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Assessment of Physico-chemical Properties of Soil in Dadrol Block, Shahjahanpur District, Uttar Pradesh, India

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A B S T R A C T

Industrial activities sequel a demolishing influence on the soil health. The present investigation was analysed at Sam Higginbottom University of agriculture technology and sciences in the department of Soil Science and Agricultural Chemistry lab. The objective of this study was to analyse various soil physico-chemical properties. Depth wise soil samples were collected from three selected farmer's field in Piprola village of Dadrol block of Shahjahanpur district. Three different sites were taken in each farmer's field represented three profile depths *viz*., 0-15, 15-30 and 30-45 cm, totally 27 samples were collected. The results revealed that the texture was sandy loam, bulk density ranged from 1 to 1.23 Mg m^{-3}, particle density from 2 to 2.66 Mg m^{-3}, pore space from 42.52 to 55.19(%), water holding capacity from 54.54 to 78.21 (%) and specific gravity from 2.1 to 4.43. The pH ranged from7.17 to 8.84, E.C. from 0.15 to 0.51(dS m^{-1}).Available nitrogen ranged from 142.16 to 424.39 (kg ha^{-1}), phosphorous from 20.67 to 41.42 (kg ha^{-1}) and potassium from 62.88 to 108.23 (kg ha^{-1}). Exchangeable calcium, magnesium ranged from 0.7 to 2.57, 0.2 to 0.82 (cmol (p^{+}) kg^{-1}) and available sulphur from 6.03 to 11.34 (ppm). Overall soils were in moderate condition. Farmers required maintaining soil health card, adopting suitable management practices and providing proper nutrition to the soil to overcome the pollution effect.

Keywords

Soil Physico-chemical properties, depth, Nutrients, etc

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Introduction

Agriculture is one of the world's oldest economic practices. It has developed into a technologically advanced industry and it currently plays a substantial role in global sustainability(Harrell, 2014) [(7)]. Soils need maintenance, but exploitation of soils has only intensified due to increasing pressure. Today, soil, crops and vegetables globally provide ample food for 7 billion people. The availability though is unevenly distributed and 1 billion people are structurally underfed. To provide for food for 9-10 billion people by

2050, the biophysical as well as the socio-economic availability of food as well as of the food productive capacity are to be strongly improved. Crucial is the capacity of land users worldwide to manage their soils sustainably and productively (ISRIC, 2021) [(10)]. Soil health is the "state of the soil being in sound physical, chemical, and biological condition, having the capability to sustain the growth and development of land plants" (Idowu *et al.*, 2019) [(9)]. Soil acts as a filter and buffer for contaminants, but its potential to cope is finite. If the capacity of the soil to mitigate the effects of pollutants is exceeded, the contaminants pollute other compartments of the environment. Soil pollution causes a chain reaction that starts with reduced soil biodiversity, alters organic matter incorporation rates, and then weakens soil structure and ability to resist erosion. Main sources of soil pollution are by industrial activities that release large amounts of chemicals into the environment during manufacturing, transportation and use (Bhattacharyya *et al.*, 2015) [(2)]. Degradation of the soil is the most problematic problem of the Indian soil. The process of soil degradation is the result of natural forces and human activities. India is now reaping what it had sown decades ago (Supriya, 2021) [(23)]. The food productivity and environmental quality is dependent on the physico-chemical properties of soil, so it is very important to know the basic knowledge about the physico-chemical properties of soil (Tale *et al.*, 2015) [(24)].

Materials and Methods

The present study entitled "Assessment of Physico-chemical Properties of Soil in Dadrol Block, Shahjahanpur District, Uttar Pradesh, India", was carried out during 2020-21 and comprised of a lab experiment which was carried out in Department of Soil Science and Agricultural chemistry, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (U.P.)., India.

Site details

Shahjahanpur is situated in west-central part of Uttar Pradesh. It is an Agriculture based district of Uttar Pradesh lying between latitude 27°27'N and 28°28'N, and longitude 79°19'E and 80°23'E. Its geographical area is 4,575 km^2 (1,766 m^2) and at the altitude of 194 metres (600 feet) above the sea level. Shahjahanpur district has the population of 3006538 as per census data of 2011. Dadrol block population is 168586. Geographical area of Piprola Ahmedpur village is 408.55 ha with the population of 5000 as per census data of 2011, in which male population is 2660 and female population is 2340.The soils in the district are deep and well drained, with loamy surface. Wheat is grown in the maximum area of the district, followed by rice. Other crops of minor importance are sugarcane, potato, cotton *etc.*There are many Industrial units in the district, namely wood/wooden based furniture's; paper & paper products; leather based; chemical/chemical based; rubber, plastic & petro based; metal based (Steel fabrication); Soda water; cotton textile *etc.*(Ranjan, 2013)[(17)].

