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Research Article

Physicochemical Properties of Soil Samples on *Allium cepa* L. (Onion) fields from Ahmednagar District, (M.S) India

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Abstract

Onion is a good source of vitamins and minerals and has various health benefits. It is cultivated all over India and is considered the world's most valuable vegetable. The onion (*Allium cepa* L.) is the second-most important commercial crop in India. Soil chemical parameters analyzed, such as pH, show acidic soil and physicochemical parameters. Farmers in rural areas are not aware of the use of a proportion of chemical fertilizers and pesticides in the onion fields. The present study focuses on all the physicochemical properties of soil samples of *Allium cepa* L from the Ahmednagar district. Field experiments were carried out from June-July 2021 to September-October 2021 and from Novmber- December 2021 to March-April 2022.The rhizosphere and non-rhizosphere pH values range from 6.92 to 7.66 and 7.2 to 7.91, respectively. Electrical conductivity ranged from 0.69 to 0.93 mm/cm3 and 0.69 to 0.93 mm/cm3, respectively. The organic carbon ranges from 0.42 to 0.86% and 0.40 to 0.85%, respectively. Nitrogen content was 166.44 to 272.22 kg/ha and 154.06 to 213.94 kg/ha, respectively. The phosphorus content ranged from 7.3 to 16.71 kg/ha and 8.05 to 17.78 kg/ha, respectively. The potassium content ranged from 166.33 to 476.67 kg/ha and 136 to 462.67 kg/ha, respectively. The moisture content was 79.33 to 92% and 79.67 to 92.33%. The zinc content was 0.7 to 1.35 ppm and 0.14 to 1.57 ppm, respectively. The iron ranges from 0.47 to 1.71 ppm and 0.25 to 10.70 ppm, respectively. The manganese ranges from 3.22 to 16.39 ppm and 1.90 to 11.25 ppm, respectively. The copper ranges from 0.40 to 1.31 ppm and 0.40 to 1.78 ppm, respectively. Information helps farmers solve the problems of soil nutrients and the amount of fertilizer used in agricultural practices.

INTRODUCTION:

The climate of the Ahmednagar district has moderate variation in temperature ranging between 16^0C to 39^0C can be classified as semi-humid. It is situated at 19°6'3.7908" N and $74^0$44'26.4372" Latitude and longitude respectively.In India, onion is cultivated mainly in three different seasons' rainy Kharif (20 %), late Kharif (20 %) and Rabi (60%) (N.K. Agale, 2021). In the State of Maharashtra, the Rabi onion crop is grown at moderate temperatures (16-25℃). The onion is grown in the areas where average annual rainfall is 600-800 mm (A.A. Devikar, 2021). It is estimated that more than 8.087 million hectares of land in India are affected by problems of salinity and sodality. In Maharashtra, about 0.54 million hectares of soil are reported to be salt-affected and waterlogging. It is important to maintain soil health for sustainable productivity, food security and increasing agricultural production for multiple demands against fast mounting pressure on the limited soil resource base (K. K. Deshmukh,

2012). The soil texture plays an important role in productivity. The soil texture depends upon constructive and destructive processes of soil. In the destructive process, there is a loss of more soluble and volatile compounds. In the constructive process, a new chemical compoundis formed between the mineral and organic matter(Dattatraya D. Virkar, 2017). Therefore it is necessary to carry out the soil analysis. Also in indian agriculture, there is cultivation of onion, wheat, sugarcane, pulses and vegetables. Therefore soil analysis is the way to determine the available nutrient status. In the soil and from that we can develop specific fertilizer recommendations. The deficiency of nutrients has become a measure restriction to the productivity and stability of soil (Bell and Dell, 2008). In the Ahmednagar district main crops are Onion, parameters likewise total Organic Carbon, Nitrogen (N), Phosphorous (P), Potassium (K), Electrical Conductivity (EC) and pH of soil was studied. Soil electrical conductivity can serve as a measurement of soluble nutrients and it is useful in monitoring the mineralization of organic matter in soil (Seema Meenaet, 2020).Results of physical and chemical tests provide evidence about the capacity of soil to supply mineral nutrients (Wodaje Addis, 2014).

