



## Delineation of Leaf Nutrient Status of Rice Crop Grown in Various Mandals in Nellore District of Andhra Pradesh

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### ABSTRACT

A survey was undertaken to delineate the leaf nutrient status of rice crop grown in various mandals in Nellore district of Andhra Pradesh. The analysis of the rice index leaf samples revealed that the nitrogen and phosphorus contents were found to be low to sufficient, potassium content was found to be low to high, while calcium, magnesium and sulphur contents were found to be sufficient to high in all the rice index leaf samples. Further, the iron, manganese, zinc and copper contents in the rice index leaf samples were also found to be sufficient.

**Key words :** Correlation, Leaf nutrients, Rice grown soils, Soil orders.

Rice (*Oryza sativa* L.) is the most important and staple food crop for more than two thirds of the population. The slogan 'RICE IS LIFE' is the most appropriate for India as this crop plays a vital role in our national food security. India has the largest area under rice (about 42.4 m.ha.) with a production of about 90 million tonnes. In Andhra Pradesh rice occupies an area of 43.87 lakh hectares with a production of 142.10 lakh metric tons. Andhra Pradesh is surplus in rice grain production and can comfortably claim to be the granary of Southern India.

### MATERIAL AND METHODS

The survey area in Nellore district of Andhra Pradesh is located between East longitudes of 70° 50' to 80° 15' and North latitudes of 13° 30' to 15° 60' and lies on the eastern side of peninsular India.

The index leaf samples were collected from in the farmers fields from which soil samples were drawn. All the 60 plant samples were collected after harvesting from 60 holdings, by counting 3<sup>rd</sup> leaf from top. The procedure which was followed by Munshi *et al.* (1979) was adopted for preparation of leaf samples for analysis. The nitrogen content of foliar tissue was estimated by microkjeldahl distillation method (A.O.A.C., 1970). The phosphorus content of foliar tissue was determined by vanado-molybdo phosphoric yellow colour method and the concentration of potassium

was determined by using flame photometer (Jackson, 1973). The calcium and magnesium contents were determined by versenate method while sulphur content was determined by turbidometric method (Vogel, 1978). The leaf diacid extract was fed to atomic absorption spectrophotometer and the concentration of Fe, Mn, Zn and Cu were determined (Vogel, 1978).

All the major (N, P and K), secondary (Ca, Mg and S) and micro (Fe, Mn, Zn, Cu and B) nutrients in the rice index leaf samples were rated as low, sufficient and high categories as per the limits suggested by Tandon (2005) (Table 1).

### RESULTS AND DISCUSSION

#### Major nutrients (N, P and K) concentration in rice index leaf

The result of the rice index leaf sample analysis revealed that the leaf nitrogen content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 2.40 to 2.51, 2.44 to 2.77, 2.42 to 2.90, 2.45 to 2.85 and 2.40 to 2.97 per cent, respectively. The mean leaf nitrogen content of rice crop grown in the above mandals was 2.44, 2.58, 2.60, 2.57 and 2.55 per cent, respectively. The leaf phosphorus content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 0.07 to 0.12, 0.07 to 0.14, 0.07 to 0.14, 0.07 to 0.17 and

Table 1. Low, sufficiency and high limits of nutrients for rice crop.

Element*	Low	Sufficient	High
Nitrogen (%)	2.40 – 2.50	2.60 – 3.20	> 3.20
Phosphorus (%)	0.07 – 0.08	0.09 – 0.18	> 0.18
Potassium (%)	0.80 – 0.90	1.00 – 2.20	> 2.20
Calcium (%)	< 1.20	1.20 – 1.40	> 1.40
Magnesium (%)	< 0.20	0.20 – 0.30	> 0.30
Sulphur (%)	< 0.12	0.15 – 0.20	> 0.20
Iron (mg kg <sup>-1</sup> )	60 – 69	70 – 150	> 150
Manganese (mg kg <sup>-1</sup> )	100 – 149	150 – 800	> 800
Zinc (mg kg <sup>-1</sup> )	16 – 17	18 – 50	> 50
Copper (mg kg <sup>-1</sup> )	6 – 7	8 – 25	> 25

\* Concentrations less than the low category denote the deficiency

0.07 to 0.17 per cent respectively. The mean leaf phosphorus content of rice crop grown in the above mandals was 0.09, 0.10, 0.10, 0.11 and 0.10 per cent, respectively. The leaf potassium content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 0.90 to 2.26, 1.10 to 2.28, 1.28 to 2.56, 1.00 to 2.47 and 0.90 to 2.56 per cent respectively. The mean leaf potassium content of rice crop grown in the above mandals was 1.38, 1.87, 1.91, 1.59 and 1.67 per cent respectively. As per the limits of Tandon (2005) all the rice index leaf samples were low to sufficient with respect to N and P whereas low to high with respect to K in all the mandals of Nellore district.

