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A STUDY ON THE EFFECT OF MULTIPLE CROPPING ON THE ORGANIC CARBON STATUS OF UPLAND ALLUVIAL SOILS

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The organic carbon content of soil gives information us to the total content of organic matter in the soil. Organic matter is one of the total important factors that influences both physical and chemical properties of soil and the organic matter status is considered as an index of soil fertility. Under tropical humid conditions, cultivation and cropping exhaust the soil organic matter and the capacity of the soil to produce gradually declines.

Various workers have shown that cropping patterns including legumes maintained organic matter in the soil at an optimum level. (Salter and Green, 1933., Metzger and Hide, 1938 and Greaves and Braken, 1946). Acharya and Rajgopalan (1956) reported an increase in carbon content of the soil by 20 to 40 percent in long term experiments in plots receiving farm yard manure. But no significant increase in carbon content was noticed in plots receiving chemical fertilizers. Biswas *et al* ., (1964) and Das *ft al* , (1966) also reported similar results.

The present investigation was undertaken with the object of finding the change in organic carbon status of the soil due to multiple cropping.

Materials and Methods

The soil samples for the study of organic carbon 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 every crop. The cropping patterns followed were Potato-rice-rice, Maize-rice-rice, Groundnut-jute-rice, Rice-jute-rice and Rice-rice.

Organic carbon percentage in the soil was determined by Walkley and Black's rapid titration method.

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Results and Discussion

The data showing the organic carbon status of the soil before starting of the experiment and after each crop and crop cycle during the years 1967-68 and 1966-69 are presented in Table 1. The change in organic carbon percentage in soil over initial status due to different cropping patterns are presented in Table 2.

The data reveal that there was change in organic carbon percentage of soil after every crop during both the years in all the cropping patterns.

In treatment potato-rice-rice, there was an increase in organic carbon percentage after potato during both the years, a slight decrease after *dalue* rice crop and a heavy decrease aftea *kharif* rice. In treatment maize-rice-rice, there

Table 1

Organic carbon **content** (%) in soil **after** each crop

Treatment	Initial status	1967-68			1968-69		
		after potato	after *dalua* rice	after *kharif* rice	after potato	after *dalua* rice	after *kharif* rice
t. Potato-rice-rice	0.4016	0,4367 after maize	0.4266	0.3413	0.4904 after maize	0.4107	0.3544
2. Maize-rice-rice	0.3885	0.3933 after groundnut	0,3525 after jute	0.3000	0.4875 after groundnut	0.3994 after jute	0.3112
3V Groundnut-jute-rice	0.3845	0.3469 after *dalua* rice	0.3150	0.3291	0.41S2 after ***dalua*** rice	0,4125	0.3478
4. Rice-jute-rice	0.3802	0.3448	0.3535 after *dalua* rice	0.3.478	0.3244	0.3272 after ***dalua*** rice	0.3356
5. Rice-rice	0.4208		0.3638	0.3178		0.3057	0.3000

Table 2

Change in organic carbon percentage in soil due to cropping patterns

1. After potato, maize, groundnut and *dalua* rice (treatment 4)

Treatment	Increase or decrease over initial status	
	1967-68	1968-69
1. Potato-rice-rice	0.0381	0.1478
2. Maize-rice-rice	0.0108	0.1875
3. Groundnut-jute-rice	—0.0378	0.0891
4. Rice-jute-rice	—0.0454	—0.0235
S. Em.	±0.0105**	±0.0158**
C. D. (0.05)	0.03246	0.05054
C. D. (0.01)	0.04664	0.07261

II. After *dalua* rice and jute

Treatment	Increase or decrease over initial status	
	1967-68	1968-69
1. Potato-rice-rice	0.0250	0.0694
2. Maize-rice-rice	—0.0300	0.0994
3. Groundnut-jute-rice	—0.0694	0.0835
4. Rice-jute-rice	—0.0367	—0.0207
5. Rice-rice	—0.0570	—0.0234
S. Em.	±0.0138**	±0.0143**
C. D. (0.05)	0.0425	0.0441
C. D. (0.01)	0.0596	0.0618

III. After *kharif* rice

Treatment	Increase or decrease over initial status	
	1967-68	1968-69
1. Potato-rice-rice	—0.0606	0.0133
2. Maize-rice-rice	—0.0809	0.0122
3. Groundnut-jute-rice	—0.0554	0.0188
4. Rice-jute-rice	—0.0423	—0.0122
5. Rice-rice	-0.0917	- 0.0306
S. Em.	±0.0128 N. S.	±0.0109*
C. D. (0.05)	—	0.0336

N. S. Not Significant
* Significant at 5% level
** Significant at 1% level

was a slight increase after maize, but a decrease after the next two crops during both the cycles. In the cropping pattern groundnut-jute-rice, although there was a decrease in organic carbon after groundnut and jute during the first year, during the second year there was an increase after groundnut and the same level was maintained after jute, but there was a heavy fall after *kharif* rice.