Soil sampling

Soil samples were collected from village Piprola Ahmedpur in Shahjahanpur district. In the village 3 farmers was selected randomly for sampling. Soil samples were collected from each farmer's field after harvest or before sowing. Three different sites were taken in each farmer's field represented three profile depths *viz.*, 0-15 cm, 15-30 cm and 30-45 cm, totally 27 samples were collected with 9 samples representing one farmer's field. At sampling site, soil samples were collected separately by a random selection from field with help of khurpi, spade, digging bar and meter scale. Samples were collected from centre of the fields in order to avoid the edge effect. Each soil sample is about 500mg collected from the 0–15 cm layer (which represented the plough layer), 15-30cm and 30-45cm depth.

Analysis of physico-chemical parameters

Soil textural analysis of particles less than 2 mm was performed by the hydrometer method (Bouyoucos, 1927) [4]. The bulk density, particle density, pore space and water holding capacity was determined by the graduated 100 ml measuring cylinder method (Muthuvel *et al.,* 1992) [14]. Specific gravity of soil was determined by the relative density bottle or pycnometer method as laid out by Black (1965) [3]. The pH was determined by1:2 soil-water suspension method using digital pH meter (Jackson, 1958) [11]. EC was determined by1:2 soil-water suspension method using digital EC meter (Wilcox, 1950) [29]. Organic carbon was determined by the wet oxidation method (Walkley and Black, 1947)[27]. Available N was determined by alkaline potassium permanganate method (Subbiah and Asija, 1956) [21]. Available P was determined by colorimetric method (Olsen *et al.,* 1954) [16]. Available K was determined by flame photometer method (Toth and Prince, 1949) [25]. Exchangeable calcium and magnesium was determined by neutral ammonium acetate extraction method or EDTA method (Cheng and Bray, 1951) [5]. Available S was determined by turbidimetric method (Bardsley and Lancaster, 1960) [1].

Statistical analysis

The data recorded during the course of investigation was subjected to statistical analysis by the method of analysis of variance (ANOVA) technique (Fisher, 1960) [6]. The type of ANOVA adopted for the experiment was two-factor analysis without replication. The implemented design of experiment in the analysis done was Completely Randomized Design (CRD). It is used when experimental units are homogenous as it involves only two basic principles of the design of experiment, *viz.,* replication and randomization. CRD is used for laboratory purpose only. The significant and non-significant treatment effects were judged on the basis of 'F' (variance ratio) test.

Results and Discussion

The soil texture in Piprola Ahmedpur was found to be dominantly sandy loam. The sand, silt and clay (%) content were 77.27 %, 8.16 % and 14.57 % respectively. Most of the crops are grown in these soils because they retain more water and nutrients. Similar finding were reported by Khadka *et al.,* (2017) [12]. As presented in table 2 and fig. 1 statistical accumulation on bulk density(Mg m^{-3}) of soil in village Piprola Ahmedpur. No significant difference was found due to depth and significant difference was found due to site. The bulk density ranged from 1.00 to 1.23 (Mg m^{-3}). The maximum value found in F_3S_2(30-45cm depth)1.23(Mg m^{-3}) and the minimum value found in F_2S_1(0-15 cm depth)1.00(Mg m^{-3}). The bulk density increases with the increase in soil depth. The reason is that soil compactness will be more at high depth and soil organic carbon will be decreased with increasing the depth. Similar finding were reported by Singh *et al.,* (2020) [20]. As depicted in table 2 and fig. 2 statistical accumulation on particle density(Mg m^{-3})of soil in village Piprola Ahmedpur. No significant difference was found due to depth and no significant difference was found due to site. The particle density ranged from2.00 to 2.66 (Mg m^{-3}). The maximum value found in F_1S_1(0-15 cm depth) 2.66(Mg m^{-3}) which indicates that the soil has comparatively lower organic matter and the minimum value found in F_2S_2(0-15 cm depth) 2.00 (Mg m^{-3}) which indicates the presence of high organic matter. Particle density varies according to the mineral content of the soil particles. Similar finding were reported by Yuvarani *et al.,* (2019) [30].As shown in table 2 and fig. 3 statistical accumulation on pore space % of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The pore space % ranged from 42.52 to 55.19%. The maximum value found in F_2S_1(0-15 cm depth)55.19% and the minimum value found in F_3S_2(30-45 cm depth) 42.52 %. Pore space was found to decrease with increase in depth attributed to increase in compaction in the sub surface. Surface soils are having high amount of macro and micro pores compared to sub surface soils due to presence of high organic matter. Similar finding were reported by Verma *et al.,* (2019) [26]. As presented in table 3 and fig. 4 statistical accumulation on water holding capacity (%) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and no significant difference was found due to site. The water holding capacity (%) ranged from54.54 to 78.21 %. The maximum value found in F_1S_3(0-15 cm depth) 78.21% and the minimum value found in F_3S_2(15-30 cm depth) 54.54 %. WHC value decreases with the increasing depth because of soil compaction and reduction in pore space.

