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Nutrient management in wheat under middle Gujarat condition

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Abstract

The field experiment was conducted at Dept. of Soil Science and Agril. Chemistry, B. A. College of agriculture, Anand Agricultural University, Anand during 2012-13 to 2014-15 to assess the effects of nutrient management on wheat (GW-496) in *rabi* season. The pooled result revealed that treatment T₆ recorded significantly the highest plant height (70.6 cm), spikelet length (7.9 cm) and test weight (5.16 g) as well as grain (4560 kg ha⁻¹) and straw yield (5926 kg ha⁻¹) over rest of the treatments. Nutrient concentration in grain and straw were found non-significant due to different treatments except phosphorus content in grains. Significantly the highest uptake in kg ha⁻¹ of N (88.96), P (11.76) and S (8.32) were recorded under treatment T₆. Significantly the highest uptake in g ha⁻¹ of Fe (273.19), Mn (125.44), Zn (139.05) and Cu (29.47) were found in treatment T₆ as compared to other treatments.

Keywords: Nutrient management, Wheat, Balance nutrition

1. Introduction

With the introduction of high yielding varieties of wheat, the application of inorganic fertilizer became inevitable to supplement soil nutrient supply for the high yielding crops. But farmers apply fertilizer according to their best knowledge of soil fertility in the field. Moreover, cropping intensity has been increased with the increasing irrigation facility and soil became exhausted, as there is not sufficient fallow period to rejuvenate its nutrient supplying capacity. Most soils have low organic matter content, usually less than 2%. After the green revolution and due to intensive cropping, the soil C and N status decreased considerably.

Wheat is the important cereal crop in Middle Gujarat. It is grown in a vast area of middle Gujarat. Light textured soils of this area have low organic carbon, exchangeable K and S. Yield stagnation in wheat crop in cropping system is mainly due to nutrient management based on generalized recommendation. Balance nutrient management including micro nutrients and STV approach is important aspect for enhancing yield of this crop in particular field condition based on soil test value.

2. Materials and Methods

The field experiment was conducted at Dept. of Agril. Chemistry and Soil Science, B. A. College of agriculture, Anand Agricultural University, Anand during 2012-13 to 2014-15 to assess the effects of different nutrient management treatments on wheat (GW-496) in *rabi* season.

The soil of experimental field was *Typic Ustocrept* (Inceptisol) which is loamy sand of alluvial origin having good drainage and moderate moisture retention. Soil pH was neutral to alkaline with poor organic matter and nitrogen, medium in available phosphorus and high in available potash content. It was deficient to moderate in sulphur, iron and zinc contents.

The experiment was laid out Randomized Block Design (RBD) with four replications. Eight treatments comprised of T₁ : RD of N, T₂ : RD of N & P (120-60 kg ha⁻¹), T₃ : RD of N & P + ZnSO₄ (25 kg ha⁻¹), T₄ : T₃ + 0.5 % FeSO₄ spray, T₅ : T₄ + K@ 120 kg ha⁻¹, T₆ : T₅ + 20 kg S/ha through Gypsum, T₇ : STV (soli application) , T₈ : Fe-Zn enriched FYM @ 500 kg ha⁻¹. Wheat was line sown at 22.5 cm apart from line to line in the 1st week of November. The seed rate was 120 kg/ha. At maturity grain and straw yields was recorded from net plot area. Initial soil properties and nutrient content in grain and straw were analyzed using standard analytical procedures (Black, 1965; Jackson, 1962 and Page *et al.*, 1982) [1-3]. The obtained data were statistically analyzed using standard procedure.

3. Results and Discussion

3.1 Grain and Straw yield

Data presented in Table 1 indicated that, different treatments significantly influenced grain and straw yield of wheat. Treatment T₆ recorded significantly higher grain yield (4286 and 4861 kg ha⁻¹) during the year 2012-13 and 2013-14, respectively. This was at par with T₅ and T₇ treatments. Whereas same treatment recorded significantly higher yield (4540 kg ha⁻¹) in the year 2014-15 and was found on par with T₄, T₅ and T₇ treatments. On the pooled basis, treatment T₆ recorded significantly the highest grain yield (4560 kg ha⁻¹) over rest of the treatments.

