

## Progressive Uptake of Phosphorus at Different Stages of Growth of Co.7 Ragi (*Eleusine Corocana*, Gaertn)

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The influence of varying levels of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O on the uptake of P by ragi at successive growth stages was investigated by a field experiment. The effect of N on P uptake was found only at 50th day of transplanting and its influence was not pronounced either at early stages or at maturity of the crop. The application of P did not influence the P uptake of ragi at 25th and 50th day of transplanting and also in the grain. But the uptake of P in straw was significantly influenced by P application. The influence of K on the uptake of P by ragi at different stages of growth was not pronounced.

It is well known that the nutrient requirement and uptake would vary in different crops, at different stages of growth. Ragi crop utilises both applied and native forms of P equally well as indicated by the tracer work (Dutta and Goutam Dev, 1963). Venkata Rao and Sadasivaiah (1968) did not find any significant response to P application of ragi crop at 40 lb P<sub>2</sub>O<sub>5</sub>/acre. The present investigation was taken up in order to understand the uptake pattern of P by ragi crop at different stages of growth.

### MATERIALS AND METHODS

A field experiment was conducted under irrigated condition in the black soil area of the Tamilnadu Agricultural University, Coimbatore. It was a factorial (ABC) confounded design replicated twice with three levels in each of N at the rate of 0, 20 and 40, P<sub>2</sub>O<sub>5</sub> at 0, 10 and 20 and K<sub>2</sub>O at 0, 10, and 20 kg/ha.

The plot size was 5M x 4M. N was applied in the form of urea, P<sub>2</sub>O<sub>5</sub> as super and K<sub>2</sub>O as muriate of potash. The entire quantity of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O and 50 per cent of N were added basally before transplanting and the remaining 50 per cent of N was top dressed on 30th day after transplantation. Twenty one days old ragi seedlings were transplanted in the main field. The initial nutrient status of the soil was estimated as per the methods of Jackson (1967). The soil analysed medium in N (340 kg/ha) low in P (6.82 kg/ha) and high in K (560.2 kg/ha). The initial pH of the soil was 8.0.

The plant samples were collected at tillering (25th day of planting) flowering (50th day of planting) and at harvest stages and dry matter yield was recorded. The P concentration in the plant samples was estimated by vanadomolybdate method described by

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Jackson (1967). The P uptake values were calculated by multiplying the P concentration with that of the dry matter yield of plants.

## RESULTS AND DISCUSSION

The mean values of uptake of P at different stages of ragi growth are presented in Table I and the summary

TABLE I. Uptake of P by Ragi at different stages of growth (Mean of two replications in kg/ha)

