

Original Research Article

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## Study on Soil Fertility Status in Sugarcane Growing Soils of Visakhapatnam District, Andhra Pradesh

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### ABSTRACT

The present study was undertaken to assess the soil fertility status under sugar cane – sugarcane cropping system in different mandals of Visakhapatnam district of Andhra Pradesh. Seven mandals namely Munagapaka, Devarapalli, Chodavaram, Payakaraopeta, Yellamanchili, Rambilli and Ravikamatham were selected based on the area under sugarcane-sugarcane cropping system. The soil sample was taken from 0-15 cm depth with the help of augur and physical & chemical properties of the soil were analyzed. The organic carbon content in the soil of the district revealed that 25.38 per cent samples were less than 0.5, 71.07 per cent samples were ranged between 0.5 to 0.75 per cent and 3.15 per cent samples were more than 0.75 per cent. The nitrogen content in soil indicated that soils were low in nitrogen. 64.82 per cent samples were less than 280 kg /ha, 35.18 per cent samples were ranged between 280 to 560 kg/ha and no sample was found more than 560 kg/ha. In case of available phosphorus 3.1 per cent samples were less than 22 kg/ha, 66.5 per cent samples ranged between 22 to 56 kg/ ha and 30.4 per cent samples were more than 56 kg/ ha. Regarding potassium content, 72.40 per cent samples ranged between 108 to 280 kg/ ha, only 25.0 per cent samples were found more than 280 kg/ha and 2.60 per cent samples were found less than 108 kg/ha. All the four cationic micronutrients are above the critical limits except zinc, which is low in only in 5% samples in selected sugarcane growing soils of Visakhapatnam district, Andhra Pradesh.

#### Keywords

Sugarcane, Soil fertility status and Macro and micro nutrients

#### Article Info

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### Introduction

Sugarcane-sugarcane cropping system is the prominent cropping system in Visakhapatnam district of Andhra Pradesh. The physico-chemical properties of soils and their interaction with one another and variation in nutrients supplying capacity is a natural phenomenon. Therefore, the different management practices are required at

different locations to sustained crop productivity hence, the nutrient status of soil is very important. It has been observed that soil differs generally in their morphological, physical, mineralogical and biological characteristics. (Kumar *et al*, 2017).The sugarcane based crop sequences are being practiced extensively all over India. The crop is a heavy feeder of plant nutrients and removes about 1.2 kg N, 0.22 kg P, and 2.83

kg K for each tonne of cane production. As the crop, once planted, occupies the field for 2-3 years duration to accommodate one plant followed by one or more ratoon crops in succession its productivity per unit area and time heavily rests on inherent soil nutrient status and their availability. Keeping this in view fertility levels of the soils collected from the farmers' fields located in different sugar mill zones of Punjab were assessed in major sugarcane growing regions of the state that can provide base to work out fertilizer application needs and ensure cost-effective cane cultivation besides maintenance of soil health and quality.

### **Materials and Methods**

The soil survey was carried out in Seven mandals namely Munagapaka, Devarapalli, Chodavaram, Payakaraopeta, Yellamanchili, Rambilli and Ravikamatham representing all the major sugarcane growing soils of the district. Soil samples were collected from 80 locations comprising of 10-15 from every mandal, at 0-15 cm depth. Surface soil samples were collected randomly in a zig-zag way to make a composite sample (500 g) by using the quarter technique. The composite soil samples were packed and labelled properly in polythene bags and brought to the laboratory for further analyses. The samples brought to the laboratory were air dried under room temperature, ground and passed through 2-mm sieve. Processed soil samples were used for analysis of properties.

Soil pH and electrical conductivity (EC) were measured with the help of pH and EC meter, respectively using soil and water suspension in 1:2.5 ratio. Soil organic carbon (OC) was determined by Walkley and Black (1934) method. The available nitrogen (N) was determined by the alkaline potassium permanganate (KMnO<sub>4</sub>-N) method (Subbiah and Asija 1956). Available phosphorus (P) was extracted with 0.5M NaHCO<sub>3</sub> and

determined by using ascorbic acid reduction in an acidic medium (Olsen et al. 1954). Available potassium (K) was extracted with neutral normal ammonium acetate solution by displacement of the exchangeable cations and estimated by flame photometer (Jackson 1973). For micronutrients viz., zinc (Zn), copper (Cu), iron (Fe) and manganese (Mn) soil samples were extracted with DTPA (Lindsay and Norvell 1978) and the concentrations of these micronutrients were determined by atomic absorption spectrophotometer.

