), sunflower, cowpea and ragi under rainfed conditions.

135. When can we grow, inter / mixed crops in the coconut filed in Kerala?

Cereals and tapioca are recommended as intercrops in young coconut plantation up to 3-4 years. Since ginger and turmeric are shade tolerant crops with shallow roots, they can be intercropped in coconut garden even in the age group of 15-25 years. It ensures better land utilization, solar energy harvesting, efficient water use, utilization of soil nutrient resources, more returns and an insurance against crop failure. Under conditions of wider spacing i.e. beyond 7.6 m, intercropping is possible irrespective of the age of the palms.

136. When can we grow, inter / mixed crops in the coconut field of Tamil Nadu?

A. Below 7 years of age: Any suitable annual crop for particular soil type and climatic condition may be raised as intercrops upto 5 years after planting depending upon the canopy coverage. Groundnut, sesamum, sunflower, tapioca, turmeric and banana can be grown. Avoid crops like paddy and sugarcane etc.

B. 7 – 20 years of age: Green manure crops and fodder crops (Napier grass and guinea grass) alone can be grown.

C. Above 20 years of age: 20 years of age has to be adjusted based on the sunlight transmission of above 50% inside the canopy

137. When can we grow inter crops in the coconut field of Karnataka?

Intercrops are sown/planted in rainfed coconut garden taking advantage of the summer showers in May or during the onset of monsoon in June. When the intercrops are grown both the main crop and subsidiary intercrops should receive the recommended management practices for obtaining satisfactory yields without affecting the main coconut crop.

138. How the multi-storeyed cropping system helped for coconut cultivation?

The main purpose of multi-storeyed cropping is for greater utilization of the solar energy, soil moisture and nutrient resources from various depths and also air space. The rooting pattern of crop combinations should also be kept in view while selecting the individual species.

139. What are the crops suitable for multi – storeyed cropping system?

In intensive study of multi-storeyed crop combinations has brought out a four-crop architecture i.e., coconut, pepper, cocoa and pineapple under irrigation.

140. What are the spacing adopted for multi – storeyed cropping system?

The feasibility and success of this multi-storeyed architecture depends on the crown habit of coconut spaced at 7.5 to 8.0 m apart, which form 'top floor, pepper vine trained up to 8.0m on the coconut palm trunk form the 'second floor', cocoa branch spread confined to a height of up to 3.5 m forms the 'first floor' and pineapple forms the 'ground floor', till the canopy of cocoa completely covers the interspace.

141. Is intercropping of teakwood trees inside coconut gardens harmful to the coconut trees?

It is generally not advisable to plant teakwood as an intercrop in coconut gardens. Being hardy by nature, teakwood trees are mostly planted as fence crops. They are effective wind barriers especially while planting flower crops.

142. Is there any multiple cropping systems used in coconut field?

Yes, multiple cropping systems are also used.

- In eastern region : Coconut + Banana + Sirukizhangu + Bhendi
- In western region: Banana + Pepper + Cocoa + Nutmeg + Vanilla

In all the systems, apply recommended quantity of water, manures, and fertilizers to the intercrops separately.

143. What are all the perennial crops suitable for multi-cropping system?

Cocoa, nutmeg, pepper, clove, lemongrass and cinnamon

144. What are all the annual crops suitable for multi-cropping system?

(a) Kharif: Rice, maize, groundnut, ginger, turmeric, chilli, yams, colocasia, red gram, vegetables, sweet potato, tapioca, banana, pineapple, papaya and fodder grass.

- (b) Rabi: Sesame, horse gram, red gram, vegetables, cowpea, sweet potato and banana.
- (c) Summer: Vegetables

145. Why banana has planted as multi crop of coconut palm?

Among the mixed crops tested, banana is found to be the most important intercrop for coconut garden. It responds to similar irrigation and manuring systems as coconut and also comparatively free from serious pests and diseases except the burrowing nematode in certain pockets. Banana as intercrop is mostly grown under rainfed conditions. About 1000 banana plants could be raised/ha of coconut garden (125 palm/ha).

146. Why pineapple has planted as multi crop of coconut palm?

Pineapple could be successfully raised as an intercrop both under rainfed and irrigated conditions. Under irrigated conditions, the size of each fruit would be about 1.5 kg; while as a rainfed crop, the size is reduced to half (0.71 kg). About 4000 kg pineapple/ha can be harvested in multi-storeyed cropping system and much more when only pineapple in grown as inter-corp.

147. Why cocoa has planted as multi crop of coconut palm?

Cocoa is found to be the best shade loving crop and most suitable in coconut and arecanut gardens, where irrigation facilities exist. In the coconut, cocoa mixed cropping system, the single hedge cocoa planting (400 plants/ha at row spacing of 3 m) becomes complementary and supplementary to coconut.

By growing cocoa in between coconut palms, there would be considerably yield increase in coconut and the root system is not competitive. Thus, the combination of coconut-cocoa crops has a mutually beneficial effect and there is the profitability of the whole cropping programme.

148. What crops can be grown as green manure in the coconut filed?

Crotalaria juncea (sunn hemp), Tephrosia purpurea (kolinji), Giricidia maculate, Indigofera hirsute, Pueraria phasedoides.

149. What crops can be grown as cover crops in the coconut field?

Calapagonium muconoides, Mimosa invisa, Stylosanthes gracilis can be grown as cover crops.

150. What crops can be grow as shade cum green manure shrub in the coconut field? *Tephrosia Candida*

151. What are all the weed management practices to be taken in the main filed? During May – June, Sep –Oct, plough or dig the field and rake the field in Jan.

152. In areas where high run off exposes the roots, what management practices should be done?

Form mounds in Sep – Oct and level them in Nov – Dec.

153. What are all the chemicals used in the coconut weed management practices?

- Broad leaved weeds ;re-emergence spraying of Atrazine @ 1.0 kg a.i./ha
- Grasses & sedges post emergence spraying of Glyphosate @ 10 ml and 20 g Ammonium Sulphate / litres of water

154. When replanting or under planting is done in coconut field?

Replanting or under planting becomes necessary when the yield is very low due to old age, long-term neglect and continuous exposure to adverse conditions. Generally under planting is practiced where old palms are removed in stages over a period of three to four years.

NUTRIENT MANAGEMENT

155. What are the elements essential for coconut?

Essential elements in coconut nutrition

- Of the primary nutrients, potash (K) has been found to be the most important in coconut cultivation, followed by nitrogen (N). There is a general response to the application of K and N; while response to phosphorous (P) is seen only in certain restricted and localized condition.
- Among the secondary nutrients, magnesium (Mg) and chlorine (Cl) have beneficial effects, followed by calcium (Ca), Sulphur(S) and sodium (Na). Among micro-nutrients, zinc (Zn), boron (B) and manganese (Mn) are required under certain restricted conditions.

156. What are the effects of nitrogen element?

The supply of nitrogen which is a constituent of plant cells as well as chlorophyll, the green colouring matter of leaves, is of great importance for the rapid development and growth of the trees. Nitrogen promotes the developments of the vegetative parts of the plant especially the leaves and shoots as well as to increase the number of leaves.

157. What are the effects of potassium element?

Potash has its important and specific functions apart from those, which it jointly performs in association with phosphorus. It regulates the water economy of the plant and so is indispensable for the rational utilization of limited water supplies for the production of the highest possible yields. It enables the plant to withstand drought. Potash is known to help root development, enabling the palm to take up more nutrients from the soil. Since potash is particularly necessary for the formation of sugar, fat, and fibrous material, the coconut palm may be expected to have a high requirement of potash.

158. What are the effects of phosphorus element?

Phosphorus is found especially in leaves and seeds and also in parts of the plants where vigorous cell division is taking place. It plays an important role in root growth and increased yields.

159. What are the effects of manganese element?

It aids in the formation of chlorophyll in leaves. It is present mostly in lower leaves and provides favourable growth conditions during younger stages of palm.

160. What are the effects of magnesium element?

Magnesium (Mg) has beneficial effects on the general growth and productivity of palm. Magnesium improved production of more female flowers, high setting percentage and more number of nuts per bunch. It also plays an important role in photosynthesis and greenness of leaves.

161. Can I apply the entire fertilizer recommended at one time?

It is always beneficial to apply fertilizer in different split dozes. Since coconut continues to produce nuts and leaves throughout the year it requires regular supply of nutrients on a continuous basis. If the nutrients are applying as one dose major quantity of the nutrients are lost by leaching. Hence the nutrients will not be available for a continuous period of time. To avoid thus nutrients have to be applied as split doses

162. What is the fertilizer recommendation for young palm in Kerala?

Fertilizer requirement of young palms in relation to that of adult palms – KERALA (Under Rainfed Condition)

Time after planting	N (g/palm)	Urea (g/palm)	P (g/palm)	Super Phosphate (g/palm)	K (g/palm)	Muriate of potash (g/palm)
3 months	50	110	32	200	120	200
1 st year	167	360	107	670	400	660
2 nd year	334	720	214	1340	800	1330

Time after	DAP & Others (g/palm)			17:17:1′ (g/	7: Com /palm)	plex	20:20:0 complex (g/palm)			
planting	DAP	Urea	MOP	17:17:17 Complex	Urea	МОР	20:20:0 complex	Urea	МОР	
3 months	70	81	200	188	40	146	160	40	200	
1 st year	232	271	660	630	130	486	535	130	660	
2 nd year	464	545	1330	1258	260	973	1070	260	1330	

Under irrigated conditions, the fertilizers can be applied in 3-4 equal split doses.

163. What is the fertilizer recommendation for coconut palm in Tamil Nadu?

Fertilizer may be applied in two equal splits during June – July and December – January. Apply manures and fertilizers in circular basins of 1.8 m from the base of the palm, incorporate and irrigate sufficient moisture should be present at the time of manuring. Phosphorous may be applied as super phosphate in the basins and incorporated or as DAP through drip when good quality of water is available.

Time after	Compost (kg/palm/	Blanke	et Recomme (g/palm)	ndation	Straight Fertilizer (g/palm)			
planting	year)	N	Р	К	Urea	Super Phosphate	Muriate of potash	
6 th month after planting	10	-	-	-	-	-	-	
2 nd year	20	140	80	300	300	500	500	
3 rd year	30	280	160	600	610	1000	1000	
4 th year	40	420	240	900	910	1500	1500	
5 th year	50	560	320	1200	1300	2000	2000	

Fertilizer Requirement of Palms – TAMILNADU

Time	DAP & Others	17:17:17: Complex	20:20:0 complex (g/palm)
after	(g/palm)	(g/palm)	

planting	DAP	Urea	МОР	17:17:17 Complex	Urea	MOP	20:20:0 complex	Urea	МОР
2 nd year	174	235	500	470	130	365	400	130	500
3 rd year	348	470	1000	940	260	730	800	260	1000
4 th year	522	700	1500	1410	390	1095	1200	390	1500
5 th year	696	940	2000	1880	520	1460	1600	520	2000

Under irrigated conditions, the fertilizers can be applied in 3-4 equal split doses.

