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Soil Micronutrient Status and its Uptake in Little Millet (*Panicum sumatrense*) as Influenced by Integrated Nutrient Management and Seed Priming

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A B S T R A C T

A field experiment was conducted in the experimental plots of DKS farm, IGKV, Bhatapara Dist- Baloda Bazaar, Chhattisgarh during *kharif* season of the year 2019. The soil of the experimental field was alfisol and climate was sub-humid with a total rainfall of 872.2 mm during the crop growth. The objectives of experiment were to the study changes in soil micronutrient status by different nutrient management and seed priming and its effect on yield and micronutrient uptake of little millet (*Panicum sumatrense*). The experiment was laid out in split-plot design. The treatments constituted with five nutrient management N1 (control), N2 (125 kg Neem cake + 1.25 tons ha^{-1} vermicompost), N3 (50"Kg/ha N : 50 Kg/ha P_2O_5 : 50 Kg /ha K_2O"and 2% Borax spray at flowering), N4 (125 Kg Neem cake + 1.25 tons ha^{-1} vermicompost + 50 Kg/ha N : 50 Kg/ha P_2O_5 : 50 Kg /ha K_2O and 2% Borax spray at flowering) and N5 (Recommended"dose of fertilizer i.e. 20 Kg/ha N": 20 Kg/ha P_2O_5 : 10 Kg /ha K_2O) in main plots with four priming treatment P1 (control), P2 (Hydro priming for 8 hrs), P3 (Seed priming with 2% KH_2PO_4 for 8 hrs) and P4 (Seed priming with 20% liquid *Pseudomonas fluorescens*) in sub plots. Results revealed that available cationic micronutrients in soil increased significantly and found higher where either higher doses of chemical fertilizers or the chemical fertilizers in combination with organic manures were applied. The grain, straw and ultimately the biological yields were found higher where either higher doses of chemical fertilizers or the chemical fertilizers in combination with organic manures were applied however, the priming treatments did not influenced the yield significantly. The content of cationic micronutrient namely Fe, Mn, Cu, Zn in plant tissue was not affected by any nutrient management and seed priming treatments however, the uptake Fe, Cu and Zn by grain, straw and ultimately total uptake in little millet increased significantly where either higher doses of chemical fertilizers or the chemical fertilizers in combination with organic manures were applied, however manganese uptake was influenced significantly only in grain.

Introduction

Millets are known for store-houses of nutrition as on dietary criterion, as compared with rice and wheat. Millets nutritional composition varied species to species and is depended on the generic as well as the environmental factors (McDonough *et al.*, 2000). The Government of India has declared the year 2018, as "National Year of Millets" and designated "Millets" as "Nutri-Cereals" to recognize the nutritional and socio-economic importance. Millets are adapted to wide range of temperatures, soil-moisture regimes and input conditions supplying food and feed for a large segment of the population, especially those with low socio-economic status particularly in the developing world. All these have made millets quite indispensable to tribal, rainfed and hill agriculture where crop substitution is challenging .Besides, many types of millet also form major raw material for potable alcohol and starch production in industrialized countries.

Little millet (*Panicum sumatrense* Roth ex Roemer and Schultes), known as kutki in Hindi, Samai in Tamil, same in Kannada, samalu in Telugu, chama in Malayalum, sava in Marathi, gajaro in Gujrati and Kangani in Bengali is one of the hardiest short duration minor cereal crop belong to the family Poaceae (Gramineae) and is indigenous to Indian sub continent. The species name is based on a specimen collected from Sumatra (Indonesia) (de Wet *et al.*, 1983). Little millet is widely grown in India, Sri Lanka, Pakistan and Western Myanmar. Little millet can tolerate water logging and drought conditions (Rachie, 1975). Seed priming is a proscribed hydration process which involves soaking of seed in water and drying back to storage moisture that check germination, but permits pre-germinative physiological and biochemical processes to occur (Rinku *et al.*, 2017). These processes that precede the germination are triggered by priming. Therefore, primed seed rapidly imbibe and revive the seed metabolism resulting in higher seed viability and vigour and a reduction in intrinsic physiological heterogeneity in germination and crop stand. There are various methods of priming of seeds. Some of scientists consider the hydro priming superior to other methods. Whereas nutrient priming is considered to be novel technique that combine the positive effects of seed priming with an improved nutrient supply. The productivity of little millet is very low on account of inadequate and imbalanced application of fertilizers, non-addition of secondary and micronutrients, organic manure as well as bio fertilizers. Another reasons for low productivity is the use of locally available untreated seeds. In view of above fact, present study was undertaken to study the effect of nutrient management and seed priming on micronutrient content and its uptake in little millet.

