

Original Research Article

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Influence of Various Zinc and Iron Treatments on Nutrient Content and Uptake of Grain and Stover of Pear Millet Crop

C. D. Parmar¹, R. R. Kharadi¹ and K. P. Bhuriya^{2*}

¹Department of soil science and agricultural chemistry, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat (India)-388 110, India
²Junagadh Agricultural University, Kodinar, Gujarat, India

*Corresponding author

ABSTRACT

Keywords

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The present investigation was undertaken to study the “Influence of various zinc and iron treatments on nutrient content and uptake of grain and stover of pearmillet crop” was carried out during *kharif* season of the year 2016, at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand. The soil of experimental plot was loamy sand in texture, low in organic carbon and available nitrogen, high in available phosphorus and potassium, DTPA extractable iron and zinc medium in available status. Pearlmillet variety GHB 558 was used as test crop. The non-significant effect of Zn and Fe containing fertilizer application was noticed on N, P and K content in grain and stover of pearlmillet. Similarly, the N, P and K uptake by pearl millet were also not affected significantly due to different treatments.

Introduction

Pearl millet (*Pennisetum glaucum* (L.) is one of the important food grain crop of India ranking fourth in average to rice, wheat and sorghum in that order. Its common name over a large part of India is *bajra* or *bajri*. Pearlmillet cultivation is mainly confined to the arid and semi - arid zones prehistoric time. Gujarat ranks third in the production of pearl millet in India whereas Rajasthan tops the list and Uttar Pradesh is in second position. It is cultivated over an area of 0.39 million hectares in Gujarat. The total production is

0.79 million tones and the productivity is 2004 kg ha⁻¹ (Anon., 2016-17). The nutritive value of pearlmillet is fairly high. It contains 5 per cent fat (either extract), 9.15 per cent protein, 2.7 per cent mineral matter and gives 360 calorie per 100 g with high amount of vitamins A and B, it imparts substantial energy to the body with easy digestibility. In addition on grain, it also supplies fair quality dry fodder in large bulk.

Agricultural produces, lower in micronutrient content, failed to meet up its (Zn) requirements for human nutrition (Singh

&Prasad, 2014). Continuous reliance on high proportion of cereals-based foods with low amount and availability of Zn appears to be the major reason for the widespread occurrence of the Zn deficiency problem in human.

Iron (Fe) plays an important role in the plant growth. It is a cofactor for approximately 140 enzymes that catalyze unique biochemical reactions. Deficiency or low activity of iron in the plant causes chlorophyll is not produced in sufficient quantities and the leaves are pale. It helps in the formation of chlorophyll and is constituent of enzyme systems which bring about oxidation reductions in plants. Fe is essential for respiration, photosynthesis and fixation of atmospheric nitrogen by nitrogen fixing organisms.

Scenario of micronutrient deficiency in north India in early eighties was different than now after four decades. Zinc deficiency remained a major problem all over country. Zinc deficiency has increased from 44 % to 48% and expected to further increase up to 63 % by 2025 as most of the marginal soil are showing higher response to added zinc(Singh& Ram 2006).

Materials and Methods

The filed study was planned to during *khari* season of the year 2016 at the College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand. The experimental plot was prepared as per the method described by Bhuriya *et al* (2019). The soil of the experimental field was alkaline in reaction and soluble salt content under safe limit. It was low in organic carbon, available N, low in available nitrogen, high in available phosphorus and available potash, while medium in available zinc and iron. Total 10 treatments were included in the present investigation treatments were

comprised of Zn and Fe fertilizers application through ZnSO₄ and FeSO₄ as well as chelated forms of Zn and Fe. T₁ 0 kg Zn ha⁻¹ + 0 kg Fe ha⁻¹ (control), T₂ 0 kg Zn ha⁻¹ + 50 kg FeSO₄ ha⁻¹, T₃ 0.5 kg Chelated Zn ha⁻¹ + 50 kg FeSO₄ ha⁻¹, T₄ 1.0 kg Chelated Zn ha⁻¹ + 50 kg FeSO₄ ha⁻¹, T₅ 1.5 kg Chelated Zn ha⁻¹ + 50 kg FeSO₄ ha⁻¹, T₆ 25 kg ZnSO₄ ha⁻¹ + 0 kg Fe ha⁻¹, T₇ 25 kg ZnSO₄ ha⁻¹ + 0.5 kg Chelated Fe ha⁻¹, T₈ 25 kg ZnSO₄ ha⁻¹ + 1.0 kg Chelated Fe ha⁻¹, T₉ 25 kg ZnSO₄ ha⁻¹ + 1.5 kg Chelated Fe ha⁻¹, T₁₀ 25 kg ZnSO₄ ha⁻¹ + 50 kg FeSO₄ ha⁻¹.