Treatment T₆ recorded significantly higher straw yield (5987 and 5883 kg ha⁻¹) during the year 2012-13 and 2013-14, respectively but was found at par with treatments T₅ and T₇ in 2012-13 and treatment T₇ in 2013-14, respectively. Whereas same treatment recorded significantly higher straw yield (5911 kg ha⁻¹) in the year 2014-15 this was on par with T₄, T₅ and T₇ treatments. On the pooled basis, treatment T₆ recorded significantly the highest straw yield (5926 kg ha⁻¹) over rest of the treatments.

3.2 Yield attributes

Data presented in Table 2 indicated that, different treatments significantly affected yield attributes of wheat. Treatment T₆ recorded significantly the highest plant height (70.6 cm), spikelet length (7.9 cm) and test weight (5.16 g) over rest of the treatments on pooled basis. Whereas, plant population was not significantly affected due to different treatments.

3.3 Nutrient content

Nutrient concentration in grain and straw were found non-significant due to different treatments except phosphorus content in grain. Significantly higher sulphur (0.25 %) was observed under T₆ treatment which was at par with T₃, T₄, T₅ and T₇ treatments on pooled basis (Table 3 & 4).

3.4 Nutrient Uptake

Uptake of nutrient by grain was found significant due to different treatments. Significantly the highest uptake in kg ha⁻¹ of N (88.96), P (11.76) and S (8.32) were recorded under treatment T₆ as compared to rest of the treatments on pooled basis. Whereas, treatment T₆ recorded significantly higher K uptake (21.77 kg ha⁻¹) which was at par with treatment T₇ on pooled basis. In straw, significantly higher uptake in kg ha⁻¹ of N (49.44) was recorded under treatment T₆ which was on par with treatment T₇ on pooled basis. Significantly higher uptake in kg ha⁻¹ of K (73.61) was recorded under T₆ which

was on par with T₄, T₅, T₇ and T₈ treatments on pooled basis. Significantly higher uptake in kg ha⁻¹ of S (7.18) was recorded under T₆ which was on par with T₅ treatments on pooled basis. Uptake of K were non-significantly affected by different treatments (Table 5 & 6).

3.5 Micro-nutrient Content

Data presented in Table 7 revealed that micro-nutrient concentration in grain was found significant due to different treatments. Significantly higher Fe content (60.33 ppm) was observed under treatment T₅ which was at par with treatments T₃, T₄, T₆ and T₇ on pooled basis. Significantly higher Zn (33.58 ppm) was observed under T₃ and was found at par with T₄, T₅, T₆ and T₈ treatments on pooled basis. Whereas, Mn and Cu contents were affected non-significantly by different treatments on pooled basis.

Micronutrient concentration in straw was also found significant due to different treatments. Significantly higher Fe content (109.41.0 ppm) was observed under treatment T₄ which was at par with treatments T₃, T₅, T₆, T₇ and T₈ on pooled basis. Significantly higher Mn content (16.50 ppm) was observed under T₅ which was at par with treatments T₆, T₇ and T₈ on pooled basis. Treatment T₃ gave significantly higher Zn content (13.53 ppm) but was found on par with treatments T₄, T₅, T₆, T₇ and T₈ on pooled basis. Whereas, Cu content was not affected significantly due to different treatments on pooled basis (Table 8).

3.6 Micro-nutrient uptake

Data given in Table 9 indicate that micro-nutrient uptake by grain was found significant due to different treatments. Significantly the highest uptake in g ha⁻¹ of Fe (273.19), Mn (125.44), Zn (139.05) and Cu (29.47) were recorded under treatment T₆ as compared to rest of the treatments on pooled basis. Micro-nutrients uptake by straw was also found significant. Significantly the highest uptake by straw in g ha⁻¹ of Fe (647.70) and Zn (77.35) were recorded under treatment T₆ on pooled basis. Significantly higher Mn uptake by straw in g ha⁻¹ (90.58) was observed under treatment T₆ which was found at par with treatment T₅ on pooled basis (Table 10).

4. Conclusion

Application of 120-60-120 kg NPK/ha along with 25 kg ZnSO₄/ha, 20 kg S/ha and one foliar spray of 0.5 % FeSO₄ (5 g/ lit + 1g/lit citric acid) at 30 DAS gave higher yield and nutrient uptake in wheat crop.