Treatment	25th day	50th day	Grain	Straw	Grain + straw
N <sub>0</sub> P <sub>0</sub> K <sub>0</sub>	1.15	6.67	10.95	8.65	19.60
N <sub>0</sub> P <sub>0</sub> K <sub>1</sub>	0.91	5.95	11.00	9.14	20.14
N <sub>0</sub> P <sub>0</sub> K <sub>2</sub>	1.32	13.61	8.60	9.29	17.90
N <sub>0</sub> P <sub>1</sub> K <sub>0</sub>	1.13	11.12	7.98	10.15	18.14
N <sub>0</sub> P <sub>1</sub> K <sub>1</sub>	1.40	8.19	10.27	13.36	23.63
N <sub>0</sub> P <sub>1</sub> K <sub>2</sub>	1.34	6.12	9.03	11.67	20.20
N <sub>0</sub> P <sub>2</sub> K <sub>0</sub>	1.56	10.11	9.28	10.93	20.21
N <sub>0</sub> P <sub>2</sub> K <sub>1</sub>	1.32	10.18	8.36	12.90	21.27
N <sub>0</sub> P <sub>2</sub> K <sub>2</sub>	1.15	8.59	11.49	12.86	24.35
N <sub>1</sub> P <sub>0</sub> K <sub>0</sub>	1.44	12.22	8.74	10.12	18.86
N <sub>1</sub> P <sub>0</sub> K <sub>1</sub>	1.55	11.47	7.89	11.38	19.26
N <sub>1</sub> P <sub>0</sub> K <sub>2</sub>	0.98	11.20	11.04	5.69	17.23
N <sub>1</sub> P <sub>1</sub> K <sub>0</sub>	1.25	11.08	8.64	12.60	21.24
N <sub>1</sub> P <sub>1</sub> K <sub>1</sub>	1.34	14.28	9.46	12.89	22.35
N <sub>1</sub> P <sub>1</sub> K <sub>2</sub>	1.32	13.16	12.08	11.89	23.97
N <sub>1</sub> P <sub>2</sub> K <sub>0</sub>	1.44	14.10	10.68	13.59	24.26
N <sub>1</sub> P <sub>2</sub> K <sub>1</sub>	1.71	12.79	11.22	11.95	23.17
N <sub>1</sub> P <sub>2</sub> K <sub>2</sub>	1.72	10.69	11.56	13.45	25.01
N <sub>2</sub> P <sub>0</sub> K <sub>0</sub>	1.69	8.93	8.38	10.79	19.17
N <sub>2</sub> P <sub>0</sub> K <sub>1</sub>	1.45	12.20	11.42	8.28	20.14
N <sub>2</sub> P <sub>0</sub> K <sub>2</sub>	1.44	15.31	13.12	7.10	20.22
N <sub>2</sub> P <sub>1</sub> K <sub>0</sub>	1.76	10.89	9.15	12.51	21.67
N <sub>2</sub> P <sub>1</sub> K <sub>1</sub>	2.03	10.65	9.76	13.10	22.86
N <sub>2</sub> P <sub>1</sub> K <sub>2</sub>	1.84	9.68	11.05	12.42	23.47
N <sub>2</sub> P <sub>2</sub> K <sub>0</sub>	1.60	9.96	8.69	12.64	21.33
N <sub>2</sub> P <sub>2</sub> K <sub>1</sub>	2.02	9.72	8.45	12.31	20.77
N <sub>2</sub> P <sub>2</sub> K <sub>2</sub>	1.95	16.50	11.53	12.61	24.13
Mean	1.47	10.93	9.99	11.28	21.27
% P taken by the plant	6.91	51.38	46.96	53.04	100.00%

of statistical analysis of the data in Table II.

**Uptake of P at 25th day of planting:** It was found that the various levels of  $P_2O_5$  (0, 10 and 20 kg/ha) tried, did not influence the uptake of P on 25th day after planting. Neither N nor K individually or in combinations improved the uptake of P by ragi crop.

on 25th day of planting which corresponded to the tillering stage. This could be due to the meagre requirement of P by the young plants at this stage as could be seen from the data in Table I. The percentage utilisation of P at this stage (Fig. 1) was only 6.91 per cent to the total P uptake. Possibly the P requirement of the crop could have been met from the native source of P.

