International Journal of Plant & Soil Science

34(20): 125-133, 2022; Article no.IJPSS.88084
ISSN: 2320-7035

Evaluation of Soil Nutrient Index and Physico-Chemical Parameters of Soil from Different Blocks of Kurnool District, Andhra Pradesh, India

K. Manivikas[1φ], Amreen Hasan[1#*], Arun Alfred David[1†], Tarence Thomas[1‡] and I. Srinath Reddy[1¥]

[1]Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2022/v34i2031135

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/88084

Original Research Article

Received 20 May 2022
Accepted 04 June 2022
Published 09 June 2022

ABSTRACT

The evaluation of Physico-chemical properties of soil of different blocks of Kurnool district was carried out in 2021-2022. The main objectives of this study is to evaluate the Physico-chemical properties of soil and to analyze the soil nutrient index of soil. For evaluation 9 sampling sites were selected with different depths of 0-15cm, 15-30cm and 30-45cm. The research findings revealed that the Bulk density ranges from 1.33 to 1.52 (Mg m^{-3}). The Particle density ranges from 2.36 to 2.66 (Mg m^{-3}). The Pore space ranges from 46.66 to 59.09 (%). The Water Holding Capacity ranges from 49.52 to 60.22 (%). The Soil pH ranges from 7.66 to 8.44. The Electrical Conductivity ranges from 0.15 to 0.57 (dS m^{-1}). The Soil Organic Carbon ranges from 0.35 to 0.66 (%). The Available Nitrogen ranges from 94.30 to 218.58 (kg ha^{-1}). The Available Phosphorous ranges from 12.7 to 52.6 (kg ha^{-1}). The Available Potassium ranges from 135.42 to 402.4 (kg ha^{-1}). The Exchangeable Calcium ranges from 13.66 to 34.62 (cmol (p^+) kg^{-1}). The Exchangeable Magnesium ranges from 4.21 to 8.35 (cmol (p^+) kg^{-1}). The Available Zinc ranges from 0.16 to 0.57 (ppm). The

[φ]M.Sc. Scholar;
[#]Assistant Professor;
[†]Associate Professor;
[‡]Professor and Head;
[¥]Ph.D. Scholar;
**Corresponding author: E-mail: amreen.hasan@shuats.edu.in;*

Available Copper ranges from 0.18 to 0.77 (ppm). The Available Iron ranges from 3.22 to 6.89 (ppm). Based on the outcomes soil is good for cultivation of different crops and this data will aid farmers in application of nutrients to soil and also in maintaining good soil health.

Keywords: Soil fertility status; macro-nutrients; micro-nutrients; kurnool etc.

1. INTRODUCTION

Soil is a critical natural resource for the existence of life on Earth, and its evaluation is required to determine soil productivity and long-term sustainability of the ecosystem. The biggest challenge to the mankind today, is to provide the basic necessities for living, from the ever shrinking and non-renewable soil resource. For the planned development of soil resources to sustain their productivity and management, precise scientific knowledge on their features, potentials, limitations, and management is essential to meet the demands for the future [1]. Soil fertility, especially micronutrients, must be assessed in locations where commercial crops are grown in order to manage natural resources, diversify crops, and increase production levels. Soil is critical in determining an agroecosystem's long-term production. The ability of a soil to give critical nutrients to the crop determines its long-term production. Macro and micronutrient levels in soils are decreasing as a result of continual fertiliser mining without restoration. It is well understood that optimal plant development and crop yields are determined by plant accessible nutrients in the soil to the crop rather than their total concentration [2]. Soil and water are the greatest natural resources gifted to mankind. Our country basically depends upon agriculture; thus, it becomes more so important study, analyse and effectively manage “soil”. Soil being the basic media for the plants to stand and grow and water becomes the lifeline to the plants. In view of this, a greater importance has been attached for management of soil and water by way on analysis, there by contributing increased productivity in modern agriculture [3]. Soil is the intermediary zone between the atmosphere and the earth's rock layer, the lithosphere. It also serves as the interface between water bodies (hydrosphere) and the lithosphere, making it a component of the biosphere. The soil is the top weathered layer of the earth's crust that contains mixed creatures and the results of their death and decay. It is also known as the region of the earth's crust where plants are anchored. The soil is a complex structure composed of six constituents: organic matter, inorganic matter, soil solution, soil moisture, soil organisms and soil air [4].