They are low in calories with only 30 calories per serving, yet add abundant flavours to a wide variety of foods. Onions are also cholesterol free, and provide dietary fibres, vitamin C, vitamin B6, potassium, and other key nutrients (Kebede Dinkecha 2017). The combination of inorganic fertilizers with organic manures registered more increase in available N and P content of the soil against the use of only inorganic fertilizers as decomposition and mineralization of organic manures increase the availability of nutrients like N and P due to solubilization of nutrients from their native source (Iqbal Singh Dhillon, 2020). Integrated Nutrient Management reduces the inorganic fertilizer requirements, to enhance nutrient use efficiency and maintains soil quality interms of physical, chemical and biological properties (Emmanuel Kwada, 2017).The use of organic manures can maintain long-term soil fertility and attitude higher productivity of crops. Nitrogen is considered to be the most limiting factor in understanding higher yields (R. N. Meena, 2014).The EC, pH, sodium adsorption ratio, lime content, organic matter content and soil fertility are among the soil chemical characteristics (Ullah K., 2022).Soil fertility map for a particular area can Sugarcane, Wheat, Jawar, Bajara and different types of vegetables. Certain external factors control plant growth, air temperature, light, mechanical support nutrients and water. Plants have elements for their growth and completion of the life cycle. These elements include carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium etc. The bulk density influences the fertility and productivity of soil by affecting infiltration, root penetration, moisture content and water holding capacity, soil porosity, nutrient availability and microbial activity (Vikas D. Umare, 2018).Based on morphology, nutrient status, quantity of organic matter, color and general climatic consideration soils are placed into ten general categories (S. S. Patil, 2014).Analysis of soil carried out for the studies of various

prove highly beneficial in guiding the farmers,manufacturer's planners and researchers in ascertaining the requirement of variousfertilizers in a season or year and making projections for increased requirements based oncropping pattern and intensity (Rajshri Shinde, 2022). Continuous use of chemical fertilizers slowly changes soil properties; ultimately the production in the long run is reduced. It has resulted in the leaching of the chemical into the surface and groundwater (Sangita Changdeo Dandwate, 2020).All living things depend on plants, and plants grow in soil for day-to-day needs. Soils are medium in which crops grow to food and cloth. Soil is not only important for agriculture but also more useful for living organisms(Ku. Smita Tale and Sangita Ingole, 2015)Altogether, out of 22% of the land suitable for sustaining agricultural productivity, around 5 to 7 Million hectares are being lost annually due to land degradation, threatening food security of the world. Soil and water resources conservation and management are important for the welfare of the people (T. Tanto-Doko, 2022). Conservation agriculture is accredited to provide ecological and agronomical benefits, by buffering the soil pH and EC. (Subhra Sahoo, 2021).The soil contains 50-60% mineral matter, 25-35% water, 15-25% air and a small percentage of organic matter (KD Thete, 2019). The soils were sampled at soil depths of 0- 15cm to make a detailed characterization of selected soils (Renuka. R. Pawar and Mohan. D. Sangale, 2019). The production depends on the nutrient level of the soil. It is the need of time that we have to study the physicochemical analysis of soil for the study of the quality of soil (Supriya B.Gedam 2022).

