~~Assessment Of~~ Soil ~~Physico-Chemical~~ Physicochemicals ~~Properties of Soil~~ and Irrigation Water Quality of Phulpur ~~Blocks Blocks of Prayagraj District,~~ in Uttar Pradesh

ABSTRACT

~~The~~ We aimed to study ~~of~~ nutrient status in the ~~phulpur~~ Phulpur block of Prayagraj District of Uttar Pradesh. ~~Representative~~ We collected representative soil samples ~~were collected~~ covering nine villages of the ~~phulpur~~ Phulpur division at depths like 0-15cm, 15-30cm, and 30-45cm before the sowing of crops. The soil samples were analyzed for their ~~Physico-chemical~~ physicochemical properties. ~~The samples were taken from different villages of phulpur blocks and depths like 0-15cm, 15-30cm and 30-45cm~~. Results show that the soil samples of the areas of the ~~phulpur~~ Phulpur division were found to be mildly alkaline and non-saline. There are many reasons leading to soil quality deterioration, including changes in land use types from forest to arable land and the consequences ~~from~~ of intensive land use. The colo~~u~~r of the soil changes between the three depths at all ~~the~~ locations. There ~~was~~ were ~~also~~ differences in the colour of dry and wet soils was dark brown to dark yellowish brown. ~~Results show that~~ The soil Bulk Density varied from 1.31 to 1.48% Mgm^{-3}, soil Particle Density ~~varied~~ from 2.44 to 2.57% Mgm^{-3}, ~~Percent of~~ Pore Space from 43.09 to 48.21%, Water Holding Capacity from 35.73 to 44.24% ~~respectively~~. Soil pH varied from 77.25 to 8.92 ~~%~~ and EC ~~is~~ was 0.18 to 0.37% ~~respectively~~ while soil Organic Carbon varied from 0.28 to 0.55% and Available Nitrogen ~~varied~~ from low to medium (~~i.e.,~~ 216 to 323% $kgha^{-1}$), a ~~A~~vailable Phosphorous ~~varied~~ from medium to high ~~range i.e.,~~ (14.05 to 25.71% $kgha^{-1}$), ~~and~~ Potassium was found to be medium range ~~i.e.,~~ (137.00 to 236.00% $kgha^{-1}$), and ~~Exchangeable~~ exchangeable Calcium and Magnesium low from 3.34 to 5.66% ($Meq100g^{-1}$) and 1.36 to 2.74% ($Meq100g^{-1}$). The water pH ~~of water~~ varied from 6.24 to 7.50, ~~T~~the Electrical Conductivity ~~of water ranged~~ from 0.31 to 0.90 dS m^{-1}, ~~The~~ the water Bicarbonate ~~of water varied~~ from 7 to 18 Meq L^{-1}, ~~The~~ chloride ~~of water varied~~ from 4.5 to 10.4 Meq L^{-1}, ~~T~~the Available calcium ~~of water varied~~ from 4.2 to 8 kg ha^{-1}, ~~T~~the Available Magnesium ~~of water varied~~ from 2.5 to 3.6 kg ha^{-1}, ~~T~~he Potassium ~~of water varied~~ from 0.05 to 0.17 Meq L^{-1}, and ~~T~~he Sodium ~~of water varied~~ from 0.08 to 0.21 Meq L^{-1} ~~respectively~~. The Sodium Absorption Ratio (SAR) values ranged from 0.03 to 0.1 Meq L^{-1}, indicating low to moderate levels of sodium content in the water samples. The soluble sodium percent (SSP) ~~values~~ ranged from 1.47 to 3.93 Meq L^{-1}, providing further insight into the sodium content in the water. The residual sodium carbonate (RSC) ~~values~~ varied from -2.4 to 7.4 Meq L^{-1}. The Permeability Index (PI) ~~values~~ ranged from 28 to 56 Meq L^{-1}, serving as an indicator

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of the potential impact of water on soil permeability. ~~Lastly, t~~The Kelley's ratio (KR) ~~values~~ ranged from 0.08 to 0.024 Meq L^{-1}. The lower KR ~~is a measure of the sodium hazard in irrigation water, with lower~~ values ~~indicating~~ indicatea lower risk of sodium-related issues in soil and crops.The range of the irrigation water quality index ~~value~~ ranged from 44 to 157 Meq L^{-1}it was determined that 100% of the samples are in good range for irrigation.

Keywords: Nitrogen, Organic Carbon, pH, ~~Physico-chemical,Properties, Organic Carbon, pH, Nitrogen,~~ Phosphorus, Potassium, Soil Physico-chemical Properties~~Soil,Potassium, Analysis~~.

Introduction

Soil and water are two important natural resources for plant growth development. Soil provides the mechanical support and nutrient reservoir necessary for plant growth. Water is essential for the plant life process. Effective management of these resources for crop production requires an ~~to produce to~~ understandingof the relationships between soil and water.

Soil~~, an unconsolidated material from the Earth's crust,~~ serves as a natural medium for plant growth, dependent on factors like adequate water, temperature, nutrients, and low toxic concentrations. It comprises 50% pore space (air and water) and 50% solid phase, with 45% mineral matter and 5% organic constituents.(Soils and Plant Nutrients).

