THE MALAYAN DWARF COCONUT

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Studies on the yield performance and fruit analysis of green, yellow and red forms of Malayan Dwarf and of green and orange forms of Chowghat Dwarf indicate that Chowghat Dwarf is different from Malayan Dwarf. Nut and copra characters of Malayan Dwarf yellow and red forms studied and those reported from other countries show considerable variation between them. Nut and copra characters of individual palms of Malayan Dwarf yellow studied also show variation between palms. On the basis of fruit analysis the palms of Malayan Dwarf yellow have been classified into four groups. The variation between palms is likely to result in the variable performance of Dwarf x Tall hybrids produced from them.

Introduction

Dwarf coconuts are known to occur in most of the coconut growing countries. Among the different cultivars of dwarf cocounts, Malayan Dwarf coconut is extensively planted in countries where there is fair distribution of rainfall because of its early bearing nature, short stature and easy accessability for harvest. The Malayan Dwarf race known as "Nyior Gading" is reported to have originated as a sport or mutant in Java [Handover 1919]. It is generally supposed that they were first introduced into Malaya between 1890 and 1900 [Anon, 1938]. Jack and Sands [1922] described the chief characteristics of these dwarf forms and compared them with King Coconut of Sri Lanka and Coconino of Philippines and found them to be quite distinct. They [1929] have recorded their observations on the performance of these dwarfs and compared their production with those of tall palms in Malaya Marechal [1928] compared Malayan Dwarf introduced into Fiji in 1922 with Niuleka – the indigenous dwarf of Fiji and found it to be different from Niuleka. Cooke and Jagoe [1933] found the Malayan Dwarf palms to be more sensitive to unfavourable conditions than the tall and stated that they have given remarkable yield when conditions were good. The Malayan Dwarf has three distinct colour forms, one form has Ivory yellow, the second apricot red and the third has green nuts. According to Jack [1930], the green race of dwarf is hardier than either the red or the yellow race and produces a larger nut which gives a better copra. Observations on these dwarfs by Jack and Sands [1922] indicate that they are self-pollinated in the low lands of Malaya and that the Ivory yellow forms of the Nyior Gading race appear to breed true since as high as 96 per cent of

the Ivory yellow seedlings were obtained from the nuts of this form which supported the contention that self pollination is the rule in this form. It has been reported that the green form has less uniform progeny but preferred for hardiness and size of nut and that Dwarf Yellow requires greatest number of nuts to make a picul [133 1/3 lbs] of copra [Anon, 1938]

Malayan Dwarf in India

In India there are no large plantations of dwarfs The only plantation of dwarfs in an area of 16 hectares is in a private estate - New Ambady Estate in Kulasekharam in Kanyakumari District of Tamil Nadu. Three dwarf forms Yellow, Red and Green were introduced into this estate from Sri Lanka during the year 1934 - 1936 [Gopinathan Nair 1959 a] . Though they were introduced from Sri Lanka they resembled the Malayan dwarfs described in the literature. Besides, the name Torkington Red given to the red dwarf indicated that they must have come from Torkington Estate in Malaysia through Sri Lanka. Though no detailed studies were made on the nut and copra characters of these forms, a few nut characters of these dwarfs were compared with those of the local Tall and Dwarf Green and Orange forms grown on the West Coast of India by Gopinathan Nair [1959 b], who reported that the copra content of these dwarf introductions compared favourably with that of the tall variety commonly cultivated in India. The excellent performance of dwarf forms in this estate, according to Thampan [1975] could be attributed to the well distributed optimum rainfall and the inherent high soil fertility conditions. These palms have not been manured for the past 35-40 years.

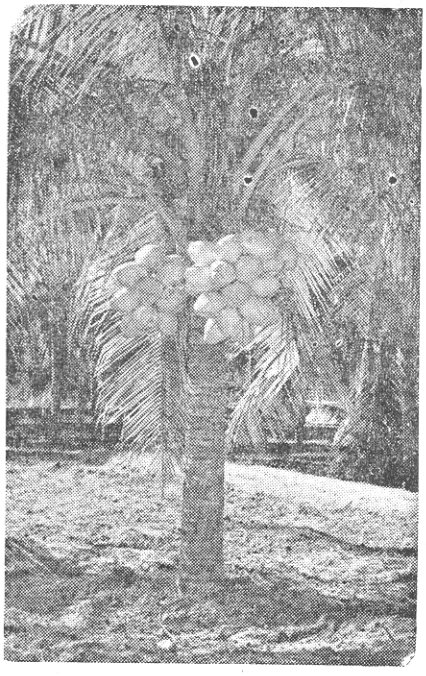

Fig. 1. Malayan Dwarf Yellow

Malayan Dwarf Compared with Chowghat Dwarf

In 1960, seedlings of the three dwarf forms - yellow, red and green - were obtained from the New Ambady Estate and planted at the Central Plantation Crops Research Institute, Kasaragod, Kerala. Though these palms were raised under rainfed conditions earlier, since 1972 they are being irrigated as some multi level cropping trials are laid out in this plot. In 1965 a few seedlings of Malayan Dwarf Yellow, Red and Green forms raised form seednuts directly introduced from Malaysia were planted in another plot in the same block and raised under