MATERIALS AND METHODS:

In the present research investigation, the study area soil samples were collected, from selected onion fields. In the physicochemical properties of soil, analysis was carried out, To calculate Moisture percentage, pH, Electrical conductivity (EC), Organic carbon (OC), Macro-elements such as Nitrogen, Phosphorus and Potassium, and Micro-elements like Iron, Zinc, Copper and Manganese. The moisture percentage of soil samples was calculated by subtracting the dry weight from the moist weight, and further dividing it by the dry weight of soil.The soil pH was estimated by using a pH meter. The electrical conductivity (EC mmhos/cm3) was measured by the concentration of soluble salts in the soil, which was determined using a conductivity meter in 1:5 (W/V) soil water suspensions at 25^0C. The organic carbon was calculated by using the total carbon analyzer method. The available phosphorous in the soil was calculated by extracting sodium bicarbonate using a spectrophotometer.The potassium present in the soil was determined by the ammonium acetate, by using a flame photometer method.To calculate the Zn, Fe, Mn, and Cu DTPA was used for a mild chelating agent and extracted.The content of the element in the soil was extracted and determined by using an Atomic Absorption Spectrophotometer.

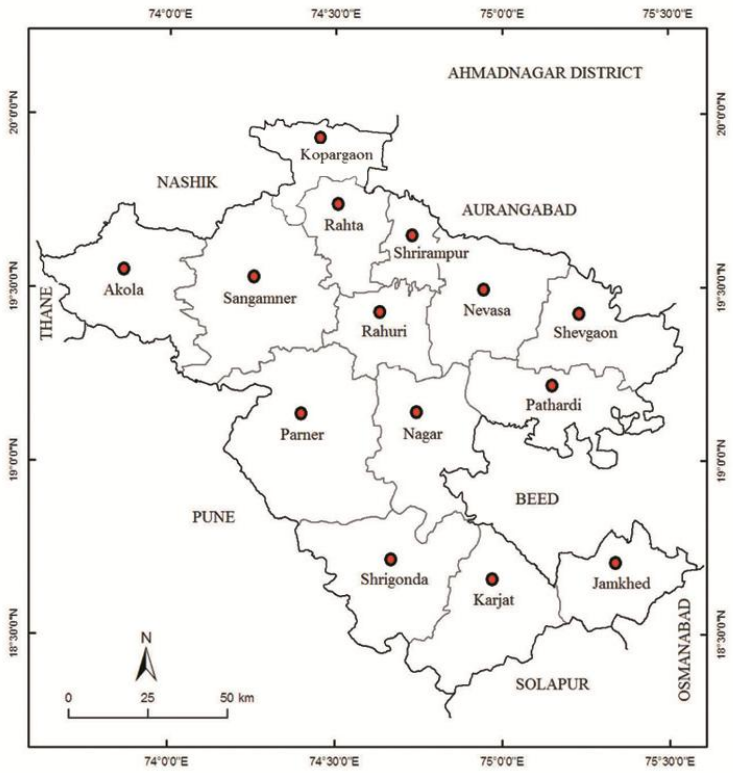

Fig. No. 1. Map Ahmednagar District showing different tahsil with study area.

RESULTS AND DISCUSSION:

Soil samples of the Present investigation of the physicochemical analysis of Rhizosphere and Non-Rhizosphere soil samples from the Ahmednagar district were studied. The results obtained from the study area are presented in Table No.1. And Table No.2. Analysis of soil samples represented by Macronutrients and Micronutrients such as pH, electrical conductivity, Organic carbon, Potassium, Nitrogen, Phosphorous, Moisture Percentage, Zinc, Iron, Copper Sulphate, and Manganese etc. was analyzed.The rhizosphere and non-rhizosphere soil samples show variations in the pH of soil from different localities. A greater amount (7.66 ±0.441 and 7.91±0.226 respectively) was observed at locations S10 and S12 while the lowest (6.92±0.189 and 7.2±0.195 respectively) was observed at location S1. (Nilam B Kondvilkar 2017).

Electrical Conductivity (EC) obtained at all studied locations lies between mmhos/cm^3**.**The maximum (0.93±0.885 and 0.93±0.611 mhos/cm^3 respectively) value of EC was documented at locations S8 and S9 while the lowest (0.69±0.540 and 0.68±0.576 mmhos/cm^3 respectively) at location S3.

Table No. 1: **Physicochemical Properties of Rhizosphere soil in different tahsil from Ahmednagar district**.

