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Biofortification: Effect of Zn and Fe application on wheat genotypes in Bangladesh

M R Khan[1], A A Mahmud[2], M Jahiruddin[3], M A Tarafder[1], M H Rahman[1]

[1]Soil Scientist, Soil Science Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh
[2]Soil Scientist, RCRC Green Riyadh Project, KSA Dorsch Holding GmbH, Saudi Arabis
[3]Professor, Department of Soil Science, Bangladesh Agricultural University, Mymensingh, Bangladesh

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***Abstract*— *Biofortification of zinc (Zn) and iron (Fe) will be an important effort for the combat of malnutrition in Bangladesh. The experimental site was Bangladesh Agricultural University (BAU) farm to increase the Zn and Fe content in wheat grain. The design of the experiment was split-plot and replicated thrice. Ten varieties and seven advanced lines were tested under 3 treatments: control, Zn and Zn + Fe; for the study. For control plots, the grain Zn concentration varied from 20.3 – 30.5 µg g^{-1}, across the genotypes, with the highest performance by advanced line BAW 917 and the lowest performance by variety Sufi. The average grain Zn concentration over the 17 genotypes was noted as 26.3 µg g^{-1}. When Zn was applied to soil, the grain Zn concentration ranged from 29.1 - 40.9 µg g^{-1} with a mean of 34.2 µg g^{-1}. The Fe content ranged from 20-35 µg g^{-1} with a mean of 30.5 µg g^{-1}. The protein content also increases due to the Zn application. The Zn application increase the Zn content in grain as well as increase the yield with protein content. Among the genotype, there are some potential varieties for biofortification.*

***Keyword*— Zinc, iron, grain yield and wheat.**

I. INTRODUCTION

One of the very important micronutrient is zinc (Zn) for both human as well as plant and insufficient availability become a global health issue now by covering half of total population in earth (Hotz and Brown 2004; Stein 2010). The zinc deficiency in human and soil is very near that overlap geographically (Alloway 2008; Cakmak 2008) and show that there are a very close relationship between soil, food crops and human (Welch 2008). The people with cereal based food habitant are mainly suffering from Zn deficiency (Cakmak 2008; Gibson 2006) as bioavailability of Zn is low in cereal (Cakmak et al. 2010a).

As reported in Bangladesh by Islam *et al.* (2013), around 60% Zn and 55% Fe is provided from cereals in daily consumption. Anemia is widespread in Bangladesh especially to children and women due to inadequate Fe uptake. Increasing cropping intensity from 143% in 1971-72 to 194% in 2015-16 (BBS, 2018) declining soil fertility resulted micronutrient deficiency in Bangladesh. Among the micronutrient, Zn deficit is the top complication for crop growth. This element deficiency in the country was identified in late 1970s (Jahiruddin *et al.*, 1981) and with advancement of time its extent has increased. In Bangladesh, about 70% of the arable land is found Zn deficit (Jahiruddin and Islam, 2014).

Biofortification means to prepend micronutrients to food crops by improving breeding lines as well as fertilization methods that will create a opportunity for the rural people to get food intake with Zn as they could not afford fortified foods (Bouis, 2013). In Bangladesh, "baby zinc" tablet developed by icddr'b (Brooks, 2005) reduced child mortality from diarrhoea.

Iron (Fe) is an essential plant nutrient and its deficiency causes chlorosis, nutritional disorder and reduces crop yield. It will be very important if Fe could be increased in main food crops which can reduce common deficiency among the general people (Cakmak, 2002). Micronutrient deficiency is now a big challenges for the world population specially Zn and Fe (WHO, 2007). The grain yield and grain Zn concentration generally found have inverse relationship between them (McDonald et al. 2008). This inverse relationship problem can be address by breeding, transgenic technology or agronomic approaches. To increase the micronutrients in food grain an combined approaches needs to undertaken by both breeding (Potential genotype) and fertilizer management approaches for mitigation of Zn insufficiency among the general people (Cakmak *et al.*, 2004). This experiment was undertaken to increase the Zn and Fe content in wheat grain by fertilizer application and variety selection.