Andhra Pradesh is a state in India's south-eastern coastline area. It is the seventh-largest state in terms of land area, with a total area of 162,975 km^2. Agriculture and allied activities employ 60% of the population. Rice is the main food crop and staple diet of the state. It exports a variety of agricultural goods and is recognised as the "Rice Bowl of India."

The proposed study includes analysing the soil for its physical state, constituents, and nutrients, present in soil. Various Physico-chemical characteristics of different blocks of Kurnool district region of Andhra Pradesh State has been determined by using standard methods.

2. MATERIALS AND METHODS

Kurnool is a city in the state of Andhra Pradesh, India. Kurnool is located at 15.8333°N 78.05°E. It has an average elevation of 273 metres (898 feet). Kurnool lies on the banks of the Tungabhadra River. Major soils in Kurnool District are black soils comprising 5,84,000 ha (61.4%) and red soils comprising 317000 ha (33.3%) and other soils comprising 51000 ha. (5.3%). The proposed research includes 3 blocks of Kurnool district i.e., Kallur block, Kurnool block, Orvakal block. Methods used for analysis of Physico-chemical parameters are given in Table 1.

Table 1. Procedure used for Physico-chemical analysis of soil

S.No.	Particulars	Methods	Scientist
1.	Soil colour	Munsell colour chart	Albert Henry Munsell, (1971)
2.	Soil texture	Bouyoucos Hydrometer	Bouyoucos, [5]
3.	Bulk density (Mg m^{-3})	Graduated measuring cylinder	Muthuvel et al. [6]

S.No.	Particulars	Methods	Scientist
4.	Particle density (Mg m^{-3})	Graduated measuring cylinder	Muthuvel et al. [6]
5.	Pore space (%)	Graduated measuring cylinder	Muthuvel et al. [6]
6.	Water Holding Capacity (%)	Graduated measuring cylinder	Muthuvel et al. [6]
7.	Soil pH	Digital pH meter	Jackson, [7]
8.	EC	Digital conductivity meter	Wilcox, [8]
9	Organic carbon (%)	Walkley and Black wet oxidation method	Walkley and Black, [9]
10.	Available Nitrogen (kg ha^{-1})	Modified alkaline permanganate oxidation method	Subbiah and Asija, [10]
11.	Available phosphorus (kg ha^{-1})	Olsen's extraction followed by spectrophotometric method	Olsen et al. [11]
12.	Available potassium (kg ha^{-1})	Neutral normal ammonium acetate extraction followed by Flame photometric method	Toth and Prince, [12]
13.	Exchangeable calcium and magnesium (cmol (p+) kg^{-1})	Versenate titration method	Cheng and Bray, [13]
14.	Zinc, Iron, Copper (ppm)	DTPA method /Atomic absorption spectroscopy	Lindsay and Norvell, [14]

Table 2. Physical properties of soil at various depths i.e., 0-15, 15-30 and 30-45cm from different blocks of Kurnool district

Villages	Depth (cm)	BD (Mg m^{-3})	PD (Mg m^{-3})	Porosity (%)	WHC (%)
Thadakanapalli (B_1V_1)	0-15	1.33	2.36	59.09	56.81
	15-30	1.38	2.43	56.25	55.55
	30-45	1.47	2.60	52.94	52.17
Chinnatekur (B_1V_2)	0-15	1.36	2.36	56.66	55.62
	15-30	1.41	2.53	53.63	54.71
	30-45	1.52	2.66	51.09	53.63
Peddatekur (B_1V_3)	0-15	1.33	2.43	58.42	59.09
	15-30	1.39	2.50	53.15	55.55
	30-45	1.49	2.60	52.75	53.52
Munagalapadu (B_2V_1)	0-15	1.36	2.50	57.89	59.23
	15-30	1.42	2.53	55.55	56.66
	30-45	1.50	2.60	55.55	53.15
Singavaram (B_2V_2)	0-15	1.39	2.43	56.66	56.87
	15-30	1.44	2.36	52.85	53.75
	30-45	1.52	2.43	46.66	49.52
Nidzur (B_2V_3)	0-15	1.38	2.36	57.89	56.66
	15-30	1.42	2.43	55.55	52.50
	30-45	1.44	2.50	52.63	51.53
Nannur (B_3V_1)	0-15	1.36	2.43	58.82	59.97
	15-30	1.42	2.43	55.55	58.05
	30-45	1.49	2.50	52.94	55.66
Loddipalle (B_3V_2)	0-15	1.38	2.36	58.75	60.22
	15-30	1.46	2.43	54.70	57.56
	30-45	1.47	2.43	52.50	54.42
Uyyalawada (B_3V_3)	0-15	1.33	2.43	56.66	58.15
	15-30	1.41	2.36	54.70	56.50
	30-45	1.49	2.53	52.50	55.53