Materials and Methods

Study site description

The field experiment was conducted at DKS farm, IGKV, Bhatapara, Dist- Baloda Bazar, Chhattisgarh during *kharif* season, 2019. Experimental site was situated at 21°45'25" North latitude and 81° 59'22" East longitudes having an altitude of about 930 m above Mean sea level (MSL).

Experimental details

The field experiment was conducted in split plot design with three replications. The soil was silty clay loam with neutral pH, non-saline condition, medium in organic carbon content, low in available nitrogen and sulphur, medium in available phosphorus and high in available potassium, calcium, magnesium and available DTPA extractable micronutrients content. Treatments constituted with five nutrient management N1 (control), N2 (125 kg Neem cake + 1.25 tons ha^{-1} vermicompost), N3 (50"Kg/ha N : 50 Kg/ha P_2O_5 : 50 Kg /ha K_2O"and 2% Borax spray at flowering), N4 (125 Kg Neem cake + 1.25 tons ha^{-1} vermicompost + 50 Kg/ha N : 50 Kg/ha P_2O_5 : 50 Kg /ha K_2O and 2% Borax spray at flowering) and N5 (Recommended dose of fertilizer i.e. 20 Kg/ha N": 20 Kg/ha P_2O_5 : 10 Kg /ha K_2O) in main plots with four priming treatment P1 (control), P2 (Hydro priming for 8 hrs), P3 (Seed priming with 2% KH_2PO_4 for 8 hrs) and P4 (Seed priming with 20% liquid *Pseudomonas fluorescens*) in sub plots. Magnesium through MgSO4 @ 20 Kg $acre^{-1}$ and calcium CaO @ 6 kg $acre^{-1}$ was applied uniformly in all the plots before seeding except control treatment plots.

Cultivation details

The experimental field was dry ploughed twice and later leveled uniformly. Field was laid out and prepared bunds for 60 individual plots. Nine lines were demarked manually with the help of mattock for line sowing of little millet. Direct seeding method was adopted for sowing the little millet after priming as per treatments. Seeds were shown at 3-4 cm depth manually. Thinning was performed four days after seeding to maintain desired plant to plant spacing of 30 × 10 cm, and to maintain desired plant population. Being a rainfed crop under study, there was no single irrigation applied to the field. Crop experiment was totally dependent on rainfall occurred during the crop season that was 872.2 mm. Manual weeding by hand was performed at 30 DAS, for control of weeds and keeps the crop weed competition at minimum level during critical period for weed control. Fertilizers were applied as per the treatments. One third of nitrogen, full dose of phosphorous and full dose recommended dose of potassium were applied in the form of urea, SSP and MOP as basal dose at the time of sowing. One-third nitrogen required was applied at maximum tillering stage as urea and remaining one-third nitrogen was applied at panicle initiation stage as urea. Magnesium through MgSO4 @ 20 Kg $acre^{-1}$ and calcium CaO @ 6 Kg $acre^{-1}$ was applied uniformly in all the plots before seeding except control treatment plots. 2% Borax spray application was done at the time of flowering. The crop was affected from stem borer. However, monocrotophos @ 1.5ml/liter of water was sprayed at maximum tillering stage (45 DAS). The crop was harvested manually at 90 DAS. The five representative sample plants were harvested separately, and then crop was harvested from net plot area and kept for threshing. The plants from each plot were sun dried properly to facilitate easy threshing. Threshing was performed manually using the wooden sticks followed by winnowing.

