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INORGANIC AND ORGANIC SOURCES OF NITROGEN AND PHOSPHORUS AS FERTILIZERS FOR COCONUT

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ABSTRACT

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Results of a long term experiment to investigate the performance of inorganic and organic sources of nitrogen and phosphorus as fertilizers for coconut on a sandy loam soil in the Intermediate Zone (rainfall) are presented and discussed. The inorganic sources were sulphate of ammonia and saphos phosphate and the organic sources fish guano, bone meal and cattle manure.

Except for the first two years of the experiment, all the fertilizer treatments were consistently and significantly superior to the control. However, there was no significant difference between the effects of the inorganic and organic fertilizer mixtures on yield (Kg copra per hectare).

INTRODUCTION

The fertilizer field experiment conducted by the Tea Research Institute (Sri Lanka) to assess the performance of 3 kinds of nitrogenous fertilizers demonstrated that there was no difference in effect between organic and inorganic sources of nitrogenous fertilizer (Eden, 1937). The 3x3x3 NPK fertilizer experiment at Bandirippuwa on coconut in which nitrogen was supplied as sulphate of ammonia, calcium cyanamide and groundnut cake too showed that all three forms were equally effective (Salgado, 1946). Despite these experiences and the phenomenal increases in yield, recorded all over the world by the use of inorganic fertilizers, the clamour for the use of organic fertilizers persist. In response to this clamour, the Coconut Research Institute conducted a field experiment with coconut wherein, organic and inorganic sources of nitrogen and phosphorus were compared, along with two frequencies of application. This paper is confined to the comparison of organic and inorganic sources of nitrogenous and phosphatic fertilizers.

Materials and Methods

The experiment was laid out at Marandawila Estate, Bingiriya, on a loamy sand soil in the Intermediate Zone (rainfall). The chemical and physical characteristics of the soil are given in Table 1.

The treatments consisted of (i) control, (ii) inorganic mixture applied annually, (iii) inorganic mixture applied biennially (iv) organic mixture applied annually, (v) organic mixture applied biennially, and (vi) cattle manure and supplements applied biennially. The experimental layout was randomized design consisting of 6 blocks of 6 plots each. Each plot contained 18 palms. The different plots were separated by guard rows of palms.

Table 1. *Physical and chemical characteristics of Marandawila soil, Bingiriya.*

Coarse sand	80.85%
Fine sand	11.69%
Silt	1.39%
Clay	5.83%
Total Nitrogen	237 ppm
Ammoniacal Nitrogen	8.85 ppm
Nitrate Nitrogen	17.25 ppm
Available phosphorus (Olsen)	3.05 ppm
Total exchangeable bases	1.04 m.e/100 g
Exchangeable Potassium	0.15 m.e/100 g
Exchangeable Calcium	0.52 m.e/100 g
Exchangeable Magnesium	0.31 m.e/100 g
Organic Carbon	0.88%
pH .... 5.21 (H_2O) ; 4.57 (KCl)	

The inorganic mixture consisted of equal parts by weight of sulphate of ammonia (20.6% N), Saphos phosphate (28.5% P_2O_5), and Muriate of potash (50% K_2O). The rate of application was 2.27 kg per palm annually and 4.54 kg per palm biennially. The organic mixture was composed of 1.82 kg fish guano (7% N, 5% P_2O_5), 0.57 kg bone meal (3% N, 22% P_2O_5) and 0.80 kg muriate of potash (50% K_2O). The rate of application was 3.18 kg per palm annually and 6.36 kg per palm biennially. For the cattle manure (and supplements) a pair of neat cattle was tethered for 5 nights to each plot palm. This practice was followed for only an year. On later occasions cattle manure, collected for this purpose, was used. Before each application, the cattle manure was analysed for its nutrient content and appropriate quantities applied. The supplements were Saphos phosphate and muriate of potash.

Results and Discussion

The yield data (kg copra per hectare per annum) and the differences in yield between the various treatments are given in Tables 2 and 3 respectively.

It will be noted that except for the first two years of the experiment all the fertilizer treatments proved superior to the control.