Note: BD= Bulk Density, PD= Particle Density, WHC= Water Holding Capacity

Table 3. Chemical properties (pH, EC, OC, N, P, K) of soil at various depths i.e., 0-15, 15-30 and 30-45cm from different blocks of Kurnool district

Villages	Depth (cm)	pH	EC (dS m^{-1})	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})
Thadakanapalli (B_1V_1)	0-15	7.89	0.16	0.66	210.48	28.83	402.40
	15-30	8.25	0.17	0.50	169.46	24.96	396.23
	30-45	8.26	0.18	0.36	130.08	22.36	375.64
Chinnatekur (B_1V_2)	0-15	8.13	0.30	0.61	190.58	18.50	298.72
	15-30	8.05	0.33	0.62	152.36	18.82	180.37
	30-45	8.14	0.35	0.50	133.60	16.82	175.65
Peddatekur (B_1V_3)	0-15	7.92	0.15	0.62	188.36	14.59	326.49
	15-30	7.96	0.18	0.53	147.34	13.43	290.85
	30-45	8.23	0.19	0.35	105.59	12.75	258.55
Munagalapadu (B_2V_1)	0-15	7.66	0.18	0.61	218.58	52.60	398.27
	15-30	7.95	0.18	0.57	158.46	42.14	376.76
	30-45	8.12	0.19	0.37	114.83	41.67	260.84
Singavaram (B_2V_2)	0-15	7.96	0.15	0.60	195.83	27.97	192.83
	15-30	8.13	0.16	0.53	163.02	23.68	165.55
	30-45	8.25	0.19	0.36	110.08	21.18	135.42
Nidzur (B_2V_3)	0-15	7.75	0.42	0.60	173.46	18.82	294.65
	15-30	7.89	0.50	0.50	153.15	18.50	250.31
	30-45	8.22	0.57	0.35	94.30	16.06	257.11
Nannur (B_3V_1)	0-15	7.85	0.23	0.57	192.80	46.69	291.38
	15-30	7.88	0.25	0.50	139.68	44.33	257.25
	30-45	8.44	0.29	0.37	97.47	42.19	255.69
Loddipalle (B_3V_2)	0-15	8.04	0.19	0.58	172.24	25.36	283.43
	15-30	8.10	0.20	0.53	151.34	20.90	272.55
	30-45	8.27	0.27	0.36	103.60	20.79	253.91
Uyyalawada (B_3V_3)	0-15	8.06	0.28	0.53	183.88	20.71	327.58
	15-30	8.23	0.30	0.50	142.74	18.37	330.26
	30-45	8.35	0.40	0.37	116.31	16.06	295.45

Note: EC= Electrical Conductivity, OC= Organic Carbon, N= Nitrogen, P= Phosphorus, K= Potassium

Table 4. Chemical properties (Ca, Mg, Zn, Cu, Fe) of soil at various depths i.e., 0-15, 15-30 and 30-45cm from different blocks of Kurnool district

