Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(6): 1646-1649
Received: 04-09-2019
Accepted: 06-10-2019

Swarnima Shrivastava
Department of Soil Science and Agricultural Chemistry, RVSKVV, Gwalior, Madhya Pradesh, India

Vinay Arya
Department of Soil Science and Agricultural Chemistry, RVSKVV, Gwalior, Madhya Pradesh, India

PS Tomar
Department of Soil Science and Agricultural Chemistry, RVSKVV, Gwalior, Madhya Pradesh, India

SK Verma
Department of Soil Science and Agricultural Chemistry, RVSKVV, Gwalior, Madhya Pradesh, India

Corresponding Author:
Swarnima Shrivastava
Department of Soil Science and Agricultural Chemistry, RVSKVV, Gwalior, Madhya Pradesh, India

Study of the effect of organic and inorganic sources of fertilizers on uptake and yield of pearl millet crop under inceptisols

Swarnima Shrivastava, Vinay Arya, PS Tomar and SK Verma

Abstract
A study was conducted to assess the effect of combined use of vermicompost, FYM and fertilizer on yield and uptake of pearl millet in alluvial soils (Inceptisols) of College of Agriculture, Gwalior, with nine treatments and 3 replications is in progress since 2004 in randomized block design. The results indicate that integrated use of 50% NPK + 50% vermicompost produced significantly higher grain yield over remaining treatments except optimum NPK. Use of alone vermicompost and farm yard manure resulted lower yield and 50% NPK + 50% vermicompost showed higher grain yield except optimum NPK. However, maximum total uptake of micronutrient was recorded in 100% NPK.

Keywords: Farm yard manure, manganese, pearl-millet, nutrient uptake, vermicompost

Introduction
Pearl-millet is a common crop grown in kharif by marginal and small farmers in alluvial soil of northern Madhya Pradesh under Pearl millet – mustard and Pearl millet-wheat cropping systems. Due to constant use of NPK fertilizers, reduction in yield under intensive cultivation is a serious problem. The reduction in the yield is generally traced due to deficiency of secondary and micronutrients. Many soil research show that at the present time, among micronutrients, Zn deficiency is the most detrimental to effective crop yield. Other important micronutrients that increase crop yield are Mn, Fe, B, Cu, and Mo. Enhanced removal of micronutrients as a consequence of adoption of high yielding varieties and intensive cropping together with the use of high analysis NPK fertilizers coupled with limited/no use of organic manures and less recycling of crop residues are important factors contributing to the accelerated depletion of micronutrients from the soils has resulted in the depletion of micronutrient cation from the soil reserves. (Dhane and Shukla, 1995) [2]. Integrated nutrient management (INM) is a concept, which aims at the maintenance of soil fertility and plant nutrient supply in an optimum amount for sustaining soil health and crop productivity through optimization of the benefits from all possible sources of plant nutrient in an integral manner. There are many literatures reports the reduction of yield due to constant use of NPK fertilizers. The reduction in the yield is generally traced due to deficiency of secondary nutrients and micronutrients. The decline in nutrient use efficiency is particularly attributes to increase incidence of deficiency of zinc and boron in many parts of the country (Singh, 2014) [9].

Materials and Methods
Field study was conducted at the Crop Research Farm of Rajmata Vijayaraje Scindia Agriculture University, Gwalior (M.P.) in Kharif season 2014-15 with Pearmillet as a test crop. The 100% NPK recommended dose of fertilizer for Pearlmillet was 80 kg N, 40 kg P_2O_5 and 20 kg K_2O ha^{-1} respectively. The experiment consisted of nine treatments replicated three times in a randomized block design viz., FYM @ 160 q ha^{-1} (T1), N40 P_20 K10 + FYM @ 80 q ha^{-1}: T2, N20 P10 K5 + FYM@120q ha^{-1}: T3, N60 P30K15 + FYM@ 40 q ha^{-1}: T4, Vermicompost 5334 kg ha^{-1}: T5, N40P20K10 +Vermocompost @ 2667 kg ha-1: T6, N20P10K5 + Vermicompost @ 4000 kg ha^{-1}: T7, N60P30K15 + Vermicompost @ 1334 kg ha^{-1}: T8, N80P40K20 : T9. The farmyard manure (FYM) was obtained from small dairy holders. The FYM @ 160 q ha^{-1} was incorporated one month before sowing as per treatments. Total N, P, and K contents of the FYM were 0.50, 0.25 and 0.50% respectively. Half of the N and entire dose of P, K were applied at the basal dose and remaining quantity of N was top dressed after 35 days, in the form of urea, di-ammonium phosphate, murate of potash. Grain and straw yields were recorded after harvest of crop. The grain and straw samples were digested in di-acid mixture of HNO_3 and HClO4 (2:5) for micronutrients estimation.

