International Journal of Chemical Studies 2019; 7(5): 3405-3407

International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(5): 3405-3407

Received: 07-07-2019
Accepted: 09-08-2019

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Effect of site specific nutrient management on residual status of available N, P, K and Zn of rice in vertisol

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Abstract
A field experiment was carried out during the kharif season (June–October) of 2016 at the Research Farm of the Indira Gandhi Agricultural University, Raipur (C.G.), India to study the "Effect of site specific nutrient management on uptake of nutrient of rice in vertisol". The experiment was laid out in a Randomized block design with three replications and eight treatments namely i.e. RDF(100:60:40:5 NPK and Zn kg ha^{-1}),SSNM based on nutrient expert (120:60:60:5, NPK & Zn kg ha^{-1}), SSNM based on leaf color chart (60:60:60:5, NPK & Zn kg ha^{-1}, rest 50% N based on LCC), SSNM-N, SSNM-P, SSNM-K, Control (N_0, P_0, K_0) and Farmer Fertilizer Practices (N_{80}, P_{40}, K_0).The results was that available nitrogen in soil at harvest stage found- nitrogen 196.67 kg ha^{-1}, Total phosphorus 16.52 kg ha^{-1} and 498.33 kg ha^{-1} potassium was recorded under treatment T_2 SSNM based (NE) similarly the available Zinc content in soil at harvest stage of rice was found higher in treatment T_3- SSNM on LCC (0.8 mg kg$^{-1)}$. Overall concluded that treatment based on nutrient expert (NE) recommendations proved superiority over applied different treatments on yield, nutrients uptake (N,P,K & Zn) involved balance removal as required by rice(cv. Rajeshwari) as well sustaining soil available nutrient status.

Keywords: Leaf color chart (LCC), site specific nutrient management, uptake, residual status of soil

Introduction
Rice (*Oryza sativa* L.) is cultivated in more than hundred countries and undoubtedly a dominant staple food of world and 91 per cent of the world's area and production of rice grown and consumed in Asia (Dobermann and Witt, 2003) [2]. Rice is grown in a wide range of climatic conditions viz., temperature ranging from 17 to 33 °C, rainfall 100 to 5100 mm with an altitude of 2600 meters from mean sea level. Demand for rice is growing every year and it is estimated that by 2025 AD the requirement would be 140 million tonnes. On a global scale, rice provides 21 per cent of per capita energy and 5-7 per cent of per capita protein for humans (Maclean *et al.*, 2002). The warm and moist climatic conditions in much of Asia are very well suited to rice production. In Asia, more than two billion people are getting 60-70 per cent of their energy requirement from rice and its derived products. Area under rice in the world is 161.4 million hectare with a production of 678.7 million tonnes and average productivity of 4204 kg ha-1 (Anon, 2011). According to Doberman and Witt (2003) [2] it will be necessary for rice yields in Asia to increase by 25 per cent from 2010 to 2020. In India, rice occupies an area of 42 million hectare with production of 103.04 million tonnes with an average productivity of 2137 kg ha-1 (Ministry of Agriculture & Farmer Welfare, 2015), which is half of the global average. In Chhattisgarh, rice occupies an area 3.7 million ha with production of 7.65 million tonnes with an average productivity of 1322 kg ha-1 (Directorate of Agriculture, Raipur, 2015-16). Demand for rice is growing every year and it is estimated that by 2025 AD the requirement would be 140 million tonnes. To sustain present food self-sufficiency and to meet future food requirements, India has to increase its rice productivity by 3 per cent per annum.