II. MATERIALS AND METHODS

Experimental Site

The experiment site was Bangladesh Agricultural University farm (BAU), Mymensingh, Bangladesh (location: 24^0 42´ 56.04´´ N and 90^0 25´ 31.01´´ E) and the agro-ecological zones (AEZs-9) is namely Old Brahmaputra Floodplain (FRG, 2018). The physical and chemical properties of soil at experiment sites are present at Table 1.

Table 1 Soil physical and chemical characteristics of the experimental fields

Textural Class	OC (%)	pH	Total N (%)	Avail. P (mg kg^{-1})	Exch. K (cmol kg^{-1})	Avail. S (mg kg^{-1})	Avail. Zn (mg kg-^{1})	Avail. Fe (mg kg^{-1})
Silt loam	1.14	6.5	0.11	7.5	0.12	14.0	0.78	55.4

Treatments and design

In these experiments there were three treatments of zinc and iron viz. Zn_0Fe_0, Zn_3Fe_0 and Zn_3Fe_4; subscripts represent the dose nutrients in kg ha^{-1}. All other fertilizers like N, P, K, S and B were applied at $N_{120}P_{30}K_{50}S_{12}B_{1.5}$ kg ha^{-1} to the all plots. The split plot design was used and replicated thrice.

Crop and Soil Management

There were 10 varieties and 7 advanced lines of wheat were tested for grain Zn & Fe concentrations as well as grain yield. The wheat varieties and advanced line were: Shatabdi (V_1), Sufi (V_2), Bijoy (V_3), Prodip (V_4), BARI Gom 25 (V_5), BARI Gom 26 (V_6), BARI Gom 27 (V_7), BARI Gom 28 (V_8), BARI Gom 29 (V_9) and BARI Gom 30 (V_{10}), and Rawal 87 (L_1), Vijay (L_2), BAW 917 (L_3), Fery 60 (L_4), BL 1040 (L_5), KRLI-4 (L_6), BL 1883 (L_7). Wheat seeds were sown on 16 November 2016 and the crop was harvested on 12 March 2017. The mature harvested crops were threshed, cleaned and processed for chemical analysis.

Chemical analysis

The soil samples of the experimental site were collected following standard procedure and processed by air-drying, ground and sieving in a 2-mm sieve. The soil texture, soil pH, organic matter, total nitrogen, exchangeable potassium, available phosphorus, sulphur, zinc and iron were measured following standard methods.

Analysis of plant sample

The harvested grain sample was collected from each plot and were analysed for N, Zn and Fe concentrations. The collected samples were dried in an oven at 65°C for about 48 hours and then ground by grinding machine to pass through a 20-mesh sieve to obtain homogenous powder. The prepared plant samples were kept in paper bags into desiccators for further analysis for the determination of N, Zn and Fe content.

Statistical analysis

The statistical analysis of the different plant parameters as well as soil and plant analysis data was done through computer based program (Statistics 10) and was followed the basic principles, as outlined by Gomez and Gomez (1984). For the determination of analysis of variance (ANOVA) of the significant effects of treatments, genotypes and their interaction were compared at 5% level of significance by Duncan's Multiple Range Test (DMRT).

III. RESULTS

Biofortification of Zn in wheat grain

Zinc fortification in wheat grain differed due to the treatments as well as to the different genetic makeup. The Zn concentration of wheat grain varied significantly with the genotypes (varieties and breeding lines) and with the Zn & Fe fertilization.

Genotypic effects

Different Zn content are found among the genotype used in the experiment. The treatment T_1 (control plots) presents a wide range of Zn concentration where the grain Zn concentration varied from 20.3 - 30.5 µg g^{-1}, across the genotypes. The highest Zn concentration was found in two advanced lines BAW 917 and Vijoy (30.5 µg g^{-1}) whereas in variety Sufi obtained lowest (20.3 µg g^{-1}) zinc concentration. The average grain Zn concentration over the 17 genotypes was noted as 26.3 µg g^{-1} (Table 2)

Fertilizer effect

The Zn concentration of the different genotype varied significantly due to the zinc fertilizer application. In treatment T_2, the grain Zn concentration ranged from 29.1 - 40.9 µg g^{-1} and the highest concentration was found in advanced lines BAW 917 (40.9 µg g^{-1}) and the lowest Zn concentration was found in variety Shatabdi (29.1 µg g^{-1}). The average Zn concentration was found 34.2 µg g^{-1} (Table 3) and the highest increase in Zn concentration in advanced line BL1883 is 11.7 µg g^{-1} where as the lowest increase is 3.5 µg g^{-1} is found in variety BARI Gom 30. The mean increase in Zn concentration in treatment T_2 is 7.99 µg g^{-1} which is very noticeable.