Parameter	pH	EC (mmhos /cm^3)	OC (%)	N (kg/ha)	P (Kg/ha)	K (Kg/ha)	Moisture (%)	Zn (PPM)	Fe (PPM)	Mn (PPM)	Cu (PPM)
S1	6.92± 0.189	0.83± 0.555	0.56± 0.266	187.10 ±21.964	8.58± 3.924	284.67± 69.859	90.67± 1.528	0.66± 0.811	1.06± 0.468	4.44± 0.876	0.96± 0.300
S2	7.00± 1.046	0.74± 0.733	0.66± 0.371	166.44 ±49.357	10.21± 2.159	238.67± 28.711	91.67± 3.512	0.10± 0.060	0.90± 0.705	5.37± 0.911	0.72± 0.275
S3	7.57± 0.153	0.69± 0.540	0.66± 0.212	178.96 ±28.824	10.91± 5.607	221.67± 45.325	88.67± 2.082	0.15± 0.106	0.47± 0.340	3.43± 0.615	0.62± 0.405
S4	7.53± 0.379	0.76± 0.666	0.42± 0.074	238.48 ±62.397	7.55± 5.323	291.67± 103.636	85.33± 3.055	0.39± 0.165	0.58± 0.312	5.54± 2.476	0.82± 0.500
S5	7.42± 0.720	0.72± 0.601	0.75± 0.095	171.93 ±18.826	10.14± 4.924	344± 122.650	86.67± 3.055	0.51± 0.155	0.56± 0.244	6.76± 2.311	0.86± 0.555
S6	7.23± 0.379	0.76± 0.633	0.72± 0.159	222.67 ±50.846	11.80± 2.469	323.33± 142.047	92.00± 3.000	0.45± 0.199	1.57± 1.061	6.08± 1.520	0.72± 0.230
S7	7.47± 0.513	0.70± 0.637	0.61± 0.165	272.22 ±82.854	15.45± 6.731	313.33± 101.002	89.33± 3.512	0.23± 0.113	0.99± 0.809	6.02± 0.440	0.64± 0.308
S8	7.27± 0.858	0.93± 0.885	0.57± 0.182	256.13 ±80.419	16.71± 2.090	267± 99.050	85.67± 6.110	0.23± 0.159	1.49± 0.954	4.48± 1.019	0.40± 0.337
S9	7.6± 0.546	0.8± 0.551	0.8± 0.159	206.2± 74.100	7.3± 4.804	249± 82.456	85.3± 3.055	0.7± 0.254	0.6± 0.488	3.9± 1.621	0.7± 0.265
S10	7.66± 0.441	0.76± 0.633	0.61± 0.165	218.49 ±47.972	9.11± 4.712	166.33± 53.613	84.67± 4.163	0.47± 0.260	1.37± 1.051	4.03± 0.924	0.72± 0.316
S11	7.48± 0.624	0.75± 0.640	0.78± 0.159	225± 64.444	10.14± 4.924	223.67± 85.500	87.33± 1.528	0.16± 0.197	0.62± 0.353	3.22± 2.010	0.80± 0.499
S12	7.57± 0.685	0.83± 0.609	0.75± 0.216	240.63 ±85.553	12.20± 2.832	458.67± 289.277	83.33± 4.726	0.84± 0.137	0.90± 0.745	7.65± 1.113	1.31± 0.137
S13	7.62± 0.679	0.74± 0.558	0.86± 0.069	223.26 ±46.953	12.40± 3.056	380.33± 186.270	87±5	0.51± 0.234	1.09± 0.826	10.23± 2.610	0.94± 0.367
S14	7.53± 0.802	0.73± 0.653	0.85± 0.050	293.71 ±96.042	10.51± 5.220	476.67± 242.879	79.33± 2.517	1.35± 0.380	1.71± 1.313	16.39± 3.467	0.84± 0.448

Data Presented as Mean ± Standard Deviation. The means were obtained from three replicate (N=3) pH, EC: Electrical conductivity, OC: Organic Carbon, N: available Nitrogen, P: available Phosphorous, K: available Potassium, Fe: Iron, Mn: Manganese, Zn: Zinc, Cu: Copper.