Similar finding were reported by Singh *et al.,* (2019) [18].As depicted in table 3 and fig. 5 statistical accumulation on specific gravity of soil in village Piprola Ahmedpur. No significant difference was found due to depth and no significant difference was found due to site. The specific gravity ranged from2.04 to 2.45. The maximum value found in F_2S_2(15-30 cm depth) 2.45 and the minimum value found in F_2S_1(30-45 cm depth) 2.04 and this due to presence of organic matter and porous particles in soil. Similar finding were reported by Sujatha *et al.,* (2016)[22].

As presented in table 4 and fig. 6statistical accumulation on pH of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The pH ranged from7.17 to 8.84. The maximum value found in F_3S_1 (30-45 cm depth) 8.84 and the minimum value found in F_1S_1(0-15 cm depth) 7.17, thereby indicating the soils are moderately alkaline. pH value increases with the increasing depth because the upper horizons receive maximum leaching by rainfall and by dissolved carbonic acids and presence of high amount of exchangeable sodium ions. Similar finding were reported by Okolo *et al.,* (2016) [15]. As depicted in table 4 and fig. 7statistical accumulation on EC (dS m^{-1}) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The electrical conductivity ranged from 0.15 to 0.51dS m^{-1}. The maximum value found in F_1S_1(30-45 cm depth) 0.51dS m^{-1} and the minimum value found in F_3S_1(15-30 cm depth) 0.15dS m^{-1}. It indicates that the soil are non-saline and salinity effect is mostly negligible for the crops. Similar finding were reported by Mallick *et al.,* (2019) [13].As shown in table 4 and fig. 8statistical accumulation on organic carbon (%) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The soil organic carbon (%) ranged from 0.58 to 2.40 (%).

The maximum value found in F_3S_1(0-15 cm depth) 2.40(%) and the minimum value found in F_1S_3(30-45 cm depth) 0.58(%). The organic carbon decreases with increasing depth due to the fact that surface soil contains undecomposed and partial decomposed organic matter while subsoil contains decomposed organic matter which has undergone chemical and biological changes. Similar finding were reported by Singh *et al.,* (2012) [19].

Table.1 Sampling sites and GPS coordinates of Dadrol block, Shahjahanpur

S. No.	Farmer	Village	Site	Latitude (˚N)	Longitude (˚E)
1	Mr. Gulgari (F_1)	Piprola Ahmedpur	S_1	27 ˚49 ′ 29 ″	79 ˚ 55 ′ 40 ″
			S_2	27 ˚ 50 ′ 30 ″	79 ˚ 49 ′ 30 ″
			S_3	27 ˚ 48 ′ 29 ″	79 ˚ 55 ′ 33 ″
2	Mr. Raghunandan Prasad (F_2)	Piprola Ahmedpur	S_1	27 ˚ 50 ′ 30 ″	79 ˚ 50 ′ 30 ″
			S_2	27 ˚ 50 ′ 30″	79 ˚ 49 ′ 29 ″
			S_3	27 ˚ 51 ′ 28 ″	79 ˚ 52 ′ 33 ″
3	Mr. Sonpal Singh (F_3)	Piprola Ahmedpur	S_1	27 ˚ 50 ′ 30 ″	79 ˚ 52 ′ 31 ″
			S_2	27 ˚ 49 ′ 29 ″	79 ˚ 50 ′ 30 ″
			S_3	27 ˚ 49 ′ 29 ″	79 ˚ 50 ′ 30 ″

