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Physico-chemical characterization of some agricultural soils in Moradabad district, Uttar Pradesh, India

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ABSTRACT

Soil physicochemical characterization helps determine soil nutrient levels, aiding in fertilizer control, soil quality improvement, and assisting farmers in understanding economic productivity and food production. Physicochemical parameters are fundamental to soil research because they influence soil and crop health. Physicochemical characteristics studied, (from April 2022 to July 2023) were pH, E.C, W.H.C, soil temperature, O.C, N, P, and K. Different soil surface depth (0-10, 10-20 and 20-30 cm) composite soil samples were collected from different 8 administrative blocks and analysed by using standard laboratory techniques at Moradabad soil and culture laboratory. pH of soil across the sampling sites ranged between 7.03 to 7.40 and min. pH was reported from BT-JSP-1 and MP-JSP-2 block as 7.03 that represent neutral status and max reported from CH-JSP-3 and MP-JSP-2 as 7.40 with little alkaline nature. 7.06 pH (0-10cm) was reported from MP-JSP-2 block of Moradabad sub-division and 8.07 pH at (20-30cm) from CH-JSP-3 block of Kanth subdivision. E.C. ranged from 0.40 to 0.88 dSm^{-1} that represents the min. value for seed germination in district. (0-10cm) 0.46 dSm^{-1} reported from MP-JSP-2 block and 0.89 at (20-30cm) from DL-JSP-8 block. Available nitrogen content varied from 71.24 to 103.56 kg ha^{-1}, (0-10cm) 73.19 kg ha^{-1} nitrogen reported from BL-JSP-5 and 39.87 kg ha^{-1} (20-30cm) from KN-JSP-6. Available phosphorus content varied from 13.66 to 23.50 kg ha^{-1}, 13.78 kg ha^{-1} (0-10cm) reported from TK-JSP-7 block and 9.45 kg ha^{-1} (20-30cm) from TK-JSP-7 and the potassium content is 159.10 to 217.91 kg ha^{-1}, 213.95 kg ha^{-1} (0-10cm) from BT-JSP-1 block and 151.17 kg ha^{-1} (20-30cm) from TK-JSP-7 block. Phosphorus ranged represents the low soil status of the district and potassium content ranged show the medium status of soil. The organic carbon values fluctuated from 0.26 to 0.51 % that represents the low value status of district soil profile. W.H.C. of the different blocks was ranged from 22.85 to 54.28% and soil temperature ranged 10.1 to 25.2^{0}C. Concluded, fertilisers administered during crop establishment may cause uneven nutrient distributions and varying parameter concentrations in soils. The findings suggest that more development is required to enhance soil quality by using improved cropping strategies rather than continuous cropping. Soil in Moradabad is nutrient imbalanced in all the blocks. It can be restored by providing enough amounts of certain nutrients and controlling the use of chemical fertilisers in the soil. The use of organic manure instead of chemical fertilisers can improve soil health and boosts nitrogen concentrations. This study can help discover crop compatibility and cropping calendars in different agro-ecosystems in the Moradabad district.

Keywords: Electrical conductivity, macronutrient, pH, physicochemical analysis, Soil's depth

INTRODUCTION

Soil is crucial for agriculture, and its physicochemical study is vital as its physical and chemical properties significantly influence its production. Aside from climatic conditions, soil texture and depth, nutrients, salinity and alkalinity, and drainage all influence which crop is best suited to a given location. The arrangement of particles and pores in soil impacts its physical properties, such as top soil depth, porousness, water-holding capacity, texture, crusting, and aggregation. Soil is a thin layer on the earth's crust that provides life support for biotic components (More, 2022). Soil covers any area of the earth's surface where plants can grow. Soil conditions have a significant impact on vegetative dispersion and growth (Kardol *et al.,* 2006). Soil fertility is a key factor determining plant growth. It is determined by the levels of N, P, K organic and inorganic materials, micronutrients, and water. In general, soil chemical fertility, particularly a lack of nutrient inputs, plays an important role in soil degradation (Hartemink, 2010). The physicochemical characteristics of different soils alter in place and time due to changes in topography, climate, physical weathering

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processes, plant cover, microbiological activity, and several other biotic and abiotic variables (Paudel and Sah, 2003). Variability of nutrition availability is a natural phenomenon; certain locations may have enough nutrients, while others may be deficient. Variability within a soil may exist depending on the soil's hydrological properties (Kumar *et al.,* 2013). Soil health refers to the soil's physical, chemical, and biological condition, as well as its capacity to support plant growth (Idowu *et al.,* 2019). A healthy soil comprises around 40% minerals, 23% water, 23% air, 6% organic matter, and 8% living organisms (Zaiad, 2010). Soil contains intrinsic and dynamic properties, including vertical and horizontal geographical fluctuations (Potdar *et al.,* 2020). There is a strong link between agriculture and soil physical and chemical qualities. These qualities vary greatly with soil types, which limit the water and nutrient intake by plants (Mueller *et al.,* 2011). Real-time physicochemical study of soil is crucial due to the growing usage of chemical fertilisers and the challenges of controlling their negative impacts on soil, plants, animals, and people (Kulkarni *et al.,* 2011) and (Raut and Ekbote 2012).

