CP 2670

Mysore J. agric. Sci., **35** : 5-9, 2001

Long Term Effect of Fertilization on High Yielding Coconut Variety and Hybrids under Rainfed and Irrigated Conditions

D. V. SRINIVASA REDDY AND P. GOPALASUNDARAM

Division of Crop Production, Central Plantation Crops Research Institute, Kasargod - 671 124,

ABSTRACT

A long-term fertilizer experiment was conducted to study the differential response of high yielding West Coast Tall variety, Chowghat Orange Dwarf (COD) x West Coast Tall (WCT) and WCT x COD hybrids of coconut for yield and economic returns under rainfed and irrigated conditions at Central Plantation Crops Research Institute, Kasaragod. The average yield for eight years showed that the fertilizer treatment 1000 g N : 1000 g P_2O_5 : 2000 g K_2O/palm/year (M_2) recorded significantly higher nut yield (136 nuts/palm/year) over both 500 g N : 500 g P_2O_5 : 1000 g K_2O/palm/year (M_1) and no fertilizer (M_0) treatments. Amongst the variety/hybrids, the hybrid COD x WCT (128 nuts/palm/year) out-yielded its reciprocal cross (114 nuts/palm/year) and WCT variety (115 nuts/palm/year). The cost benefit ratio was most favourable under fertilizer treatments. For every rupee invested on manuring, the total net return was Rs. 2.80 in M_1 level and Rs. 2.85 in M_2 level of fertilizers indicating the economic advantage of fertilizing coconut.

COCONUT palm produces fronds and nuts throughout the year and hence, demands continuous supply of nutrients from the soil. Coconut varieties give different yield response to fertilizer application (John and Jacob, 1959) and hybrid vigour observed in other crops is often associated with higher fertilizer requirements for realising increased yields. Hybrid palms (PB-121) require more N and P compared to talls and utilise higher proportion of absorbed N and P for the production of more nuts. In talls, N and P nutrients are utilized more or less equally in the growth and production of nuts. The K removal through bunches is 78 per cent of K uptake (Pillai and Davis, 1963 ; Ouverier and Ochs, 1978) for both cultivars. The general recommendation from CPCRI for fertilizing the matured nut bearing palms is 500 g N, 320 g P_2O_5 and 1200 g K_2O/palm/year, in two split doses (Nelliat, 1973). Nelliat and Muliyar (1971) reported that the response was negligible in palms with yield more than 50 nuts per year indicating that the palms with high yield potential always needed high fertilizer inputs. Application of NPK fertilizers to young palms of Chowghat Orange Dwarf (COD) x West Coast Tall (WCT) and its reciprocal cross and high yielding talls resulted in significant increase in all growth characters and helped in early flowering (Nelliat and Muliyar, 1971). Later, Khan *et al.* (1986) observed that high yielding WCT palms responded to high levels of fertilization (1000 g N + 1000 g P_2O_5 2000 g K_2O/palm/year) whereas only marginal yield improvement was observed in the hybrids on COD x WCT and WCT x COD. Palms in red sandy soils responded more to N and K fertilizers under rainfed conditions for satisfactory growth and yield. The aim of the study was to examine the long- - term effect of fertilizer application on West Coast Tall variety, COD x WCT and

WCT x COD hybrids of coconut for yield and economic returns under rainfed and irrigated conditions.

Material and Methods

The field experiment was laid out in the year 1965 in a strip plot design with three replications in the Research Farm of Central Plantation Crops Research Institute at Kasaragod. High yielding coconut variety *viz.* West Coast Tall (WCT) and hybrids *viz.*, Chowghat Orange Dwarf x West Coast Tall (COD x WCT) and its reciprocal cross (WCT x COD) received three levels of fertilizers, M_0 : No fertilizer ; M_1 : 500 g : 500 g : 1000 g N, P_2O_5 and K2O/palm/year and M_2 : 1000g :1000 g :2000 g N, P_2O_5 and K_2O/ palm/year. The palms were planted at a distance of 7.5 x 7.5 m in a square system. Each treatment consisted of a plot size of six palms 9337.5 sq. meters) and replicated thrice. The response of the palms to differential fertilizer levels were studied under rainfed condition since planting upto 1984 and the results of which have been reported by Khan *et al.* (1986). In 1984-85, each treatment block was subdivided into two *viz.*, rainfed and irrigated and response of the palms to these conditions was studied. The experimental site is located near the sea and receives an annual rainfall of 3500 mm. The soil is very deep red sandy loam (*Arenic Paleustults*) in nature, with pH of 5.3, clay content of 22 per cent and CEC of 4.7 cmol (p^+)/kg soil and with less than one per cent slope. The nutrients, N, P and K were applied in the form of urea, mussoriphos and muriate of potash, respectively, in two splits *viz.*, one-third (33%) in May-June (beginning of monsoon) and two-third (66 %) in September-October (receding monsoon). Fertilizers were broadcasted in circular basins of 1.8 m around the palm. In the irrigated treatment, palms were irrigated at 100 per cent open pan evaporation (E_0) through perfo -irrigation upto 1990. From 1990 onwards, the palms were irrigated under drip system with 32 lit/palm/day during summer months from November to May. The yield data was recorded every month from all the palms and annual yield per palm was computed. The yield obtained from 1990-91 after introduction of irrigation has been included in this paper.

