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Assessment of Soil Fertility Status of Cuddapah Block in YSR District, Andhra Pradesh, India

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ABSTRACT

A study was conducted to examine the fertility status of soils in Cuddapah block of YSR district, Andhra Pradesh. A total Forty soil samples were collected from ten different villages of Cuddapah block at a depth of 0-15 cm and analyzed for different soil quality parameters viz., soil pH, EC, organic carbon, primary macronutrients (available nitrogen, available phosphorous, available potassium) and secondary macronutrients (calcium, magnesium and available sulphur) by using standard analytical methods in the laboratory. By considering the soil nutrient index values the soil fertility rating as low, medium and high has been given for each fertility parameter. The results revealed that the pH of the soil was found to be neutral to slightly alkaline with a mean value of 7.6. The Electrical conductivity of the soil was free from salinity with a mean value of 0.52 dSm^{-1}. According to the nutrient index values soil samples of Cuddapah block were found to be medium in organic carbon (1.92), low in nitrogen (1.52) , low in sulphur (1.00), medium in phosphorous (1.95) and high in potassium content (2.45).

Key words : *Soil fertility, Soil nutrient index, Macronutrients and Soil health.*

Introduction

Soil is the most important component for food cycle as it is the basic support for all the crops and plants in any agricultural operations. In order to achieve better crop yield the farmers should be made awareness about status of soil constituents, chemistry of water available, climatic conditions and nutrient supply to the crop. With this knowledge one can maintain proper crop yield and economy of the production. For this reason the present investigation has been undertaken that could be helpful in evaluating the current status of soils in the study area. This also helps to suggest the farmers about proper nutrient supply for healthy growth of crops and to maintain their economy by increasing productivity.

According to Tisdale *et al*. (1993) Soil fertility being the complex and dynamic natural property, is the inherent capacity of soil to provide essential nutrients for crop growth and yield enhancement. Soil fertility and Soil health plays a crucial role in sustainable agricultural production because these are soil chemical reactions, availability of essential nutrients, depletion of nutrients and their replenishment in soil. As the population is increasing in the country, it became a continuous pressure on soils leading to its degradation and making the soils gradually unsuitable for the crop cultivation. So to feed the alarming population it is important to maintain soil fertility. Thus without prior knowledge on soil fertility status, it might have been resulted in adverse effects on both soils and crops in terms of nutrient deficiency and nutrient toxicity either due to adequate or over use of fertilizers.

The present study site Cuddapah block, YSR district, Andhra Pradesh is lacking the detailed information about soil fertility status. Soil testing reveals the present fertility status of the soil that provides information with respect to availability of nutrient in soils which forms the basis for fertilizer recommendations to increase crop yields and maintain optimum soil fertility (Singh *et al*. 2018).

Materials and Methods

Analysis of various soil quality parameters

Total of 40 soil samples were collected from Cuddapah block in YSR district of Andhra Pradesh by selecting ten different villages/sites i.e, total of 40 surface soil samples (0-15 cm depth) for the determination of major soil fertility parameters by adopting standard laboratory methods.

The Soil pH was determined by using potentiometric method in 1:2.5 soil: water suspension and electrical conductivity of the soil was estimated by using EC meter (Jackson, 1973). Walkley and Black method (Walkley and Black, 1934) was used to determine the Organic carbon content of the soil. Available nitrogen was estimated by alkaline permanganate method (Subbaiah and Asija, 1956) by using Kjeltech semi auto analyser. Available phosphorous was extracted by Olsen's method using Spectrophotometer (Olsen *et al*.1954). Available potassium was estimated by Flame photometer with an extractant i.e, neutral normal ammonium acetate (Schollenberger and Simon, 1945). Exchangeable calcium and magnesium were determined by using Versanate titration method (Jackson, 1973). Available sulphur content was determined by turbidometric method using Spectrophotometer (Chesnin and Yien, 1950).

Results and Discussion

The obtained results from the analysis of pH, EC, primary and secondary macronutrients are given in the Table 2.

Soil pH and EC

The pH of the soil samples were identified as alkaline to neutral in condition with the values ranged from 6.8 to 8.5 with 7.6 as a mean value. The current findings concluded that 27.5% of the soil samples are in neutral condition whereas 72.5% of the soil samples are in alkaline nature. The results are being in conformity with the observations made by Singh *et al*. (2016). The Electrical Conductivity values of the soil samples were ranged from 0.094 to 1.273 dS/m with 0.527 dS/m as a mean value. The current findings observed that 67.5 % of the soil samples are within permissible range and suitable for all crop types and 32.5 % of the samples have shown slightly higher than the permissible range but suitable for most of the crops.