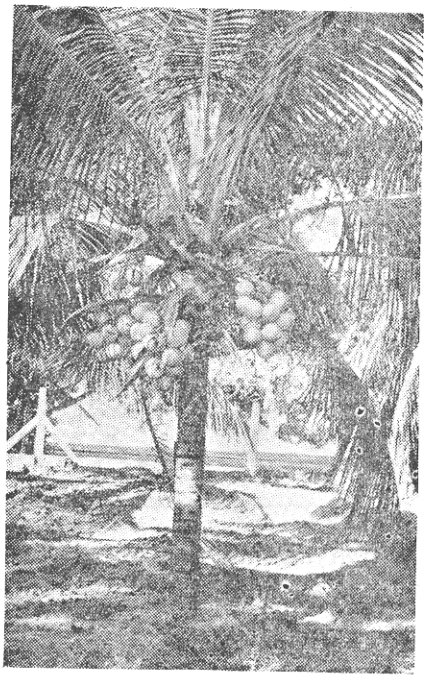

Fig. 2. Chowghat Dwarf Orange

rainfed conditions. A few seedlings of the local Chowghat Dwarf Orange and Chowghat Dwarf Green forms were also planted in the same field in 1965 for a comparative study of their performance with those of the direct introductions planted in 1965. In general Malayan Dwarf forms are more vigorous in growth than Chowghat Dwarf forms.

Data on the yield attributes namely spathe production, female flower production, setting percentage and yield of nuts of the three groups of dwarfs are presented in Table 1. The data indicate that the performance of the dwarf forms introduced in 1960 from the private estate is superior to those directly introduced from Malaysia as they have produced more bunches, female flowers and nuts. This may be due to the effect of irrigation and also to the difference in the age of palms. Between the direct introductions

and the local Chowghat Dwarf forms planted in 1965, the Chowghat Dwarf forms produce more female flowers but the setting percentage is low than those of direct introductions. In yield of nuts there is not much difference between the green forms, the Malayan Dwarf Green yielding 67.5 nuts while that of Chowghat Dwarf Green 66.1 nuts. In the case of Malayan Dwarf Yellow and Red, the yield is 50.1 and 50.8 nuts respectively while that of Chowghat Dwarf Orange is 68.8 nuts. According to Jack and Sands (1922) 96.2, 68.7 and 74.6 per cent of seedlings raised from Ivory yellow, green and red respectively are true to type indicating that Ivory yellow is highly self pollinated in nature. In Chowghat Dwarf, Dwarf Green is highly self pollinated while in Dwarf Orange both self and cross pollination occur in nature (Bhavanisankar Rao and Koyamu 1955).