#### **Secondary nutrients (Ca, Mg and S) concentration in rice index leaf**

The leaf calcium content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 1.20 to 1.36, 1.27 to 1.42, 1.23 to 1.41, 1.24 to 1.48 and 1.20 to 1.48 per cent, respectively. The mean leaf calcium content of rice crop grown in the above mandals was 1.28, 1.33, 1.33, 1.37 and 1.33 per cent, respectively. The leaf magnesium content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 0.20 to 0.30, 0.20 to 0.29, 0.21 to 0.31, 0.21 to 0.31 and 0.20 to 0.31 per cent respectively. The mean leaf

magnesium content of rice crop grown in the above mandals was 0.24, 0.24, 0.25, 0.25 and 0.24 per cent respectively. The leaf sulphur content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 0.15 to 0.31, 0.19 to 0.37, 0.27 to 0.38, 0.15 to 0.34 and 0.15 to 0.40 per cent, respectively. The mean leaf sulphur content of rice crop grown in the above mandals was 0.24, 0.28, 0.30, 0.25 and 0.27 per cent, respectively. The leaf calcium content of the rice crop under investigation varied from 1.20 to 1.48 per cent with a mean value of 1.33 per cent. As per the ratings for leaf calcium content in rice crop established by Tandon (2005), it was noticed that the calcium content in the leaf was sufficient in all the samples (83.33 %) except 10 samples (16.66 %) which were found to be high in leaf calcium content. The leaf magnesium content of rice crop under examination varied between 0.20 and 0.31 per cent with a mean value of 0.24 per cent. As per the ratings for leaf magnesium content in rice crop established by Tandon (2005), it was noticed that the magnesium in the leaf was sufficient in all the samples (70 per cent) except in 13 samples (21.67 per cent) which were found to be high in leaf magnesium and 5 samples (8.33 per cent) were found to be low in leaf magnesium content. The leaf sulphur content in the rice crop under study ranged from severe deficit to sufficient as per the ratings given by Tandon (2005). Further, it was

Table 2. Nitrogen, phosphorus and potassium status in rice leaf at harvesting stage grown in different soil orders

Sl. No.	Mandal Name	Number of samples	Major nutrients concentration (%)					
			N		P		K	
			Range	Mean	Range	Mean	Range	Mean
1	Buchireddypalem	12	2.40-2.51	2.44	0.07-0.12	0.09	0.90-2.26	1.38
2	Kovur	12	2.44-2.77	2.58	0.07-0.14	0.10	1.10-2.28	1.87
3	Nellore rural	12	2.42-2.90	2.60	0.07-0.14	0.10	1.28-2.56	1.91
4	Indukurpet	12	2.45-2.85	2.57	0.07-0.17	0.11	1.00-2.47	1.59
5	Alluru	12	2.40-2.97	2.55	0.07-0.17	0.10	0.90-2.56	1.67

Table 3. Calcium, magnesium and sulphur status in rice leaf at harvesting stage grown in different soil orders

Sl. No.	Mandal Name	Number of samples	Secondary nutrients concentration (%)					
			Ca		Mg		S	
			Range	Mean	Range	Mean	Range	Mean
1	Buchireddypalem	12	1.20-1.36	1.28	0.20-0.30	0.24	0.15-0.31	0.24
2	Kovur	12	1.27-1.42	1.33	0.20-0.29	0.24	0.19-0.37	0.28
3	Nellore rural	12	1.23-1.41	1.33	0.21-0.31	0.25	0.27-0.38	0.30
4	Indukurpet	12	1.24-1.48	1.37	0.21-0.31	0.25	0.15-0.34	0.25
5	Alluru	12	1.20-1.48	1.33	0.20-0.31	0.24	0.15-0.40	0.27

Table 4. Iron, Manganese, Zinc and Copper status in rice leaf at harvesting stage in rice grown soil orders

