Time and Form of Zn Application Effect on Sugar Beet Growth Trend

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INTRODUCTION

Sugar beet is one of the twelve main crops and is becoming popular. Sugar products are cheap and have an important role in human nutrition. Nowadays, Zn application is recommended to increase yield quantity and quality. The most argued issue is time and method of Zn application.

The need of plants for microelements should be determined for every region (Havlin et al. 1999). Zn has an import role as promoter and catalyzer in enzymatic systems, as contributor in protein synthesis and denaturizing, and structurally. Zinc deficiency affects Ribonucleic Acid (RNA) synthesis and ribosome stability (Malakouti and Kalantari 1988). Chlorosis caused by Zn defieciency in the parenchyma of the leaf can lead to leaf death (Anonymous 2004). Foliar or soil applications may solve these problems. Zinc sulfate is recommended for alkaline soils instead of ZnO (Stevens et al. 2002).

METHODS

A factorial Randomized Complete Block Design (RCBD) with three Zn levels (control, $ZnSO_4$, complete micronutrient fertilizer including $ZnSO_4$ + $FeSO_4$ + $MnSO_4$ + $CuSO_4$ + BO_3 + N $ZnSO_4$) and three application methods (seed treatment, soil application and foliar application) with 3 replicates was used to evaluate their effects on Crop Growth Rate (CGR), Relative Growth Rate (RGR), Net Assimilation Rate (NAR), Leaf Weight Ratio (LWR) and Specific Leaf Area (SLA) of sugar beet. The foliar application consisted of a treatment at $5^0/_{00}$ at two growth stages (8-10 leaf and 14-16 leaf stage). After the foliar application, samples were collected every other week, and the desired parameters were measured. The sugar beet mono-germ cultivar 'Rasoul' was studied in this experiment.

RESULTS AND DISCUSSION

Results show that the soil application of Zn increased SLA and RGR at the end of the season, and LWR. Foliar applications caused leaf thinning, decreased SLA and increased LAR. The highest CGR and NAR with 22.76 g m^{-2} day^{-1} and $4.5*10^{-4}$ g cm^{-2} day^{-1}, respectively, were achieved with the seed treatment. This resulted in a 41.34% increase compared to the control (Fig. 1). Hence, soil application is not recommended because of an increase in leaf area and the development of new leaves. The foliar application decreased leaf diameter and lowered photosynthesis. The seed treatment with Zn resulted in higher growth, net assimilation and yield and, thus, is recommended. The complete micronutrient application was not more effective in all parameters than the $ZnSO_4$ application. There were some antagonistic effects among elements. The complete micronutrient treatment applied as foliar spray increased CGR by 16.61% compared to other treatments.

Altogether, foliar complete micronutrient application can be used to increase CGR and yield, and seed treatment with Zn can be applied to increase net assimilation and RGR (Fig. 2).

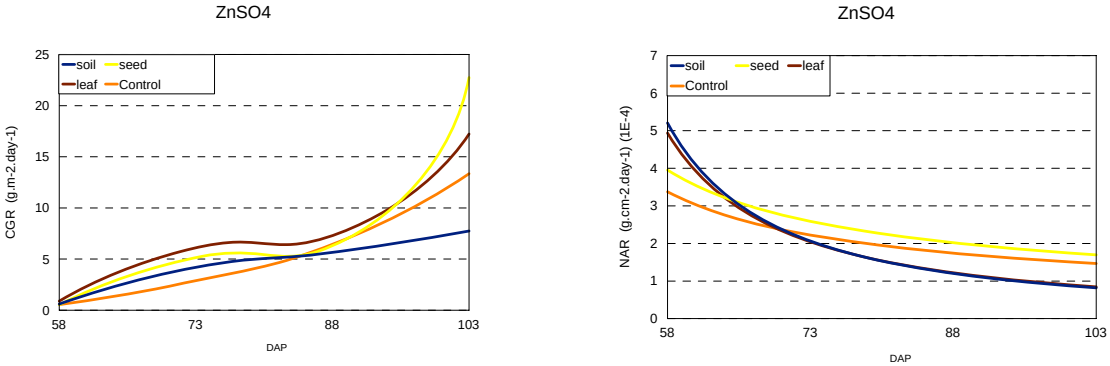

Fig. 1. Type and form of $ZnSO_4$ application on CGR and NAR.

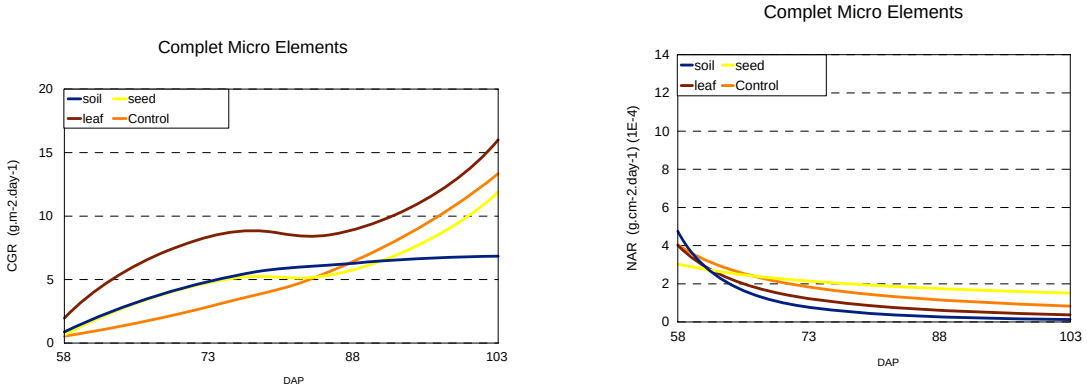

Fig. 2. Type and form of full fertilizer application on CGR and NAR.

REFERENCES

Anonymous (2004) Uptake of mineral nutrients from foliar (factors related to spray solution). Journal of Fruit and Ornamental Plant Research 12: 120-126.

Havlin, J.L., Beaton, J.D., Tisdale, S.L. and Nelson, W.L. (1999) Soil fertility and fertilizers, an introduction to nutrient management. Prentice – Hall, Inc.

Malakouti, M.J . and Kalantari, I. (1988) Yield increase and fortification of Wheat grains by composts, Fe chelate and ZnSo4 in the calcareous soils of Iran. 16th Soil Science Congress. Montpoliet, France.

Stevens, B. Killen, M. and Bjornestad, L. (2002) Use of micronutrient fertilizers in sugar beet production. Powell research and extension center: 22-25.