Effect Of Foliar Application Iron Fertilizers On Nutrients Concentration Of Wheat Grain

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ABSTRACT: A field trail was conducted to evaluate the efficacy of foliar application of iron on nutrient availability in wheat grain. The plot design was RCBD with three replications and eight treatments. T1: Control (without fertilizer), T2: Control (with RDF), T3: RDF+ FeSO4 + Urea (at flowering stage), T4: RDF + FeSO4 (at flowering stage), T5: RDF + FeSO4 + Urea (at milking stage), T6: RDF+ FeSO4 (at milking stage), T7: RDF+ FeSO4 + Urea (at pre-maturity), T8: RDF + FeSO4 (at pre-maturity). After harvesting, estimation of nutrients in grain revealed that for most of the nutrients application of Fe at flowering and miliking stage has great impact on increased nutrients in grain.

Keywords: Foliar application, Iron, RCBD, Treatments, Wheat.

1. INTRODUCTION

Wheat is the one of extremely essential cereal crop that's grown-up across vary of environments around the world. There are several species of wheat that raise along the genus *Triticum* and therefore the extremely wide grown-up is wheat (*T. aestivum*). Wheat is additionally referred to as the “King of cereals” from hundreds of years and it retain’s the pride till now. The quantity foodstuff consumed directly by kinsfolk is wheat and it's calculable that over (35%) percent of the planet people depends on wheat, because it provides additional nutrients not ably, essential amino acids than the other single crop. It's been a staple food with the extent of consumption for the most part unaffected by changes in its costs and therefore the value of alternative crops like rice, maize and millets. Wheat is that the second extremely essential crop in Asian country next to rice. The micronutrients play a necessary role in rising crop yield. Deficiency of iron is a growing health concern within the developing world and liable for numerous of health complications as well as anaemia and impairments in system Welch and Graham (2004). It's calculable that regarding 1/2 the planet population is affected from iron deficiency downside. Major reason for widespread incidence of iron deficiency in human populations is extremely very little dietary diversity and high consumption of cereal-based foods with very low amount and poor availableness of iron Bouis (2003), Welch and Graham (2004). Rising concentration and bioavailability of iron in commonly-eaten food crops is, therefore, an enormous international challenge and a necessary public health issue. Numerous methods are accessible to alleviate iron deficiency downside globally. Among these methods, agricultural methods like plant breeding (e.g., genetic biofortification) and science approaches (e.g., fertilization) appear to be extremely cost-efficient and simply applicable within the developing world Cakmak (2008). Therefore, present study was aimed to investigate the effect of foliar application of Fe on availability of other nutrients in wheat grain.

2. MATERIALS AND METHODS

To evaluate the efficacy of foliar application of iron on nutrient uptake by wheat grain a field experiment was conducted with eight different treatments i.e. . T1: Control (without fertilizer), T2: Control (with RDF), T3: RDF+ FeSO4 + Urea (at flowering stage), T4: RDF + FeSO4 (at flowering stage), T5: RDF + FeSO4 + Urea (at milking stage), T6: RDF+ FeSO4 (at milking stage), T7: RDF+ FeSO4 + Urea (at pre-maturity), T8: RDF + FeSO4 (at pre-maturity). Thee replication of each treatments was used and experiment was carried out with Randomized Block Design. After Harvesting grains were collected from each treatments and further analyzed.

Estimation of nutrients in grains

For estimation of nutrient was done by using (ICP-MS) method. Liquid samples are ordinarily processed and after that reconstituted in a watery framework to settle components as an ionic arrangement. The framework normally contains 2% nitric acid, and may have 0.5% hydrochloric acid added to settle certain components. The last piece of any framework is exceedingly reliant on the idea of the analyses being estimated. Liquids can be examined legitimately without disintegration utilizing a standard ICP-MS presentation pack-gave the TDS (complete broke down solids) level is beneath 0.5%. Over this dimension, the TDS may encourage in the nebulizer or over-burden the plasma, both of which adjust the manner in which the sample is prepared in the plasma. This can result in an information accumulation issue called float. Specific nebulizers and splash chambers might be required to neutralize float; all the more usually, test weakening is performed. Natural liquid samples can be dissected in the sample with minor alterations to the ICP-MS framework. For the most part, a littler injector and platinum tipped cones are utilized, and oxygen is added to the plasma to counteract carbon affirmation and flag float.