Plant uptake of Cu, Fe, Zn and Mn were computed by multiplying the yield with the respective nutrient content. After harvest of the crop, the composite surface (0-15 cm) soil samples from each plot of the experimental field were analyzed for pH, EC, organic carbon by following standard procedures.

Results and Discussion

A perusal of data in table 1 showed that continuous use of chemical fertilizers and their combination with organics resulted in no changes in pH and EC of the soil. The organic carbon of soil increased significantly with the application of FYM and vermicompost along and with graded dose of fertilizers (table 1). The highest buil-up of organic carbon in the soil was recorded in 100% NPK, which was at par with 25% vermicompost + 75% NPK and 75% vermicompost + 25% NPK. Thus, integrated application of organics with chemical fertilizers (vermicompost + NPK) resulted in significantly higher organic carbon content in soil. The increase in organic carbon content in the manorial treatment combinations is attributed to direct addition of organic manure in the soil which stimulated the growth and activity of microorganisms and also due to better root growth, resulting in the higher production of biomass, crop stubbles and residues (Moharana *et al.*, 2012) [7]. The subsequent decomposition of these materials might have resulted in the enhanced carbon content of soil. These results are in agreement with the findings of Majumdar *et al.*, (2008) [6]. There was a significant response of different treatments as compared to organic sources (100% FYM and 100% vermicompost). Maximum grain yield was recorded in 50% vermicompost + 50% NPK treatments i.e. 4192.46 kg ha^{-1} (table 1). Application of P along with N considerably increased yield of pearl-millet compared to the application of FYM alone. A better supply of phosphorus has been associated with prolific root growth resulting in enhanced water and nutrient absorption. The highest straw yield was found in 100% NPK treated plot i.e. 14507 kg ha^{-1}.The application of K along with NP significantly increased the grain and straw yield of pearl-millet over FYM and vermicompost alone, emphasizing on the essentiality of balanced fertilization to obtain higher pearl-millet productivity. As K play a number of indispensable roles in a wide range of function. Increasing fertility levels increased the yield of pearl-millet in different combination of NPK + vermicompost. The results obtained in present study are in conformity with Kavimani *et al*., (2000) [4] and Sharma *et al*., (2012) [8].

The micronutrients uptake by different plant parts viz., grain and straw as influenced by application of fertilizer alone and its combination with farm yard manure and vermicompost was computed and data over presented in Table 2. Copper uptake in grain varied from 37.73 to 58.69 g ha^{-1} and minimum was recorded in 100% vermicompost treated plot. The maximum Cu uptake was recorded with application of 100% NPK, which have shown the increased Cu content over organic treated plots. Cu uptake in straw ranged between 26.82 to 95.87g ha^{-1}. The maximum uptake of Cu in straw was recorded with the application of 100% NPK, which was increased over other treatments. Lowest Cu uptake by straw was recorded in 100% FYM treated plot. However, the maximum total uptake was found in 100% NPK i.e.154.55 g ha^{-1}. This could be attributed to effective utilization of nutrients through the extensive root system developed by crop plants under adequate P application (Jain and Dahama, 2005) [3]. Fe uptake in grain significantly varied between 198.71to 275.57g ha^{-1}. The maximum Fe uptake was recorded with application of 50%Vermicompost+50% NPK, which was greater than the other. The lowest uptake of Fe was recorded with 100% Vermicompost. Fe uptake in straw ranged between 217.23 to 374.06 g ha^{-1}. However, minimum uptake was recorded with 100% FYM (table 2). As the uptake is the result of yield and conc. trend of values in straw was different than grain and was highest in 100% NPK treatments which was significantly higher over other treatments except 25% Vermicopost + 75% NPK, later treatment was also significantly superior in comparison to other treatments except 25% FYM +75% NPK. Remaining treatments were statistically at par but were better than 100% FYM. Manganese uptake by pearl millet grain ranged from 94.71 to 132.16 g ha^{-1} in different treatment with maximum (132.16 g ha^{-1} in 50% vermicompost + 50% NPK) which was at par with 25% Vermicopost + 75% NPK and 100% NPK but significantly higher over other treatments, in general vermicompost + inorganic gave higher uptake values in comparison to FYM + inorganic added together and minimum was in 100% FYM and 100% Vermicompost (94.93 and 94.71 g ha^{-1}) respectively. In general graded levels of NPK added with organic matter sources did not show any definite trend, however maximum uptake was in 100% NPK, which was significantly higher than other treatments. As regards total (grain+straw) uptake of Mn it was highest (313.18 g ha^{-1}) in 100% NPK which was significantly superior over other treatments except 25%Vermicopost + 75% NPK. Zinc uptake in grain in different treatments differed significantly from each other, however maximum (145.85 g ha^{-1}) was obtained in 50% Vermicompost + 50% NPK which was significantly higher than other treatments except 100% NPK, 25%Vermicopost + 75% NPK and 25% FYM +75% NPK. Minimum was found in 100% FYM (Table 2). There was much variation in uptake values of straw in different treatments and highest (193.20 g ha^{-1}) was in 100% NPK treatment, it was significantly higher in comparison to other treatments. Next in order was 25%Vermicompost + 75% NPK, it was significantly superior to other treatments. Since total uptake (grain + straw) was obtaining by adding uptake by grain and straw, values in treatments were almost like uptake by straw, however maximum (362.74 g ha^{-1}) and lowest (203.40 g ha^{-1}) were in 100% NPK and 100% FYM respectively. 25% Vermicompost + 75% NPK also gave higher value over other treatments except 25% FYM + 75% NPK and 50%Vermicompost + 50% NPK. The higher micronutrient removal especially that of Zn and Fe due to its application through organic sources along with NPK could also be attributed to the priming effect caused by higher crop growth and consequential higher removal due to balanced fertilizations. The results obtained in present study are in line with those reported by Antil *et al.*, (2011) [1].

