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Effect of Iron and Zinc Enriched FYM on Growth, Yield and Quality of Wheat (*Triticum aestivum* L) in Salt Affected Soils of Gujarat

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A field experiment entitled "Effect of iron and zinc enriched FYM on growth, yield and quality of wheat in salt affected soils of Gujarat" was conducted during 2014-15 to 2015-16, 2016-17 and 2017-18 at Agricultural Research Station, Sardarkrushinagar Dantiwada Agricultural University, Adiya, Gujarat. The experiment encompassed eight treatments combinations *viz.*, T_1: RDF (Based on STV), T_2: T_1 +1.0 t FYM ha^{-1}; T_3: T_1 + 1.5 kg Zn ha^{-1}; T_4: T_1 + 3.0 kg Fe ha^{-1}; T_5: T_1 +1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}; T_6: T_1 + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn; T_7: T_1 + 0.5 t FYM ha^{-1} enriched with 1.5 kg Fe; T_8: T_1 + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe. The experiment was laid out in randomized block design with four replications. The results reveal that application of recommended dose of fertilizer (120-60-00 NPK kg ha^{-1}) on the basis of STV + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe (T_8) recorded significantly higher effective tillers per plant, length of spike, no. of spikes per plant, no. of seeds per spike, plant height, grain and straw yields of wheat over T_1 (Recommended dose of fertilizer on the basis of STV only) during all the individual years as well as on pooled basis. The farmers of North Gujarat Agroclimatic zone having salt affected soil and interested to grow wheat are advised to apply recommended dose of fertilizer on the basis of STV + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe for getting higher yield and net returns.

Introduction

Wheat is one of the first cereals known to be grown and its ability to self pollinate greatly facilitated the selection of many distinct domesticated varieties. Wheat is the most important grain of trade for human consumption. It is produced in a vast range of environments from central Russia to the great India and Chinese river valleys and across the Great Plains and pampas of Americas. In India wheat is the second most important food crop after rice, both in terms of area and production. Wheat production of India is

98.38 million tonne from 30.59 million hectares with productivity of 3.22 tonne per hectare during 2016-17. It accounts for about 36 percent of country's total food grain production as per the fourth advance estimate (Anonymous, 2017).

Zinc and iron deficiencies are well-documented public health issue affecting nearly half of the world population especially in developing countries like India. Zinc and iron deficiencies are the common micronutrient deficiencies in light textured soils of North Gujarat limiting both crop production and nutritional quality. Further, very low concentrations and poor bioavailability of Zn and Fe in the commonly used cereals aggravated the micronutrient deficiencies. Breeding new cereal genotypes with high genetic capacity for grain accumulation of micronutrients is widely accepted and most sustainable solution to the problem. However, the breeding approach is a long-term process and may be affected from very low chemical solubility of Zn and Fe in soils due to high pH and low organic matter (Cakmak, 2008). Therefore, agronomy-related approaches offer short-term and complementary solutions to the Zn and Fe deficiency in crop production and human health. Soil amendments contributing to solubility of Zn and Fe in soil solution, cereal-legume intercropping systems, and soil and foliar application of micronutrient-containing fertilizers are well-documented agronomic tools which contribute to root uptake, shoot and grain accumulation of Fe and Zn. Addition of organic material had beneficial effect on crop growth, productivity by sustaining soil health. Mixing inorganic salts of micronutrients with different organic materials can enhance the efficacy of micronutrients. On decomposition of organic manures numerous compounds like humic acid and fulvic acid and biological substances like organic acids, amino acids and polyphenols are produced which act as chelating agents that form stable complexes with native micronutrients and also prevent added inorganic micronutrients from precipitation, fixation, oxidation and leaching resulted in improvement in efficiency of applied micronutrients. The enrichment of organics with micronutrients not only improve the quality of organics but also reduced the quantity of both inorganic chemicals and as well as quantity of organics. It is reported that addition of enriched organics in lower quantities had similar effects on soil properties to that of high quantity (without enrichment). The enriched organics are expected to provide beneficial effect on plant growth for longer time. The information on Fe and Zn enriched organics are lacking on Fe and Zn deficient soils of North Gujarat where wheat crop is mainly grown as cereal crop.