Statistical analysis

All data tabulated according treatment wise under three replications. To develop ANOVA table was done data entry while has rejected the null hypothesis. For identify most efficient treatment applied Duncan Multiple Range Test (DMRT) and mean separation technique. Regarding software programs Ms Word 2010 used for processing and Ms Excel used for making graphs and tables. For running statistical analysis used IBM SPSS 22 licence. ANOVA was done for test significance difference for each parameter. Calculation has done 5 per cent significant level.

3. RESULTS AND DISCUSSION

Effect of foliar spray of iron on phosphorus content in grains (g kg^{-1})

Phosphorous concentration in grain was determined and presented in figure 1.There was no significant difference reported among treatments. In this experiment the phosphorus range in grain samples was 2.66 to 3.18 g kg^{-1}. The highest amount of total phosphorus was obtained is 3.18 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage), followed by 3.01 g kg^{-1} T7: RDF+ FeSO4 + Urea (at pre-maturity), T6: RDF+ FeSO4 (at milking stage) and T8: RDF + FeSO4 (at pre-maturity) had same amount of total phosphorus that is 2.81 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) 2.66 g kg^{-1}. Phosphorus uptake in the grains were increased by the application of iron but not significantly. However results from Jatav (2004) showed that iron application help in the increase of phosphorus.

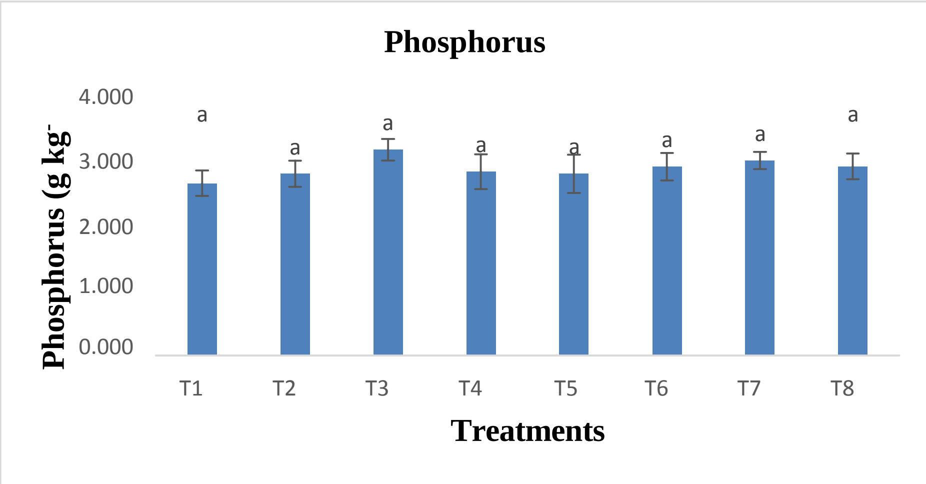

Fig. 1 Effect of foliar spray of iron on phosphorus content in grains (g kg^{-1})

Effect of foliar spray of iron on potassium content in grains (g kg^{-1})

Potassium concentration in grain was determined and presented in figure 2. There was no significant difference reported among treatments.In this experiment the potassium range in grain samples was 3.09 to 3.94 g kg-1. The highest amount of total potassium was obtained is 3.94 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage), followed by 3.87 g kg^{-1} T7: RDF+ FeSO4 + Urea (at pre-maturity), T6: RDF+ FeSO4 (at milking stage) 3.86 g kg^{-1}, T5: RDF + FeSO4 + Urea (at milking stage) 3.79 g kg^{-1}, T2: Control (with RDF) 3.69 g kg^{-1}, T4: RDF + FeSO4 (at flowering stage 3.59 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) 3.09 g kg-1. There was significant increase in the treatments as compared to control treatment.