Available status of primary nutrients

The available Nitrogen content ranged from 76.3 to 708.2 kg/ha with 298.4 kg/ha as a mean value. On the basis of prescribed limits by Muhr *et al*. (1963) it is observed that 57.5% of the soil samples were reported as low range of nitrogen content, 32.5% of the soil samples were reported as medium and 10% of the soil samples were reported as high range. The present findings are being in conformity with the observations made by Ramana *et al.* (2015) and Bharteey *et al.,* (2017).

The available phosphorous varied from 4.18 to 44.9 kg/ha with 19.5 kg/ha as a mean value. Based on the limits prescribed by (Ramamoorthy and Bajaj, 1969) 37.5 % of the soil samples were reported as low range in phosphorus content due to alkaline nature of soil which in turn causes fixation of phosphorus ion by Ca, Mg and Na oxides, 32.5% of the soil samples were reported as medium and 30% of the samples were reported as high.

The available potassium content varied from 78.6 to 864.4 kg/ha with 385.5 kg/ha as a mean value.

Table 1. Nutrient Index Values of Cuddapah block in YSR district of Andhra Pradesh

S.No.	Available Nutrients	Nutrient index values	Category
1	Organic carbon	1.92	Medium
2	Nitrogen	1.52	Low
3	Phosphorous	1.95	Medium
4	Potassium	2.45	High
5	Sulphur	1.00	Low

Based on the limits prescribed by Ramamurthy and Bajaj, (1969) 7.5 % of the soil samples were reported as low range in potassium content, 40% of the soil samples were reported as medium and 52.5% of the samples were reported as high range. Similar results were reported by Singh *et al.,* (2016) while studying the fertility status of soils in Lahar block of Bhind district in Madhya Pradesh.

Table 2. Soil quality parameters of different villages of Cuddapah block in YSR district of Andhra Pradesh.

Sample No.	Village Name	pH	EC (dSm^{-1})	OC (%)	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Ca (Meq/ 100gm)	Mg (Meq/ 100gm)	S ($mgkg^{-1}$)
S_1	Mamillapalli	7.6	0.359	0.92	394.4	33.9	302.4	2.92	1.00	0.65
S_2	Mamillapalli	7.7	0.286	0.43	965	16.8	245.4	1.16	0.84	0.38
S_3	Mamillapalli	8.2	0.148	0.34	84.9	8.84	190.4	2.60	1.32	0.41
S_4	Mamillapalli	6.8	0.094	0.62	105.7	42.4	78.6	2.74	0.38	0.21
S_5	Modimedapalli	8.3	0.118	0.52	110.6	8.84	336.0	3.78	0.50	0.37
S_6	Modimedapalli	7.8	0.273	0.24	168.5	23.2	268.0	3.18	1.08	0.29
S_7	Modimedapalli	6.8	0.395	1.12	467.4	44.9	448.0	1.50	0.50	1.05
S_8	Modimedapalli	6.9	0.220	0.33	98.6	34.5	346.4	2.54	1.68	0.19
S_9	Puttlampalli	7.9	0.367	0.26	129.2	26.4	538.2	3.56	0.26	0.6
S_{10}	Putlampalli	8.3	0.147	0.49	166.1	8.17	100.8	2.04	0.6	0.29
S_{11}	Puttlampalli	8.5	0.653	0.33	234.6	4.18	313.6	4.22	1.68	0.49
S_{12}	Puttlampalli	7.6	0.168	0.45	248.7	18.6	235.2	2.42	0.52	0.36
S_{13}	Nanapalli	8.0	0.643	0.79	276.1	8.07	313.6	2.60	0.36	0.29
S_{14}	Nanapalli	7.2	1.110	0.58	235.4	36.8	616.0	1.92	0.74	0.26
S_{15}	Nanapalli	7.3	0.876	0.83	526.5	28.1	425.6	1.64	1.26	0.44
S_{16}	Nanapalli	8.1	0.802	0.70	342.8	17.5	280.0	1.46	0.58	0.39
S_{17}	Jamalpalli	8.5	0.702	0.68	467.2	3.66	638.8	2.70	0.24	0.29
S_{18}	Jamalpalli	8.2	0.533	0.24	76.3	5.36	89.40	3.04	1.84	0.53
S_{19}	Jamalpalli	7.6	0.806	0.74	138.9	16.5	294.2	3.10	1.02	0.35
S_{20}	Jamalpalli	7.1	0.518	0.35	165.0	35.4	280.0	2.46	0.18	0.48
S_{21}	Chalamareddypalli	6.8	0.384	0.86	586.7	43.2	339.6	1.94	0.72	0.16
S_{22}	Chalamareddypalli	7.8	0.998	0.82	696.8	8.09	708.0	0.43	0.70	0.38
S_{23}	Chalamareddypalli	8.3	0.643	0.38	188.0	4.24	628.4	3.46	1.32	0.64
S_{24}	Chalamareddypalli	7.0	0.830	0.71	455.6	31.6	361.0	1.90	2.16	1.14
S_{25}	Ukkaypalli	7.7	0.106	0.66	226.1	13.1	418.2	0.78	0.34	0.62
S_{26}	Ukkaypalli	7.2	0.336	0.46	175.0	23.3	436.0	2.30	0.46	0.21
S_{27}	Ukkaypalli	7.2	0.327	0.76	302.6	21.2	247.0	4.28	1.24	0.39
S_{28}	Ukkaypalli	8.1	0.395	0.6	274.0	6.87	236.0	0.86	0.70	0.25
S_{29}	Apparajupalli	7.1	0.791	0.72	695.3	30.2	864.4	3.16	2.72	0.25
S_{30}	Apparajupalli	8.2	0.934	0.43	167.2	4.18	728.2	4.00	1.90	0.62
S_{31}	Apparajupalli	7.7	0.532	0.36	118.0	13.6	559.0	2.90	0.28	0.27
S_{32}	Apparajupalli	8.0	0.288	0.48	134.9	29.3	178.2	6.70	0.56	0.70
S_{33}	Peddamusalreddypalli	7.8	0.992	0.65	312.6	13.8	259.0	3.96	0.44	0.56
S_{34}	Peddamusalreddypalli	7.6	0.243	0.84	454.0	18.0	232.0	0.94	0.28	0.41
S_{35}	Peddamusalreddypalli	7.8	0.739	1.18	7082	12.4	547.2	0.88	1.26	1.06
S_{36}	Peddamusakreddypalli	7.9	1.226	1.12	546.4	16.5	406.8	2.72	0.94	0.98
S_{37}	Subbanavaripalli	7.0	1.273	0.87	317.7	39.0	287.0	198	0.60	0.37
S_{38}	Subbanavaripalli	8.0	0.287	0.95	223.8	8.17	703.2	3.56	0.34	0.23
S_{39}	Subbanavaripalli	8.3	0.391	0.72	389.0	3.1	384.4	0.60	1.36	0.34
S_{40}	Subbanavaripalli	8.0	0.178	0.74	432.6	12.1	568.0	1.08	0.20	0.39
MEAN		7.6	0.527	0.63	298.4	19.5	385.8	2.49	0.87	0.45
RANGE		6.8-8.5	0.094-1.273	0.24-1.18	76.3-7082	1.24-44.9	78.6-864.4	0.43-6.70	0.18-2.72	0.16-1.14
SD±		0.51	0.32	0.24	182.9	12.6	189.1	1.25	0.60	0.24
CV(%)		6.69	62.4	39.3	61.2	65.7	49.0	50.3	68.76	53.9

