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Physico-Chemical Propertiesof Soil InVarious Cropping Systems In Marathwada Region Of Maharashtra

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ABSTRACT
In the present investigation twenty soil samples were collected from different cropping systems. The soil samples were analyzed for chemical properties such as pH, EC, CEC, organic carbon, CaCO3, available N, P and K and total N, P and S along with different fractions of humus i. e. humin, humic acid, fulvic acid and HA:FA ratio. These results are summarized below.
The pH of soil samples varied between 7.40 and 7.57. C3 (Sorghum based cropping system) i.e. (7.5) significant over C2 and C4 and at par with C1 (green gram-based cropping system). whereas EC ranged from 0.33 to 0. 70 dSm-1. The organic carbon in soil ranged from 6.32 to 8.04 g kg-1. Organic carbon content is varied between 5.60 to 8.00 per cent. The soil pH, EC of soil are significant, or all cropping systems are significant. CaCO3 content varied from 5.36 to 8.04 in various cropping systems and more CaCO3 were recorded in green gram-based cropping systems.
Key Words: *Soil organic matter (SOM), CaCO3, EC, Humus, humic acid, fulvic acid and HA:FA ratio*

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I. INTRODUCTION

The term soil organic matter (SOM) refers to all organic matter in soil including living (active roots, living organisms) and non-living components (root exudates, decomposing plant and animal material, humus, and charcoal). The amount of SOM is determined by the net difference between new inputs of organic material, outputs including carbon dioxide (CO_2) losses from decomposition and any direct losses (erosion). Organic matter contains many nutrients essential to the growth of plants. However, plants cannot generally take up nutrients in organic forms. Soil organisms use the organic matter (including other organisms) as food, and in doing so release plant available nutrients and CO_2 (depending on conditions, 50% to 75% of the carbon in living organic material may be released as CO_2). Soil organisms such as earthworms, beetles and ants break large pieces of organic debris into smaller pieces and can incorporate surface residues deeper into the soil, but the greatest concentration of organic matter remains in the top ten centimeters of soil and is associated with surface residues and prolific root growth. The microbial population rapidly decomposes these organic residues and they themselves contribute to the organic matter. The organic matter loses mass and eventually, the more resistant components remain as humus (dark brown or black organic matter). Organic matter is the single property which influences soil fertility, soil formation, soil biology, other physical and chemical properties of soil, organo-chemical, biotic and hydrothermal characteristics. The nature, content, composition, and behavior of organic matter in soil are of degree of decomposition, stabilize with other soil components, subsequent incorporation of organic residue under prevailing soil conditions leads to the synthesis of more stable and highly complex form of soil humus. Further, the biological activity of an agricultural soil always remains in a stable of dynamic equilibrium which can be altered by change in water content and temperature by addition of more usual organic material. Most of our productive agricultural soils have between 3% and 6% organic matter.

The part of soil consists of a complex system of substances, the dynamics of which is determined by continuous entry of organic residues of plant and animal origin into the soil and their continual transformation under the action chiefly of biological factors and to the little extent of chemical and physical factors. This explains that in organic part of soil, various compounds are present which represent the compounds of organic nature undergoing decomposition, metabolic products of microorganisms utilizing organic residue as a source of energy, product of secondary synthesis in the form of bacterial plasma and humic substances (*Kononova*, 1966). Many times, organic humus is classified as specific (humic substances) and non-specified (non-humic fraction) substances. Nonspecific humic fractions provide short range effects such as source of food and energy form micro-organism including source of native soil fertility. However, specific substances (humic nature) involve in long range effects like buffering capacity and water holding capacity. These observations are indicative of the fact that the nature of humus ordinarily depends on the organic materials, material added to the soil. Thus, it becomes necessary to assess and characterizes the raw organic material, its rate of decomposition, factors of decomposition, C: N and other related ratio and in turn quality of humus ultimate formed.

