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CHARACTERISTICS OF RICE GROWINGS SOILS IN AMGAON TAHSIL OF GONDIA DISTRICT

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ABSTRACT

The experiment was conducted to study the "Influence of rice monocropping on soil fertility in Amgaon tahsil of Gondia district" during year 2015-2016. The 50 soil samples were collected from 10 villages in Amgaon tahsil and analyzed in laboratory. The results showed that, the soils were neutral in reaction, non saline, non calcareous to slightly calcareous in nature and low to moderately high in organic carbon. The soils of study area were low in available nitrogen, low to moderately high in available phosphorus, medium to very high in available potassium and low to moderately high in available sulphur. Soils were sufficient for DTPA extractable iron, copper and manganese, whereas deficient for zinc.Available potassium, boron and zinc had significant and positive correlation with yield of rice. Similarly,the yield of rice had significant and negative correlation with phosphorus, iron and manganese.

(Key words : Characterization, Rice -growing soils, Amgaon tahsil, Gondia district)

INTRODUCTION

One of the major cereal consumed by the people in South East Asia is paddy (*Oryza sativa* L.). This has significance with the origin of paddy in South East Asia, particularly in India and China (Chandraratna, 1964). Rice is a staple food of Asia. Over 90 per cent of the world, rice is produced and consumed in Asia- Pacific Region with growing prosperity and urbanization, capita^{-1} rice consumption has started declining in the middle and high- income Asian countries. The Asian population is growing at 1.8 per cent hr^{-1}at present, and population may not stabilize before the middle of the next country. Rice is life for thousand million of people. In Asia more than 2,000 million people obtained 60-70 per cent of their calories from rice and its products. The world rice supply has more than doubled from 261 million tonnes in 1950 (with Asian production of 240 million tonnes) to 573 million tonnes in 1997 (including the region's production of 524 million tonnes).

Soil fertilityand nutrient supplying capacity of a soil can be maintained on a long term basis only by replenishing, by addition through external inputs, nutrients removed by cropping and those lost through physical, chemical and bio-logical processes. The essential components of wetland rice culture comprise cultivation of land in the wet or flooded state (puddling), transplanting of rice seedlings into puddled rice paddies, and growing the rice crop under flooding. The land is dry or flood fallowed during the turns around period between two crops. Following these cultural practices, two or three crops of rice or rice with upland crops in sequence are grown. However, in the present context of increasing freshwater scarcity, there is a case to shift from the traditional way of growing rice to ways that are water wise. In this context, it is crucial that the benefits of the wetland rice system on soil fertility and productivity are considered (Sahrawat *et al*., 2005).

Soil fertility and nutrient supplying capacity of a soil can be maintained on a long term basis only by replenishing, by addition through external inputs, nutrients removed by cropping and those lost through physical, chemical and bio-logical processes.

MATERIALS AND METHODS

The survey for soil of rice field was carried out in the month of November-December, at Amgaon tahsil of Gondia district. The Amgaon tahsil has total 62 villages growing rice of which of the following ten villages were selected for study.The villages namely such as Anjora, Bamhani, Bhajepar, Borkanhar, Gortha, Javari, Kalimat, Kavadi, Pangaon and Thana.The soil samples were collected from these fields. The total 50 rice field samples were collected. Bulk Density was determined on clod coating method by Black *et al*.(1965). Soil Reaction (pH) was determined in 1:2.5 soils water suspension with the help of glass electrode using pH meter (Jackson, 1967). Electrical conductivity (EC) of the soil was determined in 1:2.5 soil water supernant using conductivity bridge (Richard, 1954). Calcium carbonate was determined by the Rapid Titration method (Piper, 1966). Organic Carbon determined by oxidizing soil organic matter by chromic acid using heat of dilution sulphuric acid, (Walkley and Black, 1934). Available nitrogen was estimated using alkaline permanganate method (Subbiah and Asija, 1956). Available P was determined by Olsen's method (Jackson, 1967). Available K was determined by Neutral Normal Ammonium Acetate method

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(Jackson,1967). S was determined by Turbidity method (Chesnin and Yien, 1951). Micronutrients viz., Zn, Cu, Fe, Mn and B were estimated by the method described by Lindsey and Norvell (1978).