Data on the nut and copra characters of the three groups are presented in Table 2. Since the palms introduced from the private estate are under irrigation, the nut and copra characters of Dwarf Green and yellow forms are superior to those of direct introductions which are raised under rainfed conditions. In Dwarf Red, the direct introduction seems to be better. Between the direct introduction and the local Chowghat Dwarfs, Malayan Dwarf Green is superior to Chowghat Dwarf Green in nut and copra characters. The fruits of Malayan Dwarf Green palms introduced are large sized and have low husk content (46 per cent of the fruit weight) while those of Chowghat Dwarf Green are small sized and have a high husk content (67 per cent of fruit weight). The husked nut of Malayan Dwarf Green is large sized and has a kernel, water, shell and copra content of 57.6, 22.1, 20.3 and 31.3 per cent respectively of the mean husked nut weight of 470.4 g whereas it is 56.1, 14.1, 29.8 and 41.2 per cent respectively of the mean husked nut weight of 154.4 g in Chowghat Dwarf Green. The copra content per nut is 147.0 g per nut in Malayan Dwarf Green which as reported by Jack (1930) produces a larger nut which gives a better copra whereas in Chowghat Dwarf Green the copra content per nut is 64.7 g and the quality of copra is poor. On account of these distinct differences Chowghat Dwarf Green seems to be distinctly different from Malayan Dwarf Green. Between Malayan Dwarf Yellow and Malayan Dwarf Red, the latter seems to be superior in nut and copra characters. In Chowghat Dwarf, palms with yellow nuts are very rarely met with. Therefore Chowghat Dwarf Orange which is commonly grown on the West Coast of India is compared with Malayan Dwarf Yellow and Red forms which are very distinct. In Malayan Dwarf Yellow and Orange forms the husk content in the fruit is 47.7 per cent and 36.3 per cent by weight respectively whereas in Chowghat Dwarf Orange it is 33.8 per cent. In Malayan Dwarf Yellow and Red forms the kernel content is 48.6 and 49.8 per cent of the mean husked nut weight of 599.58 and 739.4 g respectively whereas in Chowghat Dwarf Orange it is 43.1 per cent of the mean husked nut weight of 527.7 g. The husked nuts of Malayan Dwarf Yellow and Red have a water content of 34.6 and 31.9 per cent and a shell content of 16.7 and 18.3 per cent of husked nut weight respectively whereas it is 31.4 per cent and 25.5 per cent of husked nut weight in Chowghat Dwarf Orange. The copra content per nut is 124.2 g in Malayan Dwarf Yellow, 181.5 g in Malayan Dwarf Red and 149.0 g in Chowghat Dwarf Orange. These differences indicate that Chowghat Dwarf Orange is different from Malayan Dwarf Yellow and Red forms.

Variation in Nut and Copra Characters of Yellow and Red Forms of Malayan Dwarf Grown in Different Countries.

Malayan Dwarf coconuts are grown in most of the coconut growing countries in the world. Romney (1971) has reviewed the performance of Malayan Dwarf in Malaysia, Fiji, Sri Lanka and Trinidad and reported that those in Trinidad and Jamaica appear to produce larger nuts than in Malaysia, Fiji and Sri Lanka. The performance of Malayan Dwarf in some of the countries has been discussed by Thampan and Markose (1973). The dwarfs grown in Sri Lanka are, according to Manthriratna (1972), suspected to be of Malayan origin but the data on copra content per nut in green, yellow and red forms reported by him indicate considerable difference between them and those of Malayan Dwarfs. Data on the nut and copra characters of Malayan Dwarf yellow and Red reported by workers in Malaysia and other countries including those obtained in the

present study are presented in Table 3. The data indicate that there is considerable variation in nut and copra characters of Malayan Dwarf Yellow and Red forms grown in different countries. They differ from country to country and even within a country. In Malaysia itself the data reported by different workers indicate the variability in nut and copra characters of both the forms. In Malayan Dwarf yellow the variation in the mean weight of fruit, husked nut, kernel, water and shell is from 634.0g to 1139.4g, from 412.0g to 681.0g, from 223.0g to 334.0g, from 108.0g to 207.7g and from 81.0g to 151 0g respectively. The weight of copra per nut varied from 107.4g in Nigeria (Obasola 1972) to 187.0g in Jamaica (Harries 1971). The husk content in the fruit has been worked out from the percentage of husked nut in fruit. It varied from 27.1 per cent in Nigeria (Obasola 1972) to 47.4 per cent in India (present study). The kernel content in husked nut weight varied from 47.1 per cent in Malaysia (Harries 1970) to 60 0 per cent in Ivory Coast (Fremond and de Nuce de Lamothe 1972). The water content in the husked nut weight varied from 25.0 per cent in Ivory Coast (Fremond and de Nuce de Lamothe 1972) to 34.6 in India (present study) and the shell content from 16.0 per cent in Ivory Coast (Fremond and de Nuce de Lamothe 1972) to 25.2 per cent in Malaysia (Harries 1970). The percentage of copra in husked nut weight varied from 20.7 in India (present study) to 30.0 in Ivory Coast (Fremond and de Nuce de Lamothe 1972). Similarly in Malayan Dwarf Red also considerable variation is noticed. The variation in mean weight of fruit, husked nut, kernel, water and shell is from 892.0 g to 1159.9 g, from 542.0 g to 739.4 g, from 252.6 g to 377.0 g, from 159.0 g to 236.3 g and from 110.0 g to 153.3 g respectively. The copra content per nut varied from 130.0 g in Malaysia (Chan 1979) to 181 5 g in India (present study). The husk content in fruit varied from 34.2 per cent in Ivory Coast (de Nuce de Lamothe and Rognon 1977) to 45.8 per cent in Malaysia (Harries 1970). The kernel content in husked nut weight varied from 45.0 per cent in Malaysia (Harries 1970) to 53.8 per cent in Ivory Coast (de Nuce de Lamothe and Rognon 1977). The water content varied from 27.7 per cent in Ivory Coast (de Nuce de Lamothe and Rognon 1977) to 32.2 per cent in Fiji (Satyabalan 1976) and the shell content from 17.5 per cent in Ivory Coast (de Nuce de Lamothe and Rognon 1977) to 25.4 per cent in Malaysia (Harries 1970). The percentage of copra in husked nut weight from 24.0 in Malaysia (Chan 1979) to 26.5 in Fiji (Satyabalan 1976).

