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Physical Properties of the Soil Around the Lanka, Mirzamurad and Babatpur, Varanasi

G. K. Bagri, P. Raha, D. K. Bagri, D. L. Bagdi

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ABSTRACT

The analysis of soil samples taken from the areas around the Lanka, Mirzamurad and Babatpur, Varanasi for evaluating its physical properties were carried out in the Department of Soil Science and Agricultural Chemistry Laboratory at the Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during 2015. The bulk density, particle density, water holding capacity%, porosity%, particle distribution% and texture of these soil samples was determined by using standard methods. These soil samples were collected from Vaishnov nagar, Susuwahi, Newada, Gandh, Nasirpur, Agriculture farm, Sankat mochan colony, Naria, Sear govardhan and Karadhi locations of Lanka, Nayapur, Todarpur, Rupapur, Sheorampur, Tribhuvanpur, Bharkala, Dewapur khurd, Ram rathauna, Kasara and Pratappur locations of Mirzamurad and Chherapur, Narayandaspur, Dallipur, Tadi, Fattepur, Kathraon, Rajapur, Nindeva, Belwa and Khemapur locations of Babatpur, Varanasi. The result showing that bulk density (1.33) was recorded more in Pratappur location of Mirzamurad, particle density (2.60) in Vaishnov nagar location of Lanka, water holding capacity% (63.82) in Todarpur location of Mirzamurad, porosity% (54.49) in Belwa location of Babatpur, under particle distribution sand % (44.56) in Chherapur location of Babatpur, silt % (34 and 34) in Dewapur khurd and Ram rathauna location of Mirzamurad and clay% (35.44) were recorded more than other locations of Lanka, Mirzamurad and Babatpur of Varanasi.

Keywords Bulk density, Particle density, Water holding capacity, Porosity, Sand, Silt, Clay.

G. K. Bagri[1], P. Raha[2]
[2]Professor and Head
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Uttar Pradesh, India

D. K. Bagri[3]
[3]Subject Matter Specialist
Krishi Vigyan Kendra, Nagaur-II, Maulasar, Agriculture University, Jodhpur 341506, India

D. L. Bagdi[4]*
[4]Assistant professor
Department of Plant Physiology, S. K. N. College of Agriculture, Jobner, Rajasthan, India

Email: dlbagadi.2000@gmail.com
*Corresponding author

INTRODUCTION

The chemical composition of rainwater varies from site to site and region to region due to influence of local sources. In countries like India, dust particles (e.g., soil dust) are an important part of the atmosphere, which contains significant base cations. These base cations neutralizing the acidity of rainwater before deposited on the ground surface. Precipitation in coastal areas is strongly affected sea salt, while precipitation in inland areas (as in Varanasi) contains

proportionately more substances originating from soil. Thus, the study of the chemical composition of rain water is associated with the evaluation of the physical and chemical nature of surface soils in that sites of collection of rain water and that provide the actual fact of the bio-geochemical cycle of the earth-atmosphere system.

The physical properties of soil, in order of decreasing importance for ecosystem services such as crop production, are texture, structure, bulk density, porosity, consistency, temperature, color and resistivity. Soil texture is determined by the relative proportion of the three kinds of soil mineral particles, called soil separates: Sand, silt and clay. At the next larger scale, soil structures called peds or more commonly soil aggregates are created from the soil separates when iron oxides, carbonates, clay, silica and humus, coat particles and cause them to adhere into larger, relatively stable secondary structures. Soil bulk density, when determined at standardized moisture conditions, is an estimate of soil compaction. Soil porosity consists of the void part of the soil volume and is occupied by gases or water. Soil consistency is the ability of soil materials to stick together. Soil temperature and color are self-defining. Resistivity refers to the resistance to conduction of electric currents and affects the rate of corrosion of metal and concrete structures which are buried in soil. These properties vary through the depth of a soil profile, i.e., through soil horizons. Most of these properties determine the aeration of the soil and the ability of water to infiltrate and to be held within the soil. Keeping in view these facts this research work was conducted to know the physical properties of soil samples of different locations of Varanasi.