RESULTS AND DISCUSSION

Physical properties of rice growing soils

As regard to the physical properties of the selected soils, the bulk density ranged from 1.26 to 1.54 Mg m^{-3}. Porosity ranged from 41.88 to 52.45 %.Similar findings were observed by Singh and Agrawal (2005), they found that, the lowest bulk density in Eastern Region of Varanasi might be due to the effect of organic matter. The increase in bulk density with depth was attributed to lower organic matter, more compaction and less aggregation. Porosity depends upon bulk density as bulk density increases porosity decreases. The bulk density of these soils were medium, therefore porosity was also medium in range.

Soil chemical properties of rice growing soils

The pH of these soils was ranged from 7.0 to 7.8 indicating all the soils under this area were neutral in reaction. EC ranged from 0.11 dS m^{-1} to 0.38 dS m^{-1} indicating that all the soils are non- saline in nature and suitable for plant growth. Aondoakaa and Agbakwuru (2012) stated that, the topsoil and subsoil of Dobi soil is towards neutral and this type of soil makes the absorption of nutrients for plant growth difficult because rice plant grows optimally under an acidic soil.

Organic carbon content in soils varied from 4.0 to 6.9 g kg^{-1} indicating the soils were low to moderately high content in organic carbon.High temperature during most part of the year might be responsible for high rate of decomposition and low value of organic carbon in soil. Mandavgade *et al*. (2015) collected surface soil samples from northen tahsils of Parbhani district (Jintur, Selu and Pathari) and found that the organic content was varied from 2.2 to 10.5 g kg^{-1} with an average value of 6.0 g kg^{-1} in Jintur soils (0.7 to 13.9 g kg^{-1})with an average value of 4.6 g kg^{-1} in Selu and (2.7 to 9.7 g kg^{-1}) with an average value of 6.6 g kg^{-1} in Pathari. The high content of organic carbon might be due to addition of organic matter through either artificially or naturally and its subsequent decomposition.

Calcium carbonate in soil varied from 1.00 to 3.00 per cent indicating soils were non calcareous to slightly calcareous in nature. All the soils of the study area were under controls from free lime and this might be the reason why these soils were acidic to neutral in reaction. Nachtergaele *et al*. (2009) studied on soil properties in Jhunjhunu tahsil of Rajsthan state and found the $CaCO_3$ moderately calcareous on nature. The accumulation of $CaCO_3$ in soil might be due to semi-arid climatic condition and drainage problem of the area.

Available macro nutrient status of rice growing soils

The available nitrogen of these soils ranged from 128.57 to 241.47 kg ha^{-1}. By considering less than 280 kg ha^{-1} N as low, 280-420 kg ha^{-1}as medium and more than 420 kg ha^{-1} as moderately high (Muhr *et al.,* 1965). According to this in Amgaon tahsil selected villages were observed low nitrogen.As the organic carbon content in soils were low to medium and therefore nitrogen availability was also low. The available phosphorus in these soils ranged from 12.10 to 22.80 kg ha^{-1}. The available phosphorus in these soils found to be low to moderately high. The low amount of P in some soils might be due to application of lower doses of P fertilizers or fixation of P on clay minerals surfaces with the time elapsed between fertilizer application and crop uptake. Whereas, some soils were found to be moderate in amount for available P may be attributed to continuous application of phosphate fertilizers to crops which resulted in build of phosphorus as efficiency of applied P_2O_5 was very low and it comes in available form very slowly.Coulombe *et al.* (1996) observed that, the phosphorus is generally limiting due to its low content in parent material and its high propensity to absorption on mineral surface. Beacause of the clay minerals with high CEC can be stable for a long time (Yerima and Van Ranst, 2005). The available K_2O in these soils ranged from 227.40 to 406.60 kg ha^{-1}, indicating all the soils of Amgaon tahsil were moderately high to very high in available potassium status. The high potassium content may be attributed to the presence of potassium supplying minerals in parent rock of the area. Bhatt *et al.*(2004)found that, the deficiency of potassium due to the erosion of topsoil and unscientific method of cultivation are responsible for lower crop productivity. The values of available sulphur in soils are 9.55 to 12.50 mg kg^{-1} indicating the soils are low to medium in available sulphur content respectively. Available sulphur were stated to have direct relationship with organic matter content in these soils, indicating that the availability of sulphur depends upon the content of organic matter in the these soils. Nearpass and Clark (1960) studied that, sulphur deficiency of rice occurred on plants grown in Evesboro soil in pot culture. In comparisons of submerged and upland conditions on five other soils, sulfur uptake was lowered by flooding the soil, regardless of the type of yield response, whether negative or positive, obtained from flooding. Sulfur percentage in the plants grown in flooded cultures was related to the yield response obtained from flooding. The soils which gave negative yield responses produced the lowest sulfur contents.

