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Effect of morpho-physiological assessment of iron and zinc biofortification on yield and quality of sweet corn (*Zea mays* L. *Saccharata*)

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Abstract
Field experiment was carried out during *kharif* 2017 and 2018 in black soil at farmer field at Kumarnahally village, Huvina hadagali Tq, the experiment was laid out in a randomized block design (RCBD) comprising 13 treatments replicated thrice. Bellary District representing the Northern Dry Zone (Zone-II) which is located at latitude of 15.04' N, longitude of 75.94' E and 561 meters which is above mean sea level to study the effect of morpho-physiological assessment of iron and zinc biofortification on yield and quality of sweet corn (*Zea mays* L. *Saccharata*) to evaluate and analysis of sweet corn through biofortification to achieve higher yield and quality parameters. The results of pooled data revealed that seed treatment by $ZnSO_4$ @ 0.5% & $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% & $FeSO_4$ @1.0% which was on par with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded significantly higher number of seeds per row, number of seed rows per cob, cob length, cob girth, cob weight and fresh cob yield and also quality parameter like protein content, reducing sugar, non reducing sugar, zinc concentration in grain and iron concentration in grain.

Keywords: Sweet corn, yield parameters, zinc and iron concentration

Introduction
Maize is called "Queen of Cereals" because of its productive potential compared to any other cereal crop. In India, maize occupies an area of 9.2 m ha, production of 23.6 million tonnes with the productivity of 2564 kg ha^{-1}. Among all the cereals, maize in general and hybrids in particular are responsive to nutrients, and water management practices. Maize being a C_4 plant has more photosynthetic efficiency than other cereals. It is an exhaustive crop which consumes large quantity of nutrients for growth and development. Under the present trend of exploitive agriculture in India, inherent soil fertility can no longer support for the sustainable yields. It is said that nutrient supplying capacity of soil declines steadily under continuous and intensive cropping system. The intensive crop rotation and imbalance fertilizer use have resulted in a wide range of nutrient deficiencies in field. Further, about 50 per cent of applied N and 70 per cent of applied potassium to the soil remain unavailable to a crop due to a combination of leaching, fixation and volatilization

Sweet corn (*Zea mays* L. *saccharata*) also known as sugar corn, is a hybridized variety of maize (*Zea mays* L.) specifically bred to increase the sugar content. Sweet corn is introduced to India from United States of America. It has a sugary rather than a starchy endosperm with a creamy texture. The low starch level makes the kernel wrinkled rather than plumpy. The modern sweet corn varieties are classified as "normal sugary" (Su); "sugary enhanced" (Se) and "shrunken" (Sh_2), which are also called as "super sweet". These differ in sweetness and ratio of conversion of sugar to starch. All these varieties are most popular while "super sweet" is commercially used because it is very sweet with minimum conversion of sugar to starch. The sweet corn contains relatively good amount of calcium (Ca), phosphorus (P), iron (Fe) and potassium (k). It contains a higher proportion of sitosterol (47%). Due to high oil content, flavor and color develop in processed sweet corn. Sweet corn is rich in thiamine, riboflavin, niacin, vitamin B_6 and vitamin A as major vitamins. Lipoxygenase and peroxidase enzymes Are directly associated with off-flavor and other quality deteriorations. In sweet corn, aroma develops due to dimethyl sulphide (DMS) and hydrogen sulphide (H_2S).

To alleviate iron and zinc deficiency, it is required to increase iron and zinc concentration in the endosperm. Currently, there is growing concern to address micronutrient malnutrition through different interventions. Typically, these interventions are categorized into 4 major groups: pharmaceutical supplementation, industrial fortification, dietary diversification, and biofortification (Meenaski, 2014) [5]. Generally, food fortification and supplementation strategies have been followed across world to alleviate malnutrition. However, such method has not been successful because they are neither sustainable nor cost effective for treatment of large population. Recently new approach called biofortification has been developed for alleviating malnutrition problem. Biofortification strategy involves developing crop varieties with superior nutrient qualities and it includes both increasing nutrient levels in the edible parts of fruit crops as well as their bioavailability.