164. What is the fertilizer recommendation for adult palms of Kerala?

Fertilizer requirement of adult palms – KERALA (Under Rainfed Condition)

	N (g/palm)	Urea (g/palm)	Amm. sulpha te (g/pal m)	P (g/pal m)	Super Phosphat e (g/palm)	Rock Phosphat e (g/palm)	K (g/palm)	Muriate of potash (g/palm)
General recommendation								
(a) Average management	340	750	1650	170	1060	570	680	1140
(b) Good management	500	1080	2000	320	2000	1070	1200	2010
For reclaimed clayey soils (as in Kuttanad)	250	540	1190	350	2190	1170	900	1490
Red loam soils (southern Kerala)	680	1480	3240	230	1440	770	900	1490
Hybrids & high vielding palms								
(a) For irrigated areas	1000	2170	4880	500	3130	1670	2000	3330
(b) For rain fed conditions	500	1090	2380	320	2000	1070	1200	1990

Time after plantingDAP & Others (g/palm)	17:17:17: Complex (g/palm)	20:20:0 complex (g/palm)
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	DAP	Urea	МОР	17:17:17 Complex	Urea	MOP	20:20:0 complex	Urea	МОР
(a) Average management	370	595	1130	1000	370	847	850	370	1130
(b) Good management	695	814	1990	1882	390	1460	1600	390	1990
For reclaimed clayey soils (as in Kuttanad)	760	297	1495	1470	625 (SSP)	1080	1250	625 (SSP)	1495
Red loam soils (southern Kerala)	500	1280	1495	1353	977	1112	1150	977	1495
Hybrids & high vielding nalms									
(a) For irrigated areas	1085	1750	3320	2940	1085	2490	2500	1085	3320
(b) For rain fed conditions	695	814	1990	1882	390	1460	1600	390	1990

165. What is the fertilizer recommendation for palm of Karnataka?

Organic Matter

FYM/ Compost:

Before Planting – 12.5 t/ha

Every Year – 50 kg/palm

Fertilizers requirement for Pre monsoon condition

Time after	Blank	xet Reco	mmend	ation (g/palm	/year)	Straight Fertilizer (g/palm/year)					
planting	Pre monsoon			Post Monsoon		Pre monsoon			Post Monsoon			
	Ν	Р	K	Ν	Р	K	Urea	SSP	MOP	Urea	SSP	MOP
1 st year after planting	Planting in May – June		50	40	135	-	-	-	110	250	225	
2 nd year after planting	50	40	135	110	80	270	110	250	225	240	500	450
3 rd year after planting	110	80	270	220	160	540	240	500	450	480	1000	900

4 th year after planting	170	120	400	330	200	800	370	750	670	720	1250	1335

	DAP & Others (g/palm)								
Time after planting	P	re monso	oon	Post monsoon					
	DAP	Urea	МОР	DAP	Urea	МОР			
1 st year after planting	-	-	-	87	75	225			
2 nd year after planting	87	75	225	175	170	450			
3 rd year after planting	175	170	450	348	340	900			
4 th year after planting	260	267	670	435	545	1335			

	17:17:17: Complex (g/palm)							
Time after planting	Pre	e monsoon	l	Post monsoon				
	17:17:17 Complex	Urea	МОР	17:17:17 Complex	Urea	MOP		
1 st year after planting	-	-	-	235	22	158		
2 nd year after planting	235	22	158	470	65	315		
3 rd year after planting	470	65	315	941	130	630		
4 th year after planting	705	110	465	1176	282	664		

	20:20:0 complex (g/palm)							
Time after planting	Pre	e monsoon	l	Post monsoon				
	20:20:0 complex	Urea	МОР	20:20:0 complex	Urea	МОР		

1 st year after planting	-	-	-	200	22	225
2 nd year after planting	200	22	225	400	65	450
3 rd year after planting	400	65	450	800	130	900
4 th year after planting	600	110	670	1000	282	1335

Apply MgSO₄ for bearing trees @ 0.5 kg/palm in coastal region (Note: Lime

incorporation – 15 days prior to application of fertilizer during September – October.

166. How is nutrigation done?

Fertilizers that are applied through irrigation water: 88-50-187 g N-P-K per hectare (**156** palms/ha)

S.No	Name of the fertilizer	Quantity kg/ha
1.	Super phosphate	312 kg @ 2 kg/ tree
2.	13-00-45	416
3.	Urea	74

Super phosphate should be applied as basal dressing @ 312 kg/ hectare in 4 split doses namely July, October, January and April.

Crop growth	Fertigation	Required	Number of	Quantity(Kg/application)
stages	frequency	fertilizer	times	
	interval			
July – August	Weekly once	13-00-45	8 times	13.00
		Urea	8 times	2.3
Aug –Nov	Weekly once	13-00-45	8 times	13.00
		Urea	8 times	2.3
January – Feb	Weekly once	13-00-45	8 times	13.00
		Urea	8 times	2.3
April – May	Weekly once	13-00-45	8 times	13.00
		Urea	8 times	2.3

The above fertilizer schedule should be given to palms that are four years old and above.

167. Why the bio-fertilizers used in the coconut filed?

- For fixing nitrogen in the root regions.
- It will enhance the growth and performance of seedlings.

168. What are all the bio-fertilizers used in coconut field?

Azospirillum amazonense, Azospirillum brasilense, Herbaspirillium frisingense, Bacillus

spp., Burkholderia spp., Azoarcus spp., Arthrobacter spp.,

169. How to improve coconut yield organically?

Apply Calotrophics gigantean (1kg), Kolingi (1kg), Pothakalli (*poeciloneuron pauciflorum*) (1kg), Fish meal (1kg), Salt (1kg) and Sand in a semi-circular basin.

170. How the coconut plantation wastes can be used in vermicompost?

The local species of *Eudrilus* identified from coconut garden which is superior to other species in composting of coconut plantation wastes. This earthworm can be multiplied fast in a 1:1 mixture of cowdung and decayed organic wastes. Keep 10 kg of this mixture in bucket and release 50 to 100 worms. Mulch the mixture with grass and cover with a net. Maintain the moisture. In 1 to 2 months 150 to 300 g earthworm will be produced.

171. What are all the wastes obtained from coconut?

Leaves, crown waste, dried spathes and husk

172. How the wastes can be used effectively?

- Based on the recycling practices, the coconut wastes are reused in the coconut field.
- The wastes deposited in a small trench of convenient length 0.5 m to 0.75 m wide and 0.3 to 0.5 m deep at a distance of 2-2.5 m away from the base of the trunk. Fill up this trench with the palm wastes along one side of the palm (say north) in one year, opposite side (south) in the next year, east in the third year and so on. This practice of organic recycling of waste has been found to improve the growth and productivity of the palms.

173. What is the bio-fertilizer recommendation for coconut?

- 50 g of Azospirillum
- 50 g of Phosphobacteria (or) 100 g Azophos
- 50 g of VAM

Mix all the contents in sufficient quantity of compost or FYM and apply near feeding roots once in 6 months / palm starting from planting. Don't mix with chemical fertilizers and pesticides

174. What is the TNAU recommendation for nut bearing coconut?

TNAU Recommendation – Root feeding coconut tonic @ 200ml / palm once in 6 months can be used.

175. What is the reason for nitrogen deficiency?

N deficiency is typically caused by insufficient N in the soil.

Reasons for Deficiency:

- Non adoption of recommended doses of organic and inorganic fertilizers in light soils
- Due to not practicing of giving extra doses of fertilizers to inter crops in multiple cropping systems.
- In new plantation gardens and in new pits even though the roots grow in deeper layers, the plants show deficiency (yellowing) symptoms if sufficient nitrogen is not available.
- In alkaline soils, low rainfall areas and in drought prone areas the organic matter is not completely decomposed. In such situations N-deficiency will occur.
- Similarly if sufficient water is not present or efficient drainage facilities are not available, it leads to N-deficiency.

176. What are the symptoms of Nitrogen deficiency?

Nitrogen deficiency begins as a uniform light green discoloration / yellowing (uniform chlorosis) of the oldest leaves. Yellowing starts from tip to base of the lower leaves and will proceed up. As the deficiency progresses, younger leaves will also become discoloured. Older leaves are golden yellow colour. Growth virtually stops when N deficiency is severe and become shedding of leaves.

177. Nitrogen deficiency is confused with other deficiency of coconut?

Nitrogen deficiency can be confused with Fe or S deficiency, although the chlorosis in those deficiencies is typically most severe on the youngest leaves. The reverse is true for N deficiency.

178. How to manage Nitrogen deficiency?

Foliar application of 2% urea thrice at fortnightly interval or soil application of 1-2 kg urea / tree or Root feeding of 1% urea 200 ml twice a year.

179. What are the symptoms of Potassium deficiency?

Symptoms first appear on oldest leaves and later spread to young leaves. Translucent yellow or orange spots develop on leaflets (Yellowing of leaf margin). Potassium deficiency manifested by scorching on the margins or the lower leaves. Leaflets with necrotic areas along the margins which later withero.

180. If potassium deficiency is confused with any other deficiency of coconut?

Visual symptoms alone may be sufficient for diagnosis of this disorder although leaf nutrient analysis may be helpful in distinguishing late stage K deficiency from manganese (Mn)
deficiency. These two deficiencies can be extremely similar from a distance, but close examination should reveal characteristic spotting and marginal necrosis in K deficiency or necrotic streaking for Mn deficiency. Potassium deficiency symptoms are also more severe toward the leaf tip and are less so at the leaf base. The reverse is true for Mn deficiency.

181. How to manage potassium deficiency?

Regular applications of K fertilizers will prevent K deficiency and treat palms already deficient. On sandy soils, or those having little cation exchange capacity, controlled-release K sources are much more effective than the easily leached water-soluble K sources. Application of resin coated K_2SO_4 @ 3.4 kg/tree, four times a year along with 2 kg MgSO₄ / tree. Root feeding of 200ml of 1% KCL per tree thrice a year.

182. How to identify the phosphorus deficiency in coconut?

- Purple coloration in leaves (In severe cases may leaves turn yellow before drying prematurely)
- Sluggish growth
- Leaves stay upright
- Premature leaf shedding

The growth, leaf size and leaf number reduced. The root growth is restricted if phosphorus deficiency is recorded. There are no clear visual symptoms of phosphorus deficiency other than stunting and decrease in yield. This deficiency common in wide range of soil

183. How to manage the phosphorus deficiency?

Foliar spray of DAP 2% twice at fortnightly interval or soil application of FYM 5kg/tree. Root feeding of 1% DAP 2 ml twice a year.

184. How to identify the boron deficiency in coconut palm?

B deficiency on coconut palm is manifested as sharply bent leaflet tips, commonly called "hook leaf". Leaves have a serrated zigzag appearance. Young and newly developing leaves become deformed called as little leaf. One of the most common symptoms of B deficiency is the failure of newly emerging spear leaves to open normally. They may be tightly fused throughout their entire length, or the fusion can be restricted to basal or distal parts of the spear leaf. In a chronic stage, multiple unopened spear leaves may be visible at the apex of the canopy.

185. How to manage the boron deficiency?

Soil application of borax 0.2 to 0.5 kg /tree/year or foliar spray of borax 0.2%. Spraying is commonly practiced when coconut palms are at the nursery stage at a rate of 1 to 1.5 grams per seedling.

186. What are the symptoms of Manganese deficiency?

The newest leaves of Mn deficient palms emerge chlorotic with longitudinal necrotic streaks. As the deficiency progresses, newly emerging leaflets appear necrotic and withered on all but basal portions of the leaflets. This withering results in a curling of the leaflets about the rachis giving the leaf a frizzled appearance ('frizzle top'). On new leaves of Mn-deficient palm, necrotic leaflet tips fall off and the leaf has a signed appearance. In severely Mn- deficient palms, growth stops and newly emerging leaves consist solely of necrotic petiole stubs.

187. What are the symptoms of Magnesium deficiency?

Magnesium deficiency appears on the oldest leaves of palms as broad chlorotic (yellow) bands along the margins with the central portion of the leaves remaining distinctly green. In severe cases leaflet tips may become necrotic. Older leaves become bronzed and dry appearance. Leaflets show necrosis and turn to reddish brown with translucent spots yellowing starts at the tip and spreads to the base.

188. How to identify the Sulphur deficiency symptoms in coconut?

Typical symptoms are yellowish-green or yellowish-orange leaflets. Leaves droop as the stem becomes weak. In older palms, leaf number and size are reduced. Sometimes an apron of dead fronds develops around the stem due to weakness of the rachis. Nuts may fall prematurely. Copra is rubbery and of poor market quality.

189. What are the symptoms of zinc deficiency?

- Little leaf symptoms
- Rosette appearance
- Necrotic patches in interveinal areas
- Delayed fruiting
- Zinc deficiency is characterized by formation of small leaves wherein the leaf size is reduced to 50%. Leaflets become chlorotic, narrow and reduced in length. In acute deficiency, flowering is delayed. Zinc deficiency will also lead to button shedding.

190. What are the symptoms of iron deficiency?

- Interveinal chlorosis in terminal leaves
- Older leaves remain green
- Necrotic spots in chlorotic region
- Iron deficiency usually appears on palms growing in poorly aerated soils or those that have been planted too deeply. Water logged soils and deep planting effectively suffocate the roots and reduce their effectiveness in taking up nutrients such as Fe. The main symptom of iron deficiency is chlorosis or yellowing between the veins of new leaves (Uniform chlorotic new leaves as the deficiency progresses, the tips become necrotic and leaf size reduced.

191. What are the minor deficiencies in coconut palm?

Calcium, chlorine, Copper, Molybdenum deficiency

192. What are the symptoms of calcium deficiency?

- Young leaves exhibit narrow white bands at margins
- Interveinal chlorosis
- Rusty appearance in leaf margin
- Rolling up of leaves
- Occurs only in acid soil

193. How to identify the chlorine deficiency of coconut palm?

Yellowing and / or orange mottling of older leaves with drying up of the outer edges aand tips of the leaflets (similar to K deficiency). The leaves are droopier and leaflets folded (similar to drought). Nut number and size reduced.