The organic carbon concentration was obtained from all fourteenth localities. The highest amount (0.86±0.069% and 0.85±0.050 respectively) of organic carbon was recorded from locations S13 and S2, while the lowest amount (0.42±0.074% and 0.40±0.072 respectively) was recorded at location S4 and S10. Available nitrogen content of the rhizosphere and Non-rhizosphere soil of onion from fourteenth localities ranged between 100 and 150 kg/ha.

The maximum amount (272.22±82.854 and 213.94±73.334 kg/ha respectively) of available nitrogen was observed at locations S7 and S5, while the minimum amount (166.44±49.357 and 154.06±21.313kg/ha respectively) was observed at location S2. The average phosphate content in the rhizosphere soil of onion from all localities ranged between 15 kg/ha and 20 kg/ha. It was noticed lowest (7.3±4.805 and 8.05±6.189 kg/ha respectively) at locations S9 and S1, while the largest amount (16.71±2.090 and 17.78±4.487 kg/ha respectively) of available phosphorus was noted at location S8. The potassium (kg/ha) content of the rhizosphere soil of onion plants from the fourteenth surveyed localities ranged between 110 kg/ha and 280

Table No. 2: Physicochemical Properties of Non-Rhizosphere soil in different tahsil from Ahmednagar district.

Parameter	pH	EC (mmhos /cm^3)	OC (%)	N (kg/ha)	P (Kg/ha)	K (Kg/ha)	Moisture (%)	Zn (PPM)	Fe (PPM)	Mn (PPM)	Cu (PPM)
S1	7.20± 0.195	0.83± 0.569	0.63± 0.142	203.40 ± 61.401	8.05± 6.189	306.33± 169.795	88.33± 3.055	0.20± 0.229	0.25± 0.252	2.40± 0.759	0.77± 0.304
S2	7.44± 0.465	0.75± 0.616	0.85± 0.050	154.06 ± 21.313	12.73± 3.474	216± 90.139	92.33± 3.786	0.36± 0.101	1.15± 0.821	3.80± 2.564	0.68± 0.287
S3	7.50± 0.362	0.68± 0.576	0.78± 0.159	170.19 ±31.346	11.81± 4.931	202.67± 68.245	82.67± 5.033	0.55± 0.301	0.42± 0.382	3.21± 1.061	0.94± 0.376
S4	7.54± 0.351	0.83± 0.760	0.68± 0.257	155.04 ±32.451	14.23± 1.363	355.67± 190.132	85± 2.646	0.47± 0.259	0.47± 0.321	3.28± 2.111	0.93± 0.363
S5	7.58± 0.355	0.78± 0.650	0.60± 0.229	213.94 ±73.334	9.68± 5.595	300.67± 167.813	87.00± 2.00	0.29± 0.212	1.23± 0.744	6.95± 1.984	0.88± 0.512
S6	7.27± 0.318	0.75± 0.639	0.52± 0.085	170.50 ±25.204	8.35± 6.709	314.33± 162.586	91.00± 4.583	0.42± 0.390	10.70± 1.064	1.90± 0.489	0.40± 0.217
S7	7.44± 0.573	0.70± 1.66	0.43± 0.78	164.47 ±128	12.04± 17.5	284.33± 168	88.67± 78	0.37± 0.78	1.32± 2.34	3.62± 2.31	0.66± 0.82
S8	7.57± 0.480	0.86± 0.759	0.59± 0.200	179.41 ± 45.049	17.78± 4.487	235.00± 67.000	82.00± 4.000	0.54± 0.312	1.56± 1.030	4.07± 1.550	0.70± 0.304
S9	7.49± 0.511	0.93± 0.611	0.85± 0.050	165.03 ± 32.950	11.11± 5.822	271.67± 135.692	83.00± 2.646	1.57± 1.015	0.30± 0.118	5.73± 5.506	0.81± 0.553
S10	7.64± 0.407	0.75± 0.656	0.40± 0.072	164.04 ± 33.583	13.00± 3.839	136.00± 28.844	83.00± 3.000	0.14± 0.090	1.39± 1.199	2.24± 0.550	0.57± 0.237
S11	7.62± 0.725	0.81± 0.675	0.76± 0.151	159.67 ±25.697	8.22± 6.478	281.33± 116.792	86.00± 3.606	1.67± 0.316	0.60± 0.327	3.01± 0.460	1.78± 0.702
S12	7.91± 0.226	0.79± 0.651	0.60± 0.335	162.04 ± 44.609	10.18± 6.398	417.33± 256.028	88.33± 3.215	0.69± 0.257	1.13± 0.943	3.98± 4.729	0.89± 0.498
S13	7.61± 0.700	0.73± 0.595	0.90± 0.107	167.67 ± 29.872	11.77± 6.619	271.33± 220.659	84.67± 3.055	0.47± 0.259	1.23± 0.808	9.59± 3.134	1.04± 0.116
S14	7.80± 0.458	0.70± 0.585	0.88± 0.156	157.03 ±27.753	9.75± 5.701	462.67± 256.114	79.67± 2.082	0.88± 0.663	1.45± 0.802	11.25± 5.272	0.58± 0.307