Variability in Malayan Dwarf Yellow Form

Among the three forms of Malayan Dwarf - Yellow, Red and Green, Yellow is mainly used for the production of Dwarf x Tall hybrids. Fruit analysis of Malayan Dwarf Yellow palms which are reported to be highly self pollinated (Jack and Sands 1922) has indicated considerable variation in nut and copra characters from palm to palm. Data on fruit analysis of 23 Dwarf Yellow palms (which are considered to be of Malayan origin) introduced from the private estate are presented in Table 4. The variation in fruit weight is from 374 8 g to 1061 2 g while in husked nut weight it is from 229.5 g to 810.0 g. The variation in kernel, water and shell weight is from 150 1 g to 392.5 g, from 30.6 g to 288.8 g and from 48.9 g to 154.5 g respectively. The variation of husk content in fruit is from 19.9 to 38.7 per cent of fruit weight while the variation of kernel, water and shell content is from 43.1 to 66.9 per cent from 9.1 to 38.8 per cent and from 14.2 to 24.1 per cent respectively of husked nut weight. The copra content per nut has varied from 78.9 g to 196.3 g which form 21.2 to 35.8 per cent of husked nut weight. On the basis of fruit analysis data the palms can be roughly classified into four groups. The palms in the first group produce nuts which have a mean husk content of 34.5 per cent of fruit weight and 53.7 per cent and 16.7 per cent of its husked nut weight is kernel and shell content respectively. The variation in the copra content is from 102.7 g to 146.5 g per nut. The palms in the second group produce nuts which have a mean husk content of 26.1 per cent of fruit weight and 48.9 per cent and 17.0 per cent of its husked nut weight is kernel and shell content respectively. The variation in copra content is from 153.8 g to 196.3 g per nut. The palms in the third group produce fruits which have a mean husk content of 37.7 per cent of fruit weight and 64.5 per cent and 21.6 per cent of its husked nut weight is kernel

and shell content respectively. The copra content varies from 78.9 to 113.0 g per nut. The palms in the fourth group produce fruits which have a mean husk content of 26 per cent of fruit weight and 54.3 per cent and 21.7 per cent of its husked nut weight is kernel and shell content respectively. The copra content varies from 160.3 to 182.5 g per nut. Thus there is high variation in shell and copra characters in the palms of Malayan Dwarf Yellow. Similar variation is noticed in the case of Malayan Dwarf Green and Red palms as well as in Chowghat Dwarf Green and Orange palms On account of this variation in nut and copra characters, it is possible that the performance of Dwarf x Tall hybrids from the Malayan Dwarf Yellow and Red palms as well as from Chowghat Dwarf Orange palms is likely to vary depending on the combining ability of the parents as indicated by Satyabalan (1982). Therefore each Malayan Dwarf Yellow and Red as well as Chowghat Dwarf Orange palm has to be studied in detail and pollinated with local tall to find out the combining ability of the palms for the production of promising hybrids

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Table - I

Mean values of yield of nuts and attributes related to yield in different forms of local and introduced dwarf cultivars.

Sl. No.	Forms	No. of spathes produced per year	No. of female flowers per year	Setting percentage	Yield of nuts	Source
1.	Dwarf Green	10.1	255.3	30.7	78.3	Introduced from a private estate in India planted in 1960.
2.	Dwarf Yellow	11.4	252.5	33.9	85.7	
3.	Dwarf Red	10.7	211.5	35.5	75.2	
4.	Malayan Dwarf Green	8.9	193.3	34.9	67.5	Direct introduction from Malaysia planted in 1965.
5.	Malayan Dwarf Yellow	9.4	145.9	34.3	50.1	
6.	Malayan Dwarf Red	9.2	146.5	34.7	50.8	
7.	Chowghat Dwarf Green	9.2	219.1	30.2	66.1	Local forms planted in 1965
8.	Chowghat Dwarf Orange	9.4	215.9	31.8	68.8	