Soil is crucial for various ecological services, including stimulating plant growth and regulating water, nutrients, and contaminants movement (Kumar *et al.,* 2016; Scholes and Scholes, 2013). Crop production is heavily influenced by the physicochemical qualities of soil (Gairola and Soni, 2010). The soil resource database must be updated in order to apply fertiliser efficiently and choose crops suitable for a specific region (Nayak *et al.,* 2022). Soil's physical properties, including depth, porosity, water holding capacity, texture, crusting, and aggregation, influence root growth, seedling development, and water transport between particles (Yadav and Verma, 2019). Soil contains intrinsic and dynamic properties, including vertical and horizontal geographical fluctuations (Potdar *et al.,* 2020). Soil fertility is crucial for plant growth, influenced by the levels of N, P, K, micronutrients, and water in organic and inorganic materials. Variability of nutrition availability is a natural phenomenon; certain locations may have enough nutrients, while others may be deficient. The availability of nutrients and organic matter in the soil influences plant development (Yadav and Verma, 2019). Depending on the hydrological qualities of the soil, there may be some variability within it (Kumar *et al.,* 2013). Farmers tend to apply more nitrogen fertiliser for a greener crop and use sub-optimal amounts of phosphorus or completely disregard its administration, resulting in uneven nutrient application and consequently decreasing nutrient utilisation efficiency (Sapkota *et al.,* 2014). N, P, and K are known as soil's key macronutrients, and they are needed for the health and performance of plants (Tewari *et al.,* 2016). Plants rely on soil components like nitrogen, potassium, and phosphorus to flourish, hence soil type has a significant role (Wagh *et al.,* 2013). Different land uses have a significant impact on soil physiochemical characteristics, nutrient dynamics, and supplies (Murty *et al.,* 2002; Jiang *et al.,* 2009). Cropping systems affect soil qualities based on crop rotations, fertiliser additions, and tillage techniques (Jokela *et al.,* 2011). Land-use impacts the distribution and availability of macro-nutrients, including phosphorus (P), biomass output, and SOM levels. Land-use also has an indirect impact (Genxu *et al.,* 2004; Gowthamchand *et al.,* 2023; Somasundaram *et al.,* 2013). Soil parameters including pH, EC, OC, CaCO3, and available P and K vary depending on the land use system in the particular region (Dhaliwal *et al.,* 2021). Soil physicochemical analysis is a beneficial procedure for determining the quantity of nutrients in soil, including potassium, phosphorus, organic content, and pH. This information is critical for increasing soil quality and assisting with fertiliser control. Soil physico-chemical analysis may also assist farmers comprehend economic productivity, as well as the quality and amount of food that can be produced.

MATERIALS AND METHODS

Study area

The research region is located in Western Uttar Pradesh's Moradabad district (28°-21 to 28°-16 north latitude and 78°-4 to 79° east longitude).

Soil sampling

Between April 2022 and July 2023, 80 soil samples from different depth (0-10, 10-20 & 20-30cm) were collected from different agricultural fields. Soil samples were obtained from eight administrative blocks in Moradabad district, each representing a different agro-ecosystem. The entire study area was divided into four different sub-divisions: Sub-division-I Moradabad (Blocks i.e. Moradabad-MO-JSP-4, Mundapandey-MP-JSP-2, Bhagatpur Tanda - BT-JSP-1), Sub-division-II Bilari (Blocks i.e. Bilari-BL-JSP-5, Kunderki-KN-JSP-6), Sub-division-III Kanth (Block i.e. Chhajlet-CH-JSP-3), and Sub-division-IV Thakurdwara (Blocks i.e. Thakurdwara-TK-JSP-7 and Dilari-DL-JSP-8), and 10 soil samples FROM deferent soil depths were collected from each administrative block, using the conning and quartering technique. The samples were transferred to clean polythene bags and tagged. The process involved removing unwanted items, shattering clods, sieving samples, and analysing their physical and chemical characteristics using a 2 mm sieve and aluminium tag.

Soil physicochemical analysis

All physicochemical analyses of soil were carried out at Moradabad Soil and Culture Laboratory. Moisture (%) is determined using the weighting method. Water retention capacity (%) was calculated using the method described by (Trivedy and Goel, 1984). The organic carbon (%) in soil samples was determined using the fast titration method developed by (Walkley and Black, 1934). Phosphorus (kg ha^{-1}), availability in soil is determined by bicarbonate test (Olsen, 1954). The potash (kg ha^{-1}) concentration of the soil was measured using a flame photometer (Aines, 1951). The alkaline potassium permanganate method was used to determine the amount of nitrogen (kg ha^{-1}) extracted from soil samples (Subbiah and Asija, 1956). The pH and electrical conductivity (EC) (dSm^{-1}) of soil samples in soil water suspension were measured using a glass electrode in a digital pH meter and a systronics electrical conductivity meter, respectively (Jackson, 1973).

RESULTS AND DISCUSSION

Soil Moisture

Water content, often known as soil moisture, refers to the amount of water present in a substance. Moisture is one of the most significant characteristics of soil. The absorption of nutrients by soil is heavily influenced by the moisture content of the soil. Moisture content also has an effect on soil texture (Kekane *et al.,* 2015). In one instance, soil with higher organic matter content can result in decreasing the irrigation water demand relative to soil with lower organic matter content because it retains more soil moisture (Murphy, 2015). In our findings we reported that moisture content of soil will increase as the soil depth (0-10, 10-20, 20-30cm) increase, in BT-JSP-1moisture content represent as 21.95 to 24.08%, 18.24 to 21.35% in MP-JSP-2, 16.28 to 18.97% in CH-JSP-3, 20.35 to 21.98% in MO-JSP-4, 19.46 to 22.78% in BL-JSP-5, 21.86 to 23.65% in KN-JSP-6, 20.67 to 22.78% in TK-JSP-7 and 21.96 to 23.05% in DL-JSP-8 (Table 2) blocks of district and similar findings were represented by (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023).

Soil temperature and Water holding capacity

Soil temperature is proportional to the amount of energy received and lost. Soil has a temperature range of -20 to 60°C. Soil temperature is crucial for plant growth since it affects chemical, physical, and biological processes. Soil temperature varies depending on season, time of day, and local climate (Kekane *et al.,* 2015). Soil temperature of soils ranged from 10.1 to 25.2°C (Table 1). Lower organic matter in the region might be attributed to the high temperature and adequate aeration in the soil, which accelerates the rate of oxidation of organic matter content (Kumar *et al.,* 2013). Soil temperature decrease as we move towards the soil depth (0-10, 10-20, 20-30cm) and we reported that 14.6 to 10.1°C depth wise in BT-JSP-1, 15.75 to 11.2°C in MP-JSP-2, 16.2 to 10.3°C in CH-JSP-3, 16.6 to 11.2°C in MO-JSP-4, 18.25 to 10.3°C in BL-JSP-5, 16.75 to 10.4°C in KN-JSP-6, 16.05 to 11.2°C in TK-JSP-7 and 16.45 to 10.3°C in DL-JSP-8 (Table 2) blocks of district and (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023) also reported similar results from soils.

W.H.C. (%) of soil ranged from 22.85% to 54.28% (Table 1). Minimum W.H.C. (22.85%) was reported from BT-JSP-1 and KN-JSP-6 block and maximum (54.28%) from Bilari. In the context of sub-division level minimum value (22.85%) from Moradabad and Thakurdwara while maximum from Bilari.

