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Soil quality along the water course of selected distributory-4 of Shahapur branch canal of UKP command area

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Summary

A survey work on quality of red soils along the water course of SBC carried out during 2014-15 which indicated that soil quality parameters such as WSA, MWHC AW, SEI, BD, total soil porosity, pH, SOC, CEC, MBC and DHA were comparatively better in tail reach soils than in head and middle reach soils as the amount of water discharged at soils of later reaches was more than that of farmer reach and in general soil quality was not deteriorated as much as excepted as the land use was paddy the bellow ground portion of paddy crop is being incorporated into the soil year after the year added organic matter to the soil and in addition to this coarser soil texture did not encourage accumulation of salt in soils and thus, the significant correlation of soil quality parameter with both particle size classes and SOC was evident of it.

Key words : : Bulk density, Available water, Water stable aggregates, Soil erosion index, SOC, CEC, Microbial biomass carbon, Dehydrogenase activity

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Introduction

Irrigation continues to play an important role in contributing to the food and fibre production and is one of the vital factors to achieve food sufficiency across the world and at global level cultivable land under irrigation is very less (20 % of total cultivated land) and its contribution to the total food production of the world is 40 per cent and on an average crop yield from irrigated land is two times more than that of rain fed. Thus, irrigation was one of the factors for the success of green revolution in India and however, the success did not last long due to excessive use of water in addition to improper management of agricultural inputs. Excessive use of chemicals and water for irrigation lead to deterioration of physical, chemical and biological qualities of soil which in turn decreased productive capacity of soils in command areas. Over exploitation of soil by mankind without giving importance to her health has resulted in poor quality of soil. Soil quality speaks about its capacity in nourishing and providing proper anchorage to crops besides keeping the health of land, air, water and animals including man. Physical (bulk density, total porosity, maximum water holding capacity, available water, erosion index and water stable aggregates), chemical (soil reaction, organic matter, cation exchange capacity and base saturation percentage) and biological (microbial biomass carbon and dehydrogenase activity) quality indicators have tremendous influence on nutrients availability to crops and thus soil productivity. Thus, present investigation was taken upto know the impact of irrigation on soil quality.

Resource and Research Methods

The area selected for the present study includes Shahapur and Shorapur taluks of Yadgir district and lies between North latitude 16°36'58.40'' to 16°74'11.63'' and East longitude 76°38'04.99'' to 76°97'31.66'' along the water course of Shahapur branch canal of UKP command area (Fig. A). The study area is characterised by semi arid climate where annual rainfall is 872.02 mm and is mean of ten years. Nearly 74, 16 and 8 per cent of mean annual rainfall is received during south-west monsoon, north-east monsoon and summer seasons, respectively. The minimum temperature is recorded during December (15.68^{o}C) and maximum in May (40.33^{o}C). The maximum temperature remains between 29.91^{o}C to 35.33^{o}C from June to December. The mean relative humidity for forenoon and afternoon is 65.94 and 49.10 per cent, respectively. The mean monthly relative humidity is the highest in the month of September (81.33 %) and the lowest in March (46.84 %). The red soil area under paddy land use along the water course of distributory-4, the head reach of SBC was selected for the study and distributory-4 was divided into head, middle and tail sections. From each section of the distributory-4, one lateral was selected. Again each of these laterals was divided into head, middle and tail sections. Composite soil samples, one from each depth (0-20 and 20-40 cm) were drawn from head, middle and tail reaches of each lateral and thus, 18 soil samples were collected from the fields along the water course at the head reach of SBC and geographical position of the sampling spots were recorded using GPS. Collected soil samples were air dried in shade, ground in wooden pestle and mortar, passed through 2.00 mm sieve and the mineral matter left on the sieve was washed, dried, weighed and expressed as per cent gravels content of total soil. Processed soil samples were analysed for particle size classes, bulk density, available water, maximum water holding capacity, water stable aggregates, erosion index, soil reaction, soil organic carbon, cation exchange capacity, exchangeable cations, microbial biomass carbon and dehydrogenase activity following standard procedures and however, soil samples were analysed for dehydrogenase activity within ten days from date of sampling.

