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Short Communication:

EFFECT OF PADDY GROWING PRACTICES ON ACTIVE POOLS OF SOIL ORGANIC CARBON IN NAGPUR DISTRICT, MAHARASHTRA

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Effect of paddy growing practices on soil organic carbon and active pools were studied during the year 2017 in Kamthi and Mouda block of Nagpur district, Maharashtra. Six surface soil samples of farmer fields at maturity stage of crop from each paddy growing practices were collected and analyzed to evaluate the effect on active carbon pools. Variation in paddy growing practices and inputs used were recorded. The soil organic carbon (SOC) content was slightly higher in organic and INM lowland practices. The readily oxidizable carbon (ROC) was significantly high under organic and INM lowland and upland practices. ROC comprised of 21.8 to 31.2 % of SOC. Effect on hot water extractable carbon (HWOC) was non significant. Cold water extractable carbon (CWOC) was significantly less under INM lowland practice which might be due to arrestment of carbon compounds by algal growth. It comprised of 4.4 to 8.6 5 of SOC under various paddy growing practices. SOC and ROC were maintained in organic and INM lowland practice, however, water soluble carbon and mineral nutrition sequesters carbon through the path of algal biomass increased in case of INM lowland practice. Therefore, INM lowland practice of growing paddy was beneficial for soil health security.

Soil organic matter plays a significant role for regulating energy and nutrients for soil organisms. It has effect in stabilizing enzyme activities and making available nutrients for plant growth through mineralization. SOC pools are very sensitive to changes in total soil organic matter. Paddy soils can be better sink than source of carbon emission if the crop residues and other sources of organic matter regularly incorporated in soil. Soil health security in subtropical climate is only possible with sequestration of SOC to maintain a quasi equilibrium (Bhattacharya *et al.,*2009). SOC levels are depended on balance between carbon input and output and strongly influenced by a soil management practices (Paustian *et al.,* 2000). Therefore, for mitigating the effect of climate change on soil health the dataset on active carbon pools is important, so that the appropriate information can be obtained for the climate smart agriculture.

The study was conducted during the year 2017 in the area of Moauda and Kamthi block of Nagpur district, Maharashtra. Agro-ecologically the area falls under hot dry sub humid 10.2 AESR. These soils are developed in alluvial plain and paddy is a major crop in the area. These soils were clayey, slightly alkaline and free from salinity.

Table1. Variation in paddy growing practices and input used

Practices/ Input Used	Conventional practice of growing low land paddy	Organic farming of growing low land paddy	INM practice of growing Lowland paddy	Conventional Upland paddy	INM practice of Upland paddy
Manure	Rare and low use(2-3 t ha^{-1})	Regular and high use (10 t)	Regular (5 t ha^{-1})	Rare and low use(2-3 t ha^{-1})	Regular (5 t ha^{-1})
Sowing	Transplanting	Transplanting	Transplanting	Drilling	Drilling
Fertilizer (Soil application)	Low dose	No dose	Optimum dose	Low dose	Optimum dose
Fertilizer Spray)	(No Spray)	Manurial liquid (500 l ha^{-1})	Spraying of 2% Urea solution	No Spray	Spraying of 2% Urea solution
Residue addition	Low residue in the form of root stubles	Straw 5 t ha^{-1}	Straw 2-3 t ha^{-1}	Low residue in the form of root stubbles	Low residue in the form of root stubbles
Biofertilizer used	No Use	Biola (Azola)	Blue green algea	No Use	Azotobactor

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The five different paddy growing practices viz. conventional low land, organic farming lowland, INM lowland, Conventional Upland and INM upland were selected and surface soil samples of 0-20 cm depth were collected at the time of maturity stage of paddy. Soil samples were processed and analyzed for organic carbon (Walkley and Black, 1934),readily oxidizable carbon(Blair *et al.,*2001) and Hot water and cold water soluble carbon (Mc Gill *et al*., 1986). The data of five paddy growing practices at six farmer field were statistically analyzed in completely randomized design.

The area under Kamthi and Mouda block was traversed for sampling the soils under various paddy growing practices adopted by the farmers and collected information on inputs used is presented in table1. The data indicates variation of paddy growing practices and inputs used by the farmers. Manuring and returning the paddy straw to soils was more under organic and INM practices than the conventional practices. Suboptimal doses of fertilizers were used by the farmers in case of conventional practices.