Observations recorded

Initially a representative soil sample (0-15 cm depth) was taken by collecting soil from eight different places followed by quartering process; the soil was passed through 2 mm sieve. After harvest of crop surface, soil samples (0-15 cm depth) were collected from each plot separately and shade dried. Samples were powdered with wooden rod and sieved in 2 mm sieve and analyzed for available micronutrients. DTPA-extraction method was used for determination of available iron, manganese, zinc and copper in soil. It involved extraction of soil with DTPA-$CaCl_2$-TEA reagent (pH 7.3) and measuring the extracted amounts in AAS. From each plot, grain and straw yields were recorded for five sample plant and whole plot separately. The straw was sun dried properly in field and the yield was recorded. The grain weight was taken after threshing the crop for each plot separately plant. The grain and straw yields were expressed as kg ha^{-1}. Plant samples were collected at harvest of little millet and were oven dried with hot air oven until the constant weight was achieved. Dried samples were prepared by grinding with grinding machine and analyzed for plant nutrients content. For micronutrient estimation of plant, one gram of powdered sample was digested with 10 ml di-acid mixture (nitric acid and perchloric acid at 10:4) after overnight pre digestion. The white residue left at the bottom of flask was diluted with water to known volume after filtration. This extract was used in the estimation of micronutrients. The reading of iron, manganese, zinc and copper was taken with the help of atomic absorption spectrophotometer (Zosoki and Burau, 1977).

Results and Discussion

Effect of different nutrient management and seed priming on available micronutrient in soil

Effect of different nutrient management and seed priming on available Fe in soil

Plant available iron in soil varied from 20.88 mg/kg to 17.50 mg/kg. The highest available iron was found in N4 treatment (20.88 mg/kg) which was significantly higher than rest of the treatments. The lowest soil available iron was found in N1 treatment (17.50 mg/kg). Plant available iron in soil differed non-significantly between priming treatments. Highest available iron was found in P1 treatment (19.16 mg/kg) followed by P4 (19.14 mg/kg) and the lowest was recorded in P3 treatment (18.77 mg/kg). The interaction effect of N×P for plant available iron in soil was found to be differed non-significantly. The maximum available iron was recorded in N4P3 (21.53 mg/kg) and the lowest was recorded in N1P3 (17.43 mg/kg) treatment combination.

Effect of different nutrient management and seed priming on available Mn in soil

Plant available manganese in soil varied from 7.16 mg/kg to 5.66 mg/kg. The highest available manganese was found in N4 treatment (7.16 mg/kg) which was significantly higher than rest of the treatments. The lowest soil available manganese was found in N1 treatment (5.66 mg/kg). Plant available manganese in soil differed non-significantly between priming treatments. The highest available iron was found in P1 (6.24 mg/kg) followed by P2 (6.14 mg/kg) and the lowest was recorded in P3 and P4 treatment (6.12 mg/kg). The interaction effect of N×P for plant available manganese in soil was found to be differed non-significantly. Maximum available manganese was recorded in N4P1 (7.57 mg/kg) and the lowest was recorded in N3P4 treatment combination (5.32 mg/kg).

Effect of different nutrient management and seed priming on available Cu in soil

Plant available copper in soil varied from 2.35 mg/kg to 3.9 mg/kg. The highest available copper was found in N4 treatment (2.35 mg/kg) which was statistically at par with N3 treatment (3.55mg/kg) and significantly higher than rest of the treatments. The lowest soil available copper was found in N1 treatment (2.35 mg/kg). Plant available copper in soil differed non-significantly between priming treatment. The highest available copper was found in P3 (3.35 mg/kg) followed by P1 treatment (3.2 mg/kg) and the lowest was recorded in P4 treatment (3.00 mg/kg). The interaction effect of N×P for plant available copper in soil was found to be differed non-significantly. Maximum available copper was recorded in N4P3 (4.23 mg/kg) and the lowest was recorded in N1P4 treatment combination (2.18 mg/kg).