Material and methods
SSNM aims at dynamic field-specific management of N, P, and K fertilizer to optimize the balance between supply and demand of nutrients. The plants need for N, P, or K fertilizer are determined from the gap between the supply of a nutrient from indigenous sources, ~ 1022 ~

International Journal of Chemical Studies as measured with a nutrient omission plot, and the demand of the rice crop for that nutrient, as estimated from the total nutrient required by the crop to achieve a yield target for average climatic conditions. SSNM, a decision support system provides – before planting – a pattern for splitting an estimated total N fertilizer requirement among pre-set application times (Witt and Dobermann, 2004). Fertilizer P and K recommendations with SSNM are based on the indigenous supply of these nutrients from soil, organic materials, and irrigation water considering nutrient removal with grain and straw. Needs for micronutrients such as zinc and sulphur are based on local recommendations. Nutrient Expert (NE) is as a computer-based decision support tool having nutrient decision support software that uses the principles of site-specific nutrient management (SSNM) and enables to develop fertilizer recommendations tailored to a specific field or growing environment. The parameters needed in SSNM are usually measured in nutrient omission trials. With NE, parameters can be estimated using proxy information, which allows to develop location specific fertilizer guidelines without data from field trials (International Plant Nutrition Institute, 2017). The optimum use of N can be achieved by matching N supply with crop demand. A simple and quick method for estimating plant N demand is LCC i.e. leaf is easy to use and an inexpensive diagnostic tool for monitoring the relative greenness of a rice leaf as an indicator for the plant N status and can be used as an alternative to chlorophyll meter. Use of LCC for N management has consistently increased grain yield and profit in comparison to the farmers' fertilizer practice in Bangladesh. (Sen *et al.*, 2011) [10]. A field experiment was carried out during the kharif season (June–October) of 2016 at the Research Farm of the Indira Gandhi Agricultural University, Raipur (C.G.), to "Evaluate the effect of SSNM on yield and yield attributing parameters of rice in vertisol". The experiment was laid out in a Randomized block design (RBD) with three replications and eight treatments namely i.e. RDF (100:60:40:5 NPK and Zn kg ha-1), SSNM based on nutrient expert (120:60:60:5, NPK & Zn kg ha-1), SSNM based on leaf color chart (60:60:60:5, NPK & Zn kg ha-1, rest 50% N based on LCC), SSNM-N, SSNM-P, SSNM-K, Control (N0, P0, K0) and Farmer Fertilizer Practices (N80, P40, K0). The soil (black soil) was clay loam in texture with alkaline pH (7.3.). It was non saline (EC 0.23 dS m-1) and high in organic carbon content (0.51%). The soil was low in available nitrogen (180 kg ha-1) (Subbiah and Asija 1956), high in available phosphorus (14.35 kg P2O5 ha-1) (Olsen *et al.*, 1954) [7] and high in available potassium (387 kg K2O ha-1). Available zinc content (1.0 mg kg-1) was above the critical level (0.7 mg kg-1). The treatmentmeans were compared using least significant differences at 5% level of significance (Gomez and Gomez 1984)

Result and Discussion

Data pertaining to available N, P, K (kg ha^{-1}) and Zinc (mg kg^{-1}) content in soil after harvest of rice as influenced by different SSNM treatments are presented in Table 1 and depicted in fig.1 revealed that available nitrogen in soil at harvest stage found higher under T_2- SSNM on nutrient expert (196.67 kg ha^{-1}) followed by T_3- SSNM on LCC (188.33 kg ha^{-1}) based treatment, T_6- SSNM- K (179.67 kg ha^{-1}) and T_1-RDF (175.6 kg ha^{-1}). The minimum available content of soil at harvest stage in T_7- Control (159.0 kg ha^{-1}) treatment. Similar trend found in available phosphorus higher under T_2-SSNM on nutrient expert (16.52 kg ha^{-1}) followed by T_3-SSNM on LCC (15.86 kg ha^{-1}) based treatment, T_1-RDF (15.74 kg ha^{-1}) and T_4- SSNM- N (13.71 kg ha^{-1}). The minimum available phosphorus content of soil at harvest stage in T_6- SSNM- K (11.95 kg ha^{-1}) treatment and potassium of soil at harvest stage found higher under T_2- SSNM on nutrient expert (498.33 kg ha^{-1}) followed by T_1-RDF (489.33 kg ha^{-1}), T_3- SSNM on LCC (489.00 kg ha^{-1}) based treatment and T_8-FFP (486.00 kg ha^{-1}) and the minimum available potassium content of soil at harvest stage in inT_7- Control (468.00 kg ha^{-1}) treatment and omission of N, P, K, SSNM on LCC based and FFP were statistically at par with each other. The available Zinc content in soil at harvest stage of rice was found higher in treatment T_3- SSNM on LCC (0.8 mg kg$^{-1)}$ followed by T4-SSNM-N treatment (0.73 mg kg$^{-1)}$ and minimum was found in treatment T7- Control (0.47 mg kg^{-1}).T_2 and T_4 were at par. Similar improved soil available nutrient status was observed in increasing levels of N and K fertilizers applied to rice reported by Babou *et al.* (2009). The results are in conformity with the findings of More *et al.* (2010) [2] while study the impact of integrated nutrient management on residual fertility status of soil.