Regarding treatment T_3 where both Zn and Fe was applied, the maximum increased of Zn concentration was obtained from variety Sufi is 12.2 µg g^{-1} and the lowest increase in Zn concentration was found in variety BARI Gom 29 that is 2.8 µg g^{-1} ,. The mean increase in Zn concentration in treatment T_2 is 7.54 µg g^{-1} which is also very noticeable.

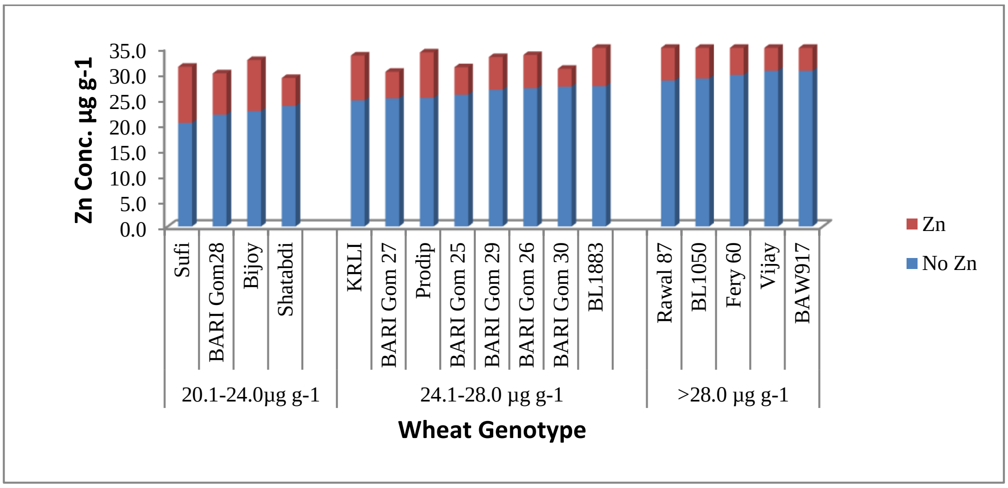

Fig. 1 Amount of zinc content of different wheat genotype

Table 2 Effects of Zn and Fe application on grain Zn concentrations (µg g^{-1}) of different genotypes of wheat

Genotypes	T_1 (Control)	T_2 (Zn)	T_3 (Zn + Fe)	T_2-T_1	T_3-T_1
V_1: Shatabdi	23.6 f-i	29.1 g	30.8 d	5.50	7.20
V_2: Sufi	20.3 i	31.3 d-g	32.5 cd	11.00	12.20
V_3: Bijoy	22.6 g-i	32.6 d-g	29.7 d	10.00	7.10
V_4: Prodip	25.2 d-h	34.1 cd	31.3cd	8.90	6.10
V_5: BARI Gom 25	25.8 c-g	31.2 d-g	31.1 cd	5.40	5.30
V_6: BARI Gom 26	27.1a-f	33.6 c-e	34.6 bc	6.50	7.50
V_7: BARI Gom 27	25.1 d-h	30.3 e-g	29.2 d	5.20	4.10
V_8: BARI Gom 28	21.9 hi	30.0 fg	31.7 cd	8.10	9.80
V_9: BARI Gom 29	26.8 b-f	33.2 c-f	29.6 d	6.40	2.80
V_{10}: BARI Gom 30	27.4 a-e	30.9 d-g	31.6 cd	3.50	4.20
L_1: Rawal 87	28.6 a-d	39.1 ab	37.8 ab	10.50	9.20
L_2: Vijay	30.5 a	37.6 ab	37.1 ab	7.10	6.60
L_3: BAW 917	30.5 a	40.9 a	39.3 a	10.40	8.80
L_4: Fery 60	29.7 ab	38.9 ab	36.9 ab	9.20	7.20
L_5: BL 1040	29.0 a-c	36.6 bc	38.2 a	7.60	9.20
L_6: KRLI-4	24.7 e-h	33.5 c-e	34.5 bc	8.80	9.80
L_7: BL 1883	27.5 a-e	39.2 ab	38.6 a	11.70	11.10
Max	**30.5**	**40.9**	**39.3**	**11.70**	**12.20**

Min	**20.3**	**29.1**	**29.2**	**3.50**	**2.80**
Mean	**26.3**	**34.2**	**33.8**	**7.99**	**7.54**

Genotypes V_1 - V_{10} represent varieties and L_1 - L_7 represent advanced breeding lines. Means followed by same letter in a column are not significantly different at 5 % level by DMRT.