Zn₀, Zn_{0.5}, Zn_{1.0} and Zn_{1.5}: 0.0, 0.5, 1.0 and 1.5 kg Zn Chelated

Fe₀, Fe_{0.5}, Fe_{1.0} and Fe_{1.5}: 0.0, 0.5, 1.0 and 1.5 kg Fe Chelated

Zn₂₅: ZnSO₄ 25 kg ha⁻¹

Fe₅₀: FeSO₄ 50 kg ha⁻¹

Analysis dried samples (leaf and grain) were digested in di-acid mixture (4HNO₃:1HClO₄) and volume was made up with double distilled water (Jackson, 1973). The extract was filtered through Whatman filter paper No. 42. The digested extract of plant samples was used for analysis of P, K micronutrients and N content was analyzed by Kjeldahl digestion method.

Results and Discussion

Effect of treatment on nutrient content and uptake by grain on pearl millet

Nitrogen, phosphorus and potash content of grain of pearl millet as influenced by application of zinc and iron are furnished in Table 1. It was observed from the data presented in Table that N, P and K content did not significantly altered due to different treatments. In a trial with pearl millet, Yadav *et al.*, (1989) reported that increasing Zn rates

from 0, 5 and 10 kg Znha⁻¹ did not affect on N content of grain of pearl millet.

The nutritive value of pearl millet crop is fairly high. It contains 12.4% moisture, 11.6 % protein, 5 % fat, 67% carbohydrates and

about 2.7 % minerals. it is also rich in Vit-A, Vit-B and impart substantial energy for baby (360 calories 100g⁻¹) (Malik,2015). Pearl millet grains are eaten cooked like rice or “chapatis” are prepared out of flour like maize or sorghum flour.

Table.1 Effect of treatments on nutrient content and uptake by grain on pearmillet

Treatments		Nutrient content in grain (%)			Nutrient uptake in grain (%)		
		N	P	K	N	P	K
T ₁	Zn ₀ Fe ₀	1.86	0.32	0.56	49.00	8.16	14.45
T ₂	Zn ₀ Fe ₅₀	1.81	0.32	0.55	50.42	9.04	15.21
T ₃	Zn _{0.5} Fe ₅₀	1.65	0.34	0.56	47.10	9.71	15.92
T ₄	Zn _{1.0} Fe ₅₀	1.86	0.33	0.53	54.93	9.61	15.75
T ₅	Zn _{1.5} Fe ₅₀	1.84	0.32	0.55	55.21	9.66	16.40
T ₆	Zn ₂₅ Fe ₀	1.67	0.32	0.56	47.25	9.02	15.89
T ₇	Zn ₂₅ Fe _{0.5}	1.69	0.32	0.56	49.35	9.33	16.28
T ₈	Zn ₂₅ Fe _{1.0}	1.65	0.30	0.58	48.69	8.90	16.98
T ₉	Zn ₂₅ Fe _{1.5}	1.86	0.32	0.53	53.85	9.22	15.45
T ₁₀	Zn ₂₅ Fe ₅₀	1.60	0.32	0.55	49.45	9.95	17.01
SEM _±		0.09	0.01	0.02	3.27	0.50	0.60
CD at 5%		NS	NS	NS	NS	NS	NS
CV %		10.38	8.38	5.47	12.94	10.74	7.53

Table.2 Effect of treatments on nutrient content and uptake by stover on pearmillet