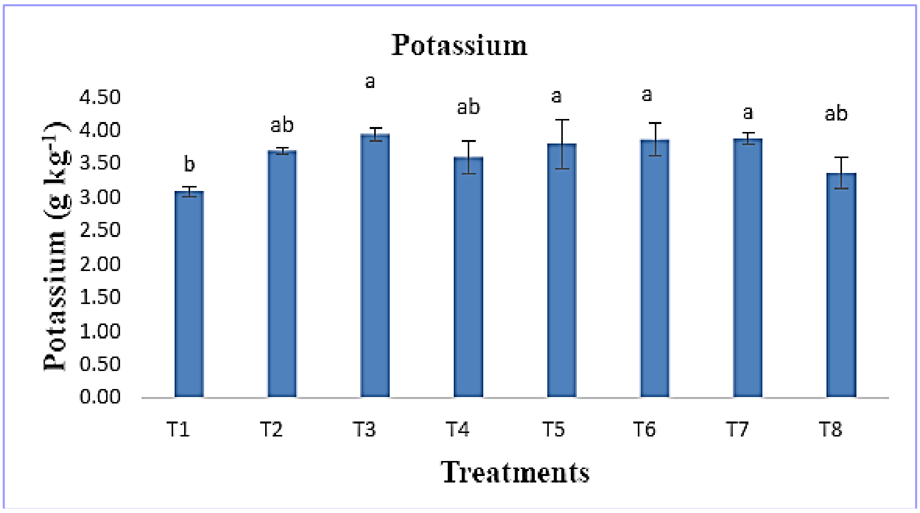

Fig. 2 Effect of foliar spray of iron on potassium content in grains (g kg^{-1})

Effect of foliar spray of iron on iron content in grains (g kg^{-1})

Iron concentration in grain was determined and presented in figure 3. There was no significant difference reported among treatments. In this experiment the total iron range in grain samples was 0.124 to 0.177 g kg^{-1}. There was no significant increase in all treatments as compared to control. The highest amount of total iron was obtained is 0.177 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage), followed by T5: RDF + FeSO4 + Urea (at milking stage) 0.165 g kg^{-1}, T7: RDF+ FeSO4 + Urea (at pre-maturity) 0.156 g kg^{-1}, T4: RDF + FeSO4 (at flowering stage 0.153 g kg^{-1} T6: RDF+ FeSO4 (at milking stage) 0.148 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) and T2: Control (with RDF) that is 0.124 and 0.131 g kg^{-1} respectively.

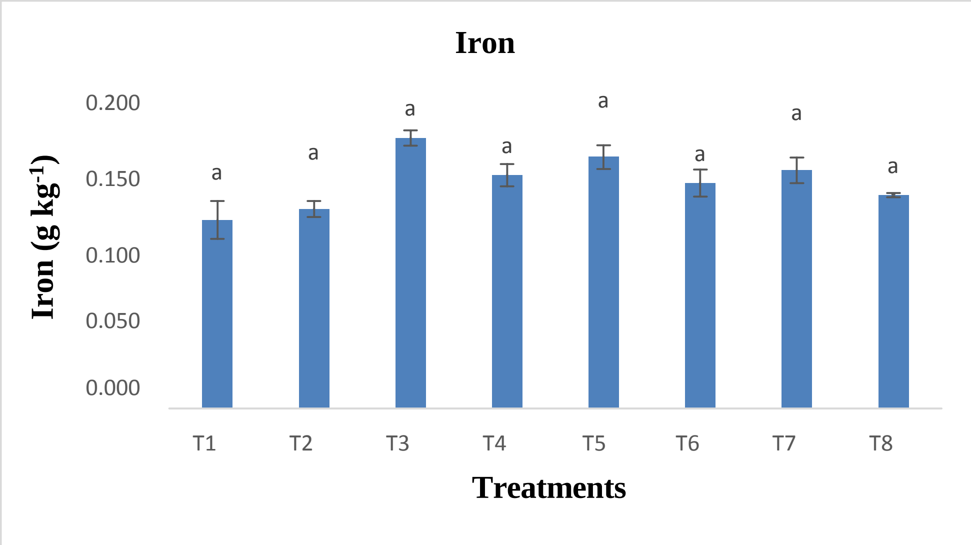

Fig. 3 Effect of foliar spray of iron on iron content in grains (g kg^{-1})

Effect of foliar spray of iron on zinc content in grains (g kg^{-1})

Zinc concentration in grain was determined and presented in figure 4. There was no significant difference reported among treatments. In this experiment the zinc range in grain samples was 0.033 to 0.038 g kg^{-1}. The highest amount of total zinc was obtained is 0.388 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage), T4: RDF + FeSO4 (at flowering stage) and T5: RDF + FeSO4 + Urea (at milking stage). T2: Control (with RDF), T6: RDF+ FeSO4 (at milking stage), T7: RDF+ FeSO4 + Urea (at pre-maturity) T8: RDF + FeSO4 (at pre-maturity) has having same amount of total zinc in grain samples that is 0.037 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) is 0.033 g kg^{-1}. There are few studies which supports the results that there is no direct influence of Fe application on Zn. The results found in present study were non-significant in zinc concentration. However the few results were not in favor of present study they reported that there was significant increase in zinc content by the application iron and boron Rawashdeh (2015).

