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Correlation Studies Between Available Soil and Leaf Nutrients of Rice Crop Grown in Various Mandals in Nellore district of Andhra Pradesh

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

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 44 m.ha.) with a production of about 104 million tonnes. In Andhra Pradesh rice occupies an area of 43.87 lakh hectares with a production of 142.10 lakh metric tonnes.

In several rice growing areas of our country, many soils might be unable to supply the available nutrients at the rate at which the rice crop needs for its maximum growth and yield. Nitrogen, phosphorus and potassium are required in large quantities while most of the remaining essential nutrients are needed only in small amounts. Rice crop removes about 15 kg N, 4 kg P_2O_5 and 24 kg K_2O to produce one tonne grain. Nutrient uptake by high yielding rice variety is usually more than that applied through fertilizers.

The survey area in Nellore district of Andhra Pradesh is located at the 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.

About 60 soil samples were collected from various mandals in Nellore district of Andhra Pradesh. Soil samples were collected at two different depths *i.e.* 0-15 cm and 15-30 cm, by covering six locations in the field and mixed thoroughly and pooled as one sample (0-30 cm). The samples were air dried and pounded with a wooden hammer and passed through 2 mm sieve and used for particle size distribution. The index leaf samples were also collected from the plants in the farmer's fields from which soil samples were drawn. All the 60 soil samples were analysed for available N by alkaline permanganate method. The available P was extracted with 0.5M $NaHCO_3$ extractant and was determined by using ascorbic acid as reducing agent and the available K in the soils was extracted by employing neutral normal ammonium acetate and determined by aspirating the extract into the flame photometer (Jackson, 1973). Available Ca and Mg were determined by versenate method (Chopra and Kanwar, 1991) whereas available S was determined turbidimetrically using 0.15% $CaCl_2$ extractant (Cottenie *et al.,* 1979). DTPA extractable Fe, Mn, Zn and Cu were determined as per Lindsay and Norvell (1978). 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). Ca and Mg 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). The data were subjected to statistical analysis by adopting the simple correlations to find out the extent of relationship between soil characteristics and leaf nutrients status, as per the procedure described by Gomez and Gomez (1984).

Correlation coefficients between available soil nutrients and leaf nutrients Status

The leaf nitrogen content had shown highly significant and positive correlation (r = + 0.857) with the available soil nitrogen (Table 1). The increase in nitrogen content in rice plants by each additional dose of nitrogen application was attributed to the increased nitrogen availability in the soil (Gupta *et al.,* 1980). These findings were in accordance with those reported by Tandon (2005), Chaudhary and Sinha (2007), Narendra Pandey *et al*. (2008) and Masthan Reddy (2009). The leaf

Table 1. Correlation coefficients (r) between available soil nutrients and leaf nutrients in rice crop grown in Nellore district

Available soil nutrients	Leaf nutrients									
	N	P	K	Ca	Mg	S	Fe	Mn	Zn	Cu
N	**0.857****	0.010	0.273*	0.083	-0.013	0.254*	-0.168	-0.038	0.294*	-0.003
P	-0.102	**0.846****	0.095	0.183	0.152	-0.145	-0.097	0.220	0.168	-0.111
K	0.257*	0.078	**0.879****	-0.026	0.054	0.335**	0.015	-0.186	0.291*	0.267*
Ca	0.164	0.215	-0.046	**0.942****	0.483**	-0.008	-0.039	0.030	0.233	-0.059
Mg	0.033	0.247	-0.032	0.472**	**0.910****	-0.070	-0.169	-0.053	0.049	-0.015
S	0.206	-0.067	0.397**	0.039	-0.162	**0.952****	-0.042	-0.031	0.197	0.106
Fe	-0.113	-0.150	-0.068	-0.184	-0.226	-0.001	**0.665****	0.358**	0.128	0.159
Mn	-0.084	0.260*	-0.061	0.044	-0.031	-0.036	0.299*	**0.919****	0.244	0.164
Zn	0.149	0.280*	0.122	0.133	-0.015	0.089	0.109	0.140	**0.799****	-0.015
Cu	-0.130	-0.039	0.164	0.001	0.090	-0.005	0.269*	0.107	0.094	**0.848****

phosphorus content was positively and significantly correlated (r = + 0.846) with available phosphorus content in the soil. Similar findings were also reported by Bandyopadhyay *et al*. (2003), Laxminarayana and Rajagopal (2005) and Tandon (2005). The leaf potassium content showed highly significant and positive correlation (r = + 0.879) with the available potassium content in the soil. These findings were in agreement with those reported by Tandon (2005) and Patra *et al*. (2008).

The leaf calcium content showed a highly significant and positive correlation (r = + 0.942) with available calcium content of the soil. The leaf magnesium content had shown highly significant and positive correlation (r = + 0.538) with available magnesium content of the soil. The leaf sulphur content was positively and significantly correlated (r = + 0.952) with the available sulphur content in the soil. Similar findings were also reported by Ram *et al*. (1999).

