

## EFFECT OF ORGANIC AND INORGANIC FORMS OF NITROGEN ON THE CONTENT AND UPTAKE OF PHOSPHORUS AND POTASSIUM BY RAGI

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The P content in ragi grain was increased by the application of N. Increased levels of P in the form of FYM and  $(\text{NH}_4)_2\text{SO}_4$ , when applied, increased the K content in the straw but not in grains. Application of N in both the forms found to increase the P and K uptake by grain and straw were pronounced.

Addition of one nutrient to the soil would interact with other nutrients and result synergistic or antagonistic effect. In normal cases, addition of N-fertilizers has increased the P and K availability and their content. It is also known that P and K content in ragi could be markedly influenced by the application of N in the form of farm yard manure (FYM) and ammonium sulphate  $(\text{NH}_4)_2\text{SO}_4$ . Hence an experiment was conducted to study the effect of FYM and  $(\text{NH}_4)_2\text{SO}_4$  on the availability of P and their uptake in ragi and the results are presented.

### MATERIALS AND METHODS

A field trial was conducted during kharif 1978, with the variety Co-7 and Co-9 ragi in a split plot design replicated thrice consisting the varieties as main plots and levels of N as subplot treatments. The nitrogen was applied @ 0,30,60 and 90 kg/ha in the form of FYM

and  $(\text{NH}_4)_2\text{SO}_4$  alone and in combinations. The entire dose of P and K was applied as basal dressing in the form of superphosphate @ 45 kg  $\text{P}_2\text{O}_5$ /ha and muriate of potash 22.5 kg  $\text{K}_2\text{O}$ /ha respectively. The crop was transplanted with a spacing of 15 x 15 cm with a plot size of 20m<sup>2</sup>. The entire dose of FYM was applied as basal dressing while  $(\text{NH}_4)_2\text{SO}_4$  was applied twice i.e 50% N basally and the remaining 50% at tillering stage. The content and uptake of  $\text{P}_2\text{O}_5$  and  $\text{K}_2\text{O}$  were assessed after harvest both in straw and grain at per the method suggested by Pipey (1966).

### RESULTS AND DISCUSSION

*a. Content and uptake of P in grain and straw:* Application of N as FYM had significantly increased the P content in grain, but not so in ragi straw. This finding is in corroboration with the results of Sree Ramulu and Mariakulandi (1964).

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The probable reason is that application of FYM would have increased the nucleic acid content which is primarily responsible for the increase in P content required for grain formation. This observation is in conformity with the findings of Rani Perumal *et al.* (1969) who reported that ragi grain contained more of N and P (Table 1).

The variety Co. 7 recorded significantly higher uptake of P compared to Co. 9 as a whole. The

uptake of P by grain is higher in Co. 7 than Co. 9 because of higher grain yield and P content. Application of  $(NH_4)_2 SO_4$  @ 95 kg/ha recorded the highest uptake of 12.38 kg/ha whereas combined application of FYM @ 60 kg N/ha and  $(NH_4)_2 SO_4$  @ 30 kg N/ha recorded the uptake of P 12.33 kg/ha. Increased uptake of P due to application of N was also reported by Dev (1964) and Govindan (1975) (Table 2).

Table 1 Phosphorus content of ragi grain (Mean values in percentage)

| Sources and levels of N kg/ha | Farm Yard Manure |       |       | N levels 90 | Ammonium sulphate |       |       |       | Mean  |
|-------------------------------|------------------|-------|-------|-------------|-------------------|-------|-------|-------|-------|
|                               | 0                | 30    | 60    |             | 0                 | 30    | 60    | 90    |       |
| Varieties                     |                  |       |       |             |                   |       |       |       |       |
| Co. 7                         | 0.185            | 0.198 | 0.205 | 0.202       | 4.171             | 0.205 | 0.205 | 0.209 | 0.198 |
| Co. 9                         | 0.170            | 0.157 | 0.149 | 0.149       | 0.115             | 0.155 | 0.153 | 0.162 | 0.156 |
| Mean                          | 0.178            | 0.178 | 0.177 | 0.175       | 0.163             | 0.180 | 0.179 | 0.185 |       |

| Sources                 | SED   | CD (P=0.05) |
|-------------------------|-------|-------------|
| Between varieties       | 0.003 | 0.006       |
| .. levels of FYM        | —     | — NS        |
| .. .. Ammonium sulphate | 0.005 | 0.010       |

Table 2 Total uptake of phosphorus by ragi plant (Mean values in kg/ha)

| Sources and levels of N kg/ha | Farm Yard Manure |       |       | N levels 90 | Ammonium sulphate |       |       |       | Mean  |
|-------------------------------|------------------|-------|-------|-------------|-------------------|-------|-------|-------|-------|
|                               | 0                | 30    | 60    |             | 0                 | 30    | 60    | 90    |       |
| Varieties                     |                  |       |       |             |                   |       |       |       |       |
| Co. 7                         | 10.03            | 11.11 | 12.21 | 11.13       | 9.14              | 11.24 | 11.74 | 12.37 | 11.12 |
| Co. 9                         | 8.79             | 10.3  | 10.44 | 10.47       | 8.90              | 10.75 | 10.09 | 10.26 | 10.00 |
| Mean                          | 9.41             | 10.71 | 11.33 | 10.80       | 9.02              | 11.00 | 10.92 | 11.32 |       |

| Sources                 | SED   | CD (P=0.05) |
|-------------------------|-------|-------------|
| Between varieties       | 0.170 | 0.364       |
| .. levels of FYM        | 0.240 | 0.515       |
| .. .. Ammonium sulphate | 0.239 | 0.481       |

