EFFECT OF DIFFERENT ORGANIC SOURCES ON THE PERFORMANCE OF COCONUT SEEDLINGS IN COASTAL SAND

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ABSTRACT

Response of coconut seedlings during the prebearing stage (5 years) to inorganic fertilisers and addition of organic matter in coastal sand was investigated at the Central Plantation Crops Research Institute, Kasaragod. Addition of organic matter, especially farmyard manure or green leaves in combination with inorganic fertilisers resulted in spectacular improvement of the vigour of the seedlings and enhanced their early establishment in the sand. Despite the porous nature of sand, fertiliser application helped to retain P and K. Organic matter content of sand was increased following continuous annual applications of organic manures for five years.

INTRODUCTION

Perhaps the only crop grown on plantation scale on coastal sands in Kerala is coconut. Information regarding the management of establishing coconut garden in sandy soil is very meagre as no systematic fertiliser experiment has been carried out on this soil and it is particularly so with organic manures. The present study with different sources of organic manures, was undertaken to find out whether the establishment and later performance of transplanted coconut seedlings could be improved by the application of organic manures and also to evaluate the efficiency of the various commonly used organic manures. Agricultural and industrial wastes like coconut sheddings and coir dust were also included as sources in the study to adjudge the possibility of recycling these materials which would normally be treated as waste.

MATERIAL AND METHODS

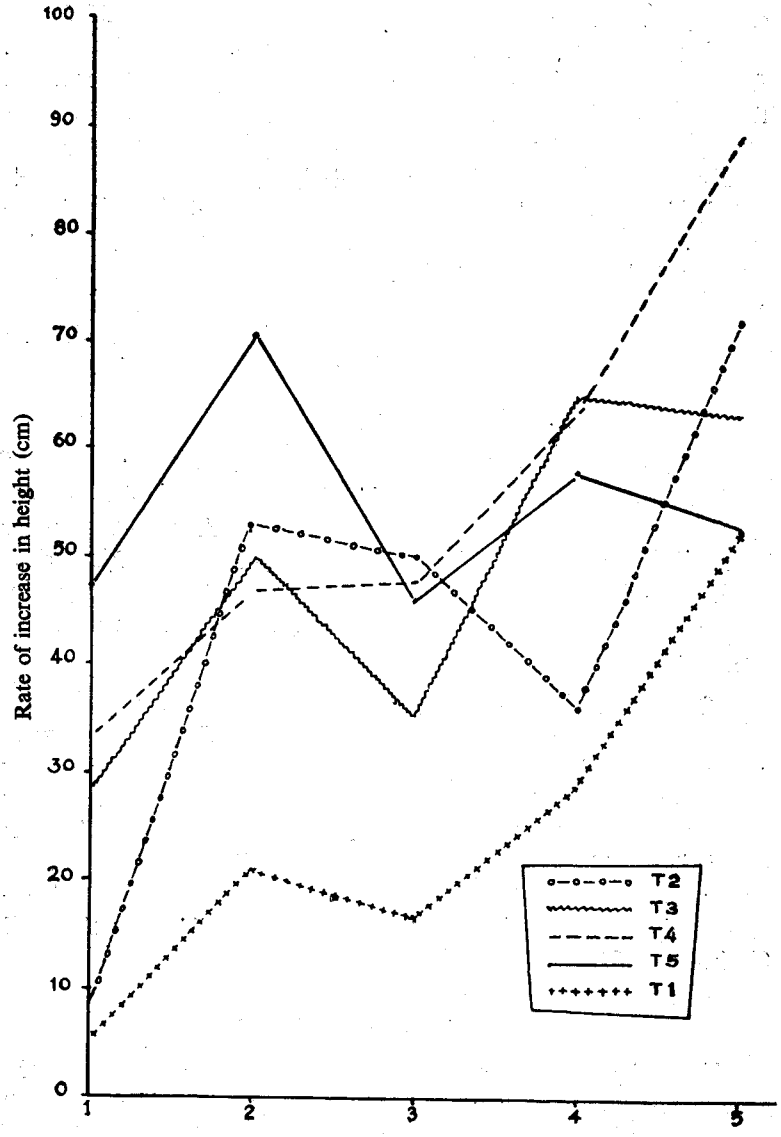
Twelve month old West Coast Tall coconut seedlings were planted in June 1971 on coastal sand (97% sand fractions) in

