International Journal of Statistics and Applied Mathematics

ISSN: 2456-1452
Maths 2023; SP-8(5): 125-129
© 2023 Stats & Maths
https://www.mathsjournal.com
Received: 19-07-2023
Accepted: 23-08-2023

Anil Kumar
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences Bundelkhand University Jhansi, Uttar Pradesh, India

Anil Kumar Sahu
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences Bundelkhand University Jhansi, Uttar Pradesh, India

SV Singh
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences Bundelkhand University Jhansi, Uttar Pradesh, India

Dharmendra Singh
Department of Soil Science and Agricultural Chemistry, Kulbhaskar Aashram PG College Prayagraj, Uttar Pradesh, India

Deepchandra
Department of Soil Science and Agricultural Chemistry, R B S College Bichpuri Agra, Uttar Pradesh, India

Seema Kumari
Department of Soil Science and Agricultural Chemistry, R B S College Bichpuri Agra, Uttar Pradesh, India

Corresponding Author:
Anil Kumar
Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences Bundelkhand University Jhansi, Uttar Pradesh, India

Analysis of samples for its physicochemical parameters of red soil from Jhansi Bundelkhand region, Uttar Pradesh under cabbage cultivation

Anil Kumar, Anil Kumar Sahu, SV Singh, Dharmendra Singh, Deepchandra and Seema Kumari

Abstract

The current research was carried out in the Rabi season of 2019–20 in the Uttar Pradesh district of Jhansi. Numerous factors, including soil pH and electrical conductivity, are the foundation of a physicochemical study of soil. A total of 27 typical samples were collected, and their alkalinity, pH, electrical conductivity, organic carbon, sodium, and potassium contents were all examined. In order to identify soils that were neutral to slightly alkaline, 27 soil samples were taken at a depth of 0–20 cm. The soil's pH ranged from 7.1 to 7.5, its conductivity was 0.51 to 0.55 dSm-1, and its organic carbon content was reported to be 0.45 to 0.64%, range of bulk density was 1.17 to 1.31 g/cm^3, Particle density 2.15 to 2.24 g/cm^3 and porosity 39.07% to 47.77% kg/ha. This information will help the farmers to know the condition of soil.

Keywords: Physicochemical parameters, Jhansi Bundelkhand, cabbage cultivation

Introduction

Cabbage (*Brassica oleracea* L. var. capitata) is one of the most important vegetables grown worldwide. It belongs to the family Cruciferae, which includes broccoli, cauliflower, and kale. The different cultivated types of cabbage show great variation in respect of size, shape and color of leaves as well as the texture of the head. Cabbage has many uses in the kitchen. Raw, it brings crunch and zest to salads and slaw. You can braise, stir-fry, stuff, add to soups, mix into the filling for egg rolls, and ferment cabbage to make sauerkraut and kimchi. In Minnesota, you can plant cabbage in spring for a summer crop, and again in mid-summer for a fall crop. Many Minnesota soils have adequate amounts of phosphorus. Unless your soil test report specifically recommends additional phosphorus, use a low- or no-phosphorus fertilize Improve your soil by adding well-rotted manure or compost in spring or fall. Do not use fresh manure as it may contain harmful bacteria, and may increase weed problems. The plant needs to absorb water and nutrients steadily during its growth.

Cabbage is a relatively easy crop to grow and doesn't require much pre-planning. Nonetheless, there are a few things you would want to check off your to-do list before you plant the seeds. Cabbage can be grown in different kinds of soils ranging from sandy loam to clay soil. But make sure that the pH level of the soil is maintained at 6.5 to 7 to get a good yield. Soil rich in organic matter with good drainage is all that your cabbage plants need to thrive. micronutrients. Out of 17 essential plant nutrients N, P, K, Ca, Mg, and S are macronutrients.

The sustainable productivity of a soil mainly depends upon its ability to supply essential nutrients to the growing plants. Soil fertility fluctuates throughout the growing season each year due to alteration in the quantity and availability of mineral nutrients by the addition of fertilizers, manure, compost, mulch, and lime in addition to leaching. Hence, evaluation of fertility status of the soils of an area or a region is an important aspect in the context of sustainable agriculture. Soil testing assess the current fertility status and provides information regarding nutrient availability in soils which forms the basis for the fertilizer recommendations for maximizing crop yields and to maintain the optimum fertility in soil year after year.