Table 1: Blocks wise physicochemical analysis of agricultural soil (0-10cm) from Moradabad District Uttar Pradesh, India

Soil Parameters	BT-JSP-1		MP-JSP-2		CH-JSP-3		MO-JSP-4		BL-JSP-5		KN-JSP-6		TK-JSP-7		DL-JSP-8	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
pH	7.03	7.18	7.03	7.1	7.21	7.4	7.3	7.4	7.29	7.3	7.31	7.32	7.1	7.12	7.07	7.14
Average	7.10	N/A	7.06	N/A	7.30	N/A	7.35	N/A	7.29	N/A	7.31	N/A	7.11	N/A	7.10	N/A
Temp. ^{0}C	10.1	19.1	11.3	20.2	10.4	22	12.2	21	11.3	25.2	12.1	21.4	12	20.1	11.5	21.4
Average	14.6	N/A	15.75	N/A	16.2	N/A	16.6	N/A	18.25	N/A	16.75	N/A	16.05	N/A	16.45	N/A
W.H.C (%)	22.85	45.71	25.71	48.50	34.28	42.80	34.28	51.42	25.71	54.28	22.85	51.42	34.28	48.50	22.85	45.71
Average	34.28	N/A	37.10	N/A	38.54	N/A	42.85	N/A	39.99	N/A	37.13	N/A	41.39	N/A	34.28	N/A
Soil Moisture (%)	19.00	24.90	16.25	20.23	12.24	20.32	16.29	24.41	13.46	25.46	18.34	25.38	18.27	23.07	18.78	25.14
Average	21.95	N/A	18.24	N/A	16.28	N/A	20.35	N/A	19.46	N/A	21.86	N/A	20.67	N/A	21.96	N/A
E.C (dSm^{-1})	0.42	0.84	0.4	0.52	0.41	0.53	0.59	0.63	0.65	0.65	0.7	0.73	0.85	0.88	0.87	0.88
Average	0.63	N/A	0.46	N/A	0.47	N/A	0.61	N/A	0.65	N/A	0.71	N/A	0.86	N/A	0.87	N/A
O.C (%)	0.44	0.47	0.46	0.5	0.26	0.35	0.36	0.36	0.33	0.36	0.38	0.43	0.45	0.51	0.45	0.45
Average	0.45	N/A	0.48	N/A	0.30	N/A	0.36	N/A	0.34	N/A	0.40	N/A	0.48	N/A	0.45	N/A
N (kg ha^{-1})	86.96	100.81	82.54	84.13	81.83	88.08	82.37	83.33	71.24	75.15	83.04	85	102.49	103.56	101.75	103.5
Average	93.88	N/A	83.33	N/A	84.95	N/A	82.85	N/A	73.19	N/A	84.02	N/A	103.02	N/A	102.62	N/A
P (kg ha^{-1})	22.13	23.5	20.29	20.91	18.72	18.76	19.53	19.71	17.28	18.03	16.52	16.76	13.66	13.9	14.14	14.61
Average	22.81	N/A	20.60	N/A	18.74	N/A	19.62	N/A	17.65	N/A	16.64	N/A	13.78	N/A	14.37	N/A
K (kg ha^{-1})	210	217.91	179.63	216.1	175.78	189.46	170.39	172.94	182.42	187.29	161.98	170.9	159.1	159.31	159.15	167.7
Average	213.95	N/A	197.86	N/A	182.62	N/A	171.66	N/A	184.85	N/A	166.44	N/A	159.20	N/A	163.42	N/A

These variances were caused by clay, silt, and O.C. (%), whereas sandy soils had low W.H.C. due to high sand and low clay content. We found that water holding capacity will decrease as the soil depth increase and our findings are as 34.28 to 28.20% WHC in BT-JSP-1, 37.10 to 33.24% in MP-JSP-2, 38.54 to 34.65% in CH-JSP-3, 42.85 to 38.67% in MO-JSP-4, 39.99 to 35.85% in BL-JSP-5, 37.13 to 32.12% in KN-JSP-6, 41.39 to 37.24% in TK-JSP-7 and 34.28 to 30.14% in DL-JSP-8 (Table 2) blocks of subdivisions, and similar findings were also presented by (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023).In all samplings, the average W.H.C. was found to be higher in fields located distant from the banks of rivers at all sites tested. W.H.C. increases with higher organic carbon levels and soil silt and clay particles due to their larger surface area for water storage (Tewari *et al.,* 2016). Verma *et al.* (2019) reported that the water holding capacity in Allahabad district of Uttar Pradesh soils ranged from 45.71 to 66.66%.

Soil pH

pH is an essential physicochemical property of soil because it influences the activity of microorganisms. The solubility of most nutrients' changes with pH (Singh *et al.,* 2016). Lower pH in surface soil limits microbial activity and nitrogen nodulation, leading to nitrogen deficiency for plants (Cienciala *et al.,* 2016). Soil pH in Moradabad district ranged from 7.03 to 7.40, indicating neutral to alkali character. At block level minimum pH (7.03) was reported from BT-JSP-1 and MP-JSP-2 while maximum (7.40) from CH-JSP-3 and MO-JSP-4 (Table 1). Soil depth wise pH will be increase and we found that 7.10 to 8.05 in BT-JSP-1, 7.06 to 8.06 in MO-JSP-2, 7.30 to 8.07 in CH-JSP-3, 7.35 to 8.08 in MO-JSP-4, 7.29 to 8.01 in BL-JSP-5, 7.31 to 8.02 in KN-JSP-6, 7.11 to 8.03 in TK-JSP-7 and 7.10 to 8.03 in DL-JSP-8 (Table 2) Blocks and similar findings were from (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023). Kumar and Verma, (2019) reported that the pH in Bareilly district of Uttar Pradesh soils ranged from 6.50 to 7.80. Kumar *et al.* (2015) found that the pH in subtropical Uttar Pradesh soils ranged from 4.36 to 8.57. Amritanshu *et al.,* (2023) reported that the pH in Dehradun district of Uttarakhand soils ranged from 5.38 to 7.88. Verma *et al.,* (2019) reported that the pH in Allahabad district of Uttar Pradesh soils ranged from 7.35 to 8.12.

