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A note on the seasonal variation in yield, nut characters and copra content in a few cultivars of coconuts*

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INFLUENCE of weather factors on agricultural crops, especially those raised under rainfed conditions is well known. Coconut palm growing under rainfed conditions in West Coast is no exception to this. Considerable data on the effects of season on the different characters of the tall variety palm of the West Coast have been gathered as a result of detailed investigations carried out at this Research Station (Central Coconut Research Station, Kasaragod) and have been published by Patel (1938), Sayeed and Narayana (1953), Gangolly and Chathukutty Nambiar (1953) and Sayeed (1955). Marked differences in the development of nuts that are harvested in fully ripe condition in the different seasons have been observed. The influence of season on various nut characters, yield and copra content in few exotic cultivars is presented in this paper.

MATERIALS AND METHODS

One of the important items of research work in progress at the Central Coconut Research Station, Kasaragod is the introduction and study of cultivars of coconut from different coconut producing countries of the world. Cultivars like Laccadive, Philippines, Cochin-China, New Guinea, Fiji, Straits Settlements, Federated Malaya States, etc., have been planted in the year 1940 and now they are in the full bearing stage. Nuts harvested every month from few selected exotic cultivars of the coconut were stored for a month and then studied for their measurable characters. For the purpose of presentation and discussion, the data for the different months of the year have been summarised for the following four quarters representing roughly the four seasons of the tract.

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I. June, July and August – South-west monsoon.

II. September, October and November – North-east monsoon.

III. December, January and February – winter.

IV. March, April and May — summer.

TABLE I

The meteorological data in respect of the different quarters

Quarter	Rainfall		Temperature (F°)			
	Total quantity in inches	No. of rainy days	Mean maximum	Mean minimum	Mean humidity percentage	Mean no. of hours of bright sunshine per day
June – August	103.99	76	84.2	74.3	96.0	3.2
Sept. – Nov.	25.64	35	86.8	73.2	90.5	6.8
Dec. – Feb.	0.20	—	89.4	69.8	83.8	9.3
March – May	20.32	27	91.4	76.0	82.4	8.1

RESULTS

In Table 2 the averages of weight of unhusked nut, volume of unhusked nut, weight of husked nut, volume of husked nut, volume of coconut water inside, thickness of kernel and weight of copra are given for the four seasons. Salient features observed are summarised below.

Laccadive ordinary gives maximum amount of copra during north-east monsoon. During this season the yield is less. Hence the higher copra content may be due to the fewer nuts in the bunch. In this cultivar the other characters of the nut are at their maximum during summer season. It is in this season that it gives the smallest nut.

Laccadive small gives maximum copra content as well as yield during summer indicating that there is not much relationship between the size of the nut and copra content. In this type biggest nut is obtained during north-east monsoon with lowest amount of copra during south-west monsoon season. Thickness of kernel is at its maximum in both the Laccadives during summer. This is in conformity with the findings of John *et al.*; (1955).

Philippines: This gives maximum amount of copra per nut during summer while smallest nut is obtained during winter season. The yield in this cultivar

is high during summer. The lowest yield and the lowest amount of copra are obtained during north-east monsoon. Here it is seen that there is no relation between the yield and copra content and the size of the nut.

Philippines Laguna: This form gives biggest nut during summer and smallest nut during north-east monsoon season. Yield in this type is highest during south-west monsoon period while the lowest amount of copra is also obtained during the same period. Maximum copra content per nut is during summer season.

Philippines Kalambahim: Even though the nut is at its maximum in size during south-west monsoon, copra content is maximum during summer. Lowest amount of copra is during north-east monsoon with smallest nut during winter. Maximum yield is during summer while minimum is during north-east monsoon.

New Guinea: This also gives maximum yield during summer season with minimum during north-east monsoon. Maximum copra content and biggest nut are obtained in summer. Smallest nut and lowest amount of copra are obtained during winter season.