Material and methods

Field experiment was carried out during *kharif* 2017 and 2018 in black soil at farmer field at Kumarnahally village, Huvina hadagali Tq, Bellary District representing the Northern Dry Zone (Zone-II) which is located at latitude of 15.04' N, longitude of 75.94' E and 561 meters above mean sea level. Laboratory studies were carried out in the Department of Crop Physiology, College of Agriculture, University of Agricultural Sciences, Raichur. The experiment was laid out in randomized block design and comprised of thirteen treatments for study *viz.*, T_1: Seed treatment with $ZnSO_4$ @ 0.5%, T_2: Seed treatment with $FeSO_4$ @ 0.5%, T_3: Foliar application of $ZnSO_4$ @ 1.0%, T_4: Foliar application of $FeSO_4$ @ 1.0%, T_5: Seed treatment with $ZnSO_4$ @ 0.5% + Seed treatment with $FeSO_4$ @ 0.5%, T_6: Seed treatment with $ZnSO_4$ @ 0.5% + foliar application of $ZnSO_4$ @ 1.0%, T_7: Seed treatment with $ZnSO_4$ @ 0.5% + foliar application of $FeSO_4$ @ 1.0%, T_8: Seed treatment with $FeSO_4$ @ 0.5% + foliar application of $ZnSO_4$ @ 1.0%, T_9: Seed treatment with $FeSO_4$ @ 0.5% + foliar application of $FeSO_4$ @ 1.0%, T_{10}: Seed treatment with $ZnSO_4$ @ 0.5% + foliar application of $ZnSO_4$ @ 1.0% + foliar application of $FeSO_4$ @ 1.0%, T_{11}: Seed treatment with $FeSO_4$ @ 0.5% + foliar application of $ZnSO_4$ @ 1.0% + foliar application of $FeSO_4$ @ 1.0%, T_{12}: Seed treatment with $ZnSO_4$ 0.5% + Seed treatment with $FeSO_4$ 0.5% + foliar application of $ZnSO_4$ 1.0% + foliar application of $FeSO_4$ 1.0% and T_{13}:Control. The soils of the experimental site belong to black soil with optimum pH (8.34) and electrical conductivity was normal (0.108 dsm^{-1}). The nitrogen content in the soil was low (248.0 kg ha^{-1}), whereas the phosphorous was medium (43.0 kg ha^{-1}) and the potash was high (386.0 kg ha^{-1}). The organic carbon content was medium (0.45%) besides, zinc (0.85 mg/kg^{-1}) content found to be slightly below the normal, iron (0.87 mg/kg^{-1}).

Result and discussion

In the present study, number of seeds per row results noticed that seed treatment with $ZnSO_4$ @ 0.5% & $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% & $FeSO_4$ @1.0% recorded significantly higher (35.2, 35.9 and 35.6 during the year 2017, 2018 and pooled analysis data respectively). Which was on par with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded (30.6, 33.3 and 31.9 seeds per row during both the year 2017, 2018 and pooled analysis data, respectively) compared to control. Similarly number of seed rows per cob recorded significantly higher seed treatment by $ZnSO_4$ @ 0.5% & $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% & $FeSO_4$ @1.0% (16.0, 16.1 and 16.0 during the year 2017, 2018 and pooled analysis data, respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded (15.2, 15.3 and 15.2 during both the year 2017, 2018 and pooled analysis data, respectively) compared to control number of seed rows per cob (11.9, 12.0 and 11.9 during the year 2017, 2018 and pooled analysis data, respectively).

