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Soil Analysis and Fertilizer Recommendations for Paddy Cultivars of Pentapadu Tehsil with Special Reference to Zinc.

D. Madhava Sarma[1]*, B. Venkata Rao[1], M. Vasantha Lakshmi[2], B.Chakravarthi[2], P.S.S. Sravanthi[3] and T.V.S. Padmavathi[3]

[1]*Department of Chemistry, D.R.G. Govt. Degree College, Tadepalligudem, 534166, India.*
[2]*Department of Zoology, D.R.G. Govt. Degree College, Tadepalligudem, 534166, India.*
[3]*Department of Botany, D.R.G. Govt. Degree College, Tadepalligudem, 534166, India.*

***Corresponding Author's E-mail*: dmadhavasarma@gmail.com**

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ABSTRACT

ORYZA SATIVA (Paddy) is the main cultivated crop in the Pentapadu mandal of Andhra Pradesh. Growth and yield of any crop depends on factors like soil fertility and nutrient availability from the soil, besides other soil properties. To know the soil characteristics of the study area, soil samples are collected and analyzed for physico-chemical characteristics like pH, EC, % OC, macronutrients and micronutrients. It has been found that, in most of the soils zinc is below the critical value. According to recent studies, zinc deficiency in soils of Andhra Pradesh is further expected to increase from the current 49% to 63% by the year 2025 as most of the marginal soils are being brought under cultivation. It is proposed to advise the stake holders about the results obtained in this analysis so that they can apply the fertilizers according to the need only. Sincere efforts are going on to convince farmers about the use of fertilizers basing on soil testing is a good practice. It is a practical tool for optimizing the use of fertilizers which leads to higher yields.

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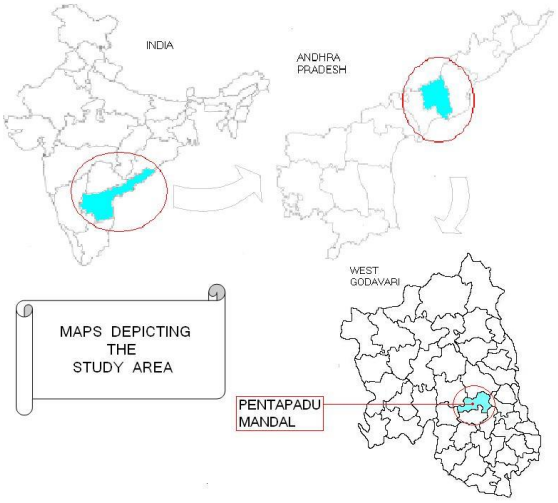
Introduction:

Growth and yield of any crop is dependent on factors like agro-climatic conditions, variety, crop management practices, spacing, seed rate, weed control, water management, soil fertility and nutrient availability from the soil besides other soil properties3. Since some years there are big efforts to convince farmers that using fertilizers based on sound soil testing as a practical tool for optimizing the use of fertilizers and thus, leads to higher yields6. In the present study, soil samples are collected from Pentapadu mandal of West Godavari district, Andhra Pradesh and analysed for physico-chemical properties like soil pH, EC, OC, N,P,K, and micronutrients. In the present study an attempt was made to decipher the soil characteristics and convince the farmers to go for soil test based fertilizer application which helps to avoid unnecessary expenditure on nutrient(s). This will rationalize the apportionment of different nutrient quantities that need to be applied to maximize the returns from investment on nutrient application.

Materials and Methods:

The area selected for study, as shown in the maps, is Pentapadu mandal of Andhra Pradesh, India. It lies between the latitudes 16.6564(N) – 16.8102(N) and longitudes 81.4737(E) – 81.5935(E) with an altitude of 18metres above the sea level. The mean annual rainfall is about 115 cm. The soils in the study area are black cotton soil. Representative soil samples are collected from all the 31 villages (two samples from each village) in the mandal during Nov – Dec 2013(inbetween kharif and rabi) by following standard soil sampling

procedures1,2,3. These soil samples are analysed according to standard procedures.



The geographical parameters are measured using GPS instrument of Garmin make, model: Oregon 550. pH is measured by using water extract method on Elico L1 120 pH meter, EC also by water extract method on Systronics, MK-509, Organic carbon by rapid titration method12, mineralizable nitrogen by alkaline permanganate method14, estimation of available phosphorus was done on Olsen's extract by ascorbic acid method15. Estimation of available potassium is done by flame photometry. Estimation of available micronutrients isdone by DTPA method17 using atomic absorption spectrophotometer (AAS) of Elico make, model: SL 194. In all these analyses, reagent grade water and analytical grade chemicals are used.