Cochin-China: This type gives maximum yield during summer. The yield is very low during north-east monsoon period. Copra content is highest during summer season with biggest nut during south-west monsoon. Smallest nut is obtained during north-east monsoon with lowest amount of copra during winter season.

Fiji: During summer season it gives the maximum yield. It is during north east monsoon period that it gives the lowest yield while during the other two seasons it gives identical yield. In this type the highest amount of copra is obtained during winter season while the biggest nut is obtained during summer season.

F. M. S.: This form also gives maximum copra and yield during summer season. Lowest yield is obtained during north-east monsoon with minimum copra during south-west monsoon. The nut is smallest during north-east monsoon.

S. S. Apricot: The yield and copra content are at their maximum during summer. The lowest yield is during north-east monsoon with lowest amount of copra during south-west monsoon period. The nut is at its maximum in size during south-west monsoon period while minimum during north-east monsoon time.

S. S. Green: In this cultivar the yield is at its maximum during summer with highest copra

content during the same season. Biggest nut is also obtained during summer itself. Smallest nut is obtained during winter while lowest amount of copra is during north-east monsoon. It is during north-east monsoon that it gives lowest yield.

Gangabondam: In this type the highest yield is obtained during summer. It is during the same season that all the nut characters are at their maximum. The lowest yield in this cultivar is during north-east monsoon while smallest nut and lowest amount of copra are obtained during south-west monsoon period.

For an ordinary *West Coast tall* type the highest yield as well as maximum copra are obtained during summer season. The smallest nut is obtained during north-east monsoon with lowest amount of copra during the same season.

DISCUSSION

The main point of importance arising from the results presented above is that the effect of the season is not the same in all the varieties. The inter-relationship among the characters of the nut is also low and differs in certain cultivars. According to Patel (1938) the average volume and weight of copra per nut of the West Coast tall variety are at their maximum in May (summer) and minimum in October (N. E. monsoon) indicating that when the volume of the husked nut is at its maximum the weight of copra is also at its maximum. Data presented in Table 2 indicate that only in cases of few cultivars like Laccadive Small, Philippines Laguna, New Guinea and Gangabondam the above relation prevails. In Table 3 the the seasonal variations in the yield of the cultivars are given. In all the cases except in Philippines Laguna the highest yield is obtained during summer season and lowest during north-east monsoon period. In Philippines Laguna the highest yield is during south-west monsoon and lowest during winter. In majority of the cultivars studied the thickness of kernel is at its maximum during north-east monsoon. But this thickness of kernel does not have any influence on the weight of copra as seen in Philippines Kalambahim where the maximum thickness—11·6 mm.—is obtained during north-east monsoon with the lowest amount of copra during the same season. In a majority of cases, the number of nuts obtained and the size of the nut are low during north-east monsoon period when compared with other seasons. Biggest nuts as well as

maximum number of nuts are obtained during summer.

Patel has observed that variation in nut characters, yield and copra content may be due to the age of palm, the soil and environmental conditions and the inherent nature of the tree. Since all the above cultivars studied were planted in the same field more or less at the same time these variations may be attributed to be due to the differences in the genetic make up of the tree. Since the number of trees under each of the cultivars studied is very few the above conclusions are to be taken only as indications of probable differences in behaviour.

CONCLUSIONS

There are seasonal variations in yield, nut characters and copra content in some of the exotic forms of coconut growing at Central Coconut Research Station, Kasaragod. Variation in yield is high during the different seasons. In the majority of cases highest yield is observed in summer and lowest during north-east monsoon period. In the case of the West Coast tall, it is during summer that large nut and maximum copra content are obtained. This relationship between the volume of husked nut and weight of copra is noted only in some cultivars. The variations observed may be a peculiarity of the cultivars.

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REFERENCES

1. Gangolly, S. R. and Chathukutty Nambiar, M., (1953) *Indian Coconut J.*, 7: 5-19.
2. John, C. M., and Satyabalan, K., (1955) *Indian Coconut J.*, 2: 72-73.
3. Patel, J. S., (1938) *The Coconut — A Monograph*, Supt. Govt. Press, Madras.
4. Sayeed, P. M. and Narayana, G. V., (1953) *Indian Coconut J.*, 6: 102-125.
5. Sayeed, P. M., (1955) *Indian Coconut J.*, 8: 49-57.