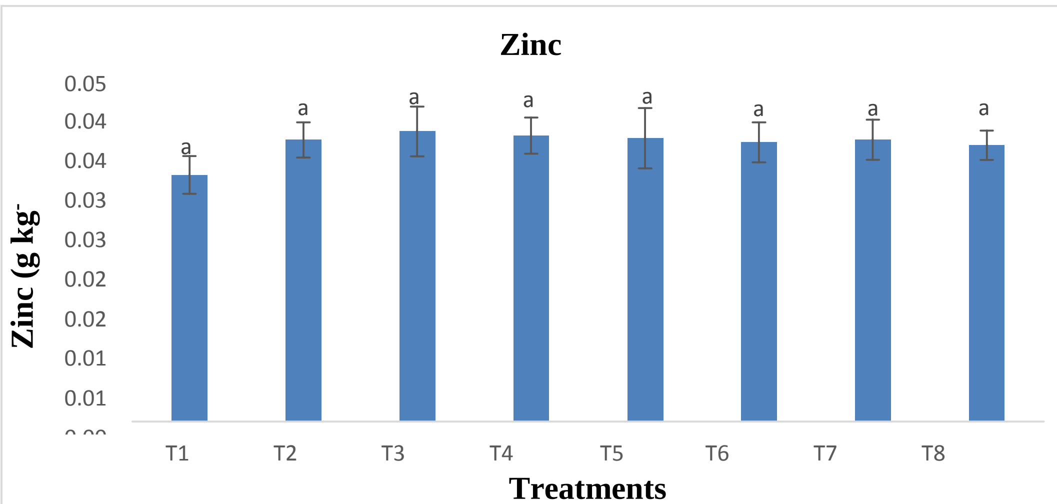

Fig. 4 Effect of foliar spray of iron on zinc content in grains (g kg^{-1})

Effect of foliar spray of iron on sulphur content in grains (g kg^{-1})

Sulphur concentration in grain was determined and presented in figure 5. There was no significant difference reported among treatments. In this experiment the sulphur range in grain samples was 1.258 to 1.554 g kg^{-1}. The highest amount of total sulphur was obtained is 1.554 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage), followed by T5: RDF + FeSO4 +Urea (at milking stage)1.543 g kg^{-1}, T7: RDF+ FeSO4 + Urea (at pre-maturity) 1.533 g kg^{-1}, T6: RDF+ FeSO4 (at milking stage) 1.499 g kg^{-1}, T4: RDF + FeSO4 (at flowering stage) 1.496 g kg^{-1}, T8: RDF + FeSO4 (at pre-maturity) 1.420 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) and T2: Control (with RDF) that is 1.258 and 1.365 g kg^{-1} respectively.

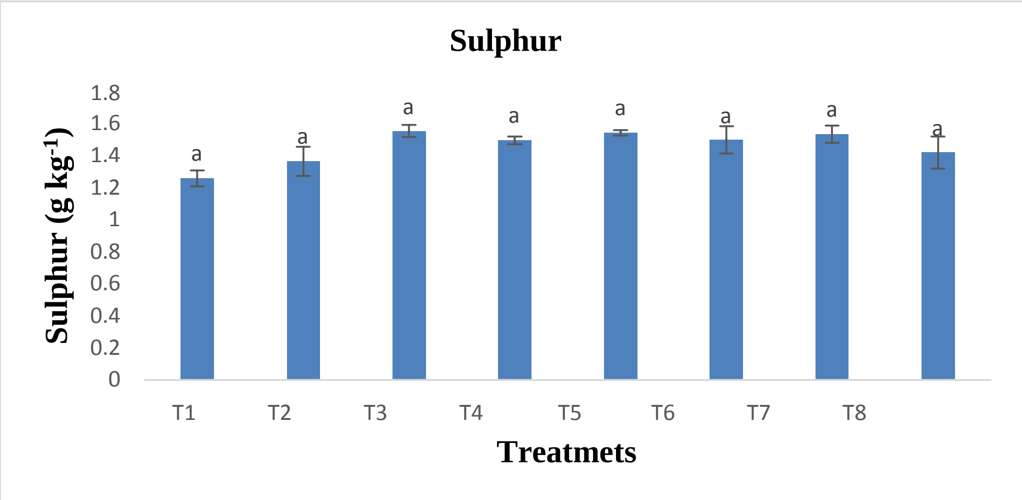

Fig. 5 Effect of foliar spray of iron on sulphur content in grains (g kg^{-1})

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The past studies revealed that the iron and nitrogen foliar spray helps in the uptake of sulphur and also increase the sulphur content in the grain. Ravi *et al.*, (2010) reported that there was positive influence of iron foliar spray in grains.