Electrical conductivity (dSm^{-1})

Electrical conductivity is a powerful indicator of soil texture (Kekane *et al.,* 2015). Soil electrical conductivity (EC) is a measurement that connects with soil qualities and influences soil texture, cation exchange capacity, drainage conditions, organic matter level, salinity, and sub-soil features (Solanki and Chavda, 2012). Furthermore, electrical conductivity is an excellent indicator of dissolved solids (Singare *et al.,* 2011). In Reasi district (J&K), Choudhary, 2024 found EC values

Table 2: Block wise physicochemical analysis of agricultural soil depth (0-10), (10-20) and (20-30cm) from eight blocks of Moradabad district

Sr. No.	Soil Depth	Soil Parameter	BT-JSP-1	MP-JSP-2	CH-JSP-3	MO-JSP-4	BL-JSP-5	KN-JSP-6	TK-JSP-7	DL-JSP-8
1a.	0-10 cm	pH	7.10	7.06	7.30	7.35	7.29	7.31	7.11	7.10
1b.	10-20 cm	pH	7.93	7.87	7.93	7.92	7.45	7.84	7.77	7.86
1c.	20-30 cm	pH	8.05	8.06	8.07	8.08	8.01	8.02	8.03	8.03
2a.	0-10 cm	Moisture (%)	21.95	18.24	16.28	20.35	19.46	21.86	20.67	21.96
2b.	10-20 cm	Moisture (%)	22.65	19.35	18.24	21.23	21.22	22.78	21.98	22.45
2c.	20-30 cm	Moisture (%)	24.08	21.35	18.97	21.98	22.78	23.65	22.78	23.05
3a.	0-10 cm	Temp. ^{0}C	14.6	15.75	16.2	16.6	18.25	16.75	16.05	16.45
3b.	10-20 cm	Temp. ^{0}C	12.3	11.3	13.2	14.2	11.3	11.3	12.2	13.2
3c.	20-30 cm	Temp. ^{0}C	10.1	11.2	10.3	11.2	10.3	10.4	11.2	10.3
4a.	0-10 cm	W.H.C (%)	34.28	37.10	38.54	42.85	39.99	37.13	41.39	34.28
4b.	10-20 cm	W.H.C (%)	31.22	35.73	36.88	41.02	37.23	35.24	39.65	32.16
4c.	20-30 cm	W.H.C (%)	28.20	33.24	34.65	38.67	35.85	32.12	37.24	30.14
5a.	0-10 cm	E.C (dSm^{-1})	0.63	0.46	0.47	0.61	0.65	0.71	0.86	0.87
5b.	10-20 cm	E.C (dSm^{-1})	0.65	0.49	0.49	0.62	0.67	0.72	0.88	0.88
5c.	20-30 cm	E.C (dSm^{-1})	0.67	0.50	0.50	0.64	0.68	0.74	0.89	0.89
6a.	0-10 cm	O.C (%)	0.45	0.48	0.30	0.36	0.34	0.40	0.48	0.45
6b.	10-20 cm	O.C (%)	0.34	0.35	0.19	0.26	0.23	0.29	0.37	0.34
6c.	20-30 cm	O.C (%)	0.22	0.24	0.10	0.14	0.12	0.17	0.25	0.26
7a.	0-10 cm	N (kg ha^{-1})	93.88	83.33	84.95	82.85	73.19	84.02	103.02	102.62
7b.	10-20 cm	N (kg ha^{-1})	54.83	52.65	53.78	51.24	54.68	55.37	64.65	62.96
7c.	20-30 cm	N (kg ha^{-1})	47.23	44.89	43.25	44.26	40.26	39.87	48.43	47.98
8a.	0-10 cm	P (kg ha^{-1})	22.81	20.60	18.74	19.62	17.65	16.64	13.78	14.37
8b.	10-20 cm	P (kg ha^{-1})	18.23	16.47	15.34	15.24	13.25	12.36	10.35	12.35
8c.	20-30 cm	P (kg ha^{-1})	12.54	13.96	11.36	12.97	11.23	10.34	9.45	10.37
9a.	0-10 cm	K (kg ha^{-1})	213.95	197.86	182.62	171.66	184.85	166.44	159.20	163.42
9b.	10-20 cm	K (kg ha^{-1})	209.11	195.65	180.43	170.23	182.22	163.66	157.67	162.21
9c.	20-30 cm	K (kg ha^{-1})	204.16	191.35	175.78	162.34	178.25	154.35	151.17	153.35

Bhagatpur Tanda BT-JSP-1, Mundapandey MP-JSP-2, Chhajlet CH-JSP-3, Mordabad MO-JSP-4, Bilari BL-JSP-5, Kunderki KN-JSP-6, Thakurdwara TK-JSP-7, Dilari DL-JSP-8

ranging from 0.04 to 0.47 dSm^{-1} with an average of 0.18 dSm^{-1}. The EC of surface soil samples from the study site was 0.40 to 0.88 it was less than 1dSm^{-1} (Table 1). Block Mundapandey represents the minimum value (0.40 dSm^{-1}), and Thakurdwara as maximum (0.88 dSm^{-1}). Sharma *et al.,* (2008) found similar results in Amritsar soils with EC values ranging from 0.10 to1.00 dSm^{-1}. Yadav and Verma (2019) reported that the EC in Bareilly district of Uttar Pradesh soils ranged from 0.40 to 0.80. Amritanshu *et al.,* (2023) reported that the EC in Dehradun district of Uttarakhand soils ranged from 0.11- 0.44 dSm^{-1}. Verma *et al.,* (2019) reported that the EC in Allahabad district of Uttar Pradesh soils ranged from 0.48 - 0.54 dSm^{-1}. EC of soil will increase depth wise, in our findings EC of soil in BT-JSP-1 was 0.63 to 0.67 dSm^{-1}, 0.46 to 0.50 dSm^{-1} in MP-JSP-2, 0.47 to 0.50 dSm^{-1} in CH-JSP-3, 0.61 to 0.64 dSm^{-1} in MO-JSP-4, 0.65 to 0.68 dSm^{-1} in BL-JSP-5, 0.71 to 0.74 dSm^{-1} in KN-JSP-6, 0.86 to 0.89 dSm^{-1} in KN-JSP-7 and 0.87 to 0.89 dSm^{-1} in DL-JSP-8 (Table 2) block of district and (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023) found the similar findings of soil.