DTPA- extractable micronutrient status of soil (mg kg^{-1})

The available zinc varied from 0.30 to 0.48 mg kg^{-1} in soil, it means low in zinc content. Similar observations were recorded by Ambegaonkar and Bharambe (2007),who found that the soils of the Jayakwadi command area which varied from deficient to sufficient in levels of Zn with a range of 0.5 to 3.0 ppm. The low content of Zn in the soils might be due to fact that under alkaline condition, the zinc cation are changed largely to their oxides or hydroxides and thereby lower the availability of zinc.Sorte *et al*. (2016) studied that, the available zinc extracted by DTPA varied from 0.18 to 1.44 mg kg^{-1} in surface soil as well as 0.15 to 1.41 mg kg^{-1} in sub-surface soil. Highest value of 1.44 mg kg^{-1} for

Table 1.Available nutrient status of rice growing soils

Sr. No.	Name of Villages	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})	Available S (mg kg^{-1})	Sr. No.	Name of villages	Available N (kg ha^{-1})	Available P (kg ha^{-1})	Available K (kg ha^{-1})	Available S (mg kg^{-1})
1	**Anjora**					6	**Javari**				
i	AN1	228.92	13.40	350.60	11.25	i	JA1	151.71	18.40	406.60	10.40
ii	AN2	222.65	15.00	373.00	11.23	ii	JA2	161.71	16.40	395.40	11.75
iii	AN3	213.24	14.40	350.60	10.35	iii	JA3	154.84	17.80	395.40	10.50
iv	AN4	225.79	13.80	373.00	9.55	iv	JA4	164.84	17.40	406.60	10.00
v	AN5	238.33	13.20	350.60	10.63	v	JA5	158.57	17.60	384.20	10.12
	Mean	225.79	13.96	359.56	10.60		**Mean**	158.33	17.52	397.64	10.55
2	**Bamhani**					7	**Kalimati**				
i	BA1	235.20	22.60	317.00	10.37	i	KL1	131.71	14.00	328.20	11.09
ii	BA2	222.65	22.00	355.20	10.36	ii	KL2	131.71	16.30	328.20	11.69
iii	BA3	241.47	22.50	355.20	9.75	iii	KL3	134.84	15.30	339.20	10.35
iv	BA4	194.43	22.30	355.20	10.40	iv	KL4	134.84	15.50	350.60	9.58
v	BA5	216.38	22.80	317.00	9.55	v	KL5	128.57	16.00	339.40	11.75
	Mean	222.03	22.44	339.92	10.09		**Mean**	132.33	15.42	337.12	10.89
3	**Bhajepar**					8	**Kavadi**				
i	BH1	141.12	13.70	294.60	12.50	i	KV1	175.61	12.60	328.20	10.67
ii	BH2	159.93	14.50	294.60	10.50	ii	KV2	176.34	12.10	339.40	10.36
iii	BH3	163.07	14.00	305.80	11.25	iii	KV3	169.34	13.00	350.60	11.09
iv	BH4	137.98	13.80	285.80	11.69	iv	KV4	176.34	12.50	328.20	10.40
v	BH5	144.25	14.60	317.00	13.75	v	KV5	170.54	12.80	339.40	11.33
	Mean	149.27	14.12	299.56	11.94		**Mean**	173.63	12.60	337.16	10.77
4	**Borkanhar**					9	**Pangaon**				
i	BO1	137.98	12.80	261.00	10.12	i	PA1	232.06	15.35	261.00	10.00
ii	BO2	147.39	13.20	272.20	11.15	ii	PA2	241.47	16.78	227.40	10.12
iii	BO3	144.25	13.50	261.00	11.25	iii	PA3	241.47	16.40	238.60	11.25
iv	BO4	150.52	13.00	283.40	10.37	iv	PA4	238.33	15.58	227.40	10.37
v	BO5	144.25	12.90	272.20	10.36	v	PA5	238.33	13.99	227.40	10.35
	Mean	144.88	13.08	269.96	10.65		**Mean**	238.33	15.62	236.36	10.42
5	**Gortha**					10	**Thana**				
i	GO1	188.16	14.20	373.00	10.35	i	TH1	200.70	16.60	238.60	10.50
ii	GO2	175.61	16.20	420.40	9.58	ii	TH2	197.56	16.30	261.00	11.69
iii	GO3	166.20	15.80	420.40	10.67	iii	TH3	203.84	16.80	261.00	12.50
iv	GO4	175.61	15.50	406.60	9.89	iv	TH4	197.56	16.10	249.80	10.67
v	GO5	169.33	15.60	395.40	10.37	v	TH5	206.97	16.50	249.80	12.03
	Mean	174.98	15.46	403.16	10.17		**Mean**	201.33	16.46	252.04	11.48