Villages	Depth (cm)	Ca (cmol (p^+) kg^{-1})	Mg (cmol (p^+) kg^{-1})	Zn (ppm)	Cu (ppm)	Fe (ppm)
Thadakanapalli (B_1V_1)	0-15	20.56	7.99	0.57	0.77	6.02
	15-30	20.13	7.15	0.35	0.46	4.76
	30-45	19.24	7.10	0.31	0.22	3.97
Chinnatekur (B_1V_2)	0-15	19.87	6.14	0.31	0.68	5.12
	15-30	19.16	4.52	0.25	0.59	4.33
	30-45	18.13	4.29	0.20	0.32	3.39
Peddatekur (B_1V_3)	0-15	22.57	8.12	0.44	0.55	6.44
	15-30	21.43	6.93	0.40	0.31	5.03
	30-45	19.12	5.44	0.33	0.20	4.78
Munagalapadu (B_2V_1)	0-15	26.67	8.32	0.48	0.42	5.67
	15-30	23.13	5.79	0.43	0.28	5.25
	30-45	21.45	4.32	0.34	0.18	4.32
Singavaram (B_2V_2)	0-15	16.30	7.19	0.32	0.63	6.10
	15-30	14.72	6.33	0.31	0.42	5.13
	30-45	13.66	5.21	0.28	0.27	4.21
Nidzur (B_2V_3)	0-15	26.26	7.37	0.36	0.55	6.16
	15-30	27.93	7.71	0.23	0.39	4.57
	30-45	20.15	6.28	0.20	0.26	3.22
Nannur (B_3V_1)	0-15	34.62	6.75	0.52	0.68	6.89
	15-30	32.53	5.93	0.44	0.48	4.65
	30-45	31.13	4.21	0.40	0.40	4.06
Loddipalle (B_3V_2)	0-15	27.53	7.94	0.43	0.65	5.29
	15-30	26.79	7.46	0.34	0.49	4.13
	30-45	25.21	6.72	0.27	0.42	3.67
Uyyalawada (B_3V_3)	0-15	23.24	8.35	0.36	0.71	6.25
	15-30	22.13	7.27	0.20	0.53	5.34
	30-45	18.32	5.86	0.16	0.45	3.84

Note: Ca= Calcium, Mg= Magnesium, Zn= Zinc, Cu=Copper, Fe= Iron

2.1 Soil Nutrient Index

In order to compare the levels of soil fertility of one area with those of another it was necessary to obtain a single value for each nutrient. Nutrient index (N.I) value is a measure of nutrient supplying capacity of soil to plants [15].This index is used to evaluate the fertility status of soils based on the samples in each of the three classes, i.e., low, medium and high. The Nutrient index values of Organic carbon, Nitrogen, Phosphorus, Potassium, Sulphur, Zinc, Iron, Manganese and Copper are shown in the Fig. 1. The nutrient index is calculated by using the formula as given by Muhr et al., [16].

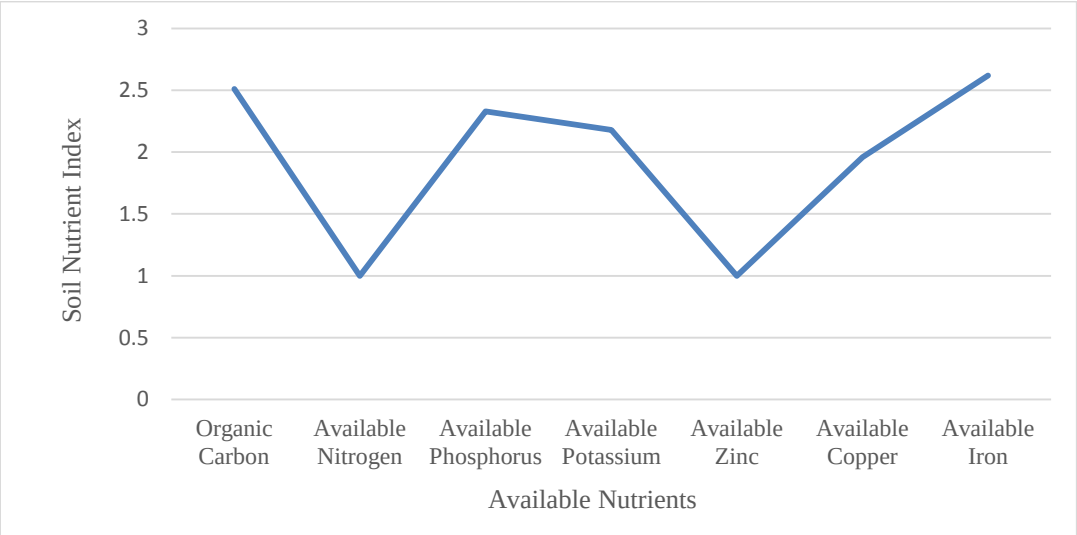

Fig. 1. Graphical representation of Nutrient Index range of different nutrients

Nutrient Index (N.I.) = (N_L × 1 + N_M × 2 + N_H × 3) / N_T

Where

N_L: Indicates number of samples falling in low class of nutrient status
N_M: Indicates number of samples falling in medium class of nutrient status
N_H: Indicates number of samples falling in high class of nutrient status
N_T: Indicates total number of samples analysed for a given area
The nutrient index value of less than 1.5 is rated as low, 1.5 to 2.5 is rated as medium and more than 2.5 is rated as high fertility status as suggested by Ramamurthy and Bajaj, [17].