Results and Discussion

The yield of palms as influenced by variety, fertilizer levels and rainfed/irrigation are presented in Table I and II. Significantly higher nut yield was recorded in M_1 treatment compared to M_0 treatment in all the years except during 1997-98. In the control (M_0) treatment, the nut yield over the years ranged between 82 and 118 nuts/palm/year for all the three cultivars, whereas, with the application of M_1 level of fertilizers, it ranged from 112 to 152 nuts/palm/year. In two consecutive years, 1996-97 and 1997-98, the yield recorded with M_2 level of fertilizers was significantly higher compared to M_1 and M_0 levels. The average of yield data for eight years (1990-91 to 1997-98) showed significant yield increase due to M_2 level of fertilizer (136 nuts/palm/year) over M_1 level (122 nuts/palm/year).

A comparative analysis of the cultivars indicated that, the hybrid COD x WCT significantly out-yielded its reciprocal hybrid, WCT x COD and variety WCT during 1992-93, 1993-94, 1995-96 and also when average yield of eight years was considered. Further in rest of the years,

TABLE I

Coconut yield (nuts/palm/year) as influenced by variety/hybrid and fertilizer levels under rainfed (RF) and irrigated (IRR) conditions

Treatments	1990-91		1991-92		1992-93		1993-94		1994-95		1995-96		1996-97		1997-98		1990-91 to 1997-98	
	RF	Irri.	RF	Irri.	RF	Irri.	RF	Irri.	RF	Irri.	RF	Irri.	RF	Irri.	RF	Irri.	RF	Irri.
WCT																		
M_0	77	97	105	135	79	96	100	96	115	139	84	103	86	110	105	128	94	110
M_1	87	120	113	146	96	115	120	116	110	125	102	99	124	113	91	107	105	118
M_2	111	129	136	169	103	124	135	127	137	144	112	130	127	136	138	126	125	135
Mean	92	115	118	150	93	112	118	113	120	136	100	111	112	120	111	120	108	121
COD x WCT																		
M_0	62	85	91	124	69	111	84	108	90	128	80	129	102	109	83	131	83	115
M_1	116	114	167	200	116	125	164	156	135	136	132	161	149	97	124	132	139	134
M_2	119	145	162	184	120	135	156	158	151	160	137	154	144	182	135	153	141	158
Mean	99	115	140	169	102	124	135	141	125	141	117	148	132	129	114	139	121	136
WCT x COD																		
M_0	67	102	93	105	65	109	87	103	99	137	79	96	98	114	89	103	84	108
M_1	127	123	144	142	105	117	142	113	132	127	108	121	137	110	106	124	111	122
M_2	106	145	122	179	91	129	114	128	127	155	92	132	123	158	106	139	110	146
Mean	100	123	120	142	87	118	114	114	120	140	93	116	119	128	100	122	102	125
Mean	97	118	126	154	94	118	122	123	122	139	103	125	121	126	108	127	110	127
C.D. at 5%																		
RF *vs* Irr	NS		NS		NS		NS		10.66		15.94		NS		10.61		NS	
CV %	36.87		28.42		39.53		27.11		7.00		16.92		14.66		7.78		19.05	
V X F xRF *vs* Irr	NS		NS		NS		NS		NS		NS		14.32		NS		NS	
CV%	17.07		23.99		20.38		16.51		21.56		20.90		24.69		16.89		16.57	

M_0 : No fertilizer, M_1 : 500 g N + 500 g P_2O_5 + 1000 g K_2O ;, M_2 : 1000 g N + 1000 g P_2O_5 + 2000 g K_2O

TABLE II

Coconut yield (nuts/palm/year) as influenced by variety/hybrid and fertilizer levels (1990-98)

Treatments	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	Average (1990-91to 1997-98)
Variety									
WCT	104	134	102	116	128	105	116	116	115
COD x WCT	107	154	113	138	133	132	130	126	128
WCT x COD	112	131	103	114	130	105	123	111	114
Cv %	**24.11**	**26.17**	**12.29**	**18.12**	**18.28**	**18.7**	**19.37**	**17.93**	**14.62**
C.D. at 5%	**NS**	**NS**	**9.21**	**15.67**	**NS**	**13.29**	**NS**	**NS**	**12.27**
Fertilizers									
M_0	82	109	88	96	118	95	103	106	99
M_1	114	152	112	135	128	121	122	114	122
M_2	126	158	118	136	146	126	145	133	136
CV %	**24.11**	**26.17**	**12.29**	**18.12**	**18.28**	**18.7**	**19.37**	**17.93**	**14.62**
C.D. at 5 %	**18.28**	**25.82**	**9.2**	**15.67**	**16.85**	**19.52**	**16.87**	**14.90**	**12.27**

