On the other hand female population showed ¾ FxC, 4/5 FxC, 5/6 FxC, 6/7 FxC, 3/6 FxC, 4/3 FxC, 4/6 FxC, 5/3 FxC, 5/4 FxC as 10.70 %, 3.57 %, 7.14 %, 0.0 %, 1.1 %, 7.14 %, 3.57 %, 1.1 %, & 2.38 % respectively. Palm Line Pattern showed seasonal variations during winter season, number of secondary creases increases due to wrinkling of skin. Officials, clerk, manager, officers showed 5FxC pattern while labours (carpenter, farmer) have deep and ugly palm lines with 3FxC and 4FxC pattern indicating the environmental regulation of palm line pattern.

Under observation of palm line pattern in population, 4FxC pattern is most abundant pattern i.e. 38 % in male while 28.75 % in female population and 7FxC pattern is repeated very least i.e. 0.4 %, in male population and 0.0 % in female population. For centuries physicians have recognized a line between the conditions of our palm their line pattern nails and our health. Fatty palm Darker DFC (Heart Line) with; Iceland and star over it in Saturn zone with break VLC II and a vertical line from Venus region to Jupiter region are indicator of cardiovascular diseases (Priyadarshi 2009).

The data of palm line pattern distribution has been analyzed bio statistically by student t-test and chi square test of significance. The obtained value was 1.771 at $P < 0.10$ and 2.160 at $P < 0.05$ at 13 degree of freedom, which is less than the tabulated value indicating the significance of data. The 6FxC pattern is more abundant in female population than male population. 6FxC pattern is indicator of poor health and mental retardation.

Conclusion

Out of five types of palm line pattern 4FxC and 3FxC type of palm line pattern is more common. 5FxC type of pattern is reported in officer, clerk and high status peoples while 3FxC pattern in poor and laborer class people. 6FxC type of palm pattern is more common in female population while 7FxC pattern is absent in female population.

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Long-term effect of fertilizers and manure application on soil organic carbon dynamics under rice-wheat cropping system in Inceptisol

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Abstract

Decline in soil fertility, low crop productivity and sustainability issues warned much attention for improving soil health and environment. Studied on soil organic carbon and its dynamics for long term restoration of soil health, maximizing crop production and reducing environmental pollution. In view of this, studies were planned to investigate long-term effect of fertilizer and manure application on soil organic carbon dynamics and their impact on sustainability of rice – wheat cropping system in an Inceptisol of Varanasi since 1985. Balanced and integrated use of 50 % NPK + 50 % N through FYM/ ha not only sustained the higher grain yield compared to control 50 % NP and 100 % NPK alone but also helped in sustaining high fertility status of soil. Studies on soil organic carbon (SOC) pools and dynamics revealed that active pools of carbon and water soluble carbohydrates in soil increased by 57 % (0.28-0.44 %) and 190 % (344.16 – 654.85 ppm) in surface soil depth (0-15 cm) compared to SOC content in control. The soil microbial biomass carbon comprised 3.8 – 6.8 % of SOC, 3.0 – 3.4 % of soil N. The adverse effects of imbalanced application of either NP or NPK without manure decrease productivity of rice-wheat cropping system such Inceptisol.

Key words: Soil organic carbon, long-term experiment, soil quality, soil microbial biomass carbon.

Introduction

Deterioration in soil quality, especially soil organic matter and its associated nutrient supply to soil, has been cited as one of the major factors for yield decline or stagnation under intensive rice-wheat based cropping systems in most of the South-Asian countries (Dawe *et al.,* 2000 and Swarup *et al.,* 2000). Soil

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degradation occurs due to nutrient depletion, soil structure degradation and sub-optimal addition of organic and inorganic fertilizer to soil. Long-term addition of organic matter improves crop yield, water holding capacity, porosity and decreases bulk density and surface crusting (Edwards and Lofty, 1982). The large organic matter returns with fertilizer addition can stimulate soil biological activity. After, about 130 years on the Broad balk experiment at Rothamsted, biomass C content had equilibrated to 128 mg C $g^{-}1$ with unfertilized control and 189 mg C $g^{-}1$ with annual application of N, P, K, Mg and Na (Sparling, 1985) in crops and pasture land (Haynes and Williams, 1992). Soil organic matter is an essential component with key multifunctional roles in soil quality and related to many physical and biological properties of soil (Smith *et al.,* 2000), during the last few decades, identified specific soil organic matter fractions with functional significance in the turnover of soil. Among these fractions, soil microbial biomass C and water-soluble C fractions are the most active and labile pools, which have short turnover times (Janzen *et al.,* 1992). However, a relationship is needed to better predict yield sustainability from soil organic matter fractions under long-term fertilizer and manure application. The objectives of this study were (i) to evaluate the impact of fertilizer and manure applications on yield and SOC and (ii) to assess soil C and N fractions in an Inceptisol soil with 25 years of continuous cropping under rice–wheat cropping system.