Effect of foliar spray of iron on copper content in grains (g kg^{-1})

Copper concentration in grain was determined and presented in figure 6. There was no significant difference reported among treatments. In this experiment the copper range in grain samples was 0.010 to 0.012 g kg^{-1}. The highest amount of total copper was obtained is 0.012 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage) and T5: RDF + FeSO4 + Urea (at milking stage). T2: Control (with RDF), T4: RDF + FeSO4 (at flowering stage), T6: RDF+ FeSO4 (at milking stage), T7: RDF+ FeSO4 + Urea (at pre-maturity) T8: RDF + FeSO4 (at pre-maturity) has having same amount of total copper in grain samples that is 0.011 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) is 0.010 g kg^{-1}. The results found in present study was non-significant in copper concentration. The results were in support to present study that there was no effect of iron foliar spray on the copper concentration Jatav (2004), revealed that there was decrease in copper concentration when there was increase in the iron level.

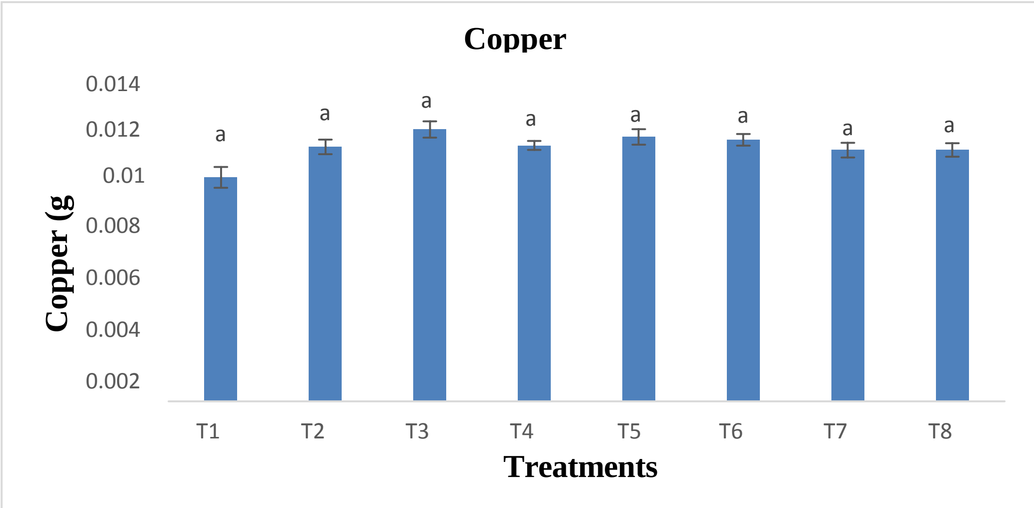

Fig. 6 Effect of foliar spray of iron on copper content in grains (g kg^{-1})

Effect of foliar spray of iron on calcium content in grains (g kg^{-1})

Calcium concentration in grain was determined and presented in figure 7. There was no significant difference reported among treatments. In this experiment the calcium range in grain samples was 1.059 to 1.669 g kg^{-1}. The highest amount of total calcium was obtained is 1.669 g kg^{-1} in T3: RDF+ $FeSO_4$ + Urea (at flowering stage), followed by T5: RDF + $FeSO_4$ + Urea (at milking stage)1.644 g kg^{-1}, T7: RDF+ $FeSO_4$ + Urea (at pre-maturity) 1.526 g kg^{-1}, T4: RDF + $FeSO_4$ (at flowering stage 1.504 g kg^{-1}, T6: RDF+ $FeSO_4$ (at milking stage) 1.466 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) and T2: Control (with RDF) that is 1.059 and 1.249 g kg^{-1} respectively. There was significant increase in the calcium content when iron and urea was applied by foliar spray as compared to control.