The implementation of agronomic biofortification of cereal crops with iron and zinc appear to be a rapid and simple solution to the deficiency of these elements in the soils and plants. Zinc plays an important role in carbohydrate metabolism, detoxification of super oxide radical and imparts resistance to disease in plants. Since Zn is associated with enzymes, its deficiency leads to several disorders in plants. Zn deficiency has received great attention in India, because nearly half of the Indian soils are poor in available Zn content. (Shivay *et al.*, 2014). Zinc is mainly localized and concentrated in the aleurone and embryo parts of wheat grain. Zinc concentration of the endosperm (white flour) is very small. Wheat grain is consumed after milling, which removes the Zn-rich parts and leaves just the Zn-poor endosperm behind (Cakmak, 2017).

Iron plays a key role in the synthesis of chlorophyll, carbohydrate production, cell respiration, chemical reduction of nitrate and

sulphate, and in N assimilation. The Fe is mainly involved in biochemical processes which are mostly enzymatic oxidation-reduction reactions in plants. With the progress of time and advancement in agricultural technology, there is a need to maximize awareness regarding healthy nutrition at both national and international level. There is a paucity of research data on agronomic biofortification of new wheat varieties using fertilizer strategies for improvement in yield and grain quality in Gujarat (India). Keeping in view the above facts, this study was initiated to assess the effect of iron and zinc enriched FYM on growth, yield and quality of wheat in salt affected soils of Gujarat.

Materials and Methods

A field experiment was conducted during 2014-15 to 2015-16, 2016-17 and 2017-18 at Agricultural Research Station, Sardarkrushinagar Dantiwada Agricultural University, Adiya, Gujarat. This experiment take in eight treatment combinations *viz.*, T_1: RDF (Based on STV), T_2: T_1 +1.0 t FYM ha^{-1}; T_3: T_1 + 1.5 kg Zn ha^{-1}; T_4: T_1 + 3.0 kg Fe ha^{-1}; T_5: T_1 +1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}; T_6: T_1 + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn; T_7: T_1 + 0.5 t FYM ha^{-1} enriched with 1.5 kg Fe; T_8: T_1 + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe in randomized block design, which was replicated four times and wheat variety Raj-3077 was sown.

The soil of the experimental field was loamy sand in texture, alkaline in reaction and soluble salt content under unsafe limit. It was low in organic carbon, medium in available P_2O_5 and medium to high in available K_2O and DTPA extractable Zn as well as in DTPA extractable Fe (Table 1). The data of seed yield and straw yield recorded from net plot and converted on hectare basis. The collected data for various parameters were statistically analyzed using Fishers' analysis of variance (ANOVA) technique and the treatments were compared at 5% level of significance.

Methodology for the enrichment of FYM with Fe and Zn

The enrichment process was started 45 days before their use.

Required quantity of $ZnSO_4.7H_2O$ or $FeSO_4.7H_2O$ (as per treatment *i.e.* 0.75 & 1.5 kg Zn/ha and 1.5 & 3.0 kg Fe/ha) was thoroughly mixed with 500 kg FYM/ha.

Cow dung slurry @ 1% was added to boost up the microbial activities for enhancement of natural process of composting to fix the externally added inorganic Fe and Zn in to organically bound and naturally chelated form of Fe and Zn.

It was filled in the pre-dug polythene lined pits of 1.5 X 1.5 X 1.5 m^3 size.

About 75 percent moisture of this mixture was maintained after mixing of $ZnSO_4.7H_2O$ or $FeSO_4.7H_2O$ with FYM and addition of cow dung slurry.

The pit was covered with polythene sheet and allowed for decomposition. The mixture was turned over periodically (Weekly) and moisture loss was maintained. The enrichment process was considered as completed after 5 to 6 weeks.