Table 1: Influence of different treatments on grain and straw yield of wheat

Treatments	Grain yield (kg ha ⁻¹)				Straw yield (kg ha ⁻¹)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	3264	3167	3368	3266	4608	4052	4333	4331
T ₂	3275	3241	3449	3321	4649	4168	4461	4426
T ₃	3403	3287	3565	3418	4762	4276	4619	4552
T ₄	3319	3819	4167	3769	4604	4648	5229	4826
T ₅	3785	4016	4213	4004	5191	4770	5447	5135
T ₆	4282	4861	4540	4560	5987	5883	5911	5926
T ₇	3866	4363	4125	4118	5287	5146	5402	5278
T ₈	3000	3671	3782	3484	4099	4552	4883	5410
S. Em.±	225	331	195	136	315	253	268	148
CD at 5 %	663	974	575	400	928	746	790	435
Y XT				NS				NS
S. Em.±								
CD at 5 %								
CV %	12.79	17.42	10.03	17.8	12.89	10.84	10.68	12.36

Table 2: Influence of different treatments on yield attributes of wheat

Treatments	Plant Population (No. Per m row length)				Plant height (cm)				Spikelet length (cm)				Test weight (g)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	23	23	26	23	63.9	64.9	68.0	65.5	6.60	6.65	7.55	6.9	4.59	4.56	4.61	4.58
T ₂	23	24	26	24	62.8	63.8	68.1	64.9	6.90	6.90	7.55	7.1	4.61	4.56	4.11	4.42
T ₃	22	23	26	23	62.5	63.5	68.4	64.8	7.30	7.30	7.65	7.4	4.62	4.51	4.43	4.51
T ₄	23	24	26	24	65.6	66.3	69.2	66.9	7.10	7.35	7.50	7.3	4.50	4.39	4.38	4.42
T ₅	23	23	25	23	67.1	68.3	69.4	68.1	7.70	7.75	7.60	7.6	4.90	4.77	4.53	4.73
T ₆	23	24	26	24	70.7	71.6	69.5	70.6	8.15	7.80	7.90	7.9	5.25	5.32	4.93	5.16
T ₇	23	24	26	24	63.5	64.5	68.2	65.4	7.10	6.90	7.75	7.2	4.50	4.60	4.52	4.54
T ₈	23	23	26	23	62.9	63.9	69.5	65.4	6.20	6.15	7.50	6.6	4.65	4.52	4.49	4.55
S. Em.±	0.35	0.26	0.43	0.22	1.24	1.16	0.72	0.82	0.18	0.26	0.08	0.11	0.06	0.08	0.10	0.059
CD at 5 %	NS	NS	NS	NS	3.64	3.42	NS	2.41	0.52	0.76	0.24	0.34	0.18	0.22	0.28	0.17
Y XT	-	-	-	NS	-	-	-	Sig	-	-	-	Sig	-	-	-	Sig
S. Em.±	-	-	-	-	-	-	-	0.82	-	-	-	0.17	-	-	-	0.068
CD at 5 %	-	-	-	-	-	-	-	2.34	-	-	-	0.49	-	-	-	0.19
CV %	3.06	2.22	3.30	2.85	3.82	3.53	2.09	2.47	4.93	7.29	2.10	4.78	2.58	3.27	4.27	2.96

Table 3: Influence of different treatments on nutrient content by wheat grain

Treatments	N content (%)				P content (%)				K content (%)				S content (%)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	1.95	2.08	2.02	2.01	0.21	0.26	0.23	0.23	0.42	0.47	0.44	0.44	0.15	0.18	0.19	0.17
T ₂	1.97	2.09	2.04	2.03	0.20	0.26	0.24	0.23	0.42	0.48	0.43	0.44	0.16	0.18	0.20	0.17
T ₃	2.01	2.14	2.08	2.06	0.23	0.27	0.24	0.24	0.41	0.47	0.44	0.44	0.16	0.19	0.20	0.18
T ₄	1.91	2.04	1.98	1.97	0.23	0.28	0.24	0.24	0.47	0.52	0.44	0.47	0.17	0.20	0.20	0.19
T ₅	1.86	1.98	1.92	1.92	0.22	0.27	0.25	0.24	0.44	0.49	0.49	0.47	0.16	0.18	0.20	0.18
T ₆	1.97	2.10	2.04	2.04	0.24	0.28	0.25	0.25	0.45	0.50	0.48	0.47	0.16	0.18	0.22	0.18
T ₇	2.05	2.18	2.12	2.11	0.25	0.27	0.25	0.25	0.49	0.55	0.49	0.51	0.16	0.18	0.21	0.18
T ₈	2.05	2.18	2.12	2.11	0.23	0.28	0.25	0.25	0.42	0.47	0.49	0.45	0.16	0.19	0.21	0.18
S. Em.±	0.10	0.10	0.10	0.10	0.01	0.01	0.005	0.004	0.04	0.04	0.02	0.02	0.01	0.01	0.003	0.005
CD at 5 %	NS	NS	NS	NS	0.02	NS	0.01	0.013	NS	NS	0.05	NS	NS	NS	0.01	NS
Y XT	-	-	-	NS	-	-	-	NS	-	-	-	NS	-	-	-	NS
S. Em.±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CD at 5 %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CV %	10.09	9.48	9.82	8.46	5.66	4.84	3.70	4.54	17.68	15.75	6.68	11.00	9.73	8.41	2.79	7.13