194. What are the symptoms of copper deficiency?

Coppery bluish leaf

Rolling of terminal leaves due to loss of turgor

Leaves appear to be bleached grey

Fail to produce flowers

195. What are the symptoms of molybdenum deficiency?

Chlorotic leaf blade Small slender leaves Rosetted plants Occurrence of whip tail

196. If manganese deficiency confused with any other deficiency of coconut palm?

Visual symptoms may be sufficient to diagnose this disorder, but leaf nutrient analysis is also suggested, since symptoms of boron (B) deficiency can be similar. Late stage potassium (K) deficiency symptoms are virtually indistinguishable from those of Mn deficiency at a distance and close examination is required to look for characteristic longitudinal streaking and basal symptom distribution of Mn deficiency.

197. How to control Manganese deficiency?

Management: Soil application of MnSO₄ @ 25kg/ha

198. If Magnesium deficiency symptoms confused with any other deficiency of palm?

Visual symptoms alone are usually sufficient to diagnose Mg deficiency. Magnesium deficiency symptoms differ from those of K deficiency in that symptom severity of discoloration K- deficient leaves is usually orange to bronze, shading gradually to green at the base of the leaf, whereas Mg- deficient leaves have distinctly green leaf centers and bright lemon yellow to orange margins.

199. How to manage magnesium deficiency?

Soil application of MgSO₄ 1-2 kg/tree/year. Root feeding of 200 ml of 0.2% MgSO₄ twice a year.

200. How to manage copper deficiency?Soil application of gypsum 2 - 5 kg/tree/year. Root feeding of 0.2% gypsum.

201. How to control Zinc deficiency? Soil application of ZnSO₄ @ 25kg/ha

202. How to control Iron deficiency of coconut palm? Application of Feso₄ 0.25 to 0.5 kg/tree/year

- 203. How to control calcium deficiency of coconut palm? Soil application of lime based on lime requirement and root feeding of 1% calcium nitrate
- **204.** How to manage copper deficiency of coconut palms? Soil application of CuSO₄ @ 25 kg per ha.

205. How to manage nutrient in coconut palm? Any other management protective technologies are there?

Management practices include growing green manure (sun hemp) as an intercrop and ploughing in situ. Application of 650g urea, 1kg super phosphate and 1 kg potash per tree along

with 25 kg farmyard manure (FYM) once in six months in June- July and December- January. Application of micronutrients viz., magnesium sulphate 150g, zinc sulphate 75g, borax 50g along with 10kg of well decomposed FYM per tree prior to rainy season. These measures help overcome nutritional disorders and restore the vigour and productivity of the trees.

206.

207.

IRRIGATION MANAGEMENT

208. How to irrigate adult palms in TamilNadu?

Irrigation schedule depending upon the various regions:

Western region of Tamil Nadu

Months	Normal condition (for best yield)	Moderate water scarcity condition	Severe water scarcity condition
A. Drip irrigation			
February to May	65 lit / day	45 lit/ day	22 lit / day
January, August and	55 lit / day	35 lit / day	18 lit/day
September			
June and July,	45 lit / day	30 lit/ day	15 lit / day
October to December			
B. Basin irrigation			
February to May	410 lit / 6 days *		
January, August and	410 lit /7 days*		
September			
June and July,	410 lit /9 days*		
October to December			

Eastern region of Tamil Nadu

Months	Normal condition (for best yield)	Moderate water scarcity condition	Severe water scarcity condition
A. Drip irrigation			
March - September	80 lit / day	55 lit / day	27 lit/day
October – February	50 lit / day	35 lit/ day	18 lit /day
B. Basin irrigation			
March – September	410 lit / 5 days*		
October – February	410 lit /8 days*		

* Quantity of water to be applied in the basin. Add 30 - 40 % of the above quantity of water (135 -165 litres/palm) to meet the conveyance loss.

209. How to irrigate adult palms in Kerala?

Donomotons	Soil texture			
Parameters	Sandy	Sandy loam	Loam	Silty clay
Available soil moisture (cm/m)	8	12	17	21
Quantity of water / irrigation /				
palm in litres in a basin of 1.8	600	900	1300	1600
m radius				
Frequency of irrigation (days)				
All areas in Kerala except				
north eastern portion of	3-4	5	7-8	9
Thrissur and Palakkad districts				
North eastern portion of	23	`3 /	5.6	67
Thrissur and Palakkad districts	2-3	5-4	5-0	0-7

Irrigation requirement of coconut

Note: In coastal sandy soils, seawater can be used for irrigation. Do not irrigate seedlings and very young palms upto 2 year with sea water. In irrigated gardens, interruption of irrigation would lead to serious set back in yield and general condition of palms. Hence, when once started, irrigation should be continued regularly and systematically. Drip irrigation is the best suited method of irrigation for coconut. It saves water, labour and energy.

210. How to irrigate adult palms in Karnataka?

- Coconut palm responds to summer irrigation. Production of female flowers and setting % increases considerably due to irrigation. Since spadix initiation to ripening of nuts takes nearly 42 months, the full benefit of irrigation can be felt only after 3 years.
- Burying the Coconut husk or coir dust is one of the most effective ways of conserving soil moisture.
- These husks coir dusts can act as sponge and absorb and retain moisture about 6-10 times respectively to their own weight and slowly relative to the coconut trees during dry periods.
- As the husk or dust breaks down slowly, their effect will last for 4-6 years and 8-10 years respectively. On decomposition they also add potash to the soil. These husks or dusts can be added in pits / trenches taken in between the trees but in all the cases depth should be 0.6m and 1.8m away from the bole. Husks / dusts can be added in alternate layers with soil.

• Each palm requires 55 to 120 litres of water every day. Since availability of irrigation water is scanty, for judicious utilization of this resource, adoption of drip irrigation system is most ideal.

211. What is the impact of Drip Irrigation?

Drip irrigation is known to save about 30 -40 % water with 38% to 40% increase in yield compared to basin irrigation system apart from conserving soil and reducing the competition from weeds for water and nutrients. Through fertigation, we can achieve efficient utilization of both water and nutrients.

212. What are the other advantages of drip irrigation system?

- It saves water
- Enhances plant growth and yield
- Saves energy and labour, most suited for soils having low water holding capacity and undulating terrain
- Reduces weed growth and improves efficiency of fertilizers.

213. How to arrange drippers in coconut field for irrigation?

For coconut, generally, three to four drippers are given per palm. For drip irrigation, open four pits of size of $30 \times 30 \times 30 \times 30$ cm opposite to each other at one meter distance from the trunk. Place 40 cm long PVC pipe (16 mm) in a slanting position in each pit and place the drippers inside the tube and allow the water to drip 30 cm below the soil surface. Fill the pits with coir pith to prevent evaporation.

214. How much cost for drip irrigation system?

The cost of drip system including installation will be Rs. 130 to 150 per palm (exclusive of pump) which works out to Rs. 23000 to 26000/- approximately per hectare of coconut garden with 4 emitters per palm.

215. What type of irrigation channels to be used in main field?

Irrigation by main and sub channels.

216. What is the method for soil moisture conservation in coconut field?

Mulching is an effective method of conserving soil moisture.

217. When and how to adopt mulching in coconut field?

Mulch the coconut basins with green / dry leaves at the close of northeast monsoon (October-November). Mulching also adds organic matter to the soil and reduces the soil temperature. Do not disturb soil in the coconut garden during summer months. In level lands, during rainy seasons excess water may be conserved in small trenches dug out in the plantation. In sloppy areas, land may be terraced and trenches dug across. This will facilitate maximum percolation of rainwater and water storage. For moisture conservation, lowermost 3-5 leaves may be cut and removed. Provide adequate shade for the transplanted seedlings for 1-2 years. To minimize the heat load on the stem, application of lime solution on the trunk up to a height of 2-3 m at the start of the summer season is recommended.

218. How to mulch the pits with coconut husks?

Apply coconut husks with convex surface facing upwards (100 Nos.) or dried coconut leaves (15 Nos) or coir pith up to a height of 10 cm in the basin of 1.8 m radius around the palms as mulch for soil moisture conservation particularly during summer season.

219. How to bury the pits with coconut husk / coir pith to overcome drought or button shedding?

Husk burial can be done in coconut basins or in the interspaces to overcome drought and button shedding. Bury husks @ 100 Nos. with concave surface facing upwards or 25 kg of coir pith /palm in circular trenches, dug 30 cm width and 60 cm depth at 1.5 - 2.0 metres radius. The husk can be also buried in the trenches at a distance of 3 m from the palm with a size of 45 cm deep and 150 cm width in between two rows of coconut. The soaking of the coconut husk or coir pith as the case may be preserves the monsoon rains. The beneficial effect of husk burial will last for about 5-7 years. – TNAU

State	Area (m ha)	% to All India	Production ('00 Million	Yield (nuts/ha)
			nuts)	
Kerala	0.87	44.85	6.05	6951
Tamilnadu	0.37	19.07	5.43	14495
Karnataka	0.40	20.62	1.63	4052
Andhra Pradesh	0.10	5.15	1.33	12629

220. Name the states producing coconut in large

221. What are all the organizations working for coconut development in Tamilnadu?

• TamilNadu Agricultural University, Coimbatore 641003. 91-422-6611200 www.tnau.ac.in

- Coconut Research Station, Veppankulam (Post), Nattuchalai (via) 614 906. Thanjavur. 04373 - 260205
- Coconut Research Station, Aliyar Nagar, 642101, 04253 2288722, arsaliar@tnau.ac.in
- 222. What are all the organizations working for coconut development in Kerala?
 - Kerala Agricultural University, Mannuthy-680 656, Thrissur, Kerala, India. Phone: 91 487 2370432; Fax: 91 487 2370019. http://www.kau.edu/
 - Central Plantation Crops Research Institute, Kasargod, 671124, Phone: 04994-232 894-5, Fax: 91-4994-232 322, E-mail: <u>cpcri@gov.in</u>, <u>www.cpcri.nic.in</u>
 - **CPCRI (RS) Kayangulam**, Krishanpuram post 690 533, Alappuzha District, Kerala. Phone: 04792-442160. Fax: 04792-445733. e-Mail : <u>cpcrirskgm@yahoo.com</u>
 - CPCRI (RS), Lakshadweep, Minicoy 673 559, Lakshadweep, Phone/Fax : 04892 22239
 - **CPCRI (RC) Kidu**, Nettana 574 230, Dakshina Kanada District, Phone/Fax : 08251 62221. It is the **International Coconut Gene Bank for South Asia;** Production of quality planting materials of coconut, areca nut and cocoa & maintenance of germplasm
 - Coconut Development Board, KERA BHAVAN, SRVHS Road, Cochin, Kerala 682011, Phone: 91-484-2376265, 2477267, 2376553, Fax: 91-484-2377902, website: <u>http://cocountboard.nic.in</u>

Indigenous Technical Knowledge

223. How to control rats from climbing coconut trees?

- To prevent rats from climbing coconut trees, a large palm leaf is split along its mid rib; one set of leaflets is wrapped around the trunk below the crown and the other set is wrapped in the opposite direction.
- Tie branches of Seemai Karuvel (Prospis juliflora) or barbed wires around the mid truck to the height of 2 to 3 feet. This prevents climbing of rats and squirrels.

224. How to control flower and button shedding in coconut trees?

- To control flower shedding in coconut trees, apply salt (2kg/tree) on the apical portion of the flower buds and also spread at the root zone and give plenty of water
- Spraying neem oil to reduce the flower shedding
- Apply ash

• Apply Kolingi (Tephrosia purpurea) and Calotropis gingantea in circular basin, just before flowering

225. How to reduce Rhinoceros beetle population?

- Place earthern pots in small pits in the garden and fill half of the pot with water and caster cake. After three days, due to the smell Rhinoceros beetles gets attracted and die.
- Pour neem cake extract on growing tips and adjoining fronds.

226. How to manage red palm weevil attack?

Clean the hole bored by the weevil and plugs it after putting common salt in it.

227. How to prevent termite attack on the trunk?

- Lime washing for two feet height, at the base of coconut trees.
- Pour mixture of 500 g of common salt in 5 lit of water on the trunk.
- Grow poultry birds in coconut gardens to feet on termites.

228. How to control Thanjavur wilt organically?

- Raise Kolingi (Tephrosia purpurea), Daincha (Sesbania sp) etc., and plough insitu
- Apply neem cake followed by well decomposed FYM

229. How to manage stem bleeding in coconut trees?

The bleeding mouth on the truck is cut to certain extent, cleaned and poured with lime solution.

230. How to separate dust to make coconut oil clear?

Add a peace of jaggery in coconut oil.

Coconut Harvesting

231. How many months old coconuts are harvested for seed, copra making and tender nut purpose?

Seed and copra making : 12 months old nuts

Tender coconut : 7 - 8 months old nuts

232. What are the methods are used for coconut harvesting?

Harvesting methods: climbing, power tiller operated ladder and climbing cycle / equipment.