Organic carbon (%)

Organic matter in soil improves plant nutrient absorption by decomposing plant and animal wastes using microbial biomass (Asadi *et al.,* 2012). Soil organic carbon serves a crucial function in preserving soil integrity and providing plant nutrients (Solanki and Chavda, 2012). Soil pH, SOM concentration, and rhizosphere conditions all have an impact on soil micronutrient availability, which may be altered by land-use changes that modify both physicochemical and biological features (Jiang *et al.,* 2009**).** Crop waste, animal manure, green manure, and organic fertilisers are some of the sources of organic carbon in soil. In our findings organic carbon percentages ranged from 0.26% to 0.51% (Table 1). Block CH-JSP-3 represents the minimum value (0.26%) and TK-JSP-7 maximum (0.51%) organic carbon. Soil OC showed an increasing trend with time in all the residue incorporation (Ladha *et al.,* 2004). Meena *et al.,* (2006) discovered that the OC content ranged from 0.19 to 0.90%, with a mean value of 0.45% in Tonk, Rajasthan soils. Yadav and Verma (2019) reported that the OC in Bareilly district of Uttar Pradesh soils ranged from 0.15% to 1.20%. Amritanshu *et al.,* (2023) reported that the OC in Dehradun district of Uttarakhand soils ranged 0.27 to 1.16%. Verma *et al.,* (2019) reported that the OC in Allahabad district of Uttar Pradesh soils ranged from 0.84 to 1.51%. Organic matter improves water retention capacity, making water more available in sandy and loamy soils (Yadav and Verma, 2019). Depth wise OC will decrease and we reported, 0.45 to 0.22% from BT-JSP-1, 0.48 to 0.24% from MP-JSP-2, 0.30 to 0.10% from CH-JSP-3, 0.36 to 0.14% from MO-JSP-4, 0.34 to 0.12% from BL-JSP-5, 0.40 to 0.17% from KN-JSP-6, 0.48 to 0.25% from TK-JSP-7 and 0.45 to 0.26% from DL-JSP-8 (Table 2) blocks of district Moradabad and similar results were presented by (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023).

Available nitrogen in soil (kg ha^{-1})

Nitrogen appears to have the quickest and most dramatic impact among the macro and micro nutrients often employed in chemical fertilisers, therefore it is regarded as a potent nutrition element that must not only be converted but also appropriately maintained (Kumar *et al.,* 2013). The majority of N in the soil is affected by the OC present in the soil (Baruah and Barthakur, 1997). In our results available N, concentration of soil samples ranged from 71.24 to 103.56 kg ha^{-1}, as shown in Table 1. Findings represents that minimum nitrogen value (71.24 kg ha^{-1}) reported from Bilari and maximum (103.56 kg ha^{-1}) from Thakurdwara. Kumar *et al.,* (2013) reported the range of Nitrogen 99.32 to 398.97 kg ha^{-1} in different soil samples of Muzaffarnagar District of U. P. India, along with Ganga canal command area. Borkotoki *et al.,* (2024) reported, available N levels varied from 37.33 kgha^{-1} to 687.76 kgha^{-1}, with an average of 280.94 kgha^{-1} in Lakhimpur district of Assam. Nitrogen level of soil will decrease as the soil depth increase and we reported, 93.88 to 47.23 kg ha^{-1} in BT-JSP-1, 83.33 to 44.89 kg ha^{-1} in MP-JSP-2, 84.95 to 43.25 kg ha^{-1} in CH-JSP-3, 82.85 to 44.26 kg ha^{-1} in MO-JSP-4, 73.19 to 40.26 kg ha^{-1} in BL-JSP-5, 84.02 to 39.87 kg ha^{-1} in KN-JSP-6, 103.02 to 48.43 kg ha^{-1} in TK-JSP-7 and 102.62 to 47.98 kg ha^{-1} in DL-JSP-8 (Table 2) blocks and (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023) also reported the same findings. Low nitrogen status in soils might be related to a lack of organic carbon in the soils, and variable rainfall has a significant influence on nitrogen availability.

Table 3: Fertility categories of agricultural soil as per Soil and culture lab Moradabad, Uttar Pradesh, India

Soil Parameters	Minimum Value	Low value	Medium Value	High value
pH	0 – 6.5 acidic soil	6.5- 8.5 normal soil	> 8.5 alkaline	-
E.C (dSm^{-1})	< 1.0 normal	1-2 optimums for seed germination.	2-3 salt active, optimum for crop	>3 harm full for more crops
O.C (%)	< 0.20	0.21 - 0.50	0.51- 0.80	> 0.81
P (kg ha^{-1})	0 - 10.0	10.1-20.0	20.1- 40.0	> 40.0
K (kg ha^{-1})	0 - 50.0	51- 100	101- 250	> 250

Bhagatpur Tanda BT-JSP-1, Mundapandey MP-JSP-2, Chhajlet CH-JSP-3, Mordabad MO-JSP-4, Bilari BL-JSP-5, Kunderki KN-JSP-6, Thakurdwara TK-JSP-7, Dilari DL-JSP-8

Available phosphorus in soil (kg ha^{-1})

Phosphorus, the Master Key element to Agriculture, is crucial for maintaining plant nutrient balance and ensuring appropriate crop growth, despite low crop output often attributed to phosphorus shortages. The available P in soils of our study ranged from 13.66 to 23.50 kg ha^{-1} in different soil, mentioned in Table 1. Block TK-JSP-7 represents minimum value (13.66 kg ha^{-1}) and maximum value (23.50 kg ha^{-1}) from BT-JSP-1. Kumar *et al.,* (2013) reported the range of phosphorus 11.17 to 52.61 kg ha^{-1} in different soil samples of Muzaffarnagar District of

Table 4: Sub-division wise physicochemical properties of soil (0-10 cm) in Moradabad district, Uttar Pradesh, India

