The Effect of Iron Fertilization Practice on Soybean Yield in an Iron-Deficient Prone Soil in South-Central Saskatchewan

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INTRODUCTION

- Iron (Fe) is an essential nutrient; involved in oxidation-reduction reactions associated with photosynthesis and respiration.
- As the amount of soybean acres increase, so do the reports of iron deficiency chlorosis (IDC), which can significantly reduce soybean yield and even lead to plant death in extreme cases.
- Despite having abundant soil Fe, a number of edaphic factors can decrease Fe availability to plants, including excessive carbonates, nitrate, alkalinity, salinity, and moisture (Kaiser et al., 2011).

OBJECTIVE

- Examine the ability of different Fe fertilizer rates, forms, and application methods to alleviate IDC in two soybean varieties differing in their sensitivity to IDC, in an IDC prone soil.

MATERIALS & METHODS

- The plots were located within a shallow depressional area in a farm field near Central Butte (Solonetzic Brown Chernozem); having E.C. 2.5 mS/cm, pH 7.6, and 20 NO_3^--N and 36 Fe mg/kg.
- A split-plot experimental design was used. Whole plots: IDC tolerant (McLeod) and sensitive (Moosomin) soybean varieties. Split-plots: six fertilizer Fe treatments varying in rate (0.1, 0.25, and 5 kg Fe/ha) and application method (seed-placed and foliar), along with a control (i.e., no fertilizer applied).
- Fertilizer N, P, K, and S also applied to prevent any deficiencies.
- Variables: soil Fe supply rate; soybean grain and straw yield.

RESULTS & DISCUSSION

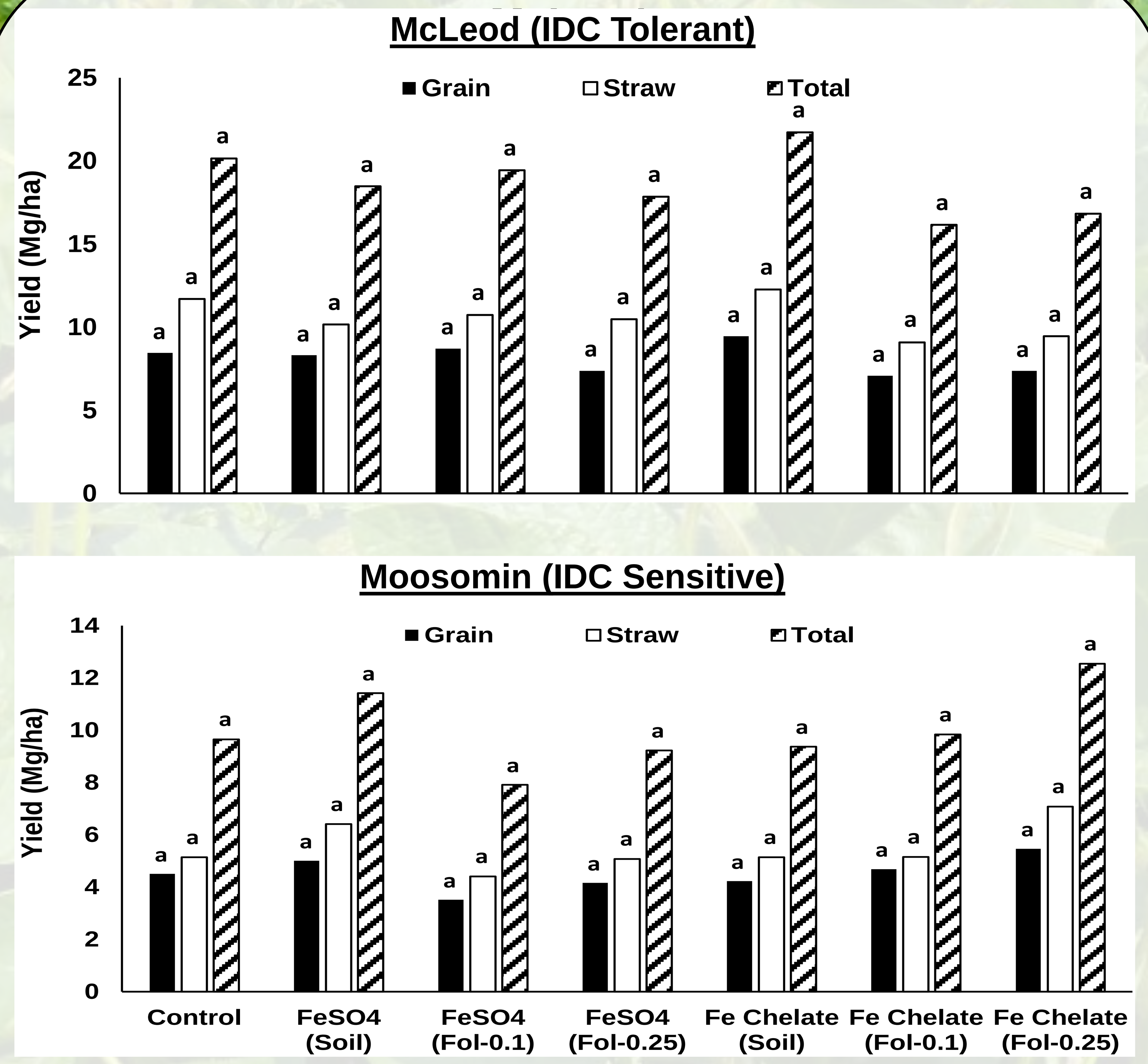

Figure 1. The effect of varying the rate, form, and application method of fertilizer Fe on the growth of two soybean varieties, differing in IDC sensitivity, within a field prone to IDC. The fertilizer Fe treatments included seed-placed Fe sulphate or chelated Fe (5 and 0.25 kg Fe/ha, respectively) or foliar application of Fe sulfate and chelated Fe at two different rates (0.1 kg and 0.25 kg Fe/ha). For each variety and variable, columns with the same letter are not significantly different (P >0.05) using LSD.

Table 1. ANOVA summary comparing the effect of varying the rate, form, and application method of fertilizer Fe on the growth of two soybean varieties (differing in their sensitivities to IDC), along with PRS™-probe Fe supply rate.

Effect	Grain Yield	Straw Yield	Total Yield	Straw:Grain	Soil Fe
			P-value		
Variety	**0.0239***	**0.0319**	**0.0274**	0.3235	0.4145
Treatment	0.6045	0.6749	0.6547	0.4521	0.1122
Variety*Treatment	0.1367	0.1730	0.1690	0.0609	0.2579

[a]Significant (*P* <0.05) effects are highlighted in bold.

- The lack of response in soybean growth and soil Fe availability to Fe fertilization (Fig. 1 and Table 1) is likely due to the atypically dry growing season conditions experienced *(i.e., May and June rainfall at the site was only 5% of the long-term average).*
- The IDC tolerant variety McLeod produced more grain and straw (80 and 92%, respectively) compared to IDC sensitive Moosomin (Fig. 1,Table 1) in all treatments; possibly reflecting differences in growth habit, maturity, and root morphology between varieties.

CONCLUSION

- Despite a favourable landscape position and soil conditions prone to IDC, the dry growing season, no flooding can explain lack of IDC development and no response to Fe fertilization.
- The best option for managing IDC risk on prone soils may be to seed a relatively IDC tolerant soybean variety, given the uncertainty about environmental conditions and potential for response to Fe fertilizers applied at seeding.

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