Days to 50% silking of sweet corn was results noticed that seed treatment by $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded lesser number (44.6, 43.4 and 44.0 days during the year 2017, 2018 and pooled analysis data, respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded (45.4, 46.5 and 45.1 days during 2017, 2018 and pooled analysis data, respectively) compared with all other treatments. However, the control treatment recorded higher number of days to attain 50% silking (44.7, 45.8 and 45.6 days during the year 2017, 2018 and pooled analysis data, respectively).However, there was no significant difference among treatments during both the years. Similarly significantly lesser number of days were taken to attain 50% tasseling with seed treatment by $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% (48.6, 49.8 and 49.2 days During 2017,, 2018 and pooled analysis data, respectively) as compared to control (53.6, 54.7 and 54.1 days to attain 50% tasseling during the year 2017, 2018 and pooled analysis data, respectively). Similar results were obtained by El-Azab (2015) [2] the foliar nutrition at the early vegetative stage reduced variation in days to 50 per cent silking and days to 50 per cent tasseling increased chlorophyll contents, photosynthesis rate which in turn increased the sugar contents and dry matter production. In addition, the foliar nutrients improved translocation and assimilation of nutrients by sweet corn plants leading to significant increase in grain yield.

The variation in the yield was due to the variation in the yield components *viz.*, cob length, cob girth, cob weight, fresh cob yield, days to 50 per cent silking and 50 per cent tasseling of sweet corn as influenced by the application of zinc and iron through bio-fortification. is mainly due to higher cob length results noticed that with seed treatment by $ZnSO_4$ @ 0.5% & $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% & $FeSO_4$ @1.0% recorded significantly higher cob length (24.4, 25.1 and 24.8 cm during the year 2017, 2018 and pooled analysis data respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded (24.2, 22.5 and 23.7 cm during both the year 2017, 2018 and pooled analysis data, respectively) compared to control.

Cob girth was noticed that with seed treatment by $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded significantly higher cob girth (15.7, 15.5 and 15.3 cm during the year 2017, 2018 and pooled analysis data respectively) compared to control (11.8, 12.8 and 12.1 cm during the year 2017, 2018 and pooled analysis data, respectively). Similarly cob weight recorded significantly higher with seed treatment $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded (316.4, 323.1 and 319.8 g cob weight during the year 2017, 2018 and pooled analysis data respectively). as compared to the control (241.5, 246.7 and 244.1g cob weight during the year 2017, 2018 and pooled analysis data, respectively).

Similarly fresh cob yield per ha of sweet corn as influenced by seed treatment and foliar application with $ZnSO_4$ and $FeSO_4$ through biofortification. Application with seed treatment by $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded significantly higher fresh cob yield (174.6, 184.0 and 179.3 q ha^{-1} during the year 2017, 2018 and pooled analysis data, respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded fresh cob yield (168.2, 179.0 and 173.6 q ha^{-1} during both the year 2017, 2018 and pooled analysis data, respectively) as compared to control (146.1, 154.0 and 150.1 q ha^{-1} was recorded during the year 2017, 2018 and pooled analysis data, respectively). Similar results were observed by Fakeerappa *et al.* (2017) who reported that seed treatment and foliar application of micronutrients $ZnSO_4$ and $FeSO_4$ 1.0 per cent was recorded higher yield it might be due to foliar spray of micronutrients (zinc and iron) are essential for several enzymes that regulates the metabolic activities in plants. They involve in auxin production, transformation of carbohydrates and regulation of sugars in plants. Especially zinc and iron involved in synthesis of growth promoting hormones and reproductive process of many plants which are vital role for grain formation. Interaction effect of enriched $ZnSO_4$ and $FeSO_4$ @ 20 and 40 DAS was recorded higher yield in sweet corn