Effect of different nutrient management and seed priming on available Zn in soil

Plant available zinc in soil varied from 2.15 mg/kg to 2.57 mg/kg. The highest available zinc was found in N4 treatment (2.57 mg/kg) which was significantly higher than rest of the treatments. The lowest soil available zinc was found in N1 treatment (2.15 mg/kg). Plant available zinc in soil differed non-significantly between priming treatment. Highest available zinc was found in P1 (2.33 mg/kg) followed by P3 treatment (2.32 mg/kg) and the lowest was recorded in P4 treatment (2.27 mg/kg). The interaction effect of N×P for plant available zinc in soil was found to be differed non-significantly. Maximum available zinc was recorded in N4P1 (2.70 mg/kg) and the lowest was recorded in N1P4 treatment combination (2.09 mg/kg).

The higher availability of micronutrients in soil particularly with use of organic manure with higher doses of fertilizers may be ascribed to mineralization, reduction in fixation of nutrients by organic matter and complexing properties of humic substances released from vermicomposts with micronutrients. Similar results were reported by Kanzaria *et al.,* (2010) and Rani *et al.,* (2017).

Effect of different nutrient management and seed priming on yield of little millet

Grain yield

Grain yield of little millet varied from 8.8 q/ha to 10 q/ha. The highest grain yield was recorded in"N4 treatment (10 q/ha) which was at par with N3 treatment (9.81 q/ha) and significantly higher than the other treatments. The lowest grain yield was recorded in N1 treatment (8.8 q/ha). Grain yield differed non-significantly between priming treatment. The highest grain yield was found in P4 treatment (9.75q/ha) followed by P3 (9.74q/ha) and the lowest yield was recorded in P2 treatment (9.21q/ha). The interaction effect of N×P for grain yield was found to be differed non-significantly. Maximum grain yield was recorded in N3P4 (10.71 q/ha) and the minimum grain yield was recorded in N1P1 treatment combinations (8.52 q/ha). Higher grain yield with combined application of organic manure and inorganic fertilizers may be due to increased availability of nutrients which improved the soil properties, this in turn, increased absorption and translocation of nutrients by crop leading to increased production of photosynthates by the crop. Organic manures provided favorable environment for microorganisms like *Azospirillum* which fixes atmospheric nitrogen available to plant and PSB which converts insoluble phosphate into soluble forms by secreting organic acids. These results are in line with the findings of Malinda *et al.,* (2015) and Rao *et al.,* (2018).

Straw yield

Straw yield of little millet varied from 83.15 q/ha to 94.72 q/ha. The highest straw yield was recorded in"N4 treatment (94.72 q/ha) which was at par with N3 treatment (94.14 q/ha) and significantly higher than the other treatments. The lowest straw yield was found in N1 treatment (83.15 q/ha). Straw yield differed non-significantly between priming treatments. The highest straw yield was found in P3 treatment (91.51 q/ha) followed by P4 (90.07 q/ha) and lowest straw yield was recorded in P1treatment (88.14 q/ha). The interaction effect of N×P for straw yield was found to be differed non-significantly. Maximum straw yield was recorded in N4P3 (98.24 q/ha) and the lowest straw yield was recorded in N1P1treatment combinations (80.21 q/ha). Higher straw yield recorded in plots where higher doses of fertilizers along with organic manure was used, this may be due to enhancement of the photosynthetic rate resulting in more vegetative growth and dry matter production. These results are in conformity with the findings of Raudal *et al.,* (2017) and Rao *et al.,* (2018).

Biological yield

Biological yield of little millet varied from 91.95 q/ha to 104.72 q/ha. The highest biological yield was found in N4 treatment (104.72 q/ha) which was at par with N3 treatment (103.96 q/ha) and significantly higher than the other treatments. The lowest biological yield was found in N1treatment (91.95 q/ha). Biological yield differed non-significantly between priming treatments. The highest biological yield was found in P3 treatment (101.25 q/ha) followed by P4 (99.82 q/ha) and lowest biological yield was recorded in P1 treatment (97.47 q/ha). The interaction effect of N×P for biological yield was found to be differed non-significantly. Maximum biological yield was recorded in"N4P3 (108.11 q/ha) and the lowest biological yield was recorded in N1P1 treatment combinations (88.66 q/ha). Greater total yield of little millet in plots where organic manure and inorganic fertilizers were used was due to enhanced growth and yield parameters. The results obtained were in close conformity of Rani *et al.,* (2017) and Raudhal *et al.,* (2017). Seed priming with 20% *Pseudomonas fluorescens* and 2% KH_2PO_4 showed higher yield than hydro priming and control however their effects were masked by the rainfall on the week of sowing and next week after showing. Similar results were obtained by Zida *et al.,* (2017).

