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EFFECT OF METHODS OF PHOSPHORUS APPLICATION ON THE YIELD, CONTENT AND UPTAKE OF PHOSPHORUS AT DIFFERENT STAGES OF CROP GROWTH BY RICE I. R. 20.

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A field experiment was conducted on red sandy clay loam (Typic Haplustalfs) with rice IR. 20 as test crop to find out the efficacy of different methods of phosphorus on the yield, content and uptake of P at different stages of crop growth. The treatments consisted of full basal application, half basal + foliar and foliar application, alone and in combination with slurry dipping of roots. The results revealed that slurry dipping with half basal and foliar application of 2% DAP recorded an yield of 5312 kg/ha of rice grain and it was on par with treatment, slurry dipping alone (5240 kg/ha). The content and uptake of P were increased at all the stages of crop growth due to slurry dipping. The P recovery was also the highest (18.7%) in slurry dipping alone.

Phosphorus is an essential input and its deficiency is a major constraint for successful crop production in India. Thus there is a need for the application of phosphorus for achieving higher yields of crop. Judicious management of P should take into account of the soil factors, fertilizers and their time and method of application. Crop recovery of added 'P' seldom exceeds 20% and there is a need to increase the efficiency of P utilization Ramasamy *et al* (1974) observed slurry dipping gave yield comparable to that of basal application. However, Gopal Rao (1974) reported that entire dose of P applied as basal gave the highest yield. Gupta (1971) indicated that foliar application not only increased the yield but also the

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quality of crop produce. In view of the above results, this study was undertaken to find out the efficacy of different methods of P application on the yield, content and uptake of P by rice IR. 20.

MATERIALS AND METHODS

A field experiment was conducted in Agricultural College and Research Institute, Madurai during kharif 1979 using rice IR 20 as test crop on red sandy clay loam (Typic Haplustalfs) which is low in available N and P, medium in available K. The soil was neutral with EC 0.112 ds/m having 0.75% organic carbon. The treatments consisted of (S0) no 'P' application (S_1) full does as basal, (S_2) half dose as basal + foliar spray (2% DAP twice), (S_3) Foliar spray, (S_4) Slurry dipping alone, S_5) slurry dipping + full basal, (S_6) slurry dipping + half basal + foliar spray, (S_7) slurry + foliar spray.

The recommended dose of 120: 60:60 kg N, P_2O_5 and K_2O/ha was applied. Nitrogen as urea applied in two splits, while entire dose of K as muriate of potash applied as basal. 'P' was applied as per treatments. For slurry dipping and soil application, single super-phosphate was used and in the case of foliar spray, two sprays of diammonium phosphate was used at 2.0 per cent. To compensate the effect of N added through the foliar application of DAP spray, 0.8 percent of urea was resorted to the splits which received no DAP spray.

Slurry was prepared by mixing 30 kg P_2O_5/ha as superphosphate with puddled soil in 1:1 proportion. The roots of the seedlings were dipped in slurry and transplanted. Foliar application of phosphorus was done on 30th and 50th day. The plant samples were collected at tillering, panicle initiation and harvest stages and analysed for total N (Humphries, 1956), phosphorus and potash (Jackson, 1973). The yield of grain and straw was recorded.

RESULTS AND DISCUSSION

The data of grain and straw yield and response are given in Table 1.

Table : 1. Effect of methods of P application on yield of rice grain and straw and response.

S.No.	Treatment	Grain (kg/ha)	Straw (kg/ha)	Response (kg/ha)
1.	No P application	4115	7321	—
2.	Full basal	4639	6125	8.73
3.	Half basal + Foliar spray	5009	7144	14.98
4.	Foliar spray	4702	6988	19.60
5.	Slurry	5240	7575	37.50
6.	Slurry + Full basal	4837	6731	8.02
7.	Slurry + Half basal + Foliar Spray	5312	7043	3.22
8.	Slurry + Foliar spray	5001	6969	14.73
	CD (P = 0.05)	97	75	

The grain yield was significantly influenced by different methods of application. The highest grain yield of 5312 kg/ha was observed in slurry dipping + half basal + foliar spray and it was on par with slurry dipping alone, while the lowest yield of 4115 kg/ha was recorded in control. The treatments received slurry dipping recorded higher grain yield than that of the corresponding treatments without slurry consisting of single superphosphate, soil and water has been found to increase the crop growth which usually was observed during first 30 days after transplanting. This resulted in increased crop growth and vigour which in turn lead to higher yields. Similar results were reported by Katyal *et al.*, (1975), Katyal (1979) and Wajid Ali Mirza *et al.*, (1979).

