Journal of Plantation Crops 4 (1): 16–20. *June* 1976.

EFFECT OF MONTH OF HARVEST OF SEEDNUTS AND FERTILIZER APPLICATION TO NURSERY ON VIGOUR AND QUALITY OF COCONUT SEEDLINGS

E. V. NELLIAT, P. K. R. NAIR, AND B. L. KUSHWAHA*

Central Plantation Crops Research Institute,
Kasaragod 670 124, *Kerala State, India*

ABSTRACT

The germination pattern and quality of seedlings produced from seed coconuts harvested during different months of the year and the effect of application of fertilizers to seedlings in the nursery were studied. The nuts germinated satisfactorily irrespective of the month of harvest, but nuts sown during June–September (harvested during April–June) germinated early (mean 125 days). Considering seedling vigour as measured by number and area of leaves, height of plants and girth at collar, May and June were the most favourable months for sowing seednuts. Application to the nursery of NPK fertilizers in combination with Ca + Mg improved seedling vigour and quality as indicated by higher chlorophyll content and nutrient concentration in leaves. Seedling growth was adversely affected by application of Ca + Mg in the absence of NPK.

INTRODUCTION

SEED coconuts are normally collected during February–June, sown in nursery after two months, and one year seedlings are transplanted in mainfield (Menon and Pandalai, 1958). The nursery is not usually supplied with fertilizers on the assumption that there is sufficient stored food inside the seednuts, and that the intrinsic quality of the seed material measured in terms of the seedling growth characters may be vitiated by fertilizer application. Foale (1968) found that the contribution of nutrients from the endosperm to the growing seedling was reduced from the fourth month after germination. In Sri Lanka, application of potash to seed beds had remarkable effect on growth of seedlings (*Annual Report, Coconut Research Station, Sri Lanka* for 1941). In Ivory Coast, seedlings produced from K-fertilized mother palms showed better growth than those from unfertilized palms (*Annual Report, IRHO* for 1956). Ziller and Fremond (1961) recommended application of N, P, K, Ca, and Mg to the nursery in order to produce young palms with a satisfactory nutrient status. In the present study, an attempt has been made to determine the quality of seedlings produced from nuts harvested in different months. The possibility of selecting vigourous seedlings during early stages and the fertilizer requirement of nursery were also looked into.

MATERIALS AND METHODS

The seednuts required for the study were harvested every month commencing from June 1971 from 100 mother palms of West Coast Tall variety. The nuts were sown in the nursery after storing for two months.

Layout and method of planting.— The experiment was laid out in the Institute Farm in a randomized block design with eight fertilizer treatments and three replications. The soil was predominantly sandy with a mechanical composition of 0·25% clay, 0·25% silt, 3·26% fine sand, and 96·24% coarse sand, pH 6·0, and field capacity 3·81. Nuts were sown in an upright position with the perianth exposed above the ground in beds raised 30 cm from

* now at Regional Research Station, Kalyanpur, Kanpur, U.P.

ground level, with 43 nuts/row and four rows/bed, at a spacing of 30 cm between nuts and rows. Each bed consisted of four plots of 16 plants with a border row all around. There was an additional guard row between two contiguous plots in each bed. The first sowing of nuts was done in August, 1971 and thereafter every month till July, 1972. Beds were irrigated regularly using hoses during dry months.

The fertilizer treatments are given in Table I.

TABLE I

Fertilizer treatments in the nursery nutrient levels, in kg/ha/month

	N	P_2O_5	K_2O	CaO	MgO
T_1	0	0	0	0	0
T_2	0	0	0	30	20
T_3	40	20	40	0	0
T_4	40	20	40	30	20
T_5	80	40	80	0	0
T_6	80	40	80	60	40
T_7	120	60	120	0	0
T_8	120	60	120	90	60

N was supplied as ammonium sulphate, P as single superphosphate, K as muriate of potash, Ca as slaked lime, and Mg as magnesium sulphate. The first dose of fertilizer was applied five months after sowing and thereafter every month. Fertilizers were applied on the surface and raked in.

Observations.— The emergence of the plumule above the husk was taken as the indicator for germination. Nongerminated nuts and dead sprouts were also counted. Growth measurements of seedlings were made on number of leaves, girth at collar, height from ground surface to the tip of the longest leaf, number of leaflets of the last emerged leaf, and length and maximum breadth of the most recent fully opened leaf. They were recorded at fornightly intervals, starting from five months after sowing (or after germination in case of nuts which germinated after five months), till one year after sowing. The data on the growth characters of 11 month old seedlings were pooled and analysed statistically.

Leaf samples of seedlings from nuts sown in June, 1972 were collected in June, 1973, separately from each fertilizer treatment, and analysed for N, P, K, Ca, Mg, S, and Na. Chlorophyll fractions *a* and *b* were also determined after acetone and ether extraction (Meyer and Anderson, 1952) using one year old seedlings so as to simulate the normal conditions regarding age of seedlings at the time of transplanting and month of sowing.