Materials and methods

Site description- A long-term fertilizer experiment was initiated at Institute of agricultural sciences, BHU, Varanasi (1985–86 to 2009–2010) under the All India Coordinated Research Project on Long-Term Fertilizer Experiments at the Banaras Hindu University, India. Annual precipitation was 1150 mm yr^{-1}, with nearly all occurring between June and September. Average annual temperature was $23.18^{0}C$ with maximum of $40.58^{0}C$ during April and minimum of $6.8^{0}C$ in January. The surface (0–15 cm) soil pH (1:2: soil: water) was 7.8 at the initiation of this long-term experiment. Detailed initial physicochemical properties were reported in table 1. For treatment establishment, the experimental field was planted to wet season rice (June–October, 1985) followed by winter wheat (November, 1985–April, 1986) and this same crop rotation were continued until 2010. Traitements were T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8 and T_9. Half of recommended N along with full P and K were given as basal and the remaining half of N at 21 days after sowing through urea, single super phosphate and KCl to both rice and wheat. The farm yard manure, crop residue and green manure were applied each year before sowing of rice. Grain was separated from straw using a plot thresher, air dried and the grain yield was recorded. The experimental design was a randomized block of nine treatments with four replications. Soil sample was collected in April 2010 from one depth (0–15 cm) from a composite of four 8 cm diameter soil cores per plot. Crop residues were carefully removed before soil sampling. Soil samples were divided into two sub-samples: one for chemical (air dried sample) and one for biochemical (moist sample) analysis, which was sieved through a 2 mm mesh and kept in polyethylene bags at $4.8^{0}C$.

Physico-chemical analysis

The soil samples were air dried and ground to pass through 2 mm sieve and were analyses for particle size followed by International pipette method (Piper, 1966). The pH of soil was measured with Buckman glass electrode in (1:2): soil:water suspention. Electrical conductivity in (1:2): soil: water suspention was determined in saturation extracts with digital EC meter (Richards, 1954). The organic carbon in soil was analyses by the method at laid (Walkley and Black, 1934), Total nitrogen (Bremner, 1965), $KMnO_4$ extractable available nitrogen (Subhiah and Asija, 1956); available phosphorus 0.5M $NaHCO_3$ solution buffered at pH 8.5 and determined by spectrophotometer at wavelength 780 nm using blue color method (Olsen, et al., 1954), available potassium by extraction with 1N neutral ammonium acetate at (Jackson, 1967) .

Table. 1 Physico-chemical properties of experimental soil

Soil properties	Initial soil
Texture	Sandy loam
Sand (%)	28.53
Silt (%)	49.60
Clay (%)	21.87
CEC (mol (p+) kg^{-1})	13.70
pH (1:2.5)	7.80
EC (dSm^{-1})	0.12
Organic Carbon (%)	0.27
Available N (kg ha^{-1})	121.40
Available P (kg ha^{-1})	11.25
Available K (kg ha^{-1})	135.30

Biochemical analysis

Soil samples were processed and analyses for different biochemical properties. A 40 g moist soil sample (2 mm) was kept for pre-incubation (3 days at 25.8^{0}C) to attain basal respiration conditions (Srivastava and Singh, 1989). The soil microbial biomass carbon (SMBC) was determined by the ethanol–free chloroform- fumigation extraction method (Vance *et al*., 1987) using kc value of 0.45 for SMBC (Jenkinson and Ladd, 1981). The samples of both fumigated and non-fumigated soil were extracted with 0.5 M K_2SO_4 and organic C were determined by titrimetry followed dichromate digestion. For soil microbial biomass N (SMBN), soil samples were extracted with 2 M KCl (1:10 ratio) and NH_4–N and NO_3–N were measured (Bremner, 1965) using the following relationship (Brooks *et al*., 1985): microbial N = N flush/0.54. Acid hydrolysable carbohydrates (HCH) were determined in dilute H_2SO_4. A 5 g sample (oven dried at 105.8^{0}C) was hydrolyzed for 24 h at about 85.8^{0}C with 1.5 M H_2SO_4 and filtered through glass fiber paper (Whatman GF/C). The carbohydrate content of the extract was determined using anthrone reagent (Brink *et al.,* 1960).

