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Crotalaria striata

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A Note on Phosphate Manuring of *Crotalaria striata*

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E. J. VERGHESE, P. L. RAMANANDAN AND P. K. THOMAS

GREEN manure, the wonder key to soil fertility and economic crop returns, has been the subject of a very considerable volume of research work. A survey of the extensive literature available on the different aspects of this problem is beyond the scope of this note. It may, however, be stated that most of the published work relates to application of green manure to cereal crops. Pandalai *et al.* (1954) and Vergheese (1951) have examined the nutrient aspects of raising green manure crops in coconut gardens. But no work on the phosphate fertilization of such crops, on the lines of similar work on green manures for cereal crops—*vide* Parr and Bose (1944, 1945, 1947), Parr and Sen (1948), Mukerji and Agarwal (1950), Acharya (1952), Ganguly and Relwani (1954), Sen and Bains (1955), Sen (1956), Bains (1957) and others—appears to have been done with regard to a perennial plantation crop like the coconut. The present note relates to a

preliminary investigation in this direction.

MATERIALS AND METHODS

The experiment was conducted for three years at the Central Coconut Research Station, Kasaragod, Kerala State, in the same field in red loamy sand having the following mechanical composition:-

Coarse sand	80.3	per cent
Fine sand	2.1	" "
Silt	3.5	" "
Clay	12.5	" "

The field was divided into four plots, two of the diagonal plots being manured with superphosphate at 60 lb. (27.2 kg.) phosphoric acid per acre and the other two plots left unmanured. The superphosphate was applied by placement six inches (15 cm.) deep. *Crotalaria striata* was sown in April-May, soon after the receipt of pre-monsoon showers of the south-west monsoon. Care was taken to see that each plot contained an equal number of plants. The crop was harvested when in the flowering stage and

the green matter obtained from each plot was buried in the plot itself. Soil samples were collected from the 0-24" (0-61 cm.) layer, before commencement of the experiment and after it was concluded. The samples were analysed for nitrogen and available phosphoric acid according to the methods of Piper (1944).

RESULTS AND DISCUSSION

Yield of green matter

The yield of green matter was as follows:-

	Yield		Percentage increase over control
	Control plot	Manured plot	
First season	3,216	3,806	18.3
Second "	5,716	7,201	26.0
Third "	7,681	8,547	11.3

It will be seen from the above data that the yield of green matter increases with the application of phosphate. This is in conformity with results reported by other workers. Mukerji and Agarwal (1950); for instance, found a 10 per cent increase in the yield of sunnhemp manured with 50 lb. (23 kg.) phosphoric acid per acre at Padaqaon (Bombay) and that in Borbhetta (Assam) cowpeas, *dhaincha* and *matikalai* hardly grow without the addition of some phosphate. They have also reviewed similar beneficial results in experiments carried out in Rhodesia and Ceylon. The yield of *berseem*, manured with different quantities of phosphates

have been reported to be increased by 100 to 150 per cent by Parr and Bose (*loc. cit.*), 68.2 per cent by Ganguly and Relwani (1954) and 75 per cent by Bains (1957). Similar results were obtained by Sen and Bains (1955). By manuring *berseem* with 120 lb. (54.4 kg.) phosphoric acid per acre, Sen (1955) found 102 kg. of extra yield of green fodder per kg. of phosphoric acid applied. *Crotalaria striata* used in this investigation gives an increase in yield of 22 to 54 kg. per kg. of phosphoric acid. This lower rate of response may be due to the individual peculiarity of the green manure plant studied. It may also be noted that the legume was introduced into the field under the experiment for the first time and that the dose of phosphate applied is lower than that used by most other workers.

Increased yield means increased production and addition of organic matter. Stewart (1947) is of the view that "fertilizers can indeed be used to produce humus when necessary, as, for instance, in the phosphate manuring of legumes." Pandalai *et al.* (1954) reported that farmyard manure and green manure are two main forms in which the entire range of coconut soils receive their organic matter and that *Crotalaria striata* is a suitable green manure crop for coconut gardens. Phosphate fertilization of *Crotalaria striata*, therefore, opens up a great possibility of enriching coconut soils with organic matter.

Nitrogen and available phosphoric acid

Data in respect of nitrogen and available phosphoric acid of the soil are presented below:-

	Nitrogen %.		Available phosphoric acid %.	
	Control plot	Manured plot	Control plot	Manured plot
Before the experiment	0.041	0.037	0.010	0.010
After the experiment	0.067	0.073	0.029	0.035
Percentage increase	63.40	97.30	190.00	250.00

The data show that the nitrogen content of the soil increases by growing *in situ* the leguminous green manure crop, *Crotalaria striata*. The treated plot shows a greater increase in soil nitrogen, the increase being 33.7 per cent more than that obtained in the control plot. The results for available phosphoric acid are similar.

Vergheese (1951) found that a crop of *Crotalaria striata* grown at the Central Coconut Research Station, Kasaragod, Kerala State, would add to the soil 63 to 137 lb. (29 to 62 kg.) of nitrogen per acre. A more complete picture of the effect of raising green manure crops *in situ* in coconut gardens, with regard to major and micro nutrients, have been furnished by Pandalai *et al.* (1954). The application of readily available phosphatic fertilizers to the green manure crops would certainly augment these beneficial effects.

Jensen (1917) has reported that the addition of three per cent of green manure to the soil raised the solubility of lime and phosphoric acid by 30 to 100 per cent. Oberholzer (1936) and Moser (1942) have collected extensive evidence to show that phosphoric acid and potash are rendered more soluble by decomposing green manure. Similar results have been reported by many other workers. The results reported here are in agreement with these findings.

Sen and Bains (1955) have stated that the increased availability of phosphate may be due to (1) production of large quantities of carbon dioxide during the decomposition of organic matter leading to the lowering of the pH of the soil solution and (2) conversion under the influence of decomposing organic matter to organic phosphates which are better available. Struthers and Siebing (1950) favour the latter view and showed that organic acids produced by bacterial decomposition of organic manure form compounds and complexes with phosphate inhibitors such as aluminium and iron in the soil and release phosphates for the benefit of crop growth. Considering the fact that the soil under investigation is acidic, pH ranging from 4.8 to 5.2, this view appears to be the more probable cause for rendering soil phosphates more available. Greater phosphate availability to the extent of 60 per cent is obtained by manuring the crop of *Crotalaria striata* with superphosphate at the rate of

A NOTE ON PHOSPHATE MANURING OF *CROTALARIA STRIATA*

60 lb. (27.2 kg.) phosphoric acid per acre.

These studies have been extended to an investigation of the effect of phosphate along with small quantities of nitrogen and potash on the growth of *Crotalaria striata* in a sandy soil area of the Research Station and this will form the subject of a future communication.

SUMMARY

A trial was conducted for three consecutive years in a field having red loamy sand soil at the Central Coconut Research Station, Kasaragod, Kerala State, to study the effect of manuring *Crotalaria striata* with superphosphate at

60 lb. (27.3 kg.) phosphoric acid per acre. Manuring with phosphate at this rate increased the yield of green matter from 11 to 26 per cent, soil nitrogen by 33.9 per cent and available phosphoric acid by 60 per cent compared to unmanured control plots.

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