Results and Discussion

Growth and quality characters

The results presented in Table 2 to 7 reveal that application of recommended dose of fertilizer (120-60-00 NPK kg ha^{-1}) on the basis of STV + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe (T_8) recorded significantly higher effective tillers per plant (6.50, 6.50, 6.55, 6.86 and 6.60), length of

spike (9.23, 8.74, 9.14, 9.78 and 9.22 cm), no. of spike per plant (6.35, 5.97, 6.17, 5.92 and 6.10), no. of seeds per spike (34.14, 35.96, 35.25, 36.02 and 35.34), plant height and (75.78, 74.85, 74.85, 79.74 and 75.56 cm) of wheat over T_1 (Recommended dose of fertilizer on the basis of STV only) during all the individual years as well as on pooled basis. But, it was at par with T_5 on pooled basis in case of effective tillers per plant (6.46), no. of spikes per plant (5.94), no. of seeds per spike (34.99) and plant height (74.18 cm). The better efficiency of organic matter might be due to the fact that the organic manure especially FYM would have provided micronutrient at optimum level which play important role in chlorophyll formation which increase rate of photosynthesis and ultimately growth of the plant. These results are in accordance with the findings of Navrang and Tomar (2016). Beneficial effect of Zn through soil incorporation and foliar application of $FeSO_4$ at tillering stage to affect an increase in growth characteristics in this study may probably be assigned to harmonious plant physiology as stated by Gul *et al.*, (2011).

Table.1 Physicochemical properties of the experimental soil

Sr. No.	Parameters	Years			
		2014-15	**2015-16**	**2016-17**	**2017-18**
1.	pH	7.70	8.12	7.64	6.98
2.	EC (dSm^{-1})	1.10	1.18	1.35	1.45
3.	OC %	0.31	0.25	0.38	0.26
4.	Available P_2O_5 (kg/ha)	45.87	41.25	43.25	46.58
5.	Available K_2O (kg/ha)	241.25	285.54	356.14	266.14
6.	DTPA extractable Fe (mg kg^{-1})	3.78	3.95	3.51	2.25
7.	DTPA extractable Zn (mg kg^{-1})	0.89	1.08	0.89	0.76
	RDF Based on STV	**140:60:0**	**150:60:0**	**140:60:0**	**140:60:0**

Table.2 Effect of iron and zinc enriched with FYM and without enriched FYM on no. of effective tillers per plant of wheat

Treatments	**No. of effective tillers per plant**				
	2014-15	**2015-16**	**2016-17**	**2017-18**	**Pooled**
T_1 RDF (Based on STV)	4.75	5.00	4.61	4.88	**4.81**
T_2 T_1 + 1.0 t FYM ha^{-1}	5.01	5.00	4.96	5.46	**5.11**
T_3 T_1 + 1.5 kg Zn ha^{-1}	5.01	5.00	5.17	5.43	**5.15**
T_4 T_1 + 3.0 kg Fe ha^{-1}	5.51	5.50	5.01	5.57	**5.40**
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	6.25	6.50	6.42	6.66	**6.46**
T_6 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	5.25	5.50	5.34	5.48	**5.39**
T_7 T_1 + 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	5.25	5.50	5.61	5.73	**5.52**
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	6.50	6.50	6.55	6.86	**6.60**
S.Em.±	0.30	0.40	0.14	0.19	**0.14**
C.D. at 5 %	0.89	NS	0.42	0.55	**0.39**
C.V. %	11.06	14.48	5.22	6.52	**10.00**
Interactions					
Y x T	NS				

Table.3 Effect of iron and zinc enriched with FYM and without enriched FYM on length of spike (cm) of wheat

Treatments	Length of spike (cm)				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	6.53	7.01	6.86	7.19	**6.90**
T_2 T_1 + 1.0 t FYM ha^{-1}	7.38	7.55	7.26	7.54	**7.43**
T_3 T_1 + 1.5 kg Zn ha^{-1}	7.45	7.60	7.88	7.82	**7.69**
T_4 T_1 + 3.0 kg Fe ha^{-1}	7.71	7.76	7.88	7.84	**7.80**
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	8.45	8.24	8.48	9.49	**8.66**
T_6 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	7.80	7.82	7.53	8.82	**7.99**
T_7 T_1 + 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	7.98	7.94	8.20	8.77	**8.22**
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	9.23	8.74	9.14	9.78	**9.22**
S.Em.±	0.25	0.20	0.35	0.16	**0.13**
C.D. at 5 %	0.73	0.60	1.04	0.47	**0.35**
C.V. %	6.35	5.20	8.91	3.83	**6.29**
Interactions					
Y x T	NS				

