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RESPONSE OF FODDER SORGHUM [*SORGHUM BICOLOR* (L.) MOENCH] TO ZINC AND IRON

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SUMMARY

A field experiment was conducted during **kharif** season of 2009 and 2010 at main Forage Research Area, CCSHAU, Hisar. The experiment was laid out in randomized block design with three replications and eight treatments. The foliar application of 0.5 per cent $ZnSO_4$ at 35 and 45 DAS recorded maximum green fodder yield of 593.3 and 488.3 q/ha as well as dry matter yield of 171.6 and 141.6 q/ha during 2009 and 2010, respectively. The foliar application of $ZnSO_4$ and $FeSO_4$ with RDF did not improve the quality of fodder.

Key words : Zinc and iron, foliar application, fodder yield, fodder sorghum

It is well established that with the introduction of high yielding varieties, increasing intensity of cropping, irrigation and imbalanced use of fertilizers, the soils are becoming deficient in nutrients. Major problems are deficiency of nitrogen and phosphorus, however, recent research has revealed that micronutrients deficiency especially zinc and iron is also hampering crop production. Zinc deficiency is the most wide spread problem, because of other factors also like alkaline soil pH, low organic matter or/and use of zinc free fertilizers. The second most important micronutrient is iron. Soil fertilizer application for iron is problematic, therefore, foliar spray remains the practical solution. Micronutrient though required in very low quantity but plays a major role in improvement of yield potential of field crops. The micronutrient deficiency is now being recognized as a critical yield limiting factor in forage crops and becomes major cause of yield stagnation and quality deterioration. Zinc deficiency not only adversely affects plant growth but also impairs health of milch animals indirectly. Zinc plays a vital role in oxidation processes in cells and helps in transformation of carbohydrates and regulation of sugar in plant (Swaminathan and Kannan, 2001). Yield potential of sorghum is higher than other fodder crops, hence, it requires higher amount of fertilizers which contain micro nutrients particularly zinc and iron. Very limited work has been carried out on micronutrient nutrition of sorghum, which is a major fodder crop grown in Haryana. The present study was, therefore, undertaken to analyze the influence of zinc and iron spray at different growth stages of crop on yield and quality of fodder sorghum.

MATERIALS AND METHODS

A field experiment was conducted during **kharif** season of 2009 and 2010 at main Forage Research Area, CCSHAU, Hisar. The experiment was laid out in randomized block design with three replications and eight treatments (Table 1). Fodder sorghum variety HC 308 was grown in last week of June. The soil of experimental field was low in organic matter and available nitrogen and medium in available phosphorus and available potassium. The recommended dose of fertilizer (80 kg N+30 kg P_2O_5/kg) was applied. The full dose of phosphorus and half dose of nitrogen was applied as basal at the time of sowing and remaining half dose of nitrogen was top dressed at crop knee high stage. The micronutrients zinc and iron were applied as per the treatments. The crop was harvested at 50 per cent flowering stage. The plant samples were collected at

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crop harvest and analyzed for quality parameters by standard procedure.

RESULTS AND DISCUSSION

Data presented in Table 1 reveal that plant height, number of tillers, green fodder yield and dry matter yield were influenced significantly by different treatments. The maximum plant height (266.3 in 2009 and 257.0 in 2010) and number of tillers (23.3 and 20.6 in 2009 and 2010, respectively) were recorded in the treatment RDF +0.5 per cent $ZnSO_4$ foliar application at 35 and 45 DAS. The plant height and number of tillers varied significantly with the foliar application of Zn during 2010, however, during 2009 the foliar spray of Fe and Zn at any stage did not show any significant effect over recommended dose of fertilizer (RDF).

All the treatments produced significantly higher green as well as dry matter yield as compared to control. The foliar application of 0.5 per cent $ZnSO_4$ at 35 and 45 DAS recorded maximum green fodder yield of 593.3 q/ha (2009) and 488.3 q/ha during 2010 as well as dry matter yield of 171.6 and 141.6 q/ha during 2009 and 2010, respectively, followed by foliar application of 0.5 per cent $ZnSO_4$ at 45 DAS only. The increase in green fodder yield was 51.51 and 64.63 per cent by foliar application of $ZnSO_4$ at 35 and 45 DAS and a gain of 53.76 and 66.59 per cent in dry matter yield over control during 2009 and 2010, respectively.

