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Effect of Phosphate Carriers and Doses on Yield of Co. 7 *Ragi* in Major Soil Groups of South India*

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Introduction: Response of several crops to added phosphate fertilizers is well known. In South India experiments have generally indicated only marginal responses to applied phosphorus. It is possible that soil levels of phosphorus are adequate in certain of these soils and deficient in others. Effect of phosphate carriers also is likely to be reflected finally in crop yields. Comprehensive data regarding the phosphorus requirements of *ragi* crop grown in South Indian soils are not available. The present work was accordingly undertaken to supply the information, in relation also to differences in phosphate carriers.

Review of Literature: Some of the generally recognised factors which determine the apparent relative efficacy of a particular phosphate fertilizer are soil reaction, degree of soil phosphorus deficiency, rate of application, needs of the specific crop and certain pedological differences. Houghland *et al.* (1942) reported the results of field tests conducted in Maine, New Jersey and Pennsylvania using potatoes as a test crop. Dicalcium phosphate was found to be as effective as concentrated superphosphate in acid soils. Glenn *et al.* (1950) found that fertilizers with phosphorus in citrate-soluble form did not increase plant growth in calcareous soils. Olsen *et al.* (1950) with fertilizers tagged with radio active phosphorus showed that water insoluble materials such as dicalcium or tricalcium phosphates were relatively poor sources of phosphorus than the more water-soluble forms, on calcareous soils. Carbona (1961) has recommended application of phosphorus fertilizers of an alkaline reaction for tropical soils, which have a high clay and sesquioxide content. Bennet *et. al.* (1954) compared eighteen sources of phosphate fertilizers on Honston black clay and obtained significant increases in yield in the case of the most soluble forms of phosphatic fertilizers.

Mattingly (1963) reported from the recent reports of Rothamsted Experiment Station that none of the newer fertilizers were significant and consistently better than superphosphate. On rapidly growing crops (cereals

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and radish) early growth was found proportional to the amount of water-soluble phosphorus in fertilizers. Motiramani *et al.*, (1964) found that availability of phosphorus was maximum with regard to superphosphate on black soils and with dicalcium phosphate on alluvial soils. Dev (1964) found a significant increase in the absorption of phosphorus by plants when urea was applied at 40 and 80 lb per acre N combined with 40 lb per acre P_2O_5 as tagged super-phosphate. The same trend was noticed by Fontane *et al.* (1964).

Material and Method: Three soils, namely red and black soils from Coimbatore and laterite soil from Nanjanad were taken for a pot culture study. Under each soil, seven treatments *viz.*, (1) control, (2) 20 lb P_2O_5 as superphosphate, (3) 40 lb P_2O_5 as superphosphate, (4) 20 lb P_2O_5 as dicalcium phosphate, (5) 40 lb P_2O_5 as dicalcium phosphate, (6) 20 lb P_2O_5 as ammophos and (7) 40 lb P_2O_5 as ammophos were included.

All the treatments were replicated twice. A common basal dressing of 40 lb N as ammonium sulphate and 20 lb potassium as potassium chloride was given for all the treatments. *Ragi* (Co. 7) was used as the test crop. The grain and straw yields were recorded. Statistical significance of the results was assessed.

TABLE 1. *Yield of grain and straw* (g / pot)

Treatments	Red soil		Black soil		Laterite soil	
	Grain	Straw	Grain	Straw	Grain	Straw
Treatment 1	10.20	19.98	17.55	20.95	4.92	21.60
2	12.25	21.16	15.53	21.41	16.22	29.98
3	14.23	21.50	18.40	24.93	12.99	24.65
4	13.43	20 84	16 97	23.59	22.18	27.73
5	16.70	21.25	22.17	23.14	20.72	32.75
6	15.85	23.26	17.43	23.84	15.87	25.91
7	16.98	23.36	22.03	25.10	20.72	32.25

(i) **Comparison of soils** (grain yield):

Red	Black	Laterite	S. E	C. D.
14.23	18.58	15.95	0.9{	2 04

Conclusion: Black, Laterite, Red.

(ii) **Comparison of control Vs. rest:**

Control	Rest	S. E.	C. D.
10.89	17.15	1.15	2.39

Conclusion: Rest, Control.

(iii) **Comparison of kinds of phosphates:**

Super-phosphate	Dicalcium phosphate	Ammophos	S. E.	C. D.
14.94	18.70	17.81	1.06	2.20

Conclusion: Dicalcium phosphate, Ammophos, Superphosphate.

(iv) **Comparison of doses:**

20 lb.	40 lb.	S. E.	C. D.
16.19	18.17	0.86	1.79

Conclusion: 40 lb., 20 lb.

(v) **Comparison of soil means** (straw yield):

Red	Black	Laterite	S. E.	C. D.
21.68	24.07	27.84	0.96	2.00

Conclusion: Laterite, Black, Red.

(vi) **Comparison of control Vs. rest means:**

Control	Rest	S. E.	C. D.
20 84	25.12	1.11	2.31

Conclusion: Rest, Control.