233. How long can the nuts of tall dwarf and hybrids be stored before sowing to be used as seed nuts?

Tall varieties : 2 - 3 months of harvest

Dwarf varieties and hybrids : 10 - 15 days of harvest

234. On an average, how many harvests can there be in a year from a tree?

Average of 8 harvests, through the palm produces inflorescence every month.

235. What would be the average nut yield of coconut?

- Average yield: 80 100 nuts/palm/year depending on the variety.
- Dwarf varieties-70 80 nuts/palm/year
- Tall varieties -80 100 nuts/palm/year
- Hybrids -100 130 nuts/palm/year

236. What would be the oil yield of WCT palms under rain fed conditions?

It would be around 1.7 to 2 tone / ha.

Post harvest technology

237. What should be the moisture content of copra after drying under sun or by other driers?

Moisture content in copra: 6 %

238. How are the bunches harvested for the purpose of seed nuts / tender coconuts?

The coconut bunches should be brought down by using ropes to prevent the damage to nuts.

239. How can the storage period of copra be increased and how long can it be extended?

The storage period of copra can be increased upto 6 months by storing the copra in polythene tar coated gunny bags.

240. How can the nuts be stored for household purpose?

For household storage, the nuts may be kept in vertical position.

241. How are dehusking of coconuts are practiced?

Dehusking was carried out manually with the help of an iron rod driven to the ground, which is skill oriented. Presently, mechanical devices are used fro dehusking.

242. What are the commonly used drying methods in copra processing?

Sun drying, smoke drying, klin drying and indirect hot air drying are commonly used drying methods in copra processing.

243. What are the major pests of importance that affect the storage of copra for more than 6 months?

Ham beetle – Necrobia rufipes

Saw tootbed grain beetle - Oryzaphilus surinamensis

244. What are the precautions to be followed for safe storage of copra for more than 3 months?

- Dry the products to four percent moisture content.
- Avoid heap storage, which causes maximum damage.
- Store copra in netted polythene bags or gunny bags.

245. What are the pests of copra while in storage?

- Carpophilus dimidiatus
- Foreign grain beetle Ahasvevus advena
- San tootbed grain beetle Oryzaephilus surinameusis
- Red flour beetle Tribohium castaneium
- Khapra Trogoderma granasia
- Rice moth Corcyra cephalonica
- Almond / Fig moth Ephestia cantella

Pest & Disease

246. What are the major pests in coconut?

- Rhinoceros beetle : Oryctes rhinoceros
- Coconut Eriophyid mite : Aceria guerreronis
- Red palm weevil : *Rhynchophorus ferrugineus*

• Black headed caterpillar : Opisina arenosella

247. What causes triangular cuts in leaf of coconut tree?

Rhinoceros beetle attack causes triangular cuts. They attack the fronts & spathes. These fronds when fully opened shows characteristics triangular cuts. Additionally, central spindle appears cut or toppled and holes with chewed fibre sticking out at the base of central spindle appears.

248. How to identify the rhinoceros beetle attack in coconut palm?

- The adult beetle bores into the unopened fronds and spathes. Damage by the pest leads to 10 to 15% loss in yield.
- The attacked frond when fully opened shows characteristic triangular cuts.
- Central spindle appears cut or toppled
- Fully opened fronds showing characteristic diamond shaped cuttings
- Holes with chewed fibre sticking out at the base of central spindle.

249. What is the cycle of rhinoceros beetle and how to identify the beetle?

Egg: oval creamy white egg in manure pits or decaying vegetable matter at a depth of 5 to 15 cm. Egg periods is 8 to 18 days. Female laid 140 to 150 eggs/female. Eggs laid in manure pits or decaying matter at a depth of 5 to 15 cm

Grub: Grub is stout, sluggish, white "C"-shaped with pale brown head and found at a depth of 5 to 30 cm.

Pupa: Grub pupates in earthen cells at a depth of 0.3 to 1 m

Adult: Adult beetle is stout, brownish black or black and has a long horn projecting dorsally from the head in male. Horn is short in female.

250. What is the solution for the problem of rhinoceros beetle in coconut palms?

Rhinoceros beetle problem can be resolved by

- Removing and burning all dead coconut trees in garden.
- Avoid the chances of beetles to breed, like collect and destroy the beetles in manure pit and spray 0.01% Carbaryl (50 WP) on week to week basis in every three month.
- Soak castor cake at 1kg in 51 of water in small mud pots and keep them in coconut garden to attract the adult beetle.

251. Is there any bio control agent to keep the Rhinoceros beetle in check? If so what are the methods?

- Soak castor cake at 1 kg in 5 liter of water in small mud pots and keep them in the coconut gardens to attract and kill the adults.
- Field release of *Baculovirus oryctes* inoculated adult rhinoceros beetle @ 15 beetles/ha reduces the leaf and crown damage caused by this beetle.
- Apply mixture of either neem seed powder + sand (1:2) @150 g per palm or neem seed kernel powder + sand (1:2) @150 g per palm in the base of the 3 inner most leaves in the crown

252. What are the chemical sprays that can be used to control Rhinoceros beetle?

- Apply mixture of either neem seed powder + sand (1:2) @150 g per palm or neem seed kernel powder + sand (1:2) @150 g per palm in the base of the 3 inner most leaves in the crown.
- Place Phorate 10 G 5 g in perforated sachets in two inner most leaf axils for 2 times at 6 months intervals.
- Sevidol 8G 25 g + fine sand 200 g, which is to be done thrice in a year in April-May, September-October and December-January. (b) Naphthalene balls 10.5 g (approx. three balls) covered with fine sand, once in 45 days. –KAU).

253. What are the mechanical methods can be used to control Rhinoceros beetle?

- Treat the longitudinally split tender coconut stem and green petiole of fronds with fresh toddy and keep them in the garden to attract and trap the beetles.
- Examine the crowns of tree at every harvest and hook out and kill the adults.
- Set up light traps following the first rains in summer and monsoon period to attract and kill the adult beetles.
- Set up Rhino lure pheromone trap @ 1 per ha to trap and kill the beetles.

254. What measures can be taken to increase copra content? Why copra content gets reduced?

Pest attack especially coconut Eriophyid mite can decrease the copra content. It must be controlled to increase the copra content.

255. What is the reason for triangular, yellow patches on 2-3 month old buttons & gummy exudation in older ones?

Eriophyid mite causes these symptoms. Its symptoms include

• Initial stage - Triangular pale or yellow patches close to perianth

- Necrotic tissues
- Brown colour patches, longitudinal fissures and splits on the husk
- Oozing of the gummy exudation from the affected surface
- Reduced size and copra content.
- Malformed nuts with cracks and hardened husk.
- The earliest symptom on 2-3 month old buttons is pale yellow triangular patches seen below the perianth. Later, these patches become brown. Severely affected buttons may fall.

256. How does eriophyid mite affect the husk quality of coconuts?

Eriophyid mites cause brown patches on the surface of buttons. As the buttons grow, brown patches lead to black necrotic lesions with longitudinal fissures on the husk. Uneven growth results in distortion and stunting of nuts leading to reduction in copra yield. In severe cases, the losses are compounded because the quality of fibre is reduced and distorted nuts increase the labour requirements for dehusking.

257. How to identify the pest of eriophyid mite?

Nymph and Adult – pale in colour with elongate body and worm like appearance

258. How chemicals are used to manage Eriophyid mite in coconut garden?

- Borax 50 g + gypsum 1.0kg + Manganese sulphate 0.5 kg/palm/ year.
- Triazophos 40 EC 5 ml/lit or mono crotophos 36 WSC @ 2 ml / lit or carbosulfan 25 EC 2 ml/ lit in alternation with neemazal 1% 5ml/lit as spot application.
- Root feeding with TNAU Agro Biocide 30 ml/tree.
- Monocrotophos 36 WSC @ 15ml or triazophos 40 EC @15 ml or carbosulfan 25EC @ 15 ml / 15 ml of water.

Note: Pluck nuts before root feeding

259. How to identify the Eriophyid mite in coconut palm?

Nymph and Adult will look pale in colour with elongate body and worm like appearance.

260. What are the formulations for botanical spray application for controlling Eriophyid mite?

Round	Eco-friendly Botanical	Quantity / tree
1.	Azadirachtin 1%	5 ml in one lit. of water
2.	Neem oil + Teepol	30 ml in one lit. of water

Method of application

- The botanicals should be applied in the sequence 1, 2 as above at 45 days interval using a one litre hand sprayer. Rocker or Pedal sprayer can be used for spraying small trees.
- The spray should be applied at the crown region by a climber covering only the top six bunches during non rainy season.
- The bunches must be covered well by the spray fluid and approximately 1 litre / tree.
- Spraying bio pesticides on the bunches

a) 2% neem oil - garlic emulsion (20ml neem oil + 20g garlic + 5g bar soap in 1 litre water). Emulsion has to be prepared on the same day of application itself.

b) Other neem based pesticides at 0.004% (Azadirachtin). If the pesticide formulation contains 1% Azadirachtin, 4ml has to be used in 1 litre water. Wherever spraying is difficult root feeding may be resorted to with Azadirachtin 5% formulation (7.5ml+7.5ml water) or Azadirachtin 1% formulation (10ml + 10ml water).

261. What are the standard recommendations for preventing the eriophyid mite damage in coconut palm?

• 2% Neem oil + Garlic emulsion or Neemazal T/S 1% @ 4ml / litre of water or wettable sulphur 0.4%.

Note: To prepare 10 liters of 2% neem oil + garlic emulsion, 200g garlic (extracted with 300 ml water), 50g of ordinary soap bar (dissolved in 500ml water) are added to 200ml of neem oil.

- Along with this they recommend to follow a holistic approach like improving the nutrient status by applying organic manure @ 50kg and neem cake 5kg per palm/year.
- Recycling of biomass generated within the coconut system by vermi compost method or by using lignin degrading fungus.
- Rising of green manure crops in the coconut basins (like sunhemp, cowpea, calapagonium etc.) and incorporation into the soil in the basin itself, they act

as mulch during summer and slowly decompose and provide nutrients when incorporated to soil.

- Application of recommended dosages of fertilizers, in two split doses, as per the package of practices prevailing in the respective states.
- Recommended level of irrigation during summer months i.e. 250-500 litres of water per tree per week (based on evapo transpiration in the given area).
- Soil moisture conservation by following methods.
- Burial of coconut husk in the basin.
- Mulching the basins (2m radius) with coconut leaves/green manure / green leaf manure.
- Mulching with coir pith wherever available (2m radius).

262. What are the terms and conditions to be followed while spraying coconut trees to protect from eriophyid mite?

- Rocker sprayer can be used and 1.0 to 1.5 litres of spray fluid per palm is required. If hand sprayer 500 to 750 ml is sufficient for one tree.
- Spraying has to be done from second to seventh bunch avoiding the unpollinated inflorescence. Spray more on 3rd, 4th, 5th bunches as they have more insects harboured.
- Spraying has to be done 3 times a year December-February, April-June and September-October. While spraying, ensure that the spray fluid falls over the perianth region especially on button and tender nuts. On an average 1-1.5 litre spray fluid is required per palm. Care should be taken to harvest mature bunches before spraying.

263. What are the fertilizer recommendations for managing coconut Eriophyid mite?

Package of recommendations for the management of the coconut eriophyid mite especially at Tamil Nadu

- Manurial and fertilizer recommendation (Soil application/tree/year)
 - o Urea 1.3 kg
 - Super phosphate 2.0 kg

- Muriate of potash* 3.5 kg
 - Increased quantity is recommended to increase the plant resistance to the mite.
- Neem cake application @ 5 kg
- Organic manure (well rotten FYM) @ 50 kg
- Micronutrients (Soil application / tree / year)
 - o Borax 50 g
 - o Gypsum 1.0 kg
 - o Magnesium sulphate 500g
- Grow sunnhemp as intercrop twice a year (Seed rate 30 kg/ha)

264. What makes holes on coconut trunk with brown oozes?

Red palm weevil causes holes on trunk with brownish ooze. It also causes yellowing of inner leaves and gradual wilting of central shoot in the crown.

- Other symptoms includes,
- Extrusion of chewed up fibrous matter through hide
- Longitudinal leaf base splitting
- Central shoot wilting

265. How to identify the red palm weevil?

To identify the presence of pest, one can look for light yellow grow without legs, red brown weevil and male weevils will have conspicuous long snout.

266. What are the immediate measures to be taken when the incidence of the red palm weevil is noticed?

- Avoid making injuries on the stem of palm. If needed to cut leaves, leave 120cm from the stem to avoid the grubs entering through cut ends.
- Fill the crown and the axils of top most three leaves with a mixture of fine sand and neem seed powder or neem seed kernel powder (2:1) or lindane 1.3 D (1:1 by volume) once in three months to prevent the attack of rhinoceros beetle damage in which the red palm weevil lays eggs.
- Follow the chemical sprays and traps as prescribed.