Effect of different nutrient management and seed priming on micronutrient content of little millet

Micronutrient content of little millet grains found in the order Fe>Zn>Cu>Mn and the similar order was found for micronutrient content in straw of little millet. The range of different micronutrient content was very narrow in grain and straw of little millet. The iron content of little millet straw was higher than little millet grain and ranged from 8.39 mg/ 100g to 8.78 mg/ 100g in little millet grain and 35.94 mg/100gm to 38.81mg/100gm in little millet straw. The manganese content was lowest among cationic micronutrients and ranged from 0.74 to 0.78 mg/ 100gm in little millet grains and 0.78 to 0.81 mg/100 gm in little millet straw. Copper content of little millet grain and straw was nearly same and ranged from 0.94 mg/100 gm to 1.03 mg/ 100 gm for little millet grain and 0.94 mg/ 100 gm to 0.99 mg/100 gm in little millet straw. Zinc content of little millet grain varied from 3.49 mg/100 gm to 3.58mg / 100gm and from 4.04 mg/100 gm to 4.12 mg/100gm in little millet straw. No trend regarding micronutrient content in grain and straw was found for nutrient management and priming treatments. This may be due to the higher plant available Fe (17.15mg/kg), Mn (5.21mg/kg), Cu (2.37mg/kg) and Zn (2.07mg/kg) content of the initial soil and the lower requirements of micronutrients by the plants.

Effect of different nutrient management and seed priming on micronutrients uptake in little millet

As shown in table no 4, Fe uptake in little millet grain was found highest among all the micronutrients and followed the order Fe>Zn>Cu>Mn. Similar order was followed for little millet straw's micronutrient uptake and total uptake of different micronutrients. In little millet grains, the highest values of Fe (86.7 g/ha), Mn (7.76 g/ha), Cu (9.99 g/ha) and Zn (35.44 g/ha) uptake was recorded by N4 treatment. The lowest value of Fe (73.79 g/ha), Mn (6.73 g/ha), Cu (8.31 g/ha) and Zn (30.71 g/ha) uptake by little millet grains was found in N1 treatment which was significantly lower than N4 except for iron where difference was non-significant.

Table.1 Effect of different nutrient management and seed priming on available micronutrient in soil

Treatment	Available iron(mg/kg)	Available copper(mg/kg)	Available manganese(mg/kg)	Available zinc(mg/kg)
Nutrient management				
N1: Control	17.50	2.35	5.66	2.15
N2:125 kg Neem cake + 1.25 tons ha^{-1} vermicompost	18.82	3.02	6.11	2.35
N3: 50 kg/ha N: 50 kg/ha P_2O_5: 50 kg /ha K_2O and 2% Borax spray at flowering.	19.21	3.55	6.02	2.25
N4: N2+N3	20.88	3.97	7.16	2.58
N5: Recommended dose of fertilizer i.e. 20 kg/ha N : 20 kg/ha P_2O_5 : 10 kg /ha K_2O	18.81	2.93	5.82	2.21
SEm±	**0.18**	**0.14**	**0.22**	**0.03**
C.D.(P=0.05)	**0.60**	**0.46**	**0.71**	**0.11**
Priming				
P1: Control	19.17	3.20	6.24	2.33
P2: Hydro priming for 8 hrs	19.10	3.09	6.14	2.31
P3: Seed priming with 2% KH_2PO_4 for 8 hrs	18.77	3.35	6.12	2.32
P4: Seed priming with 20% liquid *Pseudomonas fluorescens*	19.15	3.01	6.12	2.27
SEm±	**0.22**	**0.11**	**0.17**	**0.04**
C.D.(P=0.05)	**NS**	**NS**	**NS**	**NS**
Interaction	**NS**	**NS**	**NS**	**NS**

Table.2 Effect of different nutrient management and seed priming on grain, straw and biological yield of little millet

