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Phosphates for Sugarcane in the Nellikuppam Sugar Factory Zone

by

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Ranganathan *et al.* (1964) reported that the addition of phosphate and potash both in low and high doses neither increased the yield nor improved the juice quality of sugarcane in the Nellikuppam factory zone. In this experiment phosphate was added as super to soil at planting. Since phosphates applied to soil in such a soluble form get more or less 'fixed up' it is not unlikely that the a absence of response to phosphates in the experiment is to some extent atleast caused by such fixation, which makes phosphate non-available in adequate quantity. Response to phosphates should therefore, be tested under conditions which do not favour soil fixation before the utility of phosphate fertilisers to sugarcane in the tract is finally settled. Accordingly, an experiment with different phosphate carriers was conducted in the Sugarcane Research Station, Cuddalore for three years and results obtained are presented and discussed in this paper.

Materials and Methods: The experiment with the different phosphate carriers was conducted with eight treatments on Co. 419; 1) Compost at 12·4 tonnes/ha (basal dressing), 2) Superphos as 56 kg P_2O_5/ha (basal dressing), 3) (1)+(2), 4) (3) after digestion (as explained below), 5) (2)+56 kg N/ha, 6) Foliar spray of the phosphoric acid to give 56 kg P_2O_5/ha in 2 split doses, 7) Water spray (no phosphate) and 8. Control (no phosphate). Super and compost were mixed and kept moist for 15 days before application in treatment, (4). One per cent of the phosphoric solution (20 kg P_2O_5 at each spray) was given during the 3rd and 4th months of growth at 15 days interval in treatment (6). All treatments were given 150 lb N as Ammonium sulphate in two equal doses at 45th and 90th day respectively. For treatment (5), however, the dose was split into three, the first 50 lb being applied along with super at planting. The treatments were laid out in two randomised blocks in different fields (different randomisation) each year. Initial soil analysis for texture and nutrient status (0–12" soil samples), and leaf analysis for P every month during the growth period were carried out.

The method of collecting the leaf sample consisted in selecting randomly 20 standard leaf samples (3rd leaf) from each plot. The middle one-third portion without the mid-rib from each leaf was next collected, mixed, dried and powdered

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to give the leaf sample for the plot. The estimation of P was done by the standard method by precipitating as Ammonium phosphomolybdate after ashing and extraction with hydrochloric acid (1 : 1). In addition data on plot-wise yield and juice quality were also recorded.

Results: *Soil analysis:* Soil samples from the experimental fields (clay soil type) up to 12" depth at four different places were tested for texture, total N, P and available P. The average status of N and P in the experimental fields (0–12") was 0.035 total N (%) and 1383 lb/acre of total P and 291 lb of available P per acre. The total P in the surface soils is medium, its availability is poor possibly due to the phenomenon of "P fixation" in soils. Response to P fertilisation should therefore, be expected for crops grown in such soils provided the added P does not also get fixed up and become non-available to any large extent.

Crop growth and uptake of P: Germination and tillering of the crop were uniform in all the treatments in all the years and the crop growth was normal in stand and vigour. The monthly values of leaf P for the various treatments and for the three years were statistically analysed. The treatment effect did not prove significant on testing against the relevant interaction effects. The years, however, proved significantly different. The treatment means for three years period are presented in Table 1.

TABLE 1. *Mean monthly values of l.af 'P' during the growth phase for the different treatments*

	Treatments								
Months	1	2	3	4	5	6	7	8	Mean
4	0.28	0.25	0.27	0.31	0.29	0.35	0.25	0.29	0.29
5	0.32	0.32	0.34	0.32	0.29	0.32	0.29	0.32	0.32
6	0.28	0.26	0.28	0.29	0.26	0.26	0.27	0.24	0.27
9	0.24	0.24	0.23	0.24	0.23	0.23	0.24	0.23	0.24
Mean	0.28	0.27	0.29	0.29	0.27	0.29	0.26	0.27	

C.D. (5%) for the interaction mean = 0.03%
C.D. (5%) for the months mean = 0.02%

There is no preference to any phosphate carrier in making the nutrient more available to the plant under the different treatment conditions. Fixation and the consequent less availability of P applied as super is thus not evidenced by the average P status in the leaf during the growth phase. None of the phosphate carriers is superior to control (no phosphate) in maintaining a better P status in the leaf during the growth phase. In other words, P added in any form does not help to maintain a better leaf P status than the control which is without any phosphate. Therefore, the utility of phosphate addition itself in the tract is doubtful.