Table 1: Available N, P, K (kg ha^{-1}) and Zinc (mg kg^{-1}) in soil at harvest of rice as influenced by applied SSNM treatments

Treatment	Residual nutrient status of soil (kg ha^{-1})			
	N	P	K	Zn (mg kg^{-1})
T1 RDF	175.67	15.74	489.67	0.60
T2 SSNM (NE)	196.67	16.52	498.33	0.73
T3 SSNM (LCC)	188.33	15.86	489.00	0.80
T4 SSNM –N	167.33	13.71	485.00	0.73
T5 SSNM-P	171.33	13.68	485.33	0.67
T6 SSNM-K	179.67	11.95	487.33	0.53
T7 (C)	159.00	13.02	468.00	0.47
T8 FFP	171.67	13.35	486.00	0.60
CD (P=0.05%)	NS	NS	36.53	0.20

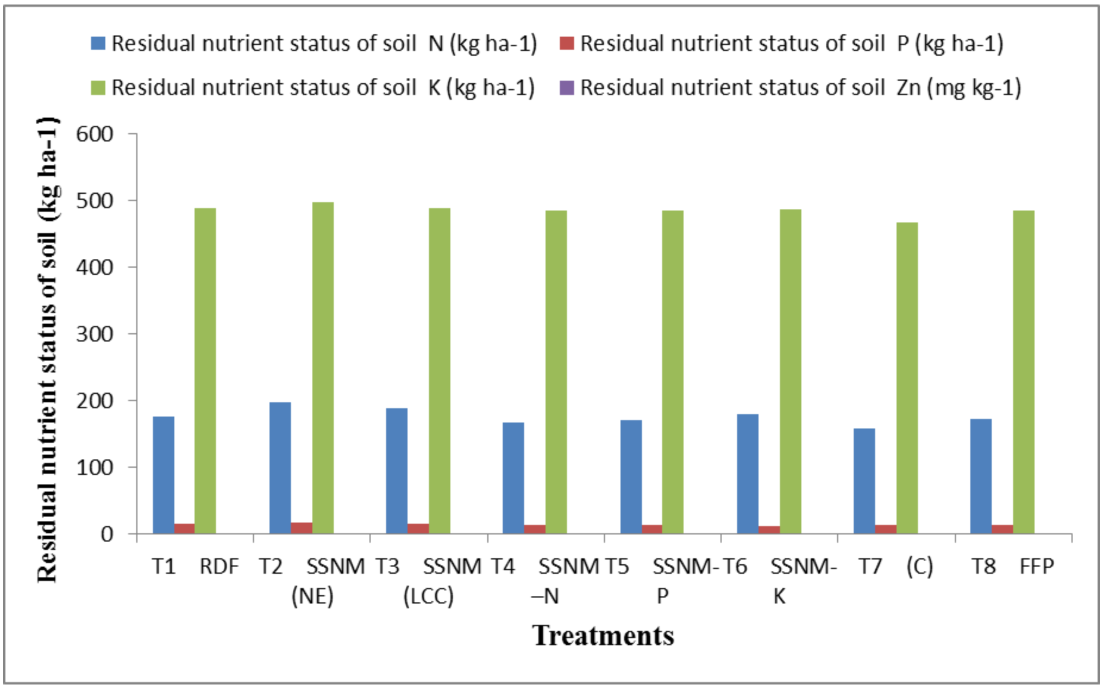

Fig 1: Available N, P, K (kg ha^{-1}) and Zinc (mg kg^{-1}) in soil at harvest of rice under different SSNM treatments