Particle size analysis of soil was done by International pipette method (Piper, 1966) based on the principle of Stoke's law. Bulk density of soil was determined by core sampler method (Black, 1965). Maximum water holding capacity of soils was determined by Keen- Rackzowski box method (Black, 1965). Available water content of soil was determined by using pressure plate apparatus (Richards, 1954). Water stable aggregates present in 2.0 mm sieved soil samples were determined as per the procedure outlined by Baruah and Barthakur (1998), based on the principle that, larger soil aggregates are ruptured by shaking the soil sample in a soil-water ratio of 1:5 for 16 hours. Two sieves of size 0.25 and 0.1 mm were placed on one above the other in descending order of their size and below the 0.1 mm size sieve tall beaker was kept. Soil-water (1:5) mixture was shaken for 16 hours in an end to end horizontal mechanical shaker was poured on 0.25 mm sieve. Aggregates left on 0.25 mm sieve were washed with distilled water for several times till the liquid passing through the sieve was free from turbidity. The liquid passing through the sieve was collected in a tall beaker kept below 0.1 mm sieve. Soil aggregates left on 0.25 and 0.1 mm sieve were oven dried, weighed and expressed in percentage of total soil as macro aggregates of size 0.25 to 2.0 mm and micro aggregates of size 0.1 to 0.25 mm, respectively. Liquid collected in the tall beaker was transferred to a 500 ml measuring cylinder and volume was made up. Soil aggregates of size < 0.1 mm in the liquid were determined based on the principle of sedimentation velocity of different soil particles similar to that of particle size analysis. The aliquots of different size soil aggregates *viz*., 0.05 to 0.10, 0.02 to 0.05 and 0.002 to 0.02 mm were pipetted at specified depth after the lapse of specified time depending on the temperature of soil suspension. The aliquots were oven dried, weighed and expressed in percentage of total soil as respective size soil aggregates.

Soil reaction was determined potentiometrically in 1:2.5 soil water suspension (Jackson, 1973). Organic carbon content of soil was determined by Walkley and Black's wet oxidation method (1934). Cation exchange capacity of soil was determined by neutral normal ammonium acetate saturation method (Black, 1965). Microbial biomass carbon was determined by chloroform

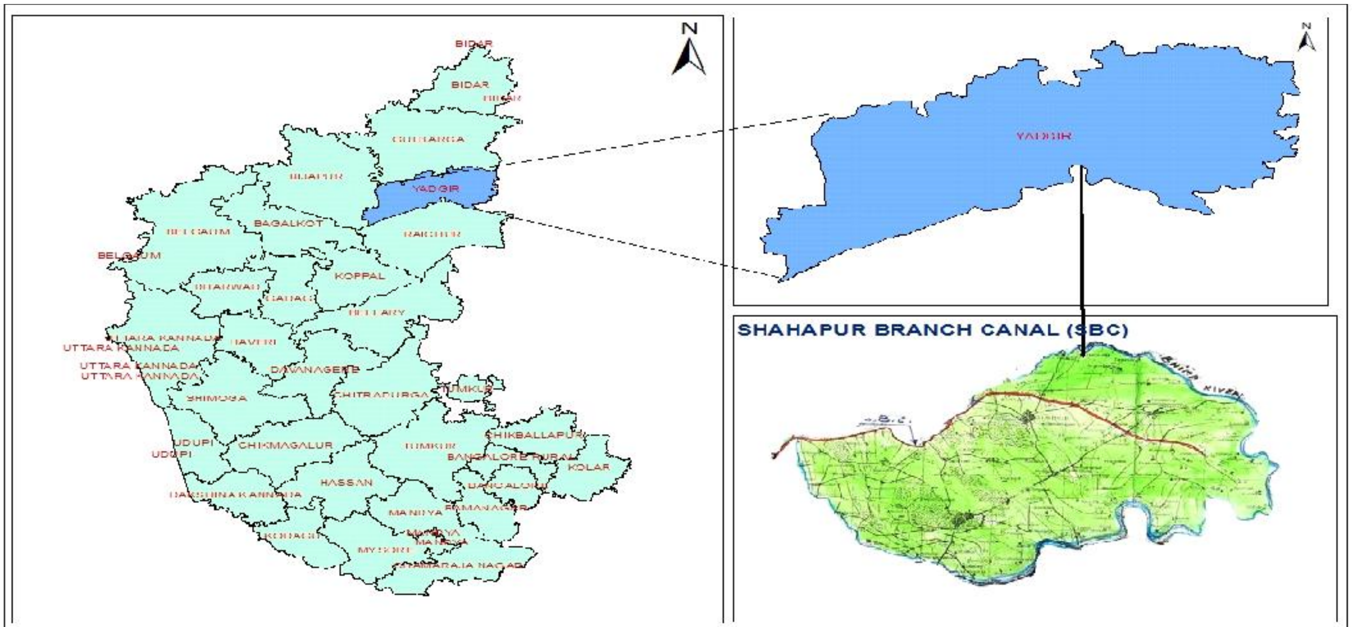

Fig. A : Location map of SBC of UKP command area selected for stduy

fumigation cum incubation method (Jenkinson and Ladda, 1981). Dehydrogenase activity of soil was determined as per the procedure outlined by (Casida *et al.*, 1964). Soil quality parameters were subjected to statistical tool person's correlation with soil properties which are very much influenced by continuous irrigation and land use for more than 30 years.