OC= Organic carbon, N= Nitrogen, P=Phosphorous, K=Potassium, Ca= Calcium, Mg=Magnesium, S= Sulphur.

Available status of Secondary nutrients

The exchangeable calcium varied from 0.43 to 6.7 Meq/100g with 2.49 Meq/100g as a mean value. On the basis of prescribed limits by (Ramamoorthy and Bajaj *et al*. 1969) it was observed that 22.5% of the soil samples were reported as low range whereas 77.5% of the samples were reported as high in calcium content. The exchangeable magnesium varied from 0.18 to 2.72 Meq/100 g with 0.87 as a mean value. On the basis of limits prescribed by (Ramamoorthy and Bajaj *et al*., 1969) it is observed that 62.5% of the samples were reported as low range in magnesium content whereas 37.5% of the soil samples were reported as high. The available sulphur content varied from 0.16 to 1.14 mg/g with 0.45 mg/g as a mean value. The results in the present investigation revealed that all the 40 samples in Cuddapah region deficient in sulphur content due to lesser concentration of sulphur.

Evaluation of Soil Nutrient Index

In order to compare the fertility levels of soil from one area to the other area it is necessary to procure a single value for each and every nutrient. Soil Nutrient Index is nothing but a measure of capacity of soil to supply nutrients to plants (Singh *et al.*, 2016). The calculated nutrient index values for different nutrients are given in Table 1. This index is calculated by using the following formula which was given by Muhr *et al*. (1965).

$$\text{Soil Nutrient Index} = \frac{\text{\% in high category} \times 3 + \text{\% in medium category} \times 2 + \text{\% in low category} \times 1}{100}$$

Conclusion

The results of soil analysis has been interpreted by using the literature which helps the farmers to analyze and to add up the deficient nutrients. The present study gives a detailed information about soil fertility status and its nature. According to the soil test results it can be concluded that the soils of Cuddapah block are alkaline to neutral in condition. By considering the nutrient index values the recorded macronutrients of Cuddapah block are low in nitrogen and sulphur whereas medium in phosphorous and organic carbon content and high in available potassium content. Hence, these essential nutrients have to be supplemented by the addition of fertilizers or organic manures in proper amounts to fulfill the deficiency in order to increase the soil fertility, to maintain soil health and to bring maximum crop yields. A farming system needs to be developed which includes both soil enriching and restoring for efficient sustainable crop production.