### **Results and Discussion**

The farmers usually apply 120-150 kg nitrogen along with 60-80 kg phosphorus and 30-60 kg potassium per hectare against the recommended dose of 112 kg Nitrogen per ha, 100kg phosphorus per hectare and 120 kg potassium per ha. It was noted that 85 percent farmers reported more use of nitrogen fertilizers and application of potassium fertilizers was very low. Many farmers have not applied any kind of manures to the fields (Table 1).

#### **pH**

While considering the eighty collected soil samples analysis results revealed that the samples were neutral in reaction with a pH range of 7.2-8.3 in 1:2.5 soil : water ratio.

In Munagapaka mandal pH ranged from 7.4-8.2, with a mean value of 7.75, In Devarapalli mandal it ranged from 7.6-8.2 with a mean of 7.82, In Chodavaram mandal it ranged from 7.5-8.1 with a mean of 7.75, In Payakaraopeta mandal it ranged from 7.2-7.9 with a mean of 7.65, In Yellamanchili mandal it ranged from 7.4-8.3 with a mean of 7.72, In Rambilli mandal it ranged from 7.5-8.2 with a mean of 7.85 and In Ravikamatham mandal it ranged from 7.6-8.2 with a mean of 7.99.

**Table.1** Soil physic chemical, available macro and micro nutrient analysis results

S.No	Name of the Mandal	pH	E.C	Organic Carbon	Available Nitrogen	Available Phosphorus	Available Potassium	DTPA Extractable Micronutrients (ppm)			
			(dS/m)	(%)	(Kg/ha)			Zn	Fe	Cu	Mn
1	Munagapaka	7.4 - 8.2	0.15 –	0.45-	119-352	29.6 –	56.5 –	0.59 –	2.72 –	0.79 -	2.21 -
			0.35	0.87		73.4	231.2	1.52	8.43	4.04	14.25
	Mean	<b>7.75</b>	<b>0.21</b>	<b>0.51</b>	<b>168</b>	<b>56.9</b>	<b>136.5</b>	<b>0.99</b>	<b>5.28</b>	<b>2.16</b>	<b>4.79</b>
2	Devarapalli	7.6 - 8.2	0.12-	0.30-	140-305	38.6-63.8	75.3-	0.53-1.55	2.09-	0.94-	1.61-
			0.46	0.65			148.5		15.16	2.05	13.52
	Mean	<b>7.82</b>	<b>0.24</b>	<b>0.48</b>	<b>165</b>	<b>52.6</b>	<b>128.5</b>	<b>1.03</b>	<b>7.73</b>	<b>1.45</b>	<b>6.33</b>
3	Chodavaram	7.5-8.1	0.15-	0.33-	205-324	31.1-73.4	51.7-	0.69-1.62	3.68-	0.82-	1.60-
			0.35	0.63			153.8		9.16	1.54	8.978
	Mean	<b>7.75</b>	<b>0.21</b>	<b>0.55</b>	<b>302</b>	<b>55.8</b>	<b>105.1</b>	<b>1.26</b>	<b>6.49</b>	<b>1.13</b>	<b>6.22</b>
4	Payakaraopeta	7.2-7.9	0.12-	0.32-	132-232	21.2-75.1	88.7-	0.55-1.85	2.77-	1.45-	3.07-
			0.41	0.63			190.8		7.75	3.63	11.54
	Mean	<b>7.65</b>	<b>0.20</b>	<b>0.52</b>	<b>169</b>	<b>57.1</b>	<b>137.4</b>	<b>1.19</b>	<b>4.42</b>	<b>2.44</b>	<b>5.58</b>
5	Yellamanchili	7.4-8.3	0.13-	0.35-	137-279	30.8-73.4	102.1-	0.18-1.54	3.58-	1.18-	3.95-9.01
			0.31	0.74			183.5		9.16	3.25	
	Mean	<b>7.72</b>	<b>0.19</b>	<b>0.41</b>	<b>152</b>	<b>47.9</b>	<b>134.7</b>	<b>1.24</b>	<b>5.77</b>	<b>2.27</b>	<b>6.64</b>
6	Rambilli	7.5-8.2	0.15-	0.44-	116-270	36.9-69.7	89.6-	0.14-1.32	2.81-	2.10-	5.57-
			0.36	0.86			263.4		11.02	5.12	16.01
	Mean	<b>7.85</b>	<b>0.25</b>	<b>0.39</b>	<b>157</b>	<b>49.8</b>	<b>160.9</b>	<b>1.01</b>	<b>7.76</b>	<b>3.66</b>	<b>12.01</b>
7	Ravikamatham	7.6-8.2	0.14-	0.45-	163-357	23.3-73.8	64.5-	0.55-1.47	3.52-	0.87-	1.67-
			0.32	0.74			123.6		12.25	1.97	5.42
	Mean	<b>7.99</b>	<b>0.25</b>	<b>0.36</b>	<b>210</b>	<b>48.0</b>	<b>52.8</b>	<b>7.24</b>	<b>1.07</b>	<b>7.89</b>	<b>1.26</b>

