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Soil Quality Variables in Organically and Conventionally Cultivated Crop Fields

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Abstract: The physicochemical properties of soil under conventional and organic farming system in three agricultural fields were studied to have an idea on the seasonal as well as the crop field variation. Organic fields showed significantly higher values for soil organic carbon, mineralisable nitrogen, available phosphorus and available potassium irrespective of soil depth, crop field and seasons. The values of these parameters showed a decreasing trend with increasing soil depth in winter and rainy seasons whereas reverse trend was noted with respect to summer. No significant variation among crop fields were observed for the above said soil parameters.

Key words: Soil organic carbon · Mineralisable nitrogen · Available phosphorus and available potassium

INTRODUCTION

Soil is the shallow upper layer of earth crust, whose initial characteristics depend on the parent rock material and who's late depends upon climate, topography and vegetation. In the process defining monitoring sustainable land management, soil scientists and practitioners have tried to identify specific soil physical, chemical and biological indicators associated with soil quality, fertility and health [1]. Soil organic carbon is an important constituent of all organic matter. Carbon is continually being fixed into organic form by photosynthetic organisms under the influence of light and once bound, the carbon becomes unavailable for use in the generation of new plants life. Soil contains carbon (C) in both organic and inorganic forms, but in most soils (with the exception of calcareous soils) the majority of C is held as soil organic carbon (SOC). Nitrogen occurs in the soil mainly as organic substances, ammonia, molecular nitrogen, nitrite and nitrate. The transformation of nitrogen is largely microbiological inter-conversions regulated by the physical and chemical environment of the soil. Phosphorus is found in soil in a number of organic and inorganic compounds. It is second to nitrogen as a mineral nutrient required both by plants and microorganisms. Potassium in soil is present in four forms, viz., soluble K (instantly available K), exchangeable (easily mobilizable reserve of available K), non exchangeable K (slowly mobilizable stocks of available K) and mineral K (semi permanent reserve). These forms of K are always in a dynamic equilibrium and the concentration of each form as well as the rate of interconversion is determined by the soil physic-chemistry and microbial activity [2].

Previous studies have shown various results with respect to different soil parameters in different agricultural fields. An attempt has been made here to go further to derive more relation by comparing soil organic carbon, mineralizable nitrogen and available phosphorus and available potassium in both organic and conventional farming systems in different agricultural fields.

MATERIALS AND METHODS

The study was conducted during March 2007 to January 2009 in three different seasons i.e. summer (March-May), rainy (July-September) and winter (November-January). Soil samples were collected from rice fields under both organic and conventional farming systems located in Khurda district of Orissa state. Sampling was done at an interval of 15 days during the entire period of study. The sites were characterized by a climate with most rainfall occurring during rainy months (July-September). The ambient temperature average ranged from a minimum of 11.1°C to a maximum of 44.6°C and annual normal rainfall of 1449.1 mm. Soil samples were collected from top 20 cm of soil and were segregated into five depth classes at 4 cm intervals. Collection was made

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in sterilized polythene bags using a steel corer and each sample was divided into three replicates. The replicates were then labeled and left for isolation and enumeration of bacteria and fungi within 24 h of collection. The enzymatic activity of soil samples were measured immediately after collection. Soil Organic carbon (SOC) was estimated titrometrically [3], mineralisable nitrogen (MN), Available Phosphorus (AP) and Available Potassium (AK) were carried standard protocols [4, 5, 6] respectively.

RESULTS

Soil Organic Carbon (SOC): The organic carbon obtained in percentage was converted to g/kg of dry soil for rice by multiplying the values obtained with 10 for the three crops under two systems of farming (Table 1). The organic carbon content was the highest in winter followed by rainy and lowest in summer. The SOC values decreased with soil depth except in summer season. Irrespective of crop, season and soil depth the amount of soil organic carbon was more in organic fields than in conventional fields. Among the crop field rice field was found to have maximum content of soil organic carbon under both cultivation. From the annual average conventional farming system was found to be 54% than that of organic rice field. Corresponding percentage for pulses and vegetable were found to be 55% and 54% respectively (Fig. 1). Soil organic carbon content in summer were found to be 82%, 78% and 80% than winter, respectively for rice, pulses and vegetable fields under conventional farm practice. The soil organic carbon content at the deeper soil layer (16-20 cm) in organic rice, pulses and vegetable fields were found to be 84%, 78% and 80%, respectively of the surface. The corresponding values for conventional farming system were found to be 89%, 85% and 92%, respectively for rice, pulses and vegetable fields. Corresponding values for organic farms were 84%. Considering the C.D values (Table 1) for the organic carbon among treatments was clear that all were statistically different from each other at 1% ($p<0.01$) level of significance.