Treatment	Grain yield (q/ha)	Straw yield (q/ha)	Biological yield (q/ha)
Nutrient management			
N1: Control	8.80	83.15	91.95
N2:125 kg Neem cake + 1.25 tons ha^{-1} vermicompost	9.41	85.84	95.25
N3: 50 kg/ha N: 50 kg/ha P_2O_5: 50 kg /ha K_2O and 2% Borax spray at flowering.	9.81	94.14	103.96
N4: N2+N3	10.00	94.72	104.72
N5: Recommended dose of fertilizer i.e. 20 kg/ha N : 20 kg/ha P_2O_5 : 10 kg /ha K_2O	9.52	90.07	99.59
SEm±	**0.13**	**1.23**	**1.28**
C.D.(P=0.05)	**0.43**	**4.01**	**4.18**
Priming			
P1: Control	9.33	88.14	97.47
P2: Hydro priming for 8 hrs	9.21	88.61	97.82
P3: Seed priming with 2% KH_2PO_4 for 8 hrs	9.74	91.51	101.25
P4: Seed priming with 20% liquid *Pseudomonas fluorescens*	9.75	90.07	99.82
SEm±	**0.17**	**1.28**	**1.27**
C.D.(P=0.05)	**NS**	**NS**	**NS**
Interaction	**NS**	**NS**	**NS**

Table.3 Effect of different nutrient management and seed priming on micronutrient content of little millet

Treatment	Iron content (mg/100gm)		Manganese content (mg/100gm)		Copper content (mg/100gm)		Zinc content (mg/100gm)	
Nutrient management	Grain	straw	Grain	straw	grain	straw	grain	Straw
N1: Control	8.39	35.94	0.77	0.79	0.94	0.94	3.49	4.04
N2:125 kg Neem cake + 1.25 tons ha^{-1} vermicompost	8.57	36.28	0.76	0.81	1.03	0.94	3.55	4.06
N3: 50 kg/ha N: 50 kg/ha P_2O_5: 50 kg /ha K_2O and 2% Borax spray at flowering.	8.78	37.98	0.74	0.80	0.98	0.99	3.45	4.12
N4: N2+N3	8.71	38.81	0.78	0.80	1.00	0.97	3.58	4.05
N5: Recommended dose of fertilizer i.e. 20 kg/ha N : 20 kg/ha P_2O_5 : 10 kg /ha K_2O	8.76	38.62	0.75	0.78	1.02	0.95	3.54	4.04
SEm±	**0.36**	**1.17**	**0.01**	**0.02**	**0.02**	**0.02**	**0.09**	**0.17**
C.D.(P=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Priming								
P1: Control	8.67	38.48	0.75	0.79	1.03	0.96	3.67	4.08
P2: Hydro priming for 8 hrs	8.56	38.93	0.76	0.82	0.99	0.96	3.54	4.04
P3:Seed priming with 2% KH_2PO_4 for 8 hrs	9.19	35.83	0.77	0.79	0.97	0.96	3.48	4.11
P4:Seed priming with 20% liquid *Pseudomonas fluorescens.*	8.15	36.85	0.74	0.79	1.00	0.96	3.40	4.02
SEm±	**0.29**	**1.19**	**0.01**	**0.01**	**0.02**	**0.02**	**0.10**	**0.16**
C.D.(P=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table.4 Effect of different nutrient management and seed priming on micronutrient uptake of little millet