The site specific nutrient management practices reduce the cost of cultivation and environmental pollution due to the imbalanced application of chemical fertilizers. For proper soil management, the farmer should know what amendments are necessary to optimize the productivity of soil for specific crops. The degradation of soil has started occurring both due to natural and human induced factors which in turn affecting the productivity. As human population continue to increase, human disturbance of the earth's ecosystem to produce food and fiber will place greater demand on soil to supply essential nutrients (Walkley and Black, 1934) [21]. Cabbage (*Brassica oleracea* var. capitata) is one of the most important cole crop widely grown both in tropical and temperate countries. Cabbage is 4 herbaceous, biennial, dicotyledonous flowering plant distinguished by a short stem up to which a crowded mass of leaves, usually green but in some varieties red or purplish, which while immature from a characteristics compact, globular cluster (Cabbage head). Cabbage is a high feeder of nutrients. Therefore, the judicious application of macro and micronutrients along with required dose of organic manures is essential for getting high yield of quality produce. In cultivation of cabbage, nutrition is one of the most important factor which governs the productivity and quality of cabbage. It is reported that, the use of micro-nutrients plays an important role in enhancing the translocation of carbohydrates from the site of synthesis to the storage organ and also helps in increasing yield and quality of cabbage (Jany *et al*., 2008) [22]. During the era of "Green Revolution", the hybrid varieties of high yielding cabbage were introduced and their high demand for nutrients also contributed to increased amounts of macro and micronutrients mining, which led to their deficiencies.

Materials and Methods

The current study, "Red Soils under Cabbage (*Brassica oleracea* var. capitata) Cultivation in Jhansi District of Uttar Pradesh," was carried out accurately enough to be taken into statistical consideration in 2019–20. The study's methodology and materials were regarded as being of utmost significance. As a result, the ensuring account was prepared similarly. The following section includes a comprehensive summary, under the proper headings, of the materials used and procedures followed during the course of the investigation.

The present experiment was carried out at Organic Research Farm, Karguanji, Department of Soil Science & Agricultural Chemistry, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (U.P.) which is located at 27˚ 15' N latitude and 77˚ 30' E longitude at a height of 228m above the mean sea level in the Bundelkhand Agro-climatic region of Uttar Pradesh.

S. No.	Component	Method employed
Physical properties of soil		
1	Bulk density (g/ m^{-3})	Method given by Cresswell and Hamilton (2002) [23]
2	Particle density(g/ m^{-3})	
3	Porosity (%)	
Chemical properties of soil		
1	Soil (pH)	Blackman"s Glass Electrode pH meter (Muhur *et al.* 1965) [24]
2	EC (dSm^{-1})	Solubridge method (Richard, 1954)
3	Organic Carbon O.C (%)	Walkley and Black"s Rapid Titration method (Piper, 1966) [25]
4	Available Nitrogen (kg ha^{-1})	Alkaline permanganate method (Subbiah and Asiza, 1956) [16]
5	Available Phosphorus (kg ha^{-1})	Olsen"s method (Olsen *et al.*, 1954) [17]
6	Available Potassium (K_2O kg ha^{-1})	Flame Photometer (Muhur *et al.* 1965) [24]
7	Available Sulphur (mg kg^{-1})	0.15% $CaCl_2$ extractant and turbidimetric determination (Chesnin and Yien, 1950) [7]
8	Available Boron (mg kg^{-1})	Azomethine H Method (John *et al.*, 1975)
9	Available Molybdenum (mg kg^{-1})	Atomic Absorption Spectrophotometer By Elwell and Gridley (1967) [26]
10	Available Iron (mg kg^{-1})	
11	Available Zinc (mg kg^{-1})	
12	Available Manganese (mg kg^{-1})	

Descriptive statistics (mean, range, standard deviation and coefficient of variation) of soil parameters were computed using the standard statistical method by Panse and Sukhatme (1985) [27]. Rating (very low, low, medium, high and very high) of determined values were based on standards reported by different scientists as mentioned in table 3.1. The coefficient of variation was ranked according to the guidelines of (Aweto, 1982) [28] where, CV < 25% = low variation, CV >25 ≤ 50% = moderate variation, CV >50% = high variation.