Table 4: Influence of different treatments on nutrient content by wheat straw

Treatments	N content (%)				P content (%)				K content (%)				S content (%)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	0.86	0.89	0.84	0.86	0.13	0.17	0.17	0.15	1.09	1.13	1.14	1.12	0.09	0.11	0.10	0.09
T ₂	0.83	0.87	0.82	0.83	0.12	0.16	0.18	0.15	1.27	1.31	1.21	1.26	0.09	0.11	0.11	0.10
T ₃	0.80	0.83	0.78	0.83	0.13	0.17	0.17	0.15	1.21	1.25	1.20	1.22	0.11	0.12	0.12	0.11
T ₄	0.74	0.77	0.72	0.74	0.12	0.16	0.16	0.14	1.22	1.26	1.26	1.24	0.10	0.12	0.12	0.11
T ₅	0.79	0.82	0.78	0.79	0.12	0.16	0.16	0.14	1.29	1.33	1.33	1.32	0.11	0.13	0.12	0.12

T ₆	0.83	0.86	0.81	0.83	0.12	0.16	0.16	0.14	1.19	1.23	1.31	1.24	0.11	0.13	0.13	0.12
T ₇	0.83	0.86	0.81	0.83	0.12	0.15	0.18	0.15	1.26	1.31	1.31	1.29	0.12	0.14	0.12	0.13
T ₈	0.88	0.91	0.86	0.88	0.14	0.17	0.17	0.15	1.19	1.23	1.29	1.23	0.09	0.01	0.13	0.10
S. Em.±	0.05	0.05	0.05	0.05	0.01	0.01	0.01	0.005	0.10	0.10	0.10	0.10	0.01	0.02	0.01	0.007
CD at 5 %	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	0.02	NS	NS	NS
Y XT	-	-	-	NS	-	-	-	NS	-	-	-	NS	-	-	-	Sig
S. Em.±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.003
CD at 5 %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.010
CV %	13.15	12.76	13.57	1.23	9.06	7.12	8.07	6.39	17.24	16.69	16.46	4.25	13.87	11.81	12.11	6.10

Table 5: Influence of different treatments on nutrient uptake by wheat grain

Treatments	N uptake (kg/ha)				P uptake (kg/ha)				K uptake (kg/ha)				S uptake (kg/ha)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	63.41	67.42	68.15	66.32	6.79	8.13	7.67	7.53	13.75	15.22	14.88	14.61	5.10	4.38	6.29	5.26
T ₂	64.65	68.65	70.13	67.80	6.58	8.33	8.35	7.75	13.93	15.38	14.97	14.76	5.19	4.58	6.77	5.51
T ₃	68.03	72.04	73.97	71.34	7.73	8.79	8.69	8.40	14.06	15.30	15.81	15.05	5.59	4.97	7.10	5.88
T ₄	63.14	67.14	82.97	71.08	7.46	10.60	10.05	9.36	15.49	19.72	18.29	17.83	5.72	6.24	8.39	6.78
T ₅	65.22	69.23	81.10	71.85	7.85	10.53	10.68	9.68	15.38	19.18	20.51	18.35	5.60	5.72	8.59	6.63
T ₆	85.23	89.24	92.41	88.96	10.21	13.61	11.46	11.76	19.09	24.15	22.09	21.77	6.81	8.40	9.77	8.32
T ₇	60.40	64.40	87.20	70.66	7.33	11.77	10.40	9.83	14.48	24.02	20.29	19.59	4.57	7.05	8.59	6.73
T ₈	61.57	65.58	80.21	69.12	6.99	10.22	9.56	8.92	12.60	17.59	18.47	16.21	4.85	5.66	7.91	6.14
S. Em.±	3.85	3.85	5.31	3.70	0.31	0.98	0.49	0.35	1.18	2.55	1.11	1.13	0.32	0.31	0.43	0.21
CD at 5 %	11.33	11.33	NS	10.90	0.92	2.87	1.45	1.03	3.46	NS	3.26	3.35	0.96	0.92	1.26	0.63
Y XT	-	-	-	Sig	-	-	-	NS	-	-	-	NS	-	-	-	Sig
S. Em.±	-	-	-	3.32	-	-	-	-	-	-	-	-	-	-	-	0.41
CD at 5 %	-	-	-	9.44	-	-	-	-	-	-	-	-	-	-	-	1.17
CV %	11.59	10.93	13.37	9.20	8.22	19.04	10.25	16.96	15.84	27.14	12.20	18.80	11.96	10.56	10.82	12.83