Research Findings and Discussion

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Soil properties :

Basic texture of both surface and sub surface soils was sandy loam all along the water course and as appreciable amount of gravels (Table 1) were present, the basic textural class sandy loam was prefixed by gravel. As the gravels content was comparatively more in sub surface than in surface the texture of soil was comparatively more coarser in sub surface than in surface soils all along the water course. Though soil texture was same (sgsl) in surface soils all along the water course of selected laterals, the content of finer soil particles like silt and clay was comparatively more in tail reach than in head and middle reach soils and this could be attributed to the physiography as it is sloppy towards tail reach and thus finer soil particles of surface layer were eroded from head reach leaving behind coarser particles and accumulated at tail reach via middle reach of distributory-4. These findings are in agreement with Pandey and Singh (2015). All along the water course exchange site of both surface and subsurface soil was dominated by calcium and followed by magnesium, sodium and potassium (Table 1). All along the water course these exchangeable cations in both surface and sub surface soils showed more are less increasing trend from head to tail reach and this could be attributed to the physiography. With exception to the potassium the content of rest of the cations was comparatively more in subsurface soil than in surface soil all along the water course as the soil texture was coarser which facilitated leaching of these cations to lower layers and however, potassium content in sub surface soil was less than that of surface soil as the potassium is less mobile cation.

Soil quality :

Soil bulk density (*BD*) :

Higher soil BD (Table 2) in sub surface soil than in surface soil all along the water course of distributiry-4 could be attributed to the lower organic matter, high clay content and more compaction in the former than in the later and it was confirmed by the strong correlation co-

Table 1 : Properties of soils along the water course

Properties of soils	Distributory 14 / Laterals	Water course sections/reaches											
		Head				Middle				Tail			
		Co-ordinates		Soil depth (cm)		Co-ordinates		Soil depth (cm)		Co-ordinates		Soil depth (cm)	
		Latitude	Longitude	0-20	20-40	Latitude	Longitude	0-20	20-40	Latitude	Longitude	0-20	20-40
		Lateral-3				Lateral-7				Lateral-10			
Gravels (%)	Head	16°36'58.40"	76°38'04.99"	12.96	16.20	16°36'52.09"	76°39'07.10"	12.84	16.10	16°36'31.42"	76°40'17.17"	12.74	15.94
	Middle	16°36'57.76"	76°38'09.02"	12.88	16.06	16°36'57.75"	76°39'03.70"	12.75	15.97	16°36'27.91"	76°40.12.81"	12.61	15.85
	Tail	16°36'58.15"	76°38'11.48"	12.70	15.92	16°36'58.09"	76°38'57.53"	12.62	15.84	16°36'31.76"	76°40'09.82"	12.59	15.80
	Mean			12.85	16.06			12.74	15.97			12.65	15.87
Sand (%)	Head	16°36'58.40"	76°38'04.99"	69.42	64.99	16°36'52.09"	76°39'07.10"	69.12	64.67	16°36'31.42"	76°40'17.17"	68.91	64.39
	Middle	16°36'57.76"	76°38'09.02"	69.14	64.57	16°36'57.75"	76°39'03.70"	68.72	64.45	16°36'27.91"	76°40.12.81"	68.54	63.99
	Tail	16°36'58.15"	76°38'11.48"	68.83	64.26	16°36'58.09"	76°38'57.53"	68.32	64.15	16°36'31.76"	76°40'09.82"	68.13	63.49
	Mean			69.13	64.61			68.72	64.42			68.52	63.96
Silt (%)	Head	16°36'58.40"	76°38'04.99"	15.19	15.50	16°36'52.09"	76°39'07.10"	15.34	15.65	16°36'31.42"	76°40'17.17"	15.55	15.77
	Middle	16°36'57.76"	76°38'09.02"	15.43	15.53	16°36'57.75"	76°39'03.70"	15.61	15.68	16°36'27.91"	76°40.12.81"	15.73	15.91
	Tail	16°36'58.15"	76°38'11.48"	15.58	15.55	16°36'58.09"	76°38'57.53"	15.74	15.72	16°36'31.76"	76°40'09.82"	15.93	16.23
	Mean			15.40	15.56			15.56	15.69			15.74	15.94
Clay (%)	Head	16°36'58.40"	76°38'04.99"	15.39	19.42	16°36'52.09"	76°39'07.10"	15.54	19.61	16°36'31.42"	76°40'17.17"	15.55	19.94
	Middle	16°36'57.76"	76°38'09.02"	15.43	19.72	16°36'57.75"	76°39'03.70"	15.67	19.87	16°36'27.91"	76°40.12.81"	15.73	20.10
	Tail	16°36'58.15"	76°38'11.48"	15.58	19.96	16°36'58.09"	76°38'57.53"	15.94	20.13	16°36'31.76"	76°40'09.82"	15.94	20.28
	Mean			15.47	19.70			15.72	19.87			15.74	20.10
Soil texture	Head	16°36'58.40"	76°38'04.99"	sgsl	gsl	16°36'52.09"	76°39'07.10"	sgsl	gsl	16°36'31.42"	76°40'17.17"	sgsl	gsl
	Middle	16°36'57.76"	76°38'09.02"	sgsl	gsl	16°36'57.75"	76°39'03.70"	sgsl	gsl	16°36'27.91"	76°40.12.81"	sgsl	gsl
	Tail	16°36'58.15"	76°38'11.48"	sgsl	gsl	16°36'58.09"	76°38'57.53"	sgsl	gsl	16°36'31.76"	76°40'09.82"	sgsl	gsl
Calcium {cmol (P^+) kg^{-1}}	Head	16°36'58.40"	76°38'04.99"	8.27	10.47	16°36'52.09"	76°39'07.10"	8.37	10.60	16°36'31.42"	76°40'17.17"	8.37	10.70
	Middle	16°36'57.76"	76°38'09.02"	8.30	10.63	16°36'57.75"	76°39'03.70"	8.40	10.70	16°36'27.91"	76°40.12.81"	8.53	10.87
	Tail	16°36'58.15"	76°38'11.48"	8.50	10.83	16°36'58.09"	76°38'57.53"	8.50	10.83	16°36'31.76"	76°40'09.82"	8.63	10.87
	Mean			8.36	10.64			8.42	10.71			8.51	10.84
Magnesium {cmol (P^+) kg^{-1}}	Head	16°36'58.40"	76°38'04.99"	1.93	2.37	16°36'52.09"	76°39'07.10"	1.93	2.37	16°36'31.42"	76°40'17.17"	1.93	2.37
	Middle	16°36'57.76"	76°38'09.02"	2.07	2.47	16°36'57.75"	76°39'03.70"	2.03	2.43	16°36'27.91"	76°40.12.81"	2.07	2.50
	Tail	16°36'58.15"	76°38'11.48"	2.10	2.50	16°36'58.09"	76°38'57.53"	2.10	2.50	16°36'31.76"	76°40'09.82"	2.13	2.53
	Mean			2.03	2.44			2.02	2.43			2.04	2.47
Sodium {cmol (P^+) kg^{-1}}	Head	16°36'58.40"	76°38'04.99"	0.73	0.96	16°36'52.09"	76°39'07.10"	0.73	0.96	16°36'31.42"	76°40'17.17"	0.76	0.99
	Middle	16°36'57.76"	76°38'09.02"	0.79	1.03	16°36'57.75"	76°39'03.70"	0.79	1.02	16°36'27.91"	76°40.12.81"	0.79	1.03
	Tail	16°36'58.15"	76°38'11.48"	0.80	1.01	16°36'58.09"	76°38'57.53"	0.81	1.04	16°36'31.76"	76°40'09.82"	0.80	1.05
	Mean			0.77	1.00			0.78	1.01			0.78	1.02
Potassium {cmol (P^+) kg^{-1}}	Head	16°36'58.40"	76°38'04.99"	0.23	0.16	16°36'52.09"	76°39'07.10"	0.25	0.17	16°36'31.42"	76°40'17.17"	0.26	0.18
	Middle	16°36'57.76"	76°38'09.02"	0.24	0.17	16°36'57.75"	76°39'03.70"	0.25	0.18	16°36'27.91"	76°40.12.81"	0.26	0.18
	Tail	16°36'58.15"	76°38'11.48"	0.25	0.18	16°36'58.09"	76°38'57.53"	0.26	0.18	16°36'31.76"	76°40'09.82"	0.27	0.19
	Mean			0.24	0.17			0.25	0.18			0.26	0.18