Results and Discussion

Yield and soil organic C trends

Long-term effect of fertilizer and manure on yield sustainability and SOC trends a major component of sustainable land use to sustain and improve the quality of the soil resource base. Monitoring is important to correct deficiencies or improve the quality of the soil resource. Various studies have attempted to identify sets of attributes or properties that can characterize a soil processes in regard to a specific soil function. More recently, measurement of soil organic matter is relatively straight forward, so there is need for an indicator to assess its status in soil at any time (Carter, 2002). However, highest yield recorded for rice (Table.2) by 50% NPK + 50% N through FYM and wheat by 100% NPK treatments. Lowest soil organic C occurred from 20 to 25 years of cropping in all systems, but targeted parameters were increased by T_4 treatment that was able to maintain the highest soil organic C throughout years of experimentation. Results from long-term experiments could be helpful in establishing cause and affect relationship to monitor long-term changes in organic pools and nutrient supply. Yield decline in long-term experiments could occur because of adversity of many factors such as decline of soil organic matter and associated nutrients, imbalanced fertilizer use, cultivars, climate, insect pest, soil types and crop management practices, but the insect and disease are probably not the cause of yield decline (Dawe *et al.,* 2000).

Table 2. Long-term effect of fertilizer and manure on grain yield and active pools of carbon in Inceptisol

Treatment combination		O.C. (%)	SMBC (mg C/100 soil)	Total N (ppm)	SMBN (ppm)	Water Soluble carbohydrates (ppm)	Grain yield (Q ha^{-1})	
Rice	Wheat	0-15 cm	0-15 cm	0-15 cm	0-15 cm	0-15 cm	Rice	Wheat
T_1 Control*	Control*	0.28	105.00	468.88	14.00	344.16	23.00	12.50
T_2 50% RF	50% RF	0.29	145.22	517.86	15.25	357.55	39.20	27.50
T_3 100% RF	100% RF	0.31	162.92	575.89	16.78	390.06	47.30	37.50
T_4 50% RF + 50% N through FYM	100% RF	0.49	295.00	781.47	26.50	654.85	51.50	40.70
T_5 75% RF + 25% N through FYM	75% RF	0.37	287.00	758.93	25.20	572.22	50.20	36.40
T_6 50% RF + 50% N through CR	100% RF	0.31	184.92	629.47	17.52	406.12	41.10	38.20
T_7 75% RF + 25% N through CR	75% RF	0.36	212.18	611.61	19.92	418.08	44.80	35.10
T_8 50% RF + 50% N through GM	100% RF	0.42	265.01	705.4	23.84	549.11	48.20	38.40
T_9 75% RF + 25% N through GM	75% RF	0.39	232.82	669.86	21.46	432.83	46.70	35.70
CD at (5 %)		0.017	1.63	10.38	1.09	1.04	3.27	2.71

***No fertilizer, No organic manure, RF: Recommended fertilizer (120 Kg N + 60 Kg P_2O_5 + 60 kg K_2O ha^{-1})**
FYM- Farm yard manure, CR- Crop residue, GM- Green manure.

Active fractions of C and N

The increase in SOC and total N with FYM, CR or GM addition could be attributed to an increase in belowground biomass production compared to other treatments. Therefore, Inceptisol with low fertility may not be able to sustain continuous cropping unless an adequate balanced fertilizer along with amendment is ensured in the long run. We also observed that a significant increase in crop yield could be achieved in T_4 treatment. FYM had been reported to increase microbial biomass content, soil enzyme activity and net mineralization of organic N (Badalucco *et al.,* 1992). There was a significantly increased of SOC and TN in the treatment receiving T_3 or T_4. Application of 50% NPK in combination with 50 % FYM in rice crop and 100 % NPK in wheat crop maintained SOC and TN even after 25 years of continuous cropping. A higher on concentration of active C and N fractions was evident in surface soil (0–15 cm) (Table 2). The SMBC and SMBN values in T_3 and T_4 treatments were statistically significant ($P < 0.05$). The results showed that SMBC ranged from 3.8% to 6.8% of SOC and MBN from 3.0% to 3.4% of total N in the surface layer (0–15 cm) whereas in lower depths the SMBC/SOC ratios were relatively higher in all treatments. The content of water soluble carbohydrates accounted for 190 %. increased with compared to control (T_1) treatment in the top surface layer (0–15 cm depth). The continual addition of FYM usually increases SMBC and SMBN which could lead to a positive effect on both soil aggregation and macro porosity (McGill *et al.,* 1986).

Conclusions

Two decades of continuous rice–wheat cultivation revealed a significant loss of active fractions of C and N with control and 50 % NPK fertilizer application. A positive effect of balanced fertilizer (50 %NPK + 50 % N through FYM) on crop yields led to positive effects on soil C and N fractions. Effects of imbalanced application of either NP or NPK, regular balanced fertilizer application with organic manures is necessary or maintaining organic pools of SOC in rhizosphere and thereby sustaining soil quality and productivity of rice-wheat cropping system such Inceptisol.

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