Table.2 Assessment of Bulk density, Particle density and Pore spaceof Soil from different depth 0-15, 15-30 and 30-45 cm of village Piprola Ahmedpur, Shahjahanpur

Farmer site	Bulk density (Mg m $^{-3}$)			Particle density (Mg m $^{-3}$)			Pore space (%)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
F_1S_1	1.05	1.11	1.17	2.66	2.66	2.50	53.50	47.23	43.43
F_1S_2	1.05	1.05	1.05	2.50	2.50	2.66	51.32	46.37	45.22
F_1S_3	1.02	1.05	1.05	2.50	2.66	2.61	52.75	43.55	42.56
F_2S_1	1.00	1.05	1.17	2.65	2.22	2.65	55.19	51.39	47.63
F_2S_2	1.00	1.05	1.05	2.00	2.50	2.22	54.33	52.63	50.00
F_2S_3	1.00	1.11	1.11	2.15	2.22	2.50	52.68	50.38	45.27
F_3S_1	1.05	1.11	1.05	2.50	2.35	2.66	50.52	47.89	42.77
F_3S_2	1.05	1.11	1.23	2.50	2.35	2.66	47.89	45.77	42.52
F_3S_3	1.11	1.11	1.11	2.22	2.35	2.35	54.23	52.77	52.77
	F-test	**S. Ed. (±)**	**C.D. @ 0.05%**	**F-test**	**S. Ed. (±)**	**C.D. @ 0.05%**	**F-test**	**S. Ed. (±)**	**C.D. @ 0.05%**
Due to depth	NS	0.037118	0.005604	NS	0.0687	0.204737	S	3.358068	0.000002
Due to site	S	0.033665	0.113281	NS	0.138604	0.066577	S	2.783892	0.000247

Table.3 Assessment of Water holding capacity and Specific gravity of Soil from different depth 0-15, 15-30 and 30-45 cm of village Piprola Ahmedpur, Shahjahanpur

Farmer site	Water holding capacity (%)			Specific gravity		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
F_1S_1	62.85	58.82	65.23	2.35	2.10	2.31
F_1S_2	61.42	58.91	64.51	2.08	1.98	2.43
F_1S_3	78.21	75.00	62.50	2.27	2.14	1.98
F_2S_1	76.66	64.51	70.58	2.08	2.07	2.04
F_2S_2	69.69	60.60	65.71	2.31	2.45	2.18
F_2S_3	62.16	61.79	63.63	2.38	2.41	2.08
F_3S_1	72.72	64.70	66.66	2.20	2.26	2.43
F_3S_2	59.37	54.54	62.82	2.40	2.23	2.70
F_3S_3	69.69	70.58	64.7	2.19	2.34	2.09
	F-test	**S. Ed. (±)**	**C.D. @ 0.05%**	**F-test**	**S. Ed. (±)**	**C.D. @ 0.05%**
Due to depth	S	2.426042	0.074028	NS	0.017356	0.910851
Due to site	NS	4.455908	0.016553	NS	0.113419	0.294745

Table.4 Assessment of Soil pH, EC and organic carbonof Soil from different depth 0-15, 15-30 and 30-45 cm of village Piprola Ahmedpur, Shahjahanpur