Organic addition may accelerate decomposition of the native organic, although some freshly added plant residues may have positive effect on indigenous organic matter (*Smith*, 1966). Deciduous forest litter, shift in organic input addition and more use of organics in intensive agriculture likely to make many changes in dynamics of organic carbon in soil in near future. Thus, it becomes imperative to undertake such studies well in advance to understand the complex nature of soil humus. Further, the biological activity of an state of dynamic equilibrium which can be altered by change in water content and temperature by addition may accelerates decomposition of the native organic matter, although some freshly added plant residues may positive effect on indigenous organic matter (*Smith*, 1966) deciduous forest litter, shift in organic input addition and more use of organic in intensive agriculture likely to make many changes in dynamics of organic carbon in soil in near future. Thus, it becomes imperative to understand the complex nature of soil humus.

Conventionally, surface soils showed relatively more accumulation of organic matter which decreases with depth. But where the ground water table exists within the soil profile, there is an abrupt increase in the organic matter content of the soil near ground water table (*Bandyopadhyayet al* 1998). The complexity, composition organic, chemical, and optical properties vary widely from one situation to another situation. So far, soil organic matter was viewed very broadly, but now there is need to study more closely, critically, and comprehensively considering integrated effect of climate complex, altitude, agro ecology, soil physiographic/landscape, land use pattern (*Tomar and Joshi*, 1998), vegetation and parent material. (*Bora and Mazumdar*,1969)

Organic input of different nature plays an important role in setting a new organic matter equilibrium level in soil. The land use patterns (crop sequence, cropping systems, inter cropping) affects the humus content of soil through their quantity of crop residues, root to shoot ratio and crop canopy. Crop that produces large quantities of residue with high C: N ratio favor higher organic matter than those that produce less residue with low C:N ratio. Significant differences in organic matter content in soil under different cropping sequences and crop combinations. The rate of decline in organic over a long period of time was much higher under cowpea and soybean rotation than under maize. (*Lal and Kong*, 1982, *Hunisgi and Patil, 1972 and Malewar, 1995*). *Hunisgi and Patil* (1972) observed that incorporation of cotton in a rotation increased soil organic matter. Though fertility aspects of varied cropping systems were studied, the nature of organic matter produced under different systems and its characterization in terms of humic fractions was remained untackled. This is also the fraction that darkens the soil’s color.

II. MATERIAL AND METHODS

The present study was undertaken to investigate the composition and characterization of organic matter in the soils of different four cropping systems (viz. Cotton based cropping system, Soybean based cropping system, greengram-based cropping system and Sorghum based cropping system) under VNMKV, Parbhani. The experimental material used, and methods adopted to study organic matter and its fractions in various cropping systems.

Statistical analysis

The results obtained on various soil and humus fractions were subjected to statistical analysis as per the method suggested by *Panse and Sukhatme* (1985).

Effect of various cropping systems on Physico-chemical properties of soil.

Soil pH (1:2.5)

The effect of various cropping systems on soil pH is reported in Table 1 which shows that pH of soil in Sorghum based cropping system (C_3) i.e. (7.5) was significant over C_2 and C_4 and at par with C_1 (green gram-based cropping system). There is increased soil pH with an increase amount of organic matter, might be due to fact that the organic matter act as buffering agent in the soil. Similar result was reported by *Jatav* et al., (2010).

Table: 1. Effect of cropping systems on chemical properties of soil.

Cropping system	pH (1:2.5)	EC (dSm^{-1})	$CaCO_3$ (%)	OC ($g\ kg^{-1}$)	IOC	TOC
C_1 Cotton based cropping system	7.51	0.35	7.48	6.32	1.31	1.81
C_2 Greengram-based cropping system	7.40	0.33	8.04	8.00	1.06	1.86
C_3 Sorghum based cropping system	7.57	0.70	5.36	5.60	1.20	1.74

C_4 Soybean based cropping system	7.40	0.52	6.44	7.66	1.78	1.55
Mean	7.47	0.48	6.83	6.90	1.18	1.74
SE±	0.022	0.011	0.15	0.12	O.13	1.04
CD at 5%	0.067	0.035	0.47	0.030	0.39	1.13

Soil EC (dSm^{-1})

The effect of various cropping systems on chemical properties of soil is reported in Table 1. The Electrical Conductivity of Sorghum based cropping system (C_3) i.e. (0.70dSm^{-1}) was found significant over all other cropping systems.