Mineralisable Nitrogen (MN): The mineralisable nitrogen (kg/ha) for rice, pulses and vegetable was measured for the three crops under two systems of farming (Table 2). The amount of available nitrogen was found to be highest in winter and lowest in summer at the top most layer of soil in all the three crop fields. The nitrogen content was found to be 93% for rice crop in conventional field compared to the organic one. The content of mineralisable nitrogen in deeper soil layer were found to be 87% and 95% (rice), 86% and 96% (pulses) and 94% and 96% (vegetable), respectively for organic and conventional farming systems when compared to that of the surface soil indicating that nitrogen level decreased with depth independent of any parameters. Such pattern of the distribution of nitrogen was found to be observed in all the three crop fields. However, the rate of reduction in the level of mineralisable nitrogen with increase in the depth of soil was found to be more in the organic fields than in the conventional one. The annual average values of nitrogen content of conventional rice, pulses and vegetable fields were calculated to be 89%, 91% and 91%, respectively compared to that of organic fields. The nitrogen content of summer season was calculated to be 93% for conventional rice, pulses and vegetable fields (Fig. 2). However, the mineralisable nitrogen content in organic rice, pulses and vegetable field was found to be 93%, 94% and 91%, respectively. Considering the C.D values (Table 2) for mineralisable nitrogen among all parameters under study it was clear that they were all significantly different from each other at 1% ($p<0.01$) level of significance.

Available Phosphorus (AP): The available phosphorus (kg/ ha) for rice, pulses and vegetable under two systems of farming were found to be significantly different (Table 3). The amount of available phosphorus was found to be minimum in summer and maximum in winter in each farming system and in each crop fields. The level of phosphorus in organic rice, pulses and vegetable was found to be 70%, 77% and 83% in summer than winter and the respective percentage for conventional fields were 79%, 84% and 83% (Fig. 3). But the amount decreased with increasing soil depth as the least values were recorded in last layer in all the three seasons' except summer. The amount of phosphorus in deeper soil layer (16-20cm) was calculated to be 73% and 76% (rice), 74% and 75% (pulses) and 81% and 68% (vegetable), than the surface soil layer respectively for organic and conventional farming system. The available phosphorus content of conventional rice, pulses and vegetable fields were calculated to be 69%, 72% and 85% than that of organic farms, respectively indicating that only for vegetable field minimum variation was noted between the two farming systems. Considering the C.D values (Table 3) for available phosphorus among all treatments it was clear they were statistically different from each other at 1% ($p<0.01$) level of significance.

Table 1: Seasonal and annual variation of the soil organic carbon level (g/kg dry soil) of organic (O) and conventional (C) farming systems