~~Distinguished as a natural body, s~~Soil consists of layers, known as soil horizons, which encompass weathered mineral materials, organic matter, air, and water. The formation of soil is a complex result of the combined influences of climate, topography, organisms (flora, fauna, and human activities), and parent materials (original rocks and minerals) over time. Consequently, soil exhibits unique properties, different from its parent material, including variations in texture, structure, consistency, color, chemical, biological, and physical characteristics.

~~Recognized as an essential component of both "Land" and "Eco-systems," s~~Soil plays a crucial role in broader concepts encompassing vegetation, water, and climate within the realm of land. Moreover, in the case of ecosystems, social and economic considerations come into play as well (FAO). The significance of soil as a non-renewable dynamic resource cannot be overlooked, as it constitutes unconsolidated minerals and organic matter, including water and air, within the uppermost layers of the Earth's surface. It plays a critical role in maintaining terrestrial ecosystems, which support

all life (Andrew et al.,2020).

The soil'sphysical and ochemical properties of soil hold immense importance in facilitating a plant's ability to extract water and nutrients. The product of biochemical weathering of parent material, soil formation is influenced by factors such as climate, organisms, parent material, relief, and time (Belwal and mehta Mehta 2014). High-quality soils not only yield better food and fiber but also foster the establishment of natural ecosystems and enhance air and water quality. Physical properties, such as shape, structure, size, pore space, organic matter, and mineral composition, directly impact the supporting capability, movement, retention, and availability of water and nutrients to plants. Additionally, they influence root penetration, heat and &airflow, and interact with the chemical and biological properties of the soil. Soil and water constitute fundamental resources for plant growth and agriculture. However, despite Earth's extensive water coverage, only a minute fraction is available for human consumption due to environmental stress caused by developmental activities.

Irrigation water quality significantly impacts soil quality and crop growth. With only 1% freshwater available, its quality, influenced by sediment and salt quantities from various sources, affects osmotic potential, hindering root water absorption.The quality of irrigation water significantly impacts crop yield and soil characteristics, influenced by diverse factors like climate, environment, and soil compositionAlper*et al.*, (2016). Analysis of water quality involves assessing physical, chemical, and biological properties(Chapman, 1996),critical for plant health and environmental preservation. Irrigating crops with sewage water containing heavy metals poses severe health risks to consumers and farmers. The suitability of irrigation water depends on dissolved constituents, with lower divalent ions deemed better. Urbanization and industrialization exert pressure on water resources, especially groundwater, leading to compromised quality and health hazards. India's heavy reliance on groundwater for drinking necessitates thorough quality assessment. Extensive research on the Water Quality Index (WQI) aids in evaluating and managing groundwater resources, essential for sustainable usage amid increasing pollution concerns(Meireles *et al.*, 2010).

In this context, theWe aimed to study of the physico-chemical properties of soil and water collected from various locations of inthe PhulpurPhulpur block of Prayagraj assumes paramount significance. Understanding and optimizing these properties are crucial for sustainable agricultural practices, ecosystem health, and the preservation of this invaluable resource.

1. MaterialsandMethods

1.1 Location:

Comment [es1]: Provide a map for the study area and the sampling sites.

The location of the ~~phulpur~~Phulpuris located ~~on the map with the GPS coordinates of~~at25°55'10"Nand 82°08'84"E.

1.2 SoilandClimate:

In the ~~Phulpur~~Phulpur block of Prayagraj District, the climate is moderate both in the winter and summer seasons in the delta area. The normal maximum and minimum temperatures recorded ~~in the district~~ are 36.20°C to 19.0°C respectively. The annual rainfall is between 1045 and 1170 mm in ~~northern~~ Northern Uttar Pradesh. Districts of the ~~southern~~ Southern ~~region of the~~ Uttar Pradesh state receive less rain during the ~~southwest~~ Southwest monsoon. Uttar Pradesh contains various soil types, some of which are red soil, Alluvial soil, Black soil, Saline soil, Sandy coastal soil, and Rocky hill soil, while red soil is the most abundant among these soils. These soil types allow the planting of a variety of fruits and vegetable crops such as mangoes, Lemon, coconut, sugarcane, paddy, Maize, and Chilies.

1.3 SamplingandAnalysis

The soil sample collection ~~is~~ was carried outfrom the ~~Phulpur~~Phulpur block of Prayagraj district, ~~in the state of~~Uttar Pradesh selecting9villages.Sampleswerecollectedrandomlyfromasite~~ofeach~~pervillageusingsoilkhurpibycompositesamplingmethodat~~a~~depthsof0-15cm,15-30cm,and30-45cm.~~After sampling t~~The samples were airdried ~~in shade and then these samples were~~and processed for~~various~~physical ~~and~~ ochemical tests. ~~The data was recorded during the course of investigation were subjected to statisticalanalysis by analysis of Completely Randomized Design (CRD) as per the method of"AnalysisofVariance"(ANOVA)technique.~~

2.4METHOD OF WATER SAMPLING AND PRESERVATION

~~First, in this study~~ The sample collection of Irrigation water was done in a ~~Sterilized~~ sterilized bottle. Nine water samples were collected from nine ~~different~~ villages in the ~~Phulpur~~Phulpur block of Prayagraj district and ~~analysed~~ analyzed in the Department of Soil Science and Agricultural ~~chemistry~~Chemistry, Sam Higginbottom University of Agriculture, Technology & Sciences, Uttar Pradesh. 2-3 drops of nitric acid~~was also~~were added ~~in~~ tothe samples to stop the microbial growth ~~of microbes~~.