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References

Aradhana Barooah, Hiranya Kumar Bhattacharya and Karma Bhadur Chetri 2020. Assessment of Soil fertility of some villages of Lahowal block, Dibtrugarh, India. *International Journal of Current Microbiology and Applied Sciences*. 9 : 1438-1450.

Barker, Pilbeam. Handbook of plant nutrition. Second edition, 2007.

Bharteey, P.K., Singh, Y.V., Sharma, P.K., Sukirtee, Kumar. M. and Rai, A.K. 2017. Available macro nutrient status and their relationship with soil physico-chemical properties of Mirzapur District of Uttar Pradesh, India. *International Journal of Current Microbiology and Applied Sciences*. 6 : 2829-2837.

Black. C.A. 1965. Methods of Soil Analysis . Part 1 and 2 . *American Society of Agronomy*. Inc.,Madison, Wisconsin, U.S.A., 1-2 : 1572.

Chesnin, L. and Yien, C.H. 1950. Turbidimetric determination of available sulphur. Proceeding of Soil Science.

Food and Agriculture Organisation of the United Nations Rome, FAO, 2008.

Jackson, M.L. 1973. Soil Chemical Analysis. Prentice Haall of India Pvt. Ltd., New Delhi.

Madhavi, E., Syamkumar, B. and Raja Sekhar, P.S. 2018. Assessment of soil quality under Rice (*Oryza sativa*) Croppoing Systems, Yelsmanchili mandal , Visakhapatnam district, Andhra Pradesh, India. *Journal of Pharmaceutical Chemical and Biological Sciences.* 6 : 35-41.

Muhr, G.R., Datta, N.P., Shankara Subraney, N., Dever, F., Lecy, V.K. and Donahue, R.R. 1965. Soil Testing in India, USAID Mission to India.

Olsen, S.R., Cole, C.V., Watanabe, F.S. and Dean, L.A. 1954. Estimation of available phosphorous in soils by extraction with sodium bicarbonate. U.S. Department of Agriculture: Washington DC. 1-19.

Ramamoorty, B. and Bajaj, J.C. 1969. Nitrogen, Phospho-

rus and Potash status of Indian soils. *Fertilizer News*. 59 : 13-24.

Ramana, Singh, Y.V, Jat, L.K., Meena, SK. 2015. Available Macronutrient Status and their Relationship with Soil Physico-Chemical Properties of Sri Ganganagar District of Rajasthan, India. *Journal of Pure and Applied Microbiology*. 9 : 2887-2894.

Schollenberger, C.J. and Simon, R.H. 1945. Determination of Exchage Capacity and Exchangeable Bases in Soil Ammonium Acetate Method. *Soil Science*. 59 : 13-24.

Singh, Y.V., Singh, P.K., Yadav, R.N., Sharma, P.K., Shahi, S.K. and Singh, R.K. 2016. Evaluation of soil fertility status from Tedia village, Araji line Block, Varanasi District, Uttar Pradesh, India. *Indian Journal of Agriculture and Allied Sciences*. 1 : 55-59.

Singh, Y.V., Singh, S.K., Sahi, S.K., Verma, S.K., Yadav, R.N. and Singh, P.K. 2016. Evaluation of Soil Fertility status from Mikipur Village, Arajiline Block, Varanasi District, Uttar Pradesh, in Relation to Soil Characteristics. *Journal of Pure and Applied Microbiology*. 10 : 1455-1461.

Singh, Y.V. 2018. Available Macro Nutrient Status and their Relationship with Soil Physico Chemical Properties of Chandauli District of Uttarpradesh. *Technofame – a journal of multidisciplinary advance research*. 7 : 21-25.

Subbaiah, B.V. and Asija, G.L. 1956. A rapid procedure for the determination of available nitrogen in soils. *Current Science*. 25: 259-26.

Tisdale, S.L., Nelson, W.L. and Beaton, J. D. 1993. Soil fertility and fertilizers, 5 ed Macmillan publishing Co. Inc. New York and Colloir Macmillan Publishers, London.

Wagh, G.S. and Sayyed, M.R.G. 2013. Assessment of Macro and Micronutrients in Soils from Panvel area, Maharashtra, India. *Universal Journal of Environmental Research and Technology*. 3 :72-78.

Walkley, A. and Black, T.A. 1934. An examination of the Degt. Jarett method for determination of soil organic matter and a proposed modification of chromic acid titration. *Soil Science*. 37 : 29-38.