Farmer site	Soil pH			Electrical conductivity (dS m^{-1})			Soil organic carbon (%)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
F_1S_1	7.17	8.04	8.65	0.25	0.28	0.51	1.50	1.12	0.97
F_1S_2	7.24	7.65	7.74	0.29	0.32	0.34	1.20	1.13	1.08
F_1S_3	7.89	8.17	8.23	0.29	0.33	0.35	1.10	0.87	0.58
F_2S_1	8.12	8.25	8.18	0.35	0.41	0.43	1.65	1.54	1.35
F_2S_2	8.32	8.40	8.54	0.29	0.30	0.28	1.30	1.21	1.01
F_2S_3	8.05	8.11	8.28	0.29	0.33	0.38	1.14	1.02	0.79
F_3S_1	8.54	8.73	8.84	0.16	0.15	0.17	2.40	2.25	1.80
F_3S_2	8.32	8.24	8.58	0.24	0.28	0.32	2.10	1.10	0.83
F_3S_3	8.54	8.73	8.79	0.20	0.24	0.23	1.11	1.05	0.82
	F-test	**S. Ed. (±)**	**C.D. @ 0.05%**	**F-test**	**S. Ed. (±)**	**C.D. @ 0.05%**	**F-test**	**S. Ed. (±)**	**C.D. @ 0.05%**
Due to depth	S	0.203198	0.00464	S	0.036226	0.011973	S	0.237271	0.000281
Due to site	S	0.365023	0.000198	S	0.070119	0.000376	S	0.388219	0.00001

Table.5 Assessment of available Nitrogen, Phosphorous and of Soil from different depth 0-15, 15-30 and 30-45 cm of village Piprola Ahmedpur, Shahjahanpur

Farmer site	Nitrogen (kg ha^{-1})			Phosphorous (kg ha^{-1})			Potassium (kg ha^{-1})		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
F_1S_1	424.39	330.08	157.18	41.42	37.54	25.60	105.33	97.54	78.07
F_1S_2	411.21	306.34	166.36	40.51	34.67	24.32	101.91	82.16	70.86
F_1S_3	406.45	317.88	173.47	41.03	35.29	26.71	102.21	77.21	67.32
F_2S_1	285.34	237.65	154.65	36.15	27.03	21.38	108.23	93.27	81.29
F_2S_2	279.77	221.32	142.16	34.21	28.18	22.08	106.29	88.53	72.81
F_2S_3	260.92	220.05	157.18	33.62	29.41	20.67	101.10	72.91	65.22
F_3S_1	323.76	287.65	185.43	37.90	32.28	28.79	103.15	81.04	63.22
F_3S_2	312.21	262.34	166.32	38.24	33.18	30.71	102.34	73.31	62.88
F_3S_3	304.93	260.92	179.18	38.46	32.81	32.39	104.45	78.21	64.39
	F-test	S. Ed. (±)	C.D. @ 0.05%	F-test	S. Ed. (±)	C.D. @ 0.05%	F-test	S. Ed. (±)	C.D. @ 0.05%
Due to depth	S	85.78907	0.00000001	S	6.055716	0.00000002	S	17.32161	0.00000000001
Due to site	S	36.04452	0.0080572	S	3.053152	0.0015092	S	5.654408	0.000805119

Table.6 Assessment of Exchangeable calcium, magnesium and available sulphur of Soil from different depth 0-15, 15-30 and 30-45 cm of village Piprola Ahmedpur, Shahjahanpur

Farmer site	Exchangeable calcium (cmol (p^+) kg^{-1})			Exchangeable magnesium (cmol (p^+) kg^{-1})			Available sulphur (ppm)		
	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm	0-15 cm	15-30 cm	30-45 cm
F_1S_1	2.32	1.98	1.51	0.82	0.51	0.39	10.02	8.52	7.21
F_1S_2	1.83	1.45	1.23	0.67	0.54	0.47	9.78	7.91	6.45
F_1S_3	1.02	0.90	0.86	0.73	0.54	0.32	9.32	7.17	6.93
F_2S_1	1.23	1.05	1.01	0.64	0.59	0.23	7.21	6.92	6.03
F_2S_2	2.24	2.12	2.10	0.57	0.43	0.37	8.21	7.42	6.65
F_2S_3	1.87	1.48	1.34	0.43	0.35	0.30	8.63	7.68	6.93
F_3S_1	1.65	1.39	1.24	0.21	0.20	0.20	11.34	9.73	8.33
F_3S_2	2.57	1.98	0.97	0.39	0.25	0.21	9.21	8.22	5.34
F_3S_3	1.61	1.23	0.72	0.49	0.38	0.29	8.67	7.15	6.43
	F-test	S. Ed. (±)	C.D. @ 0.05%	F-test	S. Ed. (±)	C.D. @ 0.05%	F-test	S. Ed. (±)	C.D. @ 0.05%
Due to depth	S	0.297822	0.000313	S	0.120652	0.00006	S	1.227877	0.0000002
Due to site	S	0.407755	0.000142	S	0.127932	0.00043	S	0.871542	0.000222