Table 1: Effect of application of inorganic and organic fertilizers on soil chemical properties of post harvest soil and yield

Treatments	pH	EC (dSm^{-1})	Organic carbon ($gm\ kg^{-1}$)	Grain yield ($kg\ ha^{-1}$)	Straw yield ($kg\ ha^{-1}$)
T_1- 100% FYM	7.64	0.42	4.24	3170.66	9723
T_2- 50% FYM + 50% NPK	7.7	0.42	4.36	3549.3	12038
T_3- 75% FYM + 25% NPK	7.77	0.43	4.49	3468.23	12038
T_4- 25% FYM +75% NPK	7.5	0.44	4.46	3693.43	12346
T_5- 100% Vermicompost	7.7	0.42	4.34	3044.73	11575
T_6- 50%Vermicompost+50% NPK	7.63	0.45	4.50	4192.46	11266
T_7- 75%Vermicompost+25% NPK	7.57	0.45	4.50	3450.16	10957
T_8- 25%Vermicopost+75% NPK	7.63	0.46	4.59	3774.46	12964
T_9- 100% NPK	7.4	0.46	4.61	3891.6	14507
SEm (±)	0.11	0.005	0.05	215.55	605.15
C. D. (5%)	NS	0.016	0.17	646.271	1814.04

Table 2: Effect of application of inorganic and organic fertilizers on nutrient uptake by grain and straw and yield of pearl millet crop

Treatments	Uptake by Grain ($g\ ha^{-1}$)				Uptake by Straw ($g\ ha^{-1}$)			
	Cu	Fe	Mn	Zn	Cu	Fe	Mn	Zn
T_1- 100% F Y M	39.054	202.81	94.932	102.5	26.824	217.23	100.26	100.9
T_2-50% FYM + 50% NPK	44.483	228.52	106.6	115.6	41.25	272.77	127.6	134.86
T_3-75% FYM + 25% NPK	44.433	223.5	105.31	114.51	48.457	280.3	130.38	140.57
T_4-25% FYM +75% NPK	48.742	239.02	113.35	124.84	54.522	292.64	126.67	151.57
T_5-100% Vermicompost	37.735	198.71	94.714	104.74	41.79	277.39	127.55	137.1
T_6-50%Vermicompost+50% NPK	57.481	275.57	132.17	145.85	54.675	275.41	129.19	145.89
T_7-75%Vermicompost+25% NPK	48.535	227.66	109.66	118.8	59.536	274.89	131.53	149.16
T_8-25%Vermicopost+75% NPK	54.85	250.56	121.16	132.98	78.207	331.98	161.09	186.88
T_9-100% NPK	58.694	259.61	126.48	141.17	95.874	374.06	186.71	193.2
SEm (±)	2.78	14.00	6.85	7.45	3.27	15.4	7.41	7.76
C. D. (5%)	8.33	41.99	20.55	22.35	9.82	46.19	22.22	23.28