the beach block at Central Plantation Crops Research Institute, Kasaragod. The mean annual rainfall of the area is 3500 mm, a major portion of which is obtained from June to September. The seedlings were planted in 1 m^3 pits with a spacing of 8 m × 7.5 m. The five experimental treatments were T_1 Control—NPK fertiliser alone (recommended dose 0.5 kg N, 0.32 kg P_2O_5 and 1.2 Kg K_2O/palm/year), T_2 Coir dust+T_1, T_3 Coconut sheddings+ T_1, T_4 Forest leaves+T_1 and T_5 Cattle manure+T_1. The treatments were replicated five times with net plot size of eight palms per plot. Ten kg of the different organic sources (on oven dry basis) were applied to the seedlings in June–July in the first two years and the dose was increased to 20 kg thereafter. All the seedlings received 1/3rd the recommended dose of NPK as ammonium sulphate, single super phosphate and muriate of potash in the first year, 2/3rd in the second year and full dose from third year onwards, after making allowances for the NPK contents of the organic materials applied. Fertilisers were applied in two equal splits, one in May–June and other in August–September in the first 3 years and 1/3rd dose in May–June and 2/3rd dose in August–September in subsequent years. Summer irrigation was given uniformly to all the seedlings from the month of December to May.

The growth parameters i.e. plant height and number of leaves produced were recorded every year in June. Soil samples were collected from first year onwards and leaf samples from 3rd year and analysed for different nutrients. Soil samples were analysed for organic carbon (Walkley and Black method), available N (Subbiah and Asija, 1956), exchangeable K and pH (1:2 soil water ratio) as suggested by Jackson (1967). Leaf samples were collected (Chapman, 1964) and analysed for N, P, K, Ca, Mg, Fe, Mn, S and B (Jackson, 1967).

Results and Discussion

The effect of application of different organic sources on the growth characters of coconut seedlings is given in Fig. 1 and 2 In all the treatments with organics, the height and number of leaves produced were higher than that of the control. Treatment differences in the rate of increase in height was quite evident even after one year of transplanting; while in the case of leaf production,



No. of years after planting

Fig 1. Rate of increase in height under different organic sources.

it was observed after 2 years. During the first two years palms treated with cattle manure+NPK fertilisers were showing the highest rate of increase in height and leaf production while they were least with NPK fertilisers alone. In the third year, a decline in the rate of growth with respect to these two characters was noticed

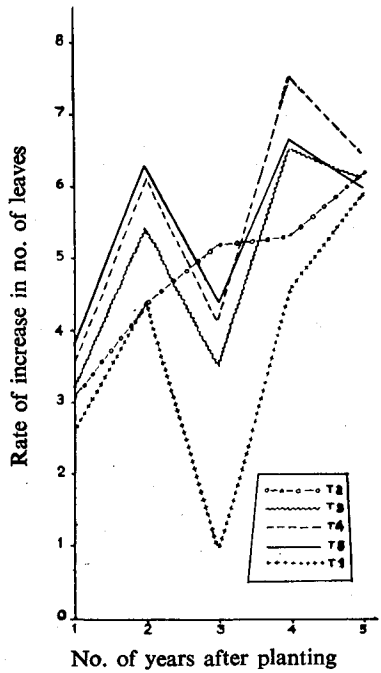


Fig 2. Increase in number of leaves under different organic sources.

uniformly in all the treatments. During this year, the field was submerged under water for a number of days due to heavy rains in the monsoon. From the fourth year onwards, maximum vegetative growth was recorded in seedlings receiving forest leaf. From fourth year onwards, the rate of growth of control palms started increasing though the total height and number of leaves in the palms under this treatment still remained lower than those receiving organic matter +NPK.

The number of young palms died showed that the mortality rate of palms was the lowest (7%) in palms receiving coconut

sheddings and cattle manure; while it was the highest (50%) in the palms receiving NPK fertilisers without organic matter.

The poor vegetative growth and high mortality rate in control treatment emphasise the need for application of organic manures for the initial establishment of seedlings in littoral sand.

Soil characteristics

The effect of different treatments on the soil chemical characters are presented in Table 1. Initially, there was no increase in organic matter level in the soil. At the end of 5th year, a rise in soil organic matter level was evident in plots receiving organic sources. Despite this, the available nitrogen in soil remained unaffected. Accumulation of P in soil irrespective of treatment difference was noticed from the third year onwards. As compared to control plot, the organic matter receiving plots showed better ability to retain K.

Leaf nutrients

The nutrient status of the index leaf of seedlings under different treatments is given in Tables 2 and 3. No consistent trend was noticed in the case of leaf N or P. P level increased with age of the seedlings irrespective of the treatment. In the control plot, the K level remained more or less static throughout the period of observation, while in the treated plot a decreasing trend in K level was noticed probably because of higher dry matter production and consequent dilution effect. Leaf samples collected 3 years after transplanting showed significantly lower K concentration in the control plot, while this difference was not apparent in subsequent years. Significant differences in the Fe (except those under coconut sheddings) and Mn concentration between the treated and control plots were observed after 5 years. Both nutrients were very high in the palms under cattle manure. Analysis of organic sources also indicate that these two nutrients are maximum in cattle manure compared to others (Table 4). Treatment differences were not significant in the case of other nutrients.