Fig.1 Graphical representation of Bulk density (Mg m $^{-3}$) in different sites of village Piprola Ahmedpur

Fig.2 Graphical representation of Particle density (Mg m $^{-3}$) in different sites of village Piprola Ahmedpur

Fig.3 Graphical representation of Pore space (%) in different sites of village Piprola Ahmedpur

Fig.4 Graphical representation of Water holding capacity (%) in different sites of village Piprola Ahmedpur

Fig.5 Graphical representation of Specific gravity in different sites of village Piprola Ahmedpur

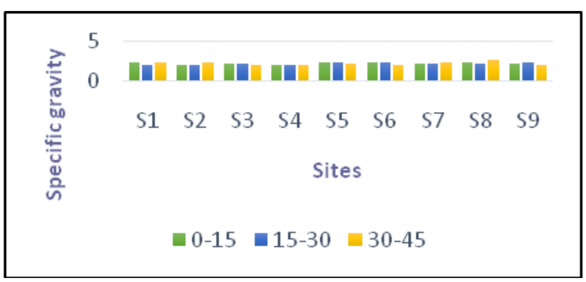

Fig.6 Graphical representation of pH in different sites of village Piprola Ahmedpur

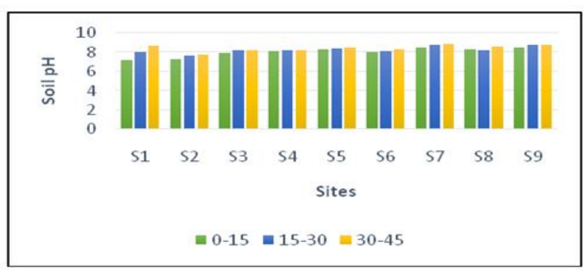

Fig.7 Graphical representation of EC (dS m^{-1})in different sites of village Piprola Ahmedpur

Fig.8 Graphical representation of Organic carbon (%) in different sites of village Piprola Ahmedpur

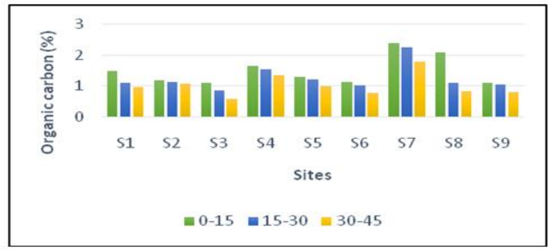

Fig.9 Graphical representation of Available N (kg ha^{-1}) in different sites of village Piprola Ahmedpur

Fig.10 Graphical representation of Available P (kg ha^{-1}) in different sites of village Piprola Ahmedpur

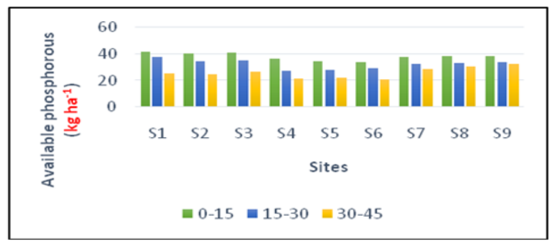

Fig.11 Graphical representation of Available K (kg ha^{-1}) in different sites of village Piprola Ahmedpur

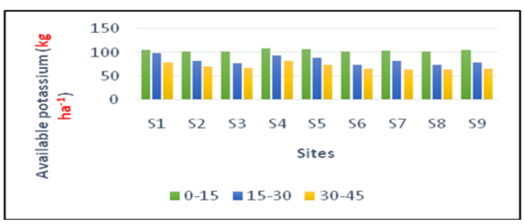

Fig.12 Graphical representation of Exchangeable Calcium (cmol(p^{+}) kg^{-1}) in differentsites of village Piprola Ahmedpur

Fig.13 Graphical representation of Exchangeable Magnesium(cmol(p^{+}) kg^{-1}) in differentsites of village Piprola Ahmedpur

Fig.14 Graphical representation of Available sulphur (ppm) in different sites of village Piprola Ahmedpur