TABLE 2

Statement showing the detailed nut and copra characters during different seasons

Name of variety and season (1)		Weight of unhusked nut in gms. (2)	Vol. of unhusked nut in cc. (3)	Weight of husked nut in gms. (4)	Vol. of husked nut in cc. (5)	Vol. of coconut water in cc. (6)	Thickness of kernel in mm. (7)	Weight of copra in gms. (8)	Year of study (9)
Laccadive Ordinary	S. W. Monsoon	1240	2557	499	474	111	11.5	144	1952, 1953, 1958
	N. E. Monsoon	1156	2494	489	470	95	12.3	170	1953, 1955 1957, 1958
	Winter	1015	2221	445	399	80	12.0	147	1953, 1954, 1958
	Summer	1265	2805	581	560	141	10.6	150	1957, 1958
	Average	1169	2519.3	503.5	475.8	106.8	11.6	152.8	
Laccadive Small	S. W. Monsoon	651	1139	268	253	27	12.2	80	1952, 1958
	N. E. Monsoon	753	1565	312	309	32	12.4	104	1955, 1957, 1958
	Winter	524	1284	274	281	33	11.0	101	1953, 1954, 1955
	Summer	679	1433	324	353	39	12.1	106	1953, 1955, 1957
	Average	651.8	1355.3	294.8	299	32.8	11.9	97.8	
Philippines	S. W. Monsoon	1684	2691	810	758	315	13.0	190	1957, 1958
	N. E. Monsoon	941	1539	493	486	134	11.8	138	1952, 1955, 1957, 1958
	Winter	979	2086	559	487	122	11.9	151	1953, 1954, 1955
	Summer	1256	2407	822	469	256	12.8	220	1953, 1954
	Average	1215	2180.8	671	550	206.8	12.4	174.8	
Philippines Laguna	S. W. Monsoon	1525	2881	1016	983	380	11.5	199	1952, 1953, 1957
	N. E. Monsoon	1483	2498	921	911	295	11.9	226	1957, 1958
	Winter	1712	2776	1027	1038	400	10.9	265	1953, 1955, 1958
	Summer	1627	3278	1138	1045	353	12.3	276	1953, 1955, 1957
	Average	1586.8	2858.3	1025.5	994.3	357	11.7	241.5	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
New Guinea	S. W. Monsoon	1152	2362	616	677	129	11.8	195	1953, 1957
	N. E. Monsoon	1349	2769	734	725	174	12.7	205	1957, 1958
	Winter	1771	1885	552	518	104	12.1	175	1953, 1954
	Summer	1392	3226	803	766	203	11.8	233	1953, 1954
	Average	1416	2560.5	676.3	671.5	152.5	12.1	202	
Cochin China	S. W. Monsoon	2430	4015	1086	1127	256	12.9	201	1952, 1957
	N. E. Monsoon	1348	3235	735	771	196	10.0	203	1952, 1957, 1958
	Winter	1407	3797	860	871	253	9.8	179	1953, 1954, 1957
	Summer	1370	3667	952	1019	288	10.7	251	1954, 1955
	Average	1638.8	3678.5	908.3	947	248.3	10.9	208.5	
Fiji	S. W. Monsoon	1465	2675	565	590	143	11.1	194	1952, 1957
	N. E. Monsoon	1294	2529	622	609	134	12.8	202	1952, 1957, 1958
	Winter	1431	2896	692	725	143	12.0	215	1953, 1957
	Summer	1452	3325	803	766	203	10.8	211	1953, 1957
	Average	1410.5	2856.3	670.5	672.5	155.8	11.7	205.5	
F. M. S.	S. W. Monsoon	1480	2725	700	633	158	11.1	143	1952, 1957
	N. E. Monsoon	1054	2339	542	554	101	11.7	158	1952, 1957
	Winter	1770	3215	957	958	197	12.2	237	1953, 1957
	Summer	1693	4288	942	880	250	14.0	271	1953, 1955
	Average	1499.2	3166.7	785.2	756.2	176.5	12.2	202.2	
S. S. Apricot	S. W. Monsoon	1059	2000	569	569	214	9.9	132	1952, 1957
	N. E. Monsoon	1118	1719	601	605	192	10.2	144	1952, 1957
	Winter	323	1977	533	643	170	11.0	146	1953, 1957, 1958
	Summer	1165	1482	700	525	232	10.0	155	1953, 1957
	Average	1041.2	1794.5	608.2	585.5	202.0	10.2	144.2	