Similar results were recorded that different sources of iron and nitrogen application resulted in significant increase in calcium content in grain (Aciksoz *et al.*, (2011). The present study was favored by Rawashdeh (2015), they reported that there was significant increase in P content by the application iron and boron. There was significant increase in calcium content in all treatments as compared to control.

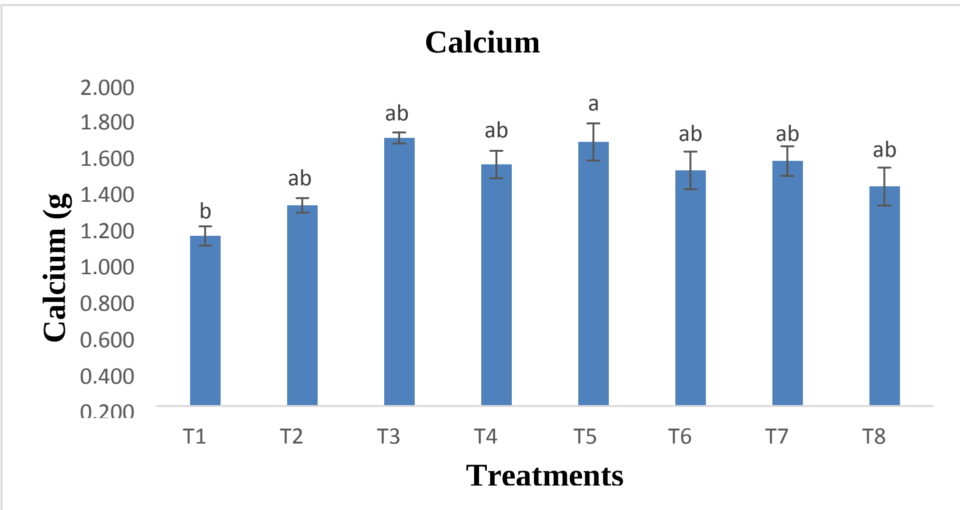

Fig. 7 Effect of foliar spray of iron on calcium content in grains (g kg^{-1})

Effect of foliar spray of iron on magnesium content in grains (g kg^{-1})

Magnesium concentration in grain was determined and presented in figure 8. There was no significant difference reported among treatments. In this experiment the magnesium range in grain samples was 1.227 to 1.577 g kg^{-1}. The highest amount of total magnesium was obtained is 1.577 g kg^{-1} in T3: RDF+ $FeSO_4$ + Urea (at flowering stage), followed by T5: RDF + $FeSO_4$ + Urea (at milking stage) 1.544 g kg^{-1}, T7: RDF+ $FeSO_4$ + Urea (at pre-maturity) 1.540 g kg^{-1}, T4: RDF + $FeSO_4$ (at flowering stage 1.521 g kg^{-1} T6: RDF+ $FeSO_4$ (at milking stage) 1.501 g kg^{-1}, T8: RDF + $FeSO_4$ (at pre-maturity) 1.508 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) and T2: Control (with RDF) that is 1.227 and 1.403 g kg^{-1} respectively.

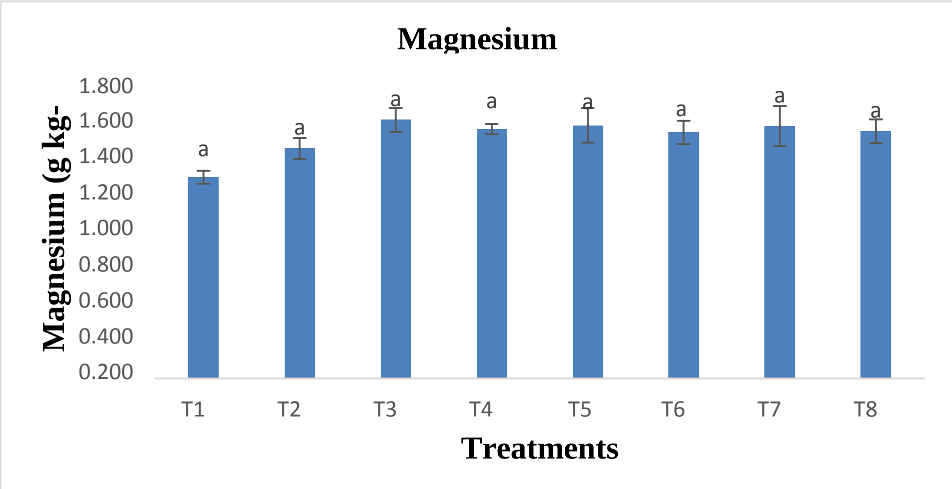

Fig. 8 Effect of foliar spray of iron on magnesium content in grains (g kg^{-1})