RESULTS AND DISCUSSION

Germination of nuts.—Table II gives the germination pattern of seednuts harvested during different months. Nuts harvested during April–July and sown during June–September germinated earlier, (average time 125 days after sowing). Similar results were obtained by Nampoothiri *et al.* (1973). Nuts harvested from August to December and sown in October–February required a longer time (about 190 days) for germination. However, total germination percentage was almost similar for nuts harvested in all months. The results indicate that though the nuts germinate satisfactorily irrespective of month of harvest, nuts harvested in April–July and sown in June–September germinate early.

Growth characters of seedlings.—The seedlings raised from nuts sown in June and August were significantly superior to others in growth characters (Table III). October to March sowing resulted in seedlings of poor vigour. However, these differences were probably a consequence of the time taken for germination. Seednuts sown during October–February took about 65 days more for germination than those sown during June–September (cf., Table II). Considering the age of plants as from the date of germination, the plants were of unequal age, and therefore, such a comparison would look descrepant. But, generally the seedlings are transplanted one year after sowing the seednuts and hence the comparison is relevant.

The effect of unequal number of days taken for germination on growth characters

TABLE II

Germination of seednuts sown in different months

Month of harvest of seednuts	Month of sowing	Mean No. of days taken for germination	Grouping based on germination	Percentage of germination	Percentage of dead sprouts
June	August	113	E	95	2
July	September	135	E	93	4
August	October	211	L	91	7
September	November	198	L	92	2
October	December	198	L	88	7
November	January	198	L	87	3
December	February	182	L	89	4
January	March	169	M	89	6
February	April	154	M	93	6
March	May	144	M	94	3
April	June	120	E	94	4
May	July	130	E	95	7

Germination grouping: E = early, M = Medium, and L = late.

TABLE III

Mean growth characters of seedlings (11 *months after sowing*)

Month of sowing	No. of leaves	Girth at collar (cm)	Length × width of leaves (dm^2)	Height of plant (cm)
August	5·0	12·0	14·93	94·6
September	4·3	10·6	8·79	76·6
October	3·7	9·5	5·76	60·0
November	4·4	10·6	7·40	67·1
December	3·5	9·1	5·01	54·9
January	3·7	8·7	4·93	58·0
February	4·1	8·8	6·40	66·8
March	4·2	9·1	7·53	73·3
April	4·3	9·3	9·68	85·0
May	4·6	9·8	12·47	94·1
June	5·2	10·7	16·75	112·7
July	4·3	9·7	12·17	100·4
F test	**	**	**	**
CD 5%	0·4	0·4	1·69	5·0

** Significant at $p = 0·01$.

was eliminated statistically by analysis of covariance, taking the number of days taken for germination as the covariate. The adjusted means for all growth characters under different months of sowing are presented in Table IV. The effect of month of sowing was significant at 1% level for all growth characters. The treatment effect was significant at 5% level for leaf area only. The effect of Treatment × Month interaction was not significant for any of the characters. Nuts sown during February–June and October–November produced seedlings with maximum number and area of leaves. On the other hand, nuts sown during April–August produced seedlings of maximum height, but girth of seedlings was maximum when sown from August–November. Considering all these characters, May and June are considered the most favourable months for sowing seednuts.

Effect of fertilizer treatments on growth characters.—Seedlings under Treatment T_8 were the best for all the characters studied. However, the differences were significant for only leaf area. The growth of seedling was adversely affected by application of lime (Ca + Mg) when NPK was absent.

TABLE IV

Growth characters of seedlings as affected by month of sowing, 11 months after sowing (adjusted means)

Month of sowing	No. of leaves	Girth at collar (cm)	Length × width of leaves (dm^2)	Height of plants (cm)
August	4·34	11·19	8·36	82·89
September	3·95	10·17	5·27	70·32
October	4·40	10·36	12·75	72·47
November	4·50	10·73	8·44	68·96
December	4·02	9·74	10·20	64·16
January	4·22	9·34	10·12	67·26
February	4·40	9·17	9·38	72·11
March	4·32	9·25	8·71	75·40
April	4·21	9·19	8·79	83·40
May	4·37	9·52	10·19	90·04
June	4·64	10·01	11·15	102·72
July	3·88	9·18	7·96	92·88
F test	**	**	**	**
CD 5%	0·46	0·54	5·98	1·64

**Significant at $p = 0·01$.

TABLE V

Growth characters of seedling as affected by fertilizer treatments

Fertilizer treatment	No. of leaves	Girth at collar (cm)	Length × width (dm^2)	Height of plant (cm)
T_1	4·4	9·7	9·23	79·1
T_2	4·2	9·6	8·47	75·1
T_3	4·3	9·8	9·38	80·6
T_4	4·3	9·9	9·92	79·2
T_5	4·2	9·9	9·52	78·7
T_6	4·3	9·8	8·49	76·7
T_7	4·3	9·6	9·42	78·3
T_8	4·3	10·0	10·10	81·4
F test				
unadjusted	NS	NS	NS	NS
adjusted	NS	NS	*	NS
CD 5%	..	..	1·52	..

* Significant at $p = 0·05$.

Chlorophyll content of leaves (Table VI).—As in the case of growth characters, the total chlorophyll content was also the highest for seedlings under treatment T_8.