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
S. S. Green	S. W. Monsoon	1567	3234	742	750	194	11.9	200	1952, 1953, 1957, 1958
	N. E. Monsoon	1682	3222	739	742	193	12.8	197	1952, 1953, 1957
	Winter	1465	3123	753	696	164	11.9	236	1953, 1954, 1955, 1957
	Summer	**1497**	**3386**	**822**	**698**	**224**	**13.6**	**240**	**1953, 1954**
	Average	**1552.7**	**3268.7**	**764.0**	**721.5**	**193.7**	**12.5**	**218.2**	
Gangabondam	S. W. Monsoon	905	1800	385	432	62	10.4	145	1955, 1957
	N. E. Monsoon	1235	2438	501	552	94	12.2	156	1953, 1955, 1957
	Winter	720	1946	445	505	33	11.8	167	1952, 1957
	Summer	**1450**	**3228**	**695**	**805**	**140**	**13.0**	**215**	**1952, 1957**
	Average	**1077.5**	**2353.0**	**506.5**	**573.5**	**82.2**	**11.8**	**170.7**	
Philippines Kalambahim	S. W. Monsoon	1349	3005	532	500	135	11.1	168	1952, 1957
	N. E. Monsoon	1177	2713	527	529	117	11.6	154	1952, 1953, 1957
	Winter	1118	2502	527	428	98	11.0	169	1953, 1954, 1955, 1956
	Summer	**1105**	**2731**	**579**	**499**	**124**	**11.6**	**180**	**1952, 1953, 1955, 1957, 1958**
	Average	**1187.2**	**2735.2**	**541.2**	**489.0**	**118.5**	**11.3**	**167.7**	
West Coast Tall	S. W. Monsoon		2349		398			163	
	N. E. Monsoon		1779		397			156	
	Winter		2208		518			166	
	Summer		**2832**		**731**			228	
	Average		**2317.0**		**511.0**			**178.2**	

TABLE 3

Seasonal variation in the yield of nuts in few exotic forms of coconut

Name of variety and season		1950	1951	1952	1953	1954	1955	1956	1957	1958	Total	Average
Laccadives Ordinary	S. W. Monsoon	20	21	33	36	36	12	35	26	25	244	27.1
	N. E. Monsoon	15	19	4	7	8	14	9	9	25	110	12.2
	Winter	49	26	37	26	38	19	37	10	28	270	30.0
	Summer	40	51	50	64	62	62	69	67	42	507	26.3
	Total	124	117	124	133	144	107	150	112	120	1131	125.6
Laccadives Small	S. W. Monsoon	—	3	32	28	30	43	58	3	47	244	27.1
	N. E. Monsoon	—	24	6	—	3	6	4	10	23	76	8.4
	Winter	22	44	—	26	15	12	14	3	26	162	18.0
	Summer	19	127	69	135	102	138	138	86	160	974	108.2
	Total	41	198	107	189	189	199	214	102	256	1456	167.7
Philippines	S. W. Monsoon	30	—	25	20	20	18	16	20	28	177	19.6
	N. E. Monsoon	17	—	10	15	5	18	11	16	19	111	12.3
	Winter	28	2	25	10	15	12	33	13	42	180	20.0
	Summer	18	7	41	15	35	43	36	25	28	248	27.5
	Total	93	9	101	60	75	91	96	74	117	716	79.4
Philippines Laguna	S. W. Monsoon	31	11	26	34	26	31	30	19	36	244	27.1
	N. E. Monsoon	3	3	7	—	8	15	1	22	15	74	8.2
	Winter	—	—	14	—	—	3	6	8	12	43	4.7
	Summer	15	8	31	9	22	17	15	39	10	166	18.4
	Total	49	22	78	43	56	66	52	88	73	527	58.4