		Soil Depth (D) (cm)									
		0-4		4-8		8-12		12-16		16-20	
		Farming Systems									
Crops	Season (S)	O	C	O	C	O	C	O	C	O	C
Rice(Rc)	Winter	10.19±0.27	5.09±0.03	9.14±0.24	5.05±0.15	9.11±0.19	4.81±0.11	8.41±0.18	4.69±0.11	8.24±0.12	4.51±0.11
	Summer	8.05±0.34	4.15±0.43	7.79±0.36	4.11±0.32	7.68±0.56	4.05±0.15	7.43±0.16	3.91±0.12	7.33±0.14	3.71±0.21
	Rainy	9.28±1.06	4.86±0.22	8.06±0.12	4.83±0.46	8.05±0.24	4.69±0.11	7.68±0.11	4.54±0.15	7.5±0.13	4.39±0.12
	Annual mean	9.12	4.72	8.39	4.66	8.28	4.52	7.84	4.38	7.69	4.21
Pulses(Ps)	Winter	9.71±0.19	5.03±0.11	9.27±0.21	5.03±0.02	8.29±0.36	5.01±0.31	7.47±0.44	4.69±0.28	7.42±0.23	4.35±0.43
	Summer	7.74±0.15	4.15±0.03	7.37±0.55	3.93±0.17	7.11±0.18	3.81±0.17	6.85±0.02	3.64±0.1	6.52±0.14	3.53±0.21
	Rainy	9.45±0.15	4.77±0.41	8.03±0.22	4.68±0.12	7.82±0.18	4.61±0.26	7.03±0.32	4.45±0.27	7.02±0.31	4.26±0.42
	Annual mean	8.97	4.61	8.22	4.55	7.76	4.47	7.12	4.17	6.98	3.92
Vegetable (Vg)	Winter	9.55±0.42	4.91±0.37	9.24±0.25	4.85±0.31	8.04±0.42	4.74±0.21	7.31±0.31	4.35±0.27	7.24±0.23	4.26±0.22
	Summer	7.52±0.15	3.85±0.17	7.02±0.01	3.680.21	6.86±0.16	3.56±0.13	6.71±0.29	3.46±0.23	6.48±0.43	3.38±0.44
	Rainy	9.04±0.04	4.35±0.28	8.01±0.22	4.32±0.27	7.81±0.18	4.22±0.12	7.53±0.19	4.15±0.17	7.27±0.19	3.89±0.12
	Annual mean	8.71	4.37	8.09	4.27	7.57	4.16	7.18	3.99	6.99	4.04

	S.E (M)			C.D			F			C.V (%)		
Factors	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg
S	0.03	0.03	0.02	0.09	0.08	0.06	327.95	444.42	671.09	2.62	2.59	2.06
D	0.04	0.04	0.03	0.11	0.10	0.08	91.03	214.27	219.94			
OC	0.02	0.02	0.02	0.07	0.06	0.05	11489.05	10919.49	18939.63			
SxD	0.07	0.06	0.05	0.19	0.18	0.14	4.63	8.98	28.38			
SxOC	0.04	0.04	0.03	0.12	0.11	0.09	39.58	4.65	40.83			
DxOC	0.06	0.05	0.04	0.16	0.14	0.12	24.29	59.44	89.76			
SxDxOC	0.09	0..09	0.07	0.27	0.25	0.19	3.42	10.54	12.44			

Note: All F values are significantly different at $p < 0.01$.

Table 2: Mineralisable nitrogen (kg/ha) content of the soil at different depths and seasons during the study periods in both organic (O) and conventional (C) farming systems

		Soil Depth (D) (cm)									
		0-4		4-8		8-12		12-16		16-20	
						Farming	Systems				
Crops	Season (S)	O	C	O	C	O	C	O	C	O	C
Rice (Rc)	Winter	163.66±2.01	137.34±2.03	155.66±2.11	135.35±2.14	148.66±1.02	139.381.04	138.66±3.31	133.66±2.41	137.34±2.71	131.84±3.52
	Summer	149.67±2.21	127.35±2.05	142.34±2.18	126.35±2.77	141.66±1.37	127.34±1.52	132.67±1.82	124.34±1.09	130.38±1.07	122.38±1.16
	Rainy	157.67±1.31	130.66±1.05	152.34±3.05	130.34±2.02	148.66±4.01	131.34±3.08	144.38±2.08	126.66±1.09	141.65±2.35	124.51±1.18
	Annual mean	156.56	131.78	150.05	130.67	146.33	132.33	138.22	128.8	136.44	126.22
Pulses (Ps)	Winter	161.66±5.17	137.33±5.13	150.66±4.01	135.33±3.04	144.33±4.22	139.33±3.78	132.16±3.56	133.16±3.45	131.66±3.97	131.39±4.08
	Summer	147.51±5.04	127.32±3.15	138.34±6.01	126.35±5.91	138.68±3.72	127.68±3.84	129.39±4.07	124.38±4.35	129.34±3.18	122.35±3.94
	Rainy	153.11±4.12	130.66±3.72	152.12±3.74	130.34±2.56	147.66±2.84	131.18±2.94	144.34±3.08	126.11±3.85	139.12±2.92	124.51±2.95
	Annual mean	153.89	131.78	146.89	130.67	143.36	132.35	135.39	128.0	133.22	126.22
Vegetable (Vg)	Winter	155.07±4.08	133.12±4.14	145.38±4.05	132.15±2.35	144.11±2.87	134.14±2.95	142.12±2.89	132.51±3.07	140.34±4.05	127.88±3.14
	Summer	131.01±4.14	126.66±2.11	127.66±2.23	123.34±2.45	132.65±2.52	122.34±3.21	132.68±2.61	121.11±3.18	129.66±4.16	101.66±3.17
	Rainy	148.24±2.47	127.66±3.32	141.12±4.05	124.51±4.25	141.34±3.54	123.11±3.17	141.34±3.56	122.31±4.12	139.35±2.27	121.66±2.74
	Annual mean	144.74	129.11	138.22	126.61	139.11	126.33	138.44	125.17	136.44	123.72