Table - 2

Fruit analysis of Malayan Dwarf and Chowghat Dwarf forms of coconut

Sl. No.	Forms	Fruit weight (g)	Husked nut		Kernel		Water		Shell		Copra		Source
			Weight (g)	% in fruit	Weight (g)	% in husked nut	Weight (g)	% in husked nut	Weight (g)	% in husked nut	Weight (g)	% in husked nut	
1.	Dwarf Green	951.4	664.5	69.8	344.9	51.9	189.5	28.5	130.0	19.6	183.2	27.5	*
2.	Dwarf Yellow	651.7	443.8	68.1	240.5	54.3	121.1	27.3	82.2	18.4	123.8	27.9	
3.	Dwarf Red	1009.7	643.5	63.7	327.1	50.8	201.2	31.3	115.2	17.9	155.3	24.1	
4.	Malayan Dwarf Green	866.3	470.4	54.3	271.0	57.6	103.8	22.1	95.6	20.3	147.0	31.3	**
5.	Malayan Dwarf Yellow	1139.4	599.5	52.6	291.5	48.6	207.7	34.6	100.3	16.7	124.2	20.7	
6.	Malayan Dwarf Red	1159.9	739.4	63.7	368.1	49.8	236.3	31.9	135.0	18.3	181.5	24.5	
7.	Chowghat Dwarf Green	462.1	154.4	33.4	86.6	56.1	21.7	14.1	46.1	29.8	64.7	41.2	***
8.	Chowghat Dwarf Orange	796.4	527.7	66.2	227.5	43.1	165.6	31.4	134.6	25.5	149.0	28.2	

*Introduced from a private estate in India, planted in 1930

**Direct introduction from Malaysia, planted in 1965

***Local forms grown in Kerala (India)

Table - 3

Fruit analysis of Malayan Dwarf (Yellow and Red) reported from different countries

Forms	Country	Fruit weight (g)	Husked nut		Kernel		Water		Shell		Copra		Source
			Weight (g)	% in fruit	Weight (g)	% in husked nut	Weight (g)	% in husked nut	Weight (g)	% in husked nut	Weight (g)	% in husked nut	
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Malayan Dwarf Yellow	Malay-sia	634.0	412.0	65.0	223.0	54.0	108.0	26.0	81.0	20.0	108.0	26.0	Chan (1979)
-do-	-do-	771.0	498.0	64.6	259.5	52.1	125.0	25.1	113.5	22.8	...	...	Harries (1970)
-do-	-do-	870.0	495.0	57.0	233.1	47.1	137.6	27.8	124.7	25.2	...	...	-do-
-do-	-do-	789.0	552.0	69 9	...	...	...	...	...	...	149.0	27.0	Vanialingam *et al* (1980)
-do-	Jamaica	1100.0	681.0	61.7	334.0	49.2	196.0	29.3	151.0	21.5	187.0	26.5	Harries (1971)
-do-	Ivory Coast	806.0	558.0	69.0	333.0	60.0	141.0	25.0	90.0	16.0	166.0	30·0	Fremond and de Nuce de Lamothe (1972)
-do-	Nigeria	642.3	468.8	72.9	...	...	...	...	85.8	18.3	107.4	22.9	Obasola (1972)
-do-	India	1139.4	599.5	52.6	291.5	48.6	207.7	34.6	100.3	16.7	124.2	20.7	Direct introduction from Malaysia. Present study.
-do-	-do-	652.5	443.8	68.1	242.5	54 3	118.9	27.3	82.3	18.4	123.8	27.9	Introduction from a private estate in India. Present study.

Malayan Dwarf Red	Malay-sia	892.0	543.0	61.0	272.0	50.0	161.0	30.0	110.0	20.0	130.0	24.0	Chan (1979)
-do-	-do-	895.0	542.0	60.5	252.6	46.6	159.0	29.3	131.0	24.1	...	...	Harries (1970)
-do-	-do-	1112.0	602.7	54.2	271.2	45.0	178.0	29.6	153.0	25.4	...	...	-do-
-do-	Fiji	1100.0	665.4	60.5	303.4	45.5	214 0	32.2	148.0	22.3	175.3	25.3	Satyabalan (1976)
-do-	Jamaica	956 5	608.3	63 6	293.8	48.3	182.5	30.2	128.3	21.1	...	...	Harries (1 970)
-do-	Ivory Coast	1079.0	710.0	65.8	377.0	53.1	209.0	29.4	124.0	17.5	171.0	24.1	de Nuce de Lamothe and Rognon (1977)
-do-	-do-	1016.0	643.0	63.3	346.0	53.8	178.0	27.7	119.0	18.5	159.0	24.7	
-do-	India	1159.9	739.4	63.7	308.1	49.8	236.3	31.9	135.0	18.3	181.5	24.5	Direct introduction from Malaysia. Present study.
-do-	-do-	1009.7	643 5	63.7	327.1	50.8	201.2	31.3	115.2	17.9	155.3	24.1	Introduction from a private estate in India. Present study.