Note: sgsl: Slightly gravelly sandy loam gsl: Gravelly sandy loam efficients between soil BD and organic matter (-0.988**) and clay (0.968**). Comparatively higher surface and sub surface soil bulk density at head reach (1.53 and 1.61 Mgm^{-3}) and lower BD at tail reach (1.52 and 1.60 Mgm^{-3}) of distributory-4 could be attributed to more of coarser soil particles at the head reach as compared to the tail reach though soil texture was same all along the water course and high BD at head reach could also be attributed to total pores space which was less in soils at head reach than in that of tail reach. It was further supported by significant correlation co-efficient between BD and total pore space (-0.993**). Similar kind of observation was reported by Thangasamy *et al.* (2005).

Total soil porosity :

Decreasing trend of soil porosity (Table 2) with depth as well as increasing trend of the same from head to tail reach along the water course of distributory-4 could be attributed to the decreasing and increasing trend of organic matter with depth and along the water course, respectively and it was further supported by the correlation studies where soil porosity was significantly and positively correlated with organic matter (0.983**). These results are in agreement with the findings of Taha and Nanda (2003).

Maximum water holding capacity (*MWHC*) *and available water* (*AW*):

Differences in both MWHC and AW of soils with depth all along the water course of distributory-4 as well as between head and tail reaches of laterals could be attributed to both clay and silt (Table 2). More of both MWHC and AW of soil in sub surface (34.26 to 35.10%) and (8.27 to 8.87%) than in surface (30.08 to 30.62) and (7.65 to 7.94%) as well as in tail reach than in head reach soils of distributory-4 could be attributed to more of both clay and silt in sub surface and tail reach soils than in surface and head reach soils. It was further supported by correlation studies where both clay and silt were significantly and positively correlated with both MWHC (0.997** and 0.474**) and AW (0.899** and 0.727**) of soil. Similar kind of observations were noticed by Thangasamy *et al.* (2005) and Rao *et al.* (2008).