Table1:ProcedureusedforPhysico-chemicalanalysisofsoil and water

A. Physical analysis

S.No.	Parameters	Scientist
1	SoilTextural Class(Sand,Silt,Clay)	Bouyoucos,(1927)
2	Bulk Density (Mg m^{-3})	Muthuvel *etal.*,(1992)
3	ParticleDensity(Mgm^{-3})	
4	PoreSpace(%)	
5	WaterHoldingCapacity(%)	

B. Chemicalanalysis

S.No.	Parameters	Scientist
1	Soil pH	Jackson,(1958)
2	ElectricalConductivity(dS m^{-1})	Wilcox,(1950)
3	OrganicCarbon(%)	WalkleyandBlack,(1947)
4	AvailableNitrogen(kgha^{-1})	SubbiahandAsija,(1956)
5	AvailablePhosphorus (kgha^{-1})	Olsen*etal*.,(1954)
6	AvailablePotassium(kgha^{-1})	TothandPrince,(1949)
7	ExchangeableCaandMg (Meq100g^{-1})	Jackson,(1973)

C. Chemicalanalysis

S. No.	Particulars	Scientist
1	pH	APHA (1992)
2	EC (dS m^{-1})	APHA (1992)
3	Carbonate and Bicarbonate (Meq L^{-1})	APHA (1992)
4	Chloride (Meq L^{-1})	APHA (1992)
5	Calcium+Magnesium (Meq L^{-1})	APHA (1992)
6	Calcium (Meq L^{-1})	APHA (1992)
7	Potassium (Meq L^{-1})	APHA (1992)
8	Sodium (Meq L^{-1})	APHA (1992)

2.5STATISTICAL ANALYSIS

The data recorded during the investigation were subjected to statisticalanalysis by analysis of Completely Randomized Design (CRD) as per the method of"AnalysisofVariance"(ANOVA)technique.

2. ResultandDiscussion

2.1 Physicalproperties of Soil

TheSoilTexturalclasswasidentifiedby SandyLoam.Thesand,silt,andclay~~percentage varied from~~ranges were75.12 to 71.46% ~~sand~~, 18.36 to 14.45%,~~silt~~ and 11.08to 9.18%, respectively~~clay in Sandy Loam~~. ~~Bulk Density was varied from the 1.22 to 1.41 Mg m^{-3}.~~ Bulk density~~wasfoundto~~increased with theincreasein soildepthinsomesitesdueto an increaseincompaction in the subsurface comparatively. ~~The ParticleDensity variedfrom~~

2.291to 2.452Mg m^{-3}. The increase in theparticledensityis due to soil depth, water quality, and their interaction.

The Pore Space (%) ranged from 41.60 to 48.20%. The pore space dwas found todecreasedwiththe increaseindepthattributedtowithan increaseincompactioninthesubsurface.TheWaterHoldingCapacity(%)rangedfrom 36.60 to 43.22%.The water holding capacity value decreased with the increase in depth because of soil compaction and reduction in pore space. Soils vary in their water water-holding capacity according to their structure, texture, Organic carbon content, and bulk density relationship to total pore size distribution.

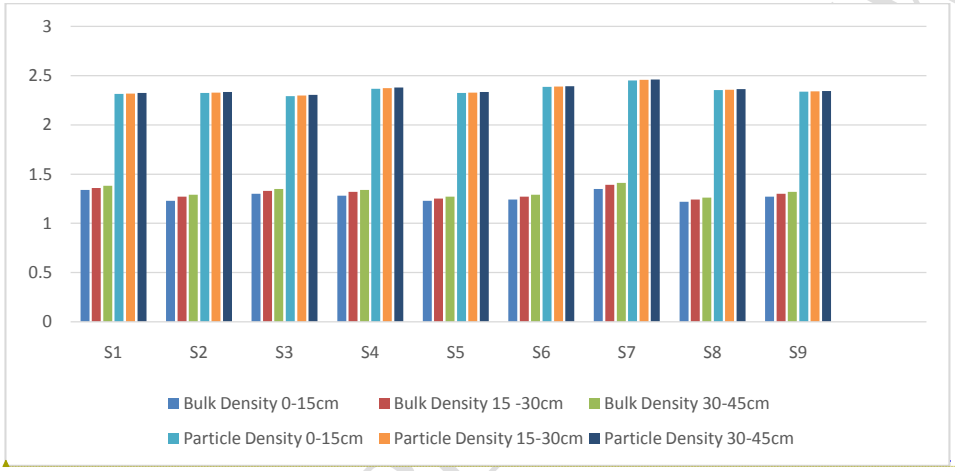
Table 2: Bulk density and Particle density (Mg m^{-3}) of soil in different villages of phulpurPhulpur block of Prayagraj districtat 0-15cm,15-30cm and30-45cmdifferentdepths.