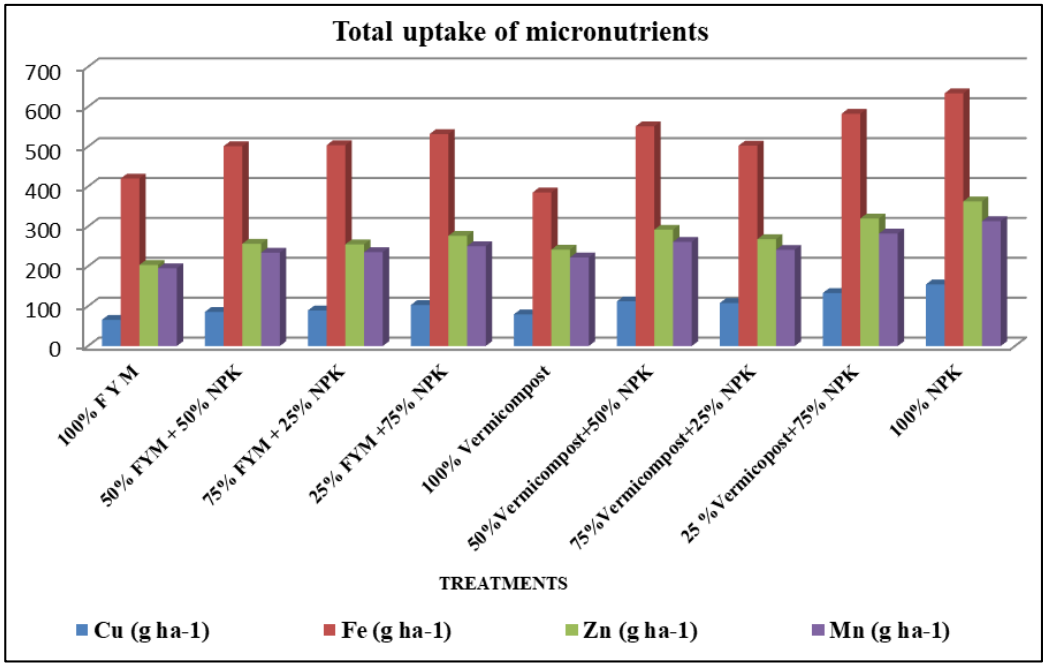

Fig 1: Effect of application of inorganic and organic fertilizers on total micronutrient uptake by pearl millet crop

Conclusion

On the basis of the findings of the present investigation, it can be concluded that the application of inorganic and organic fertilizers was found most suitable as compared to use of alone inorganic fertilizers. Application of combination of inorganic and organic fertilizer was significantly influenced the content, uptake and quality of perlmillet. Two organic sources (farm yard manure and vermicompost) are not supplying sufficient quantity of nutrients which may meet out the requirement of the crop. Integrated use of 50% vermicompost + 50% NPK appear to be a most useful and beneficial treatment combination. Different combinations of FYM with NPK to produced their superiorly over FYM alone.

References

1. Antil RS, Narwal RP, Singh Balwan, Singh JP. Long-term effect of FYM and N on soil health and crop productivity under pearl millet-wheat cropping system. Indian J. Fertilizer. 2011; 17(7):14-52.
2. Dhane SS, Shukla LM. Distribution of DT-PA-Extractable Zn, Cu, Mn and Fe in some soil series of Maharashtra and their relationship with some soil

properties. Journal of Indian Society of Soil Science. 1995; 43:597-600
3. Jain NK, Dahama AK. Residual effect of phosphorus and zinc on yield, nutrient content and uptake and economics of pearl millet (*Pennisetum glaucum*)-wheat (*Triticum aestivum*) cropping system. Indian Journal of Agricultural Sciences. 2005; 75(5):281-284.
4. Kavimani R, Annadurai K, Vijayabaskaran S, Rangaraju G. The effect of farmyard manure and nitrogen on growth and yield of pearlmillet under rainfed Alfisol. Madras Agril. J., 2000; 87(10-12):713-714.
5. Sharma PK, Chaudhari SK. Effect of organic nutrient management on productivity and soil fertility status in pearl millet. Research on crop. 2012; 13(2):503-506.
6. Majumdar B, Mandal B, Bandyopadhyay PK, Gangopadhyay A, Mani PK. Organic amendments influence soil organic carbon pools and rice-wheat productivity. Soil Science Society of America journal. 2008; 72:775-785.
7. Moharana PC, Sharma BM, Biswas DR, Dwivedi BS, Singh RV. Long-term effect of nutrient management on soil fertility and soil organic carbon pools under a 6-year-old pearl millet-wheat cropping system in an Incetisol of subtropical India. Field Crops Research. 2012; 136:3241.
8. Sharma PK, Chaudhari SK. Effect of organic nutrient management on productivity and soil fertility status in pearl millet. Research on crop. 2012; 13(2):503-506.
9. Singh. Effect of fertilizers and farmyard manure on bajra - wheat sequence and dynamics of potassium in an alluvial soil. Annals of Plants & Soil Res. 2014, 1-3.