Water stable aggregates :

Increasing trend of micro aggregates with depth as well as from head (56.31 and 59.16%) to tail (57.15 and 59.94%) reach of water course of distibutory-4 could be attributed to increasing and decreasing trend of clay and sand, respectively (Table 2), with depth as well as from head to tail reach of water course. Further it was confirmed by significant correlation of both sand and clay with water stable aggregates (-0.990** and 0.978**). As the rate of discharge of water as well as velocity of water at the head reach was comparatively more than that of tail reach the finer particles eroded from head reach were accumulated at the tail reach and favoured the formation of more of stable micro aggregates. These findings are in agreement with the findings of Demolon and Henin (1932) and Garyunov (1966).

Soil erosion index (*SEI*) :

Soil erosion index decreased not only from head to tail reach but also with depth along the water course (Table 2) and this could be attributed to the lower percentage of both water stable aggregates as well as clay at both surface and head reach soils as compared to sub surface and tail reach soils and it was confirmed by the person's correlation where SEI were significantly correlated with both clay (-0.998**) and water stable aggregates (-0.968**).

Soil reaction (*pH*) :

Irrespective of head, middle and tail reaches of water course, sub surface (6.77 to 6.92) soils recorded the highest pH as compared to surface (6.57 to 6.71) soils (Table 3) and this could be attributed to the coarse textured nature of soils besides more of acidification due to the decomposition of organic matter at surface and head reach soils than in sub surface and tail reach soils as the former soils had more of organic matter than the later soils and it favoured leaching of the basic cations to lower depths and accumulation of the same in sub surface. Soils at the tail reach of water course recorded the higher pH as compared to the soils at the head reach and this could be attributed to the transportation of bases along with irrigation water from the higher elevation at head reach and accumulation of same at the tail reach which is at lower elevation. These observations were further supported by significant correlation between pH and soil properties namely sand (-0.734**), clay (0.693**), silt (0.733**) and organic carbon (-0.521**). However, soil reaction all along the water course was neither acidic nor alkaline and was within the normal range though the soils are under continuous irrigation for more than 30 years and this could be due to better leaching environment