Villages	BulkDensity(Mgm^{-3})			ParticleDensity(Mgm^{-3})		
	0-15cm	15-30cm	30-45cm	0-15cm	15-30cm	30-45cm
V_1	1.34	1.36	1.38	2.313	2.318	2.325
V_2	1.23	1.27	1.29	2.325	2.328	2.335
V_3	1.3	1.33	1.35	2.291	2.297	2.305
V_4	1.28	1.32	1.34	2.367	2.372	2.379
V_5	1.23	1.25	1.27	2.323	2.327	2.335
V_6	1.24	1.27	1.29	2.385	2.389	2.393
V_7	1.35	1.39	1.41	2.452	2.456	2.461
V_8	1.22	1.24	1.26	2.354	2.358	2.363
V_9	1.27	1.3	1.32	2.336	2.340	2.344
	F-test	S.Em.(±)	C.D@5%	F-test	S.Em.(±)	C.D@5%
Depth (0-15cm)	S	0.023192	0.068908	NS	-	-
Depth (15-30cm)	S	0.021781	0.064714	NS	-	-
Depth (30-45cm)	S	0.013274	0.054034	NS	-	-

Table 3: Pore Space and Water Holding Capacity (%) of soil in different villages ofPhulpurPhulpur block of Prayagraj districtat 0-15cm,15-30cm and30-45cmdifferentdepths.

Villages	PoreSpace(%)			WaterHoldingCapacity(%)		
	0-15cm	15-30cm	30-45cm	0-15cm	15-30cm	30-45cm
V_1	43.60	42.70	41.60	38.48	37.21	36.60
V_2	45.70	44.20	43.80	40.57	39.20	38.80
V_3	46.10	45.37	43.80	40.91	39.37	38.80
V_4	45.80	44.38	43.42	40.60	39.38	38.42

V_5	47.90	45.20	44.80	42.72	41.20	40.80
V_6	47.80	46.29	45.80	42.69	41.29	40.80
V_7	46.70	46.20	45.90	41.58	40.50	39.90
V_8	45.60	44.00	43.80	40.40	39.65	38.80
V_9	48.20	46.39	45.67	43.30	42.39	41.67
	F-test	**S.Em. (±)**	**C.D@5%**	**F-test**	**S.Em.(±)**	**C.D@5%**
Depth (0-15cm)	S	0.746195	2.217064	S	0.588079	1.747273
Depth (15-30cm)	S	0.612464	1.819724	S	0.580013	1.723306
Depth (30-45cm)	S	0.671345	1.992669	S	0.591988	1.758888



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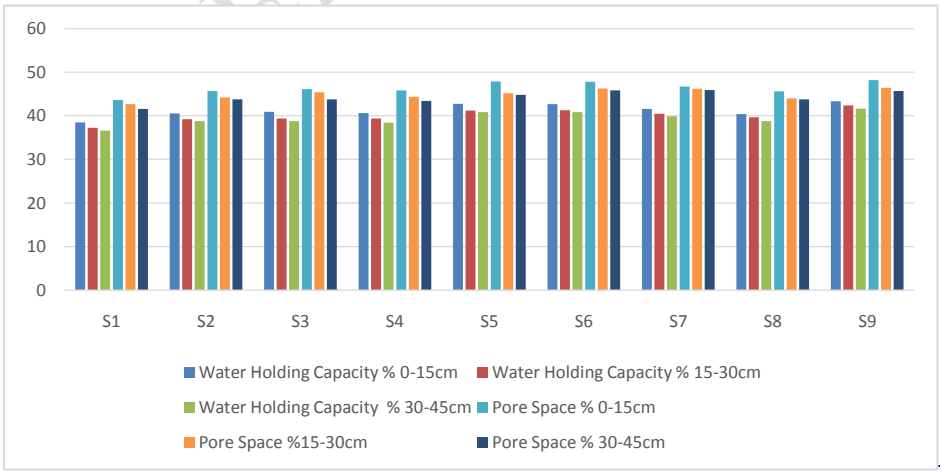
~~**Fig.1:Bulkdensity,Particledensityofsoilindifferentvillagesof Phulpur block of Prayagraj districtat0-15cm,15-30cmand 30-45cmdepth**~~



~~Fig.2:PorespaceandWaterholdingcapacityofsoilindifferentvillagesofPhulpur block of Prayagraj districtat0-15cm,15-30cmand 30-45cmdepth~~