	S.E (M)			C.D			F			C.V (%)		
Factors	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg
S	0.28	0.29	0.27	0.81	0.82	0.76	309.81	267.18	484.02	1.13	1.16	1.12
D	0.37	0.37	0.35	1.04	1.06	0.99	209.11	207.13	52.33			
OC	0.23	0.23	0.22	0.66	0.67	0.63	2283.85	9.26	5.21			
SxD	0.64	0.65	0.61	1.80	1.83	1.71	3.79	1455.48	1784.84			
SxOC	0.40	0.41	0.38	1.14	1.16	1.08	47.33	82.25	104.9			
DxOC	0.52	0.53	0.49	1.47	1.49	1.39	73.33	73.73	4.53			
SxDxOC	0.91	0.91	0.86	2.55	2.59	2.42	6.56	11.46	10.33			

Note: All F values are significantly different at $p < 0.01$

Table 3: Available phosphorus (kg/ha) content of the soil at different depths and seasons during the study periods in both organic (O) and conventional (C) farming systems

		Soil Depth (D) (cm)									
		0-4		4-8		8-12		12-16		16-20	
						Farming	Systems				
Crops	Season (S)	O	C	O	C	O	C	O	C	O	C
Rice(Rc)	Winter	30.66±0.22	24.68±0.21	31.34±0.25	20.66±0.34	30.38±0.53	20.11±0.41	28.08±0.32	17.35±0.05	25.39±0.08	17.27±0.18
	Summer	24.66±0.61	17.33±0.43	22.15±0.51	16.35±0.42	20.34±0.35	16.38±0.31	19.34±0.24	13.34±0.25	18.34±0.23	15.14±0.21
	Rainy	32.02±0.18	22.04±0.51	29.38±0.25	17.34±0.42	26.12±0.18	18.34±0.19	25.65±0.37	18.34±0.51	22.67±0.41	16.33±0.45
	Annual mean	30.11	21.11	27.56	18.11	25.56	18.06	24.11	16.22	21.89	16.11
Pulses(Ps)	Winter	32.32±1.58	22.66±1.58	31.34±0.53	21.34±0.27	27.16±0.31	19.34±0.45	25.45±0.51	18.35±0.72	23.66±0.54	17.66±0.47
	Summer	25.34±0.67	19.34±0.71	21.34±0.65	17.34±0.61	19.66±0.91	17.17±0.19	20.66±0.45	15.11±0.81	20.05±0.62	15.11±0.51
	Rainy	33.34±0.41	22.64±0.58	30.66±0.51	21.37±0.54	26.35±0.31	17.14±0.41	24.68±0.54	17.37±0.65	23.65±0.44	16.12±0.18
	Annual mean	30.35	21.56	27.78	19.99	24.22	17.67	23.56	16.78	22.44	16.22
Vegetable (Vg)	Winter	25.66±0.22	22.11±0.31	21.37±0.15	21.34±0.34	20.68±0.51	18.32±0.21	21.66±0.61	14.35±0.72	19.68±0.41	15.34±0.31
	Summer	19.01±0.41	17.04±0.51	18.34±0.58	16.65±0.21	17.64±0.55	16.34±0.61	14.05±0.71	18.65±0.52	12.68±0.57	18.34±0.63
	Rainy	23.23±0.31	21.33±0.58	22.65±0.42	19.34±0.31	19.24±0.37	17.21±0.51	18.16±0.22	16.32±0.35	18.33±0.58	14.33±0.75
	Annual mean	23.22	20.56	20.00	19.33	18.67	16.44	19.22	14.33	18.78	14.00