267. How to control the attack of the red palm weevil in coconut trees?

• Plug all holes and inject Pyrocone E or carbaryl 1% or 10 ml of monocrotophos into

the stem by drilling a hole above the points of attack. In attacked palms, observe for the bore- holes and seal them except the top most one. Through the top most hole, pour 1% carbaryl (20gm/lt) or 0.2% trichlorphon or 0.1% endosulfan suspension @ one litre per palm, using a funnel. Then plug this hole also. If needed repeat after one week. –KAU

• As an alternative, apply 1% DDVP or aluminum phosphide (for limited use only) one or two tablets per palm as a curative measure.

268. What are the traps available for red palm weevil?

- Coconut log traps
- Pheromone traps one per 2 ha

269. How to install the coconut log traps & Pheromone traps for controlling red palm weevil?

Coconut log traps

Setting up of attractant traps (mud pots) containing sugarcane molasses $2\frac{1}{2}$ kg or toddy $2\frac{1}{2}$ litres (or pineapple or sugarcane activated with yeast or molasses)+ acetic acid 5 ml + yeast 5 g + longitudinally split tender coconut stem/logs of green petiole of leaves of 30 numbers in one acre to trap adult red palm weevils in large numbers. Incorporate any of the insecticide to each trap to kill the weevils trapped.

Pheromone trap @one per 2 ha

Specialized buckets with 3 of 4 holes are made so that the pest can enter. The lure is suspended inside the bucket and water is added in the buckets. The bait buckets are placed at sites in the farm, where infestation is seen most. After a week the water is checked for the catch & re filled to prevent mosquitoes from breeding.

270. What causes wounds around trunk and reddening of petioles?

Bark weevil causes reddening of petioles and wounds around trunks. Trees shows stem bleeding diseases. Adult pests will look black in color and small.

271. How to manage bark weevil?

Stem injection through a stove wick soaked in 0.2% fenthion or 0.2% dichlorvos and plugging the hole and repeating the treatment using the same wick and hole a month after.

272. How to control the presence of minute holes on bark?

Bark borer or scolytid bark borer causes minute holes interconnected by fibrous galleries. They can be controlled by stem injection through a stove wick soaked in 0.2% fenthion or 0.2% dichlorvos and plugging the hole and repeating the treatment using the same wick and hole, a month after.

273. When do black headed caterpillar attack coconut trees? What are the symptoms?

- The incidence of the pest is noticed from the month of November to May and from August to November after rainfall. The coconut trees of all ages are attacked.
- Dried up patches on leaflets of the lower leaves
- Galleries of silk and frass on underside of leaflets.
- The attack will be severe during summer months from January-May in Kerala

274. How do identify the black headed caterpillar?

- Larvae looks greenish brown
- Pupa looks with silken cocoon
- Adult moth looks greyish white in color.

275. How to manage the black headed caterpillar?

• When infestation is very severe in young palms and if the bio control is not likely to be effective, spray the under surface of the fronds with dichlorvos 0.02% (Dichlorovos 100EC), malathion 50 EC 0.05 % (1ml/lt), quinalphos 0.05%, endosulfan 0.05% or phosalone 0.05%.

Note: Application of the insecticides should be followed by liberation of larval and pupal parasites from the 21st day.

• Root feeding with Monocrotophos 36 WSC 10 ml + water 10 ml in a 7 x 10 cm polythene bag.

276. What are the bio control methods for controlling black headed caterpillar?

- Larval parasitoid like Goniozus nephantidis, Brachymeria nosatoi (2nd & 3rd instance larvae) @ 1: 8 host Parasitoid ratio @ 3000/ha at crown region.
- Other larval parasitoids like Bethylid, Braconid, Ichneumonids & pupal parasitoid like Eulophid parasitoids periodically from January can be released to check the built up of the pest during summer.

277. What causes defoliation in coconut palm?

Slug caterpillar causes defoliation. The grubs are mostly found in sandy loam tracts of Kerala and Karnataka. It damages the roots. In seedling, it tunnels in to the bole and collar region. It has an annual life cycle with a grub period of 8 months. Peak grub population is observed from Sept. to Oct. Adult beetles emerge out of the soil after premonsoon showers in May-June during sunset hours.

278. How to identify the slug caterpillar?

- Greenish larvae & blackish grey larvae
- Dark brown cocooned pupae
- Adult moth with green wings or small greyish brown moth

279. How to manage slug caterpillar?

- Dichorvos 76 WSC 2 ml/lit
- Bacillus thuringiensis 2 g/lit,
- Triazophos 40 EC 5 ml
- Methyl demeton 25 EC 4 ml/lit
- Root feeding with monocrotophos 15 ml + 15 ml of water

280. What causes the tip of leaflets rolled?

Coconut skipper causes leaflets rolled.

281. How to control coconut skipper?

- Spray carbaryl 50 WP 2 gm/lit.
- Root feeding with monocrotophos 36 WSC @ 10 ml + 10 ml water at 45 days interval for 3 times for control of leaf caterpillar.
- Set up light traps to trap and collect adult moths
- Spray dichlorvos 76 WSC 2 ml / lit.

282. What feeds on the coconut leaf alone leaving stick and how to identify?

Leaf eating caterpillar feeds on leaflets leaving sticks. Their larvae are brown earlier and turn green later. Adults are dull white in color.

283. How to control leaf eating caterpillar?

- Spray carbaryl 50 WP 2 gm/lit.
- Root feeding with mono crotophos 36 WSC @ 10 ml + 10 ml water at 45 days interval for 3 times for control of leaf caterpillar.
- Set up light traps to trap and collect adult moths

• Spray dichlorvos 76 WSC 2 ml / lit.

284. What causes small irregular hole on leaves?

Bag worm causes irregular hole on leaves. Their larvae are found inside the conical bags constructed with silk and thread.

285. How to manage bag worm?

Same treatment as for leaf eating caterpillar

- Spray carbaryl 50 WP 2 gm/lit.
- Root feeding with mono crotophos 36 WSC @ 10 ml + 10 ml water at 45 days interval for 3 times for control of leaf caterpillar.
- Set up light traps to trap and collect adult moths
- Spray dichlorvos 76 WSC 2 ml / lit.

286. What causes premature nut shedding and root damage?

White grub causes premature nut shedding and root damage. Its other possible symptoms

are:

- Yellow leaves
- Delayed flowering
- Reduction in yield.

287. What cuts the coconut leaflets and roll them?

Suastus gremius causes one half of the leaflets are cut and rolled into a case. Their identification includes the following

- Larva: Smooth, green, tapering at either end with a constriction between head and body
- Adult: Chocolate brown with yellow spots on forewings

288. How to manage *Suastus*?

- Management is similar to bag worm and leaf caterpillar
- Collect and destroy the immature stages of the insects by conducting study (or neem compaign) wherever possible and spray carbaryl 50 WP 2 gm/lit.
- Root feeding with monocrotophos 36 WSC @ 10 ml + 10 ml water at 45 days interval for 3 times for control of leaf caterpillar.
- Set up light traps to trap and collect adult moths
- Spray dichlorvos 76 WSC 2 ml / lit.

289. How to identify the presence of white grub?

Presence of brown coloured beetles with striated wings shows the presence of white grubs.

290. How to manage white grubs?

- By use of trap crops like neem, Alianthus, Accasia or jusy by plantim neem twigs (with leaves) near coconut trees after rain to attract beetles.
- Light trap @ 1/ha
- Soil application of malathion 5 D or endosulfan 4D 25 kg/ ha at the time of planting (Treat the soil with phorate 10G @ 100 g/palm or drench with chlorpyrifos 0.04% suspension. The treatment should be given twice, first during April-May after the receipt of pre-monsoon showers and second during the month of September.-KAU)

291. How to control and prevent termite attack?

- Dip a cloth with neem oil 5% and tie it around the coconut tree trunk from base to a height of 2metres.
- Spray copper sulphate 1% or cashew nut shell oil 80% or spray chlorpyriphos @ 3ml/lit of water, neem oil 5% or NSKE 20% to preserve plaited coconut leaves from the termite attack
- Drench the nursery with 0.05% chlorpyriphos twice at 20-25 days interval Swab the affected trunk with the same chemical.

292. What is the reason for the appearance of white spots on the upper surface of the coconut leaves?

Lacewing bug is the reason for the appearance of white spots on the upper surface of the coconut leaves.

293. How to identify the lace wing bug?

- Nymph looks white with dark patch.
- Adult looks white coloured with netted venation on wing.

294. How to manage the lace wing bug infestation?

Spray any one of the following:

- Malathion 50 EC 2 ml/lit
- Dimethoate 30 EC 1 ml/lit
- Methyl demeton 25 EC 1 ml/lit
- Phosphamidon 40 SL 1.25 ml/lit
- Monocrotophos 36 WSC 1 ml/lit (0.01%.-CDB)
- Methomyl 25 EC 2 ml/lit
- Neem oïl 3%
- 295. What is the cause for round scales on the under surface of leaves along with yellowing of leaves on the upper surface in coconut palm?

Scale insects reside on the under surface of leaves and cause yellowing on the upper surface of leaves. They secrete wax in circular patches.

296. How to control the incidence of scale insects in coconut palm?

- Pluck mature nuts and spray monocrotophos 36 WSC @ 2 ml/ha. (or 1ml/ha)
- Do not harvest nuts for 45 days after spraying.

297. What makes the central leaves of coconut to become stunted and deformed together with button shedding?

Mealy bug makes the central leaves of coconut to become stunted and deformed together with button shedding.

298. How to manage the mealy bug attack?

Spray any one of the following:

- Malathion 50 EC 2 ml/lit
- Dimethoate 30 EC 1 ml/lit
- Methyl demeton 25 EC 1 ml/lit
- Phosphamidon 40 SL 1.25 ml/lit
- Monocrotophos 36 WSC 1 ml/lit (0.01%.-CDB)
- Methomyl 25 EC 2 ml/lit
- Neem oil 3%

299. How to control the pest palm civet?

Poison baiting with ripe banana fruit sandwiched with 0.5g carbofuran 3G granules.

300. How to identify the presence of rats in the field?

- Rats damage tender nuts
- They form a characteristic hole.
- Shed nuts are seen prominently at the base of the palm.

301. How to manage rats?

- Tree banding with inverted iron cones (Entry of rats on to the trunk can be prevented by fixing mechanical barriers upto 2m height from ground level using 40cm sized G.I. sheets) or Prosophis thorns.
- Baiting with bromodialone 0.005% at 10 g/tree at crown region twice at an interval of 12 days.
- Fumigate the hiding places using Aluminium phosphide tablets
- Place wax blocks containing the poison Bromodioline @ 30 blocks per ha (each weighing 10g) on 5 palms. Repeat after 12 days. Practice these two times for reducing rat population.

302. What brings the problem of deformed buttons with immature nut fall and gum exudation in coconut palm trees?

Coreid bug causes these symptoms. The cause characteristic cervices on husk below the perianth with gum exudation and tender nuts become barren.

303. How to control coreid bugs?

- Apply 0.1% carbaryl or endosulfan suspension on the newly opened inflorescence after the receptive phase of the female flowers and spray the entire crown excluding the leaves and older bunches in the afternoons.
- Tying perforated polybags (2 bags/palm) containing 2.5g phorate on to the stalk of inflorescence is also effective.

Note: The insecticide may be applied according to the severity of infection in a needbased manner.

304. How to control nematode infestation in coconut trees?

Among nematodes, Radopholus similis or **the burrowing nematode** damage the roots of coconut. This can be controlled with application of phorate @ 100 g/palm/year.

305. What are the major diseases of coconut?

- Bud rot
- Basal stem end rot or Tanjore wilt
- Root (wilt) disease, root rot disease
- Stem bleeding disease
- Mahali disease

306. What causes yellowing of heart leaves followed by decay and withering?

Infestation of Phytophthora palmivora causes bud rot. Its symptoms are yellowing of heart leaves, decaying and withering of the leaves. In adult palms, immature nut falls. Disease infestation occurs when monsoon humidity is high.

307. How to treat bud rot?

- Remove the affected tissue from the crown region and drench the crown in 0.25% copper oxychloride and also this is sprayed after the onset of monsoon
- Apply Bordeaux paste and protect it from rain till normal shoot arises. (To prepare 11 of Bordeaux paste, dissolve 100g of copper sulphate and 100g of quick lime each in 500ml of water separately and mix)

Note: this treatment is effective during May and September months.