3.2Chemicalproperties of Soil

ThepH~~valuerangedfrom7.26to7.84.T~~and theElectricalConductivity(Table 4) ~~rangedfrom 0.24to0.38dSm^{-1}~~andofthesoilwerefoundtobenormal.~~ThevalueoftotalOrganicCarbon(%) varied from 0.29 to 0.45%.~~ The organic carbon (Table 5) content decreased with increased depth, and thisisduetotheadditionofplantresiduesandfarmyardmanurestosurfacehorizonsrather thanlowerhorizons**.** The available Nitrogencontent (Table 5), ~~of soil ranged from 180.00 to 275.00 kg ha^{-1} and nitrogen content was low in allblocks. Theavailable~~Phosphoruscontent (Table 6),Potassium content (Table 7), and exchangeable calcium and magnesium (Table 8) content of the soil ~~ranged from 10.80 to 22.50 kg ha^{-1}. All the sites have~~werelow, low to medium~~phosphorus content., Available Potassium content of soil ranged from 132.0 to 231.0 kgha^{-1}. All the sites have~~low to medium, and potassium content. Exchangeable Calcium content of soil ranged from 3.48 to 5.50 Meq100g^{-1}. Exchangeable Magnesium content of soil ranged from 1.66to 2.72 Meq 100g^{-1}.CalciumandMagnesiumare~~low~~inthesoil~~.Calciumandmagnesiumbothincrease~~s~~thesoilpHa sitsavailabilityincreasesinsoil.

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Table4:SoilpHandEC(dSm^{-1})ofsoilindifferentvillagesof~~Phulpur~~Phulpur block of Prayagraj districtat~~0-15cm,15-30cm and30-45 cm~~different~~depth~~s

Villages	Soil pH			SoilEC(dS m^{-1})		
	0-15cm	15-30cm	30-45cm	0-15cm	15-30cm	30-45cm
V1	7.80	7.82	7.83	0.38	0.33	0.30
V2	7.26	7.29	7.31	0.35	0.33	0.30
V3	7.30	7.32	7.33	0.32	0.29	0.26
V4	7.67	7.69	7.72	0.35	0.30	0.25
V5	7.23	7.31	7.30	0.30	0.25	0.23
V6	7.78	7.81	7.81	0.33	0.30	0.28
V7	7.76	7.78	7.79	0.34	0.30	0.26
V8	7.79	7.79	7.80	0.35	0.32	0.29
V9	7.80	7.81	7.84	0.31	0.28	0.24
	F-test	S.Em. (±)	C.D@5%	F-test	S.Em.(±)	C.D@5%
Depth (0-15cm)	S	0.097750	0.097750	S	0.003846	0.011426
Depth (15-30cm)	S	0.080484	0.239130	S	0.004817	0.014313
Depth (30-45cm)	S	0.078097	0.232039	S	0.003031	0.009004

Table5:SoilOCandAvailableNitrogenofsoil indifferentvillages of~~Phulpur~~Phulpur block of Prayagraj district~~at at 0-15cm,15-30cmand 30-45cm~~different~~depth~~s

Villages	OrganicCarbon(%)			Nitrogen(kgha^{-1})		
	0-15cm	15-30cm	30-45cm	0-15cm	15-30cm	30-45cm
V1	0.45	0.43	0.41	275	253	238

V_2	0.40	0.39	0.38	270	253	237
V_3	0.37	0.36	0.34	264	238	217
V_4	0.35	0.34	0.33	227	197	180
V_5	0.34	0.33	0.31	224	204	187
V_6	0.32	0.30	0.29	218	198	180
V_7	0.42	0.40	0.38	255	231	207
V_8	0.38	0.37	0.36	244	224	206
V_9	0.39	0.37	0.36	237	207	194
	F-test	**S.Em.(±)**	**C.D@5%**	**F-test**	**S.Em.(±)**	**C.D@5%**
Depth (0-15cm)	S	0.005356	0.015913	S	2.965617	8.811301
Depth (15-30cm)	S	0.005727	0.017015	S	3.620043	10.75570
Depth (30-45cm)	S	0.018892	0.013723	S	3.508801	10.42518

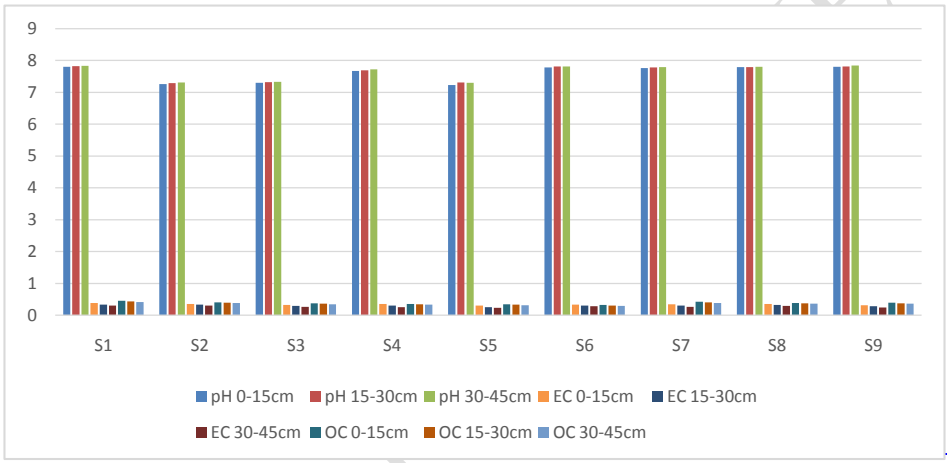
Table6:AvailablePhosphorusandPotassium(kgha^{-1})ofsoilindifferentvillagesof~~Phulpur~~Phulpur block of Prayagraj districtat~~different~~depths~~0-15cm,15-30cmand30-45 cmdepth~~