Protein content in seeds differed significantly due to the influence of seed treatment and foliar nutrition of micro nutrients at different post harvesting intervals in seeds. The pooled data of 2017 and 2018 indicated that seed treatment with $ZnSO_4$ @ 0.5 percent + $FeSO_4$ @ 0.5 per cent + foliar application of $ZnSO_4$ @1.0 percent and $FeSO_4$ @ 1.0 percent from the 0, 5 and 10 DAH has recorded (12.9, 9.96 and 2.64 mg g^{-1} fresh weight at 0, 5 and 10 DAH, respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5 per cent + foliar application of $ZnSO_4$ @ 0.5 per cent + foliar application of $FeSO_4$ @ 1.0 per cent recorded (12.8, 6.54 and 2.33 mg g^{-1} fresh weight from 0, 5 and 10 DAH, respectively). However, minimum protein content was recorded (8.87, 4.88 and 2.83 mg g^{-1} fresh weight from 0, 5 and 10 DAH respectively) as compared to control.

Reducing sugar was recorded both the year 2017 and 2018 indicated that with seed treatment by $ZnSO_4$ @ 0.5% & $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% & $FeSO_4$ @1.0% recorded maximum reduction in (67.8, 36.7 and 21.0 mg g^{-1} fresh at 0, 5 and 10 DAH weight, respectively) as compared to control. Similarly non reducing sugar was noticed that pooled data of 2017 and 2018 seed treatment with 0.5% $ZnSO_4$ @ 0.5% & $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% & $FeSO_4$ @1.0 was recorded (280.3, 297.6 and 288.2 mg g^{-1} fresh weight from 0, 5 and 10 DAH respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5 per cent + foliar application of $ZnSO_4$ @ 0.5 per cent + foliar application of $FeSO_4$ @ 1.0 per cent recorded (279.1, 296.2 and 288.0 mg g^{-1} fresh weight from 0, 5 and 10 DAH, respectively). However, the control recorded minimum non reducing sugar concentration (151.1, 160.3 and 155.1 mg g^{-1} fresh weight from 0, 5 and 10 days after harvest, respectively). Similarly results were noticed by Bakry *et al.* (2009) [1] reported that the metabolic characteristics of developing sugary-l maize *(Zea mays* L.) endosperms are increased enzyme activities were attributed to an increased sucrose concentrations and significantly least starch content at physiological maturity stage of sweet corn. Beneficial and salubrious enhancement of all physiological and yield/quality parameters of maize was due to micronutrients (zinc and iron).

Zinc concentration in grain were noticed that with seed treatment by $ZnSO_4$ @ 0.5% + $FeSO_4$ @ 0.5% and foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded significantly higher zinc concentration (49.7 55.7 and 52.7 mg g^{-1} during the year 2017, 2018 and pooled analysis, data respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded (49.4, 47.6 and 48.5 mg g^{-1} during 2017, 2018 and pooled analysis, respectively) as compared control (29.2, 31.2 and 30.2 mg g^{-1} during 2017, 2018 and pooled analysis data, respectively). Similarly higher iron concentration was noticed (25.1, 25.4 and 25.2 mg g^{-1} during 2017, 2018 and pooled analysis data respectively). Which was onpar with seed treatment with $ZnSO_4$ @ 0.5% + foliar spray of $ZnSO_4$ @ 1.0% + $FeSO_4$ @1.0% recorded fresh cob yield (22.0, 23.1 and 22.5 mg g^{-1} during 2017, 2018 and pooled analysis, respectively). However, the control treatment recorded lower iron concentration (13.5, 19.2 and 16.4 mg g^{-1} during 2017, 2018 and pooled analysis data, respectively). The plant performance is attributed to the genetic factors which are controlled by the differences in the biochemical parameters. It is well known that thousands of biochemical reactions are undergoing in plants simultaneously which ultimately decide the plant growth and development and the final yield. Similar results were recorded by Ghazvineh and Yousefi (2012) [4].