Table.4 Effect of iron and zinc enriched with FYM and without enriched FYM on No. of spikes per plant of wheat

Treatments	No. of spikes per plant				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	4.94	4.56	4.69	4.69	**4.72**
T_2 T_1 + 1.0 t FYM ha^{-1}	5.24	4.86	5.16	5.16	**5.10**
T_3 T_1 + 1.5 kg Zn ha^{-1}	5.35	4.97	4.45	4.45	**4.80**
T_4 T_1 + 3.0 kg Fe ha^{-1}	5.22	4.84	5.06	5.06	**5.04**
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	6.27	5.89	5.80	5.80	**5.94**
T_6 T_{1+} 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	5.70	5.31	4.73	4.73	**5.11**
T_7 T_{1+} 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	5.62	5.23	5.50	5.50	**5.46**
T_8 T_{1+} 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	6.35	5.97	6.17	5.92	**6.10**
S.Em.±	0.26	0.18	0.29	0.27	**0.13**
C.D. at 5 %	0.75	0.53	0.86	0.81	**0.36**
C.V. %	9.19	6.91	11.20	10.61	**9.61**
Interactions					
Y x T	NS				

Table.5 Effect of iron and zinc enriched with FYM and without enriched FYM on No. of seeds per spike of wheat

Treatments	No. of seeds per spike				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	25.75	27.57	28.58	30.70	**28.15**
T_2 T_1 + 1.0 t FYM ha^{-1}	27.68	29.50	28.94	31.11	**29.30**
T_3 T_1 + 1.5 kg Zn ha^{-1}	29.69	31.51	30.90	33.05	**31.29**
T_4 T_1 + 3.0 kg Fe ha^{-1}	30.80	32.62	29.06	33.28	**31.44**
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	33.78	35.60	34.75	35.85	**34.99**
T_6 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	32.05	33.87	32.15	34.02	**33.02**
T_7 T_1 + 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	32.31	34.13	31.40	35.11	**33.24**
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	34.14	35.96	35.25	36.02	**35.34**
S.Em.±	1.85	0.89	1.36	0.91	**0.66**
C.D. at 5 %	5.43	2.61	4.00	2.68	**1.85**
C.V. %	12.00	5.45	8.67	5.42	**8.17**
Interactions					
Y x T	NS				

Table.6 Effect of iron and zinc enriched with FYM and without enriched FYM on plant height (cm) at harvest of wheat

Treatments	Plant height (cm)				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	70.78	64.50	64.50	65.61	**66.35**
T_2 T_1 + 1.0 t FYM ha^{-1}	72.02	69.25	69.25	67.24	**69.44**
T_3 T_1 + 1.5 kg Zn ha^{-1}	72.28	71.85	71.85	71.95	**71.98**
T_4 T_1 + 3.0 kg Fe ha^{-1}	69.77	69.88	69.88	70.84	**70.09**
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	75.27	73.23	73.23	75.02	**74.18**
T_6 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	74.03	70.50	70.50	70.91	**71.48**
T_7 T_1 + 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	72.27	70.63	70.63	71.30	**71.20**
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	75.78	74.85	74.85	76.74	**75.56**
S.Em.±	1.32	1.46	1.46	1.66	**0.74**
C.D. at 5 %	3.90	4.30	4.30	4.89	**2.09**
C.V. %	3.64	4.15	4.15	4.67	**4.16**
Interactions					
Y x T	NS				

Table.7 Effect of iron and zinc enriched with FYM and without enriched FYM on protein content (%) of wheat