Villages	Phosphorus(kgha^{-1})			Potassium(kg ha^{-1})		
	0-15cm	**15-30cm**	**30-45cm**	**0-15cm**	**15-30cm**	**30-45cm**
V_1	19.00	14.60	13.00	158	140	132
V_2	21.00	17.89	14.60	169	156	141
V_3	19.56	16.87	13.10	165	154	146
V_4	18.00	16.45	12.20	230	219	207
V_5	17.40	14.40	12.20	203	195	177
V_6	22.50	19.20	16.10	191	171	159
V_7	17.70	12.60	11.10	231	216	194
V_8	15.00	12.33	10.80	225	214	192
V_9	17.00	15.56	11.20	159	140.5	135
	F-test	**S.Em.(±)**	**C.D@5%**	**F-test**	**S.Em.(±)**	**C.D@5%**
Depth (0-15cm)	S	0.281225	0.835561	S	3.081863	9.156684
Depth (15-30cm)	S	0.216823	0.644215	S	2.545029	7.561670
Depth (30-45cm)	S	0.308520	0.916659	S	2.427219	7.211638

Villages	ExchangeableCalcium (Meq100g^{-1})			ExchangeableMagnesium (Meq100g^{-1})		
	0-15cm	**15-30cm**	**30-45cm**	**0-15cm**	**15-30cm**	**30-45cm**
V_1	4.00	3.81	3.48	2.07	1.91	1.79
V_2	4.40	4.10	3.77	2.44	2.31	2.13
V_3	4.10	3.84	3.62	2.55	2.35	2.23
V_4	5.20	4.90	4.70	2.72	2.55	2.39
V_5	5.50	5.20	4.90	2.65	2.49	2.30

V_6	5.15	4.93	4.61	2.16	1.92	1.80
V_7	4.75	4.54	4.29	2.00	1.87	1.76
V_8	4.11	3.85	3.63	1.94	1.78	1.66
V_9	4.76	4.52	4.31	2.07	1.91	1.79
	F-test	**S.Em.(±)**	**C.D@5%**	**F-test**	**S.Em.(±)**	**C.D@5%**
Depth (0-15cm)	S	0.06334	0.188192	S	0.027845	0.082731
Depth (15-30cm)	S	0.08778	0.240301	S	0.031072	0.092318
Depth (30-45cm)	S	0.54626	0.162301	S	0.031052	0.092261

**Table7:ExchangeableCalciumandMagnesiumofsoilindifferentvillagesof~~Phulpur~~Phulpur block of Prayagraj districtat~~different~~depths~~0-15cm,15-30cmand30-45 cmdepth~~



~~Fig.3:SoilpH,EC and Organic Carbon ofsoilindifferentvillagesofPhulpur block of Prayagraj districtat0-15cm,15-30cm and30-45 cmdepth~~

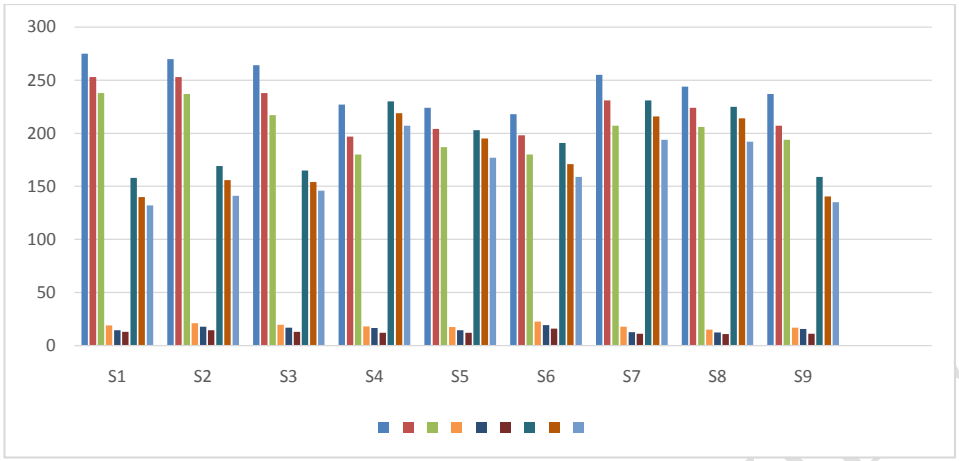


Fig.4: Available Nitrogen, Phosphorus and Potassium of soilindifferentvillagesofPhulpur block of Prayagraj districtat0-15cm,15-30cmand30-45 cmdepth

