

A STUDY OF THE CHANGES IN POTASSIUM STATUS OF SOIL DUE TO MULTIPLE CROPPING

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Potassium, along with nitrogen and phosphorus, is applied to almost all crops and in all soils in India. It is generally applied at the time of planting, and under field conditions, potassium removal by crops is very high, being often three to four times that of phosphorus and more than that of nitrogen. This situation is made more serious by the fact that plants take up potassium far in excess of their needs if sufficiently large quantities are present.

In multiple cropping where a very high intensity of cropping is followed, potassium is applied to all the crops. Although plenty of literature is available regarding the removal of potassium by individual crops, little is known about its status in the soil after each crop and crop cycle, especially in multiple cropping where the high intensity of cropping is followed.

Sturgis (1936) reported that continuous cultivation of rice reduced the potassium status of the soil. Blair and Prince (1936) and Hofmann *et al.* (1950) did not observe any change in soil potassium by cultivation of various crops with the addition of potash fertilizers. Similarly, Ghosh and Kanzaria (1964) reported that there was no change in total K₂O in soil by continuous cultivation with the addition of potassic fertilizers,

Materials and Methods

The soil samples for the study of total potassium 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 the experiment as well as after every crop. The cropping patterns followed were the following:

1. Potato-rice-rice
2. Maize-rice-rice
3. Groundnut-jute-rice
4. Rice-jute-rice
5. Rice-rice

CHANGES IN POTASSIUM STATUS DUE TO MULTIPLE CROPPING

It appears that most of the surplus potassium gets leached and this brings about an even distribution of potassium. Similar findings were reported by Blair and Prince (1936).

Summary

Potassium status of the 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.

It was evident that the total potassium content of the cultivated layer of soil (0 to 15 cm) increased after potato, maize and groundnut. In general a small decrease was noticed after *dalua* rice, and a severe fall after *kharif* rice. A remarkable fall in total potassium was also noticed after the jute crop in both the cropping patterns where jute was included as one of the crops.

After completion of each cycle, the total potassium content of the soil decreased, the maximum decrease being noticed in continuous cultivation of rice, i.e. rice-rice cropping pattern.

Acknowledgement

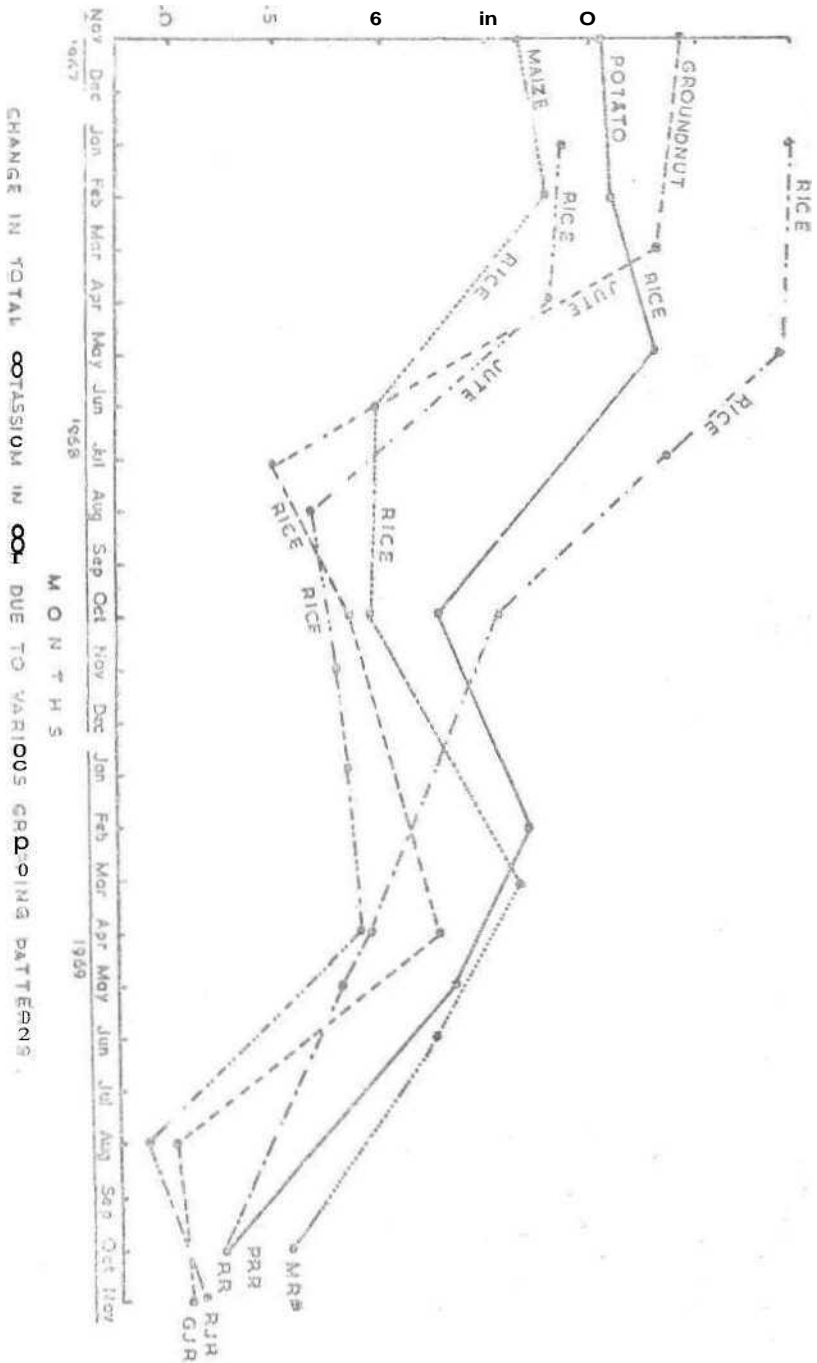
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total potassium in m.e./100 gr of soil