3. RESULTS AND DISCUSSION

3.1 Physical Properties

The Soil colour varies from dark brown to very dark greyish brown in dry condition and from dark greyish brown to very dark greyish brown in wet condition. Dark colour of the soil is due to the presence of organic matter. Similar results were reported by (Vilakar et al., 2021). The soil texture was dominantly sandy clay loam in every site. Similar results were reported by Sivaprasad et al., [18]. The Bulk density ranged from 1.33 to 1.52 (Mg m^{-3}). Both the solid portion and the pore spaces are included in the bulk density. The maximum value found is 1.52 Mg m^{-3} in singavaram at 30-45cm depth and the minimum value found is 1.33 in peddatekur at 0-15cm depth. The bulk density increases with the increase in soil depth because of lower organic carbon and higher compactness of soils. Similar results were reported by Satish et al., [19]. The Particle density ranged from 2.36 to 2.66 (Mg m^{-3}). Particle density refers to the density of the solid portions of the soil, not the pore space. The mineral makeup of soil particles influences particle density. The maximum value found is 2.66 Mg m^{-3} in chinnatekur at 30-45cm depth which indicates that the soil has comparatively lower amount of organic matter and the minimum value found is 2.36 Mg m^{-3} in nidzur at 0-15cm depth which indicates the presence of higher amount of organic matter. Similar results were reported by Geetha Sireesha and Naidu, [20]. The Pore space ranged from 46.66 to 59.09 (%). The maximum value found is 59.09% in

thadakanapalli at 0-15cm depth and the minimum value found is 46.66% in singavaram at 30-45cm depth. Pore space decreases with increase in depth due to increase in compaction of soil in the sub surface. Similar results were reported by Ramana et al., [21]. The Water Holding Capacity ranges from 49.52 to 60.22 (%). The maximum value found is 60.22% in loddipalle at 0-15cm and the minimum value found is 49.52% in singavaram at 30-45cm depth. Water Holding capacity value decreases with increasing depth due to soil compaction and pore space reduction. Similar results were reported by Balaji et al*.,* [22].