The variation in chlorophyll content under increasing levels of nitrogen with and without Ca + Mg was also looked into (Fig. 1). Apart from the fact that total chlorophyll increased under increasing levels of N, the chlorophyll content was higher in the presence of Ca + Mg under higher dose of N. The role of N and Mg in increasing the chlorophyll content of tissues is well known.

TABLE VI

Chlorophyll content of leaves of seedlings under different fertilizer treatments

Fertilizer treatments	Chlorophyll content (mg/g fresh leaves)			Ratio
	Chlorophyll *a*	Chlorophyll *b*	Total chlorophyll	Chl. *a* / Chl. *b*
T_1	0·972	0·767	1·739	1·269
T_2	0·947	0·751	1·697	1·260
T_3	1·123	0·190	2·032	1·232
T_4	1·163	0·899	2·060	1·296
T_5	1·078	0·870	1·948	1·261
T_6	1·151	0·879	2·028	1·313
T_7	1·137	0·882	2·019	1·288
T_8	1·300	1·049	2·349	1·234
CD 5%	0·147	0·107	0·236	0·102

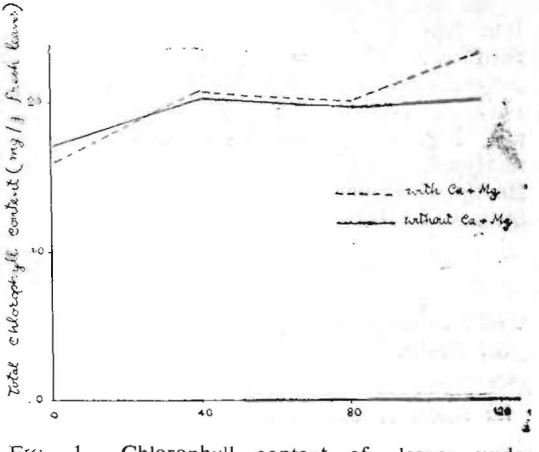

FIG. 1. Chlorophyll content of leaves under different levels of nitrogen with and without Ca + Mg.

Nutrient content of tissues.—The effect of treatments was significant only in the case of N content (Table VII). However, the content of N, P, and K was highest under the treatment T_8.

Thus, the study brings out that fertilising with N, P, and K in combination with Ca + Mg improves seedling vigour and quality. The effect, if any, of fertilizer application to nursery on improving the quality of seedlings by accelerating their otherwise poor growth, fixing up selection criteria based on growth characters at different periods of growth of seedlings, etc., are being evaluated separately. The ability of the seedlings to benefit themselves by this early vigour as reflected in subsequent growth in the field and yield performance is also being assessed by follow up studies in the field.

TABLE VII

Nutrient content of leaves

Treatments	N	P	K	Ca	Mg	S	Na
T_1	1·77	0·118	2·03	0·19	0·21	0·042	0·22
T_2	1·71	0·112	2·07	0·19	0·22	0·057	0·20
T_3	1·88	0·120	2·00	0·31	0·34	0·053	0·21
T_4	1·92	0·120	2·23	0·25	0·33	0·070	0·18
T_5	1·89	0·118	2·08	0·27	0·30	0·074	0·17
T_6	1·95	0·117	2·07	0·29	0·32	0·067	0·18
T_7	1·97	0·124	2·12	0·33	0·22	0·069	0·16
T_8	2·04	0·125	2·23	0·25	0·27	0·073	0·17
SE/plot	0·65	0·007	0·27	0·07	0·05	0·012	0·03
CD 5%	0·11	NS	NS	NS	NS	NS	NS

ACKNOWLEDGEMENTS

We thank Mr. CA Kunhiraman and the late Mr. K Shambu for their assistance in field work, Dr. A Ramadasan for chlorophyll estimations, Mr. MP Sankaranarayanan for chemical analyses, and Mr. MP Abdurazak, and Mr. P Thomas Varghese for statistical analyses. We also thank Dr. KV Ahamed Bavappa, Director, for his encouragement and interest in the study.

REFERENCES

ANNUAL REPORT 1941. *Coconut Research Station, Sri Lanka.*

ANNUAL REPORT 1956. *Inst. de Recherches pour les Huiles et Oleagineux, Paris,* for 1956.

FOALE, M. A. 1968. Seedling growth pattern. *Aust. J. Agric.* **19**: 781–789.

MENON, K. P. V. AND PANDALAI, K. M. 1958. *The Coconut Palm—A Monograph.* p. 130. Indian Central Coconut Committee, Ernakulam.

MEYER, B. S. AND ANDERSON, B. D. 1952. *Plant Physiology.* pp. 293–308. Van Nostrand, New York.

NAMPOOTHIRI, K. U. K., JACOB MATHEW, AND SUKUMARAN, C. K. 1973. Variation in germination pattern of coconut cultivars and hybrids. *J. Plant. Crops* **1** (Suppl.): 24–27.

ZILLER, R. AND FREMOND, Y. 1961. New results on manuring of coconut palm in the Ivory Coast. *Fertilite* **13**: 13–16.