The soil organic carbon (SOC) of 0-20cm depth was ranged between 5.19 to 6.35 g kg^{-1} in various paddy growing practices. The effect was not significant, however SOC was slightly higher under organic and INM practices. The continuous use of FYM (7 t ha^{-1}) with manurial liquid to rice crop from 12 years recorded highest SOC (11.1 g kg^{-1}) (Ghube *et al.,* 2018). Readily oxidizable carbon (ROC) which was determined by $KMnO_4$ oxidation also showed similar trend and varied between 115 to 195 mg kg^{-1}. ROC was significantly high under organic and INM lowland practices and also high under conventional and INM upland practices. Application of organic sources with fertilizer significantly increased ROC content over fertilizer control (Verma *et al.,* 2010).

Table 2. Soil organic carbon active pools at maturity stage of paddy in various growing practices

Paddy Growing Practice	SOC (g kg^{-1})	ROC (mg kg^{-1})	Per cent of SOC (%)	HWOC (mg kg^{-1})	Per cent of SOC (%)	CWOC (mg kg^{-1})	Per cent of SOC (%)
Conventional lowland	5.27	115.08	21.84	62.57	11.87	45.15	8.57
Organic lowland	6.35	181.82	28.63	63.72	10.03	52.44	8.26
INM lowland	6.13	157.03	25.62	54.52	8.89	26.87	4.38
Conventional upland	5.19	160.86	30.99	53.99	10.40	39.55	7.62
INM upland	6.25	195.05	31.21	52.94	8.47	48.35	7.73
SE (m)+ -	0.48	10.65	-	4.92	-	3.32	-
CD at 5%	-	31.21	-	-	-	9.80	-

Hot water soluble carbon (HWOC)ranged between 52.9 to 63.7 mg kg^{-1} and higher in organic and conventional lowland practices than INM lowland and both upland practices. HWOC comprised of 8.5 to 11.9 per cent of SOC , however the effect was not significant. Water soluble carbon varies widely between 0.8 to 14.1 % of SOC in Vertisols (Subbarao *et al.,*2009). The cold water soluble carbon (CWOC) ranged from 26.9 to 52.4 mg kg^{-1} in various paddy growing practices and significantly higher under organic followed by conventional lowland practices. The less CWOC in case of INM lowland might be due to more phosphorus saturation enhancing algal growth and arresting soluble carbon compounds. Biological activities can be improved with increase in water soluble carbon (Subbarao *et al*.,2009). SOC and ROC were maintained in organic and INM lowland practice, however, water soluble carbon and mineral nutrition sequesters carbon through the path of algal biomass in case of INM lowland practice. Therefore, INM lowland practice of growing paddy was beneficial for soil health security.

REFERENCES

Bhattacharya,T., D.K. Pal, P. Chandran, S.K. Ray, C. Mandal and B. Telpande. 2009. Soil Carbon storage capacity as a tool to Prioritise areas for carbon sequestration. Curr. Sci..**95**: 482-494.

Blair, G. J., R. Lefroy, A. Whitbread, N. Blair and A. Conteh, 2001. The development of the $KMnO_4$ oxidation technique to determine labile carbon in soil and its use in a carbon management index. In assessment methods for soil carbon (R. Lal, J. Kimble, R. Follet and B. Stewarty, eds.) Lewis Publishers, bocaraton, FL pp. 323-337.

Ghube ,N.N., R.M. Ghodpage, W.P. Badole, S.S. Balpande and V.G. Nagdeote ,2018 Soil sustainability and nutritional quality of organically grown rice under farmers fields of Nagpur district.J. Soils and Crops, **28**(1): 165-171

McGill,W.B., K.R. Cannon, J.A. Robertson and F. D. Cook, 1986. Dynamics of soil microbial biomass and water soluble organic carbon in Breton 1 after 50 years of cropping in to two rotations. J. Soil Sci. **66**: 17-19.

Paustian, K., J . Six, E. T. Elliott and H. W. Hunt, 2000.Management options for reducing CO_2 emissions from agricultural soils. Biogeochem. **48**: 147-163.

Subba Rao, A.,Biswas, A.K. Sammi, K. Reddy, K.M. Hati and S. Ramana (Eds) IISS 2009 . Two Decades of Soil Research, Indian Institute of Soil Science, Bhopal,pp.53-58.

Verma ,B.C., S.P. Datta, R.K. Rattan and A.K. Singh, 2010. Monitoring changes in soil organic carbon pools, Nitrogen, phosphorus, sulphur under different agricultural management practices in tropics. Environ. Monitoring Assessment. **58**: 579-593.

Walkley, A. and I.A.Black, 1934.An examination of the Degtjareff method for determinationof soil organic matter, and a proposed modification of the chromic acid titration method.Soil Sci. **37** : 29-38.

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