Table 3 Effects of Zn and Fe application on grain Fe concentrations (µg g^{-1}) of different genotypes of wheat

Genotypes	T_1 (Control)	T_2 (Zn)	T_3 (Zn + Fe)	T_3-T_1
V_1: Shatabdi	26.5	27.9	33.2	6.70
V_2: Sufi	23.8	25.8	33.0	9.20
V_3: Bijoy	26.5	28.4	33.9	7.40
V_4: Prodip	24.0	23.4	30.5	6.50
V_5: BARI Gom 25	29.7	28.7	36.6	6.90
V_6: BARI Gom 26	24.7	26.3	31.9	7.20
V_7: BARI Gom 27	28.8	27.3	34.8	6.00
V_8: BARI Gom 28	23.9	26.5	33.4	9.50
V_9: BARI Gom 29	26.6	23.9	32.1	5.50
V_{10}: BARI Gom 30	23.7	26.5	32.7	9.00
L_1: Rawal 87	27.4	28.1	36.3	8.90
L_2: Vijay	29.4	28.9	37.5	8.10
L_3: BAW 917	25.7	28.0	36.1	10.40
L_4: Fery 60	27.5	29.8	36.6	9.10
L_5: BL 1040	28.3	31.8	39.7	11.40
L_6: KRLI-4	28.6	27.1	36.0	7.40
L_7: BL 1883	29.4	32.4	36.7	7.30
Max	**29.7**	**32.4**	**39.7**	11.40
Min	**23.7**	**23.4**	**30.5**	5.50
Mean	**26.7**	**27.7**	**34.8**	8.03

Genotypes V_1 - V_{17} represent varieties and L_1 - L_7 represent advanced breeding lines. Lettering was not done since the treatment effects were not significant.

Zinc efficiency of wheat genotypes

The increase in grain Zn concentrations of different wheat varieties and genotype differed in their response to Zn and Zn + Fe fertilization. Based on the % Zn efficiency [(Control Zn concentration / Treatment Zn concentration) x 100], the wheat genotypes could be classified into four groups (Fig. 2): inefficient (responsive to Zn application), moderately inefficient (moderately responsive), moderately efficient (moderately unresponsive) and efficient (unresponsive).

It is appearing that 2 genotype (variety Sufi and Bijoy) were found to be Zn inefficient (<70% Zn efficient), 8 genotype (2 varieties and 6 lines) moderately Zn inefficient (71-80% Zn efficient), 7 genotype (6 varieties and 1 line) moderately Zn efficient (81-90% Zn efficient) and no genotype are found Zn efficient (>90% Zn efficient). Varieties Shatabdi, BARI Gom 25, 26, 27, 29, and 30 are found moderately Zn efficiency with a advanced line Vijoy.

Thus, the results of two locations reveal that variety BARI Gom 26, breeding lines BAW, BL 1883 & BL 1040 were observed as commonly Zn efficient or moderately Zn efficient in which plots, Zn supplement was not done.

