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

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(1): 2175-2177
Received: 17-11-2017
Accepted: 18-12-2017

Rangesh Kumar
Department of Soil Science and Agricultural Chemistry, Orissa University of Agriculture and Technology Bhubaneswar, Odisha, India

Dr. SK Pattanayak
Department of Soil Science and Agricultural Chemistry, Orissa University of Agriculture and Technology Bhubaneswar, Odisha, India

Jagtaran
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Pileshwar Singh Rajput
Department of Agronomy, IGKV, Raipur, Chhattisgarh, India

Correspondence
Rangesh Kumar
Department of Soil Science and Agricultural Chemistry, Orissa University of Agriculture and Technology Bhubaneswar, Odisha, India

Studying the influence of long term INM practices on yield and quality of Ragi crop

Rangesh Kumar, Dr. SK Pattanayak, Jagtaran and Pileshwar Singh Rajput

Abstract
Ragi is nutritionally potential upland cereal dry land crop known for its multifarious uses. The long term experiment (6 years) on upland irrigated system was initiated during 2010 with 10 different INM treatments, namely (1) Absolute control, (2) BFs, (3) ½ STD + BFs, (4) STD, (5) STD +FYM, (6) STD + BC, (7) STD + FYM + BFs, (8) STD + VC + BFs, (9) STD + FYM + Lime + BFs and (10) STD + VC + Lime + BFs. The grain yield of ragi due to long term (6 years) INM practices varied between 1.14 and 2.72t ha^{-1}, lowest in absolute control and highest in STD+FYM+Lime+BFs. Use of BFs alone increased the grain yield by 30% and its integration with 1/2 STD by 57 percent compared over control. However, this yield were not in acceptable level. Without fertilizers application (control) there was 48% yield loss compared to the yield of 2.19 t ha^{-1} due to STD. Alone organics (FYM/VC) addition either alone or with BFs or further with BFs + lime increased the grain yield by 10,16.4 and 22 percent compared to the grain yield of 2.19 t ha^{-1} due to STD.

Keywords: INM practices, Ragi crop, nutritionally potential

Introduction
The role of seed, fertilizers, water, land, sunshine and plant protection measures are well. known for the increase in crop production. Among these, fertilizers contribute more than 50 percent. Fifty years of fertilizer use history express concern on declining fertilizers use efficiency or decline in partial factor of productivity. The units of additional economic yield per unit of fertilizer nutrient-12kg of food grains per Kg of NPK during 1960- 69 declined to 9 kg per Kg NPK by 2012. Fertilizers of cores of rupees are spent in agriculture every year, which is not used efficiently. The nutrients once lost to environment dangerously enrich either hydrosphere or biosphere. The dark side of fertilizer use creates doubt on sustainable agricultural development. The integrated nutrient management is the solution.

Materials and Methods
The Study entitled “Influence of long term integrated nutrient management practices on the productivity, grain quality and post-harvest soil properties of ragi crop” Was carried out with the help of field experiment. The techniques of investigation followed and the materials used for conducting the experiment have been described in this chapter.

Field experimentation
The Field trial is in continuation in the campus of College of Agriculture, OUAT, Bhubaneswar since 2010 with ragi crop, located at $25^0$15’ N latitude and $80^0$52’ E longitude altitude of 25.9 m. Above mean Sea level (MSL), which is 60 kms west of the Bay of Bengal. The experimental site experiences a high temperature in summer (44 ^{0}C) and mild temperature during winter season. The annual rainfall is about 1505 mm, out of which more than 85 percent is received between months of July to October. The mean annual maximum temperature is 27.4 ^{0}C and maximum temperature. The present crop ragi was 15^{th} crop in the sequence. This crop had inherited residual effects 14 crops grown in the succession. The four succeeding crops were green gram, maize, cabbage, cowpea followed by present crop ragi (under discussion).

Soil of the experimental site
The soil, was loamy sand in texture at the beginning, It was strongly acidic in reaction ($_pH_w$ (1:2:5) was 5.18). The organic carbon status was low (2.7g kg^{-1} soil). The available nitrogen was low 207 kg ha^{-1}. The Bray’s I P was high. The ammonium acetate ex extractable K was low, so also the C_aCl_2 extractable sulphur.