Results and Discussions:

pH:

The pH range of the soil samples in the study area is 7.1 to 7.7 which is moderately alkaline and suitable for cultivation. The soil pH is a measure of soil sodicity, acidity or neutrality. Soil pH influences to a great extent the availability of nutrients to crops. It also affects microbial population in the soils.

Soil Electrical Conductivity (EC):

EC values of most of the soil samples studied is within the tolerable limit. (0.5 – 1.1). It is a measure of the salt content. Crops vary to the degree of sensitivity to salts, but most crops tolerate levels of 1.1 or less with no effect on yield. Excess salinity may cause moisture stress within the plant. However, too pure of can also be detrimental. Water with too few salts can lead to surface soil dispersion and soil crusting.

Organic carbon (OC):

Soil organic carbon content can be used as an index of nitrogen availability (potential of soil to supply N to plants). % OC < 0.5 % is considered low, between 0.5 and 0.75 medium and > 0.75 % as high. The results show that %OC of the soil samples is on the higher side. It indicates that the availability of nitrogen is high in the study area.

Table: 1. Physico-chemical characteristics of soil samples of Pentapadu mandal.

S. No.	Sampling Location With coordinates	pH	EC mmhos cm^{-}	% OC	Soil Available Nutrients (kg/ha)			Micro-nutrients (ppm)			
					N	P	K	Fe	Mn	Cu	Zn
1.	Pentapadu 16.7803(N), 81.5253(E)	7.1	1.1	3.2	480	22.4	210	38	6.2	3.8	.67
2.	Akuteegapadu 16.7467(N), 81.5240(E)	7.1	1.1	3.8	490	27.0	218	38	6.1	3.5	.64
3.	Alampuram 16.8063(N), 81.5884(E)	7.2	1.05	4.8	495	22.8	272	36	6.3	3.8	.78
4.	B.Kondepadu 16.6564(N), 81.5507(E)	7.4	1.0	2.2	340	28.2	214	29	6.3	3.7	.73
5.	Billagunta 16.7985(N), 81.5555(E)	7.3	1.02	3.8	490	27.2	224	37	7.4	3.5	.69
6.	Bodapadu 16.7655(N), 81.5569(E)	7.4	1.02	10.2	590	28.6	288	36	7.4	3.8	.74
7.	Chintapalli 16.7593(N), 81.5719(E)	7.3	0.95	2.8	340	17.5	198	32	7.1	3.8	.79
8.	Darsiparru 16.7918(N), 81.5521(E)	7.2	0.96	2.8	380	18.6	240	32	7.2	3.9	.85
9.	Jatlapalem 16.7863(N), 81.5019(E)	7.3	0.95	3.7	510	18.7	238	38	7.4	4.1	.82
10.	Jettalapalem 16.7888(N), 81.5444(E)	7.1	1.1	10	640	22.7	195	37	7.2	3.8	.88
11.	Kagulampadu 16.8989(N), 81.5746(E)	7.7	1.15	11.2	670	22.0	210	37	6.4	3.7	.88