Results and Discussion

Bulk density (g/ cm^3): The data presented in Table 4.1 revealed that the bulk density (BD) analyzed in all pre planting and post-harvest samples under cabbage cultivation in red soils exhibited in the range of 1.17 g/cm^3 to 1.31 g/cm^3 with a mean value of 1.22 g/cm^3 in initial samples, while a range of 1.15 g/cm3 to 1.28 g/cm^3 with a mean value of 1.20 g/cm^3 was recorded in post-harvest samples. Thus the bulk density of the soil was minutely decreased with cabbage cultivation.

Particle density (g/ cm^3)

It is clearly indicated by the data presented in Table 1 that the particle density (PD) of the red soils was minutely increased with cabbage cultivation. The initial particle density ranged from 2.15 g/cm^3 to 2.24 g/cm^3, with a mean value of 2.20 g/cm^3, while the particle density of the soil after the harvest of the cabbage ranged from 2.18 g/cm^3 to 2.28 g/cm^3, with a mean value of 2.24 g/cm^3.

Porosity (%)

The data presented in Table 4.1 is also revealed that the porosity of the red soils was increased with cabbage cultivation. The initial porosity of red soil exhibited in the range of 39.07% to 47.77% with a mean value of 44.33% while the porosity of soil was slightly increased after cultivation of the cabbage in the range of 41.28% to 49.34% with a mean of 45.11%.

Table 1: Initial and post-harvest texture of red soils under cabbage cultivation

Sample No.	Bulk density (g/ cm^3)		Particle density (g/ cm^3)		Porosity (%)	
	Initial	Post	Initial	Post	Initial	Post
S1	1.27	1.25	2.17	2.20	41.47	43.18
S2	1.25	1.24	2.16	2.18	42.13	43.12
S3	1.31	1.28	2.15	2.18	39.07	41.28
S4	1.26	1.24	2.17	2.19	41.94	43.38
S5	1.17	1.15	2.23	2.27	47.53	49.34
S6	1.21	1.20	2.18	2.23	44.50	46.19
S7	1.21	1.19	2.20	2.22	45.00	46.40
S8	1.18	1.17	2.22	2.23	46.85	47.53
S9	1.25	1.23	2.15	2.25	41.86	45.33
S10	1.24	1.20	2.15	2.19	42.33	45.21
S11	1.19	1.17	2.24	2.27	46.88	48.46
S12	1.18	1.17	2.23	2.26	47.09	48.23
S13	1.22	1.21	2.21	2.28	44.80	46.93
S14	1.25	1.23	2.19	2.24	42.92	45.09
S15	1.22	1.20	2.18	2.23	44.04	46.19
S16	1.21	1.20	2.19	2.20	44.75	46.19
S17	1.17	1.15	2.24	2.26	47.77	49.12
S18	1.17	1.16	2.23	2.27	47.53	48.90
S19	1.27	1.24	2.16	2.20	41.20	43.64
S20	1.26	1.25	2.17	2.21	41.94	43.44
S21	1.24	1.22	2.22	2.25	44.14	45.78
S22	1.22	1.21	2.24	2.26	45.54	46.46
S23	1.17	1.15	2.24	2.27	47.77	49.34
S24	1.25	1.22	2.18	2.24	42.66	45.54
S25	1.25	1.23	2.20	2.22	43.18	44.59
S26	1.19	1.17	2.21	2.24	46.15	48.00
S27	1.20	1.18	2.22	2.27	45.95	48.02
Mean	1.22	1.20	2.20	2.24	44.33	46.11
Maximum	1.31	1.28	2.24	2.28	47.77	49.34
Minimum	1.17	1.15	2.15	2.18	39.07	41.28
SD	0.07	0.05	0.03	0.04	2.41	2.19
CV (%)	5.74	4.16	1.41	1.78	5.44	4.75

Soil reaction (pH)

It is evident from the data presented in Table 4.2 that the pH of initial soil samples was varied from 7.10 to 7.50 with a mean value of 7.36 (Table 1) while, it was minutely decreased with cabbage cultivation and the pH in post-harvest soil sample ranged between 7.00 to 7.50 with a mean value of 7.25. This indicates that the entire initial and post-harvest samples were found in neutral category. Electrical conductivity (dSm^{-1})

The data presented in Table 2 indicated that the electrical conductivity of the red soils was slightly increased under cabbage cultivation. The electrical conductivity (EC) of the initial soil samples was varied from 0.51 to 0.55 dSm^{-1} with the mean value of 0.53 dSm-1 while, the electrical conductivity of post-harvest samples of soil was varied from 0.51 to 0.64 dSm^{-1} with mean value of 0.60 dSm^{-1}. The result has shown the EC values of both initial and post-harvest soil samples was under normal range (<1.0 dSm^{-1}).

