https://doi.org/10.29321/MAJ.10.A02975

Madras agric. J. 66 (7) : 437—441, July, 1979.

A Study on the Influence of N, P and K Applications on the N Uptake at Different Stages of Growth of Co. 7 Ragi (*Eleusine coracana Gaertn*)

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A field experiment conducted in black soil area at the Tamil Nadu Agricultural University farm, Coimbatore with Co. 7 ragi as test crop revealed that application of nitrogenous fertilizer significantly increased the N uptake at various stages of crop growth. Phosphorus application influenced the uptake of N at tillering (25th day after transplanting) and flowering (50th day after transplanting) stages of ragi growth. The application of K had no effect on the N uptake by ragi crop.

Ragi, a protein rich millet crop is cultivated widely and it forms a staple food for millions of people in South India. It responds positively to higher doses of N application. As the protein content of ragi would increase with increased utilisation of N it is of great practical value from the point of view of nutritive value of ragi. Tirupathi and Morachan (1977) showed that increased application of N (up to 250 kg/ha) increased the N uptake (122.8 kg N/ha.). They also observed that about 95 per cent of the N utilized was taken up before flowering stage. Sardar Singh *et al.* (1974), Susai *et al.* (1974) and Ekambaram *et al.* (1975) have reported that N application increased the N uptake. But information on the influence of the combined effect of varying doses of N, P and K on the uptake of N by ragi crop at different stages of growth is lacking. Hence this investigation was planned in order to obtain comprehensive data on the N uptake of ragi at different stages of crop growth.

MATERIAL AND METHODS

A field experiment was conducted in the black soil area of Tamil Nadu Agricultural University farm at Coimbatore. The design adopted was factorial confounded (ABC) 3 x 3 x 3 and the experiment was replicated twice. The test crop was ragi CO 7. Three levels in each of N (0, 20, 40 kg N/ha); P_2O_5 (0,10,20 kg/ha) and K_2O (0,10,20 kg/ha) were tried. Fifty per cent of N and the entire doses of P and K were applied at the time of planting and the remaining 50 per cent N was applied 30 days after transplanting. The plant samples were collected at tillering (25th day of planting), flowering (50th day of planting) and the grain and straw samples at the harvest stage besides recording dry matter yield at these stages. The dried

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plant samples were powdered and total N was estimated based on the method described by Jackson (1967). From the nutrient content in the plant samples at different stages of growth the uptake values were calculated by multiplying with the dry matter yield.

RESULTS AND DISCUSSION

The N uptake values at different stages of ragi growth are presented in Table I. The summary of statistical analysis is furnished in Table II.

N uptake on 25th day of ragi planting (tillaring stage): It was seen that the increased application of N correspondingly increased the N uptake. N application at 40 kg N/ha induced a vigorous growth and development of young plant parts thereby causing an increased uptake. It was noteworthy that with every increase in the doses of P application there was progressive increase in the N uptake. Its influence was more marked when P was applied in combination with N which indicated that for efficient utilization of N by ragi P has marked role to play. But the application of K had failed to exhibit to any positive effect on the uptake of N possibly because the soil itself was rich in available K (560.2 kg/ha) and there was no need for any extra source of K, which agreed with the observations of Venkata Rao and Govindarajan (1956), Sadasiviah and Ambasada Rao (1968).

N uptake on 50th day of ragi planting (flowering): The uptake of N at 50th day of planting was also found to be influenced by the application of N and P at the tillering stage of crop growth. The application of N at 20 kg/ha was found to be adequate to increase the N uptake at this stage as against 40 kg/ha at tillering stage. The application of P at 20 kg/ha (highest dose tried) produced a spectacular increase in the uptake of N at flowering stage indicating that the utilisation of N was found to be improved by the application of P_2O_5, which agreed with the views of Venkata Rao and Govindarajan (1956).

N uptake in grain and straw: The application of N at 40 kg/ha increased the N uptake in grain considerably compared to control indicating the enrichment of ragi grain due to N fertilization. However, the 20 kg N level was on par with both the 40 kg level and control. The application of P and K did not have any marked effect on the N uptake in grain.

This is in close agreement with the findings of Sadasiviah and Ambasada Rao (1968). With reference to N uptake in straw as influenced by the treatments of N, P and K almost the same trend as that of N uptake in grain wes noticed. Although the application of P seems to improve the N utilization by ragi crop at (early) vegetative and reproductive phases of its growth the same influence was not observed at the harvest stage in grain and straw. Venkata Rao and Govindarajan (1956) reported improved utilization of N by application of P_2O_5 by ragi which was in agreement with the present findings at early stages of ragi growth but not harvest stage. This was possibly due to the fact that though the need for P was felt in early stages of crop growth for promoting the growth of roots for the

TABLE I. Uptake of N by ragi at different stages of plant growth (Mean of 2 replication kg/N/ha)