3.2 Chemical Properties

The Soil pH ranged from 7.66 to 8.44. The maximum value found is 8.44 in nannur at 30-45cm and the minimum value found is 7.66 in munagalapadu at 0-15cm thereby indicating soils are alkaline. 100% of samples are alkaline in nature. The pH value increases with depth because the upper horizons get the most leaching from rainfall and dissolved carbonic acids, as well as a large concentration of exchangeable sodium ions. Similar results were reported by Reddy et al*.,* [3]. The Electrical Conductivity ranged from 0.15 to 0.57 (dS m^{-1}). The maximum value found is 0.57 (dS m^{-1}) in nidzur at 30-45cm depth and the minimum value found is 0.15 (dS m^{-1}) in peddatekur at 0-15cm depth. Similar results were reported by Sivaprasad et al*.,* [18]. The Soil Organic Carbon ranged from 0.35 to 0.66 (%). The maximum value found is 0.66 % in thadakanapalli at 0-15cm and the minimum value found is 0.35 % in nidzur at 30-45cm depth. The organic carbon declines with increasing depth because top soil includes undecomposed and partially decomposed organic matter, and subsurface soil contains decomposed organic matter. Similar results were reported by Sivaprasad et al*.,* [18]. The Available Nitrogen ranged from 94.30 to 218.58 (kg ha^{-1}). The maximum value found is 218.58 kg ha^{-1} in munagalapadu at 0-15cm depth and the minimum value found is 94.30 kg ha^{-1} in nidzur at 30-45cm depth. The available nitrogen declines with increasing depth because it is positively related with organic matter content, which declines with depth, and also because the high pH at depth. Similar results were reported by Supriya et al*.,* [23]. The Available Phosphorous ranged from 12.75 to 52.6 (kg ha^{-1}). The maximum value found is 52.6 kg ha^{-1} in munagalapadu at 0-15cm depth and the minimum value found is 12.75 kg ha^{-1} in peddatekur at 30-45cm depth. The available phosphorous decreases with the increasing depth. Higher level of available phosphorous in surface soil could be attribute of favourable soil pH and organic matter content. Similar results were reported by Supriya et al*.,* [23]. The Available Potassium ranged from 135.42 to 402.4 (kg ha^{-1}). The maximum value is 402.4 kg ha^{-1} in thadakanapalli at 0-15cm depth and the minimum value is 135.42 kg ha^{-1} in singavaram at 30-45cm depth. With increasing depth, the available potassium declines. The increased accessible potassium level of surface soil may be attributable to the release of liable K from organic wastes and the use of potash fertilisers. Similar results were reported by Supriya et al*.,* [23]. The Exchangeable Calcium ranged from 13.66 to 34.62 (cmol (p^+) kg^{-1}). The maximum value found is 34.62 cmol (p^+) kg^{-1} in nannur at 0-15cm depth and the minimum value found is 13.66 cmol (p^+) kg^{-1} in singavaram at 30-45cm depth. The exchangeable calcium decreases with the increasing depth due to the attribute of high pH towards the depth. Similar results were reported by Geetha Sireesha and Naidu, [20]. The Exchangeable Magnesium ranged from 4.21 to 8.35 (cmol (p^+) kg^{-1}). The maximum value found is 8.35 cmol (p^+) kg^{-1} in uyyalawada at 0-15cm depth and the minimum value found is 1.04 (cmol (p^+) kg^{-1}) in nannur at 30-45cm depth. The exchangeable magnesium decreases with the increasing depth due to the attribute of high pH towards the depth. Similar results were reported by Geetha Sireesha and Naidu, [20]. The Available Zinc ranged from 0.16 to 0.57 (ppm). The maximum value found is 0.57 ppm in thadakanapalli at 0-15cm depth and the minimum value found is 0.16 ppm in uyyalawada at 30-45cm depth. The available zinc declines with the increasing depth might be due to altitude may thus attributed to the accumulation of high organic matter, the major source of Zn in surface soils. Similar results were reported by Ismail and Umamahesh, [4]. The Available Copper ranged from 0.18 to 0.77 (ppm). The maximum value found is 0.77 ppm in thadakanapalli at 0-15cm depth and the minimum value found is 0.18 ppm in munagalapadu at 30-45cm depth. The available copper decreases with increasing depth and this significant decrease in copper content with depth may be attributed to increase in pH which makes it less soluble after oxidation thereby reducing its availability. Similar results were reported by Reddy et al*.,* [3]. The Available Iron ranged from 3.22 to 6.89 (ppm). The maximum value found is 6.89 ppm in nannur at 0-15cm depth and the minimum value found is 3.22 ppm in nidzur at 30-45cm depth. The

available iron decreases with the increasing depth. The greater amount of value in surface soil has possible due to the accumulation of water and organic material. Similar results were reported by Supriya et al*.,* [23].

4. CONCLUSION

It is concluded from the trial that the soils of three blocks of the Kurnool district are sandy clay loam with adequate Bulk density, Particle density and Pore space. All samples are alkaline in reaction and EC is in permissible limit suitable for most of the crops. More than half of samples are low to medium in organic carbon content. Macro-nutrients such as Nitrogen is low, Phosphorus and Potassium is medium to high range at all sites. Secondary nutrients calcium and magnesium are high and micro-nutrients such as Zinc is deficient, copper is adequate and iron is sufficient to excess at all sites. The usage of organic and inorganic fertilizers can help to compensate for nutritional deficiencies. The results suggest that soils are suitable for cultivation of different crops in this region. Farmers must maintain a Soil Health Card in accordance with state and central government norms for crop production, and are advised to use appropriate management practices and supply proper nourishment to soil health.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

