Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(2): 1183-1185
Received: 10-01-2018
Accepted: 14-02-2018

Yushma Sao
Asst. Prof. Dept. of soil science, BTC CARS, Bilaspur, Chhattisgarh India

Gajendra Singh
Student of M.Sc. (Agriculture.) Dept. of soil science, IGKV, Raipur, Chhattisgarh, India

Madan Kumar Jha
Student of M.Sc. (Hort.) Dept. of Vegetable science, BTC CARS, Bilaspur, Chhattisgarh, India

Correspondence
Yushma Sao
Asst. Prof. Dept. of soil science, BTC CARS, Bilaspur, Chhattisgarh, India

Site specific nutrient management for crop yield maximization using two soil types of Bilaspur District of C.G. on nutrient content in rice grain and straw grown in *Vertisol*

Yushma Sao, Gajendra Singh and Madan Kumar Jha

Abstract
The field experiment was conducted A pot experiment was carried out at the Department of Soil Science and Agricultural Chemistry, BTC College of Agriculture and research Station, Bilaspur, during *Kharif* season 2015-16. On the basis of 1st season results farmer's field demonstration was also carried out at field of farmer's (from where bulk of soils were collected for pot experiment) during *Rabi* season 2015-16. The soils used for pot experiment were two type i. e. *Inceptisol* and *Vertisol*. Both the soils were collected from two different locations of Bilaspur district. Collected soils were air dried and filled in cemented pots. The treatments constituted with application of all nutrients applied at optimum level known as All (SSNM dose) while in others, one of the nutrient elements from all the nutrient treatments (All) was omitted. There were eleven treatments for each type of soil and three replications with completely randomized design. All treatments were common for both the soils except omission of Fe and Mn in case of *Vertisol* and omission of Ca and Mg in case of *Inceptisol* were kept keeping the concept of soil reaction. After addition of all treatments, rice (MTU-1010) was transplanted in three hills/pot with 2-3 seedlings in each hill. In eleven treatments. The highest P (0.24%), Ca (0.21%), Mg (0.16%) and S (0.16%), Mn (54.32 mg kg^{-1}), Zn (27.87 mg kg^{-1}) and B (12.87mg kg^{-1}) contents in rice grain were recorded in the treatment that received all the nutrients (T_1) while, the highest Fe (38.290 mg kg^{-1}), was in treatment T_{10} B omitted were recorded in treatment T_1 which received all nutrients content in rice grain under *Vertisol.* The highest P (0.24%), Ca (0.21%), Mg (0.16%) and S (0.16%) contents in rice grain were recorded in the treatment that received all the nutrients (T_1) and The highest value of Zn (31.38 mg kg^{-1}) and B (3.86 mg kg^{-1}) content were recorded in treatment received all nutrients (T_1). Omission of Zn (T_9) and B (T_{10}) only, were reduced the Zn and B content in rice straw.

Keywords: Inceptisol, vertisol, nutrients, straw

Introduction
Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood. Agriculture, along with fisheries and forestry, is one of the largest contributors to the Gross Domestic Product (GDP). Fertilizers nutrients played a stellar role in improving crop productivity and production, Food grains production rose from 52 million tonnes in 1951-52 to 265 million tonnes in 2013-14 (Anon., 2014) [1], Chhattisgarh State has four major soils type i.e. *Entisols, Inceptisols, Alfisols* and *Vertisols*. Almost all soils are deficient in nitrogen and phosphorus and medium to high in potassium. Zinc deficiency is also reported in some patches of *Alfisols* and *Vertisols* of this region. In view of continuous use of sulfur free complex fertilizers, chances of increase in S deficiency are likely. Continuous use of high analysis fertilizer, multiple nutrient deficiencies are likely. High crop yields can only be achieved by correcting such deficiencies. Other micronutrients like Fe, Mn, Cu, B and Mo may be sufficient for low to medium level of crop production but may not be sufficient for high level of crop production. High crop yields can only be achieved when high yielding crop varieties are properly nutritioned in a correct amount and proper ratios. In addition to this limitation, low fertilizer efficiency, inadequacy of current fertilizer recommendations and the ignorance of nutrients other than N, P, and K may limit crop production.
The response of rice and wheat to fertilizer applications is often far below the potential yields due to low fertilizer efficiency, inadequacy of current fertilizer recommendations, and the ignorance of nutrients other than N, P, and K may that limit crop production. Takkar (1996) [6] has reported based on the studies from several places that normal yield of crops could not be achieved despite balanced use of NPK due to micronutrient deficiency in soils.

Deficiency of micronutrients may either be primary, due to their low total content of elements or secondary, caused by soil factors reducing their availability to plants. The emergence of micronutrients deficiency has generally been considered as secondary.