	S.E (M)			C.D			F			C.V (%)		
Factors	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg
S	0.22	0.19	0.18	0.63	0.55	0.52	220.65	182.29	91.22	5.58	4.85	5.41
D	0.29	0.25	0.24	0.81	0.71	0.67	78.77	120.95	95.32			
OC	0.18	0.16	0.26	0.51	0.45	0.42	950.87	1027.55	208.86			
SxD	0.49	0.47	0.15	1.41	1.23	1.15	2.63	5.39	2.37			
SxOC	0.32	0.28	0.26	0.89	0.78	0.73	28.0	31.24	2.15			
DxOC	0.41	0.36	0.33	1.15	1.0	0.94	6.2	4.3	14.51			
SxDxOC	0.7	0.62	0.58	1.99	1.75	1.63	1.74	1.88	4.47			

Note: All F values are significantly different at $p < 0.01$.

Table 4: Available potassium (kg/ha) content of the soil at different depths and seasons during the study periods in both organic (O) and conventional (C) farming systems

		Soil Depth (D) (cm)									
		0-4		4-8		8-12		12-16		16-20	
						Farming	Systems				
Crops	Season (S)	O	C	O	C	O	C	O	C	O	C
Rice(Rc)	Winter	197.66±3.05	154.11±2.03	177.34±4.67	136.67±1.78	154.12±1.56	132.11±7.11	133.66±1.53	119.66±6.66	142.66±1.53	113.35±2.08
	Summer	143.33±2.02	119.66±3.05	120.34±3.05	109.66±2.08	113.38±1.22	103.67±1.34	108.66±1.53	81.66±3.51	98.33±3.79	88.35±1.81
	Rainy	163.34±2.52	139.64±1.78	134.66±3.06	127.38±2.65	132.34±1.53	108.34±1.51	115.66±2.08	102.35±1.23	111.21±2.11	93.37±1.15
	Annual Mean	168.07	137.56	144.02	124.22	133.11	114.33	119.33	101.11	109.67	98.22
Pulses(Ps)	Winter	187.33±5.51	150.35±2.08	158.33±0.09	136.68±7.02	148.21±3.11	125.45±2.34	133.66±1.52	115.11±2.64	122.66±1.53	109.34±0.04
	Summer	129.33±4.03	113.66±3.02	108.33±4.04	106.66±0.58	111.66±0.02	102.67±5.01	108.66±1.53	98.34±0.01	95.34±0.03	85.35±0.04
	Rainy	153.34±0.03	145.21±1.15	131.33±0.02	125.36±1.53	148.24±0.03	115.38±0.58	115.66±0.02	104.31±0.02	110.67±0.01	92.67±0.02
	Annual Mean	156.44	136.33	132.56	122.67	135.89	114.11	119.33	105.67	109.33	105.67
Vegetable (Vg)	Winter	177.33±1.15	146.33±1.53	147.16±5.21	131.13±1.14	133.66±1.53	123.23±2.24	121.33±0.58	105.66±3.06	112.33±1.53	100.66±0.58
	Summer	119.45±3.61	114.33±4.35	108.34±1.23	103.67±1.24	104.66±1.53	98.66±2.08	97.66±0.58	85.66±1.53	89.67±2.01	82.32±1.53
	Rainy	135.66±2.08	132.66±1.15	124.51±1.23	117.66±0.58	117.35±4.04	107.66±1.53	114.35±2.23	92.66±4.73	103.66±2.08	87.39±2.05
	Annual Mean	144.00	131.00	126.39	117.22	118.56	109.78	111.00	94.67	101.67	90.00