CHANGES IN POTASSIUM STATUS DUE TO MULTIPLE CROPPING

Table 1
Change in total potassium content in soil (m.e./100 gm of soil) after various crops

1. After potato, maize, groundnut and <i>dalua</i> rice.		
Treatment	Increase or decrease over initial status	
	1967-68	1968-69
1. Potato-rice-rice	0.06	0.47
2. Maize-rice-rice	0.12	0.69
3. Groundnut-jute-rice	0.03	0.41
4. Rice-jute-rice	-0.01	-0.11
S. Em.	±0.321	±0.205
'F' test	N. S.	N. S.
2. After <i>dalua</i> rice and jute		
Treatment	Increase or decrease over initial status	
	1967-68	1968-69
1. Potato-rice-rice	0.24	0.11
2. Maize-rice-rice	-0.69	0.21
3. Groundnut-jute-rice	-1.75	-0.85
4. Rice-jute-rice	-1.16	-1.14
5. Rice-rice	-0.09	-0.77
S. Em.	±0.237	±6.167
'F' test		
C. D. (0.05)	0.7302	0.5145
3. After kharif rice		
Treatment	Increase or decrease over initial status	
	1967-68	1968-69
1. Potato-rice-rice	-0.89	-1.00
2. Maize-rice-rice	-0.72	-0.40
3. Groundnut-jute-rice	-1.41	-0.75
4. Rice-jute-rice	-0.82	-0.89
5. Rice-rice	-1.42	-1.31
S. Em.	+0.186	+0.246
'F' test	N. S.	N. S.

N. S. Not significant

*Significant at 5%.

Total potassium of the soil was extracted by nitric acid—per chloric acid digestion and determined by Beckman Du Flame photometer.

Results and Discussion

The data showing the total potassium in the soil before and after every crop and at the end of each crop cycle during the years 1967-68 and 1968-69 are presented in Figure 1. The change in total potassium status of the soil over initial status due to different cropping patterns are presented in Table 1.

The data and figure reveal that there was considerable variation in the total potassium content of the soil in all treatments after each crop. In treatment potato-rice-rice, during both the years, there was a slight increase after potato, but a decrease after *kharif*rice. Similarly, in maize-rice-rice, there was an increase after maize, but a decrease after *dalua* and *kharif* rice crops.

In treatment groundnut-jute-rice, there was a slight increase after groundnut and *kharif*rice, but a decrease after jute crop. The same trend was noticed during the second year of the crop cycle. In treatment rice-jute-rice also, a slight decrease was noticed after *dalua* rice and jute during both the years. In the case of rice-rice cropping pattern, there was a decrease in total potassium status after every crop of rice.

From the data it is evident that there was an increase in total potassium after potato, maize and groundnut during both the years. All these crops received in addition to muriate of potash, large quantities of farm yard manure. The increase in potassium content of the soil can be attributed to the large quantity of farm yard manure applied to these crops. Similar results have been reported by Raju (1952) and Chamberland and Scott (1968).

During both the years there was decrease in total potassium after jute crop in both the cropping patterns where jute was included. The growth period of the jute crop was during the rainy season and hence the loss of potassium might have occurred due to leaching. Similarly, the loss of potassium after *kharif* rice in all cropping patterns except groundnut-jute-rice and rice-jute-rice may be due to the leaching of potassium in drainage waters during the heavy rains of June and July months. The *fefiorifrice* in the above two treatments was planted late after jute, and harvested late. The decomposition of dead jute leaves in these two treatments might have taken place during the period of *kharif* rice and might have resulted in a slight increase of total potassium.

It may be noted that after completion of two cycles, the total potassium content in all treatments have come almost to the same level.