

A STUDY OF THE EFFECT OF MULTIPLE CROPPING ON THE PHOSPHORUS CONTENT OF UPLAND ALLUVIAL SOILS

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Phosphorus, along with nitrogen and potassium is applied to almost all crops and in all soils in India. It is frequently applied at the time of planting. Evidence has accumulated that phosphate from newly added fertilizer furnishes only a fraction of the crop uptake and the portion not recovered by the first crop has definite residual value (Volk, 1945). But less is known regarding the phosphorus status of the soil in multiple cropping where a very high intensity of cropping is followed, Blair and Prince (1936) and Greaves and Bracken (1946) reported that total phosphorus content of the soil was not significantly changed due to cropping systems. They found that loss of phosphorus by leaching or erosion was practically nil, and the amount recovered by crops in a cropping pattern was not sufficient to change the phosphorus content of the soil. The present investigation was undertaken with the object of finding out the total phosphorus status of the soil after each crop cycle in multiple cropping, where a very high intensity of cropping is followed.

Materials and Methods

The soil samples for the study of total phosphorus were collected from the multiple cropping experiment in progress at the Central Rice Research Institute, Cuttack, Orissa State. The experiment was started in 1967. The representative soil samples from the top 15 cm layer were taken before starting of the experiment as well as after each crop and crop cycle. The cropping patterns followed were: Potato-rice-rice, Maize-rice-rice, Groundnut-jute-rice, Rice-jute-rice and Rice-rice. The total phosphorus of the soil was extracted by nitric acid-perchloric acid digestion and determined by conventional colorimetric method.

Results and Discussion

Total phosphorus in the soil was determined before starting the experiment as well as after the completion of each cycle. The data are presented in Table 1 and Table 2. The data in Table 1 show that the

initial phosphorus content of the soil was very high ranging from 537 ppm to 563 ppm. After the first cycle, in treatment potato-rice-rice, the total phosphorus content increased from 537 ppm to 561 ppm and after the second cycle to 573 ppm. Similarly in treatment maize-rice-rice, total phosphorus increased from 552 ppm to 582 ppm in the first year and to 590 ppm in the second year. In groundnut-jute-rice treatment, total phosphorus increased from 543 to 562 ppm in the first year and to 585 ppm in the second year, So also in treatment rice-jute-rice, there was an increase during both the years, in the first year from 563 to 567 and in the second year from 567 to 579 ppm. In continuous rice cultivation i.e. rice-rice treatment there was an increase during the first year, but during the second year there was no appreciable change.

The area under the experiment was not under cultivation till 1967, but it was used in 1967 for raising rice seedlings. This may be the reason for the high initial phosphorus level in the soil- All the crops in the cropping patterns received superphosphate. In addition to this, potato, maize and groundnut also received organic manures during both the years. As pointed out above, in all treatments there has been an increase in total phosphorus content of the soil- This shows that the losses of phosphorus by leaching or erosion was practically nil and the amount removed by crops was not sufficient to change the phosphorus content of the soil. Similar observations were reported by Blair and Prince (1936) and Greaves and Bracken (1946). After the completion of two

Table 1

Total phosphorus content in the soil in ppm after each crop cycle

Treatment	Initial status	After one cycle	After two cycles
1. Potato-rice-rice	537	561	573
2. Maize-rice-rice	552	582	590
3. Groundnut-jute-rice	543	562	585
4. Rice-jute-rice	563	567	579
5. Rice-rice	554	583	582

Table 2

Change in total phosphorus in soil in ppm after each crop cycle

Treatment	Increase or decrease over initial status in ppm 1967-68	1968-69
1. Potato-rice-rice	24	12
2. Maize-rice-rice	18	8
3. Groundnut jute-rice	20	23
4. Rice-jute-rice	4	13
5. Rice-rice	24	-1
S. Em	±8.7	± 15
'F' test	N.S.	N.S.

N. S. Not significant.

cycles, it was noticed that there was an increase in total phosphorus content in all treatments although the differences between the treatments are not statistically significant. This shows that there is a tendency for build up of fertility status of soil in multiple cropping so far as phosphorus is concerned.

Summary

Phosphorus status of soil as affected by multiple cropping for six consecutive seasons was studied from an experiment conducted at the Central Rice Research Institute, Cuttack, Orissa State. No loss in total phosphorus status of the soil was noticed in any of the cropping patterns. On the other hand, there was a slight increase in total phosphorus after each cycle in all cropping patterns except in rice-rice, where there was an increase after the first year, but no change after the second year.

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REFERENCES

- Blair, S. and Prince, A. L. 1936. Some effects of long continued manure, fertilizer and lime treatment on the composition of cropped soils. *Bull. New Jersey Agric. Expt. Sin.* 604.
- Greaves, J. E. and Bracken, A. F. 1946. Effect of cropping on nitrogen, phosphorus and organic matter content of dry farm soil and on the yield of wheat. *Soil Sci.* 62: 355-364.
- Volk, G. W. 1945. Response of residual phosphorus of cotton in continuous culture. *Jour. Amer. Soc. Agron.* 37: 330-340.

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