Table 1: Treatment details

T_1	Absolute control
T_2	100% NPK
T_3	100% NPK + FYM @ 5 t ha^{-1}
T_4	100% NPK + vermicompost @ 2.5 kg/ha
T_5	100% NPK + (FYM) + Biofertilizer
T_6	100% NPK + vermicompost @ 2.5 kg ha^{-1} + biofertilizer
T_7	100% NPK + (FYM) + Line + Biofertilizer
T_8	100% NPK + vermicompost @ 2.5 kg/ha + lime + biofertilizer
T_9	Biofertilizers
T_{10}	50% NPK + Biofertilizers

Field experimentation
The test crop received N-P-K-S @ 52-15-32-10 kg ha^{-1} in the form of urea, Navaratna (20-20-0-13) and MOP respectively, The FYM and vermicompost were applied @ 5.0 and 2.5 kg ha^{-1} and biofertilizers like Azotobacter, Azospirillum and PSB were applied @ 4 kg each ha^{-1} inoculated to pre-limed vermicompost.

Source of fertilizer
The test crop received N -P-K-S @ 52-15-32-10 kg ha^{-1} in the form of urea, Navaratna (20-20-0-13) and MOP respectively. The FYM and vermicompost and were applied @ 5.0 and 2.5 kg ha^{-1} and biofertilizers like Azotobacter, and PSB were applied @ 4 kg each ha^{-1} inoculated to pre-limed vermicompost.

Yield and yield attributing characters
Plant height
About 10 plants from each plot were selected. The height was measured. The average height of 10 plants was considered as the height of the crop plant under each treatment.

Biological yield
Ragi crop was harvested at maturity (105 days). Then plants were oven dried at 70 ^{0}C temperature. The data expressed as kg ha^{-1} for biomass calculation.

Grain yield
The sundry weight of grains was measured in an electric balance. The grain yield was expressed in kg ha^{-1}.

Results and Discussion
The data related to the productivity of ragi crop has been presented in Table 2. The grain and stover yields of ragi under the influence of nutrient management practices ranged from 1.14 to 2.24 and from 2.92 to 4.06 t ha^{-1}. The total dry matter production varied between 4.06 and 4.72 t ha^{-1} lowest with no nutrient control and highest with soil test dose (STD) + FYM (F) + Lime (L) + Biofertilizers (BFs).

Table 2: Productivity of ragi crop under the influence of long term INM practices

SL. No.	Practices	Grain (t ha^{-1})	Stover (t ha^{-1})	Total	HI (%)	RAE (%)	Stover : Grain ratio
1	Control	1.14	2.92	4.06	28.1	-	1:2.5
2	BF	1.37(200)	2.72	4.09	33.5	22	1:2.0
3	½ STD + BF	1.79(57)	2.88	4.67	38.3	62	1:1.6
4	STD	2.19	3.73	5.92	37.0	100	1:1.7
5	STD + F	2.44(10)	3.62	6.06	40.3	124	1:1.48
6	STD + VC	2.35(10)	3.67	6.02	39.1	115	1:1.56
7	STD + F + BF	2.60(16.4)	3.74	6.34	41.0	139	1:1.44
8	STD + VC + BF	2.50(16.4)	3.98	6.48	38.6	130	1:1.59
9	STD + L + F + BF	2.72(22)	4.00	6.72	41.0	151	1:1.47
10	STD + L + VC + BF	2.62(22)	4.06	6.68	39.2	141	1:1.55
	LSD (P =0.05)	0.119	0.38	0.41	-	-	-
	CV (%)	4.0	6.2	5.8	-	-	-

*For RAE the grain yield due to STD has been taken as 100

Grain quality
The information on grain quality of ragi has been presented in Table 3. The protein content of ragi grains varied widely between 56 and 93 g kg $^{-1}$, lowest with no-nutrient control and highest with STD + VC + L +BFs Integration of inorganic sources of nutrients (either ½ STD) with BFs or application of full dose of it significantly increased the grain protein content. Combining organics addition either alone (15.7%), or with organics + BFs (25%) or organics + BFs + Lime (32%) increased the protein in grain compared over 70 mg protein kg^{-1} of grain produced with STD.

