

Boron Uptake in Tomatoes on Sandy Soils

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ABSTRACT

Boron (B) is an essential micronutrient for plants with important metabolic functions such as glucose transportation, cell wall synthesis, etc. In order to determine a suitable analytical method for extractable B and to determine B uptake in tomatoes cultivated in sandy soils of Florida, a replicated greenhouse study was proposed, where a comparison of granular and foliar applications of B to achieve 1, 2, and 3 mg kg⁻¹ of B was implemented. The study is ongoing in the greenhouse. Data comparing analytical methods and protocols for determining extractable B is presented here. Hot water extraction of soil B with 5 min boiling time analyzed on ICP showed promising results.

OBJECTIVES

1. To determine a suitable analytical method and protocol for extractable B in soils.
2. To determine B uptake in tomatoes grown on sandy soils grown with fertigation under plastic.

ANALYTICAL PROTOCOLS

- Hot-water extraction of soil B at 5, 10, and 15 minutes of boiling durations
- Determination of extractable B using ICP and Spectrophotometer

STATISTICAL METHODS

The analytical protocol in the laboratory employed three-factor setup in a factorial design. The factors were Equipment (ICP and Spectrophotometer), Time (5, 10, 15 mins), and B concentration (0, 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5 mg/kg).

ANOVA was performed on the data and the means were separated using Tukey's multiple comparison tests for the three factors by LSD at 5% level.

Further, initial concentration of B was plotted against individual B value from each instrument for each time duration using a linear regression model to reveal patterns of data readings in both equipment types.

The coefficient of determination (R²) was a measure of the quality of the model in relation to its ability to correctly estimate the values of the responsive variable Y.

FIELD PROTOCOLS

Tomato study was set up in pots in the greenhouse in a completely randomized block design. Pots were treated with 0, 1, 2, and 3 mg/kg of B in both granular and foliar forms.

The experiment is currently ongoing. Yields are being recorded in multiple picks and it is expected that harvest and final soil and plant tissue sampling is expected to be completed in a few weeks.



Figure 1. Greenhouse configuration at Plant Science Research and Education Unit, Citra FL

TREATMENT VS RESULTS

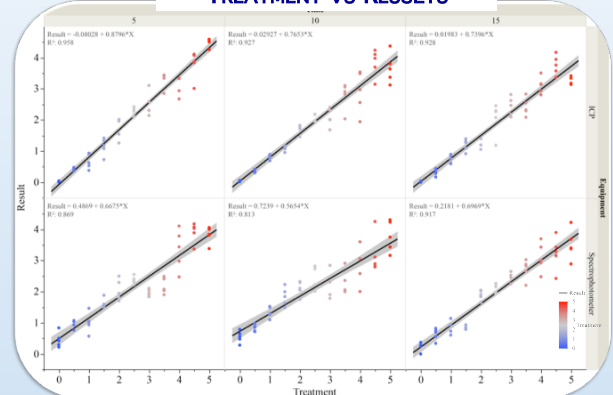


Figure 2. Treatment vs Measured results of each boiling time from both ICP and Spectrophotometer

RESULTS AND CONCLUSION

- Results from ICP were consistently closer to the treatment amounts than those from Spectrophotometer.
- Comparing durations of boiling showed a systematic increase in the amounts measured as the time decreased, with an optimal boiling time of 5 min.
- As a result of these findings, using Hot-water extraction method with a 5-min boiling time combined with determination on ICP is determined to provide the best estimate of B availability to plants.

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