Table 6: Influence of different treatments on nutrient uptake by wheat straw

Treatments	N uptake (kg/ha)				P uptake (kg/ha)				K uptake (kg/ha)				S uptake (kg/ha)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	39.64	36.19	36.55	37.46	5.81	6.77	7.43	6.67	50.19	45.90	49.61	48.57	4.15	4.37	4.52	4.35
T ₂	38.37	36.12	36.19	36.89	5.68	6.79	7.99	6.82	59.08	54.14	53.89	55.71	4.39	4.65	4.99	4.67
T ₃	38.35	35.56	36.08	36.67	6.10	7.25	7.84	7.06	56.94	53.37	55.45	55.26	4.94	5.23	5.68	5.28
T ₄	33.49	35.81	37.16	35.48	5.38	7.24	8.55	7.06	56.82	58.13	66.45	66.47	4.50	5.43	6.03	5.32
T ₅	40.65	38.64	42.51	40.60	6.11	7.55	8.66	7.44	67.61	62.08	74.71	68.13	5.74	6.15	6.71	6.20
T ₆	49.78	50.91	47.64	49.44	6.91	9.20	9.25	8.45	70.84	72.18	77.81	73.61	6.50	7.51	7.51	7.18
T ₇	43.60	44.35	44.63	44.19	6.41	7.80	9.65	7.95	67.21	66.42	69.75	67.80	6.57	7.30	6.70	6.86
T ₈	36.04	41.29	41.94	39.76	5.60	7.65	8.22	7.16	48.20	55.09	62.11	55.30	3.81	4.98	6.05	4.95
S. Em.±	3.45	3.30	3.50	2.76	0.52	0.46	0.56	0.34	6.89	4.11	7.20	5.27	0.43	0.55	0.50	0.37
CD at 5 %	NS	9.70	NS	8.13	NS	1.36	NS	1.02	NS	12.08	NS	15.52	1.27	1.63	1.47	1.08
Y XT	-	-	-	NS	-	-	-	Sig	-	-	-	Sig	-	-	-	NS
S. Em.±	-	-	-	-	-	-	-	0.17	-	-	-	1.48	-	-	-	-
CD at 5 %	-	-	-	-	-	-	-	0.49	-	-	-	4.22	-	-	-	-
CV %	17.26	16.54	17.35	12.88	17.31	12.27	13.27	13.32	23.11	14.06	22.58	13.86	16.99	19.40	16.61	15.56

Table 7: Influence of different treatments on micro-nutrient content of wheat grain