Note : In fruit analysis some workers have reported the data on the weight of nut and copra characters but have not given the percentage of the different components while some have reported the percentage of the components but not the data on the weight of nut components. In both cases the percentage of the components on the basis of the data reported and the data of the components based on the percentage reported have been worked out and presented in the table to indicate the variation in nut components in different countries.

Table - 4

Fruit analysis of Malayan Dwarf Yellow form

Sl. No.	Fruit weight (g)	Husked nut		Kernel		Water		Shell		Copra	
		Weight (g)	% in fruit	Weight (g)	% in husked nut	Weight (g)	% in husked nut	Weight (g)	% in husked nut	Weight (g)	% in husked nut
1	2	3	4	5	6	7	8	9	10	11	12
Group I											
1.	731.3	469.0	64.2	259.3	55.2	130.0	27.7	79.7	17.1	131.3	27.9
2.	696.7	445.0	63.8	259.3	58.2	110.0	24.7	75.7	17.1	133.3	29.9
3.	717.5	530.0	73.8	302.5	57.1	135.0	25.5	92.5	17.5	141.0	26.6
4.	672.5	431.3	64.0	234.8	54.5	123.8	28.7	72.8	16.9	120.8	28.0
5.	678.3	438.3	64.6	286.0	65.2	81.7	18.7	70.6	16.2	122.0	27.8
6.	870.0	560.0	64.4	288.0	51.4	177.5	31.8	94.5	16.9	135.3	24.1
7.	671.7	431.7	64.3	207.3	48.0	150.0	34.7	74.3	17.2	102.7	23.8
8.	673.8	445.0	66.1	241.3	54.2	128.8	28.9	75.0	16.0	118.0	26.5
9.	818.0	565.0	69.1	300.5	53.3	171.3	30.3	93.3	16.5	140.8	24.9
10.	882.3	559.5	63.5	274.8	49.1	196.3	35.0	88.5	15.9	146.5	26.3
11.	785.0	513.0	65.3	262.3	51.1	163.8	31.9	87.0	16.9	142.8	27.9
Mean	751.4	491.7	65.5	264.3	53.7	145.2	29.5	82.3	16.7	130.7	26.6

1	2	3	4	5	6	7	8	9	10	11	12
Group II											
12.	1050.0	776.8	74.0	361.8	46.6	273.8	35.3	141.2	18.1	195.0	25.1
13.	970.0	745.0	76.7	221.3	43.1	288.8	38.8	135.0	18.1	157.5	21.2
14.	894.3	635.0	71.0	328.5	51.8	206.3	32.4	100.3	15.8	172.5	27.2
15.	1061.2	810.0	76.3	392.5	48.5	268.8	33.2	148.8	18.4	196.3	24.2
16.	748.8	600.0	80.1	326.3	54.3	188.8	31.5	85.0	14.2	153.8	25.7
17.	933.0	615.0	65.9	314.0	51.0	197.5	32.2	103.5	16.9	159.0	25.8
Mean	942.9	696.9	73.9	340.7	48.9	237.3	34.1	118.9	17.0	172.3	24.7
Group III											
18.	374.8	229.5	61.3	150.1	65.2	30.6	13.5	48.9	21.3	78.9	34.4
19.	580.3	359.8	62.1	240.5	66.9	32.5	9.1	86.8	24.1	113.0	31.4
20.	472.5	333.3	70.4	185.3	55.5	77.5	23.4	70.5	21.3	98.0	29.4
Mean	400.1	249.1	62.3	160.6	64.5	34.7	13.9	53.8	21.6	83.3	33.4
Group IV											
21.	663.8	487.3	73.3	296.3	60.8	82.5	17.0	108.5	22.3	160.3	32.9
22.	651.3	437.5	67.3	276.5	63.2	57.5	13.2	103.5	23.7	157.0	35.8
23.	965.0	756.3	78.3	338.0	44.7	263.8	34.9	154.5	20.5	182.5	24.2
Mean	760.0	560.4	73.7	303.6	54.3	134.6	24.1	122.2	21.7	166.6	29.8
General Mean	652.5	443.8	68.1	242.5	54.3	118.9	27.3	82.3	18.4	123.8	27.9

IN APRIL MAY AND JUNE COCONUT GARDENS

ORISSA

April

Continue irrigation. Clean and deepen channels and tanks. Strengthen bunds. Prepare for planting monsoon vegetables.