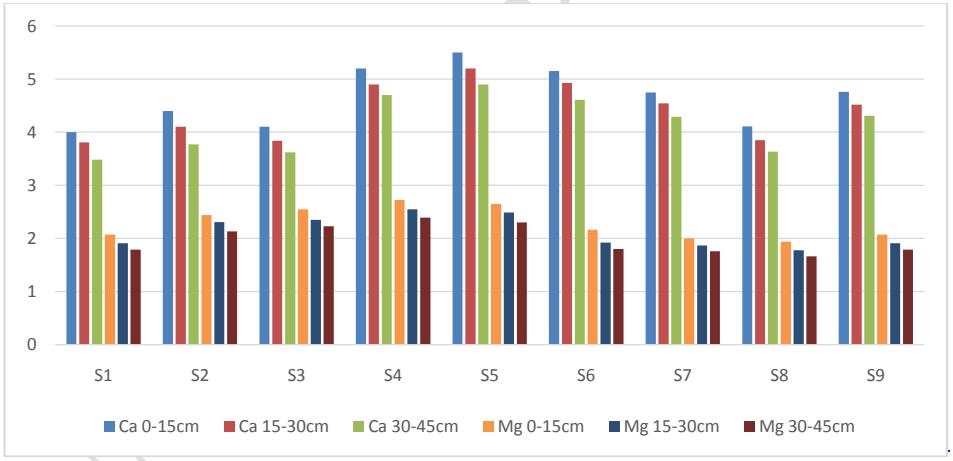


Fig.5: Exchangeable Calcium and Magnesium of soilindifferentvillagesofPhulpur block of Prayagraj districtat0-15cm,15-30cmand30-45 cmdepth

3.3 Chemical properties of water

The results are displayed in Tables 8 and 9. The pH of water varied from 6.24 to 7.50. The Electrical Conductivity of water ranged from 0.31 to 0.90 dS m^{-1}. TheBicarbonateofwatervariedfrom7to 18 Meq L^{-1}. Thechlorideofwatervariedfrom4.5to 10.4

~~Meq L^{-1}. The Available calcium of water varied from 4.2 to 8 kg ha^{-1}. The Available Magnesium of water varied from 2.5 to 3.6 kg ha^{-1}. The Potassium of water varied from 0.05 to 0.17 Meq L^{-1}. The Sodium of water varied from 0.08 to 0.21 Meq L^{-1} respectively.~~ The Sodium Absorption Ratio (SAR) values ~~ranged from 0.03 to 0.1 Meq L^{-1},~~ indicat~~inged~~ low to moderate levels of sodium content in the water samples. The soluble sodium percent (SSP) values ~~ranged from 1.47 to 3.93Meq L^{-1},~~ provid~~inged~~ further insight into the sodium content in the water. ~~The residual sodium carbonate (RSC) values varied from 2.4 to 7.4 Meq L^{-1}.~~ The Permeability Index (PI) values ~~ranged from 28 to 56 Meq L^{-1},~~ serv~~inged~~ as an indicator of the potential impact of water on soil permeability. ~~Lastly, t~~The Kelley's ratio (KR) ~~values~~ranged from 0.08 to 0.024 Meq L^{-1}. The KR is a measure of the sodium hazard in irrigation water, with lower values indicating a lower risk of sodium-related issues in soil and crops.

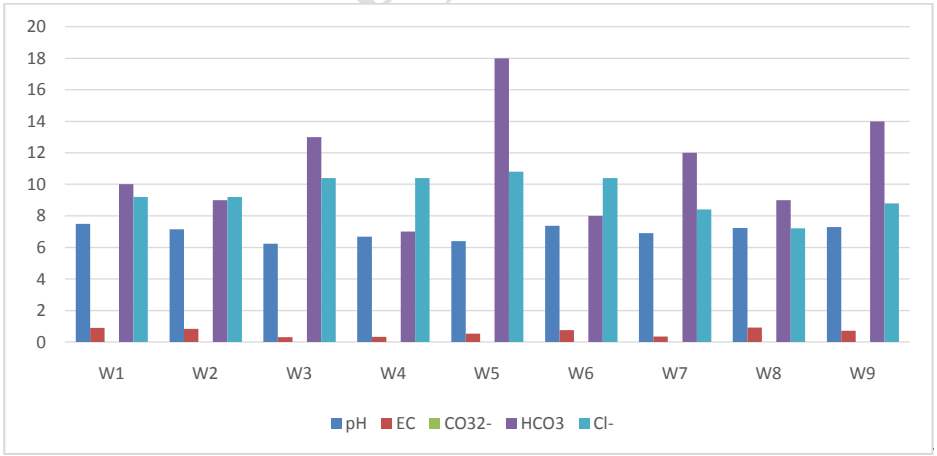
Table 8: ~~Results of~~ Irrigation Water Quality Parameters of ~~Phulpur~~Phulpur block in Prayagrajdistrict