Organic carbon (%)

The organic carbon content in the initial soil samples was ranged from 0.30% to 0.38% with a mean value of 0.33% (Table 2) whereas, the organic carbon content in post-harvest soil samples was ranged between 0.45% to 0.64% with a mean value of 0.52%. On the basis of limits suggested by Piper (1966) [25], all the initial soil samples under investigation rated low (< 0.5%) in the soil organic carbon content. Among the post-harvest soil samples, distribution of soil samples with respect to organic carbon content indicates that 11 samples had low organic carbon while, 16 samples had medium organic carbon content. 108.46 kg ha_{-1} however, it was decreased after harvest of the cabbage and ranged from 67.50 to 127.23 kg ha-1 with a mean value of 100.43 kg ha-1. On the basis of criteria, suggested by Subbiah and Asija (1956) [16] all the soils samples of both the stages (Initial and post-harvest) were found deficient (Low) to available nitrogen in the soil.

Table 2: Initial and post-harvest status of pH, EC and OC in red soils under cabbage cultivation

Sample No.	Soil pH		EC (dSm^{-1})		OC (%)	
	Initial	Post	Initial	Post	Initial	Post
S1	7.4	7.3	0.52	0.51	0.30	0.47
S2	7.5	7.3	0.54	0.63	0.32	0.49
S3	7.4	7.2	0.51	0.59	0.35	0.52
S4	7.3	7.1	0.55	0.62	0.37	0.59
S5	7.4	7.2	0.52	0.58	0.31	0.45
S6	7.3	7.3	0.53	0.59	0.34	0.46
S7	7.2	7.1	0.52	0.61	0.33	0.45
S8	7.4	7.2	0.51	0.59	0.32	0.47
S9	7.3	7.1	0.55	0.63	0.30	0.47

S10	7.4	7.3	0.51	0.60	0.31	0.45
S11	7.3	7.2	0.53	0.62	0.38	0.64
S12	7.2	7.0	0.52	0.60	0.32	0.48
S13	7.4	7.2	0.52	0.59	0.34	0.50
S14	7.5	7.4	0.51	0.58	0.35	0.57
S15	7.4	7.3	0.54	0.61	0.31	0.47
S16	7.5	7.5	0.53	0.62	0.32	0.48
S17	7.1	7.3	0.54	0.62	0.34	0.52
S18	7.4	7.3	0.52	0.61	0.33	0.53
S19	7.3	7.2	0.55	0.62	0.32	0.51
S20	7.1	7.1	0.53	0.60	0.33	0.55
S21	7.2	7.2	0.51	0.62	0.34	0.56
S22	7.5	7.4	0.52	0.61	0.35	0.58
S23	7.4	7.4	0.54	0.63	0.32	0.57
S24	7.5	7.4	0.51	0.59	0.31	0.54
S25	7.4	7.3	0.55	0.64	0.32	0.56
S26	7.4	7.2	0.55	0.63	0.34	0.58
S27	7.4	7.3	0.52	0.59	0.35	0.64
Mean	7.36	7.25	0.53	0.60	0.33	0.52
Maximum	7.50	7.50	0.55	0.64	0.38	0.64
Minimum	7.10	7.00	0.51	0.51	0.30	0.45
SD	0.12	0.12	0.01	0.03	0.02	0.06
CV (%)	1.57	1.59	2.75	4.21	6.02	10.84