		1950	1951	1952	1953	1954	1955	1956	1957	1958	Total	Average
New Guinea	S. W. Monsoon	34	23	36	27	31	21	12	26	41	251	27.8
	N. E. Monsoon	—	—	—	—	—	2	15	14	3	34	3.7
	Winter	15	10	35	20	18	—	14	16	19	147	16.3
	Summer	35	40	28	35	41	62	79	37	25	382	42.4
	Total	84	73	99	82	90	85	120	93	88	814	90.2
Cochin China	S. W. Monsoon	4	16	24	3	6	19	17	7	6	102	11.3
	N. E. Monsoon	—	4	3	—	7	8	4	14	13	53	5.8
	Winter	11	1	4	4	16	—	12	7	14	69	7.6
	Summer	37	45	32	32	19	54	32	43	33	327	36.3
	Total	52	66	63	39	48	81	65	71	66	551	61.0
Fiji	S. W. Monsoon	27	24	85	—	43	—	27	8	56	270	30.0
	N. E. Monsoon	15	—	20	10	9	—	2	3	1	60	6.6
	Winter	42	11	32	14	34	17	52	12	62	276	30.6
	Summer	—	29	39	28	67	38	74	19	73	376	40.7
	Total	84	64	176	42	153	55	155	42	192	973	107.9
F. M. S.	S. W. Monsoon	18	2	40	—	52	2	26	—	39	179	19.8
	N. E. Monsoon	2	—	—	15	4	—	7	—	17	45	5.0
	Winter	26	—	20	11	15	22	2	—	14	110	12.2
	Summer	37	22	44	20	38	25	74	38	50	348	37.5
	Total	83	24	104	46	109	49	109	38	120	682	74.5

		1950	1951	1952	1953	1954	1955	1956	1957	1958	Total	Average
S. S. Apricot	S. W. Monsoon	6	6	10	10	12	20	8	40	3	115	12.7
	N. E. Monsoon	10	2	21	—	10	22	6	9	—	80	7.7
	Winter	9	10	35	9	16	—	32	11	26	148	16.4
	Summer	25	32	15	21	21	56	16	27	21	234	26.0
	Total	50	50	81	40	59	98	62	87	50	577	62.8
S. S. Green	S. W. Monsoon	44	25	61	39	33	40	49	43	26	360	40.0
	N. E. Monsoon	5	—	9	18	25	13	20	17	30	137	15.2
	Winter	28	7	37	13	25	21	26	16	32	205	22.7
	Summer	27	20	53	60	63	74	51	59	54	461	51.2
	Total	104	52	160	130	146	148	146	135	142	1163	129.1
Gangabondam	S. W. Monsoon	55	—	68	—	29	6	13	22	15	208	23.1
	N. E. Monsoon	3	—	6	66	—	25	5	28	—	133	14.7
	Winter	37	41	43	24	—	21	—	16	34	216	24.0
	Summer	123	15	59	23	58	—	80	38	42	438	48.6
	Total	218	56	176	113	87	52	98	104	91	995	110.4
Philippines Kalambahim	S. W. Monsoon	15	27	54	17	28	16	26	22	33	238	26.4
	N. E. Monsoon	12	9	10	15	2	20	9	18	10	105	11.6
	Winter	6	4	14	8	22	13	20	31	36	154	17.1
	Summer	16	19	25	37	47	43	31	18	26	262	29.1
	Total	49	59	103	77	99	92	86	89	105	759	84.2