Treatments	Fe content (ppm)				Mn content (ppm)				Zn content (ppm)				Cu content (ppm)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	48.00	59.25	51.25	52.83	26.75	27.75	25.25	26.58	17.50	19.00	18.50	18.33	4.75	6.25	4.64	5.21
T ₂	49.00	60.25	53.25	54.16	27.00	28.00	26.00	27.00	18.25	19.75	18.75	18.91	5.25	6.75	5.03	5.67
T ₃	56.25	58.75	51.75	55.58	27.75	28.75	25.00	27.16	34.75	34.25	31.75	33.58	5.25	6.75	5.18	5.72
T ₄	55.75	58.25	51.25	55.08	29.00	30.00	28.00	29.00	33.25	34.75	30.75	32.91	4.75	6.25	4.75	5.25
T ₅	65.00	63.50	52.50	60.33	29.75	30.75	28.00	29.50	33.75	35.25	30.25	33.08	5.50	7.00	5.13	5.87
T ₆	64.00	61.25	54.25	59.83	29.00	30.00	27.25	28.75	33.75	35.25	30.75	33.25	6.50	8.00	6.35	6.95
T ₇	55.00	60.50	52.00	55.83	28.25	29.25	27.25	28.25	28.25	29.75	28.75	28.91	5.00	6.50	4.08	5.19
T ₈	51.50	54.75	49.00	51.75	30.25	31.25	29.25	30.25	33.75	32.50	31.50	32.58	5.00	6.50	4.85	5.45
S. Em.±	2.69	1.89	1.72	1.89	1.15	1.15	1.05	1.09	1.18	1.18	1.07	0.98	0.49	0.49	0.43	0.458
CD at 5 %	7.93	NS	NS	5.58	NS	NS	NS	NS	3.49	3.48	3.14	2.88	NS	NS	NS	NS
Y XT	-	-	-	Sig	-	-	-	NS	-	-	-	Sig	-	-	-	NS
S. Em.±	-	-	-	1.27	-	-	-	-	-	-	-	0.71	-	-	-	-
CD at 5 %	-	-	-	3.61	-	-	-	-	-	-	-	2.03	-	-	-	-
CV %	9.70	6.34	6.61	4.56	8.07	7.80	7.74	3.33	8.13	7.88	7.73	4.94	18.82	14.64	17.35	7.30

Table 8: Influence of different treatments on micro-nutrient content by wheat straw

Treatments	Fe content (ppm)				Mn content (ppm)				Zn content (ppm)				Cu content (ppm)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	90.75	108.00	88.75	95.83	12.75	14.00	11.88	12.87	9.05	10.69	12.13	10.62	7.50	9.25	8.25	8.33
T ₂	97.75	104.50	86.25	96.16	10.00	12.75	11.75	11.50	9.04	10.68	11.50	10.40	6.75	8.50	7.75	7.66
T ₃	112.00	111.00	91.75	104.91	12.25	14.75	13.25	13.41	12.72	14.36	13.53	13.53	6.75	8.50	7.75	7.66
T ₄	118.25	115.00	95.00	109.41	12.25	14.50	13.00	13.25	11.60	13.24	12.80	12.54	6.50	8.25	7.25	7.33
T ₅	121.75	112.00	91.25	108.33	18.25	16.25	15.03	16.50	10.75	12.39	14.50	12.54	7.50	9.25	7.75	8.16
T ₆	119.50	114.00	94.00	109.16	17.75	14.75	13.25	15.25	12.50	14.14	12.65	13.09	6.25	8.00	7.25	7.16
T ₇	118.75	109.25	89.25	105.75	13.75	16.25	14.28	14.75	10.18	11.82	14.05	12.01	7.75	9.50	8.50	8.58
T ₈	120.75	109.50	90.25	106.83	20.25	16.75	14.97	17.32	12.15	13.79	15.29	13.74	8.00	9.75	8.50	8.75
S. Em.±	2.42	2.70	2.45	2.03	1.87	0.88	0.87	0.96	0.92	0.92	0.84	0.57	0.53	0.53	0.53	0.499
CD at 5 %	7.12	NS	NS	5.98	5.49	NS	NS	2.84	2.70	2.70	NS	1.69	NS	NS	NS	NS
Y XT	-	-	-	Sig	-	-	-	Sig	-	-	-	NS	-	-	-	NS
S. Em.±	-	-	-	1.92	-	-	-	1.04	-	-	-	-	-	-	-	-
CD at 5 %	-	-	-	5.48	-	-	-	2.98	-	-	-	-	-	-	-	-
CV %	4.30	4.88	5.40	3.68	25.45	11.80	13.01	14.60	16.70	14.54	12.68	13.05	14.77	11.86	13.50	6.28

Table 9: Influence of different treatments on micro-nutrient uptake by wheat grain