Table 1: Influence of seed treatment and foliar spray of iron and zinc on cob length, cob girth and cob weight of sweet corn

Treatments	Cob length (cm)			Cob girth (cm)			Cob weight (g)			Fresh cob yield (q ha^{-1})		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T_1	19.4	19.9	19.6	12.7	13.2	12.9	310.9	317.8	314.4	150.6	158.7	154.6
T_2	18.2	18.7	18.4	12.1	13.0	12.5	309.2	316.5	312.8	150.3	158.4	154.3
T_3	20.6	21.2	20.9	12.8	13.3	12.7	311.1	317.9	314.5	154.8	170.6	164.5
T_4	18.6	19.1	18.9	12.5	12.6	12.4	308.1	315.2	311.7	150.1	158.2	154.1
T_5	19.8	20.4	20.1	13.3	13.6	13.4	308.3	316.1	312.2	158.2	163.1	159.0
T_6-	18.1	18.6	18.3	14.7	13.3	13.1	311.4	319.0	315.2	160.2	168.7	164.5
T_7	21.6	22.2	21.9	14.8	13.7	13.6	305.4	312.8	255.8	157.7	166.4	162.1
T_8	18.8	19.4	19.1	13.9	13.0	12.8	311.4	318.6	315.0	160.0	169.0	164.5
T_9	19.8	20.4	20.1	14.5	13.6	13.4	308.6	315.6	312.1	157.5	165.7	161.6
T_{10}	24.2	22.5	23.7	14.8	13.7	13.6	312.8	320.6	316.7	168.2	179.0	173.6
T_{11}	20.2	20.8	20.5	12.2	13.7	13.5	306.8	314.3	310.6	157.6	169.7	163.9
T_{12}	24.4	25.1	24.8	15.7	15.5	15.3	316.4	323.1	319.8	174.6	184.0	179.3
T_{13}	17.9	18.5	18.2	11.8	12.4	12.1	241.5	246.7	244.1	146.1	154.0	150.1
S. Em (±)	1.15	1.13	1.20	0.31	0.41	0.58	1.21	0.89	1.06	5.16	5.03	4.08
C.D. @ 5%	3.42	3.34	3.60	0.95	1.20	1.75	3.65	2.68	3.20	15.1	14.7	11.9

Table 2: Influence of seed treatment and foliar spray of iron and zinc on number of seeds row^{-1}, number of seed rows cob^{-1} and days to 50% tasseling and days to 50% silking

Treatments	Number of seeds row^{-1}			No. of seed rows cob^{-1}			Days to 50% tasseling			Days to 50% silking		
	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled	2017	2018	Pooled
T_1	29.4	29.9	29.6	12.5	12.6	12.5	44.7	45.5	45.1	50.7	51.8	51.2
T_2	28.2	28.7	28.4	12.7	12.9	12.8	45.6	46.8	45.7	52.0	54.2	53.1
T_3	28.9	29.5	29.2	13.1	13.2	13.1	44.8	45.9	45.4	52.0	53.0	52.0
T_4	28.6	29.2	28.9	11.5	11.7	11.6	44.4	45.5	44.9	52.0	54.3	53.1
T_5	30.2	30.8	30.5	14.0	14.1	13.5	44.8	44.9	44.3	51.3	52.6	52.0
T_6	30.2	30.8	30.5	14.1	14.8	14.7	44.8	45.6	45.2	51.7	52.8	52.2
T_7	30.0	30.6	30.3	13.5	13.6	13.5	44.8	45.7	45.2	53.1	54.3	53.7
T_8	29.8	30.4	30.1	13.2	13.3	13.3	44.8	45.7	45.2	51.6	53.9	52.2
T_9	28.8	29.4	29.1	13.5	13.6	12.1	45.7	44.6	44.1	53.1	54.5	53.8
T_{10}	30.6	33.3	31.9	15.2	15.3	15.2	45.4	46.5	45.1	50.2	51.4	50.8
T_{11}	29.8	30.4	30.1	12.9	13.0	12.9	45.6	46.4	46.0	53.4	54.7	54.1
T_{12}	35.2	35.9	35.6	16.0	16.1	16.0	44.6	43.4	44.0	48.6	49.8	49.2
T_{13}	28.1	28.6	28.4	11.9	12.0	11.9	44.7	45.8	45.6	53.6	54.7	54.1
S. Em (±)	1.14	1.25	1.18	1.23	1.12	1.33	1.77	1.87	10.42	1.79	2.44	1.98
C.D. @ 5%	3.32	3.64	3.45	3.6	3.3	4.10	5.18	5.47	30.4	NS	NS	NS