Material and Methods

Plant Analysis

Plant samples taken at harvest stage were washed with de-mineralized water and sun dried till constant weight achieved. Samples were first digested by different acids or acid mixtures/dry ashed and the contents of N, P, K, Ca, Mg, S, Fe, Mn, Cu, Zn, and B were estimated by adopting standard procedures as per detailed given below.

Nitrogen Content

Plant samples were digested in sulphuric acid at a temperature between 360 and 410 and nitrogen in the digest was estimated by micro-kjeldahl method (Piper 1966) [5]

Phosphorus Content:

Plant samples were digested in tri- acid mixture (HNO_3, $HClO_4$ and H_2SO_4 in 10:4:1 ratio) and phosphorus in the digest was estimated by vanadomolybdo phosphoric yellow colour method (Piper 1966) [5].

Potassium Content

Plant samples were digested in tri- acid mixture (HNO_3, $HCLO_4$ and H_2SO_4 in 10:4:1 ratio) and potassium in the digest was estimated by flame photometer (Piper 1966) [5].

Sulphur Content

Plant samples were digested in di- acid mixture (HNO_3 and $HClO_4$ in 10:4 ratio) and sulphur in the digest was estimated by turbidimetric method (Chesnin and Yien 1950) [3].

Calcium and magnesium content

Plant samples were digested in di- acid mixture (HNO_3 and $HClO_4$ in 10:4 ratio) and calcium and magnesium contents were determined by Versene titration method as suggested by Chang and Bray (1951).

Fe, Mn, Cu and Zn contents

Plant samples were digested with di- acid mixture (HNO_3 and $HCLO_4$ in 10:4 ratio) and contents in the digest were estimated using atomic absorption spectrophotometer.

Boron Content

Plant samples were dry ashed at 550 ^{o}C and the ash was digested with 0.1 N HCl. Boron in the digest was estimated by the azomethine-H method of Gupta (1967) [4].

Results and Discussion

Nutrient content in rice grain grown in *Vertisol*

The results pertaining to nutrient content in rice grain and straw grown in *Vertisol* as influenced by different treatments are presented in table 4.4 and 4.5.

Experimental results showed that, P, Ca, Mg and S content in rice grain were significantly affected with application of different treatments. But experimental treatments were failed to exert any significant effect on N and K content in rice grain. The highest P (0.24%), Ca (0.21%), Mg (0.16%) and S (0.16%) contents in rice grain were recorded in the treatment that received all the nutrients (T_1) which was statistically at par with treatment T_2, T_4 and T_{11} in case of P; T_2 in case of Ca and T_8 and T_{10} in case of S content.

Similar as macronutrient, micronutrient contents (Fe, Mn, Zn and B) in rice grain were significantly affected with application of different treatments under study expect Cu content (Table 4.5). The highest Mn (54.32 mg kg^{-1}), Zn (27.87 mg kg^{-1}) and B (12.87 mg kg^{-1}) content in rice grain were recorded in the treatment received all the nutrients (T_1) while, the highest Fe (38.290 mg kg^{-1}), was in treatment T_{10} B omitted.

Nutrient content in rice straw grown in *Vertisol*

The results pertaining to nutrient content in rice straw grown in *Vertisols* as influenced by different treatments are illustrated in table 4.6 and table 4.7.

Experimental results showed that application of different treatments were failed to exert any significant effect on K, Ca, Mg and S content in rice straw while, N and P content were significantly varied under study (Table 4.6). Treatment T_{11} had recorded significantly higheer value of N content (0.43%) and was at par with treatments T_1, T_6, T_7, T_{11} and T_{10}. Significantly higher P content (0.11%) was recorded in treatment that received all nutrients (T_1).

In case of micronutrient, only Zn and B content in rice straw were significantly changed due to the application of different treatments **(**Table 4.7). While, Fe, Mn and Cu content in rice straw were remains unchanged. The highest value of Zn (31.38 mg kg^{-1}) and B (3.86 mg kg^{-1}) content were recorded in treatment received all nutrients (T_1). Omission of Zn (T_9) and B (T_{10}) only, were reduced the Zn and B content in rice straw.

Table 1: Macro nutrient content (%) of rice grain as affected by different treatments in *Vertisol*

Treatments		Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulphur
T_1	All	1.23	0.24	0.55	0.21	0.16	0.16
T_2	All – N	1.21	0.23	0.53	0.20	0.10	0.15
T_3	All – P	1.19	0.20	0.53	0.19	0.15	0.14
T_4	All – K	1.20	0.22	0.50	0.18	0.14	0.14
T_5	All – S	1.18	0.21	0.51	0.19	0.14	0.13
T_6	All – Fe	1.27	0.21	0.48	0.15	0.15	0.14
T_7	All – Mn	1.17	0.20	0.49	0.16	0.15	0.15
T_8	All – Cu	1.18	0.19	0.51	0.15	0.13	0.16
T_9	All – Zn	1.19	0.20	0.50	0.17	0.12	0.15
T_{10}	All – B	1.20	0.19	0.49	0.18	0.14	0.16
T_{11}	All – Mo	1.16	0.22	0.47	0.18	0.12	0.15
SE(m)		0.04	0.007	0.017	0.006	0.005	0.006
C.D. at 5%		NS	0.021	NS	0.017	0.015	0.016