### **Organic carbon (%) content**

The organic carbon content of the eighty soil in different mandals of Visakhapatnam district indicated that overall, 25.38 per cent samples were less than 0.5, 71.07 per cent samples were ranged between 0.5 to 0.75 per cent and 3.15 per cent samples were more than 0.75 per cent content of organic carbon. It was revealed that more than 50 per cent samples were found 0.5 to 0.75 percent organic carbon content. Non application of organic residues and sub tropical climatic conditions resulting reduction of organic carbon content.

In Munagapaka mandal Organic carbon content (%) ranged from 0.45-0.87, with a mean value of 0.51, In Devarapalli mandal it ranged from 0.3-0.65 with a mean of 0.48, In Chodavaram mandal it ranged from 0.33-0.63 with a mean of 0.55, In Payakaraopeta mandal it ranged from 0.32-0.63 with a mean of 0.52, In Yellamanchili mandal it ranged from 0.35-0.74 with a mean of 0.41, In Rambilli mandal it ranged from 0.44-0.86 with a mean of 0.39 and In Ravikamatham mandal it ranged from 0.45-0.74 with a mean of 0.36.

### **Soil available nitrogen**

The nitrogen content in soil indicated that soils were low in nitrogen. 64.82 per cent samples were less than 280 kg /ha, 35.18 per cent samples were ranged between 280 to 560 kg/ha and no sample was found more than 560 kg/ha.

In Munagapaka mandal available nitrogen content (kg/ha) ranged from 119-352, with a mean value of 168, In Devarapalli mandal it ranged from 142-305 with a mean of 165, In Chodavaram mandal it ranged from 205-324 with a mean of 302, In Payakaraopeta mandal it ranged from 132-232 with a mean of 169, In Yellamanchili mandal it ranged from 137-

279 with a mean of 152, In Rambilli mandal it ranged from 116-270 with a mean of 157 and In Ravikamatham mandal it ranged from 163-357 with a mean of 210.

### **Available phosphorous content**

In case of available phosphorus 3.1 per cent samples were less than 22 kg/ha, 66.5 per cent samples ranged between 22 to 56 kg/ ha and 30.4 per cent samples were more than 56 kg/ ha. Regarding potassium content.

In Munagapaka mandal available phosphorus content (kg/ha) ranged from 29.6-73.4, with a mean value of 56.9, In Devarapalli mandal it ranged from 38.6-63.8 with a mean of 52.6, In Chodavaram mandal it ranged from 31.1-73.4 with a mean of 55.8, In Payakaraopeta mandal it ranged from 21.2-75.1 with a mean of 57.1, In Yellamanchili mandal it ranged from 30.8-73.4 with a mean of 47.9, In Rambilli mandal it ranged from 36.9-69.7 with a mean of 47.9 and In Ravikamatham mandal it ranged from 23.3-73.8 with a mean of 48.0.

### **Available potassium content**

72.40 per cent samples ranged between 108 to 280 kg/ ha, only 25.0 per cent samples were found more than 280 kg/ha and 2.60 per cent samples were found less than 108 kg/ha. In Munagapaka mandal available potassium content (kg/ha) ranged from 156.5-331.2, with a mean value of 236.5, In Devarapalli mandal it ranged from 175.3-348.5 with a mean of 228.5, In Chodavaram mandal it ranged from 151.7-353.8 with a mean of 205.1, In Payakaraopeta mandal it ranged from 188.7-390.8 with a mean of 237.4, In Yellamanchili mandal it ranged from 202.1-383.5 with a mean of 234.7, In Rambilli mandal it ranged from 189.6-363.4 with a mean of 260.9 and In Ravikamatham mandal it ranged from 164.5-323.6 with a mean of 252.8.

### **DTPA extractable micronutrients**

Micronutrients such as Cu, Fe and Mn were available sufficiently. However, Zn was found deficient in just 3% of samples.

This study reveals that sugarcane growing soils of Visakhapatnam district, Andhra Pradesh were neutral in soil reaction with medium soil OC content. The available N was medium, K was medium, while P was high in these soils. Micronutrients such as Cu, Fe and Mn were available sufficiently. However, Zn was found deficient in just 3% of samples. Overall, selected sugarcane growing soils had a low to medium nutrient status. These results call for urgent need to adopt soil test based balanced nutrient management for better soil health, enhanced sugarcane production and productivity as well as profitability in a sustainable manner.

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