The straw yield ranged from 6125 to 7575 kg/ha. The treatment slurry dipping recorded the highest straw yield. This revealed that slurry dipping would have contributed 'P' for root development resulting in vigorous plant growth which lead to higher straw yield. This is in line with the finding of Ramaswamy *et al.*, (1974).

The response of rice to P application as judged by kg of grain/kg P_2O_5 is given in Table 1. Response ranged from 8.73 to 37.50 kg/ha. The lowest response of 8.73 was observed in full basal (S_1) and this might have been due to the result of higher amount of P fixation. The highest response of 37 50 kg/ha was noticed in treatment slurry dipping alone. This may be due to the fact that by slurry dipping 'P' was placed adjacent to effective, root zone which facilitated increased absorption and utilization of added P. Among the treatments which did not receive slurry dipping, foliar application (S_4) alone showed the highest response (19.60).

Influence of methods of P application on content and uptake of P at different stages of crop growth are given in Table 2-3 The P content was

Table : 2. Effect of methods of P application on P content at different stages of crop growth (per cent on dry basis)

Treatment	Tillering	Flowering	Straw	Grain
S_0	0.37	0.29	0.14	0.28
S_1	0.43	0.36	0.22	0.33
S_2	0.45	0.39	0 24	0.33
S_3	0.42	0.35	0.20	0.32
S_4	0.38	0.32	0.17	0.37
S_5	0.45	0.39	0.24	0.39
S_6	0.46	0.41	0.25	0.35
S_7	0.42	0.37	0 20	0.35
CD ($P = 0.05$)	0.01	0.02	0.01	0.01

Table : 3. Effect of methods of P application on P uptake at different stages of crop growth 'P' recovery.

Stage / Treatments		Tillering	Flowering	P uptake (kg/ha) Grain	Straw	Total	Recovery%
S_0	6.79	9.99	12.12	10.65	22.77	—	
S_1	8.30	12.53	14.04	13.48	27.52	8.00	
S_2	8.92	13.97	16.64	17.40	34.04	12 53	
S_3	8.09	12.89	14.97	13.12	28.09	17.74	
S_4	7.52	10.96	16.30	12.12	28.42	18.84	
S_5	9.15	13.53	16.33	16.49	32.42	11.17	
S_6	10.27	14.48	17.69	17.69	36.27	15.00	
S_7	9.06	12.85	17.41	14.35	31.36	14.99	
CD(P =0.05)	0.21	0.80	2.18	0.66			

significantly influenced by various methods of application at all the stages of crop growth. The control recorded the lowest P content The treatment S_6 (Slurry dipping + half basal + Foliar spray) showed the highest P content. This may be due to the increased P absorption from soil application at early stages of crop growth and subsequently from foliar spray at late stages. However, irrespective of treatments, those received slurry dipping recorded higher P content than that of those without slurry dipping. By slurry dipping the P was placed within the rnizosphere zone resulted into increased absorption since diffusion coefficient of P is very low as reported by Panda (1979). The treatment slurry dipping + full basal (S_5) recorded the highest P content in grain Katyal (1979) Wajid Ali Mirza (1979) also observed an increased P content with slurry dipping.

The P uptake ranged from 6.76 to 10.25 kg/ha, 9.99 to 14.48 kg/ha at tillering, flowering stages respectively (Table 3). The highest uptake of P was noticed in treatment S_6 (Slurry dipping + half basal + foliar spray). This may be due to increased amount of P added and enhanced absorption of P form soil at early stage of the crop growth subsequntly from folia spray at later stages. Slurry dipping increased the uptake of P. This may be attributed to the increased yield and dry matter production coupled with absorption and utilization of added P. As root dipping is an extremely close form of placing of the phospate in the root zone improvement in P uptake could be possible. Similar results were

reported by Panda (1979) and Katyal (1979)

The P recovery ranged from 8.00 to 18.84% to slurry dipping treatments (S_4, 3_6, S_8 and S_7) recorded higher 'P recovery the lowest recovery as major portion of the applied P might have been fixed Among the treatments without slurry dipping, foliar spray showed the highest recovery (17.74), since the loss of nutrient associated with it is very meager. However, among all the treatments slurry dipping alone (S_4) recorded the highest recovery of 18.84%. This may be due to effective absorption and lesser losses as slurry dipping is the extreme form of placement adjacent to effective root zone.

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