

## BALANCE SHEET OF AVAILABLE PHOSPHORUS IN RICE BASED CROPPING SYSTEMS BY PHOSPHORUS MANAGEMENT

In order to arrive at a balance sheet of available phosphorus by phosphorus management in rice based cropping systems viz., rice-rice-cowpea and rice-rice-sesamum, an experiment was laid out at the College of Agriculture, Vellayani for two years from June 1984 to September 1986. The experiment was laid out in a randomized block design with three replications comprising of eight treatments. The treatments were continuous phosphorus application to all three crops in the system (T<sub>1</sub>), phosphorus application to the first and second crop of rice (T<sub>2</sub>), phosphorus application to the first crop of rice and third crop of cowpea/sesamum (T<sub>3</sub>), phosphorus application to the first crop of rice only (T<sub>4</sub>), phosphorus application to the second crop of rice and third crop of cowpea/sesamum (T<sub>5</sub>), phosphorus application to the second crop of rice only (T<sub>6</sub>), phosphorus application to the third crop of cowpea/sesamum only (T<sub>7</sub>) and control plot with no addition of phosphorus to any of the crops in the system (T<sub>8</sub>). Phosphorus was applied according to the treatments based on the package of practices recommendations of the Kerala Agricultural University (KAU,

1983) for each crop. The recommended doses of nitrogen and potassium for respective crops in respective seasons were applied uniformly to all plots. Available phosphorus status of the soil was estimated by Bray's method (Jackson, 1958) and expressed in kg ha<sup>-1</sup>.

The data on the balance sheet of available phosphorus for rice-rice-cowpea system for two years (Table 1) revealed that skipping of phosphorus fertilizer continuously (T<sub>8</sub>) drastically reduced the soil available phosphorus to the extent of incurring a loss of 12.6 kg ha<sup>-1</sup>. The highest build-up of 12.8 kg ha<sup>-1</sup> over the initial soil level was in the treatment where phosphorus was applied to all the three crops in the system (T<sub>1</sub>) followed by T<sub>3</sub>, where phosphorus was applied to the first crop of rice and third crop of cowpea. Build-up in available soil phosphorus under continuous application of superphosphate has been reported by Deka and Singh (1984). The soil fertility level almost maintained where phosphorus was applied only to the third crop of cowpea (T<sub>7</sub>) and also where phosphorus was applied to the second crop of rice and third crop of cowpea (T<sub>5</sub>).

Table 1. Balance sheet for available phosphorus in soil under rice-rice-cowpea system over two years (1984-'85 and 1985-'86), kg ha<sup>-1</sup>

Treatments	Initial level	P added	P removed by crops	Computed balance	Actual balance	Net gain
T1	45	200	155.3	89.7	57.8	12.8
T2	45	140	145.5	39.8	45.9	0.9
T3	45	130	139.8	35.2	50.6	5.6
T4	45	70	148.3	-33.3	41.3	-3.7
T5	45	130	149.0	26.0	45.8	0.8
T6	45	70	147.1	-32.1	42.4	-2.6
T7	45	60	164.9	-59.9	45.1	0.1
T8	45	0	139.1	-94.1	32.4	-12.6

Table 2. Balance sheet for available phosphorus in soil under rice-rice-sesamum system over two years (1984-'85 and 1985-'86)  $\text{kg}^{-1}$

Treatments	Initial level	P added	P removed by crops	Computed balance	Actual balance	Net gain
T1	45	170	153.5	61.5	54.6	9.6
T2	45	140	135.4	49.6	53.2	8.2
T3	45	100	137.4	7.6	46.6	1.6
T4	45	70	137.6	-22.6	40.2	-4.8
T5	45	100	148.8	-3.8	45.5	0.5
T6	45	70	142.4	-27.4	45.1	0.1
T7	45	30	159.3	-84.3	44.2	-0.8
T8	45	0	139.8	-94.8	32.1	-12.9

Thus from the soil fertility point of view it is not necessary that all three crops in the system need to be fertilized with phosphorus. For maintaining initial phosphorus status of soil, phosphorus need to be applied only to third crop of cowpea. If some build-up is needed over initial level, either one of the rice crops can be fertilized in addition to the third crop of cowpea. For rice-rice-sesamum system also, almost the same trend of rice-rice-cowpea, was observed (Table 2). Continuous skipping of phosphate fertilizer to all the three crops in rotation reduced the soil available phosphorus drastically incurring a net loss of  $12.9 \text{ kg ha}^{-1}$ . The highest build-up of  $9.6 \text{ kg}$

$\text{ha}^{-1}$  was in the treatment where phosphorus was applied to all the three crops in the system. The treatment where phosphorus was applied to the second crop of rice and third crop of sesamum ( $T_5$ ), maintained the fertility level almost to that of the initial level. The treatment where phosphorus was applied only to the third crop of sesamum ( $T_7$ ), showed a very slight reduction of available phosphorus content over initial level.

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## REFERENCES

- Deka, J.C. and Singh, Y. 1984. Studies on rice based multiple crop sequence: II. Effect of crop rotations on fertility status of soil. *Indian J. Agron* 29: 441-447
- Jackson, M.L. 1958. *Soil Chemical Analysis* Prentice Hall of India (P) Ltd., New Delhi
- KAU, 1983. *Package of Practices Recommendations*. Kerala Agricultural University, Trichur