Fig.15 Soil heath card for farmer of village Piprola Ahmedpur

As presented in table 5 and fig. 9statistical accumulation on available nitrogen (kg ha^{-1}) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The available nitrogen (kg ha^{-1}) ranged from142.16 to 424.39 (kg ha^{-1}). The maximum value found in F_1S_1(0-15 cm depth) 424.39(kg ha^{-1}) and the minimum value found in F_2S_2(30-45 cm depth) 142.16(kg ha^{-1}). The available nitrogen decreases with the increasing depth due to the fact it is positively correlated with organic matter content which decreases with depth and might be due to higher pH to the depth. Similar finding were reported by Ho *et al.*, (2019) [8]. As depicted in table 5 and fig. 10statistical accumulation on available phosphorous (kg ha^{-1}) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The available phosphorous (kg ha^{-1}) ranged from 20.67 to 41.42 (kg ha^{-1}). The maximum value found in F_1S_1(0-15 cm depth) 41.42(kg ha^{-1})and the minimum value found in F_2S_3(30-45 cm depth) 20.67(kg ha^{-1}). The available phosphorous decreases with the increasing depth. Higher level of available phosphorous in surface soil could be attribute of favourable soil pH and organic matter content. Similar finding were reported by Wani *et al.*, (2017)[28].As shown in table 5 and fig. 11statistical accumulation on available potassium (kg ha^{-1}) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The available potassium (kg ha^{-1}) ranged from 62.88 to 108.23 (kg ha^{-1}). The maximum value found in F_2S_1(0-15 cm depth) 108.23(kg ha^{-1})and the minimum value found in F_3S_2(30-45 cm depth) 62.88(kg ha^{-1}). The available potassium decreases with the increasing depth. The high content of available potassium on surface soil may be attributed to the release of labile K from organic residues and application of potassium fertilizers. Similar finding were reported by Singh *et al.*, (2020)[20]. As presented in table 6 and fig. 12statistical accumulation on exchangeable calcium (cmol (p^+) kg^{-1}) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The exchangeable calcium (cmol (p^+) kg^{-1}) ranged from 0.72 to 2.57 (cmol (p^+) kg^{-1}). The maximum value found in F_3S_2(0-15 cm depth)

2.57(cmol (p^+) kg^{-1})and the minimum value found in F_3S_3(30-45 cm depth) 0.72 (cmol (p^+) kg^{-1}). The exchangeable calcium decreases with the increasing depth due to the attribute of high pH. Similar finding were reported by Okolo *et al.*, (2016)[15]. As depicted in table 6 and fig. 13statistical accumulation on exchangeable magnesium (cmol (p^+) kg^{-1}) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The exchangeable magnesium (cmol (p^+) kg^{-1}) ranged from0.20 to 0.82 (cmol (p^+) kg^{-1}). The maximum value found in F_1S_1(0-15 cm depth) 0.82(cmol (p^+)kg^{-1})and the minimum value found in F_3S_1(30-45 cm depth) 0.20 (cmol (p^+) kg^{-1}). The exchangeable magnesium decreases with the increasing depth due to the attribute of high pH. Similar finding were reported by Okolo *et al.*, (2016) [15]. As shown in table 6 and fig. 14 statistical accumulation on available sulphur (ppm) of soil in village Piprola Ahmedpur. Significant difference was found due to depth and significant difference was found due to site. The available sulphur (ppm) ranged from 6.03 to 11.34 (ppm). The maximum value found in F_3S_1(0-15 cm depth) 11.34 (ppm)and the minimum value found in F_2S_1(30-45 cm depth) 6.03(ppm). The available sulphur decreases with the increasing depth might be due to greater plant and microbial activities and mineralization of organic matter in surface layer. Similar finding were reported by Singh *et al.*, (2019)[18].

The trial that the soils of Shahjahanpur Piprola village is sandy loam having good physical conditions. It is neutral to alkaline as favourable electrical conductivity for plant growth, fertile with high organic content and low to medium of macronutrients *viz.* nitrogen, phosphorous and potassium. Some sites showed a deficiency in secondary nutrients *i.e*. calcium, magnesium and sulphur. The deficiency of the nutrients can be mitigate by the use of organic and inorganic fertilizers. It shows that the soils are good for cultivation of paddy, wheat, maize, millet, pulses, potato, sugarcane *etc.* Farmers are required to maintain Soil Health Card according to the guidelines of central and state government for crop cultivation and advise to adopt suitable management practices and provide proper nutrition to soil health. Time to time inventory should be maintained to overcome to the pollution effect in their respective soil.

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