

Effects of a Yeast Fermentation Product on mRNA Levels of Root Growth and Development-Related Genes in Maize

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Introduction

Early root growth is essential for healthy crops and abundant yields. Nutrition plays a vital role in the development of features associated with optimal plant growth and development. ACS-GS001 (Alltech Inc, Nicholasville, KY) is a yeast fermentation product shown to increase root size, plant size, and yields when applied topically in field trials.

Objectives

The objective of this study was to determine the effects of ACS-GS001 on tissue and tissue gene expression in maize.

Methods/Materials

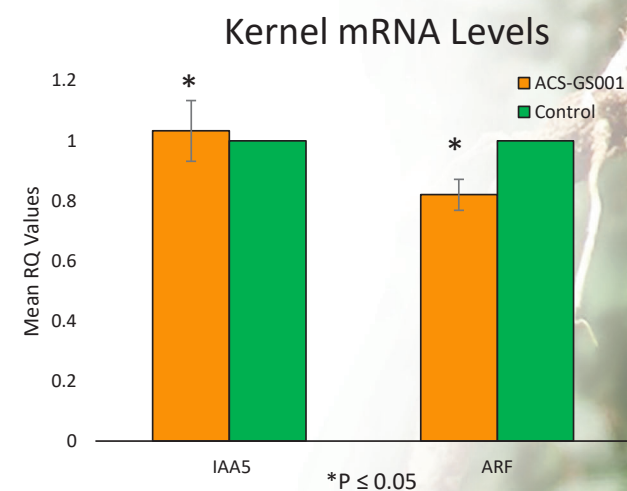
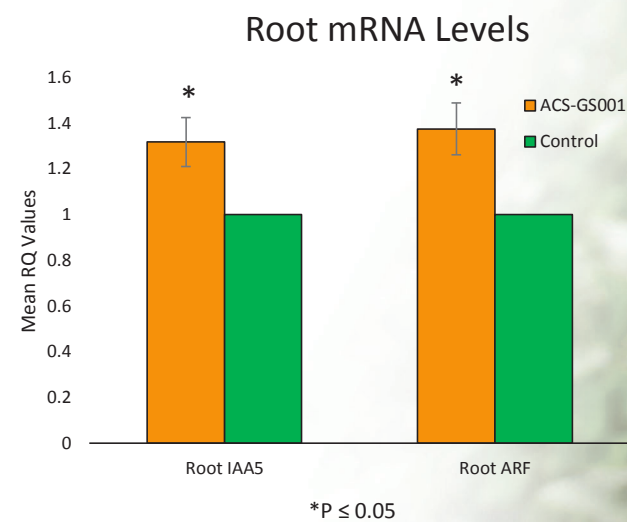
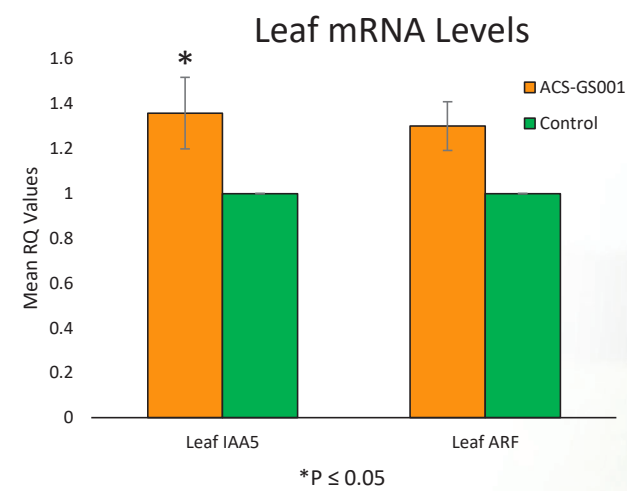
- Maize was treated with 236.6 mL/acre of ACS-GS001 during the V6 growth stage, according to industry recommendation.
- Seminal root, kernel, and leaf tissues were randomly collected from 10 plants each in the control and treatment (TRT) plots.
- Total RNA was extracted using the Qiagen RNeasy Plant Mini Kit® and cDNA was amplified using the Invitrogen High Throughput cDNA kit.
- Relative gene expression was completed in triplicate and measured using real time PCR and Taqman primers for select growth and development related genes. RQ values were calculated using the $\Delta\Delta C_T$ method. CDK was used as the endogenous control.

Results

- Maize treated with ACS-GS001 had increased root length ($P < 0.001$), plant height ($P < 0.001$), and ear size ($P = 0.03$).
- IAA5 increased 1.40 - fold ($P = 0.03$) in TRT leaf and increased 1.32 fold ($P = 0.02$) in TRT root tissue.
- Levels of ARF mRNA decreased 0.82-fold ($P = 0.069$) in TRT kernel and increased 1.4-fold ($P = 0.01$) in TRT root tissue.

Discussion

- Relevant literature has identified IAA5 as an active gene in early root development (Ludwig, 2013), with increases in relative IAA5 expression associated with improvements in early maize root development.
- ARF is an auxin response factor in maize that regulates auxin gene expression. Upregulation of ARF is typical of increased auxin signaling, which was observed in both leaf and root tissue.
- Decreased ARF gene expression may suggest that the kernel tissue had already progressed into a later stage of development. This may indicate earlier tissue development when compared to the control but future work focusing on quantifying tissue auxin levels (Saur, 2013) would be required to confirm this.



Conclusion

In this study, ACS-GS001 improved growth in corn plants. The changes in mRNA levels of these genes provides insight into a mode of action of ACS-GS001 and potential opportunities for improving corn growth.

References

- Ludwig et al. PLoS ONE. 2013. 8.11.
- Saur et al. Journal of Experimental Botany. 2013. 64.9, 2565-2577