Table 2.DTPA extractable micronutrient status of rice growing soils

Sr. No	Name of villages	Zn (mg kg^{-1})	Cu (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	B (mg kg^{-1})	Sr. No	Name of villages	Zn (mg kg^{-1})	Cu (mg kg^{-1})	Fe (mg kg^{-1})	Mn (mg kg^{-1})	B (mg kg^{-1})
1	**Anjora**						**6**	**Javari**					
i	AN1	0.42	1.27	4.81	8.54	0.52	i	JA1	0.32	1.21	8.45	10.45	0.56
ii	AN2	0.40	1.28	5.10	9.45	0.60	ii	JA2	0.42	1.20	9.01	10.68	0.68
iii	AN3	0.45	1.27	4.78	9.40	0.64	iii	JA3	0.32	1.19	8.63	10.98	0.56
iv	AN4	0.44	1.26	5.05	8.64	0.48	iv	JA4	0.38	1.19	9.45	11.26	0.52
v	AN4	0.47	1.25	4.95	8.32	0.68	v	JA5	0.40	1.21	8.45	10.54	0.64
	Mean	0.44	1.27	2.62	4.00	0.58		Mean	0.37	1.20	8.80	10.78	0.59
2	**Bamhani**						**7**	**Kalimati**					
i	BA1	0.41	1.24	6.34	11.54	0.52	i	KL1	0.36	1.23	7.45	8.75	0.64
ii	BA2	0.39	1.26	6.04	11.05	0.60	ii	KL2	0.30	1.22	6.45	7.84	0.56
iii	BA3	0.42	1.25	6.41	10.56	0.64	iii	KL3	0.32	1.22	7.89	7.65	0.48
iv	BA4	0.38	1.24	6.39	12.24	0.48	iv	KL4	0.38	1.24	8.45	8.25	0.52
v	BA5	0.40	1.25	6.50	11.89	0.68	v	KL5	0.39	1.21	7.25	8.46	0.56
	Mean	0.40	1.25	3.38	11.46	0.58		**Mean**	0.35	1.22	7.50	8.19	0.55
3	**Bhajepar**						**8**	**Kavadi**					
i	BH1	0.40	1.28	3.91	7.65	0.84	i	KV1	0.48	1.20	6.89	7.65	0.72
ii	BH2	0.39	1.29	3.65	7.35	0.88	ii	KV2	0.39	1.19	6.25	6.58	0.60
iii	BH3	0.43	1.27	3.41	8.24	0.76	iii	KV3	0.35	1.21	7.58	6.93	0.52
iv	BH4	0.48	1.29	4.27	6.94	0.68	iv	KV4	0.38	1.22	7.34	7.54	0.48
v	BH5	0.41	1.28	4.15	7.54	0.72	v	KV5	0.42	1.23	6.59	7.24	0.52
	Mean	0.42	1.28	3.88	7.54	0.78		**Mean**	0.40	1.21	6.93	7.19	0.57
4	**Borkanhar**						**9**	**Pangaon**					
i	BO1	0.32	1.24	7.38	9.54	0.60	i	PA1	0.49	1.30	5.47	9.84	0.76
ii	BO2	0.35	1.25	6.58	9.86	0.56	ii	PA2	0.43	1.29	4.98	10.54	0.52
iii	BO3	0.30	1.26	7.25	10.54	0.72	iii	PA3	0.39	1.28	6.58	8.54	0.56
iv	BO4	0.39	1.24	6.96	8.49	0.76	iv	PA4	0.48	1.31	5.54	10.22	0.72
v	BO5	0.41	1.23	8.45	10.24	0.80	v	PA5	0.45	1.30	5.89	9.86	0.64
	Mean	0.35	1.24	3.85	9.73	0.69		**Mean**	0.45	1.30	5.69	9.80	0.64
5	**Gortha**						**10**	**Thana**					
i	GO1	0.49	1.26	5.48	6.58	0.60	i	TH1	0.34	1.30	7.54	10.45	0.52
ii	GO2	0.36	1.28	5.32	6.98	0.56	ii	TH2	0.39	1.31	8.45	11.65	0.56
iii	GO3	0.42	1.27	6.48	6.45	0.80	iii	TH3	0.45	1.30	8.21	10.75	0.64
Iv	GO4	0.38	1.28	6.75	6.38	0.76	iv	TH4	0.44	1.29	6.75	11.36	0.52
V	GO5	0.33	1.26	4.87	6.75	0.44	v	TH5	0.32	1.31	7.35	11.86	0.48
	Mean	0.40	1.27	5.78	6.63	0.63		**Mean**	0.39	1.30	7.66	11.21	0.54