$CaCO_3$ (g kg ^{1})

The effect of various cropping systems on calcium carbonate content of soil shows that calcium carbonate of C_2 (Green gram-based cropping system) i.e. (8.04 %) significant over all other cropping systems. This might be due to organic matter during decomposition which releases different weak acids which might have helped in solubilization of $CaCO_{3.}$ Similar results were reported by *Patil et al.,* (2004).

Organic carbon (g kg^{-1})

The effect of various cropping systems on chemical properties of soil is reported in Table 1. Organic carbon content of C_2 (Green gram-based cropping system) i.e. (8.04 %) was found significant over all other cropping systems. might be due to leaf fall from green gram.

TOC and Inorganic carbon in soil

The effect of various cropping systems on total organic carbon and Inorganic carbon is reported in this Table 7. The data indicates significant impact of different cropping systems on TOC and IOC. (C_2) Green gram-based cropping system i.e.,legume-based cropping system showed more soil TOC and IOC as compared to other cropping system. Significantly highest values were noted in C_2 (Green gram-based cropping system) cropping systems as over other cropping systems.

III. SUMMARY AND CONCLUSIONS

Soil organic matter and its various fractions play a vital role in soil management and crop production on sustainable basis. Therefore, a precise research project was formulated "Study of soil organic matter and its fractions in various cropping systems of VNMKV, Parbhani" in the year 2012-2013. In the present investigation twenty soil samples were collected from different cropping systems. The soil samples were analyzed for chemical properties such as pH, EC, organic carbon, $CaCO_{3.}$

The results are summarized below.

The pH of soil samples varied between 7.40 and 7.57 which was noted as 7.50 in C_1cotton-based cropping system, 7.39 C_2 green gram-based cropping system, 7.56 C_3sorghum-based cropping system and 7.40 in soybean-based cropping system. The Sorghum based cropping system i.e., C_3i.e., 7.5 significant over C_2 and C_4 and at par with C_1 green gram-based cropping system. Whereas EC was ranged from 0.33 to 0. 70 dSm^{-1}. The Electrical conductivity was recorded as in Cotton based cropping system (0.34 $dSm\text{-}^{1}$), green gram-based cropping system (0.33 $dSm\text{-}^{1}$), sorghum-based cropping system (0.70 $dSm\text{-}^{1}$), soybean-based cropping system (0.52).

The organic carbon content was varied between 5.60 to 8.00 g kg^{-1}. The organic carbon content in cotton-based cropping system was observed 6.32 g $kg^{-1}$and wasnoted in medium range, whereas in green gram-based cropping system it was 8.00 g kg^{-1} and in high range, sorghum-based cropping system (5.60 %) showed organic carbon in medium range and soybean based cropping system had 7.66 g kg^{-1} which was in medium range. Organic carbon content of all cropping systems was significant.

The $CaCO_3$ content varied from 5.36 per cent to 8.04 per cent in various cropping systems and high $CaCO_3$ was recorded in green gram-based cropping systems. The calcium carbonate of C_2 (Green gram-based cropping system) i.e., 8.04 % which was significant over all other cropping systems.

Total organic carbon was ranged between 1.55 to 1.84 % and inorganic carbon was ranged between 0.78 to 1.41 % reported. The data indicates significant impact of different cropping systems on TOC and IOC. (C_3) Green gram-based cropping system i.e.,legume-based cropping system showed more availability of soil TOC and IOC as compared to other cropping system. Significantly highest values were noted in C_2 (Green gram-based cropping system) cropping systems on other cropping systems.

1. In the cropping system pH significantly showed variation but reduction in EC was noted in legume-based system over sorghum-based system.
2. Total organic carbon (TOC) and inorganic carbon (IOC) contents were also found significantly more in green gram-based cropping system over other systems studied.

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