Treatments		Nutrient content in stover (%)			Nutrient uptake by stover (kg ha ⁻¹)		
		N	P	K	N	P	K
T ₁	Zn ₀ Fe ₀	0.68	0.09	0.92	35.22	4.66	47.95
T ₂	Zn ₀ Fe ₅₀	0.68	0.08	0.91	39.44	4.91	53.35
T ₃	Zn _{0.5} Fe ₅₀	0.71	0.08	0.98	42.08	4.96	58.95
T ₄	Zn _{1.0} Fe ₅₀	0.71	0.09	0.90	43.13	5.46	54.67
T ₅	Zn _{1.5} Fe ₅₀	0.67	0.08	0.93	41.40	5.21	58.13
T ₆	Zn ₂₅ Fe ₀	0.72	0.10	0.95	42.63	5.64	56.51
T ₇	Zn ₂₅ Fe _{0.5}	0.69	0.10	0.90	41.20	5.78	53.74
T ₈	Zn ₂₅ Fe _{1.0}	0.67	0.09	1.08	40.11	5.39	64.54
T ₉	Zn ₂₅ Fe _{1.5}	0.74	0.09	1.06	44.70	5.73	64.01
T ₁₀	Zn ₂₅ Fe ₅₀	0.70	0.09	0.97	43.55	5.78	60.17
SEM _±		0.04	0.01	0.07	2.16	0.46	4.49
CD at 5%		NS	NS	NS	NS	NS	NS
CV %		10.15	14.41	14.32	10.46	17.20	15.70

Nitrogen, phosphorus and potash uptake by grain influenced by zinc and iron application are given in Table 1. A perusal of data (Table 1) revealed that application of zinc and iron failed to show any significant effect on N, P and K uptake by grain. However, higher nitrogen uptake by grain (55.21 kg ha^{-1}) was found under application of $1.5 \text{ kg chelated Zn ha}^{-1} + 50 \text{ kg FeSO}_4 \text{ ha}^{-1}$ (T_5). Though results are non-significant, increasing trend in uptake of phosphorus and potash were recorded. Application of $25 \text{ kg ZnSO}_4 \text{ ha}^{-1}$ and $50 \text{ kg FeSO}_4 \text{ ha}^{-1}$ (T_{10}) gave higher uptake of P (9.95 kg ha^{-1}) and K (17.01 kg ha^{-1}) as compare to control. The beneficial role of zinc in increasing cation exchange capacity of roots helped in increasing absorption of nutrients from the soil might have also increased zinc uptake. These results are in close conformity with Das *et al.*, (2004) and Patel *et al.*, (2008). The increasing trend in uptake of N, P and K was similar to that of in grain and stover yield of pearl millet.

Effect of treatment on nutrient content and uptake by stover on pear millet

Nitrogen, phosphorus and potash content of pearl millet stover as influenced by of zinc and iron application are furnished in Table 2. The experimental data indicated similar results as N, P and K content in grain. The application of zinc and iron treatments failed to show the significant improvement on N, P and K content of straw. However, numerically higher value for N (0.74%) under application of $25 \text{ kg ZnSO}_4 \text{ ha}^{-1} + 1.5 \text{ kg Fe ha}^{-1}$ (T_9) and for K (1.08 %) with application of $25 \text{ kg ZnSO}_4 \text{ ha}^{-1} + 1.0 \text{ kg Fe ha}^{-1}$ (T_8) were observed. Yadav *et al.*, (1989) reported that increasing Zn rates from 0, 5 and 10 kg Zn ha^{-1} did not affect on N content of stover of pearl millet.

Results in respect of nitrogen, phosphorus and potash uptake by stover (kg ha^{-1}) at harvest as

influenced by zinc and iron treatments are presented in Table 2. None of the treatments of Zn and Fe had significant effect on N, P and K uptake by stover. However, improvement in uptake was observed due to application of Zn and Fe treatments may be due to increased pearl millet yield. It was observed in the range of 35.22 to 44.70 for N, 4.66 to 5.78 for P and 47.95 to 64.54 kg ha^{-1} for K. Higher uptake of N, P and K by straw was reported with soil application of $25 \text{ kg ZnSO}_4 \text{ ha}^{-1}$ and $50 \text{ kg FeSO}_4 \text{ ha}^{-1}$ (Jain *et al.*, 2018). The non-significant effect of Zn and Fe containing fertilizer application was noticed on N, P and K content in grain and stover of pearl millet. Similarly the N, P and K uptake by pearl millet were also not affected significantly due to different treatments.

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