Table 3.Soil physical and chemical properties of rice growing soils

Sr. No	Name of villages	Bulk density (Mg m^{-3})	Porosity (%)	pH	EC (dSm^{-1})	OC (g kg^{-1})	$CaCO_3$ (%)	Sr. No	Name of villages	Bulk density (Mg m^{-3})	Porosity (%)	Ph	EC (dS m^{-1})	OC (g kg^{-1})	$CaCO_3$(%)
1	**Anjora**							**6**	**Javari**						
I	AN1	1.29	51.32	7.2	0.18	6.1	1.80	i	JA1	1.41	47.16	7.0	0.16	5.2	1.60
Ii	AN2	1.34	49.43	7.4	0.19	6.4	1.00	ii	JA2	1.37	48.30	7.2	0.22	5.8	2.00
Iii	AN3	1.42	46.41	7.5	0.22	6.5	1.60	iii	JA3	1.32	50.18	7.1	0.19	4.9	2.40
Iv	AN4	1.34	49.43	7.6	0.21	6.8	1.20	iv	JA4	1.40	47.16	7.0	0.21	5.3	2.60
V	AN4	1.32	50.18	7.6	0.23	6.9	1.40	v	JA5	1.36	48.67	7.3	0.22	4.4	1.80
	Mean	1.34	49.35	7.5	0.21	6.5	1.40		Mean	1.37	48.29	7.1	0.20	5.12	2.08
2	**Bamhani**							**7**	**Kalimati**						
I	BA1	1.35	48.67	7.3	0.24	5.4	2.20	i	KL1	1.38	47.92	7.6	0.17	5.2	1.40
Ii	BA2	1.34	49.43	7.8	0.24	5.4	3.00	ii	KL2	1.43	46.03	7.4	0.18	5.6	1.60
Iii	BA3	1.26	52.45	7.5	0.22	5.1	2.40	iii	KL3	1.35	49.05	7.6	0.19	4.9	1.80
Iv	BA4	1.34	49.43	7.8	0.21	5.2	2.20	iv	KL4	1.42	46.41	7.5	0.16	4.8	1.20
V	BA5	1.35	49.05	7.6	0.21	5.6	2.00	v	KL5	1.40	47.16	7.3	0.17	5.2	1.60
	Mean	1.33	49.81	7.6	0.22	5.3	2.36		**Mean**	1.40	47.31	7.5	0.17	5.14	1.52
3	**Bhajepar**							**8**	**Kavadi**						
I	BH1	1.29	51.32	7.5	0.21	4.3	1.00	i	KV1	1.40	47.16	7.3	0.13	4.6	3.00
Ii	BH2	1.35	48.67	7.6	0.15	4.4	1.40	ii	KV2	1.46	44.90	7.6	0.12	5.1	2.60
Iii	BH3	1.32	49.05	7.0	0.13	4.0	1.80	iii	KV3	1.54	41.88	7.4	0.14	4.8	2.20
Iv	BH4	1.35	48.67	7.5	0.11	4.3	1.20	iv	KV4	1.42	46.41	7.5	0.13	4.9	3.00
V	BH5	1.28	51.69	7.4	0.13	4.6	1.60	v	KV5	1.36	48.67	7.4	0.14	5.3	2.20
	Mean	1.32	49.88	7.4	0.15	4.3	1.40		**Mean**	1.44	45.80	7.4	0.13	4.94	2.60
4	**Borkanhar**							**9**	**Pangaon**						
i	BO1	1.33	49.81	7.6	0.24	4.6	1.60	i	PA1	1.42	46.41	7.6	0.11	5.9	1.00
ii	BO2	1.29	51.32	6.9	0.31	4.3	1.00	ii	PA2	1.32	50.18	7.7	0.12	5.8	1.60
iii	BO3	1.35	48.67	7.0	0.28	4.1	1.20	iii	PA3	1.40	47.16	7.5	0.13	6.2	1.40
iv	BO4	1.38	47.92	7.2	0.29	4.3	1.40	iv	PA4	1.34	49.43	7.6	0.12	6.1	2.00
v	BO5	1.33	49.81	7.3	0.31	4.6	1.80	v	PA5	1.41	46.79	7.6	0.14	6.3	1.80
	Mean	1.34	49.51	7.2	0.29	4.3	1.40		**Mean**	1.38	47.99	7.6	0.12	6.06	1.56
5	**Gortha**							**10**	**Thana**						
i	GO1	1.30	50.94	6.8	0.26	5.4	2.40	i	TH1	1.34	49.43	7.5	0.36	5.6	2.80
ii	GO2	1.31	50.56	7.1	0.31	4.7	2.80	ii	TH2	1.35	49.05	7.4	0.26	5.2	2.40
iii	GO3	1.34	49.51	7.0	0.38	5.5	2.46	iii	TH3	1.34	49.43	7.3	0.09	5.4	3.00
iv	GO4	1.32	49.05	7.1	0.34	4.4	2.20	iv	TH4	1.38	47.92	7.4	0.11	5.2	2.00
v	GO5	1.32	49.05	6.9	0.35	5.6	2.40	v	TH5	1.40	47.16	7.2	0.22	5.5	1.60
	Mean	1.32	49.82	7.0	0.33	5.3	2.45		**Mean**	1.36	48.60	7.4	0.21	5.38	2.36