Treatment	25th day	50th day	Grain	Straw	Grain and straw
N_0 P_0 K_0	11.22	50.12	69.49	92.28	160.77
N_0 P_1 K_0	79	63.63	73.80	87.42	161.21
N_0 P_2 K_0	60	48.07	70.10	87.74	157.84
N_0 P_0 K_1	45	44.39	71.53	87.00	158.52
N_0 P_1 K_1	94	61.75	73.30	104.96	178.25
N_0 P_2 K_1	44	66.37	67.12	109.65	176.76
N_0 P_0 K_2	32	72.46	65.74	83.72	149.46
N_0 P_1 K_2	07	40.13	69.50	98.19	167.68
N_0 P_2 K_2	31	77.74	75.93	107.53	183.45
N_1 P_0 K_0	50	74.42	79.29	99.66	178.94
N_1 P_1 K_0	88	58.78	65.63	91.88	157.50
N_1 P_2 K_0	18	97.60	76.13	104.55	180.67
N_1 P_0 K_1	50	65.89	76.25	95.84	172.08
N_1 P_1 K_1	75	77.96	79.58	110.37	189.94
N_1 P_2 K_1	19.21	80.17	76.91	97.65	174.55
N_1 P_0 K_2	11.90	65.86	79.35	110.70	190.04
N_1 P_1 K_2	14.76	90.05	77.22	107.66	184.87
N_1 P_2 K_2	21.86	73.75	76.09	116.85	192.94
N_2 P_0 K_0	21.85	54.86	69.53	99.08	168.61
N_2 P_1 K_0	21.28	56.27	79.08	102.94	182.01
N_2 P_2 K_0	19.49	87.84	72.52	120.19	192.71
N_2 P_0 K_1	17.49	57.48	87.17	108.32	195.48
N_2 P_1 K_1	23.20	65.38	84.86	115.94	200.79
N_2 P_2 K_1	25.27	53.53	74.92	103.01	177.92
N_2 P_0 K_2	17.40	78.53	89.47	132.69	222.16
N_2 P_1 K_2	20.70	62.37	75.67	113.22	188.88
N_2 P_2 K_2	23.82	103.14	71.18	113.31	184.48
Mean	17.53	67.73	75.05	103.79	178.84
Percentage of it to the total N uptake at harvest	9.80	37.87	41.96	58.04	100.00

TABLE II. Summary of statistical analysis

N uptake 25th day after transplanting

Mean values of N

N_0 : 14.79 S.E. : 0.51

N_1 : 16.84 C.D. : 1.51

N_2 : 20.95 Conclusion

$\overline{N_2 \quad N_1 \quad N_0}$

Mean values of P

P_0 : 15.52 S.E. : 0.51

P_1 : 17.71 C.D. : 1.51

P_2 : 19.36 Conclusion

$\overline{P_2 \quad P_1 \quad P_0}$

N uptake 50th day after transplanting

Mean values of N

N_0 : 58.29 S.E. : 3.86

N_1 : 76.05 C.D. : 11.32

N_2 : 68.82 Conclusion

$\overline{N_1 \quad N_2 \quad N_0}$

Mean values of P

P_0 : 62.67 S.E. : 3.86

P_1 : 64.04 C.D. : 11.32

P_2 : 76.47 Conclusion

$\overline{P_2 \quad P_1 \quad P_0}$

Nitrogen uptake in grain

Mean values of N

N_0 : 70.611 S.E. : 2.04

N_1 : 76.271 C.D. : 5.98

N_2 : 78.265 Conclusion

$\overline{N_2 \quad N_1 \quad N_0}$

Nitrogen uptake in straw

Mean values N

N_0 : 95.39 S.E. : 3.89

N_1 : 103.90 C.D. : 11.67

N_2 : 112.08 Conclusion

$\overline{N_2 \quad N_1 \quad N_0}$

N uptake in grain + straw

Mean values of N

N_0 : 166.00 S.E. : 4.87

N_1 : 180.17 C.D. : 14.62

N_2 : 190.34 Conclusion

$\overline{N_2 \quad N_1 \quad N_0}$

effective utilization of N the soil P appears to be adequate to meet the requirement at maturity stage as far as N uptake is concerned.

When the N uptake in grain and straw was pooled together and examined it was evident that the influence of N, P and K were exactly similar to that of their effect on grain and straw examined separately as could be expected.

Comparison of N uptake a successive growth stages of ragi

A closer scrutiny of the mean values o N uptake presented in Table I and the pattern of N uptake by ragi at differen stages of growth would reveal the extent of N utilization of ragi at different stages of crop growth as well as the proportion of distribution of N in ragi grain and straw. It was noteworthy that the mean total N uptake (grain + straw) worked out to 178.84 kg/ha of which only 9.80 per cent was utilised by ragi until tillering stage of growth. The N utilization of ragi up to flowering was 67.73 kg/ha amounting to only 37.87 per cent of the total uptake. It was clear from the data that the N uptake of ragi was quite considerable between flowering and harvest amounting to 62.13 per cent of the total uptake. However, Khatri and Mehta (1962) and Sadasivaiah and Ambasada Rao (1968) reported that the N uptake increased steadily up to tillering stage.

From the proportion of N distribution in ragi grain and straw it was observed the accumulation of utilized N was higher in straw than in grain. About 42 per cent of the total utilized N accumulated in ragi grain while the balance (58.04 per cent) was found to accumu-

late in straw. From this observation it is obvious that when the ragi grain is considered as a protein rich cereal, its straw is not of less importance as a fodder to cattle. When properly dried and stored or silaged ragi straw would be a good feed to the animals especially in off-seasons on account of its richness in N.

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