Cut down dead palms in the garden. Dig trenches around palms affected by *Anaberoga*. Apply two kilograms of sulphur and lime in these trenches.

May

Sow your green manure crop with the pre-monsoon showers. Apply clay if the soil is sandy and sand if the soil is clayey. Start sowing winter crops like ginger or colocasia.

June

Dig basins round the palms. Apply green leaf and cattle manure at the beginning of the South West monsoon. First apply the green leaf and then cattle manure. Cover with soil. Towards the end of the monsoon apply manures like bone-meal and cover the basins completely.

WEST BENGAL / ASSAM

April

Continue cleaning and deepening channels and tanks. Strengthen bunds. Continue irrigation Prepare the land for planting monsoon vegetables.

May

Sow a green manure crop like *Crotalaria striata*. Broadcast it at the rate of 22 to 28 kg. per hectare and cover it with a light plough.

June

If no green manure crop is sown so far, dibble cowpea or sunnhemp behind a *desi* plough using a seed rate of 20 to 25 kilograms per hectare. If it is calopogonium, broadcast the seed at the rate of 10 to 12 kilograms per hectare.

ANDAMAN & NICOBAR ISLANDS

April

Continue watering the nurseries. Irrigate the palms if dry spell continues. Repair bunds and channels to facilitate drainage.

Collect seednuts. Choose twelve month old nuts for this purpose. Lay out nurseries for raising seedlings.

In sandy and sandy loam soils dig pits of 91 cubic cm. and in clayey soils of 30 to 60 cubic cm. for replanting and underplanting at a distance of 7.6 metres both ways. In water-logged areas raise mounds with alternate layers of clay and sand. Give a prophylactic spraying with one per cent Bordeaux mixture to all the palms.

May

Sow the seednuts in the nursery. Plough deep or dig after pre-monsoon showers. Practise contour cultivation in valleys and places where possibilities of soil erosion exist.

In addition to this sow seeds of good cover crops like *Calopogonium mucunoides* @ 19 kg. per hectare and *Centrosema pubescens*. In other places dibble seeds of green manure crops like sunn-hemp (28-33 kg. per hectare) or cowpea behind a *desi* plough.

June

Plant the seedlings in the previously prepared pit in a small hole dug in the centre of the pit. Put a mixture of wood ash and surface soil. Provide additional bunds along the edge of the pit to prevent the surface water flowing into the pit which causes water stagnation.

TAMIL NADU/PONDICHERRY

April

Continue irrigation in all districts except in Kanyakumari District and Shencottah taluk of Tirunelveli District. These generally receive the summer showers during April- May which keep the soil adequately moist.

Plant tapioca as an intercrop in these two areas. Apply five to ten cartloads of cattle manure or compost and three to four cartloads of ash per acre before planting tapioca. This is also the best period to plant coconut seedlings in these two areas.

May

Apply tank silt in sandy gardens and sand in gardens with heavy soil.

With the onset of summer showers sow groundnut as an intercrop in well spaced gardens. You can also sow a green manure like *Crotalaria striata* or sunn-hemp if you feel sure of receiving sufficient rains in August-September to plough them in. Strengthen bunds to conserve moisture.

Plant tapioca as an intercrop

June

Apply the first dose of 4 kg fertilizer mixture 8:8:16 per adult palm Apply the mixture on a basal dressing of 35 kg. of green leaf and 50 kg. of cattle manure per adult palm.

KERALA / LAKSHADWEEP

April

If there are ample facilities for irrigation, plant coconut seedlings now. They will strike roots before the heavy monsoon rains and derive the full benefit of the rains. This will help the seedlings to tolerate the water-logging conditions in monsoon as they have established *in situ*.

Seednut collection is to be continued during this month.

Apply river silt or tank silt to the palms at the rate of half a ton per tree in sandy type of soil.

May

Sowing the seeds of green manure crops like sunn-hemp, calopogonium or cowpea can be

Apply green leaves

done taking advantage of the pre monsoon showers. The seeds should be sown after ploughing the land twice.

Preparation of the nursery for sowing of seednuts starts during this month. Sandy areas should be selected for the nursery to avoid termite attack, If the area of the nursery is not sandy, spread a layer of sand to a thickness of 30 cm. above the ground level. Dusting with five per cent D.D.T will repel the termite.

Continue prophylactic treatments since the attack of rhinoceros beetle is maximum during May. Intensive measures like cleaning the crowns and leaf axils and filling the axils with 250 grams of B H C five per cent and an equal quantity of sand should be taken up.

Spraying for controlling the diseases is to be continued. Pre-monsoon spraying with one per cent Bordeaux mixture or Fytolan has to be done during the month. The crowns should be clea ned and affected parts should be cut and burnt before spraying.

