Madras Agric. J. 78, (5-8): 235-237 (1991)

https://doi.org/10.29321/MAJ.10.A01856

EFFECT OF P AND K ON CROP YIELD AND SOIL FERTILITY UNDER RICE-RICE CROPPING SEQUENCE

P.MUTHUVEL, C.UDAYASOORIAN and A.CHAMY*

ABSTRACT

Field experiments conducted at the Agricultural Research Station, Bhavanisagar, during 1981-1987 to determine the P and K requirement of rice in "rice-rice" system revealed that addition of P_2O_5 and K_2O up to 50 kg/ha continuously for nine seasons failed to influence the grain yield. Continuous addition of P_2O_5 resulted in considerable build up of available P_2O_5 content of soils. Soil K status was not altered by the Continuous application of varying rates of potassium.

Key words: Soil fertility, rice-rice sequence.

Rice occupies a major area in the Lower Bhavani Project ayacut of Tamil Nadu which extends to about 80,000 ha. In about 12,000 ha where assured irrigation source exists rice-rice is the cropping system followed. The usual recommendation is to apply fertilizers without taking into account the residual effect of fertilizer nutrient added to the previous crop. In calculating optimum fertilizer needs of crops discount should be made for the manures and fertilizers applied to the previous crops. Hence, in order to find out whether the quantum of P and K which are less responsive compared to nitrogen, can be reduced for rice crop and if so to what extent, field experiments were conducted at the Agricultural Research Station, Bhavanisagar during 1981-1987 in a fixed cropping system of rice-rice.

MATERIALS AND METHODS

The investigation was carried out for nine seasons commencing from rabi 1981-82. In the first three seasons rice var. Co.37 was the test crop while in the subsequent six seasons IR 20 was raised. The experimental soils were neutral in reaction and free from salinity and alkali hazards. The available N P and K contents were 180, 11.9 and 191 kg/ha respectively. There were 25 treatments (five levels of P_2O_5 and five levels of K_2O). The five levels of P_2O_5 and K_2O included were 0, 12.5, 25, 37.5 and 50 kg/ha respectively. Each plot received uniform dose of N at 100 kg/ha. Each treatment was replicated thrice in a randomised block design. Half the dose of N and entire dose of P and K as per treatment schedule were added basally. The remaining half of N was added in two equal splits on 25th and 45th day after transplanting. The crop was given a spacing of 20 cm between rows and 10 cm within the row. The crops were grown in the same plots without changing the layout and treatments. Routine cultural practices were followed in raising the crop. At the time of harvest data were collected on plant height and number of tillers besides grain and straw yield. At the end of each season post harvest soil samples from each plot were analysed for their available P_2O_5 (Olsen *et al.*, 1954) and K_2O (Jackson, 1973) contents.

RESULTS AND DISCUSSION

The grain and straw yield data (pooled mean for the nine seasons) indicated that the same were not influenced by increasing levels of P_2O_5 and K_2O upto 50 kg/ha (Table 1). Data on plant height and number of productive tillers per plant also revealed a similar trend. Lack of

* Agricultural Research Station, Bhavanisagar - 638 451.

Table 1.Effect of varying levels of P and K on rice grain yield (kg/ha)

Treatment	Yield (mean for 9 seasons)	Treatment	Yield (mean for 9 seasons)
P_0	3744	K_0	3802
$P_{12.5}$	3717	$K_{12.5}$	3691
$P_{25.0}$	3834	$K_{25.0}$	3741
P_{50}	3740	$K_{50.0}$	3806
SEd	89	CD	NS

response to the applied phosphorus could be due to the fact that the initial available P_2O_5 content of soil was medium which could probably meet the P requirement of rice crop. Besides, phosphorus fertlizers have significant residual effect (Kanwar *et al., 1982)* and hence the fertilizers applied to the previous crop could have nullified the influence of applied phosphorus since only around 15 per cent of the added P is recovered by the first crop of paddy (Singhania and Goswami, 1974) which implies the limited utilisation of applied P by the rice crop.

In all the nine seasons addition of increasing rates of potassium failed to result in significant yield differences in rice grain and straw. Ravindran *et al.* (1987) also in their studies could not observe significant yield difference due to K in the first crop and the omission of K to the second crop did not result in yield reduction. Field experiments conducted under the All India Co-ordinated Rice Improvement Project at many locations in India involving rice-rice rotation revealed significant response to P and K only under specified situations (Anon., 1980). Non-significant response to potash was also reported by Ramankutty (1971).