The leaf iron content showed highly significant positive correlation (r = + 0.665) with the available iron content in the soil. Similar findings were also reported by Venkata Subbaiah *et al.* (1994), Duhan and Mahendra Singh (2002), Singh *et al.* (2003) and Laxminarayana and Rajagopal (2005). The leaf manganese content had shown highly positive and significant correlation (r = + 0.919) with available manganese content of the soil. Similar findings were also reported by Venkata Subbaiah *et al.* (1994).

The leaf zinc content had shown highly significant and positive correlation (r = + 0.799) with the available zinc content of the soil**.** Similar findings were also reported by Venkata Subbaiah *et al.* (1994), Duhan and Mahendra Singh (2002), Singh *et al.* (2003), Tanmoy Karak *et al*. (2006) and Chaudhary and Sinha (2007). The leaf copper content had shown highly significant and positive correlation (r = + 0.848) with available soil copper content. Similar findings were also reported by Duhan and Mahendra Singh (2002) and Singh *et al.* (2003).

It was concluded that, all the major (N, P and K), secondary (Ca, Mg and S) and micro nutrients (Fe, Mn, Zn and Cu) in index leaf samples of rice crop were positively and significantly correlated with their respective available nutrients in the soil.

LITERATURE CITED

A O A C 1970 Official and Tentative Methods of Analysis. *Association of Official Analytical Chemists*. William Star Wetglad, Washington.

Bandyopadhyay B K, Sen H S and Majf B 2003 Studies on transformation of sulphate salts under paddy cultivation in coastal saline soil and its effect on growth of rice. *Journal of the Indian Society of Soil Science,* 51 (3): 155-160.

Chaudhary S K and Sinha N K 2007 Effect of levels of nitrogen and zinc on grain yield and their uptake in transplanted rice. *Oryza*, 44(1): 44-47.

Chopra S L and Kanwar J S 1991 *Analytical Agricultural Chemistry*. Kalyani Publishers, New Delhi. pp. 279.

Cottenie A, Virloo M, Velghe G and Kiekins L 1979 *Analytical Method for Plants and Soils*. State University, Ghent, Belgium.

Duhan B S and Mahendera Singh 2002 Effect of green manuring and nitrogen on yield of and uptake of micronutrients by rice. *Journal of the Indian Society of Soil Science,* 50 (2): 178-180.

Gomez K A and Gomez A A 1984 *Statistical Procedures for Agricultural Research*. Second Edition, Wiley-Inter Science Publications, New York.

Gupta A, Shukla V and Srinivas K 1980 Response of tomato cultivars to fertilisation. *Vegetable Science*, 5: 66-71.

Jackson M L 1973 *Soil Chemical Analysis*. Oxford IBH Publishing House, Bombay. pp. 38.

Laxminarayana K and Rajagopal V 2005 Effect of organic matter on P transformation in submerged soils and their relationship with P availability to rice. *Oryza*, 42 (4): 271-279.

Lindsay W L and Norvell W A 1978 Development of DTPA soil test for zinc, iron, manganese and copper. *Soil Science Society of America Journal*, 42: 421-428.

Masthana Reddy B G, Manjunatha Hebbara, Patil V C and Patil S G 2009 Nitrogen use efficiency of transplanted rice as influenced by N, P and K levels. *Journal of the Indian Society of Soil Science,* 57 (3): 345-351.

Narendra Pandey, Verma A K and Tripathi R S 2008 Effect of planting dates and N levels on N concentration in the leaf, grain yield and N uptake by hybrid rice. *Oryza*, 45 (1): 18-22.

Patra S K, Ray R, GHosh K K and Sahu C 2008 Potassium fixation capacity in some mineralogically different rice soils. *Oryza*, 45 (4): 324-327.

Ram H, Singh S and Chaubey C N 1999 Response of rice to sulphur under reclaimed salt affected soil. *Oryza*, 36 (3): 272-273.

Singh I S and Agrawal H P 2003 Characteristics and classification of some rice growing soils of Chandauil district of Uttar Pradesh. *Agropedology*, 13: 11-16.

Tandon H L S 2005 Methods of Analysis of Soils, Plants, Waters, Fertilisers and organic manures. *Fertiliser Development and Consultation Organisation*, New Delhi, India.

Tanmoy Karak, Das D K and Debtanu Maiti 2006 Yield and zinc uptake in rice (*Oryza sativa*) as influenced by sources and times of zinc application. *Indian Journal of Agricultural Sciences*, 76 (6): 346-348.

Venkata Subbaiah V, Sreemannarayana B, Sairam A, Pawan Kumar P R and Prabhu Prasadini P 1994 Effect of zinc levels and its relative proportion to iron and manganese content in 3rd leaf of Zn deficiency and grain yield of low land rice. *Journal Research of APAU,* 22 (3&4): 135-136.

Vogel A I 1978 *A Text book of Quantitative Inorganic Analysis*. Richard clay, The Chances Press Limited, Britain.

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