MATERIALS AND METHDS

Collection of soil samples: Surface soil of Varanasi district were collected to a depth of 0-15 cm in triangular shape with the help of khurpi from thirty different locations surrounding the rainwater sampling areas viz., Lanka (Banaras Hindu University, campus), Babatpur and Mirzamurad. The soil samples were mixed thoroughly and about a half of kilogram of composite samples from each site was taken.

Preparation of soil samples for analysis: Soil samples collected from different locations were air dried at room temperature under shade. Air dried samples were grinded manually by wooden grinder and passed through a 2 mm sieve. The soil samples were analyzed for selected physical and chemical properties by standard procedures.

Soil analysis: Physical and chemical properties of soil samples were determined in the laboratory by the following standard processes.

Bulk and particle density: The bulk and particle density were determined using pycnometer bottle in laboratory in disturbed soil samples (Black 1965).

Water holding capacity (WHC): The W.H.C. of the soil was measured in laboratory using Keen-Rackzowski box (Black 1965).

Mechanical analysis: Particle sizes of soils were estimated by hydrometer method as described by Bouyoucos (1927) and then mechanical composition and textural class were determined by using USDA textural triangle.

Statistical analysis: Data obtained from all the observations were statistically analyzed. The SD. values were evaluated for each chemical and physical parameters of soil and water. The correlation of rainwater chemical composition with the physical and chemical properties of the surrounding soil in each site were statistically calculated by SPSS.

RESULTS AND DISCUSSION

Physical properties of soils:

The data on physical properties of the surface soils of Lanka, Mirzamurad and Babatpur around the rainwater sampling sites have been presented in Tables 1– 3, respectively. It was revealed from the data that the textural class of all the collected were sandy clay loam. The range of sand, silt and clay content in soil of Varanasi varied from 34.5-42.5%, 27-34%, 25.4-35.4%, respectively

Table 1. Physical properties of the soils around the Lanka.

Sl. No.	Location	BD (Mg/m^3)	PD (Mg/m^3)	WHC. (%)	Porosity (%)	Particle distribution (%)			Texture
						Sand	Silt	Clay	
1	Vaishnov nagar	1.19	**2.60**	50.54	54.42	41.56	30.00	28.44	Sandy clay loam
2	Susuwahi	1.20	2.46	52.78	51.18	39.56	30.00	30.44	”
3	Newada	1.17	2.40	51.89	51.17	38.56	29.00	**32.44**	”
4	Gandh	1.20	2.35	48.27	49.15	42.56	30.00	27.44	”
5	Nasirpur	**1.20**	2.35	48.39	48.85	39.56	30.00	30.44	”
6	Agricultural farm	1.13	2.45	50.57	**53.76**	43.56	27.00	29.44	”
7	Sankat mochan colony	1.14	2.43	48.21	53.00	41.56	**30.00**	28.44	”
8	Naria	1.12	2.31	53.13	51.47	**42.56**	27.00	30.44	”
9	Sear govardhan	1.17	2.41	**54.18**	51.54	39.56	31.00	29.44	”
10	Karadhi	1.14	2.38	54.31	52.27	40.56	29.00	30.44	”
	Range	1.13-1.20	2.35-2.60	48.21-54.18	49.15-53.76	39.56-42.56	27-30	27.44-32.44	
	Mean	1.17	2.41	51.23	51.68	40.96	29.30	29.74	
	SD ±	0.03	0.08	2.27	1.70	1.56	1.27	1.35	
	Median	1.17	2.41	51.23	51.51	41.06	30.00	29.94	

Sands are mostly composed of quartz and micas, silts are commonly composed of a mixture of quartz and small mineral particles, feldspars and micas. Clay is made up of secondary clay minerals of finer size soil particle. As the soil is a porous body, both bulk and particle densities are determined.

The order of mean values of particle density of the soils f Lanka, Mirzamurad and Babatpur areas was as follows: Babatpur > Mirzamurad > Lanka. Thus comparatively heavy soil particle (mean: 2.41 Mg m^{-3}) was found in Lanka followed by Mirzamurad (mean: 2.36 Mg m^{-3}) and Babatpur (mean: 2.22 Mg

Table 2. Physical properties of the soils around the Mirzamurad.