Village	pH	EC (d Sm^{-1})	CO_3^{2-} (Meq L^{-1})	HCO^3 (Meq L^{-1})	Cl^- (Meq L^{-1})	Ca (Meq L^{-1})	Mg (Meq L^{-1})	Ca+Mg (Meq L^{-1})	K+ (Meq L^{-1})	Na+ (Meq L^{-1})
V_1	7.5	0.9	0	10	9.2	9.2	3.4	8	0.12	0.17
V_2	7.14	0.83	0	9	9.2	10.2	3.2	5.6	0.15	0.21
V_3	6.24	0.31	0	13	10.4	8.4	3.6	7.4	0.17	0.15
V_4	6.68	0.33	0	7	10.4	10.4	2.8	4.6	0.15	0.2
V_5	6.4	0.53	0	18	10.8	10.2	3.6	7	0.1	0.08
V_6	7.37	0.75	0	8	10.4	4.6	2.7	4.2	0.05	0.21
V_7	6.9	0.35	0	12	8.4	10.4	3.1	5.3	0.07	0.1
V_8	7.23	0.92	0	9	7.2	4.5	2.5	6.7	0.09	0.12
V_9	7.28	0.72	0	14	8.8	9.6	3.2	6.8	0.07	0.08
F– test	S	S	NS	S	S	S	S	S	S	S
S.Em.(±)	0.95457	0.011479	-	0.175286	0.11492	0.088363	0.034269	0.06968	0.001428	0.001452

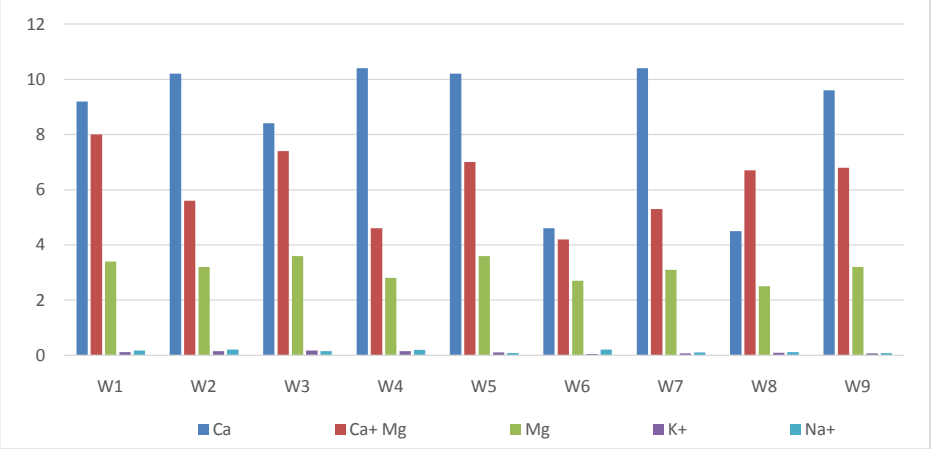
C.D.@5%	0.28491	0.34104	-	0.520801	0.341445	0.262541	0.101818	0.47893	0.004243	0.004315

Table 9: ~~Results of~~ Irrigation Water Quality Parameters of ~~Phulpur~~Phulpur block in Prayagrajdistrict

Village	SAR (Meq L^{-1})	SSP (Meq L^{-1})	KR (Meq L^{-1})	PI (Meq L^{-1})	RSC (Meq L^{-1})	IQWI (Meq L^{-1})
V1	0.07	2.48	0.015	29	-1.4	44
V2	0.1	3.93	0.024	34	0.2	110
V3	0.06	2.83	0.014	39	2	140
V4	0.09	3.59	0.021	36	-2.4	115
V5	0.03	1.67	0.008	56	7.4	121
V6	0.1	2.84	0.024	28	-0.9	57
V7	0.04	1.47	0.009	47	0.6	78
V8	0.05	2.23	0.013	33	-0.2	134
V9	0.03	1.48	0.008	47	4	154
F– test	S	S	S	S	S	S
S.Em.(±)	0.001211	0.03453	0.000214	0.018542	0.04866	0.34587
C.D.@5%	0.003599	0.102594	0.000635	0.055093	0.144577	0.37446



~~Fig.6: pH, EC, $CO3^{2-}$, HCO3, Cl^- of water sample differentvillagesofPhulpur block of Prayagraj district~~



~~**Fig.7: Ca, Mg, Ca+Mg, K^{+}, Na^{+} of water sample differentvillagesofPhulpur block of Prayagraj district**~~

3. Conclusion

~~It is concluded that both t~~The red soils and black soils were moderately to strongly alkaline inreaction and non-saline. On the soil complex, the dominant cation is calcium. The physicalproperties of both surficial and sub-surficial soils ~~are~~ werenormal as the bulk density value isnormal. The Water Holding Capacity is high. The overall fertility status of the soils was low,medium, and high in nitrogen, phosphorus, and potassium respectively. As the soils werecalcareous and strongly alkaline, there is a need for the application of any ~~acid~~ acid-forming amendment~~improves~~ and organic materials to alleviate the nutrient deficiency andimprovethe productivity of soils.The water pH was found to be slightly acidic to neutral and all the water samples~~shown~~ showedvery low sodium hazard. ~~Alkalinity~~ The alkalinity of water samples ~~have~~ hasshown that 77.77% of samples are suitable and 33.33% ~~of samples~~ are not suitable for irrigation. The total hardness of the water samples was a moderate range of soluble salts in the water sample ~~indicated~~ indicatingmoderately suitable for irrigation. Irrigation water quality index samples have shown that 100% of the samples were in good condition for irrigation purposes.

References

Comment [es2]: MUST BE UPDATED as 5.2% (1 out of 19) of the listed references were published in the past five years. The percentage has to increase to at least 35-40%. Old references negatively impact the study and indicate that the study is no longer a point of interest.

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