Foliar Application of Mg and Zn on the Yield and Quality of Three Grape Cultivars on the Calcareous Soils of Iran

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INTRODUCTION

Magnesium is absorbed by plants as Mg, and its absorption depends on available Mg, soil pH, Cation Exchange Capacity (CEC), %Mg saturation of CEC and available K and Ca. Concentrations of Mg in grapes range from 0.40 to 0.50%. Magnesium is associated with transfer reactions involving phosphate reactive groups and is also required for maximal activity of almost every phophorylating enzyme in the carbohydrate metabolism. Most reactions involving phosphate transfer from adenosine triphosphate (ATP) require Mg. Since the process of energy transfer occurs in photosynthesis, glycolsis, citric acid or Krebs cycle and respiration, Mg is important throughout the plant metabolism (Havlin et al. 2005).

Zinc is one of the essential elements for plants, animals and humans, but it is deficient (less than 1 mg kg^{-1} DTPA-extractable Zn) in most calcareous soils and consequently in plant, animal and human diets. The application of Zn-fertilizers to soils with Zn-deficiency problems has been associated with improved yield and quality of grapes (Cakmak 2006). The aim of this study was to investigate the effects of foliar applications of $MgSO_4$ and $ZnSO_4$ on yield and quality of three grape cultivars in the Azarbyjan province.

METHODS

A completely randomized factorial block designed experiment was carried out in the Maragheh region in 2004-2005 to evaluate the effects of foliar applications of Mg and Zn on yield and quality of three grape cultivars. Factor one consisted of three levels of Mg (0, 0.4, 0.8% $MgSO_4.xH_2O$), factor two of three levels of Zn (0, 0.2, 0.4% $ZnSO_4.7H_2O$), and factor three involved three cultivars of grape (*Vitis vinifera* L.) (Sahebi, Soltani, Ghezel). The foliar applications were carried out in two stages, during the enlargement of flower buds and three weeks after the flower petals dropped (late spring). Other nutrients were applied uniformly to all treatments on the basis of soil tests. Yield and quality characteristics, including total soluble solids (TSS), juice, pH and acidity, were determined.

RESULTS AND DISCUSSION

The analysis of variance showed that the main effects of Mg, Zn and cultivars on yield were statistically significant at the 1% level. The interactive effects of foliar application of Mg and Zn on yield were significant at the 5% level. The highest yield was obtained with the combined applications of Mg and Zn (Fig. 1). Ghezel produced the highest yield (47.11 tons ha^{-1}). The main effects of Mg and Zn applications and of cultivars were significant. The TSS contents were significant at the 1% level. The highest TSS level (23.8%), sugar percentage (25.2%) and pH were obtained with the foliar application of 0.8% Mg and 0.4% Zn solutions (Fig. 2). Ghezel produced the highest TSS. The main effects of foliar applications of Mg and Zn on lowering juice acidity and correcting K/Mg ratio were significant at the 1% level.

CONCLUSIONS

It can be concluded from our results that the available nutrients, especially Mg and Zn are lower than their critical level in those soils. All nutrient application methods increased yield and quality of grapes. Foliar application is an economical method in countries, in which

N, P and K fertilizers are subsidized. Changing the habits of grape growers is challenging. They are used to applying only N and P-fertilizers on their orchards. Furthermore, the cost of Mg and Zn sulphates is very high, and subsidy is given to N, P, and K fertilizers only. Thus, the foliar application of Mg and Zn seems to be an appropriate method. In addition to an increased yield, foliar application increased the quality of grapes, especially Mg and Zn concentrations in the grape juice, which is important for human health promotion.

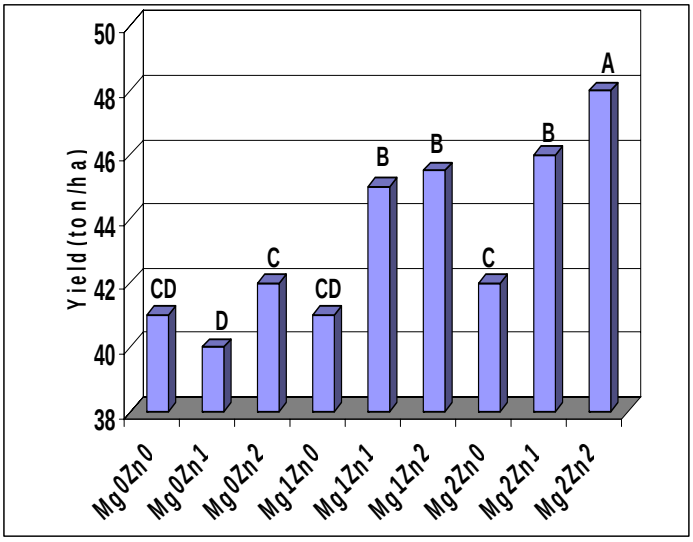

Fig. 1. Effects of foliar application Mg and Zn on grapes yield.

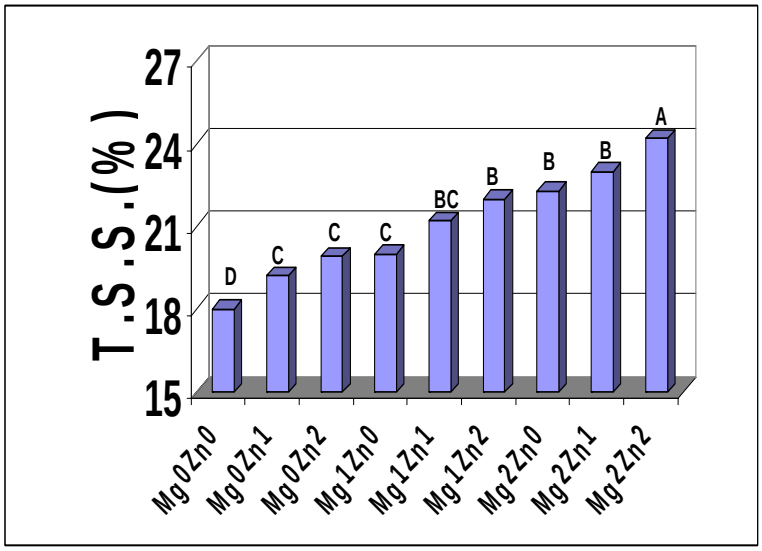

Fig. 2. Effects of foliar application of Mg and Zn on TSS of grapes.

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