available zinc recorded in Gumgaon village and lowest value of 0.15 mg kg^{-1} recorded in Khapri village. These soils are also found to contain higher zinc in their surface soils than their subsurface soils. The available copper varied from 3.41 to 7.89 mg kg^{-1} in soil i.e. very high. The higher amount of Cu in surface layer might be due to higher biological activities and chelating effect. Results closely accordance with the Ravi *et al*. (2014), who found that, lowest available copper was recored (0.31 mg kg^{-1}) in Metpallymandal and highest was (5.30 mg kg^{-1}) in Dharmapurimandal. The rice growing soil of all the mandals in Karimnagar district were found to have available copper above the critical level of 3.0 mg kg^{-1}.The Fe containing soils of Amgaon tahsil selected villages ranged from 3.15 to 7.82 mg kg^{-1}, low to medium in soil.The high Fe content in soil may be due to presence of minerals like Feldspar, Magnetite, Hematite and Limonite which together constitute bulk of trap rock in these soils (Kumar and Babel, 2011). The magnitude of available Mn content of soils ranged from 6.38 to 11.86. The available Mn in these soils found to be moderately high to high.Hundal *et al.* (2006) stated that, the relative high content of Mn in the soils could be due to the soils derived from basaltic parent material which contained higher ferromagnessium minerals.Similar observations were also recorded by Jibhkate *et al.* (2009), who stated that, all the soil series of Katoltahsil were found to be sufficient in available manganese. The available boron content in soils ranged from 0.44 to 0.88 mg kg^{-1}. Results showed closely accordance to Debnath and Ghose (2011), who reported the average dry matter yield increased with the increasing level of B application up to 1.5 mg kg^{-1}. The response to B application in rice on B- deficient soils was found to be 88.4%.

Table 4. Correlation coefficient between yield and physical properties of rice growing soils

Parameters	Correlation with yield
B.D	0.079
Porosity	-0.079
pH	0.031
EC	-0.057
OC	0.207
$CaCO_3$	-0.087
N	0.103
P	-0.382**
K	0.410**
S	-0.230
Zn	0.439**
Cu	-0.054
Fe	-0.674**
Mn	-0.775**
B	0.288*

*, ** =Significant at 5 % level (0.273) and Significant at 1% level (0.354)

Soils were sufficient for DTPA extractable iron, copper and manganese, whereas deficient for zinc.Available potassium, boron and zinc had significant and positive correlation with yield of rice. Similarly, the yield of rice had significant and negative correlation with phosphorus, iron and manganese.

The combined application of farm manure and mineral fertilizer could induce an increase in the humus content, nitrogen and available phosphorus and potassium levels (Verma *et al.* 2012). As a result of an increase in nutrient level of soil, a significant effect (P d" 0.05) on yield ha^{-1} was determined (Milosevic and Milosevic 2009).A recent study demonstrated that there was a statistically significant correlation (P d" 0.01) between the grain yields and organic C content of soil after application of organic amendments to soil (Mikanová *et al*., 2012).

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