Treatments	Fe uptake (g/ha)				Mn uptake (g/ha)				Zn uptake (g/ha)				Cu uptake (g/ha)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	156.22	188.13	172.10	172.10	86.32	89.49	85.40	87.07	56.66	59.71	62.78	59.71	15.63	18.98	15.50	16.70
T ₂	161.56	193.10	182.87	179.17	88.42	91.59	89.83	89.94	59.83	64.03	64.84	62.89	17.26	20.61	17.34	18.40
T ₃	191.18	193.36	185.25	189.92	94.54	97.71	89.72	93.98	118.16	111.74	113.26	114.38	17.70	21.05	18.41	19.05
T ₄	184.42	220.79	213.26	206.15	96.04	99.21	117.20	104.15	110.16	132.18	128.19	123.51	15.64	18.99	19.95	18.19
T ₅	228.19	254.86	220.97	234.67	104.57	107.73	117.71	110.00	118.48	136.15	126.71	127.11	19.30	22.65	21.41	21.11
T ₆	275.79	297.99	245.81	273.19	125.09	128.26	122.98	125.44	145.97	172.11	139.05	152.37	28.29	31.64	28.48	29.47

T ₇	162.55	265.01	214.34	213.96	83.54	86.71	112.54	94.26	83.18	131.16	118.49	110.94	14.75	18.10	16.73	16.52
T ₈	154.89	197.53	185.54	179.31	90.80	93.97	110.81	98.52	101.52	117.91	119.21	112.88	14.97	18.32	18.35	17.21
S.Em.±	11.05	18.96	10.94	7.91	4.64	4.64	7.50	4.72	4.86	11.31	6.75	4.97	1.97	1.97	1.92	1.87
CD at 5 %	32.51	55.78	32.18	23.292	13.64	13.64	22.07	13.91	14.29	33.27	19.84	14.63	5.79	5.79	5.66	5.52
Y XT	-	-	-	NS	-	-	-	Sig	-	-	-	NS	-	-	-	NS
S.Em.±	-	-	-	-	-	-	-	4.10	-	-	-	-	-	-	-	-
CD at 5 %	-	-	-	-	-	-	-	11.66	-	-	-	-	-	-	-	-
CV %	11.67	16.76	10.80	15.47	9.64	9.34	14.19	8.16	9.79	19.56	12.37	15.82	21.95	18.50	19.72	8.01

Table 10: Influence of different treatments on micro-nutrient uptake by wheat straw

Treatments	Fe Uptake (g/ha)				Mn Uptake (g/ha)				Zn Uptake (g/ha)				Cu Uptake (g/ha)			
	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled	2012-13	2013-14	2014-15	Pooled
T ₁	418.41	438.43	384.34	413.73	58.49	56.61	51.50	55.53	41.96	43.49	52.59	46.01	34.69	37.48	35.67	35.95
T ₂	453.90	435.89	485.55	425.11	46.33	53.05	52.51	50.63	51.76	44.20	51.43	45.80	31.69	35.22	34.84	33.92
T ₃	534.13	473.75	423.78	477.22	58.99	63.67	61.37	61.34	60.53	61.02	62.57	61.38	32.03	35.97	35.77	34.59
T ₄	547.37	534.02	497.39	526.26	55.02	67.89	66.95	63.29	53.80	61.44	65.99	60.41	29.25	38.65	37.54	35.14
T ₅	632.70	531.28	499.10	554.36	95.03	77.50	81.57	84.70	54.42	59.27	78.35	64.01	38.77	44.00	41.93	41.57
T ₆	715.69	670.85	556.54	647.70	106.32	86.85	78.57	90.58	74.97	82.31	74.77	77.35	36.93	46.57	43.12	42.20
T ₇	628.59	562.43	480.04	557.02	73.00	82.09	76.67	77.26	53.92	60.91	75.47	63.43	40.86	49.02	46.11	45.33
T ₈	495.04	496.81	439.19	477.01	82.22	76.82	73.40	77.40	49.86	62.91	74.76	62.51	33.11	44.54	41.50	39.72
S. Em.±	38.83	32.04	28.48	19.75	6.98	5.88	5.98	4.42	6.35	5.82	5.29	3.49	3.25	3.79	3.92	2.97
CD at 5 %	114.22	94.25	83.77	58.12	20.54	17.29	17.60	13.02	18.68	17.12	15.57	10.27	NS	NS	NS	NS
Y XT	-	-	-	NS	-	-	-	NS	-	-	-	NS	-	-	-	NS
S. Em.±	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CD at 5 %	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CV %	14.04	12.37	12.43	13.79	19.41	16.66	17.64	16.36	23.56	19.58	15.80	18.71	18.77	18.29	19.82	14.79

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