12.	Kaspa Pentapadu 16.7450(N), 81.4830(E)	7.4	1.12	9.4	590	23.8	215	38	7.8	3.6	.90
13.	Korumilli 16.7432(N), 81.5812(E)	7.5	1.1	4.8	422	11.7	210	31	7.4	3.2	1.1
14.	Kothapeta 16.7468(N), 81.4756(E)	7.2	1.1	7.4	510	22.7	212	38	7.3	3.7	.87
15.	Meenavalluru 16.7288(N), 81.5935(E)	7.2	1.05	8.3	590	28.4	210	37	7.2	3.8	.83
16.	Mounjipadu 16.7729(N), 81.4869(E)	7.1	0.92	2.2	640	31.8	285	42	8.2	4.1	.77
17.	Mudunuru 16.7449(N), 81.5345(E)	7.4	0.88	9.2	648	14.3	272	38	6.4	3.8	.62
18.	Muktepuram 16.7548(N), 81.5169(E)	7.3	0.90	8.4	642	18.7	248	38	5.9	3.7	.65
19.	Parimella 16.7310(N), 81.4993(E)	7.3	0.87	2.3	390	16.4	232	37	5.9	3.7	.65
20.	Prathipadu 16.8103(N), 81.5757(E)	7.4	0.85	4.9	480	18.4	248	36	6.4	3.7	.60
21.	Racherla 16.7576(N), 81.5678(E)	7.6	0.85	4.7	477	19.0	232	37	6.4	3.6	.70
22.	Ramachandrapuram 16.8756(N), 81.6576(E)	7.3	0.86	8.2	620	11.8	228	34	7.2	3.7	.84
23.	Ravikunta 16.7443(N), 81.5333(E)	7.4	0.86	8.2	618	22.8	234	37	6.9	3.8	.85
24.	Ravipadu 16.7655(N), 81.5867(E)	7.2	0.88	9.9	640	24.2	244	37	6.8	3.7	.86
25.	Sukhaladibba 16.6988(N), 81.6978(E)	7.3	0.90	1.9	340	24.8	245	42	7.2	4.1	.77
26.	Umamaheswaram 16.7765(N), 81.5034(E)	7.4	0.95	4.5	480	24.0	202	36	6.8	3.7	.80
27.	Upparagudem 16.7861(N), 81.7234(E)	7.3	0.92	3.9	479	19.2	198	38	6.9	3.6	.80
28.	Vaddigudem 16.6949(N), 81.8756(E)	7.2	1.15	4.8	482	25.6	210	38	5.4	3.2	.82
29.	Vallurupalli 16.7898(N), 81.5553(E)	7.2	1.1	4.8	495	22.8	240	37	5.6	3.2	.80
30.	West Vipparru 16.7468(N), 81.4757(E)	7.1	1.1	5.6	522	23.8	244	36	5.8	3.3	.82
31.	Yanalapalli 16.7583(N), 81.5098(E)	7.5	1.02	3.9	570	19.9	198	28	4.3	3.1	.49

Table: 1. Macronutrients (NPK):

MACRO-Nutrient (Kg/ha)	Low	Medium	High
N	< 280	280-560	>560
P	<11	11-25.6	>25.6
K	<120	120-280	>280

The study shows that the available NPK levels are to the higher side. Of the 62 soil samples analysed, in 39% of the samples nitrogen level is high and in 19% phosphorus levels are high whereas in 6% of the analysed samples potassium is to the higher side. Since several studies have reported antagonistic effect between phosphorus and zinc, care must be observed while applying macronutrients in the paddy fields.

Plant Micronutrients:

Critical levels of micronutrients in soils: The critical levels of micronutrients in soils as observed by the Hyderabad center of AICRP is;

Nutrient	Critical Level (mg/kg)
Zinc	0.70
Copper	0.30
Iron	5.00
Manganese	3.00
Boron	0.52
Molybdenum	0.20

Zinc, boron, iron, manganese, molybdenum and copper are the six essential micronutrients for plant growth. With the practice of intensive cultivation, using high yielding varieties and multiple crops, deficiencies of micronutrients is becoming more crucial in crop nutrition management and production. Among these the deficiency of zinc has become more crucial.

In most of the soil samples, the zinc levels are either low or below critical level. Zinc is required in protein synthesis and for ensuring seed quality and uniform maturity. In soils having zinc deficiency appearance of rusty-brown spots and discoloration of older leaves beginning 2-3 weeks after transplanting is noticed. Under acute conditions leaf margins of older leaves dried up, new leaves are smaller in size; crop maturity is non-uniform and delayed.

Conclusion:

The analytical results of soil samples show deficiency in zinc. In a general way zinc is associated with the development of chlorophyll in leaves and a high content of zinc is correlated with a high amount of chlorophyll. In its absence growth is less, buds fall off and seed development is limited. Zinc deficiency has strong impact on human health. Zinc is essential for the normal structure and functioning of more than 300 enzymes. Due to zinc deficiency in soils, which results in low zinc content in plant parts, zinc content in edible parts is decreasing but antinutrients are increasing. Biofortification of crops by enriching micronutrient in seeds is a better option along with advanced agronomic fertilization and biofortification techniques. Certain studies have also shown that application of zeolite and zinc under normal irrigation had a positive effect on evaluations. Hence farmers of this mandal are advised for soil test based fertilizer application.

Zinc sulphate heptahydrate (Zn – 21%) is recommended for soil application at the rate prescribed by the State Agricultural Universities/ Soil Testing Laboratories. The doses vary from 25 to 60 kg/ha depending on soil type, cropping intensity and crop productivity levels. In the absence of basal application, foliar spray of 0.5% solution of zinc sulphate heptahydrate 15 days after transplanting of rice should be practiced. Care needs to be taken that zinc sulphate should not be mixed with phosphate fertilizers, as water soluble zinc is transformed to relatively insoluble zinc phosphate

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