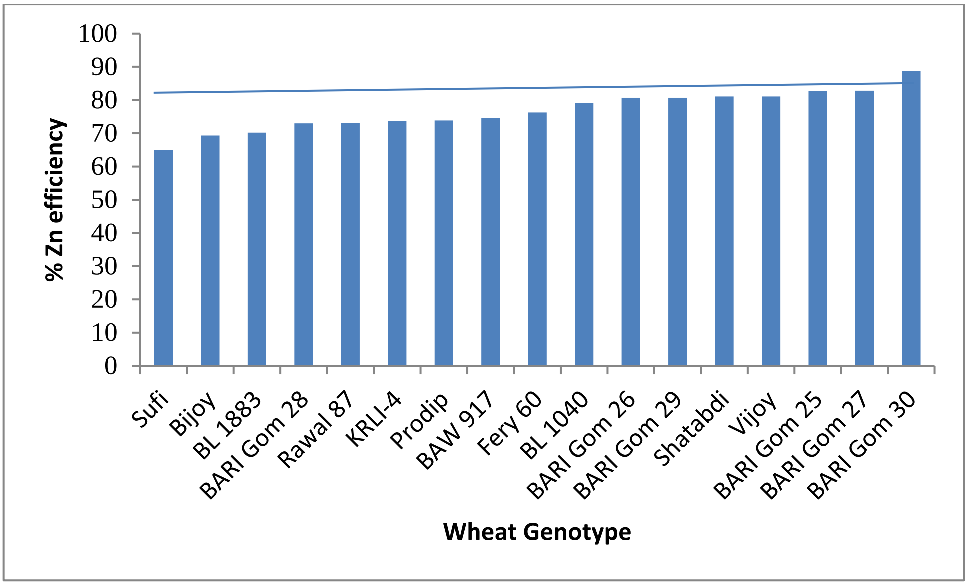

Fig. 2 Per cent Zn efficiency of different varieties and breeding lines of wheat genotype

Biofortification of Iron

The iron (Fe) was applied in treatment T_3 with the Zn fertilizer and result showed that the grain Fe concentration of 17 genotypes ranged from 23.7 - 29.7 µg g^{-1}, with the mean value of 26.7 µg g^{-1}. This result was obtained when Zn fertilizer was not used. The highest Fe concentration was found from variety BARI Gom 25 and variety BARI Gom 30 did the lowest. The grain Fe concentration increased by about 2 µg g^{-1} over Zn or Fe fertilized plots. In the Zn fertilized plots, the grain Fe concentration was found as 23.4 - 32.4 µg g^{-1}, mean 27.7 µg g^{-1} (Table 3). Among the Fe treated plots, the Fe concentration increased in all the genotypes and it ranged from 30.5 to 39.7 µg g^{-1} and the mean is 34.8 µg g^{-1}. The Fe concentration increased from 5.50 to 11.40 µg g^{-1} with a mean of 8.03 µg g^{-1} which is noticeable increment of Fe in wheat grain. The highest increase of Fe concentration was found from BL 1040 and BARI Gom 29 accumulated the lowest.

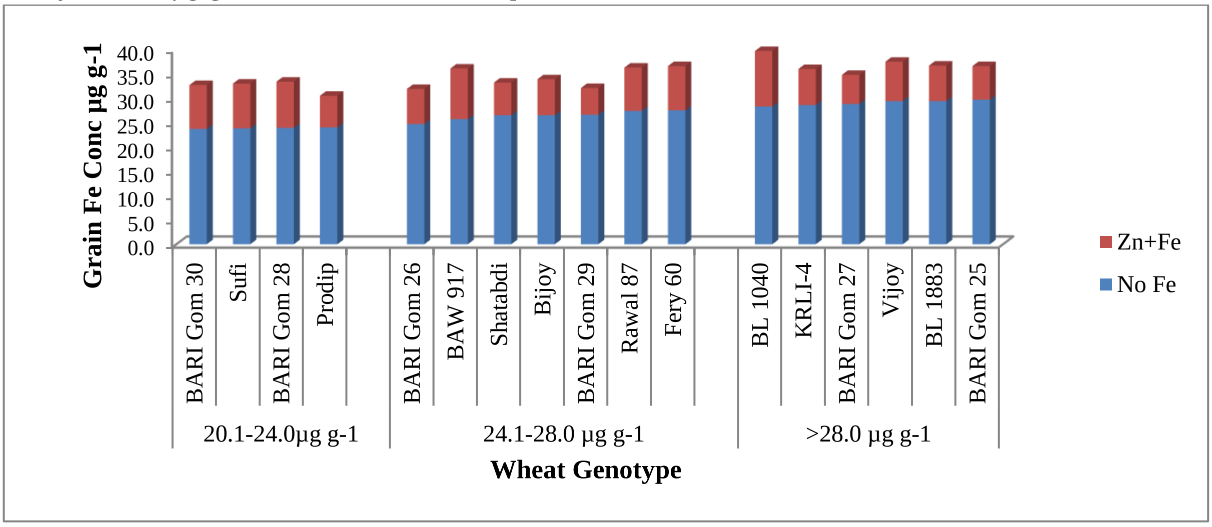

Fig. 3 Variation of iron concentration in grain of different wheat genotype

Protein content

The protein content of different varieties and advanced line are presented in Table 4.3. Obviously, the N concentration is considerably differed due to the genotype and has positively responded to the Zn fertilization. The effect of genotypes and Zn or Fe fertilization was the same for grain protein % since protein% was calculated as a multiple of 5.85 over grain N %.