Table 2. *Yield data (Kg copra per hectare) adjusted by covariance analysis for pre experimental yields*

Year	*Control*	*Inorganic*		*Organic*		*Cattle Manure Supplement*
		Annual	*Biennial*	*Annual*	*Biennial*	
1959	2519	2482	2491	2485	2601	2616
1960	2257	2431	2487	2295	2510	2600
1961	2855	3100*	2919	3211*	3129*	3259*
1962	2693	3040*	3004*	3139*	3228*	3344*
1963	2597	3092*	3085*	3092*	3094*	3195*
1964	2618	3313*	3172*	3242*	3285*	3341*
1965	2285	2873*	2853*	2928*	2938*	3260*
1966	2216	2815*	2628*	2762*	2578*	2786*
1967	1695	2266*	2073*	2125*	2014*	2137*
1968	1611	2288*	2161*	2295*	2131*	2348*
1969	1918	2732*	2680*	2675*	2537*	2677*
1970	1392	1879*	1775*	1869*	1722*	1769*
1971	1650	2563**	2463**	2601**	2493**	2670***

* Significant at P0.05
** Significant at P0.01
*** Significant at P0.001

Table 3. *Treatment differences (kg copra per hectare) calculated from Table 2*

	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
CONTROL Vs											
Inorganic annually	244*	348*	491*	694**	590**	599**	571**	677**	814**	487*	914**
Inorganic biennially	64	311*	487*	557**	571*	411*	378*	552**	761**	382*	813**
Organic annually	355*	445*	495*	623**	643**	479*	429*	684**	756**	475*	951**
Organic biennially	274*	536**	492*	668**	657**	362*	318*	517**	619**	330*	843**
Cattle Manure supplemented	405*	648**	596**	720**	976***	569**	442*	715**	759**	377*	1020**
INORGANIC ANNUALLY Vs											
Organic Annually	110	98	1	63	55	120	141	7	58	10	38
Organic biennially	27	188	1	29	67	237	251*	157	195	157	70
Cattle manure supplemented	159	300*	93	26	388*	29	129	38	55	110	108
INORGANIC BIENNIALLY Vs											
Organic annually	290*	136	4	66	73	67	53	132	6	93	138
Organic biennially	210	226*	4	109	85	49	58	30	143	53	30
Cattle manure supplemented	340*	337*	97	164	406*	158	64	165	3	7	207

* Significant at PO.05
** Significant at PO.01
*** Significant at PO.001

But the differences in yield between the treatments were significant only on a few occasions.

On a loamy sand soil in the Intermediate Zone with a total carbon content of the order of 0.88%, one expects the organic fertilizer to give the better yield. This is not so.

One of the reasons advanced in favour of organic fertilizers is that they help conserve moisture. This does not bear close examination. The maximum rate of application of organic mixtures was 94.24 kg per hectare per year. This would produce an increase of organic matter of the order of 0.07% per year.

It is also claimed that "organics" rot slowly. It has been demonstrated that organic fertilizers reach maximum nitrification in 6 weeks, same as in the case of sulphate of ammonia and cyanamide when applied to the soil, (Joachim 1926, 1927, 1928).

The results of this experiment are in agreement with the results of the 3x3x3 NPK experiment at Bandirippuwa in which 3 sources of nitrogen, viz. ground nut cake, sulphate of ammonia and calcium cyanamide showed no difference (Salgado, 1946).

Because organic fertilizers contain low amounts of plant nutrients, comparatively larger amounts of these fertilizers need to be applied. Thus the quantities of plant nutrients found in 4.54 kg of an inorganic mixture are obtained from 68.10 kg cattle manure together with 0.68 kg of saphos phosphate and 0.68 kg of muriate of potash. Hence use of organic fertilizers would result in bulky quantities being required. This would lead to increased costs of both fertilizer material and transport. For example, when the costliest inorganic mixture was priced at Rs. 1.88 per palm an organic mixture cost Rs. 4.20 exclusive of the transport cost. Thus if one wishes to use organic fertilizer material one should consider whether it would be economical. Unless the organic material is available in close proximity to the place of application, the cost of transport could be high so that the combined cost of fertilizer and transport could render the use of organic fertilizer uneconomic.

CONCLUSION

The different fertilizer treatments consistently proved significantly superior to the control. But the treatments containing organic sources of nitrogen and phosphorus showed no significant difference over the treatments containing inorganic sources of the same plant nutrients.

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