308. What is the cause of rotting at the base of the trunk?

Ganoderma luciderm, a fungi causes the disease calls tanjore wilt or basal stem end rot. Its clear symptoms are

- Exudation of reddish brown liquid through cracks at the base of the trunk and oozing spread upward.
- Decaying of tissues at bleeding point
- Drooping of leaves.
- Bracket formation at the base of the trunk.

309. How to manage Tanjore wilt disease in coconut trees?

About 40 litres of 1% Bordeaux mixture should be applied as a soil drench around the trunk. This is a common method. Apart from these many cultural and chemical methods are found to effective.

310. What are the cultural methods and practices to eradicate Tanjore wilt?

- Apply *Pseudomonas fluorescens* (Pf1) @ 200 g/palm + Trichoderma viride @ 200 g/palm/year
- Apply 200g phosphobacteria and 200 g Azotobactor mixed with 50 Kg of FYM/palm
- Isolation trench around the tree, 4 ft away from the base of the trunk. Apply Sulphur dust inside the trench.
- Green manure crops must be raised and ploughed in situ
- Apply FYM 50kg + neem cake 5kg once in 6 months along with Fertilizers
- Rising of green leaf manure and insitu ploughing at the time of flowering.
- Apply organic manure @ 50 kg / palm.
- Apply neem cake containing Trichoderma @ 5 kg / palm / year.
- Reduce fertilizer application to one-fourth of the recommended dose.

311. What are the chemical methods to control the infestation of tanjore wilt disease in coconut?

- Aureofungin-sol 2 g + 1 g Copper sulphate in 100 ml water or 2 ml of Tridemorph in 100 ml water applied as root feeding. (The active absorbing root of pencil thickness must be selected and a slanting cut is made. The solution to be taken in a polythene bag or bottle and the cut end of the root should be dipped in the solution).
- Trunk injection / root feeding with Calixin 3ml/tree.
- Drench the basin with 40 litres of 1% Bordeaux mixture or tridemorph 0.1% or any other copper fungicide to soak soil up to 15 cm depth at quarterly intervals. (Drench the basin with 25 litre of 0.1% Calixin-CDB)
- Root feed with tridemorph 2 ml mixed with 100 ml water at quarterly intervals.(Root feeding with Calixin (2ml in 100ml water) once in 3 months.-CDB)

312. What causes the tapering of terminal portion of the coconut trunk combined with reduction in leaf size?

Root wilt disease causes the above symptom. Other symptoms includes tapering of terminal portion of the trunk, reduction of leaf size, ribbing and flaccitation of leaflets, yellowing of older leaves, necrosis of leaflets, detoriaion of decay of root system.

313. How to manage root wilt disease in coconut trees?

Remove the affected palms and follow the recommended dosage of fertilizers as a precautionary measure for root wilt disease along with proper irrigation.

- Grow green manure crops cowpea, sunnhemp, Mimosa invisa, Calapagonium mucanoides, etc can be sown in the coconut basins during April May and incorporated during September October.
- Irrigate coconut palms with atleast 250 litres water in a week.
- Adopt suitable inter/mixed cropping in coconut gardens.
- Provide adequate drainage facilities.

314. What causes the grey leaf spot on mature leaves?

Pestalosia palmivora causes grey leaf spot /leaf blight. Its symptoms includes

- Minute yellow spots encircled by grayish bands appear on the surface of mature leaves of the outer whorl.
- Later they become grayish white. These spots coalesce into irregular necrotic patches.
- Complete drying and shriveling of the leaf blade are common when the infection is severe.

315. What are the control measures to safeguard coconut trees from leaf blight disease?

- Removal of the older disease affected leaves, burn them and spraying the foliage with 0.25% Copper oxychloride will check the spread of the disease. -TNAU
- Spray the trees with 1% Bordeaux mixture or propiconazole 0.3%. KAU
 - **316.** What causes stem bleeding in coconut trees?

Thielaviopsis paradoxa causes stem bleeding. Exudation of reddish brown liquid occurs through cracks especially at the basal part of the trunk and bleeding patches higher up in the trunk.

317. How to control stem bleeding in coconut trees?

- Chisel out completely the affected tissues and paint the wound with tridemorph 5% or Bordeaux paste. Apply coal tar after 1-2 days. . Burn off chiselled pieces.
- Destroy the chiseled materials by burning. Avoid any mechanical injury to trunk.
- Along with 50kg organic manure, apply 5kg neem cake containing the antagonistic fungi, Trichoderma culture to the basin during September.
- To avoid spread of disease on to upper portion of trunk Root feed with tridemorph 5% (5% Calixin (5ml in 100ml water)-CDB), thrice a year during April-May, September-October and January-February to prevent further spread of lesions.
- Apply tridemorph @ 25 ml in 25 litre of water as soil drenching once in four months. -KAU)
- Provide adequate irrigation during summer and drainage during rainy season.
- Coconut stem boring insects like Xyleborus, Diocalandra should be controlled by applying Carbaryl 50% WP on the trunk @ 3g per litre water.

318. A combination of shedding of female flowers and shedding of immature nuts occurs in coconut. What is the reason for this abnormality?

Mahali or Fruit-Rot and Nut-Fall cause these symptoms and this disease is caused by the fungus Phytophthora palmivora. Clear symptoms are

- Dropping of the buttons, before and after fertilisation and of young and nearly mature nuts in large numbers is the chief symptom of the disease.
- Near the fruit stalks, a discoloured area is developed which will appear at first watersoaked and darker green than the rest of the surface of the nut.
- In course of time, these lesions turn brownish and appear as depressions due to the decay of the underlying tissues. The fungus appears as a whitish matty growth on the surface.

- The rot extends into the husk and often into the kernel cavity.
- It is usually virulent after the rains of the S.W monsoon when the atmospheric humidity is high.

319. How to control Mahali disease in coconut?

- Spray 1% Bordeaux mixture or copper oxychloride preparation (0.5%) on the crown of palms, once before the monsoon and once or twice later on at intervals of 40 days.
- Remove and destroy fallen nuts.
- In dwarf palms, apply Dithane M-45 in place of Bordeaux mixture- KAU.

320. What causes leaf rot in coconut trees?

Fungal attack (*Colletotrichum gleosporides, Exerohilum rostratum, Fusarium* sp.) causes leaves to rot. Infected plants shows water soaked brown lesions in the spear leaves. When the rotten leaves unfurls the rotten portions of the lamina dries and gets blown off.

321. How to manage leaf rot in coconut trees?

- Remove the rotten portions from the spear and the two adjacent leaves.
- Pour fungicide solution of Hexaconazol (Contaf 5E) 2ml or Mancozeb (Dithane M45/Indifil M45) 3g in 300ml water per palm to the base of spindle leaf. 2-3 rounds of spraying is sufficient in case of mild infection.
- Treat the top two leaf axils with insecticide preparation. This can be prepared by mixing phorate 10 G / sevidol / carbaryl 20 g with 200 g sand (Apply 20g Phorate 10G mixed with 200g fine sand around the base of spindle leaf. –CDB)
- Spray crowns and leaves with 1% Bordeaux mixture or 0.5% copper oxychloride formulations or 0.4% Mancozeb in January, April-May and September. While spraying, care has to be taken to spray the spindle leaf. –KAU)

322. What makes the emerging leaves of coconut to become short and crinkled along with necrosis at leaf tips?

Crown chocking causes these symptoms.

- Clear symptoms are characterised by emergence of shorter leaves with fascinated and crinkled leaves.
- The leaflets show severe tip necrosis and fail to unfurl. In many cases, it gives a choked appearance to the frond.
- Ultimately the affected palm dies.

323. How to control crown choking?

Application of 50 g Borax at half-yearly intervals (Feb-Mar and Sept-Oct) along with recommended fertilizer in the basins will control the disease when it is in the early stage. In root wilt affected areas a dosage of 200gm - 300gm per palm per year is recommended.

324. In coconut what can cause the combination of disorders like yellowing of leaves with stunted leaf growth?

Plants that are deficient in nitrogen show these symptoms. Plants are stunted and generally yellow with lower leaves being most affected. Older leaves are golden yellow colour.

325. How to treat nitrogen deficiency?

Foliar application of 2% urea thrice at fortnightly interval or soil application of 1-2 kg urea / tree will help to overcome the defects due to deficiency of nitrogen.

326. What can cause the coconut leaf to become reduced in number, size and growth?

Deficiency on phosphorus causes these symptoms.

327. How to treat phosphorus deficiency?

Foliar spray of DAP 2% twice at fortnightly interval or soil application of FYM 5 kg/tree

328. Leaves appear yellow with brown spots the margin. What is the reason for this defect in coconut trees?

Potassium deficiency possibly creates these symptoms. Symptoms first appear on oldest leaves and later spread to young leaves.

- leaflets turn necrotic with yellow or orange spots
- mottling of leaf
- Leaflets with necrotic areas along the margins which later withers. The midrib remains alive.

329. How to treat the coconut trees with potassium deficiency?

Application of resin coated K_2SO_4 @ 3.4 kg/tree, four times a year along with 2 kg MgSO₄ / tree could eradicate the potassium deficiency.

330. What makes the copra to become rubbery in a combination with necrosis and death of leaflets?

Sulphur deficiency causes uniform yellow or orange leaves with necrosis resulting in death of leaflets and leaf tips. Arching of leaves and tend to bend and hang down ward. Nut production reduced with rubbery copra.

331. How to treat sulphur deficiency?

Soil application of gypsum 2-3 kg/tree/year can very well solve the problem of the deficiency of sulphur.

332. What causes new leaves to become necrotic in coconut trees with reduction in leaf size?

Iron deficiency can bring such symptoms in coconut plantations.

333. How to treat the deficiency of iron in coconut trees?

Application of FeSO₄ 0.25 to 0.5 kg/tree/year can reduce the problem of iron deficiency in coconut trees.

334. What makes the coconut trees to show the little leaf symptom with serrated leaf margin?

Boron deficiency is the cause for the problem of little leaf symptom. Its symptoms can also be as follows

- Leaf wrinkling and distortion
- Necrotic inflorescence

- Leaves fail to open properly
- More severe leaf distortion

335. How to manage Boron deficiency?

Soil application of borax 0.2 to 0.5 kg /tree/tear or foliar spray of borax 0.2% can subsidise the problem of boron deficiency.

336. What causes the abnormal growth of the young leaves and the death of bud in coconut trees? How to treat it?

Calcium deficiency in coconut trees causes death of bud. Application of gypsum 2-5 kg/tree/year could rectify the problem of deficiency.

337. What causes the yellowing of older leaves with bronzed, dry appearance in coconut?

Magnesium deficiency causes these symptoms and other possible symptoms are

- Broad light yellow band occurs along the margin of older leaves.
- Leaflets show necrosis and turn reddish brown with translucent spots yellowing starts at the tip and spreads to the base. Older leaves become bronzed and dry appearance.

338. How to treat magnesium deficiency in coconut trees?

Application of gypsum 2-5 kg/tree/year can treat the deficiency of magnesium in coconut trees.

339. What are the abnormalities caused in coconut trees due to improper planting depth?

Palms planted too deeply usually exhibit symptoms of root suffocation such as Chlorosis from Fe or Mn deficiency, wilting or shrivelling of the trunk, reduced canopy size, root rots, and ultimately death. Palms stressed from deep planting are also more attractive to boring insects. Deep planting results in reduced root zone oxygen levels planting of palm seedlings in containers as little as 1 inch too deep can result in chronic Fe deficiency symptoms and reduced growth rate. In shallow planted palms, newly emerging adventitious roots arising from the base of the stem axis are exposed to dry air. Always one must plant large palms such that the swollen base of the stem is about 1 inch below the soil line.

340. What are the harvest and post harvest practices followed for a coconut tree?

Harvest 11-12 months old fully matured nuts at an interval of 30-45 days depending on the yield level of the garden. For household use keep the nuts in vertical direction. Dry copra either by sun drying or by using copra dryers. Store the copra at 5-6 % moisture content. Store the copra in polythene tar coated gunny bags.

341. What are symptoms of water deficiency?

Typical water stress symptoms include reduced growth and necrosis of leaflet tips, spreading to the entire leaf as severity increases. Oldest leaves are usually the first to show symptoms, but eventually newly emerging leaves may also wither and die. Death of the meristem or bud may follow. Water stress in some species is indicated by leaflets folding about the midrib or wilting. In mature palms, shriveling or collapse of the trunk may also occur. Water stress occurs when water is limiting or the root system is incapable of taking up sufficient water.

342. How to rejuvenate an existing coconut garden?

Rejuvenation of existing garden:

The low yield in vast majority of gardens is due to thick population, lack of manuring and irrigation. These gardens could be improved if the following measures are taken.