Table 2 : Physical quality indicators of soil along the water course

Physical quality indicators	Distributory 14 / Laterals	Water course sections/reaches											
		Head				Middle				Tail			
		Co-ordinates		Soil depth (cm)		Co-ordinates		Soil depth (cm)		Co-ordinates		Soil depth (cm)	
		Latitude	Longitude	0-20	20-40	Latitude	Longitude	0-20	20-40	Latitude	Longitude	0-20	20-40
		Lateral-3				Lateral-7				Lateral-10			
Bulk	Head	16^{0}36'58.40"	76^{0}38'04.99"	1.53	1.61	16^{0}36'52.09'	76^{0}39'07.10'	1.53	1.61	16^{0}36'31.42"	76^{0}40'17.17"	1.52	1.60
density	Middle	16^{0}36'57.76"	76^{0}38'09.02"	1.53	1.61	16^{0}36'57.75'	76^{0}39'03.70'	1.52	1.61	16^{0}36'27.91"	76^{0}40.12.81"	1.52	1.60
(Mg m^{-3})	Tail	16^{0}36'58.15"	76^{0}38'11.48"	1.52	1.60	16^{0}36'58.09'	76^{0}38'57.53'	1.52	1.60	16^{0}36'31.76"	76^{0}40'09.82"	1.51	1.59
	Mean			1.53	1.61			1.52	1.61			1.52	1.60
MWHC	Head	16^{0}36'58.40"	76^{0}38'04.99"	29.91	34.09	16^{0}36'52.09'	76^{0}39'07.10'	30.07	34.46	16^{0}36'31.42"	76^{0}40'17.17"	30.30	34.79
(%)	Middle	16^{0}36'57.76"	76^{0}38'09.02"	30.09	34.39	16^{0}36'57.75'	76^{0}39'03.70'	30.17	34.66	16^{0}36'27.91"	76^{0}40.12.81"	30.74	34.95
	Tail	16^{0}36'58.15"	76^{0}38'11.48"	30.24	34.70	16^{0}36'58.09'	76^{0}38'57.53'	30.30	35.05	16^{0}36'31.76"	76^{0}40'09.82"	30.81	35.56
	Mean			30.08	34.26			30.18	34.72			30.62	35.10
AW	Head	16^{0}36'58.40"	76^{0}38'04.99"	7.46	8.07	16^{0}36'52.09'	76^{0}39'07.10'	7.64	8.57	16^{0}36'31.42"	76^{0}40'17.17"	7.72	8.73
(%)	Middle	16^{0}36'57.76"	76^{0}38'09.02"	7.64	8.28	16^{0}36'57.75'	76^{0}39'03.70'	7.76	8.70	16^{0}36'27.91"	76^{0}40.12.81"	7.95	8.85
	Tail	16^{0}36'58.15"	76^{0}38'11.48"	7.84	8.46	16^{0}36'58.09'	76^{0}38'57.53'	8.02	8.91	16^{0}36'31.76"	76^{0}40'09.82"	8.15	9.03
	Mean			7.65	8.27			7.81	8.73			7.94	8.87
Total	Head	16^{0}36'58.40"	76^{0}38'04.99"	42.26	39.75	16^{0}36'52.09'	76^{0}39'07.10'	42.39	40.04	16^{0}36'31.42"	76^{0}40'17.17"	42.87	40.39
porosity	Middle	16^{0}36'57.76"	76^{0}38'09.02"	42.38	39.84	16^{0}36'57.75'	76^{0}39'03.70'	42.35	40.04	16^{0}36'27.91"	76^{0}40.12.81"	42.85	40.41
(%)	Tail	16^{0}36'58.15"	76^{0}38'11.48"	42.55	39.98	16^{0}36'58.09'	76^{0}38'57.53'	42.86	40.30	16^{0}36'31.76"	76^{0}40'09.82"	42.96	40.50
	Mean			42.39	39.86			42.53	40.13			42.89	40.43
Water	Head	16^{0}36'58.40"	76^{0}38'04.99"	55.95	58.77	16^{0}36'52.09'	76^{0}39'07.10'	56.30	59.16	16^{0}36'31.42"	76^{0}40'17.17"	56.80	59.58
stable	Middle	16^{0}36'57.76"	76^{0}38'09.02"	56.28	59.17	16^{0}36'57.75'	76^{0}39'03.70'	56.68	59.51	16^{0}36'27.91"	76^{0}40.12.81"	57.16	59.95
aggregates	Tail	16^{0}36'58.15"	76^{0}38'11.48"	56.69	59.54	16^{0}36'58.09'	76^{0}38'57.53'	57.05	59.85	16^{0}36'31.76"	76^{0}40'09.82"	57.50	60.30
(%)	Mean			56.31	59.16			56.68	59.50			57.15	59.94
Erosion	Head	16^{0}36'58.40"	76^{0}38'04.99"	2.07	1.37	16^{0}36'52.09'	76^{0}39'07.10'	2.06	1.35	16^{0}36'31.42"	76^{0}40'17.17"	2.02	1.33
Index	Middle	16^{0}36'57.76"	76^{0}38'09.02"	2.07	1.35	16^{0}36'57.75'	76^{0}39'03.70'	2.05	1.33	16^{0}36'27.91"	76^{0}40.12.81"	2.02	1.32
	Tail	16^{0}36'58.15"	76^{0}38'11.48"	2.06	1.35	16^{0}36'58.09'	76^{0}38'57.53'	2.02	1.33	16^{0}36'31.76"	76^{0}40'09.82"	1.99	1.32
	Mean			2.07	1.35			2.05	1.34			2.01	1.32

Table 3 : Chemical and biological quality indicators of soil along the water course