Application of RDF in combination with Zn and Fe significantly increased green and dry fodder yield over control. The marked improvement in yield by the influence of foliar Zn fertilization seems to be on account of its profound effect on plant height and dry matter

TABLE 1
Effect of foliar application of micronutrients (Zn and Fe) on growth, yield and economics of forage sorghum

Treatment	Plant height (cm)		No. of tillers/ meter row length		Green fodder yield (q/ha)		Dry matter yield (q/ha)		Net Return (Rs./ha)	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
T_1–Control	214.0	215.6	18.6	16.6	391.6	296.6	111.6	85.0	16252	11246
T_2–Recommended dose of fertilizer (RDF)	233.0	248.0	20.6	19.0	560.0	471.6	160.0	133.3	27415	22725
T_3–RDF+0.5% $ZnSO_4$ foliar spray at 35 DAS	245.6	253.3	22.3	20.0	580.0	480.0	167.3	138.3	28465	23050
T_4–RDF+0.5% $ZnSO_4$ foliar spray at 45 DAS	251.0	255.6	22.6	20.3	586.6	486.6	169.3	140.0	28927	23545
T_5–RDF+0.5% $ZnSO_4$ foliar spray at 35 and 45 DAS	266.3	257.0	23.3	20.6	593.3	488.3	171.6	141.6	29046	23322
T_6–RDF+0.5% $FeSO_4$ foliar spray at 35 DAS	238.3	249.0	21.6	20.0	566.6	476.6	161.6	135.0	27477	22745
T_7–RDF+0.5% $FeSO_4$ foliar spray at 45 DAS	240.6	250.0	21.3	19.6	575.0	478.3	165.0	136.6	28065	22872
T_8–RDF+0.5% $FeSO_4$ foliar spray at 35 and 45 DAS	247.6	255.0	22.0	20.0	583.3	486.6	168.3	140.0	28246	22995
S. Em±	5.8	3.4	0.6	0.5	13.9	7.1	4.5	3.3		
C. D. (P=0.05)	18.0	10.5	1.9	1.8	42.5	21.9	13.8	10.2		

TABLE 2
Effect of foliar application of micronutrients (Zn and Fe) on forage quality of forage sorghum

Treatment	Crude protein content (%)		Crude protein yield (q/ha)		IVDMD (%)		DDM (q/ha)	
	2009	2010	2009	2010	2009	2010	2009	2010
T_1–Control	8.97	7.44	10.01	6.32	40.6	55.4	45.31	47.09
T_2–Recommended dose of fertilizer (RDF)	8.97	8.31	14.35	11.08	42.0	52.2	67.20	69.58
T_3–RDF+0.5% $ZnSO_4$ foliar spray at 35 DAS	8.53	8.10	14.27	11.20	47.2	54.8	78.97	75.79
T_4–RDF+0.5% $ZnSO_4$ foliar spray at 45 DAS	7.88	7.66	13.34	10.72	45.4	50.8	76.86	71.12
T_5–RDF+0.5% $ZnSO_4$ foliar spray at 35 and 45 DAS	8.53	8.53	14.64	12.08	43.4	53.4	74.47	75.61
T_6–RDF+0.5% $FeSO_4$ foliar spray at 35 DAS	8.32	7.88	13.45	10.64	40.4	49.8	65.29	67.23
T_7–RDF+0.5% $FeSO_4$ foliar spray at 45 DAS	9.41	7.66	15.53	10.46	41.0	49.6	67.65	67.75
T_8–RDF+0.5% $FeSO_4$ foliar spray at 35 and 45 DAS	8.53	7.88	14.36	11.03	35.6	51.8	59.91	72.52
S. Em±	0.30	0.28	0.51		1.36	0.88	4.41	
C. D. (P=0.05)		NS	NS	1.72		4.61	3.01	15.02

NS–Not Significant.

production (Kaushik *et al*., 2010; Meena *et al*., 2010). Mali and Doshora (2003) also reported that application of Fe and Zn individually or in combination via soil and plant registered significant higher fodder yield over control. However, the foliar application of $ZnSO_4$ and $FeSO_4$ with RDF at different growth stages did not produce any significant effect on yield as compared to recommended dose of fertilizer alone during both the years.

The highest crude protein content was recorded in RDF+0.5 per cent $FeSO_4$ foliar spray at 45 DAS during 2009 and in RDF+0.5 per cent $ZnSO_4$ foliar spray at 35 and 45 DAS during 2010. However, the crude protein content was not influenced significantly by different treatments. The IVDMD per cent and DDM were influenced significantly by different treatments but showed irregular trends (Table 2). The foliar application of $ZnSO_4$ and $FeSO_4$ with RDF did not improve the quality of fodder. Higher crude protein yield and DDM in these treatments might be due to its higher dry matter yield. Application of RDF in combination with Zn and Fe significantly increased content by crude protein and crude fiber over RDF alone and control (Kaushik *et al.*, 2010).

The foliar application of 0.5 per cent $ZnSO_4$ at 35 and 45 DAS with RDF gave highest gross returns during both the years and highest net returns during 2009, whereas foliar application of 0.5 per cent $ZnSO_4$ at 45 DAS with RDF gave highest net return during 2010.

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