	S.E (M)			C.D			F			C.V (%)		
Factors	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg	Rc	Ps	Vg
S	0.38	0.56	0.43	1.09	1.59	1.21	2190.0	851.61	1199.89	1.69	2.5	2.05
D	0.49	0.72	0.55	1.4	2.05	1.57	1539.72	522.38	869.57			
OC	0.31	0.46	0.35	0.89	1.29	0.99	1974.94	598.35	566.31			
SxD	0.86	1.25	0.96	2.43	3.56	2.71	19.38	24.49	29.46			
SxOC	0.54	0.79	0.61	1.54	2.25	1.72	51.27	35.51	34.79			
DxOC	0.7	1.02	0.78	1.99	2.89	2.22	47.33	11.67	7.56			
SxDxOC	1.21	1.77	1.36	3.44	5.02	3.84	39.46	11.41	14.0			

Note: All F values are significantly different at $p < 0.01$

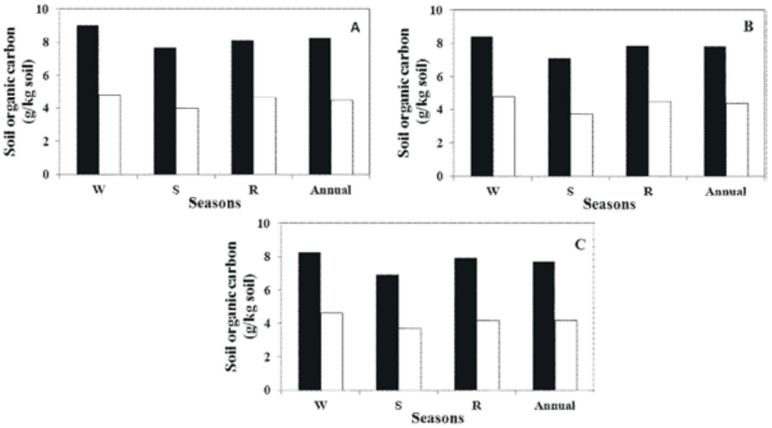

Fig. 1: Soil organic carbon (g/kg soil) in organic (full) and conventional (empty) rice (A), pulses (B) and vegetable (C) agroecosystems

Legends: W = Winter, S = Summer, R = Rainy

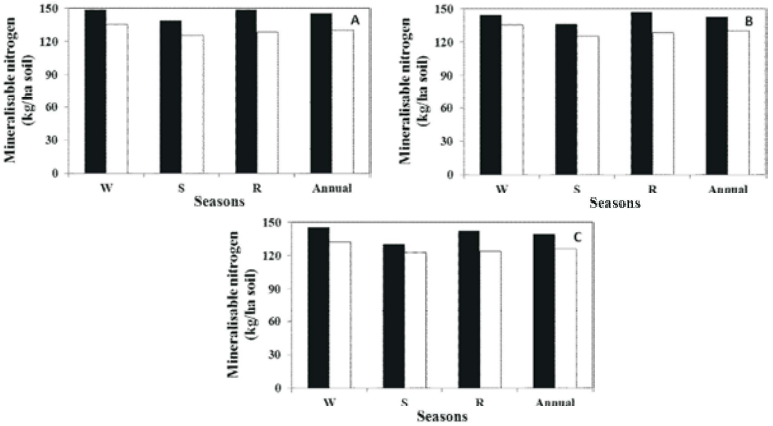

Fig. 2: Mineralisable nitrogen (kg/ha soil) in organic (full) and conventional (empty) rice (A), pulses (B) and vegetable (C) agroecosystems