Sl. No.	Location	BD. (Mg/m^3)	PD (Mg/m^3)	WHC. (%)	Porosity (%)	Particle distribution (%)			Texture
						Sand	Silt	Clay	
1	Nayapur	1.12	2.31	60.4	51.39	42.56	30.00	27.44	Sandy clay loam
2	Todarpur	1.23	2.32	**63.82**	46.98	42.56	29.00	28.44	”
3	Rupapur	1.21	**2.53**	61.86	**52.17**	41.56	30.00	28.44	”
4	Sheorampur	1.29	2.39	58.49	46.03	40.56	34.00	25.44	”
5	Tribhuvanpur	1.28	2.43	58.78	47.33	41.56	30.00	28.44	”
6	Bhalkara	1.21	2.31	50.80	47.39	38.56	33.00	28.44	”
7	Dewapur khurd	1.22	2.16	55.48	43.52	40.56	**34.00**	25.44	”
8	Ram rathauna	1.30	2.34	41.50	44.44	37.56	34.00	**28.44**	”
9	Kasara	1.26	2.33	63.51	45.92	42.56	32.00	25.44	”
10	Pratappur	**1.33**	2.47	56.69	46.15	38.56	33.00	26.44	”
	Range	1.12-1.33	2.16-2.53	41.5-63.82	43.52-52.17	37.56-42.56	29-34	25.44-28.44	”
	Mean	1.25	2.36	57.13	47.13	40.66	31.90	27.24	”
	SD ±	0.06	0.10	6.41	2.60	1.76	1.87	1.33	”
	Median	1.25	2.34	58.64	46.57	41.06	32.50	27.94	”

Table 3. Physical properties of the soils around the Babatpur.

Sl. No.	Location	BD. (Mg/m^3)	PD. (Mg/m^3)	WHC. (%)	Porosity (%)	Particle distribution (%)			Texture
						Sand	Silt	Clay	
1	Chherapur	1.16	2.32	55.97	50.00	**44.56**	29.00	26.44	Sandy clay loam
2	Narayandaspur	1.13	2.29	55.08	50.66	37.56	30.00	32.44	”
3	Dallipur	**1.25**	2.22	**63.37**	43.69	40.56	29.00	30.44	”
4	Tadi	1.12	2.27	48.31	50.66	40.56	29.00	30.44	”
5	Fattepur	1.17	1.97	49.90	40.61	35.56	32.00	32.44	”
6	Kathraon	1.13	2.27	53.50	50.22	43.56	28.00	28.44	”
7	Rajapur	1.22	2.11	47.79	42.18	24.56	30.00	35.44	”
8.	Nindeva	1.14	**2.39**	53.99	52.30	40.56	**32.00**	27.44	”
9	Belwa	1.04	2.28	45.48	**54.49**	38.56	32.00	29.44	”
10	Khemapur	1.05	2.09	45.14	49.76	34.56	30.00	**35.44**	”
	Range	1.04-1.25	2.01-2.39	45.14-63.37	42.18-54.49	34.56-40.56	28-32	27.44-35.44	
	Mean	1.14	2.22	51.85	48.46	38.06	30.10	31.84	
	SD ±	0.06	0.12	5.35	4.38	5.41	1.37	5.18	
	Median	1.14	2.27	51.70	50.11	39.56	30.00	30.44	

m^{-3}), whereas bulk density was found very low values in Babatpur (mean: 1.14 Mg m^{-3}). The surface soil erosion (by wind) and dispersion are depended on the particle density as well as soil porosity and water holding capacity.

Soil porosity was noticed higher in Lanka (mean: 51.68%) than Mirzamurad (47.13%) and Babatpur (48.56%), significance difference of the WHC was observed in the soil of Mirzamurad (57.13%) in comparison to Lanka (51.20%) and Babatpur (51.80%). The data of Table 1, 2 and 3 observed that the value of bulk density (1.33) in Pratappur location of Mirzamurad, particle density (2.60) in Vaishnov nagar location of Lanka, water holding capacity % (63.82) in Todarpur location of Mirzamurad, porosity % (54.49) in Belwa location of Babatpur, under particle distribution sand % (44.56) in Chherapur location of Babatpur, silt % (34 and 34) in Dewapur khurd and Ram rathauna location of Mirzamurad and clay % (35.44) were recorded more than other locations of Lanka, Mirzamurad and Babatpur of Varanasi.

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