Data Presented as Mean ± Standard Deviation. The means were obtained from three replicate (N=3) pH, EC: Electrical conductivity, OC: Organic Carbon, N: available Nitrogen, P: available Phosphorous, K: available Potassium, Fe: Iron, Mn: Manganese, Zn: Zinc, Cu: Copper.

kg/ha. It was recorded high (476.67±242.879 and 462.67±256.114 kg/ha respectively) at location S14 and comparatively lowest (166.33±53.613 and 136.00±28.844 kg/ha respectively) at location S10.

The moisture greater amount (92.00±3.000 and 92.33±3.786 respectively) of moisture percentage was obtained at locations S6 and S2, while a lower amount (79.33±2.517 and 79.67±2.082 respectively) was obtained at location S14. Minor elements that are commonly found in the soil like Iron (Fe), Manganese (Mn), Zinc (Zn), Copper (Cu) etc., play an extraordinary role in plant growth and development. The Zinc maximum amount (1.35±0.380 and 1.57±1.015 ppm respectively) of zinc was reported at locations S14 and S9, while a lower amount (0.7±0.254 and 0.14±0.090 ppm respectively) of zinc was recorded at location S9 and S10. The iron (Fe) content obtained at all studied locations ranges between 0.4 and 0.5 ppm.

The maximum amount (1.71±1.313 and 10.70±1.064ppm respectively) of iron was obtained at locations S14 and S6, while a lower amount (0.47±0.340 and 0.25±0.252 ppm respectively) of iron was documented at locations S3 and S1. Manganese (Mn) deficiencies generally occur in neutral or alkaline soils. The maximum amount of (16.39±3.467and 11.25±5.272 ppm respectively) of Mn was reported at locations S14, while a lower amount (3.22±2.010 and 1.90±0.489 ppm respectively) of Mn was reported at locations S11and S6. The amount of copper in the soil can cause toxicity in the plants. The maximum quantity (1.31±0.137and 1.78±0.702 ppm respectively) of copper was reported at locations S12 and S11, while lower quantity (0.40±0.337 and 0.40±0.217 ppm respectively) of copper was obtained at location S8 and S6.

Conclusion:

The present work onthe Physiochemical properties of the soil is an important parameter for agricultural and soil management. Different field shows that all the soil parameter conductivity pH, Electrical Conductivity, Organic carbon, Nitrogen, Phosphorus, potassium, Moisture, Zinc, Iron, Manganese and copper. The result indicated the irregular distribution of soil parameters. The identified concentrations of parameters present in soil which is benefitted to the local farmers for scientific agricultural practices in the future.

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