Quality indicators	Distributory 14 / Laterals	Water course sections/reaches: Head (Lateral-3)				Middle (Lateral-7)				Tail (Lateral-10)			
		Co-ordinates		Soil depth (cm)		Co-ordinates		Soil depth (cm)		Co-ordinates		Soil depth (cm)	
		Latitude	Longitude	0-20	20-40	Latitude	Longitude	0-20	20-40	Latitude	Longitude	0-20	20-40
pH_w	Head	$16^0$36'58.40"	$76^0$38'04.99"	6.44	6.61	$16^0$36'52.09"	$76^0$39'07.10"	6.57	6.78	$16^0$36'31.42"	$76^0$40'17.17"	6.63	6.85
(1:2.5)	Middle	$16^0$36'57.76"	$76^0$38'09.02"	6.48	6.68	$16^0$36'57.75"	$76^0$39'03.70"	6.62	6.81	$16^0$36'27.91"	$76^0$40.12.81"	6.69	6.88
	Tail	$16^0$36'58.15"	$76^0$38'11.48"	6.80	7.03	$16^0$36'58.09"	$76^0$38'57.53"	6.63	6.84	$16^0$36'31.76"	$76^0$40'09.82"	6.80	7.03
	Mean			6.57	6.77			6.61	6.81			6.71	6.92
Organic carbon	Head	$16^0$36'58.40"	$76^0$38'04.99"	6.53	3.62	$16^0$36'52.09"	$76^0$39'07.10"	6.92	3.71	$16^0$36'31.42"	$76^0$40'17.17"	6.43	3.90
(g kg^{-1})	Middle	$16^0$36'57.76"	$76^0$38'09.02"	6.53	3.77	$16^0$36'57.75"	$76^0$39'03.70"	7.11	3.93	$16^0$36'27.91"	$76^0$40.12.81"	7.50	4.08
	Tail	$16^0$36'58.15"	$76^0$38'11.48"	6.92	3.97	$16^0$36'58.09"	$76^0$38'57.53"	7.40	4.28	$16^0$36'31.76"	$76^0$40'09.82"	7.50	4.28
	Mean			6.66	3.79			7.14	3.97			7.15	4.09
CEC	Head	$16^0$36'58.40"	$76^0$38'04.99"	12.24	15.13	$16^0$36'52.09"	$76^0$39'07.10"	12.44	15.36	$16^0$36'31.42"	$76^0$40'17.17"	12.57	15.58
{ cmol (P^+)	Middle	$16^0$36'57.76"	$76^0$38'09.02"	12.60	15.50	$16^0$36'57.75"	$76^0$39'03.70"	12.63	15.68	$16^0$36'27.91"	$76^0$40.12.81"	13.01	15.96
kg^{-1}}	Tail	$16^0$36'58.15"	$76^0$38'11.48"	12.78	15.68	$16^0$36'58.09"	$76^0$38'57.53"	12.83	15.91	$16^0$36'31.76"	$76^0$40'09.82"	13.04	16.00
	Mean			12.54	15.43			12.63	15.65			12.84	15.75
MBC	Head	$16^0$36'58.40"	$76^0$38'04.99"	189.93	116.60	$16^0$36'52.09"	$76^0$39'07.10"	190.33	116.40	$16^0$36'31.42"	$76^0$40'17.17"	192.13	115.87
(mg kg^{-1})	Middle	$16^0$36'57.76"	$76^0$38'09.02"	191.93	118.07	$16^0$36'57.75"	$76^0$39'03.70"	192.20	119.33	$16^0$36'27.91"	$76^0$40.12.81"	195.67	121.73
	Tail	$16^0$36'58.15"	$76^0$38'11.48"	194.47	121.00	$16^0$36'58.09"	$76^0$38'57.53"	195.13	122.47	$16^0$36'31.76"	$76^0$40'09.82"	198.67	124.67
	Mean			192.11	118.56			192.56	119.40			195.49	120.76
Dehydrogenase	Head	$16^0$36'58.40"	$76^0$38'04.99"	24.48	19.13	$16^0$36'52.09"	$76^0$39'07.10"	24.00	19.43	$16^0$36'31.42"	$76^0$40'17.17"	24.17	18.76
activity(DHA)	Middle	$16^0$36'57.76"	$76^0$38'09.02"	23.67	18.74	$16^0$36'57.75"	$76^0$39'03.70"	24.84	19.58	$16^0$36'27.91"	$76^0$40.12.81"	24.75	19.54
(mg TPF kg^{-1}	Tail	$16^0$36'58.15"	$76^0$38'11.48"	24.54	20.11	$16^0$36'58.09"	$76^0$38'57.53"	25.29	19.46	$16^0$36'31.76"	$76^0$40'09.82"	26.34	20.65
24^{-1}hr)	Mean			24.23	19.33			24.71	19.49			25.09	19.65

as the dominant soil texture was slightly gravelly sandy loam. These findings are in agreement with the findings of Prasad and Govardhan (2011) and Adejumobi *et al.* (2014).

Soil organic carbon (*SOC*):

Soil organic carbon content was comparatively more in surface (6.66 to 7.15 g kg^{-1}) than in sub surface (3.79 to 4.09 g kg^{-1}) soils (Table 3) could be attributed to the land use as the paddy crop is shallow rooted most of its root zone is concentrated in the upper 20-25 cm depth and this could also be attributed fact that horizontal movement of organic matter is more than that of vertical movement. Higher SOC at tail reach than at the head reach soils could be attributed the surface erodability down the slop from head to tail reach. Similar kind of observation was made by Kovda *et al.* (1973).

Cation exchange capacity (CEC) :

Comparatively higher CEC in sub surface soils as well as in soils at tail reach than in surface and in soils at head reach (Table 3) along the water course of distributory-4 could be attributed to the leaching of bases from surface to sub surface as the soil texture is coarse and transportation of bases along with finer soil particles from head reach through water erosion against the slope gradient and accumulation of the same at the tail reach, respectively. These results are further supported by the significant correlation co-efficient value of 0.996** between CEC and clay. Taha and Nanda (2003) also attributed the same for higher CEC in sub surface and in soils at tail reach as compared to the CEC at surface and soils at head reach. Exchangeable calcium contributed more to CEC and was followed by Mg, Na and K and it was confirmed by significant correlation co-efficient values of 0.997**, 0.979**, 0.990** and -0.916** for Ca, Mg, Na and K with respect to their contribution to CEC. Contribution of both magnesium and sodium to CEC was next only to calcium and it suggested that sediments carried by irrigation water might have added more of magnesium and sodium to the soils and indicated tendency of alkalization and however, calcium to both magnesium and sodium ratios were within the permissible limit.

Microbial biomass carbon (*MBC*) *and dehydrogenase activity* (DHA) :

Both MBC and DHA decreased with depth and increased along the water course from head to tail reach (Table 3). Significantly higher content of both MBC and DHA in both surface and tail reach soils than in sub surface and head reach soils could be attributed to more of organic matter in the former than in the later. These findings were further supported by the significant correlation of both MBC and DHA with SOC (0.987** and 0.984**) . Similar kind of observation were reported by Batra (1998) and Khan (1970).

