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NOTE

Status of Major Nutrients in Acidic and Neutral Soils of Northern Hills Zone of Chhattisgarh State, India

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This study was aimed to obtain rice genotypes that tolerant and sensitive to acid soil. This study was conducted in two different soil pH condition at farmer's field at village Ajirma and research field at RMD College of Agriculture and Research Station Ajirma, Ambikapur, Chhattisgarh with twelve rice (*Oryza sativa* L.) genotypes laid out under randomized block design to identify the acid tolerant rice genotypes. Soil samples were collected from different locations of farmer's field (pH 4.5) and research field (pH 6.6) and analyzed for some important physical and chemical properties, SOC and available N, P, K. Initially, at low pH condition SOC (0.27 %), N (151.6 kg ha^{-1}), P (9.63 kg ha^{-1}), K (148.06 kg ha^{-1}) and at normal pH condition SOC (0.51 %), N (232.6 kg ha^{-1}), P (14.89 kg ha^{-1}), K (318.50 kg ha^{-1}) were analyzed.

Keywords: *Oryza sativa* L., Acidity tolerance, Soil fertility status, Genotypes, Organic carbon.

Rice (*Oryza sativa* L) is one of the world's most important crops, supplying food for nearly half its population, especially in Asia. About 13 % of global rice production occurs in acidic soils. Acid soils limit crop production have extended more than 40 % of the world's arable soils. Aluminium toxicity is considered to be one of the most serious abiotic stress factors that limiting plant growth in acid soils [1-6]. Chhattisgarh is popularly known as "rice bowl of India". It has geographical area of 13.51 million ha of which 5.9 million ha is under cultivation [7]. Although crop production on acid soils can be sustained by application of lime, runoff pollution is an undesirable effect. Liming is often not economic or practical because of the slow movement of lime especially in the deeper layers of sub-soils. Furthermore, heavy application of lime may have adverse effects on some crops in the rotation or cause deficiencies of certain nutrients. Thus, developing cultivars with improved tolerance to acid soil stress may be a solution to address this problem [8]. Knowledge about nutrients status of the soil and their inter-relationship with physical and chemical properties is helpful in understanding the inherent capacity of soil to supply essential plant nutrients for utilization to crops. Soil fertility and nutrient supplying capacity of a soil can be maintained on a long-term basis only by replenishing, by addition through external inputs, nutrients removed by cropping and those lost through physical, chemical and biological processes. Cultivars with a high nutrient efficiency ratio when grown under acid soil stress may have an advantage in adapting to mineral-stressed acid soils and genotypes that are efficient nutrient utilizers might be useful in breeding for more efficient cultivars.

The experiment was conducted to evaluate the twelve medium duration rice genotypes laid out in Randomized Block Design with three replications in two experimental sites *i.e.*, at farmers field at village Ajirma and research field at RMD College of Agriculture and Research Station Ajirma, Ambikapur District Surajpur, (Chhattisgarh) during *kharif* 2014. The experiment raised in acidic soil, sandy loam texture, pH (4.5) and EC (0.14 dS m^{-1}). Available N, P and K status in soil was 151.60, 9.63 and 148.06 kg ha^{-1}, respectively. Soil available micronutrients *i.e.* Cu, Fe, Mn and Zn were 1.20, 88.85, 23.7 and 0.50 ppm, respectively. Likewise, in neutral soil the texture was silty clay loam, pH (6.6), EC (0.18 dS m^{-1}) and available major (kg ha^{-1}) and micro nutrient (ppm) status, N, P, K, Cu, Fe, Mn and Zn *i.e.* 232.6, 14.89, 318.50, 1.60, 23.1, 11.57 and 0.60 respectively. The general recommendation doses of fertilizers were applied to the genotypes are 100:60:40. (N: P_2O_5:K_2O).

Available soil nirogen status: The data presented in Table-1 revealed the different levels of available nitrogen at harvest of the crop in acidic soil, the highest level of available N was found in treatment MTU 1010 (177.68 kg ha^{-1}) which is significantly at par with following treatments Karma Mahsuri

TABLE-2
STATUS OF MACRONUTRIENTS AND GRAIN YIELD IN ACID AND NEUTRAL SOIL AT HARVEST

Treatments	Acidic soils				Neutral soils			
	Available nitrogen (kg ha^{-1})	Available phosphorus (kg ha^{-1})	Available potassium (kg ha^{-1})	Yield (q ha^{-1})	Available nitrogen (kg ha^{-1})	Available phosphorus (kg ha^{-1})	Available potassium (kg ha^{-1})	Yield (q ha^{-1})
V1-Indira Maheshwari	175.48	10.10	151.02	36.96	253.56	14.47	324.97	53.78
V2-R-1688-2150-5-2060-1	163.17	9.61	152.91	22.76	250.21	14.58	327.64	38.58
V3-Sampada	170.59	10.01	155.15	25.52	252.59	14.49	328.22	39.20
V4-Mahamaya	173.79	10.06	158.52	39.35	246.80	14.51	323.93	59.64
V5-Bamleshwari	173.85	10.13	153.94	38.23	249.12	14.46	325.76	55.79
V6-Vijeta (MTU 1001)	171.32	10.24	148.95	26.72	254.60	14.32	325.07	44.81
V7-Shyamla	167.89	10.16	151.27	16.81	251.69	14.61	328.07	32.17
V8-R 1661-605-84-1	176.40	9.92	155.06	28.27	254.39	14.53	324.53	42.85
V9-R 304-34	171.90	9.84	155.78	27.16	249.36	14.19	327.39	57.28
V10-IGKVR2 (Durgeshwari)	176.09	10.34	153.42	34.03	253.46	14.42	329.70	43.98
V11-Karma Mahsuri	176.76	9.71	153.84	33.04	252.44	14.45	327.79	38.12
V12-MTU 1010	177.68	9.95	152.86	37.83	249.77	14.41	326.44	47.07
SEm±	2.59	0.13	1.61	0.95	1.10	0.05	1.12	3.00
CD (P = 0.05)	7.59	0.40	4.73	2.78	3.24	0.15	3.28	8.82