The grain protein content of wheat, varied from 7.68 - 8.23%, the mean value being 7.91% (Table 4) when Zn or Fe fertilizer was not applied (control). Advanced line BL

1883 demonstrated the highest grain protein% and BAW 917 did the lowest.

The grain protein concentration of wheat, whether varieties or lines, markedly increased due to Zn fertilization; however, no effect was observed for Fe application. In Zn fertilized plots, the protein% varied from 8.67 - 9.87% with a mean of 9.14% and the Zn and Fe treatment plot lied between 8.78 - 9.69% with a mean of 9.02% (Table 4). This result indicates that Zn has influence on protein synthesis and plants take up these two elements (N and Zn) at a proportionate amount. The average increase in protein percentage is 1.23% when Zn fertilization was done.

Table 4 Effects of Zn and Fe application on protein content on grains of wheat genotypes

Genotypes	**T_1 (Control)**	**T_2 (Zn)**	**T_3 (Zn+Fe)**	**T_2 -T_1**	**T_3 –T_1**
V_1: Shatabdi	7.80	9.59	9.52	1.79	1.72
V_2: Sufi	7.74	9.01	9.20	1.27	1.46
V_3: Bijoy	7.98	9.32	9.03	1.35	1.05
V_4: Prodip	7.82	9.13	8.99	1.31	1.17
V_5: BARI Gom 25	8.17	9.87	9.69	1.70	1.52
V_6: BARI Gom 26	8.00	9.48	9.24	1.48	1.25
V_7: BARI Gom 27	8.11	9.56	9.52	1.44	1.40
V_8: BARI Gom 28	7.92	9.79	9.46	1.87	1.54
V_9: BARI Gom 29	8.00	9.48	9.17	1.48	1.17
V_{10}: BARI Gom 30	8.21	9.77	8.97	1.56	0.76
L_1: Rawal 87	7.76	8.93	8.85	1.17	1.09
L_2: Vijay	8.23	9.42	9.46	1.19	1.23
L_3: BAW 917	7.68	8.76	8.89	1.07	1.21
L_4: Fery 60	8.15	8.89	8.78	0.74	0.62
L_5: BL 1040	8.11	9.32	8.93	1.21	0.82
L_6: KRLI-4	8.60	9.48	9.63	0.88	1.03
L_7: BL 1883	8.23	9.77	9.38	1.54	1.15
Max	**8.23**	**9.87**	**9.69**	**1.87**	**1.72**
Min	**7.68**	**8.67**	**8.78**	**0.74**	**0.62**
Mean	**7.91**	**9.14**	**9.02**	**1.23**	**1.10**

Grain yield

Different varieties has different grain yield normally due to its difference of genetic potential. The varieties and advanced lines of wheat used in this study have produced different yield and there are variation of grain yield of wheat genotypes varied with varieties and breeding lines as well as fertilization.

Genotype effect

The grain yield of wheat generally varied with varieties and breeding lines which can be attributed to differences in genetic make-up. The grain yield does not have wide variation and ranged from 3.37 - 3.90 t ha^{-1}, the mean yield being 3.59 t ha^{-1} (Table 5). The highest grain yield (3.90 t ha^{-1}) was obtained from variety BARI Gom 30 and very close yield was given by BARI Gom 26, Fery 60 and BL1883. Among the tested genotypes, BARI Gom 28 performed the lowest yield (3.37 t ha^{-1}) and similar yield was demonstrated by Prodip and Sufi. The average yield over the 17 genotypes was found 3.59 t ha^{-1}.