Apply the first dose of fertilizers,,i. e. 10 : 5 : 20 : 1.5 (NPK Mg) coconut mixture @ 2 kg per palm.

The channels and bunds should be repaired to facilitate drainage and to prevent soil erosion during monsoon. Continue irrigation until monsoon sets in.

June

Sowing nursery, planting seedlings in the mainfield and fencing them to protect from grazing cattle etc. are operations undertaken during this month.

Search for Nephantis affected leaves and destroy them by cutting and burning the affected leaves

If no crop is raised in the interspaces take up the first of the three annual ploughings with the outbreak of the monsoon.

Continue searching crowns of tree for rhinoceros beetle and red palm weevil. The beetle should be hooked out and destroyed. Inject one per cent Sevin to destroy the red palm weevil.

KARNATAKA

April

Continue irrigation, Prepare the nursery for planting seednuts.

May

Just before the pre - monsoon rains spread out the carted jungle earth @ one to two cart - loads par palm and also cattle manure @ 45 kg per palm. Plough these in.

After one or two showers, work a cultivator to bring the soil to a fine tilth. If there is sufficient moisture in the soil sow a green manure crop and cover.

June

Prepare the bunds and clean the water channels. Continue irrigation if the monsoon has not set in. Sow the seednuts before the onset of monsoon rains and irrigate them if necessary.

Continue the prophylactic sprayings with one per cent Bordeaux mixture.

MAHARASHTRA/GOA/GUJARAT

April

In low-lying areas where coconut is planted on bunds clean the channels between bunds and strengthen and level up bunds by adding to the sides the top soil dug up from the channels.

Store the collected seednuts in shade.

May

Apply tank silt, if available between the palms. If not, you can take silt from channels.

Continue irrigation. This is the time for installing tube - wells in coastal areas.

June

Plough the land twice or thrice and remove the grass. Sow a green manure crop such as wild sunnhemp, dhaincha, sesbania or kolinji using a seed rate of 28 to 34 kg. per hectare.

ANDHRA PRADESH

April

Give a prophylactic spraying of one per cent Bordeaux mixture @ one gallon per palm for all the palms. Continue irrigation.

May

Collect seednuts from mother palms and store them in sand. Prepare nursery and plant the seednuts. Prevent termite attack by dusting with five per cent BHC before planting.

June

If dry coconut husk is available cheap, dig trenches 180 cm. wide and 38 cm. deep between coconut rows. Fill them with the husks at 1000 husks per tree and cover The tree gets moisture and manure from the buried husks even upto five or six years.

YOU ASK WE ANSWER

Question :

I would like to know the quantity of water and also the interval of irrigation recommended for coconut.

Answer :

The quantity of water required for irrigation and the interval of irrigation depend upon the soil type, climate and stage of growth of the palm. In coastal sandy soils, 150 to 200 litres of water once in three to five days per adult palm is necessary. In red sandy loam and laterite soils, irrigation with 200 litres of water once in seven to ten days is recommended. This is only a general recommendation.

Question :

Is bud rot of coconut caused by deficiency of any nutrients? Can it be cured by application of nutrients?

Answer :

Bud-rot is a wide spread disease of coconut. Many factors are reported to be associated with bud-rot in different parts of the world. Detailed investigations on the disease have been carried out along the West Coast of India. It has been found that the disease is caused by a fungus. viz. *Phytophthora, palmivora*. However, studies conducted in Assam indicated that deficiency of boron may cause bud-rot and it could be corrected by applications of borax.

Question :

I want to raise a coconut nursery on scientific lines. Kindly furnish the technical details.

Answer :

Raising a nursery involves selection of nursery site, seednuts, sowing the nuts, cultural practices and selection of seedlings.

The nursery site is prepared by raising beds in sandy or loamy soils. The nursery beds should be 5 feet wide and of required length. Shady places close to water sources are ideal for raising the nursery. (1) Collect 12 month old, medium sized nuts with good copra content from previously selected mother palms preferably in the peak production season. Keep the nuts in a cool and dry place for about a fortnight. Then sow them in the nursery. The nuts are sown in the beds vertically or horizontally with a spacing of 30cm. X 40 cm. Adjacent beds are spaced at 60 cm. apart. Nuts germinate after about a month. After three months the ungerminated nuts have to be removed. Water the nursery on alternate days during summer months. When the seedlings are six to nine months old, they may be screened on the basis of growth vigour and collar thickness. Bear in mind that early germinated seedlings are the best. Generally 60-65 per cent of the seedlings will be of good quality.

(Continued on page 28)