The available P_2O_5 content of soils (Table 2) did not vary much upto the fifth season. From

Table 2.Effect of varying levels of P and K on available P_2O_5 and K_2O contents of post harvest soil (Kg/ha)

Treatment	Available P_2O_5						Available K_2O	
Season	I	V	VI	VII	VIII	IX	I	IX
P_0	16.9	20.0	18.7	18.8	18.7	17.9	194	168
$P_{12.5}$	17.8	22.3	20.2	20.3	20.4	20.1	194	180
$P_{25.0}$	16.9	23.7	24.7	23.8	23.6	22.4	191	172
$P_{37.5}$	19.1	23.1	24.1	23.8	23.8	23.9	205	164
$P_{50.0}$	16.4	24.0	25.2	25.5	25.4	26.0	202	175
K_0	11.5	20.5	20.8	20.3	20.4	20.9	196	172
$K_{12.5}$	9.3	20.4	20.7	20.8	20.9	20.3	202	154
$K_{25.0}$	26.6	20.8	20.5	20.7	20.8	20.6	189	167
$K_{37.5}$	22.9	20.8	20.6	21.0	20.9	21.0	187	164
$K_{50.0}$	16.7	20.9	21.0	20.0	20.6	20.2	211	172
SEd	-	0.27	0.34	0.31	0.29	0.35	-	-
CD	NS	0.60	0.67	0.62	0.60	0.70	NS	NS

the fifth season onwards addition of increasing doses of phosphorus increased the soil available P status. Even under control treatment there was no reduction. This could be due to the fact that the presence of certain fractions of P is more abundant under rice soil condition. As mentioned earlier, considerable increase in the soil build up of available P due to continuous P addition in a rice-wheat cropping sequence was already reported by Chhabra (1985) and Nad and Goswami (1984).

In the case of potassium there was a general reduction from the first season to ninth season. However, addition of increasing rates of potassium did not result in significant difference in the available K_2O status of soil. Bijay Singh *et al.* (1983) also could not observe significant improvement in the available K status of soil due to the continuous application of potassic fertilizers.

Patiram and Prasad (1983) attributed soil fixation at lower and partial loss at higher rates of K application to the non-significant build up in the exchangeable K content of soils. However, in the present case, since the experimental soils were red sandy loam it could be assumed that the fixation of applied K was negligible and as such the crop could have removed the applied potassium eventhough the same did not result in significant yield difference. Moreover, the rates at which potash were applied were within the recommended level.

REFERENCES

ANONYMOUS, 1980. Annual progress report of All India Co-ordinated Rice Improvement Project, Hyderabad for 1979. pp. 2-17, 2-19.

BIJAY SINGH, K.N. SHARMA, D.S. RANA, J.S.SOCHI and KAPUR,M.L. 1983. Available phosphorus and potassium and soil organic matter contents as influenced by long term application of fertilizers and farm yard manure to wheat-maize rotation. *J. Indian Soc. Soil Sci.* **31**:491-494.

CHHABRA, R., 1985. Crop responses to phosphorus and potassium fertilization of a sodic soil. *Agron.J.* **77**:699-702.

JACKSON, M.L., 1973 *Soil Chemical Analysis. Prentice Hall of India Ltd., New Delhi.*

KANWAR,M., GOSWAMI,N.N. and KAMATH,M.B. 1982. Phosphorus management of Indian soils - problems and prospects. *Fert.News.* **27**:43-52.

NAD, B.K. and GOSWAMI,N.N. 1984. Effect of long term application of phosphate on soil phosphorus status in rice-wheat rotation. *J. Indian Soc. Soil Sci.* **32**:288-291.

OLSEN, S.R., COLE,C.L., WANTANABE,F.S. and DEAN,D.A. 1954. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. *Circ. U.S. Dep. Agric.* 939.

PATIRAM and PRASAD,R.N. 1983. Yield response to fertilizer potassium and balance sheet of potassium in a potato-rice crop sequence. *J. Indian Soc. Soil Sci.* **31**:502-505.

RAMANKUTTY, N.N., 1971. Effect of K on growth, yield and nutrient uptake of two exotic rice varieties. *Agric. Res. J. Kerala.* 9:4-10.

RAVINDRAN, A., SUBBIAH,S. and GOPALASWAMY,A. 1987. Studies on continuous and residual effect of K and N on soil chemical properties. Proc. National Seminar on Minerology of K in relation to crop response. Tamil Nadu Agricultural University, College of Agriculture, Madurai. P.60.

SINGHANIA, R.A. and GOSWAMI,N.N. 1974. Proc. Symp. use of radiations and radio isotopes in studies on plant productivity, Pantnagar. 437 (1974).