Thinning of thickly populated gardens:

In the farmer's holdings where thick planting is adopted, many trees give an yield of less than 20 nuts/palm/year. By cutting and removal of these trees, the yield could be increased. Besides, there is saving in the cost of cultivation and increase in net profit. After removal of low yielding trees, the populations should be maintained at 175 palms/ha.

Ensuring adequate manuring and irrigation:

The yield can be increased in the existing gardens when manuring + irrigation + cultural practice is adopted as per recommendation.

343. How to overcome the micronutrient deficiency (pencil point disorder) in coconut trees?

Along with the recommended fertilizer dose, 225 g each of Borax, Zinc sulphate, Manganese sulphate, Ferrous sulphate, Copper sulphate and 10 g of Ammonium molybdate may be dissolved in 10 litres of water and poured in the basin of 1.8 m radius. This disorder can be corrected if noticed early. Severely affected palms may be removed and replanted with new seedlings.

344. What are the possible causes for button shedding in coconut palm?

Shedding of buttons and premature nuts may be due to any one of the following reasons:

- Excess acidity or alkalinity
- Genetic causes like Defects in pollination and fertilization, Structural defects in the flower, Abortion of embryos, . Limited capacity of the tree to bear fruits Lack of nutrients
- Lack of pollination
- Hormone deficiency
- Pests
- Diseases
- Soil and climatic variations
- Unfavourable conditions such as deficit of moisture, water logging and lack of aeration.

345. How to rectify the problem of soil pH in a coconut garden?

Excess acidity or alkalinity of soil may cause button shedding. If the soil pH is less than 5.5, it is an indication of excess acidity. This could be rectified by adding lime. Increase in alkalinity is indicated by soil pH higher than 8.0. This situation could be rectified by adding gypsum.

346. How to manage young coconut garden under water logged conditions?

Lack of drainage results in the roots of coconut trees getting suffocated for want of aeration. Shedding of buttons occur under such condition. Drainage channels have to be dug along the contours to drain the excess water during rainy season.

347. How to avoid button shedding due to stagnation of water?

A trench between two rows of young coconut palms should be dug during onset of the monsoon rains. The size of the trench is 3 m width, 30 - 45 cm depth to entire length of field. The soil excavated from the trench should be placed along the rows of palms to make a raised bed. Form mound around the young palms to a radius of 1.2 m width with height of 30 -45 cm.

348. Why button shedding occurs even after proper management practices?

In some trees button shedding may persist even after ensuring adequate manuring, irrigation and crop pest and disease management. This is an indication of inherent defect of the mother palm from which the seed material was obtained. This underlines the need for proper choice of superior mother palm for harvesting seed coconut to ensure uniformly good yielding trees.

349. How to manage the nutrient supply to coconut trees as a measure to prevent button shedding?

Button shedding occurs due to inadequate or lack of manuring. The recommended dose of manurial schedules and proper time of application are important to minimise the button shedding. Apply extra 2 kg of muriate of potash with 200 g of Borax/palm over and above the usual dosage of fertilizer to correct the barren nuts in coconut for period of 3 years.

350. Are there any suggestions for hormonal sprays for coconut tress to prevent button shedding? How deficiencies of hormones affect coconut trees?

The fertilised female flowers i.e., buttons shed in some cases. By spraying 2, 4- D at 30 ppm or NAA 20 ppm (2, 4-D 30 mg or NAA 20 mg per litre of water) on the inflorescence one month after opening of the spathe, the setting percentage could be increased.
351. How to identify rhinoceros beetle?

- Egg: oval creamy white egg in mature pits or decaying vegetable matter at a depth of 5 to 15 cm.
- Grub: Grub is stout, sluggish, white "C" shaped with pale brown head and found at a depth of 5 to 30 cm.
- Pupa: grub pupates in earthen cells at a depth of 0.3 to 1 m.
- Adult: Adult beetle is stout, brownish black or black and has a horn projecting.

352. What are the minor reasons for button shedding and how to manage it?

• Pests

Button shedding may happen due to the attack of bug. Spraying of systemic insecticides like Methyldematon 0.025% (1ml/lit) or Dimethoate 0.03% (1ml/lit) may reduce the occurrence.

• Diseases

Button shedding also occurs due to disease incidence such as basal stem rot. Adoption of control measures suggested for the disease reduces not only spread of the disease but also prevents shedding of buttons.

• Lack of pollination

Button shedding also occurs due to lack of pollination. Setting up of beehives @ 15 units/ha may increase the cross pollination in the garden. Further the additional income obtained through honey, increases the net profit per unit area.

Coconut Processing

353. What is India's position in coconut production?

India is the third largest coconut producing country of the world with an area of about 1.12 million hectares contributing to 18% of world production. India produces about 6000 million nuts annually.

354. What does the whole coconut consist of?

A whole coconut consists of 50% husk, 15% shell, 25% meat and 10% water.

355. Mention some common uses of coconut?

• Coconut water is a refreshing drink which also hygienic and nutritive.

- The white flesh is a calories rich extensively used for cookery in South India.
- The dried coconut meat, known as copra is the source of coconut oil, which is used in enormous quantities for making fats for baking and confectionery.
- The residual cake after the oil has been extracted is used as cattle food.
- Desiccated coconut is an important product used in the chocolate and confectionery industry.

356. What is oil content in copra?

65 to 72%

357. Explain the traditional method of oil extraction?

The coconut oil is traditionally extracted from copra. The copra can be obtained by separating the coconut meat from the whole coconut shell followed by sundrying and smoke drying for about 6 to 8 days. The copra is then chopped to small sizes and cooked by heating the small pieces of copra in a cooker for about 30 mins. The oil is squeezed out from cooked copra by an expeller and then filtered by a filter press.

358. Explain the mechanical extraction of coconut from the fresh coconut meat?

The processes and operations involved in modern mechanical expression of coconut is given below. The coconut shells are cracked and the coconut meat is separated. The fresh coconut meat is chopped and sliced into thin flakes of the desired size. The thin flakes of coconut meat are cooked in a cooker by heating them at an elevated temperature for 90 mins. The oil is expelled from the heat treated cooked coconut meat (at a temperature of about 70 0 C) in an oil expeller. The oil is stored in an air tight container in a dark cool and dry place for a log and safe storage. The deoiled cake obtained from this process is suitable for human consumption.

359. Name the value added products of coconut?

- Desiccated coconut
- Coconut kernel or white meat
- Nata-de-coco
- Dehydrated sweet coconut
- Dehydrated coconut chutney
- Coconut milk

- Coconut crisps
- Coconut chips
- Roasted young coconut
- Honey roasted coconut
- Coconut lemonade
- Coco sauce
- Coconut honey
- Coconut syrup
- Sweetened condensed coconut milk
- Coconut candy
- Coconut milk powder
- Coconut flour
- Tender coconut water concentrate
- Coconut jiggery
- Coconut vinegar
- Coconut cookies
- Ready to use Burfi mix
- Ready to use coconut chutney mix.

360. What is coconut honey?

Coconut honey is a product from coconut water containing many growth promoting trace elements besides glucose, fructose and levulose. Coconut water was filtered, evaporated and blended with a little golden syrup to produce coconut honey, a palatable nutty flavored breakfast food, soft drinks additive and a sweetener.

361. What is coco sauce?

A tangy sauce can be prepared from coconut water with red chilli, onion powder and little vinegar.

362. How is coconut lemonade prepared?

It was prepared by boiling coconut water, sugar and lemon juice. It is traditionally a popular drink in Kerala.

363. How is Nata-de-coco prepared?

Nata from fresh liquid endosperm of the matured coconut was collected and filtered by using cheese cloth. It was pasteurized after adding 8 per cent sucrose, 0.5 per cent ammonium sulphate and adjusting the pH to 4.5 by adding acetic acid. The medium was developed by inoculating *Acetobacter acetii* at 10 per cent and incubated at room temperature for about two weeks. After two weeks a gel like mass developed with a film like layer on the top. The film was then removed and the mass was cleaned and cut into cubes. The cubes (nata) were further processed to improve the colour, flavour and taste by soaking it in sugar syrup. The nata can be used to decorate desserts, ice cream, puddings and fruit salad.

364. How is preservation and pickling of coconut done?

The preservation and pickling of coconut was done by soaking the coconut kernels in brine solution maintained their colour, flavour, texture and taste and resembled like fresh coconut for 90 days. The salt and acid penetration in pickle is directly proportional to the concentration in the soak solution. The steeped coconut kernel were kept for 90 days under study, in which there was a remarkable reduction in reducing sugar, total sugar and free fatty acid content was increased gradually. The moisture content after storage ranged between 38.05 and 38.61 per cent.

The fresh coconut kernel could be preserved as long as for 3 to 6 months in the from of pieces and scrapings by steeping in a solution containing 4 per cent salt, acetic acid, sulphur dioxide and antioxidant. The product required washing in water prior to use.

365. What is desiccated coconut?

Desiccated coconut is the disintegrated, white kernel of coconut processed under strict hygienic conditions and dried to a moisture content of below 3.0 per cent. It is a food product which is ready and fit for direct human consumption.

366. How is desiccated coconut manufactured?

Desiccated coconut, a commercial product was manufactured from the white part of the meat after removing the brown parings. The meat was shredded or disintegrated and dried in hot air driers at 140-170°F to 2 per cent moisture content and used in the manufacture of cakes, pastries and chocolates.

367. What are the grades of desiccated coconut?

It is available in coarse, medium and fine grades and also in special grades such as threads, strips, granules etc. Good desiccated coconut is crisp, snow white in colour with a sweet, pleasant and fresh taste of coconut kernel.

368. How is matured coconut kernels processed?

The matured coconut kernels were steam blanched and soaked in sugar syrup of 30° brix for a period of 48hrs. The drained pieces were sulphited for 20 min and dried in the cabinet drier at a temperature of 60° C for 8 h.

369. How is desiccated coconut powder used commercially?

- Desiccated coconut powder (2%) was used in the preparation of mango bar, which increased the percentage of protein.
- Desiccated coconut powder was used in the preparation of ragi based convenience mixes viz., sweetened and spiced mix.

370. How is dehydrated coconut (savoury) prepared?

The dehydrated coconut (savoury) was prepared by soaking the blanched coconut scrapings in the soak solution containing 1.0 per cent salt, 1.0 per cent acetic acid and 250 ppm of SO₂ without antioxidant (T₁) and with antioxidant (T₂) for 24 hr and dried in the cabinet drier at 60° C for 4 to 5 hr (upto 4.0 % moisture).

371. How are treated and dehydrated coconuts samples packed and stored?

The treated and dehydrated coconut samples were packed in 300 gauge polyethylene bag without vacuum and with vacuum and stored at room temperature to observe the storage behaviour.

372. What are coconut chips?

Coconut chips, the thinly sliced crispy coconut meat which may be sweetened or salted and may come in handy as a ready -to- eat snack food.

373. How is coconut chips prepared?

It was prepared by slicing the coconut meat of eleven to twelve month old nuts thinly into strands, soaked in syrup, drained and dried in a dryer or oven.

374. What are coconut crisps and how is it prepared?

Coconut crisp is prepared from the young coconut endosperm of nine to ten month old nuts. It is white in colour, has pleasant coconut flavour and does not leave any fibrous feeling after taste. It was processed by slicing the meat into 0.6-0.7mm thickness, blanched in boiling water, cooked in light syrup and then dried which is considered as a high energy food and of a good quality product.

375. What is roasted young coconut?

Roasted young coconut was prepared by a process in order to sweeten its water and tender meat as well as to enhance their flavour.

376. How is roasted young coconut processed?

The process consisted of preliminary steps and the nuts were boiled in a solution (2% sodium meta bi- sulphite) for 20 min, dried and burnt for finishing touch and it was exposed to the fire for a minute or until the shell itself showed signs of burning. The fruit was kept at room temperature for 3 days or in the refrigerator for larger storage.

377. What is honey roasted coconut and how is it prepared?

Honey roasted coconut, a sweet, thinly sliced crispy coconut meat, eaten as a snack food. Sliced matured coconut meats was mixed with honey sugar, margarine, sweeten condensed skim milk, molasses and salt and dried in oven for half an hour. Then it was agitated frequently for 15 min until it become crispy, cooled and packed.

378. How is dehydrated sweet coconut prepared?

Young coconut meat was used for preparation of dehydrated sweet coconut. The coconut meat was washed with water and then soaked in coconut water, again washed with clean water. The meat was cut into pieces mixed with refined sugar and water in the ratio of 6:3:1 and boiled for 1 h or until it is dried, cooled and packed.

379. What is the shelf life of dehydrated coconut chutney?

The product had a shelf life of 3 months at 37°C and 6 months at ambient temperature when packed in flexible pouches.