M_0 : No fertilizer, M_1 : 500 g N + 500g P_2O_5 + 1000g K_2O, M_2 : 1000g N + 1000g P_2O_5 + 2000g K_2O

though yield variation was not-significant, relatively higher yield was recorded by COD x WCT hybrid. WCT performed better in this soil type in the absence of regular fertilizer application (102 nuts/palm/year), while heterosis vigour in yield expression was apparent with hybrids with improved nutrition by fertilization. The earlier results from the same experiment (1972-83) revealed that M_1 dose of fertilizer doubled the yields of COD x WCT palms and increased the yield of WCT x COD hybrid three times over M_0. However, at M_2 level of fertilizer application, the coconut hybrids did not respond favourably (Khan *et al.*, 1986).

The response to applied nutrients was more pronounced with irrigation in case of hybrids. In 1996-97 the hybrids, COD x WCT (182 nuts/palm/year) and WCT x COD (158 nuts/palm/year) gave significantly higher yield with M_2 level of fertilizer under irrigation as compared to other treatments. Similarly, the average yield for eight years was highest in COD x WCT hybrid (158 nuts/palm/year) at M_2 level of fertilizer under irrigation. This was followed by reciprocal hybrid WCT x COD under the same treatment (146 nuts/palm/year). However, in high yielding WCT variety, yield variation between irrigation and rainfed treatments was narrow (125 to 135 nuts/palm/year). The mean nut yield of variety/hybrids and fertilizer levels under irrigation was 127 nuts/palm/year as compared to 110 nuts/palm/year under rainfed condition. During the years 1994-95, 1995-96 and 1997-98, irrigation of

TABLE III

Additional costs and returns for the different fertilizer levels

Treatment	Additional cost over M_0 (Rs./palm/year)	Additional yield over M_0 (nuts/palm/year)	Addiitional net returns over M_0		Benefit : Cost ratio
			Rs./palm/year	Rs./ha/year	
M_1	24.2	23	67.8	11,526	1:2.8
M_2	38.4	37	109.6	18,632	1:2.85

Current price of coconut - Rs 4 / nut
Cost of fertilizers : Urea-Rs 3.6/kg, Mussoriephos-Rs. 1.925/kg, Muriate of Potash - Rs. 3.7/kg
Application charges - Rs. 10/palm/year

palms resulted in significantly higher yield over rainfed condition (Table II). Further, though non-significant, yield was also relatively higher under irrigation in other years. The palms gave 28 per cent increase in nut yield under irrigation over the average nut yield obtained for eight years under rainfed with no fertilizer (110 nuts/palm/year). Under irrigation, 6 per cent (7 nuts/palm/year) and 17 per cent (21 nuts/palm/year) increase in nut yield was observed over rainfed at M_1 and M_2 fertilizer levels, respectively.

Economics : Application of fertilizers at M_1 (500 : 500 : 1000 g NPK/palm/year) and M_2 (1000:1000:2000g NPK/palm/year) levels incurred an additional cost of Rs. 24.2 and Rs. 38.4 /palm/year as cost of fertilizers and application charges, respectively (Table III). The additional net return was Rs. 67.8/palm /year (Rs. 11,526/ha/year) at M_1 level and Rs. 109.6/palm/year (Rs. 18,632/ha/year) at M_2 level, which was three times additional cost at both the levels of fertilizers. The cost benefit ratio was most favourable under both the fertilizer treatments. For every rupee invested on manuring, the total net return was Rs. 2.80 in M_1 level and Rs. 2.85 in M_2 level of fertilizers. This clearly indicates the economic advantage of manuring coconut at M_1 and M_2 level of fertilizer application.

REFERENCES

JOHN, C. M. AND JACOB, K., 1959, Fertilizer demonstration on coconut in West coast - A review. *Indian Coconut J.* **13** : 25-44.

KHAN, H. H., GOPALASUNDARAM, P., JOSHI, O. P. AND NELLIAT, E. V., 1986, Effect of NPK fertilization on the mineral nutrition and yield of three coconut genotypes. *Fert. Res.* **10** : 185-190.

NELLIAT, E. V., 1973, NPK nutrition of coconut palm-review. *J. Plantn. Crops.* **1** : 70-80.

NELLIAT, E. V. AND MULIYAR, M. K., 1971, Response of different levels of NPK by young coconut palms of high yielding types. *In : Proc. Int. Symp. Soil Fertil. Eval.*, New Delhi, India, pp 575-583.

OUVERIER, M. AND OCHS, R., 1978, Mineral exportation of hybrid coconut PB-121. *Oleagineux* **33** : 437-437.

PILLAI, N. G. AND DAVIS, T. A., 1963, Exhaust of micronutrients by coconut palm - A preliminary study. *Indian Coconut J.* **16** : 18-19.