Based on soil or leaf nutrient status, it is not possible to draw any conclusion as to which nutrient or nutrients are res-

Table 1. *Effect of application of organic manures on soil characters.* (0–50 *cm depth*)

Treatment	pH				Organic carbon %				N (ppm)				P(ppm)				K (ppm)			
	'71*	'72	'74	'76	'71*	'72	'74	'76	'71*	'72	'74	'76	'71*	'72	'74	'76	'71*	'72	'74	'76
T_1	6.5	6.5	4.9	5.0	0.09	0.06	0.03	0.05	38	41	32	22	19	21	61	65	8	9	33	12
T_2	6.5	6.1	4.7	4.5	0.09	0.11	0.09	0.19	42	58	41	40	20	10	81	87	6	12	66	31
T_3	6.5	6.5	4.9	4.6	0.09	0.21	0.09	0.21	39	49	51	40	21	9	88	82	8	11	52	40
T_4	6.5	6.5	5.1	4.9	0.09	0.12	0.08	0.25	46	57	47	39	19	11	64	94	6	10	42	32
T_5	6.5	6.5	5.1	4.5	0.09	0.12	0.08	0.22	41	55	40	42	18	19	73	90	9	13	45	52

*Pre-treatment. NPK in available form

Table 2. *Nutrient status of leaves*

Treatments	Years after commencement of the experiment														
	3	4	5	3	4	5	3	4	5	3	4	5	3	4	5
	N(%)			P(%)			K(%)			Ca(%)			Mg(%)		
T_1	1.76	1.55	1.41	0.078	0.106	0.103	1.85	1.69	1.71	0.29	0.24	0.25	0.19	0.13	0.25
T_2	1.76	1.64	1.63	0.083	0.105	0.106	2.09	1.88	1.52	0.28	0.25	0.28	0.21	0.15	0.27
T_3	1.64	1.66	1.66	0.078	0.108	0.114	2.10	1.86	1.54	0.30	0.27	0.31	0.25	0.17	0.30
T_4	1.61	1.50	1.60	0.080	0.112	0.120	2.13	1.83	1.41	0.30	0.26	0.32	0.26	0.18	0.38
T_5	1.67	1.58	1.64	0.081	0.104	0.114	2.20	1.86	1.54	0.30	0.24	0.29	0.26	0.17	0.33

Table 3. *Nutrient status of leaves*

Treatment	Years after commencement of the experiment									
	4	5	4	5	4	5	4	5	4	5
	S (ppm)		Fe (ppm)		Mn (ppm)		Zn (ppm)		B (ppm)	
T_1	1163	1158	154	179	169	176	32	12	9	6
T_2	1442	1185	186	204	231	255	28	19	13	6
T_3	1358	1380	190	171	185	313	30	16	10	6
T_4	1350	1259	158	234	184	314	32	19	10	6
T_5	1384	1305	172	284	252	447	30	20	9	5

Table 4. *Analysis of organic manures*

Organic mannre	N (%)	P (%)	K (%)	Ca (%)	Mg (%)	S (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)	B (ppm)
Coir dust	0.5	0.08	0.50	0.23	0.58	3981	6013	67	83.0	14.8
Coconut shedding	0.6	0.04	0.40	0.31	0.41	1296	860	233	98.6	10.4
Forest leaf	1.6	0.10	0.95	0.77	0.72	2222	1867	103	71.4	28.0
Cattle manure	2.0	0.43	0.50	0.55	0.64	2778	4533	249	114.2	9.4

ponsible for the vigour of seedlings receiving organic manure. However, despite the lack of difference in the nutrient levels, the uptake of nutrients by seedlings under organic manure treatments should be very much higher than that of control plots. According to Villiemain (1965) the nutrient balance in the palm can be improved by organic manuring. This may be a possible explanation for the better performance of seedlings under organic manure in this experiment. Since there is significant improvement in the growth rate of seedings in the control plot after the establishment period, it should be presumed that organic matter addition is more important during the establishment period than at later stage. But an initial set back in growth of seedlings may affect the future yield performance of the palms. The high mortality rate of the seedlings under NPK fertiliser alone is a clear evidence for the necessity of organic manuring during the establishment period in coastal sands. Among the sources compared, cattle manure and forest leaves proved to be the best to promote early establishment of the seedlings. Other waste materials like coir dust, coconut sheddings, etc. can also profitably be utilised as organic sources, where the availability of cattle manure and forest leaves is scarce.

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