Table 3: Grain quality of ragi under the influence of INM practices

SL. No.	Packages	Grain Quality of ragi									
		Protein g/kg	Mineral Salts								
			P	K	Ca	Mg	S	Mn	Fe	Zn	Cu
			g/kg					mg/kg			
1	Abs. Cont.	56	2.5	5.3	2.8	2.2	0.3	56	63	16	5
2	BFs	57	2.6	5.5	2.9	2.0	0.4	81	68	20	6
3	½ STD + BF	75	2.9	5.8	3.7	2.1	0.6	85	65	21	8
4	STD	70	2.8	5.1	3.2	2.0	0.5	78	72	16	6
5	STD + F	77	3.0	5.3	3.5	1.9	0.6	82	50	18	8
6	ST + VC	84	3.0	5.2	3.5	1.9	0.6	90	43	20	7
7	STD+F+BF	88	3.5	5.8	3.6	2.0	0.7	97	53	20	9
8	STD+VC+BF	87	3.5	5.6	3.6	2.2	0.8	97	43	22	10
9	STD+F+L+BF	92	3.6	6.0	4.0	2.2	0.8	98	66	23	10
10	STD+VC+L+BF	93	3.7	6.1	3.9	2.4	0.9	104	46	24	11
LSD (P 0.05)		2.1	0.14	0.32	0.2	0.11	0.09	2.2	1.6	1.1	0.5

The mineral salts like P, K, Ca, Mg, S in ragi grain produced out of different INM packages varied between 205 and 3.7 gkg^{-1}, 5.3 and 6.1 gkg^{-1}, 2.8 and 9.0 gkg^{-1}, 1.9 and 2.4 gkg^{-1}, and 0.3 and 0.9 gkg^{-1} grain, respectively the INM practices favored higher content of major mineral salt content in the grain. The above dance of major mineral salts in ragi grain followed the order: K > Ca > P > Mg > S. Similarly the micro mineral salts contents like Mn, Zn and Cu in ragi grains ranged from 56 to 104 $mgkg^{-1}$, 16 to 24 $mgkg^{-1}$ and from 5 to 11 $mgkg^{-1}$ of the grain respectively. The POPs having integration of organics alone, or organics with BFs or organics with BFs and liming of acid soil positively influenced the micro mineral salt contents. The abundance of micro minerals in ragi grain followed the order: Mg > Fe > Zn > Cu.

Discussion

The 10 different long term POPs for ragi crop provided differential growing environment for the crop, which resulted in differential yields. Use of no or long input sources could not supplement the requirement to produce profitable yields. Long term STD practices alone was not sufficient to meet the crop demand for sustained yield with positive fertility balance in soil due to poor physical, chemical, nutritional and microbial activity. However integration of organic sources brought significant improvement in crop environment *Azctobater, Azosprillum* in term of physical, chemical, nutritional and biological parameters to produce more with better post-harvest soil status compare to STD alone.

Integration BFs use (& PSM) with STD + organics, brought significant changes in crop performance in terms of yield, less grain to stover ratio, nutrient uptake, their recoveries and had positives nutrient balance in post-harvest soil, except nitrogen and sulphur. In addition to N_2 fixation, the di- az- otrophs- z through their secretion of growth promoting hormone (IAA, GA and Cytokinins) influenced root growth, the basic and fundamental for better crop growth to produce the potential yields. The PSM beside P solubilazition also helped secreting hormone with regulate plant growth (Pattanayak and Rao. 2014) [4].

References

1. Alemi H, Kianmehr MH, Borghaee AM. Effect of pellet processing of fertilizer on slow-release nitrogen in soil. Asian Journal of Plant Sciences. 2010; 9(2):74-80.
2. Aproorva KB, Praksh SS, Rajesh N, Nandin B. STCR approach for optimizing integrated plant nutrient supply on growth, yield and economics of finger millet (*Eleusine coracana* (L.) Garten.). EJBS. 2010; 4:19-27.
3. Das A, Sudhari S, Lenka NK. Integrated nutrient management to improve finger millet productivity and soil conditions in hilly region of eastern India. J. Crop improve. 2013; 27:528-546.
4. Pattanayak SK, Rao DLN. Technical Bulletin “Biofertilizers improve Tribal Lively hood in Odisha” AINP on Soil Biodiversity Biofertilizers (ICAR), OUAT – Bhubaneswar, Odisha, 2014, 1-27.
5. Poorna Teja S, Ramana Murthy KV. Nitrogen uptake, quality parameters and post-harvest soil status finger millet by organic, inorganic and biofertilizer. International Journal of Applied and Pure Science and Agriculture 2015; 01(11).
6. Pushpa HM, Gowda RC, Naveen DV, Bhagyalakshmi Tand Hanumanthappa DC. Influence of long term fertilizer application on root biomass and nutrient addition of finger millet. An Asian Journal of Soil Science. 2013; 8(1):67-71.
7. Raman R, Kppuswamy G. Effect of integrated nutrient management on the growth and yield of finger millet (*Eleusine corcana*). 6th IFOAM-Asia Scientific Conference, Yangpyung, Korea, 7-11 September, 2004:”Benign environment and safe food. 2004, 504-509.