In treatments rice-jute-rice and rice-rice, there was a slight decrease after every crop during the first year, but during the second year a slight increase was noticed after jute and *kharif* rice.

The main sources of organic matter in the soil are the plant residues and the organic matter added in the soil. The crop always leaves behind much of its root system in the soil. However, the main source of organic matter is the farm yard manure that is applied to the crops,

As pointed out above, in treatment potato-rice-rice there was an increase after potato and a decrease after the next two crops during both the years. The potato crop received a quantity of twenty tons of farm yard manure per hectare. This large quantity of farm yard manure resulted in a high percentage of organic carbon after the potato crop. The decomposition of farm yard manure during the period of the potato crop was very slow due to the shading of the surface of the soil by the potato plants thereby lowering the maximum temperature and the consequent decrease in the rate of oxidation of organic matter. Similar increase in the organic carbon content of the soil by the application of farm yard manure has been reported by Acharya and Rajgopalan (1956); Biswas *et al.*, (1964); and Pandopadhya *et al* (1969).

The fall in organic carbon content noticed after *dalua* rice and *kharif* rice is due to the decomposition of organic matter. Decomposition is more during summer than during *dalua* season. The high temperature during the *kharif* season encourages high rates of decomposition, the soil micro-organisms certainly decompose organic matter more vigourously at high temperature This may be the reason for the low organic carbon status after *kharif* rice.

The maize crop in treatment maize-rice-rice also received farm yard manure at the rate of 120 quintals per hectare. But the increase in organic carbon content after maize was not as after potato. This Is because the organic matter decomposition was much faster due to the wide spacing of the crop and due to the frequent intercultivation given to the maize crop. In this case also after the *dalua* rice and *kharif* rice there was a fall in organic carbon percentage due to the same reasons as that of potato-rice-rice.

The slight increase in organic carbon noticed after the jute crop in cropping patterns groundnut-jute-rice and rice-jute-rice was due to the addition of organic matter by the dead leaves of the jute crop.

In continuous cropping of rice i. e. rice-rice treatment, there was decrease in organic carbon percentage after every crop and the lowest percentage of organic carbon was noticed in this treatment. No organic manure was applied to these crops. Due the low intensity of cropping, less amount of roots were added to the soil and this may also be the reason for the lowest percentage of organic carbon in this treatment. Rice crop requires frequent puddling and other machanical manipulations which lead to destroy the organic carbon content of the soil.

It is evident from Tables 1 and 2 that in almost all treatments after *kharif* rice there was a decrease in organic carbon content irrespective of whether organic manures have been applied or not Hence it is clear that it is not possible to build up soil fertility to a very high temperature of the region which favours rapid decomposition of organic matter. Similar findings were reported by *Bandopadhya et al.*, (1969).

Summary

A field experiment at the Central Rice Research Institute, Cuttack. Orissa State on multiple cropping conducted during the years 1967.68 and 1968-69 showed that there was a decrease in organic carbon content of soil in all cropping patterns after each cycle, the maximum decrease being noticed in continuous cultivation of rice, i. e. rice-rice cropping pattern. Among individual crops there was an increase in organic carbon content after potato and maize crops, whereas, there was a decrease after *dalua* and *kharif* rice crops.

സംഗ്രഹം

കട്ടക്കിലെ കേന്ദ്ര നെല്ലഗവേഷണകേന്ദ്രത്തിൽ 1967–68, 1968–69 എന്നീ വർഷങ്ങളിൽനടത്തിയ ഒരു ബഹുവിളകൃഷി പരീക്ഷണത്തിൽ എല്ലാതരം വിള പരിക്രമ രീതികളിലും മണ്ണിലെ ഓർഗാനിക് കാർബണിന്റെ തോതു് കുറഞ്ഞതായി കണ്ടു. തുടർച്ചയായി നെല്ല മാത്രം കൃഷിചെയ്തിരുന്ന മണ്ണിലാണു് ഈ കുറവു് ഏറ്റവും കൂടുതൽ അനുഭവപ്പെട്ടതു്. എന്നാൽ ഉരുളക്കിഴങ്ങു്, മക്കച്ചോളം എന്നീ വിളകൾക്കു ശേഷം ഓർഗാനിക് കാർബണിന്റെ തോതു് അല്പം വർദ്ധിക്കുന്നതായും ദലുവാ, ഖരീഫു് നെൽ വിളകൾക്കു ശേഷം അതു് കുറയുന്നതായും തെളിഞ്ഞിട്ടുണ്ടു്.

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