Treatments	Protein content (%)				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	12.41	12.08	11.92	12.90	**12.33**
T_2 T_1 + 1.0 t FYM ha^{-1}	12.65	12.22	12.21	13.52	**12.65**
T_3 T_1 + 1.5 kg Zn ha^{-1}	12.87	12.42	12.44	13.53	**12.81**
T_4 T_1 + 3.0 kg Fe ha^{-1}	12.87	13.16	13.82	13.50	**13.34**
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	13.34	12.99	13.27	14.87	**13.62**
T_6 T_{1+} 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	13.01	12.60	13.60	14.17	**13.34**
T_7 T_{1+} 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	13.02	13.67	14.03	14.11	**13.71**
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	13.17	13.32	14.27	14.64	**13.85**
S.Em.±	0.43	0.56	0.77	0.70	**0.31**
C.D. at 5 %	NS	NS	NS	NS	**0.88**
C.V. %	6.63	8.78	11.60	10.06	**9.50**
Interactions					
Y x T	NS				

Table.8 Effect of iron and zinc enriched with FYM and without enriched FYM on grain yield of wheat

Treatments	Grain yield (kg ha^{-1})				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	3413	3563	4044	4104	3781
T_2 T_1 + 1.0 t FYM ha^{-1}	3765	3881	4580	4712	4234
T_3 T_1 + 1.5 kg Zn ha^{-1}	3591	3733	4310	4538	4043
T_4 T_1 + 3.0 kg Fe ha^{-1}	3721	3863	4511	4660	4189
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	4159	4259	5035	5278	4682
T_6 T_{1+} 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	3724	3911	4520	4903	4264
T_7 T_{1+} 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	4014	4075	4848	5129	4516
T_8 T_{1+} 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	4281	4396	5179	5302	4790
S.Em.±	186	136	218	205	94
C.D. at 5 %	546	399	641	604	266
C.V. %	9.69	6.85	9.42	8.50	8.75
Interactions					
Y x T	NS				

Table.9 Effect of iron and zinc enriched with FYM and without enriched FYM on straw yield of wheat

Treatments	Straw yield (kg ha^{-1})				
	2014-15	2015-16	2016-17	2017-18	Pooled
T_1 RDF (Based on STV)	5722	5703	6523	7133	6270
T_2 T_1 + 1.0 t FYM ha^{-1}	6282	6009	7380	8140	6953
T_3 T_1 + 1.5 kg Zn ha^{-1}	5720	5751	6986	7828	6571
T_4 T_1 + 3.0 kg Fe ha^{-1}	5662	5657	7311	8036	6666
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	6205	6203	8281	9097	7447
T_6 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	5889	5869	7357	8418	6883
T_7 T_1 + 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	5943	5940	7914	8765	7140
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	6839	6860	8331	9303	7833
S.Em.±	213	218	385	365	153
C.D. at 5 %	628	640	1133	1073	431
C.V. %	7.08	7.25	10.25	8.74	8.77
Interactions					
Y x T	NS				

Table.10 Effect of iron and zinc enriched with FYM and without enriched FYM on the economics of wheat (Pooled data of 4 years)

Treatments	Seed yield (kg/ha)	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	BCR
T_1 RDF (Based on STV)	3781	30588	78140	47552	2.55
T_2 T_1 + 1.0 t FYM ha^{-1}	4234	32438	87372	54934	2.69
T_3 T_1 + 1.5 kg Zn ha^{-1}	4043	30995	83291	52296	2.69
T_4 T_1 + 3.0 kg Fe ha^{-1}	4189	31456	86010	54553	2.73
T_5 T_1 + 1.5 kg Zn ha^{-1} + 3.0 kg Fe ha^{-1}	4682	31863	96133	64269	3.02
T_6 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn	4264	32241	87751	55509	2.72
T_7 T_1 + 0.5 t FYM ha^{-1} En. with 1.5 kg Fe	4516	32472	92640	60168	2.85
T_8 T_1 + 0.5 t FYM ha^{-1} En. with 0.75 kg Zn and 1.5 kg Fe	4790	32676	98766	**66090**	**3.02**
S.Em.±	94	-	-	-	-
C.D. at 5 %	266	-	-	-	-
C.V. %	8.75	-	-	-	-
Y x T	NS	-	-	-	-

From the perusal of the data presented in Table 7, it could be inferred that application of iron alone @ 3.0 kg Fe ha^{-1} or iron and zinc enriched with FYM and without enriched FYM showed significant increase in protein content in wheat grain over rest of the treatments on pooled basis.