TABLE-1
INITIAL PHYSICO-CHEMICAL PROPERTIES
OF ACID AND NEUTRAL SOIL

Physico-chemical properties	Acid soil	Neutral soil
	Value	
Soil texture		
Sand (%)	54	49
Silt (%)	28	22
Clay (%)	18	29
pH (1:2.5)	4.5	6.6
EC (dS m-^{1})	0.14	0.18
Organic carbon (%)	0.27	0.51
Available nitrogen (kg ha^{-1})	151.6	232.6
Available phosphorus (kg ha^{-1})	9.63	14.89
Available potassium (kg ha^{-1})	148.06	318.50

> R 1661-605-84-1 > Durgeshwari > Indira Maheshwari > Bamleshwari > Mahamaya > R 304-34 > Vijeta and the lowest level of available N is observed in treatment R-1688-2150-5-2060-1 (163.17 kg ha^{-1}).

The results presented in Table-2 on available N in neutral soil revealed that the treatment Vijeta (254.60 kg ha^{-1}) which was significantly at par with following treatments R 1661-605-84-1 > Indira Maheshwari > Durgeshwariu > Sampada > Karma Mahsuri > Shayamla and the lowest level of available N was observed in treatment Mahamaya (246.80 kg ha^{-1}).

Available soil phosphorus status: The data presented on Table-1 revealed that available P at harvest in acidic soil was maximum in Durgeshwari (10.34 kg ha^{-1}) which was significantly superior and at par with Vijeta > Bamleshwari > Shyamla > Indira Maheshwari > Mahamaya > Sampada > MTU 1010 and the minimum level of available P was observed in R-1688-2150-5-2060-1 (9.61 kg ha^{-1}), whereas in neutral soil Table-2 available P was found maximum in Shyamla (14.61 kg ha^{-1}) which was significantly superior and at par with R-1688-2150-5-2060-1 > R 1661-605-84-1 > Mahamaya > Sampada > Indira Maheshwari > Bamleshwari and the minimum level of available P was observed in R-304-34 (14.19 kg ha^{-1}).

Available soil potassium status: The soil available K status in acid soil Table-1 was found maximum in Mahamaya (158.52 kg ha^{-1}) which was significantly superior and at par with R-304-34 > Sampada > R 1661-605-84-1 > Bamleshwari > Karma Mahsuri and the minimum level of available K was observed in Vijeta (148.95 kg ha^{-1}).

Whereas, in neutral soil Table-2 stated that in neutral soil condition available K was found maximum in Durgeshwari (329.70 kg ha^{-1}) which was significantly superior and at par with Sampada > Shyamla > Karma Mahsuri > R-1688-2150-5-2060-1 > R-304-34 > MTU 1010 and the minimum level of available K was observed in Mahamaya (323.93 kg ha^{-1}).

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REFERENCES

1. L. Simon, M. Kieger, S.S. Sung and T.J. Smalley, *J. Plant Nutr.*, **17**, 307 (1994); https://doi.org/10.1080/01904169409364729.
2. S. Doncheva, M. Amenós, C. Poschenrieder and J. Barceló, *J. Exp. Bot.*, **56**, 1213 (2005); https://doi.org/10.1093/jxb/eri115.
3. C. Poschenrieder, B. Gunsé, I. Corrales and J. Barceló, *Sci. Total Environ.*, **400**, 356 (2008); https://doi.org/10.1016/j.scitotenv.2008.06.003.
4. S. Zhou, R. Sauvé and T.W. Thannhauser, *J. Exp. Bot.*, **60**, 1849 (2009); https://doi.org/10.1093/jxb/erp065.
5. M.N. Alvim, F.T. Ramos, D.C. Oliveira, R.M.S. Isaias and M.G.C. Franca, *J. Biosci.*, **37(S1)**, 1079 (2012); https://doi.org/10.1007/s12038-012-9275-6.
6. P. Pandey, R.K. Srivastava and R.S. Dubey, *Ecotoxicology*, **22**, 656 (2013); https://doi.org/10.1007/s10646-013-1058-9.
7. Anonymous, Directorate of Economics and Statistics, New Delhi, pp. 14-15 (2011).
8. A. Kumar, A. Pandey and A. Pattanayak, *Indian J. Genet. Plant Breed.*, **73**, 153 (2013); https://doi.org/10.5958/j.0975-6906.73.2.022.