Table 2: Micro nutrient content (mg kg^{-1}) of rice grain as affected by different treatments in *Vertisol*

Treatments		Iron	Manganese	Copper	Zinc	Boron
T_1	All	38.25	54.32	6.38	27.87	12.87
T_2	All – N	38.07	53.12	6.33	27.12	12.72
T_3	All – P	37.85	53.19	6.32	27.10	12.67
T_4	All – K	36.52	52.11	6.24	26.45	11.89
T_5	All – S	36.85	51.55	6.33	26.63	11.92
T_6	All – Fe	29.32	52.57	6.32	26.72	11.83
T_7	All – Mn	38.25	44.32	6.21	27.28	12.82
T_8	All – Cu	37.38	52.18	5.86	27.18	12.62
T_9	All – Zn	37.96	53.17	6.19	20.27	12.68
T_{10}	All – B	38.29	53.18	6.36	26.18	10.87
T_{11}	All – Mo	36.28	52.17	6.31	27.12	11.52
SE(m)		1.224	1.717	0.205	0.854	0.399
C.D. at 5%		3.613	5.068	NS	2.522	1.177

Table 3: Macro nutrient content (%) of rice straw as affected by different treatments in *Vertisol*

Treatments		Nitrogen	Phosphorus	Potassium	Calcium	Magnesium	Sulphur
T_1	All	0.42	0.11	1.32	0.72	0.39	0.084
T_2	All – N	0.39	0.08	1.31	0.70	0.38	0.082
T_3	All – P	0.37	0.08	1.30	0.71	0.37	0.081
T_4	All – K	0.39	0.09	1.28	0.69	0.36	0.079
T_5	All – S	0.38	0.07	1.27	0.68	0.37	0.077
T_6	All – Fe	0.41	0.08	1.29	0.66	0.35	0.081
T_7	All – Mn	0.42	0.09	1.30	0.69	0.34	0.081
T_8	All – Cu	0.37	0.09	1.31	0.71	0.35	0.078
T_9	All – Zn	0.39	0.08	1.32	0.71	0.36	0.077
T_{10}	All – B	0.41	0.09	1.26	0.70	0.37	0.079
T_{11}	All – Mo	0.43	0.08	1.27	0.68	0.36	0.080
SE(m)		0.013	0.004	0.042	0.024	0.012	0.005
C.D. at 5%		0.038	0.013	NS	NS	NS	NS

Table 4: Micro nutrient content (mg kg^{-1}) of rice straw as affected by different treatments in *Vertisol*

Treatments		Iron	Manganese	Copper	Zinc	Boron
T_1	All	221.57	314.12	5.43	31.38	3.86
T_2	All – N	220.17	312.19	5.41	30.95	3.82
T_3	All – P	220.15	313.40	5.39	30.85	3.76
T_4	All – K	219.67	312.20	5.40	31.12	3.72
T_5	All – S	219.69	312.42	5.38	30.25	3.71
T_6	All – Fe	197.25	313.42	5.40	30.26	3.76
T_7	All – Mn	220.18	307.05	5.37	31.17	3.78
T_8	All – Cu	218.18	311.12	5.27	30.18	3.71
T_9	All – Zn	219.39	311.52	5.38	22.12	3.68
T_{10}	All – B	218.47	312.60	5.39	30.12	2.02
T_{11}	All – Mo	218.57	310.14	5.41	30.28	3.83
SE(m)		7.177	10.246	0.177	0.974	0.115
C.D. at 5%		NS	NS	NS	2.875	0.339

References

1. Anonymous. Agricultural Statistics at a Glance. GOI, Ministry of Agriculture, Department of Agriculture and Cooperation, Directorate of Economics and Statistics, 2014, 8.
2. Bray RH, Kurtz LT. Determination of total, organic and available forms of phosphorus in soils. *Soil Sci.* 1945; 59:39-45.
3. Chesnin L, Yien CH. Turbidimetric determination of available sulphates. *Proc. Soil Sci. Soc. Am*. 1950; 14:149-151.
4. Gupta UC. A simplified method for determining hot-water soluble boron in *podzol* soils. *Soil Sci.*, 1967; 103:424-428.
5. Piper CS. Soil and Plant analysis. Hans Publishers, Bombay, 1966.
6. Takkar PN. Micronutrient research and sustainable agricultural productivity in India. Journal of the Indian Society of Soil Science. 1996; 44(4):562-581.