Sub-Division	pH		Temp. ^{0}C		W.H.C (%)		Moisture (%)		E.C (dSm^{-1})		O.C (%)		N (kg ha^{-1})		P (kg ha^{-1})		K (kg ha^{-1})	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
Moradabad	7.03	7.4	10.1	21.0	22.85	51.42	16.25	24.90	0.4	0.84	0.36	0.5	82.37	100.81	19.53	23.5	170.39	217.91
Average	7.21	N/A	15.55	N/A	37.135	N/A	20.57	N/A	0.6	N/A	0.43	N/A	91.59	N/A	21.51	N/A	194.15	N/A
Bilari	7.3	7.32	11.3	25.2	22.85	54.28	13.46	25.38	0.65	0.73	0.33	0.43	71.24	85.00	16.52	18.03	161.98	187.29
Average	7.31	N/A	18.25	N/A	38.56	N/A	19.42	N/A	0.69	N/A	0.38	N/A	78.12	N/A	17.27	N/A	174.63	N/A
Kanth	7.21	7.4	10.4	22.0	34.28	42.80	12.24	20.32	0.41	0.53	0.26	0.35	81.83	88.08	18.72	18.76	175.78	189.48
Average	7.30	N/A	16.2	N/A	38.54	N/A	16.28	N/A	0.47	N/A	0.30	N/A	84.95	N/A	18.74	N/A	182.63	N/A
Thakurdwara	7.07	7.14	11.5	21.4	22.85	48.50	18.27	23.07	0.85	0.89	0.45	0.51	101.75	103.58	13.66	14.61	159.15	167.7
Average	7.10	N/A	16.45	N/A	35.67	N/A	20.67	N/A	0.87	N/A	0.48	N/A	102.66	N/A	14.13	N/A	163.42	N/A

U.P. India, along with Ganga canal command area. These findings are consistent with Singh *et al.,* (2016), who showed that phosphorus levels varied from medium to high in the Kapurthala area of Punjab. Ganorkar *et al.,* (2013) reported phosphorus ranged from 18.5 to 25 kg ha^{-1} of Soil in Rajura Bazar in Amravati District of Maharastra India. Yadav and Verma (2019) reported that the phosphorous in Bareilly district of Uttar Pradesh soils ranged from 4.50 to 13.50 kg ha^{-1}. Amritanshu *et al.,* (2023) reported that the phosphorus in Dehradun district of Uttarakhand soils ranged from 3.15 to 50.96 kg ha^{-1}. Phosphorus content decrease depth wise, in our findings we reported, 22.81 to 12.54 kg ha^{-1} from BT-JSP-1 block, 20.60 to 13.96 kg ha^{-1} from MP-JSP-2, 18.74 to 11.36 kg ha^{-1} from CH-JSP-3, 19.62 to 12.97 kg ha^{-1} from MO-JSP-4, 17.65 to 11.23 kg ha^{-1} from BL-JSP-5, 16.64 to 10.34 kg ha^{-1} from KN-JSP-6, 13.78 to 9.45 kg ha^{-1} from TK-JSP-7 and 14.37 to 10.37 kg ha^{-1} from DL-JSP-8 (Table 2) block (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023) also found the similar findings.

Available potassium in soil (kg ha^{-1})

Potassium is an essential nutrient that promotes plant development and the synthesis of amino acids and proteins (Aziz *et al.,* 2010). The available K in soils of Moradabad district ranged from 159.10 to 217.91 kg ha^{-1}, minimum from TK-JSP-7 block and maximum from BT-JSP-1 (Table 1). Singh and Pathak (2018) reported that available K was higher in top soil than sub soil. Athokpam *et al.,* (2013) observed that the extractable potassium ranged from 55.60 to 359.11 kg ha^{-1}, with an average of 208.06 kg ha^{-1} in the soils of Manipur's Senapati district. Yadav and Verma (2019) reported that the Potash in Bareilly district of Uttar Pradesh soils ranged from 134 to 179 kg ha^{-1}. K will decrease, soil depth wise and in our findings we reported, 213.95 to 204.16 kg ha^{-1} from BT-JSP-1 block, 197.86 to 191.35 kg ha^{-1} from MP-JSP-2, 182.62 to 175.78 kg ha^{-1} from CH-JSP-3, 171.66 to 162.34 kg ha^{-1} from MO-JSP-4, 184.85 to 178.25 kg ha^{-1} from BL-JSP-5, 166.44 to 154.35 kg ha^{-1} from KN-JSP-6, 159.20 to 151.17 kg ha^{-1} from TK-JSP-7 and 163.42 to 153.35 kg ha^{-1} from DL-JSP-8 (Table 2) block of district and (Noman *et al.,* 2021; Mandal *et al.,* 2018 and Pandey *et al.,* 2023) also reported the similar findings. Overall inference of current study at blocks levels reveals that, pH value ranged from (7.03 to 7.40) shows that neutral to little alkaline nature of the soil. In the context of electrical conductivity status of soil in different blocks represents that electrical conductivity ranged from (0.40 to 0.88 dSm^{-1}), and it is less than 1 dSm^{-1}, not optimum for seed germination. Organic carbon ranged from (0.26 to 0.50%), and it represent that low value of the organic carbon in all the blocks except block TK-JSP-7 (0.51%) and show medium value. Nitrogen ranged from (71 to 103.56 kg ha^{-1}). In the context of phosphorus status block BT-JSP-1 represents medium value (22.13 to 23.50 kg ha^{-1}) except all blocks as low value. K status in the soil of Moradabad represents that medium value (159.10 to 217.91 kg ha^{-1}) in all the administrative blocks of four subdivisions. The study suggests that improving soil quality through improved cropping practices and limiting chemical fertilizers, as well as using organic manure, can restore nutrient balance in Moradabad's soil. This study can help discover crop compatibility and cropping calendars in different agro-ecosystems in the Moradabad district.

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REFERENCES

Aines, P.D. (1951) Determination of Sodium and Potassium in Blood, Plasma, and Milk by Means of the *Beckman Flame Spectrophotometer*. Cornell University.

Amritanshu, S. P., Tyagi, A., Srivastava, A., and Pathak, A. (2023) Status of some extractable macro-and micro-nutrients in the soils of Dehradun district of Uttarakhand. *Annals of Plant and Soil Research* **25**(2): 221-229.

Asadi, H., Raeisvandi, A., Rabiei, B. and Ghadiri, H. (2012) Effect of land use and topography on soil properties and agronomic productivity on calcareous soils of a semiarid region, Iran. *Land Degradation & Development* **23**(5): 496-504.