Cane yield: The plot-wise yield data for each year were statistically analysed. The treatment differences did not prove significant in any. A combination of the results was next attempted in order to obtain a general conclusion in regard to the treatment differences over the years and to detect the interaction effects if any.

The error mean squares for the three years were tested for uniformity by the Bartlett's test and were found to be non-uniform. The method of weighted analysis of variance was therefore adopted for a test of the interaction 'Y×T' (Panse and Sukhatme, 1961). A non-significant X^3 value for P=0.05 was obtained for the interaction sum of squares indicating that the said effects were absent. The mean yield of cane in tonnes/ha for different treatments (average over the P) (S.E. 1.28) obtained as was follows :

1	2	3	4	5	6	7	8
96.82	103.74	106.95	111.40	109.67	108.43	103.00	101.52

It follows that the different phosphate carriers tested do not vary in their effects on cane yield. The fact that none of them has produced a better yield than the control (no phosphate) also suggests that the phosphate fertilisers in any form are not useful in enhancing sugarcane yield in the tract over normal years.

Juice quality at harvest : The commercial cane sugar percentage was calculated after juice analysis from every plot just before harvest each year. The statistical analysis of these data did not show any significant difference among the treatments in any year. A combined analysis was carried out as was done for the yield data which revealed that the 'treatment' did not come off significant on testing against the interaction 'Y×T'. The mean values of CCS% (averaged over the P) for the different treatments are given below :

1	2	3	4	5	6	7	8	
11.8	13.1	12.9	11.8	11.7	12.7	12.3	12.0	S.E. 0.6

Therefore, addition of phosphates in any form has no effect on juice quality in the tract under the normal seasonal fluctuations obtained during the years of experimentation.

Discussion and Conclusion: *Fixation of phosphates in soils:* Phosphate added in soluble forms as superphosphate is more or less fixed in the soil in non-available forms depending on certain soil characters such as clay status, pH etc. Consequently the expected response in yield to the added phosphate is often not obtained. The absence of response to added P in the Nellikuppam tract when P is added as super may therefore, be taken to be due to the phenomenon of fixation which renders the added P unavailable in adequate quantity. In order to test this belief an experiment with different phosphate carriers including foliar

spray of orthophosphoric acid has been conducted for three years at the Sugarcane Research Station, Cuddalore. Observations were made on leaf P, yield and juice quality. All the three characters do not show any marked preference to any one of the phosphate carrier. None of the phosphate carriers also prove superior to the 'no phosphate' control. It is concluded therefore, from the evidences presented that the absence of response to super in the tract is due to the non-requirement of the nutrient from any added source during the normal seasons and under the level of N manuring employed and not due to any possible 'fixation' and the consequent non-availability of the added P.

Soil analysis: The available P status in the experimental fields is poor according to the general fertility rating. However, no response to added P is obtained for sugarcane. This may be due to the fact that the total P content in the soil is rated as good and perhaps the sugarcane plant satisfies its P requirements from the soil store by contact exchange leaving the added P mostly unused. The sugarcane roots are reported to be able to absorb P through contact exchange from the unavailable soil sources.

Summary: An experiment on different phosphate carriers was conducted at the Sugarcane Research Station, Cuddalore for a period of three years with the object of finding out the best form of application of the element for maximum P availability and the consequent increase in yield and quality of sugarcane. Compost, super and foliar spray of P were tried on equal P basis and the effects produced on the uptake of P, yield and quality of sugarcane were studied. It was found that all the phosphate carriers and the 'No phosphate' control maintained the same level of leaf P and produced similar yield and quality of cane. It was, therefore, concluded that Nellikuppam tract does not require phosphate manuring in any form under the level of N manuring employed.

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