380. What is coconut milk?

Coconut milk refers to the milky fluid, freshly extracted from the coconut kernel with or without added water and coconut cream to the high-fat cream-like material obtained from the coconut milk by either gravitational separation or centrifugation.

381. How is coconut milk prepared?

Coconut milk was prepared by blending skim milk powder with coconut milk obtained from freshly grated coconut and pasteurized at 70-72°C for 10min.

382. What is the composition of coconut milk?

It contains 6 percent skim milk powder and 9.65 percent total solids (Agrawal, *et al.* (1991).

383. How is fermented beverage concentrate prepared from coconut skim milk?

Fermented beverage from coconut skim milk using different combinations of coconut skim milk and non-fat dry milk and the culture used was *Lactobacillus bulgaricus*. Based on sensory evaluation, 50 per cent of coconut skim milk: 50 per cent of non- fat dry milk ratio was the most acceptable formulation. The ready-to-drink fermented beverage concentrate (diluted at 1:3) contains protein (1%), fat (0.74%), sugar (18.70%) and water (79.25%). The fermented beverage concentrate was found to be stable even after 2 months of storage and coconut skim milk can be utilized successfully for the processing of cultured milk.

384. What is coconut cream?

Coconut cream, a concentrated form of coconut milk, which is a convenient product prepared from mature and fresh.

385. What is the shelf life of processed and packed coconut cream?

Coconut cream, the concentrated milk extracted from fresh matured coconuts can either be used directly or diluted with water to make various curry preparation, sweets, desserts, puddings etc. Processed and packed coconut cream had a shelf life of six months and once opened it should be stored in refrigerator for subsequent use.

386. What is coconut syrup and how is it prepared?

Coconut syrup, a translucent, free-flowing liquid was prepared by cooking coconut milk with an equal amount of refined sugar and di-sodium-phosphate equivalent to 0.25 per cent of the volume of the milk, until the mixture attained a TSS content of 68-70 per cent. The hot mixture was poured in sterile containers and sealed hermetically.

387. How is coconut syrup commercially used?

It was used as a topping for bakery products or as a mixer in alcoholic drinks or may be diluted in water and used in cooking rice cakes and other delicacies.

388. What is coconut honey and how is it used?

Coconut honey is viscous, free-flowing syrup, similar to coconut syrup but less creamy and less nutty in flavour was used as topping for pancakes and waffles.

389. How is coconut honey prepared?

One part of skim milk was mixed with ½ part of refined sugar and ½ part of glucose, and then blended with sodium alginate at 0.5 per cent as stabilizer. Coconut cream may be added to improve the flavour of the product. The mixture was heated for 15 minutes, homogenized and cooked with constant stirring in steam-jacketed kettle to a TSS of 75 per cent. It was poured hot into sterile containers and then sealed hermetically.

390. How is sweetened condensed coconut milk prepared and packed?

Coconut skim milk was used in the preparation of sweetened condensed coconut milk. Powdered dairy skim milk was added for protein fortification and other ingredients were corn oil, coconut cream and sugar. The skim milk was first pasteurized for 30 mins at 80-90°C and mixed with other ingredients. The mixture was blended or passed through a colloid mill, and heated in a steam jacketed kettle with constant stirring to a TSS content of 68%. It was packed hot in sterile tin cans and cooled immediately in cooling tanks.

391. How is coconut candy prepared?

Coconut candy was prepared from grated coconut meat mixed with coconut milk. The grated coconut was moistened with a portion of the milk. The remaining milk and the molasses were poured in a cooking pan, and the mixture was heated to boiling. Refined sugar was added and the mixture was cooked until it gets hardened when dropped into cold water. It was then poured in butter-greased pans, allowed to cool slightly, cut into desired sizes and individually wrapped in cellophane sheets.

392. How is coconut milk powder prepared?

Coconut milk powder was prepared by dehydrating the milk under controlled conditions. The composition of the milk was adjusted with fat percentage in the range of 50-60 per cent of the total solids. The emulsifiers and stabilizers were also added to the formulation. The most crucial step was the dehydration stage for which spray drier was employed at high temperature (around 180°C). Instant dehydration takes place converting each tiny droplet into microcapsules with fine droplet of the oil inside.

393. What is coconut flour and how is it used commercially?

Coconut flour is a unique product prepared from coconut residue. Coconut flour, a by-product in the processing of coconut milk, can provide not only value-added income to the entrepreneurs but also a nutritious and a healthy source of dietary fiber for the consumers. It can be used as fillers, bulking agents and substitute for wheat flour, rice flour and potato flour at certain levels and incorporated into various food products like baked products, snack foods, steamed and extruded products.

394. What is "Sapal" and what are its health benefits?

One by-product of coconut is the "sapal" from coconut meal, taken after extraction of the coconut milk. The "sapal" was made into coconut flour which contains dietary fibre. The utilization of coconut sapal may have some health benefits and may encourage the industry to produce value added products or functional foods which may help in the proper control and management of chronic diseases. This offers scope for utilization of coconut flour as a dietary component for diabetes. Low-fat, high fibre coconut flour, a unique product from sapal is a good source of dietary fiber. It is comparable with other cereal flour in terms of carbohydrate, fat and energy content and a good ingredient in nutraceuticals.

395. How is coconut water concentrate prepared?

Coconut water concentrate was prepared using fresh coconut water collected under hygienic condition. Suspended solids and oil in the samples were removed by means of three way centrifuge. The removal of the solids and oil was necessary in order to minimize fouling of the membranes. The salts present in coconut water may be removed if desired, prior to concentration, to produce a very sweet product. This is achievable by passing the centrifuged coconut water through a mixed-bed ion exchange resin. The concentrate can be frozen or preserved in cans and used as base for the production of carbonated and non-carbonated coconut beverage.

396. How is crystallized fruit prepared and commercially used?

Crystallized fruit was prepared using candied fruit coated with sugar or sugar crystals and allowed to deposit on it. Crystallized candy made with tender coconut kernel can be consumed as a snack.

397. Which coconut product can be used as a dessert?

Tender coconut kernel in sugar syrup can be used as a dessert or incorporated in ice cream, custard or pudding.

398. What is coconut jaggery and how is it prepared?

Sweet toddy if carefully collected in sterile glass vessels remains unfermented for a considerable time. It can be strained and boiled down to the crystallizing point, to obtain 12-15 per cent jaggery with nutritional and medicinal value. The reducing sugars and minerals made it more nutritious and health friendly.

399. What is coconut vinegar and how is it produced?

Vinegar was produced from fermenting coconut toddy and was commonly used in the preparation of fish and meat dishes. If toddy was fermented for more than 24 hours and acidification was done for 10-14 weeks and the resultant was coconut vinegar.

400. What are the ingredients in ready to use Burfi mix?

Dehydrated coconut scrapings	100g
Powdered sugar	150 g
Cardamom powder	2g

401. How is ready to use Burfi mix prepared?

The dehydrated coconut scrapings were powdered coarsely using mixie. The powdered sugar and cardamom were added to the coarsely powdered coconut and mixed thoroughly.

402. How is ready to use coconut chutney mix prepared?

Dehydrated coconut scrapings, roasted Bengal gram, ginger, garlic, green chillies, curry leaves, tamarind and salt were ground to get uniform slurry. The prepared slurry was seasoned in oil with mustard and curry leaves. The seasoned chutney was dried at 60° C for 6 h in a cabinet drier. For rehydration, 60 ml of water was added to the ready-to-use coconut chutney mix and allowed to stand for 2 minutes.

403. How can I convert coir pith into coir pith compost? How coir pith compost is made?

Coir pith is a ligno cellulolitic product and which is highly resistant to biological de composition. The C: N ratio of coir pith is usually more than 1:100. coir pith can be composted by using basidiomycites fungi such as pleurotes. Normally composted coir pith contains 1.06 per cent nitrogen, 0.06 per cent phosphorous and 1.2 per cent

potassium and micronutrients like magnesium (0.48 per cent), calcium (0.5 per cent), manganese (20 ppm) and zinc (15 ppm).

404. Normally coconut leaves used for thaching last only for 1-2 years. Are there any methods to increase the life span of coconut leaves used for thatching?

The Regional Research Laboratory at Thiruvananthapuram has standardised a simple process to extend the life of coconut leaf thatch upto four years. The process involves dipping plaits of coconut leaves for 5 minutes in copper sulphate (1kg copper sulphate in 100 litre water for 100 plaited leaves), draining out excess solution and stacking them overnight, followed by spraying with cashewnut shell liquid (3kg CNSL + 1/2 kg kerosene) and then subjecting it to sun drying for 3-4 days. The treatment costs more than about 50 per cent of the initial cost for thatching but it is economical because of durability and no recurring expenses for next four years.

405. What is dehydrated coconut ? How is it manufactured? Can it be used

for culinary purposes?

Dehydrated coconut meat in the grated or shredded form is desiccated coconut. The process of preparation involves shelling, paring, disintegrating, drying, sieving and packing. The desiccated coconut is used in confectionery and other food industries. It could also be used in the households for culinary preparations as a substitute to grated fresh coconut. ISI standard for desiccated coconut has been specified under IS:966-1975 and is as follows :

Moisture percent by mass maximum - 3.0 Fat, percent by mass minimum - 65.0 Fat, acidity as lauric acid, maximum - 0.3

406. What are the ingredients in coconut cookies and how is it prepared?

Ingredients:

Flour	60 g
Sugar	30 g
Shortening	60 g
Coconut powder	30 g
Cherry	25 g

Method of preparation:

- 1. Sieve the flour
- 2. Placed all the ingredients in a bowl except cherry and kneaded well
- 3. Made small balls and placed it on a greased tray one inch apart.

- 4. Placed a piece of cherry above the ball.
- 5. Baked at 275 ⁰F for about 12-20 minutes.

407. Fresh Tender coconut water often resembles that of a carbonated water. While it is not so from water from mature nuts. Why?

The appearance of effervescence in the water on the opening of a tender nut is common. The water of the young fruits is under hydrostatic pressure, which might facilitate the dissolution of CO2 in the water. Depletion of water on maturation causes an empty space into which the gases escape. Thus, the cavity of a mature fruit is no longer completely filled and ripe fruits splash when shaken

408. What is the shelf life of coconut oil?

Refined coconut oil should last 1½ years without showing signs of rancidity. A properly purified unrefined coconut oil will keep much longer than refined oil and this applies to other vegetable oils as well. Unrefined oils contain natural anti-oxidant agents, which protect the oil against atmospheric oxidation and rancidity. However, if the crude (unrefined) oil is of poor quality and has impurities and moisture, it will undergo hydrolysis which in turn increases the free fatty acid content. The result of this is deterioration of taste and flavour.

409. How many nuts are required to produce one ton of copra?

This may be depending upon the size and weight of the nuts. Compared to an estimated world average number of 4,500-5,000 nuts required for one ton of copra, this figure for India is about 6,800.

410. Are there any special coconut varieties suitable for toddy tapping?

Laccadive ordinary variety is reported to be good for toddy tapping. Under field conditions, the average toddy output per palm per day is about one litre.

Implements and Machinery

411. What is the approximate cost of coconut tree climbing machine?

The coconut tree climbing machine sold in TNAU costs around Rs.2000/-

412. How many trees can be climbed in one day using the cconut tree climbing machine?

50-60 trees can be climbed in a day.

413. How many holes can be dug using a auger digger in an hour?

The power tiller operated heavy duty auger digger can dig 23-30 holes in an hour.

414. What is the approximate cost of tree sprayer?

The approximate cost of tractor mounted tree sprayer will be around Rs. 45,000/-Miscellaneous

415. At what stage of the formation of the nut it produces he shell?

The shell begins to form during the fourth month after pollination.

416. What is a Thairu thengai or curd coconut?

Some palms have an abnormal type of endosperm that almost fills the total shell cavity. Instead of hard, crispy endosperm and water, there is an outer portion which is a white and soft substance viscous, somewhat and a transparent liquid Such nuts are called Makapuno in the Philippines ('filled coconut'), Kelapa Kopjor in Indonesia, or Thairu Thengai ('curd coconut') in India and Dikiri-pol in Sri Lanka. Makapuno is the most frequently used name. The Makapuno endosperm has a peculiar taste. It is considered a delicacy in all countries where it occurs. Various sweets and ice-cream are prepared from it, but it is also consumed fresh, or mixed with some syrup as a drink. Such nuts fetch higher prices than ordinary nuts. The palms cannot be recognized from other palms by eye. Not all nuts of a Makapuno palm are of the Makapuno type, usually only one or two in each bunch. These nuts can be recognized by shaking them, as they do not make the splashing sound that normal nuts do.