Conclusion:

As the amount of water discharged at the head reach soils was comparatively more than that of tail reach soils and thus, soil quality was comparatively better in later soils. physical quality indicators namely WSA, MWHC and AW showed increasing trend while SEI showed decreasing trend with depth and along the water course from head to tail reach. Another physical quality indicator, soil bulk density increased with depth and decreased along the water course from head to tail reaches while total porosity experienced the reverse trend. Chemical quality indicator, SOC showed decreasing trend with depth and increasing trend along the water course from head to tail reach whereas other chemical quality indicators such as pH, CEC showed increasing trend with depth as well as along the water course from head to tail reach. Biological quality indicators namely MBC and DHA decreased with depth and increased from head to tail reach of the water course. In spite of more than 30 years of irrigation, quality of red soils along the water course of distributory-4 of SBC was not deteriorated as much as expected because of the land use as the bellow ground portion of the paddy is being incorporated into the soil has improved organic matter content of the soils and in addition to that the soils were basically loamy textured which is the best suited soil texture for irrigation and in specific, soil texture was gravelly sandy loam. In spite of continuous irrigation for longer period soils were neither saline nor sodic as the soil texture was coarser, that provided better leaching environment and did not encourage the accumulation of salt.

Literature Cited

Adejumobi, M.A., Ojediran, J.O. and Olabiyi, O.O. (2014). Effects of irrigation practices on some soil chemical properties on OMI irrigation scheme. *Internat. J. Engg. Res. & Appl.*, **4** (10) : 29-35.

Baruah, T.C. and Barthakur, H.P. (1998). *A text book of soil analysis*, Vikas Publishing House Pvt. Ltd, NEW DELHI, INDIA.

Batra, L. (1998). Effect of different cropping sequences on dehydrogenase activity of three sodic soils. *J. Indian Soc. Soil. Sci.*, **46** (3): 370-375.

Black, C.A. (1965). Methods of soil analysis. *Can. J. Soil Sci.*, **62** : 595-597.

Casida, L.E., Klein, Jr. and Samtora, T. (1964). Soil dehydrogenase activity. *Soil Sci*., **98**: 371-376.

Demolon, A. and Henin, S. (1932). Researches surla structure des Limons et La syntheses des aggregates. *Soil Res*., **3**: 1-9.

Garyunov, N.S. (1966). Influence of methods of irrigation on certain soils properties. *Soviet Soil Sci.*, **1** : 14-19.

Jackson, M.L. (1973). *Soil chemical analysis*. Prentice Hall (India) Pvt. Ltd., NEW DELHI, INDIA.

Jenkinson, D.J. and Ladda, J.N. (1981). Microbial biomass in soil. *Soil Biochem., New York*, **15**: 415-471.

Khan, S.V. (1970). Enzymatic activity in a gray wooded soil as influenced by cropping systems and fertilizers. *Soil Biol. Biochem.*, **2**: 137-139.

Kovda, V.A., Van den, B.C. and Hagan, R.M. (1973). Some effects of irrigation and drainage on soils. In: *Irrigation, drainage and salinity*. Ed. Kovda, V. A., FAO/UNESCO. An International Source Book. pp.387-408.

Pandey, A.K. and Singh, A.K. (2015). Characterization of Tal soils of Chandan river catchment of south-east Bihar. *J. Agrisearch.*, **2(1)**: 44-52.

Piper, C.S. (1966). *Soil and plant analysis*, Hans Publishers, Bombay (M.S.) INDIA, pp. 362.

Prasad, R.M. and Govardhan, V. (2011). Characterization and classification of land resource environs of Deccan plateau. *J. Res. ANGRAU*., **39**(1&2): 1-5.

Rao, A. P. V., Naidu, M. V. S., Ramavatharam, N. and Rao, R.G. (2008). Characterisation, classification of soils of different land farms in Ramachandrapuram mandal of Chittoor district in Andhra Pradesh for sustainable land use planning. *J. Indian Soc. Soil Sci.*, **56** (1): 23-33.

Richards, L.A. (1954). *Diagnosis and improvement of saline and alkali soils*. Agric. Handbook, No. 60, USDA Washington, D. C., U.S.A. 166pp.

Taha, M. and Nanda, S.S.K. (2003). Transformation of soil characteristics under continuous irrigation in rice-based farming system. A case study of Hirakud command of Orissa. *Agropedology*, **13**: 30-38.

Thangasamy, A., Naidu, M.V.S., Ramavatharam, N. and Reddy, C.R. (2005). Characterization, classification and evaluation of soil resources in Sivagiri micro-watershed of Chittoor district in Andhra Pradesh for sustainable land use planning. *J. Indian Soc. Soil Sci.*, **53**: 11-21.

Walkley, A.J. and Black, C.A. (1934). Estimation of soil organic carbon by the chromic acid and titration method. *Soil Sci*., **37**: 29-38.