Table 3: Influence of seed treatment and foliar spray of iron and zinc on protein, reducing sugars and non reducing sugars composition of sweet corn seeds

Treatments	Protein content (mg g^{-1})			Reducing sugar (mg g^{-1})			Non reducing sugar (mg g^{-1})		
	Days after harvest			Days after harvest			Days after harvest		
	0	5	10	0	5	10	0	5	10
T_1	9.90	4.91	2.21	62.7	32.4	21.3	201.2	213.2	207.1
T_2	12.3	8.32	1.74	68.3	38.7	15.6	190.3	201.3	196.2
T_3	12.0	3.43	2.12	65.8	25.7	20.7	192.1	204.3	198.4
T_4	10.1	3.82	1.91	64.0	31.6	20.0	172.1	182.3	177.3
T_5	12.2	3.32	1.79	66.3	32.1	19.0	214.0	227.1	221.5
T_6	12.6	5.00	2.31	56.6	34.9	23.3	230.3	244.2	237.4
T_7	11.9	3.03	1.61	65.3	31.3	13.3	191.4	202.0	197.6
T_8	11.6	5.19	1.95	59.0	21.2	17.6	224.6	238.5	231.4
T_9	12.1	3.13	1.59	54.6	30.7	12.6	197.2	209.1	203.5
T_{10}	12.8	6. 54	2.33	65.7	35.6	20.6	279.1	296.2	288.0
T_{11}	12.1	4.91	2.28	61.5	29.0	15.0	228.2	241.5	235.2
T_{12}	12.9	9.96	2.64	67.8	36.7	21.0	280.3	297.6	288.2
T_{13}	8.87	4.88	2.83	52.4	28.9	11.3	151.1	160.3	155.1
S. Em (±)	0.30	0.29	0.21	2.04	1.74	1.40	12.2	13.2	12.6
C.D. @ 5%	0.89	0.84	0.60	5.95	5.09	4.10	35.6	38.4	36.7

Table 4: Influence of seed treatment and foliar spray of iron and zinc on zinc and iron composition of sweet corn seeds

Treatments	Zinc (mg g^{-1})			Iron (mg g^{-1})		
	2017	2018	Pooled	2017	2018	Pooled
T_1	23.4	32.3	22.8	17.2	20.2	18.7
T_2	24.5	39.2	26.9	14.2	15.0	14.6
T_3	38.2	36.9	37.5	14.6	14.5	18.7
T_4	24.2	35.7	24.9	13.5	19.2	16.4
T_5	32.7	36.7	34.7	12.5	19.5	16.0
T_6	44.5	43.6	44.0	20.4	17.0	18.7
T_7	31.6	36.5	34.0	17.2	19.7	18.4
T_8	39.2	30.3	34.7	16.3	17.2	16.8
T_9	32.6	32.0	32.3	18.1	14.6	16.3
T_{10}	49.4	47.6	48.5	22.0	23.1	22.5
T_{11}	32.4	42.5	37.4	19.5	19.5	19.5
T_{12}	49.7	55.7	52.7	25.1	25.4	25.2
T_{13}	29.2	31.2	30.2	13.5	19.2	16.4
S. Em (±)	2.27	1.08	1.51	3.25	1.94	0.88
C.D. @ 5%	6.82	3.25	4.52	9.72	5.82	2.65

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