Legends: W = Winter, S = Summer, R = Rain

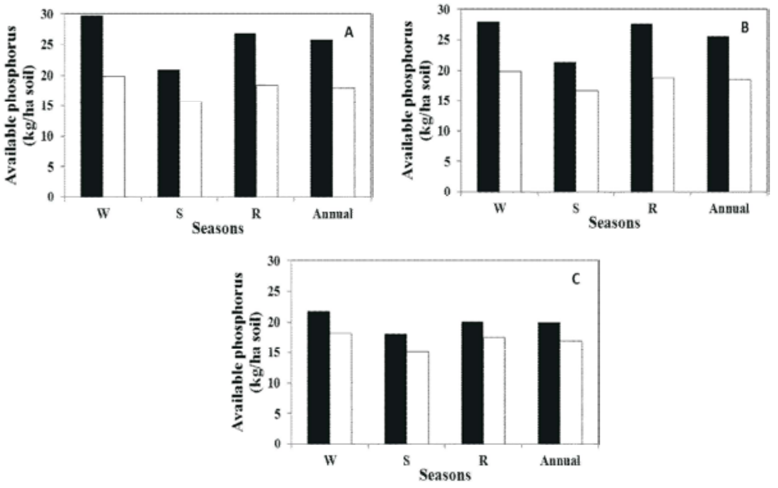

Fig. 3: Available phosphorus (kg/ha soil) in organic (full) and conventional (empty) rice (A), pulses (B) and vegetable (C) agroecosystems

Legends: W = Winter, S = Summer, R = Rainy

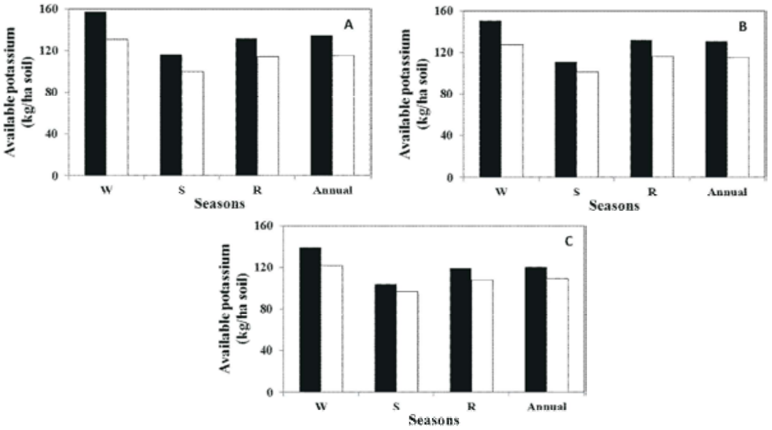

Fig. 4: Available potassium (kg/ha soil) in organic (full) and conventional (empty) rice (A), pulses (B) and vegetable (C) agroecosystems.

Legends: W = Winter, S = Summer, R = Rainy.

Available Potassium (AK): The results of available potassium (kg/ha) under two farming system have been given in for rice, pulses and vegetable in Table 4. The amount of available potassium was found to be minimum in summer and maximum in winter. The available potassium in summer was found to be 74% than that of winter for all the crops with organic farming, but the corresponding values for conventional rice, pulses and vegetable fields was found to be 77%, 79% and 80%, respectively showing the variation in the latter farming system. But the amount decreased with increasing soil depth as were recorded in D5 in all the three seasons except summer month. The amount of available AK in soil layer of 16-20 cm depth was found to 65% and 71% (rice), 70% and 76% (pulses) and 71% and 69% (vegetable) organic and conventional fields, respectively. The available AK in conventional rice, pulses and vegetable fields was found to be 85%, 88% and 90%, respectively than that of organic one (Fig. 4), proving that organic fields had higher values of AK than conventional one independent of season and crop fields. Considering the C.D values (Table 4) for available potassium among treatments it was clear that it were statistically different from each other at 1% ($p<0.01$) level of significance.

DISCUSSION

The sustainability of agriculture is important for the food security and economic stability of our nation. Intensive cropping with no return of crop residues and organic inputs result in loss of soil organic matter and nutrient supply is assumed to be a non sustainable agricultural practice. In India, Nepal and Pakistan traditional farm practices with regular input of agro and farm wastes were dominant before the green revolution [7]. However, since 1980 there is the adoption of improved cultural practices with much importance given to intensive cultivation added with extensive addition of chemical manures to enhance agricultural production [8]. As a result the Indian crop fields are experiencing a steady but continuous decline in agricultural production since the beginning of the 21st century putting a serious question mark on the food security of the nation. Deterioration of soil properties and water resources because of chemical agricultural intensive practice coupled with inadequate crop nutrient management are considered as the most basic cause for the yield decline. Inappropriate fertilizer practices and nutrient imbalance are coming as the two most important and significant causes for the decline in soil health of crop fields in India [9]. Thus there is a need to assess the impact of farm practices on the physicochemical characteristics of soil under conventional and organic farm practices.