Treatment	Iron uptake(g/ha)			Manganese uptake (g/ha)			Copper uptake (g/ha)			Zinc uptake (g/ha)		
Nutrient management	grain	straw	total	grain	straw	total	grain	straw	total	grain	Straw	total
N1: Control	73.79	2990.95	3064.74	6.73	65.79	72.52	8.31	78.51	86.82	30.71	333.83	364.54
N2:125 kg Neem cake + 1.25 tons ha^{-1} vermicompost	80.65	3111.43	3192.08	7.15	69.25	76.41	9.71	80.99	90.7	33.33	347.9	381.23
N3: 50 kg/ha N: 50 kg/ha P_2O_5: 50 kg /ha K_2O and 2% Borax spray at flowering.	86.62	3564.94	3651.56	7.27	75.29	82.56	9.64	93.18	102.82	33.85	386.62	420.47
N4: N2+N3	86.7	3677.17	3763.87	7.76	75.84	83.59	9.99	91.89	101.88	35.66	383.61	419.28
N5: Recommended dose of fertilizer i.e. 20 kg/ha N : 20 kg/ha P_2O_5 : 10 kg /ha K_2O	83.72	3474.29	3558.01	7.12	69.91	77.03	9.66	85.04	94.7	33.66	364.32	397.98
SEm±	**3.66**	**96.64**	**99.61**	**0.19**	**2.29**	**2.39**	**0.2**	**1.62**	**1.79**	**0.73**	**8.82**	**9.19**
C.D.(P=0.05)	**NS**	**315.17**	**324.83**	**0.61**	**NS**	**NS**	**0.66**	**5.29**	**5.82**	**2.37**	**28.78**	**29.98**
Priming												
P1: Control	80.94	3403.32	3484.26	7.01	69.42	76.43	9.61	84.42	94.02	34.14	357.77	391.9
P2: Hydro priming for 8 hrs	78.76	3446.09	3524.85	7.01	72.25	79.26	9.09	85.27	94.36	32.62	358.61	391.24
P3: Seed priming (2% KH_2PO_4 for 8 hrs)	89.73	3284.56	3374.29	7.52	72.17	79.69	9.45	87.29	96.73	33.87	375.12	408.99
P4: Seed priming (20% *P. fluorescens*)	79.75	3321.06	3400.81	7.28	71.02	78.3	9.71	86.72	96.42	33.14	361.53	394.67
SEm±	**3.46**	**123.75**	**125.49**	**0.21**	**1.39**	**1.47**	**0.25**	**1.65**	**1.71**	**1.04**	**7.55**	**7.71**
C.D.(P=0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**
Interaction	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

For priming treatments, no trend was found for different micronutrients uptake and interaction affect for N×P was also found non-significant. In case of little millet straw also, the highest values for Fe (3677.17 g/ha), Mn (75.84 g/ha), and Zn (383.61 g/ha) uptake was recorded by N4 and only in the case of copper, the highest uptake was seen by N3 (93.18 g/ha) which was just 1.29 g/ha more than N4treatment and differed non-significantly with N4. The lowest value of Fe (2990.95 g/ha), Mn (65.79 g/ha), Cu (78.51 g/ha) and Zn (333.83 g/ha) uptake by little millet straw was recorded in N1 treatment which was significantly lower than N4 except for Mn where the difference doesn't reach the level of significance. The highest total uptake of Fe (3763.87 g/ha), Mn (83.59 g/ha), and Zn (383.61 g/ha) of little millet was seen in N4 treatment and the highest total Cu uptake of little millet was seen in N3 treatment (102.82 g/ha) whereas, the lowest total uptake of all the micronutrients i.e Fe (3064.74 g/ha), Mn (72.52 g/ha), Cu (86.82 g/ha) and Zn (364.54 g/ha) was seen in N1 treatment. For priming treatments, no trend was found for different micronutrients' uptake and interaction affect for N×P was also found non-significant. Higher cationic micronutrient uptake by little millet grain and straw was noticed in case where higher doses of fertilizers along with organic manure was used, this might be due to complexing properties of manures with micronutrients that had prevented precipitation, fixation, leaching and kept them in soluble form by microbial activity and higher uptake of these micronutrients by crop. Similar results were reported by Prasanth *et al.,* (2019) and Punia *et al.,* (2019).

In conclusion, the available cationic micronutrients in soil increased significantly and found higher where either higher doses of chemical fertilizers or the chemical fertilizers in combination with organic manures were applied.

The grain, straw and ultimately the biological yields were found higher where either higher doses of chemical fertilizers or the chemical fertilizers in combination with organic manures were applied however, the priming treatments did not influenced the yield significantly.

The content of cationic micronutrient namely Fe, Mn, Cu, Zn in plant tissue was not affected by any nutrient management and seed priming treatments.

The uptake Fe, Cu and Zn by grain, straw and ultimately total uptake in little millet increased significantly where either higher doses of chemical fertilizers or the chemical fertilizers in combination with organic manures were applied, however manganese uptake was influenced significantly only in grain.

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