Reference

1. Mishra VN, Patil SK, Das RO, Shrivastava LK, Samadhiya VK, Sengar SS. Site-specific nutrient management for maximum yield of rice in Vertisol and Inceptisol of Chhattisgarh. A paper presented in South Asian Conference on "Water in Agriculture: management options for increasing crop productivity per drop of water" during November, 15-17, 2007 held at IGKV, Raipur C.G., India, 2007, 136.
2. More SR, Mendhe SN. Residual fertility status of soil under integrated nutrient management of soybean. International Journal of Agricultural Sciences. 2010; 6(1):182-183
3. Mukhi AK, Shukla UC. Effect of sulphur and zinc on yield and their uptake in rice in submerged soil conditions. Journal of the Indian Society of Soil Science. 1991; 39:730-734.
4. Murata Y, Matsushima S. Rice. In L.T. Evans ed., Crop Physiology, Cambridge University Press, New York, 1975, 73- 99.
5. Naidu D, Kondapa, Radder BM, Patil PL, Alagundagi S C. Effect of integrated nutrient management on nutrient uptake and residual fertility of chilli (*Byadgi dabbi*) in a vertisol. Karnataka Journal of Agriculture Science. 2009; 22(2):306-309.
6. Nath D, Haque F, Islam MSH, Saleque MA. Farmers Participatory Site Specific Nutrient Management in Gangas Tidal Flood plains Soil for High Yielding Boro Rice. International Conference on Environment, Agriculture and Food Science August, 2012, 11-12.
7. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. U.S. Dep. of Agric. Circ. 1954; 939:1-10
8. Pampolino MF, Manguiat IJ, Ramanathan S, Gines HC, Tan PS, Chi TTN, Rajendran R, Buresh RJ. Environmental impact and economic benefits of site-specific nutrient management (SSNM) in irrigated rice systems. Agricultural Systems. 2007; 1(3):1-24.
9. Pillai KG, Kundu DK. Fertilizer management in rice and Fertilizer Management in Food Crops. (Ed.) Tandon, H.L.S., FDCO, New Delhi, 1993, 1-26.
10. Piper CS. Soil and Plant Analysis, Hans Publisher, Bombay, 1966.
11. Prasad B, Prasad J. Integrated nutrient management for specific yield of rice (*Oryza sativa* L) based on targeted yield concept and soil test values on old alluvial soils. Oryza. 1994; 31:140-143.
12. Rao A, Upendra, Murthy KM, Dakishna, Shridhar TV, Rao K, Tejeswara TVP, Rajendra Prasd. Effect of site specific nutrient management on productivity, profitability and soil N, and K balance in Rice – Rice – Cropping system. Society for Recent Development in Agriculture. 2013; 13:1-6.
13. Sakeena I, Salam MA. Influence of potassium and kinetin on growth, nutrient uptake and yield of rice. Journal of Potassium Research. 1989; 5(1):42- 46.
14. Satyanarayna T, Kausik, Majumdar, Biradar P. New approaches and tools for site specific nutrient management with reference to potassium. Karnataka J Agric. Sci. 2011; 24(1):86-90.
15. Sen, Avijit, Shrivastava, Vinod Kumar, Singh MK, Kumar S. AJPS Leaf Colour Chart vis-a-vis Nitrogen Management in Different Rice Genotypes. American Journal of Plant Sciences. 2011; 2(2):223-236.
16. Shekara BG, Nagaraju, Shreedhara D. Growth and yield of aerobic rice (*Oryza sativa* L.) influenced by different levels of NPK in Cauvery command area. J Maharashtra Agri. Univ. 2010; 35(2):195-198.
17. Singh AK, Singh NP. Effect of Zn and Cu fertilization on rice yield. Fertility News. 2000; 45(7):51-53.
18. Singh PP, Witt C, Dobermann A. INM News, IRRI, Manila, Philippines, 2000.