Athokpam, H., Wani, S.H., Kamei, D., Athokpam, H. S., Nongmaithem, J., Kumar, D., and Devi, L. (2013) Soil macro-and micro-nutrient status of Senapati district, Manipur (India). *African Journal of Agricultural Research* **8**(39): 4932-4936.

Aziz, T., Ullah, S., Sattar, A., Nasim, M., Farooq, M., and Khan, M. M. (2010) Nutrient availability and maize (*Zea mays*) growth in soil amended with organic manures. *International Journal of Agriculture and Biology* **12**(4): 621-624.

Baruah, T.C., and Borthakur, H.P. (1997) *Soil Chemistry*. A textbook of soil analysis. Vikas Publishing House Pvt. Ltd., New Delhi, 118-132.

Borkotoki, B., Bhattacharyya, D., Sharma, K. K., Goswami, P.S.P., and Bora, B. (2024) Soil nutrient mapping of the Lakhimpur district of Assam using geospatial technology. *Annals of Plant and Soil Research* **26**(1): 1-13.

Chaudhary, S.K. (2024) Physico-chemical properties, available nutrient content and their inter-relationship in soils under rain fed maize-wheat cropping system, district Reasi (J&K). *Annals of Plant and Soil Research* **26**(1): 82-88.

Cienciala, E., Russ, R., Šantrůčková, H., Altman, J., Kopáček, J., Hůnová, I. and Ståhl, G. (2016) Discerning environmental factors affecting current tree growth in Central Europe. *Science of the Total Environment* **573**: 541-554.

Dhaliwal, S.S., Sharma, V., Kaur, J., Shukla, A. K., Hossain, A., Abdel-Hafez, S.H. and Singh, V.K. (2021) The pedospheric variation of DTPA-extractable Zn, Fe, Mn, Cu and other physicochemical characteristics in major soil orders in existing land use systems of Punjab, India. *Sustainability* **14**(1): 29.

Gairola, S. U., & Soni, P. (2010) Role of soil physical properties in ecological succession of restored mine land–A case study. *International journal of environmental sciences* **1**(4): 475-480.

Ganorkar, R. P., Chinchmalatpure, P. G., and Ganorkar, R. P. (2013) Physicochemical assessment of soil in Rajura Bazar in Amravati district of Maharastra (India). *International Journal of Chemical, Environmental and Pharmaceutical Research* **4**(2&3): 46-49.

Genxu, W., Haiyan, M., Ju, Q. and Juan, C. (2004) Impact of land use changes on soil carbon, nitrogen and phosphorus and water pollution in an arid region of northwest China. *Soil use and Management* **20**(1): 32-39.

Gowthamchand, Dhaliwal, S. S., Sharma, V., Verma, G., Singh, J. and Kaur, M. (2023) Variation of physico-chemical properties among different soil orders under different land use systems of the Majha Region in North-Western India. *Sustainability* **15**(6): 4779.

Hartemink, A.E. (2010) Land use change in the tropics and its effect on soil fertility. In *Proceedings 19th World Congress of Soil Science, Brisbane, Australia*, 01-06 August, 2010 (pp. 55-58).

Idowu, J., Ghimire, R., Flynn, R. and Ganguli, A. (2019) *Soil Health: Importance,* *Assessment, and Management*. Urbana, IL, USA: College of Agricultural, Consumer and Environmental Sciences. Circular 694B. aces.nmsu.edu/pubs.

Jackson, M.L., (1973) *Soil chemical analysis*, Pentice hall of India Pvt. Ltd., New Delhi, India, pp. 183- 204.

Jiang, Y., Zhang, Y.G., Zhou, D., Qin, Y. and Liang, W. J. (2009) Profile distribution of micronutrients in an aquic brown soil as affected by land use. *Plant, Soil and Environment* **55**(11): 468-476.

Jokela, W., Posner, J., Hedtcke, J., Balser, T. and Read, H. (2011) Midwest cropping system effects on soil properties and on a soil quality index. *Agronomy Journal* **103**(5): 1552-1562.

Kardol, P., Martijn Bezemer, T. and Van Der Putten, W. H. (2006) Temporal variation in plant–soil feedback controls succession. *Ecology letters* **9**(9): 1080-1088.

Kekane, S.S., Chavan, R.P., Shinde, D.N., Patil, C. L. and Sagar, S.S. (2015) A review on physico-chemical properties of soil. *International Journal of Chemical Studies* **3**(4): 29-32.

Kulkarni, A.N., Balkhande, B.D., Waghmare, B.D., Ratnakar, P.U. & Karwate, V.S. (2011) Studies of some phtsico-chemical factors of Teak forest soil from Kinwat area, Nanded, Maharashtra. *The Bioscan* **6**(3): 437-438.

Kumar, K.A.I.L.A.S.H. Adak, T.A.R.U.N. and Singh, V.K. (2015) Status and distribution of micronutrients in mango orchards under subtropical region of Uttar Pradesh. *Journal of Agricultural Physics* **15**(2): 127-139.

Kumar, P., Kumar, A., Dhyani, B.P., Kumar, P., Shahi, U.P., Singh, S.P. and Raizada, S. (2013) Soil fertility status in some soils of Muzaffarnagar District of Uttar Pradesh, India, along with Ganga canal command area. *African journal of agricultural research* **8**(14): 1209-1217.

Kumar, V., Bhatti, S.S., and Nagpal, A.K. (2016) Seasonal analysis of physico-chemical parameters of agricultural soil samples collected from banks of rivers Beas and Sutlej, Punjab, India. *Journal of Chemical and Pharmaceutical Research* **8**(8): 439-449.

Ladha, J.K., Khind, C.S., Khera, T.S., and Bueno, C. S. (2004) Effects of residue decomposition on productivity and soil fertility in rice–wheat rotation. *Soil Science Society of America Journal* **68**(3): 854-864.

Mandal, A., Toor, A.S. & Dhaliwal, S.S. (2018) Effect of land-uses on physico-chemical properties and nutrient status of surface (0–15 cm) and sub-surface (15–30 cm) layers in soils of South-Western Punjab, India. *International Journal of Current Microbiology Applied Sci*ence **7**(1): 2659-2671.

Meena, H.B., Sharma, R.P., & Rawat, U.S. (2006) Status of macro-and micronutrients in some soils of Tonk district of Rajasthan. *Journal of the Indian society of soil science* **54**(4): 508-512.