Grain and straw yield

The ultimate effect of experimental variables was reflected in the final yield of wheat crop. The consequences obtainable in Table 8 and 9 make known that application of suggested quantity of fertilizer (120-60-00 NPK kg ha^{-1}) on the basis of STV + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe (T_8) recorded significantly higher grain (4281, 4396, 5179, 5302 and 4790 kg ha^{-1}) and straw (6839, 6860, 8331, 9303 and 7833 kg ha^{-1}) yields of wheat over T_1 (Recommended dose of fertilizer on the basis of STV only) during all the individual years as well as on pooled basis. But, it was at par with T_5 on pooled basis in case of grain (4682 kg ha^{-1}) and straw (7447 kg ha^{-1}) yield. Cakmak *et al.*, (2008) reported that there is increasing evidence showing that foliar or combined soil foliar application of Zn fertilizers under field conditions are highly effective and very practical way to maximize uptake and accumulation of Zn in whole wheat grain, raising concentration up to 60 mg Zn kg^{-1}. Increase in yield was due to improved availability of iron and zinc which could be attributed to the formation of stable organometalic complexes with organic matter, especially during the enrichment process to last for a longer time and release the nutrients slowly in the soil system in such a way that the nutrients are protected from fixation and made available to the plant root system throughout the crop growth (Meena *et al.*, 2006).

The soil application of RDF (120-60-00 NPK kg ha^{-1}) on the basis of STV + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe realized significantly higher gross returns (98,766 ha^{-1}), net returns (66,090 ha^{-1}) and BC ratio (3.02) as compared to other treatments which was mainly due to higher grain and straw yield compared to others. Significantly, the lower gross returns (78,140 ha^{-1}), net returns (47,552 ha^{-1}) and BC ratio (2.55) were obtained in control compared to other treatments which was due to lower grain and straw yield of wheat (Table 10). Based on the results, it was concluded that soil application of RDF (120-60-00 NPK kg ha^{-1}) on the basis of STV + 0.5 t FYM ha^{-1} enriched with 0.75 kg Zn and 1.5 kg Fe to wheat was found optimum for getting higher grain yield, straw yield and also higher net returns compared to recommended dose of fertilizer on the basis of STV only.

References

Anonymous. Annual Report, (2017). Directorate of Economics & Statistics, Department of Agriculture, Cooperation & Farmers Welfare, New Delhi.

Meena, M. C., Patel, K. P. and Rathod, D. D. (2006). Effect of Zn and Fe enriched FYM on mustard yield and micronutrients availability in loamy sand soil of Anand. *J. Indian Soc. Soil Sci.*, 54: 495-499.

Cakmak, I., (2008). Enrichment of cereal grains with zinc: agronomic or genetic biofortification. Plant and Soil. 302(1&2):1-17.

Shivay, Y.S., Prasad, R., Shukla, A.K., Das, S. (2014). Zinc Management" Text Book of Plant Nutrient Management by Prasad *et al.*, First Edition. 182-187.

Cakmak, I., and Kutman, U.B. (2017). Agronomic biofortification of cereals with zinc: a review. *European Journal of Soil Science*, 69(1): 172-180.

Navrang, S. and Tomar, G.S. (2016). Effect of integrated use of FYM and urea on yield, nutrient uptake and protein content of wheat (*Triticum aestivum* L.). *Supplement on Agronomy*, 11(1): 663-668.

Gul, H., Said, A., Saeed, B., Fida, M. and

Ahmad, I., (2011). Effect of foliar application of nitrogen, potassium and zinc on wheat growth. *Journal of Agricultural and Biological Science*, 6(4): 56-58.

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