There are some studies reports that different sources of iron application resulted in significant increase in Mg content in grain (Aciksoz *et al.*, (2011). However the few results were not in favor of present study they reported that there was significant increase in magnesium content by the application iron and boron Rawashdeh (2015). There was no significant increase in magnesium content in all treatments including control.

Effect of foliar spray of iron on manganese content in grains (g kg^{-1})

Manganese concentration in grain was determined and presented in figure 9. There was no significant difference reported among treatments. In this experiment the manganese range in grain samples was 0.042 to 0.052 g kg^{-1}. The highest amount of total manganese was obtained is 0.052 g kg^{-1} in T3: RDF+ $FeSO_4$ + Urea (at flowering stage), followed by T5: RDF + $FeSO_4$ + Urea (at milking stage) 0.050 g kg^{-1}, T7: RDF+ $FeSO_4$ + Urea (at pre-maturity) 0.049 g kg^{-1}, T4: RDF + $FeSO_4$ (at flowering stage 0.049 g kg^{-1} T6: RDF+ $FeSO_4$ (at milking stage) 0.047 g kg^{-1}, T8: RDF + $FeSO_4$ (at pre-maturity) 0.047 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) and T2: Control (with RDF) that is 0.042 and 0.048 g kg^{-1} respectively. The results were in support to present study that there was no effect of iron foliar spray on the manganese concentration Jatav (2004), revealed that there was decrease in manganese concentration when there was increase in the iron level. However the few results were not in favor of present study they reported that there was significant increase in manganese content by the application iron and boron Rawashdeh (2015). The results found in present study was non-significant in manganese concentration **(**Kumar, P. (2019); Kumar, D., Rameshwar, S. D., & Kumar, P. (2019); Dey,

S. R., & Kumar, P. (2019); Kumar et al. (2019); Dey, S. R., & Kumar, P. (2019); Kumar, P., & Pathak, S. (2018); Kumar, P., & Dwivedi, P. (2018); Kumar, P., & Pathak, S. (2018); Kumar et al.,2018; Kumar, P., & Hemantaranjan, A. (2017); Dwivedi, P., & Prasann, K. (2016). Kumar, P. (2014); Kumar, P. (2013); Kumar et al. (2013); Prasann, K. (2012); Kumar et al. (2011); Kumar et al. (2014).

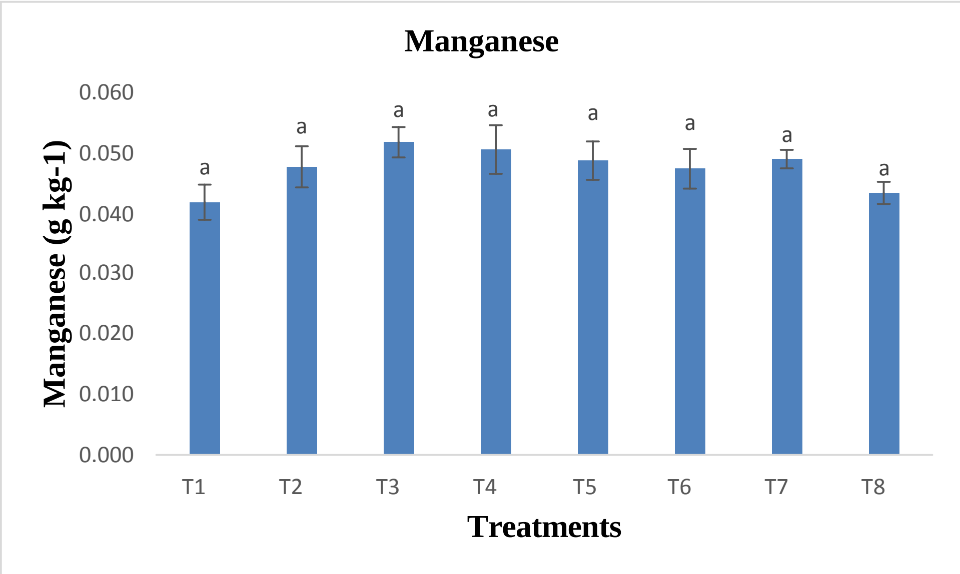

Fig. 9 Effect of foliar spray of iron on mangnese content in grains (g kg^{-1})