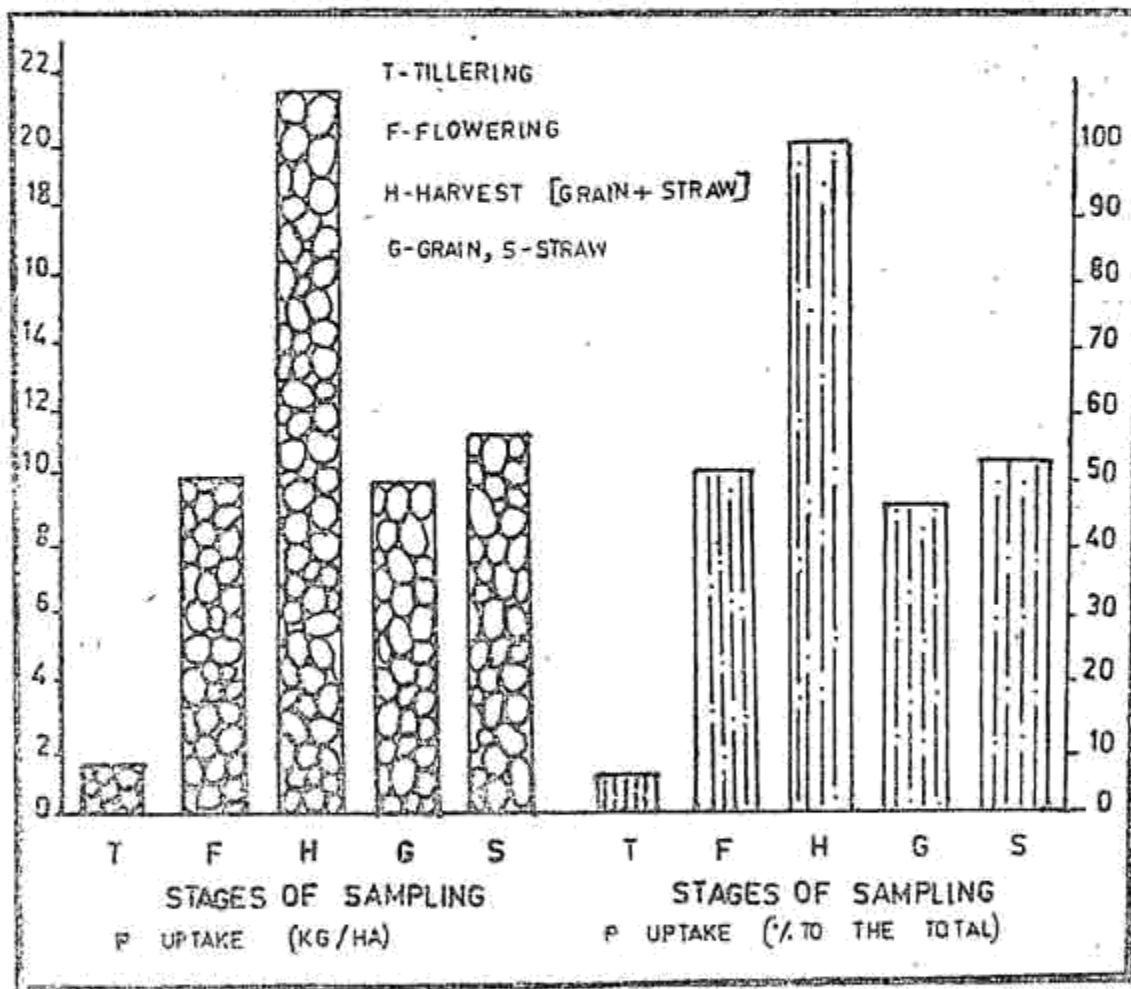


Fig. 1

**Uptake of P at 50th day of planting:** The application of P did not influence the uptake of P in ragi plants of 50 days of growth after transplanting. However, the application of N at 20

kg/ha significantly influenced the utilization of P. The results of statistical analysis (Table II) revealed that the effect of N was more pronounced at 20 kg per hectare rather than at 40 kg/N ha.