Results and discussion: Dicalcium phosphate treatment recorded the maximum grain yield (Table 1). Ammonium phosphate was on a par with dicalcium phosphate and both were definitely superior to superphosphate treatments. Fontana *et. al.* (1964) have observed a similar trend and pointed out that granular dicalcium phosphate in association with strong electrolytes lika ammonium sulphate brought about increased absorption of phosphate. Considering the soil types, black soil was superior to the other types and maximum grain yield was obtained from the black soil treatments. The trend of yield was highly significant in the case of control (no phosphate), whereas, the effects were on a par in the rest of the treatments. In the red and laterite soils, control and the rest of the treatments were significantly different from one another, while in the black soil, the effects were on a par. The calcareous nature of black soil leading to fixation of phosphate in the form of calcium phosphate may account for lack of response on black soil,

Heck (1934) classified the forms of available fixed phosphorus in soil as readily soluble calcium phosphate, moderately soluble aluminium phosphate and difficultly soluble iron phosphate, and basic iron and aluminium phosphates. In the case of black soil all the treatments have recorded yields which were on a par. In this case, the readily soluble calcium phosphate might have been utilised by the crop. However, in the case of red and laterite soils the control

and the rest of the treatments were significantly different from each other. This can be explained by the fact that during the short growth period of the crop the freshly precipitated iron and aluminium phosphates might have been partly utilised by the crop. On the contrary, in the no phosphorus (control) treatments only the already existing moderately available and difficultly soluble forms of soil phosphorus would have been available for utilization. Presumably, as these forms could not have been fully utilised in a short period significantly lower yields of grains were obtained for control.

The straw yield in all the treatments proved to be significantly superior to control. The laterite soil was significantly superior to black and red soils. This trend was probably not fully an available phosphorus effect. The high level laterite soil used for the pot culture was superior to other soils as regards all the plant nutrients, especially available N. This in turn might have induced higher straw yields. The significant correlation of available nitrogen with straw yields appeared to support this view.

Summary and conclusion: A pot culture experiment was conducted with three major soil groups of South India namely, black, red and laterite soils using common phosphatic fertilisers, namely, superphosphate, dicalcium phosphate and ammonium phosphate at 20 and 40 lb N as ammonium sulphate and 20 lb potassium as potassium chloride. *Ragi* variety (Co. 7) was used as the test crop. The maximum yield of *ragi* was obtained from black soil.

Among the various fertilisers tried dicalcium phosphate proved to be superior in all the soils. Ammophos was on a par with dicalcium phosphate. Forty pounds dose of P_2O_5 per acre was found to give the maximum yield, considering all the soil types.

Straw yield was found to be mainly affected by available N and hence it is suggested that available N estimated by alkaline permanganate method could be used for predicting straw yields.

REFERENCES

Bennett, O. L., T. C. Longnecker and C. Gray. 1954. A comparison of the efficiency of eighteen sources of phosphate fertilizers on Honston black clay. *Soil Sci. Soc. Amer. Proc.*, 18 : 408—12.

Carbona, F. 1951. Phosphate fixation by the clay fraction of the soil. *Agron. Trop.*, 6 : 304-6.

Dev, G. 1964. Influence of nitrogen on the availability of fertilizer phosphorus. *Nature.*, 203 : 899.

Fontana, P., S. Silva and A. Guerrini. 1964. The absorption by roots of P^{32} labelled phosphates associated with strong electrolytes. *Agrochimica.*, 8 - 320-9.

Glenn, C. L., G. O. Baker and R. S. Synder. 1950. Phosphate fixation in calcareous soil. *Soil Sci*, 69 : 55-62.

Heck, A. F. 1934. Effect of the degree of base saturation of a soil on its capacity to fix phosphorus in difficultly available form. *Soil Sci.*, 38 : 463 70.

Houghland, G. V. C., K. G. Clark, A. Hawkins, and J. C. Campbell. 1942. Nutrient value of some new phosphatic materials used on potatoes *Am. Fertilizer.*, 97 : 5-8, 24-6.

Mattingly, G. E. C. 1963. The agricultural value of some water and citrate soluble phosphate fertilizers. An account of recent work at Rothamsted and elsewhere. *Fertil. Soc. Proc.*, 75 : 57-108.

Motiramani, D. P., K. K. Vyas and N. K. Sharma. 1964. Availability of phosphatic fertilizers in some soils of Madhya Pradesh., *J Indian Soc. Soil Sci.*, 12 : 157-63.

Olsen, S. R., W. R. Schmehl, F. S Watanabe, C. O. Scott, W. H. Fuller, J. V. Jordan and R. Kunkel. 1950. Utilization of phosphorus by various crops affected by source of material and placement. *Colo. Agr. Exp. Sta. Tech. Bull.*, 42.

A Preliminary Study on *Ferrisia (Ferrisiana) virgata* Ckll., The White Mealy Bug (Homoptera : Pseudococcidae) In Madya Predesh.

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Introduction : *Ferrisia (Ferrisiana) virgata* Ckll is a widespread pest of many ornamental plants, fruit crops and some field crops as recorded by Hosny (1943) and Mohammad Ali (1961). Some aspects of its bionomics were studied by Betrem (1936) in Java; Das *et. al.* (1948) in India; Voelcker (1948) in Gold Coast and Highland (1956) in Maryland. Its persistent occurrence in Madhya Pradesh during recent years and insufficiently known bionomics led to the studies on its host plants, bionomics and control, the preliminary results of which are reported here.

Materials and Methods : The studies on its bionomics were conducted at room temperature during the period from December, 1965 to March, 1966. The mean minimum room temperatures during these months ranged from 65.4 to 79.0°F and 71.3 to 85.3°F, respectively. The pest was reared on small potted brinjal plants and observations were taken daily. The host plants were surveyed at five different campii of the Vishwa Vidyalaya in M.P. namely, Jabalpur, Sehore, Gwalior, Rewa and Raipur and have been classified under high,

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