*b. Content and uptake of K in ragi:* Potassium content in grain was not influenced by the application of FYM or  $(NH_4)_2 SO_4$ . But the application of FYM was found to influence the K content in straw in both the varieties. Application of  $(NH_4)_2 SO_4$  @ 60

kg/N ha recorded the highest uptake of K 35.26 kg/ha when compared to other treatments). Application of N at 90 kg/ha was found to be superior from both the sources in increasing the uptake of K. The increase in K content in straw of ragi

Table 3 Potassium content of ragi straw (Mean values in percentage)

| Sources and levels of N kg/ha | Farm yard manure |      |      |      | Ammonium sulphate |             |      |      | Mean |
|-------------------------------|------------------|------|------|------|-------------------|-------------|------|------|------|
|                               | 0                | 30   | 60   | 90   | 0                 | 30          | 60   | 90   |      |
| Varieties                     |                  |      |      |      |                   |             |      |      |      |
| Co. 7                         | 2.20             | 2.17 | 2.19 | 2.27 | 2.06              | 2.22        | 2.27 | 2.28 | 2.21 |
| Co. 9                         | 2.03             | 2.17 | 2.19 | 2.27 | 2.02              | 2.17        | 2.22 | 2.25 | 2.17 |
| Mean                          | 2.11             | 2.17 | 2.19 | 2.27 | 2.04              | 2.19        | 2.24 | 2.27 |      |
| Sources                       |                  |      |      |      |                   |             |      |      |      |
| Between varieties             |                  |      |      |      | SED               | CD (P=0.05) |      |      |      |
| .. levels of FYM              |                  |      |      |      | 0.006             | 0.013       |      |      |      |
| .. .. Ammonium sulphate       |                  |      |      |      | 0.009             | 0.018       |      |      |      |
| .. ..                         |                  |      |      |      | 0.008             | 0.015       |      |      |      |

Table 4 Total uptake of potassium by ragi Plant (Mean values in kg/ha)

| Sources and levels of N kg/ha | Farm yard manure |        |        |        | Ammonium sulphate |             |        |        | Mean   |
|-------------------------------|------------------|--------|--------|--------|-------------------|-------------|--------|--------|--------|
|                               | 0                | 30     | 60     | 90     | 0                 | 30          | 60     | 90     |        |
| Varieties                     |                  |        |        |        |                   |             |        |        |        |
| Co. 7                         | 115.40           | 124.41 | 126.50 | 131.46 | 105.34            | 124.04      | 132.36 | 135.02 | 124.4  |
| Co. 9                         | 116.38           | 142.89 | 153.57 | 157.68 | 118.34            | 139.31      | 153.16 | 159.16 | 142.64 |
| Mean                          | 115.89           | 133.65 | 140.03 | 144.57 | 112.34            | 131.67      | 143.04 | 147.09 |        |
| Sources                       |                  |        |        |        |                   |             |        |        |        |
| Between varieties             |                  |        |        |        | SED               | CD (P=0.05) |        |        |        |
| .. levels of FYM              |                  |        |        |        | 0.759             | 2.847       |        |        |        |
| .. .. Ammonium sulphate       |                  |        |        |        | 1.073             | 3.920       |        |        |        |
| .. ..                         |                  |        |        |        | 1.245             | 2.506       |        |        |        |

due to application of N was also reported by Rani Perumal *et al.* (1969) and Sankaran and Kaliappa (1974) (Table 3).

The uptake of K by grain was higher in the variety Co. 7 as against the highest uptake of K by straw in the variety Co. 9. However, the total

uptake of P both grain and straw was higher in the variety Co. 9 compared to Co. 7. This may be due to higher yield of straw of Co. 9, which is a tall and long duration variety compared to Co. 7 (Table 4). Similar results were also reported by Govindan (1975) and Muthuvel (1976.)

Tables 2 Total uptake of P by ragi plant (mean values in kg/ha)

|                 | Farmyard manure x |                | Ammonium sulphate |                |
|-----------------|-------------------|----------------|-------------------|----------------|
|                 | N <sub>0</sub>    | N <sub>1</sub> | N <sub>2</sub>    | N <sub>4</sub> |
| ON <sub>0</sub> | 5.59              | 8.87           | 10.79             | 12.38          |
| ON <sub>1</sub> | 9.53              | 10.99          | 10.48             | 11.83          |
| ON <sub>2</sub> | 10.73             | 12.22          | 11.48             | 10.88          |
| ON <sub>4</sub> | 10.83             | 11.30          | 10.91             | 10.18          |
|                 |                   | SED            | CD                |                |
| ON x N          |                   | ON at N        | 0.677             | 1.366          |
|                 |                   | N at ON        | 0.478             | 0.961          |

REFERENCES

DEV, G. 1964. Influence of N on the availability of fertilizer P. *Nature* 203 : 899

GOVINDAN, C. 1975. Studies on the N uptake pattern of ragi (Var. Co. 10) as influenced by the quantity and time of application of N. M. Sc (Ag), Dissertation Submitted and approved by Tamil Nadu Agric. Univ, Coimbatore

MUTHUVEL, P. 1976. Studies on the interaction of soil moisture and N influencing the yield, and uptake of NPK by ragi (*Eleusine coracana*) Ph. D. dissertation submitted and approved by Tamil Nadu Agric, Univ Coimbatore

PIPER, C. S. 1966. Soil Plant Analysis Hans publishers, Bombay.

RANI PERUMAL, L, MOHAMED GHOUSE and R, SOUNDARARAJAN, 1969, Effect of continuous application of fertilizers and manure on the yield and composition of certain crops. Effect on ragi *Eleusine coracana* Madras Agri, J. 56: 58-63,

SREE RAMULU U, S, and A, Mariakulandai, 1964 The composition of ragi grain and straw as affected by the application of FYM and super phosphate fertilizer. Madras Agri, J, 57 : 379-385,