ACKNOWLEDGEMENTS

I would like to thank the Department of Soil Science and Agricultural Chemistry, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. for providing the necessary equipment, basic infrastructure and laboratory for analysis.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Sathish A, Ramachandrappa BK, Devaraja K, Savitha MS, Gowda MN, Prashanth KM. Assessment of spatial variability in fertility status and nutrient recommendation in alanatha Cluster Villages, Ramanagara District, Karnataka using GIS. Journal of The Indian Society of Soil Science. 2018;66(2):149-57.
2. Prasad LK, Bindu JP, D Damodar RE, Rao CC, Ravisankar H. Assessment of soil fertility under northern light soil area of FCV tobacco in Andhra Pradesh: Fertility status of northern light soil area of FCV tobacco. Journal of AgriSearch. 2021 Jun 30;8(2):95-8.
3. Reddy PVRM, Venkaiah K, Naga MKV, Maheswara P. Preparation of soil nutrient status thematic maps of nandyal mandal of Kurnool district by geographic information system, Andhra Pradesh. J. Agril. Sci. 2015;(3):118-124.
4. Ismail M, Umamahesh M. Analysis of Soil Samples for its Physicochemical Parameters in Adoni Region, Kurnool District, (A.P). Journal of Emerging Technologies and Innovative Research. 2018;5(4):776-778.
5. Bouyoucos GJ. The hydrometer as a new method for the mechanical analysis of soils. Soil Science. 1927;23:343-353.
6. Muthuvel P, Udayasoorian C, Natesan R, Ramaswami PR. Introduction to Soil Analysis. Tamil Nadu Agricultural University, Coimbatore; 1992.
7. Jackson ML. Soil Chemical Analysis. Prentice Hall of India Pvt Ltd., New Delhi; 1973.
8. Wilcox LV. Electrical conductivity, Amer. Water Works Assoc. J. 1950;42:775-776.
9. Walkley A. Critical examination of rapid method for determining organic carbon in soils, effect of variation in digestion conditions and of inorganic soil constituents, Soil Sci. 1947;632:251.
10. Subbaiah BV. A rapid procedure for estimation of available nitrogen in soil. Curr. Sci.. 1956;25:259-60.
11. Olsen SR. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. US Department of Agriculture; 1954.
12. Toth SJ, Prince AL. Estimation of cation-exchange capacity and exchangeable Ca, K, and Na contents of soils by flame

photometer techniques. Soil Science. 1949 Jun 1;67(6):439-46.
13. Cheng KL, Bray RH. Determination of calcium and magnesium in soil and plant material. Soil science. 1951 Dec 1;72(6):449-58.
14. Lindsay WL, Norvell W. Development of a DTPA soil test for zinc, iron, manganese, and copper. Soil Science Society of America Journal. 1978 May;42(3):421-8.
15. Singh G, Sharma M, Manan J, Singh G. Assessment of soil fertility status under different cropping sequences in District Kapurthala. Journal of Krishi Vigyan. 2016;5(1):1-9.
16. Muhr GR, Datta NP, Shankara SN, Dever F, Lecy VK, Donahue RR. Soil Testing in India, USAID Mission to India; 1965.
17. Ramamurthy B, Bajaj JC. Nitrogen, Phosphorus and Potash status of Indian soils. Fertilizer News. 1969;14:25-28.
18. Prasad PS, Kavitha P, Yadav NK. Assessment of nutrient status of rice growing soils of canal ayacut soils of Kurnool District (AP), India. Plant Archives. 2015;15(2):753-8.
19. Satish S, Sreenivasulu Reddy K, Venkaiah K. Correlation Studies of Bt Cotton Growing Soils of Kurnool District in Andhra Pradesh. Int. J. Pure App. Biosci. 2018;6(5):402-409. DOI:http://dx.doi.org/10.18782/2320-7051.6980.
20. Geetha Sireesha PV, Naidu MVS. Production potential appraisal: A case study in banaganapalle mandal of Kurnool district in Andhra Pradesh, India. Int.J. Curr. Microbiol. App. Sci. 2020;9(6):787-798.
21. Singh YV, Jat LK, Meena SK, Singh L, Jatav HS, Paul A. Available macro nutrient status and their relationship with soil physico-chemical properties of Sri Ganganagar district of Rajasthan, India. Journal of Pure and Applied Microbiology. 2015 Dec 1;9(4):2887-95.
22. Balaji NS, Balaguravaiah D, Ramana KV, Giridharakrishna T, Munirathnam P, Ravindra RB. Spatial variability of soil physical and Physicochemical properties of Kurnool division of Andhra Pradesh. Journal of Pharmacognosy and Phytochemistry. 2019;8(4):427-429.
23. Supriya K, Kavitha P, Naidu MVS, Srinivasa Reddy M. Assessment of Nutrient Status of Soils in Mahanandi Mandal, Kurnool district, Andhra Pradesh. Bulletin of Environment, Pharmacology and Life Sciences Bull. Env. Pharmacol. Life Sci. 2019;8(8):115-121.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/88084