TABLE II. Summary of Statistical Analysis

P uptake in 50 days old plants					
Mean values					
N <sub>0</sub>	:	8.95	S.E.	:	0.71
N <sub>1</sub>	:	12.33	C.D. (P=0.05)	:	2.10
N <sub>2</sub>	:	11.53	Conclusion		N <sub>1</sub> N <sub>2</sub> N <sub>0</sub>
P uptake in straw					
Mean values					
P <sub>0</sub>	:	8.94	S.E.	:	0.37
P <sub>1</sub>	:	12.29	C.D. (P=0.05)	:	1.11
P <sub>2</sub>	:	12.58	Conclusion		P <sub>2</sub> P <sub>1</sub> P <sub>0</sub>
Total P uptake in grain plus straw					
Mean values					
P <sub>0</sub>	:	19.17	S.E.	:	0.66
P <sub>1</sub>	:	21.95	C.D. (P=0.05)	:	1.94
P <sub>2</sub>	:	22.72	Conclusion		P <sub>2</sub> P <sub>1</sub> P <sub>0</sub>
P <sub>A</sub>	:	Control	K <sub>0</sub>	:	Control
P <sub>1</sub>	:	10 kg/ha	K <sub>1</sub>	:	10 kg/ha
P <sub>2</sub>	:	20 kg/ha	K <sub>2</sub>	:	20 kg/ha
				:	N <sub>0</sub> : Control
				:	N <sub>1</sub> : 20 kg/ha
				:	N <sub>2</sub> : 40 kg/ha

Similar finding was reported by Venkata Rao and Govindarajan (1956) while investigating the response of ragi to NPK fertilization. The beneficial effect of N in increasing P uptake could be due to the increased vegetative growth, development and activity of roots which in turn might have solubilised the native insoluble P and enhanced the P uptake. Increased activity of micro-organisms when nitrogenous fertilizers were added along with the P might also result in increased uptake of P (Alexander 1961). The P uptake of 10.93 kg/ha amounting to 51.38 per cent of utilisation at this stage is in evidence of the above inference. The results of Sadasivaiah and Ambadasa Rao (1968) revealed that about 86 per cent of total P was absorbed before flowering. Tirupathi and Morachan (1973) also made similar observations.

**Phosphorus uptake in grain:** The various treatment combinations did not seem to have much influence on the uptake of P by grain. As the P requirement of ragi grain being comparatively small (46.96 per cent of total uptake) only a part of the absorbed P might have been translocated to the grain which agreed with the findings of Venkata Rao and Sadasivaiah (1968). When the distribution of P in ragi grain was considered, it was found that 8.99 kg/ha of P amounting to 46.96 per cent of the total P uptake was found to accumulate in grain. Another noteworthy observation in the present investigation was that there was little difference in the P utilisation of ragi grain between plots receiving fertilizer P and control. Although the available P status of the soil investigated was quite low but still a considerable quantity of

P was utilised by ragi and stored in grain and straw which indicated that the ragi crop has taken up a good amount of P from native fraction. This inference is in agreement with the findings of Dutta and Goutam Dev (1963) who found by tracer technique that the plants use P both from applied and native forms equally well.

**P uptake in straw sample:** A perusal of the data showed that P uptake by ragi straw significantly increased with P application over control treatment. However, there was little difference between the levels of P applied at 10 and 20 kg  $P_2O_5$ /ha. It was observed that comparatively a larger proportion of absorbed P was stored in straw than in grain. Out of 21.27 kg P uptake per hectare recorded, 11.26 kg P/ha accumulated in the ragi straw which was 53.04 per cent of the total P uptake. The findings of Venkata Rao and Sadasiviah (1968) however, showed that there was no significant variation in the  $P_2O_5$  content in both straw and grain samples. The application of P had a pronounced influence on the P uptake, when the total P uptake both in grain and straw was considered together. When the P application had not made a mark in the P uptake in grain and made a mark in the P uptake in straw with relatively higher proportion of absorbed P accumulating in straw than in grain it is understandable that the P application influenced the total P uptake when both grain and straw was considered together.

When the pattern of P uptake (Fig. 1) by ragi plant at successive growth

stages was examined it was noticed that only 1.47 kg P/ha amounting to 6.91 per cent of the total P uptake was absorbed up to tillering. The amount of P absorbed up to flowering was 10.93 kg/ha which worked out to 51.38 per cent of the total P uptake. At maturity stage the total uptake of P was 21.27 kg/ha of which 46.96 per cent accumulated in ragi grain and the remaining 53.04 per cent was stored in straw.

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