Fertilizer effect

The grain yield positively responded to Zn fertilization over the varieties (Table 5). The BARI Gom 30 obtained the maximum yield (4.65 t ha^{-1}) followed by BARI Gom 26 (4.57 t ha^{-1}). Regarding at the % yield increase, it ranged from 9.22 - 27.40% having the best response by advanced line Bijoy and least response by KRLI-4. The BARI Gom 30 exhibited the highest yield (4.65 t ha^{-1}) due to Zn fertilization. The mean yield across the genotypes was 4.19 t ha^{-1} showing 0.6 t ha^{-1} higher over control yield. Virtually the yield remained unaffected by Fe fertilization.

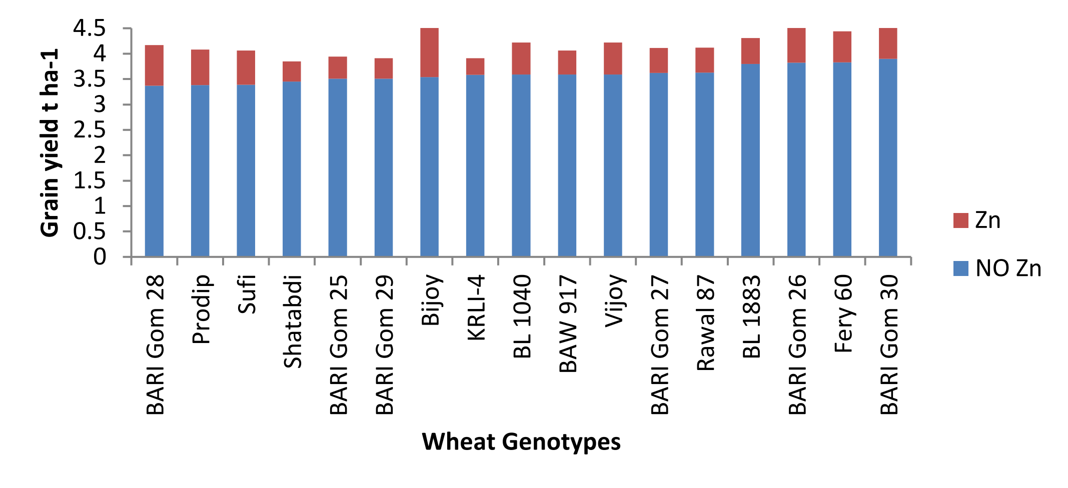

Fig. 4 Variation in grain yield of different genotypes of wheat

Table 5 Effects of Zn and Fe application on grain yield (t ha^{-1}) of wheat genotypes

Genotypes	**T_1 (Control)**	**T_2 (Zn)**	**T_3 (Zn+Fe)**	**% Increase of T_2**	**% Increase of T_3**
V_1: Shatabdi	3.45	3.85	3.90	11.59	13.04
V_2: Sufi	3.39	4.06	3.85	19.76	13.57
V_3: Bijoy	3.54	4.51	4.17	27.40	17.80
V_4: Prodip	3.38	4.08	3.99	20.71	18.05
V_5: BARI Gom 25	3.51	3.94	3.66	12.25	4.27
V_6: BARI Gom 26	3.82	4.57	4.40	19.63	15.18
V_7: BARI Gom 27	3.62	4.11	3.98	13.54	9.94
V_8: BARI Gom 28	3.37	4.17	3.71	23.74	10.09
V_9: BARI Gom 29	3.51	3.91	4.03	11.40	14.81
V_{10}: BARI Gom 30	3.90	4.65	4.68	19.23	20.00
L_1: Rawal 87	3.63	4.12	4.22	13.50	16.25
L_2: Vijay	3.59	4.22	4.35	17.55	21.17
L_3: BAW 917	3.59	4.06	4.12	13.09	14.76
L_4: Fery 60	3.83	4.44	3.92	15.93	2.35
L_5: BL 1040	3.59	4.27	4.22	18.94	17.55
L_6: KRLI-4	3.58	3.91	4.11	9.22	14.80
L_7: BL 1883	3.80	4.31	4.40	13.42	15.79
Max	**3.90**	**4.65**	**4.68**	**27.40**	**21.17**
Min	**3.37**	**3.85**	**3.66**	**9.22**	**2.35**
Mean	**3.59**	**4.19**	**4.10**	**16.52**	**14.08**

Genotypes V_1 - V_{10} represent varieties and L_1 - L_7 represent advanced breeding lines. Lettering was not done since the treatment effects were not significant.