Effect of foliar spray of iron on boron content in grains (g kg^{-1})

Boron concentration in grain was determined and presented in figure 10. There was no significant difference reported among treatments. In this experiment the boron range in grain samples was 0.0041 to 0.0058 g kg^{-1}. The highest amount of total boron was obtained is 0.0058 g kg^{-1} in T3: RDF+ FeSO4 + Urea (at flowering stage), followed by T5: RDF + FeSO4 + Urea (at milking stage) and T7: RDF+ FeSO4 + Urea (at pre-maturity) 0.0054 g kg^{-1} had same amount of total boron in grain samples. T4: RDF + FeSO4 (at flowering stage 0.0051 g kg^{-1}, T6: RDF+ FeSO4 (at milking stage) 0.0049 g kg^{-1}, T8: RDF + FeSO4 (at pre-maturity) 0.0048 g kg^{-1}. The lowest value was obtained from T1: Control (without fertilizer) and T2: Control (with RDF) that is 0.0041 and 0.0048 g kg^{-1} respectively. There was significant increase in total boron content in treatments as compared to control in grains samples. Ahamad *et al.* (2009) reported the function of boron in plant relate to sugar transport, flower production, retention, pollen tube elongation, its germination and translocation of carbohydrate and sugars to reproductive organs, which in turn improved the spikelet number and fertility that influenced the yield and productivity. The present study was favored by Rawashdeh (2015), they reported that there was significant increase in boron content by the application iron and boron. difference of iron application (ChitraMani & Kumar, P. (2020); Sharma, M., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020); Naik, M., & Kumar, P. (2020); Kumar, P., & Naik, M. (2020); Kumar, P., & Dwivedi, P. (2020). Devi, P., & Kumar, P. (2020); Kumari, P., & Kumar, P. (2020); Kaur, S., & Kumar, P. (2020); Devi, P., & Kumar, P. (2020); Sharma, K., & Kumar, P. (2020); Kumar, S. B. P. (2020); Devi, P., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020).

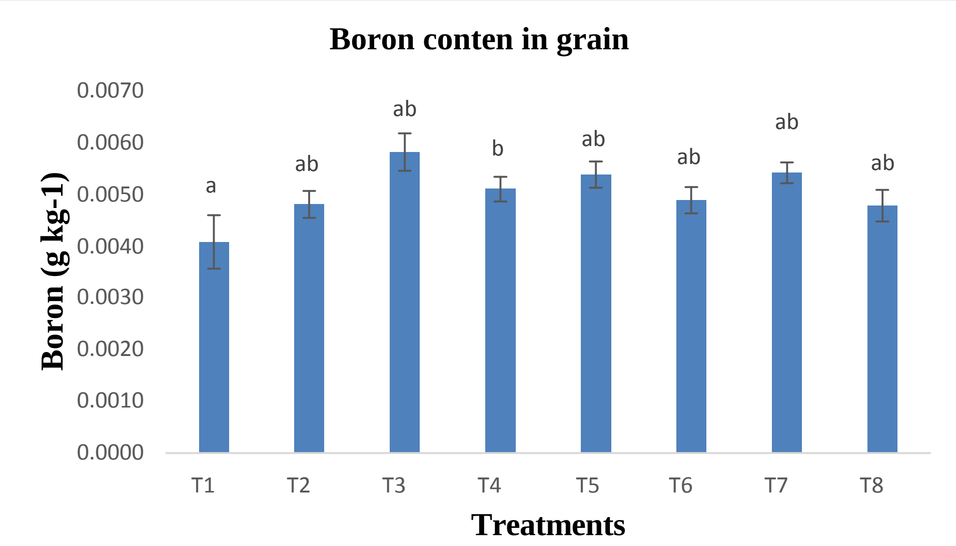

Fig. 10 Effect of foliar spray of iron on boron content in grains (g kg-1)

4. CONCLUSION

Overall analysis results showed that there was a minor change in nutrient content in grain after foliar application of Fe on wheat crop at different growth stages. However, more nutrient concentration was reported in the treatments where foliar application was done and flowering and miliking stages.

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