Sl. No.	Mandal Name	Number of samples	Micronutrients concentration (%)							
			Fe		Mn		Zn		Cu	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean
1	Buchireddypalem	12	210-301	265	206-365	279	12.80-22.80	17.52	32.00-63.40	47.40
2	Kovur	12	221-301	257	208-411	306	11.90-26.50	20.06	21.70-72.10	47.77
3	Nellore rural	12	216-295	257	212-351	252	15.60-26.80	20.50	28.90-75.70	51.50
4	Indukurpet	12	232-281	254	222-345	279	15.10-25.40	19.99	26.10-56.70	41.87
5	Alluru	12	175-301	257	206-411	275	11.90-28.30	19.79	21.70-75.70	46.94

noticed that sulphur in the leaf was sufficient in almost all samples leaf sulphur content.

#### **Micro nutrients (Fe, Mn, Zn and Cu) concentration in rice index leaf**

The leaf iron content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 210 to 301, 221 to 301, 216 to 295, 232 to 281 and 175 to 301 mg kg<sup>-1</sup> respectively. The mean leaf iron content of rice crop grown in the above mandals was 265, 257, 257, 254 and 257 mg kg<sup>-1</sup> respectively. The leaf iron content of rice crop under the investigation ranged from 175 to 301 mg kg<sup>-1</sup> with a mean value of 257 mg kg<sup>-1</sup>. The leaf iron content in the rice crop under study was considered to be high as per the ratings given by Tandon (2005). The leaf manganese content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 206 to 365, 208 to 411, 212 to 351, 222 to 345, 206 to 411 mg kg<sup>-1</sup> respectively. The mean leaf manganese content of rice crop grown in the above mandals was 279, 306, 252, 279 and 275 mg kg<sup>-1</sup> respectively. The leaf manganese content of rice crop under study varied from 206 to 411 mg kg<sup>-1</sup> with a mean value of 275 mg kg<sup>-1</sup>. The samples under study were considered to be high in leaf manganese content as per the ratings suggested by Tandon (2005).

The leaf zinc content of rice crop grown in various mandals of Nellore district, such as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 12.80 to 22.80, 11.90 to 26.50, 15.60 to 26.80, 15.10 to 25.40 and 11.90 to 28.30 mg kg<sup>-1</sup>, respectively. The mean leaf zinc content of rice crop grown in the above mandals was 17.52, 20.06, 20.50, 19.99 and 19.79 mg kg<sup>-1</sup>, respectively. The leaf zinc content of rice crop in the present investigation ranged from 11.90 to 28.30 mg kg<sup>-1</sup> with a mean value of 19.79 mg kg<sup>-1</sup>. The samples under study were considered to be sufficient in leaf zinc content as per the ratings suggested by Tandon (2005) except in 2 samples (3.33 %) which are found to be low in leaf zinc content. The leaf copper content of rice crop grown in various mandals of Nellore district, such

as Buchireddypalem, Kovur, Nellore rural, Indukurpet and Alluru ranged from 32.00 to 63.40, 21.70 to 72.10, 28.90 to 75.70, 26.10 to 56.70 and 21.70 to 75.70 mg kg<sup>-1</sup> respectively. The mean leaf copper content of rice crop grown in the above mandals was 47.40, 47.77, 51.50, 41.87 and 46.94 mg kg<sup>-1</sup> respectively. The leaf copper content of rice crop under study varied between 21.70 and 75.70 mg kg<sup>-1</sup> with a mean value of 46.94 mg kg<sup>-1</sup>. The leaf copper content was considered to be high in status according to the ratings suggested by Tandon (2005).

It was concluded that, the index leaf nitrogen content (2.40 to 3.20%) and phosphorus content (0.05 to 0.14%) in rice crop were found to be low to sufficient, in all the samples while potassium content (0.80 to 2.56%) was found to be low to high in all the leaf samples. The index leaf calcium (0.96 to 1.88%), magnesium (0.12 to 0.43%) and sulphur contents (0.07 to 0.68%) in rice crop were found to be sufficient to high. The index leaf iron (175 to 301 mg kg<sup>-1</sup>), manganese (145 to 570 mg kg<sup>-1</sup>), zinc (16.30 to 39.40) and copper (63.40 to 79.10 mg kg<sup>-1</sup>) were also found to be above their respective critical limits.

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