References

1. Bandyopadhyay KK, Ghosh PK, Chaudhary RS, Mhati K, Mandal KG, Misra AK. Integrated nutrient management practices in soybean and sorghum in sole and intercropping system in a Vertisol. Indian Journal of Agricultural Science. 2004;74:55-63.
2. Barthwal A, Swaroop N, Rao PS, Thomas T. Assessment of physico-chemical properties of soil in Dehradun district, Uttarakhand, India. International Journal of Chemical Studies. 2019;7(3):1623-1625.
3. Basavaraju D, Naidu MVS, Ramavatharam N, Venkaiah K, Ramarao G, Reddy KS. Characterisation and evaluation of soils in Chandragiri Mandal of Chittoor district, Andhra Pradesh. Agropedology. 2005;15:55-62.
4. Black CA. Methods of Soil Analysis, American Society of Agronomy, Madison, Wisconsin, USA, 1965, 1.
5. Bouyoucos GJ. The hydrometer as the new method for the mechanical analysis of the soils, Journal of Soil Science. 1927;23:343-353.
6. Cheng KL, Bray RH. Determination of Calcium and Magnesium in soil and plant material. Soil Sc. 1951;72:449-458.
7. Chesnin L, Yien CH. Turbidimetric determination of available sulphates. Proceeding of Soil Science Society of America. 1950;14:149-51.
8. Dhale SA, Jagdish Prasad. Characterization and Classification of Sweet Orange- growing Soils of Jalna District, Maharashtra. Journal of the Indian Society of Soil Science. 2009;57(1):11-17.
9. Dutta M, Diengdoh J, Ram Sewak. Physico-chemical properties of west Khasi Hills soils of Meghalaya in relation to land; c2015.
10. Jackson ML. Soil Chemical Analysis, Prentice – Hall India, New Delhi 1958.
11. Kekane SS, Chavan RP, Shinde DN, Patil CL, Sagar SS. A review on physico-chemical properties of soil. International Journal of Chemical Studies. 2015;3(4):29-32.
12. Krishnamurthy V, Chandra IJ. Changes in soil fertility during two decades of FCV tobacco cultivation in Northern light soils. Tobacco Research0 2002;28(2):114-118.
13. Munsell AH. Munsell Soil Colour Chart, Munsell Color Company Inc, 2441 N, Calvert Street, Baltimore, ~ 2092 ~The Pharma Innovation Journal http://www.thepharmajournal.com Maryland 21212, USA 1954.
14. Muthuaval PC, Udaysooriyan R, Natesa PP, Ramaswami. Introduction to Soil Analysis, Tamil Nadu Agriculture University, Coimbatore-641002. Muche, M., Kokeb, A. and Molla, E. Assessing the Physiochemical Properties of Soil Under Different Land Use Type; c1992.
15. Naga Raju Kola, Babu Rao Gudipudi. Soil Chemistry of Erravagu Sub-basin of Guntur District, Andhra Pradesh 2020. Varaprasad Rao AP, Naidu MVS, Ramavatharam N, Rama Rao G. Characterization, classification and Evaluation of soils on different land forms in Ramachandrapuram mandal of Chittoor district in Andhra Pradesh for sustainable land use planning. Journal of the Indian Society of Soil Science. 2008;56(1):23-33.
16. Subbiah BV, Asija CL. A rapid procedure for the estimation of available nitrogen in soils, Current Science. 1956;25:259-260.
17. Olsen SR, Cole CV, Watnahe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate, U. S. Department of Agriculture Circular. 1954, 939.
18. Toth SJ, Prince AL. Estimation of cation exchange capacity and exchangeable Ca, K and Na content of soil by flame photometer technique. Soil Sci. 1949;67:439-445.
19. Venkateswarlu M, Rao SM, Bhanuprasad V, Pillai RN. Nutrient status of black soils of Kandukur division in Prakasam district of Andhra Pradesh. The Andhra Agricultural Journal. 1995;42(1-4):88-90.
20. Walkley A, Black IA. Critical examination of rapid method for determining organic carbon in soils, effect of variation in digestion conditions and of inorganic soil constituents, Soil Science. 1947;632:251.
21. Walkley A, Black IA. An examination of the Degtjareff method for determining soil organic matter, and a proposed modification of the chromic acid titration method. Soil science. 1934;37(1):29-38.

22. Jany JL, Barbier G. Culture-independent methods for identifying microbial communities in cheese. Food microbiology. 2008 Oct 1;25(7):839-48.
23. Cresswell H, Hamilton GJ. Bulk density and pore space relations. Soil physical measurement and interpretation for land evaluation. 2002:35-58.
24. Muhur RN, Datta NP, Sankar Subramoney H, Leley VK. Vay Donaline L. Soil testing in India. US Agency for international development mission to India. 1965;39:40-5.
25. Piper J. Diffusion of hydrogen in copper-palladium alloys. Journal of Applied Physics. 1966 Feb 1;37(2):715-21.
26. Elwell WT, Gridley JA. Atomic absorption spectrophotometer ypergamon press Ltd. London, W-1. 1967.
27. Panse VG, Sukhatme PV. Statistical methods for agricultural research. ICAR, New Delhi. 1985;8:308-18.
28. Aweto AO. Variability of upper slope soils developed under sandstones in South-western Nigeria. Georgian Journal. 1982;25:27-37.