In this study it was observed that the organically managed crop fields has significantly high amount of organic matter compared to the conventionally managed crop fields. As it is known that the load of organic matter in soil is determinant of soil health and the ability of soil to harbor soil microbial population, high amount of organic matter in organic fields is an indication of the robustness of the practice and advocates its advantages over the conventional farm practice. There was a decrease in the organic matter content with an increase in soil layer in fields under both the farm practices but the rate of decrease was more pronounced in conventional fields than in organic one. Since the soil microbial activity and remineralisation process is strongly influenced by the level of organic matter in soil low level of organic matter and a sharp decline in content in the conventional field is an indication of poor microbial health of soil.

Soil management practices strongly affect the size of the soil microbial biomass pool which in turn determines soil fertility. In general organically rich soil bears a robust microbial population and show more intensive microbial activity than organically poor one. Such correlation has been established in the present study in conformity with the previous observations [10].

The level of N, P and K and their balance in crop field determines the crop productivity and these nutrients are always in a dynamic state of change due to regular remineralisation and uptake. Three distinct factors influence the content, balance and pattern of changes of these nutrients in the crop fields, viz., 1) reinforcement of soil through addition of organic matter and/or chemical fertilizer, 2) uptake by the crop grown and 3) remineralisation by the soil microbial assemblage. Comparison between the crop fields under two farming systems in the present study showed that unlike other soil parameters the soil nutrients, N, P and K did not show any significant difference between the organic and conventional farming systems. Moreover in some part of the year during the study period there were patches of reversal of the trend in the two farming systems. It may be noted that different crops have different nutrient use efficiency and therefore the type of crop grown in the field has an influence on the quantity of available nutrients. Total nitrogen uptake by rice did not vary significantly with farm practices unless otherwise there is a significant difference in the growth efficiency of the crop in the two fields. It is observed from the present experiment that the fluctuation in the concentration of available N, P and K was noticed in all the crop fields under both the farm practices and in the presence of the standing crop the content was comparatively lower than the period when the fields were devoid of corps. This may be possible due to a higher rate of uptake than of remineralisation during the presence of crop in field and the reverse trend in the absence of crop [11]. It has been reported that available nutrients of soil varied with the addition of organic matter, organic matter type and intensity of cropping [12]. Unfertilized soil had lower levels of nutrient than the fertilized soil. This was attributed to the fact that nutrients were removed from soil by plant uptake and subsequent harvest. The rate of decrease after harvest was found to be more in conventional crop fields than of the organic fields. Thus it is reasonable to infer that a better nutrient status in the organically managed crop fields than in the conventional fields is due to continuous and steady remineralisation of nutrients by microbes. The organic matter acted as a nutrient reserve supplying substrates for microbial activity and facilitating remineralisation.

It was observed that long term manure application contribute to nutrient accumulation, particularly phosphorus and organically rich soil show less fluctuation of nutrients during cropping period than of organically poor soil. The addition of organic matter increases the availability of phosphorus in soil having the problems of phosphorus remineralisation [13]. Thus the farm practices influence the soil nutrient status and balance and steadiness of soil nutrient level is promoted by organic amendment than by chemical fertilizer amendment. Combination of both the amendments causes a better improvement in the remineralisation and increase the nutrient level in soil. Previously reported that addition of nitrogen fertilizer accelerates the organic matter degradation most probably due to the facilitation of microbial growth by nitrogen availability [14].

CONCLUSIONS

Therefore it is time to redesign the farm practices to boost agricultural sector. The present conventional farm practices needs to be properly redesigned in combination with organic farm practices keeping in view the need of agricultural production without causing any disturbance in the health of crop fields.

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