IV. DISCUSSIONS

The existing wheat cultivars are not able to fulfill the Zn requirement for people in Bangladesh. Agronomic biofortification can solve this problem immediately which will be sustainable and easy adoptable to decipher Zn insufficiency in cereals (Qamar *et al*. 2017). The Zn concentration of wheat grain markedly increased due to Zn fertilization showing an increment of 3.5 - 11.7 µg g^{-1} Zn across the 17 genotypes used. Similarly, the grain Fe concentration had increased (5.5 - 11.4 µg g^{-1}) for the use of Fe fertilizer despite the fact that crop yield did not increase and further the experimental fields were not Fe deficient.

Some of the wheat varieties and breeding lines had potential of higher Zn accumulation and the Zn fertilization had an additive effect. The EDTA extractable Zn (0.78 mg kg^{-1}) was found low in the study location. The critical limit of Zn in Bangladesh soil is 0.60 mg kg-1 (FRG-2018). Yilmaz (1997) observed that Zn fertilization produced higher grain yield and increase the Zn concentration in grain as well in wheat and very crucial in soil where Zn is deficient (Cakmak, 2010). Duxbury *et al.* (2005) reported an elevated level of Zn, Cu and Mo in rice and wheat grains from their supplementary application.

The present study has screened out several varieties of wheat which have greater ability to uptake and accumulate Zn and Fe in grain, with a further possibility to enhance grain Zn concentration of wheat through Zn and Fe fertilization. Rawal 87, BL 1040, Vijoy & BAW 917 have been identified as Zn enriched breeding lines (>28.1 µg g^{-1} grain Zn. Virtually Fe fertilization did not influenced on Zn concentration in grain. Increment of grain Zn concentration due to Zn application is similar between varieties and lines tested. Findings from Cakmak (2010) showed that Zn concentration increased 11.7 (control) to 26.9 µg g^{-1} by Zn application.

Zinc fertilization depending on the varieties increased wheat yield by 9.2 - 27.4%. The grain yield differed with genotypes which can be attributed to differences in genetic make-up. Response of wheat yield to Zn application is much evidenced in Bangladesh and India (Khan *et al.*, 2009, Prasad *et al.*, 2010; Singh *et al.*, 2012). Numerous studies have shown pronounced increase in grain yield (9–256%) and grain Zn concentration (9–912%) of wheat with Zn application to Zn deficient soils (Rafique *et al.*, 2006; IZA, 2009).

The results showed that Fe concentration of wheat grain generally increased for Fe fertilization, the increment being on an average 6-12 µg g^{-1}. The grain Fe concentrations of different varieties have been divided into four groups with an interval of 4 µg g^{-1} Fe: <20 µg g^{-1} Fe, 20.1 - 24 µg g^{-1} Fe, 24.1 - 28 µg g^{-1} Fe and >28 µg g^{-1} Fe. Similar to classification of grain Zn concentration, not all the grain Fe concentration of the same genotypes fell into the same class between two locations. This variation could be due to varied soil and climatic conditions.

Genetic biofortification together with agronomic approach extends a good possibility of development of new cultivars more efficient in accumulating minerals in the edible part (Mingotte *et al.*, 2018). Agronomic biofortifcation with Zn can provide a practical and cost-effective option to tackle the global Zn malnutrition problem (Cakmak and Kutman, 2018).

V. CONCLUSION

Some varieties and breeding lines of wheat have genetically greater ability to uptake and accumulate Zn and Fe in grain. It is possible to enhance further Zn and Fe level by their fertilization. Varieties BARI GOM 25, 27, 28 & 29 are identified as Zn enriched varieties, having 24 - 30 µg g^{-1} Zn in grain. Concerning Fe biofortification, Shatabdi, Prodip, BARI GOM 25 & 28 and Sufi are identified as Fe enriched varieties (24 - 30 µg g^{-1}). These genotypes would serve as breeding materials for biofortification of Zn & Fe in wheat, without compromising crop yield. Genetic biofortification coupled with agronomic approach (fertilization) would help develop of new cultivars of wheat that would have ability to accumulate Zn and Fe in grain.

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