More, B.P., (2022) Analysis of soil to ensure NPK proportion at various sites of Panewadi village, District Nasidk (MS) India, *Journal of Soils and Crops* **32**(1): 164- 166.

Mueller, L., Schindler, U., Mirschel, W., Shepherd, T.G., Ball, B.C., Helming, K. & Wiggering, H. (2011) Assessing the productivity function of soils. *Sustainable Agriculture* **2**: 743-760.

Murphy, B. (2015) Key soil functional properties affected by soil organic matter-evidence from published literature. In *IOP conference series: Earth and environmental science* (**Vol. 25**, No. 1, p. 012008). IOP Publishing.

Murty, D., Kirschbaum, M.U., Mcmurtrie, R.E. and Mcgilvray, H. (2002) Does conversion of forest to agricultural land change soil carbon and nitrogen? A review of the literature. *Global change biology* **8**(2): 105-123.

Nayak, S.B., Basha, S.J., Kiranmai, M.J., and Priya, T.B. (2022) Characterization and classification of farm soils of Regional Agricultural Research Station (RARS), Nandyal, Kurnool district, Andhra Pradesh, *Journal of Soils and Crops* **32**(1): 30-36.

Noman, M., David, A.A., Thomas, T., Swaroop, N., and Hasan, A. (2021) Assessment of Physico-chemical Properties of Soil in Dadrol Block, Shahjahanpur District, Uttar Pradesh, India. *International*

Journal of Current Microbiology and Applied Sciences **10**(7): 30-42.

Olsen, S.R., (1954) Estimation of available phosphorus in soils by extraction with sodium bicarbonate (**No. 939**), US Department of Agriculture: Washington D.C. 1-19.

Pandey, P. R., Zaidi, S.F.A., Kumar, S., Pathak, D., Shukla, G., and Pal, R. (2023) Depth wise studies of physico-chemical properties of soil under different land use system at eastern UP, India. *International Journal of Plant & Soil Science* **35**(18): 762-772.

Paudel, S. & Sah, J.P. (2003) Physiochemical characteristics of soil in tropical sal (*Shorea robusta* Gaertn.) forests in eastern Nepal. *Himalayan Journal of Sciences* **1**(2): 107-110.

Potdar, S. S., Gabhane, V.V., Potdar, H., Wagh, S.P., Pusdekar, M., & Imade, S.R. (2020) Soil quality assessment and mapping for management of resources using geospatical techniques of Shegaon water shade district Chandrapur. *Journal of Soils and Crops* **30**(2): 290-297.

Raut P.P. & Ekbote P.D. (2012) Physicochemical Analysis of Soil Collected from Babhulgaon Region, Dist. Yavatmal (MS), *International Journal of Basic and Applied Research* 112-116.

Sapkota, T.B., Majumdar, K., Jat, M.L., Kumar, A., Bishnoi, D.K., McDonald, A.J., & Pampolino, M. (2014) Precision nutrient management in conservation agriculture-based wheat production of Northwest India: Profitability, nutrient use efficiency and environmental footprint. *Field Crops Research* **155**: 233-244.

Scholes, M.C., & Scholes, R.J. (2013) Dust unto dust. *Science* **342**(6158): 565-566.

Sharma, P.K., Sood, A., Setia, R.K., Tur, N.S., Mehra, D., & Singh, H. (2008) Mapping of macronutrients in soils of Amritsar district (Punjab)–A GIS approach. *Journal of the Indian Society of Soil Science* **56**(1): 23-33.

Singare, P.U., Trivedi, M.P., and Mishra, R.M. (2011) Assessing the physico-chemical parameters of sediment ecosystem of Vasai Creek at Mumbai, India. *Marine Science* **1**(1): 22-29.

Singh, A.K., & Pathak, S.K. (2018) Potassium in tea (*Camellia sinensis* (L) O. Kuntze) cultivation from soil to cup quality-A review. *Agricultural Reviews* **39**(1): 40-47.

Singh, G., Sharma, M., Manan, J., and Singh, G. (2016) Assessment of soil fertility status under different cropping sequences in District Kapurthala. *Journal of Krishi Vigyan* **5**(1): 1-9.

Solanki, H.A., & Chavda, N.H. (2012) Physico-chemical analysis with reference to seasonal changes in soils of Victoria Park reserve forest, Bhavnagar (Gujarat) *Life sciences Leaflets* **8**: 62-68.

Somasundaram, J., Singh, R.K., Parandiyal, A.K., Ali, S., Chauhan, V., Sinha, N.K. & Simaiya, R.R. (2013) Soil properties under different land use systems in parts of Chambal region of Rajasthan. *Journal of Agricultural Physics* **13**(2): 139-147.

Subbiah, B.V., & Asija, G.L. (1956) A rapid procedure for assessment of available nitrogen in rice plots, *Current Science* **31**: 196-200.

Tewari, G., Khati, D., Rana, L., Yadav, P., Pande, C., Bhatt, S., and Joshi, P. K. (2016) Assessment of physicochemical properties of soils from different land use systems in Uttarakhand, India. *Journal of Chemical Engineering and Chemistry Research* **3**(11): 1114-1118.

Trivedy, R.K., & Goel, P.K. (1984) Chemical and biological methods for water pollution studies. *Environmental publications*.

Verma, C., Lal, A., David, A.D., and Rao, P.S. (2019) Determination of physico-chemical properties in soil samples of Prayagraj (Allahabad) District, Uttar Pradesh, India. *Asian Journal of Applied Chemistry Research* **4(**2): 1-8.

Wagh, G.S., Chavhan, D.M. and Sayyed, M.R.G. (2013) Physicochemical Analysis of Soils from Eastern Part of Pune City. *Universal Journal of Environmental Research & Technology* **3**(1): 93-99.

Walkley, A., & Black, I.A. (1934) An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. *Soil science* **37**(1): 29-38.

Yadav, R.K., & Verma, N. (2019) Studies of some soil health parameters of district Bareily, UP (India). *Journal of Soils and Crops* **29**(1): 68-73.

Zaiad, G.M. (2010) Physico-chemical analysis of soils in Al-Khums city, Libya. *Journal of Applied Sciences Research* **6**(8): 1040-1044.