Evaluating the Affects of ThryvOn™ Technology on Cotton Root and Shoot Growth and Development

Mohit Kumar*, Gurpreet Virk, Simerjeet Virk, John L. Snider, Joshua Lee, Ved Parkash

University of Georgia, Crop and Soil Sciences Department, Tifton, GA.
*e-mail: MK17261@uga.edu

Introduction

- **Bayer CropScience has developed a novel genetically engineered trait known as ThryvOn™, following an extensive search for effective hemipteran-active Bt proteins.**
- **It provides protection to young cotton plants against thrips by reducing oviposition and increasing larval mortality.**
- **Being a recently introduced technology, the influence on the overall plant growth of cotton (both above and below ground) is not fully understood**
- **Studies addressing the impact of ThryvOn™ technology on the below-ground root growth and development are non existent and is crucial for better understanding efficient use of resources (water and nutrients).**

Hypothesis

Cotton cultivars with ThryvOn™ technology would demonstrate vigorous above and below ground growth because of lesser impact and injury by pests.

Objectives

The objective of the study was to quantify the effect of ThryvOn™ on cotton root and shoot growth.

Materials and Methods

Site: Lang Rigdon Farm, University of Georgia, Tifton GA, 2023 growing season.
Experimental Design: Randomized complete block design with 6 replications
Treatments: 4 Treatments -

- *ThryvOn with and without AgLogic (Nematicide) was also tested*

Treatment	ThryvOn™	AgLogic
1	X	-
2	-	X
3	X	X
4	-	-

Cultivar	ThryvOn™
DP 2211 B3TXF	X
DP 2012 B3XF	-

Sampling: 3 weeks after planting (Sampling 1) and at peak flowering (Sampling 2)
Measurements:

Growth analysis

- ✓ *From 2-m row section*
- ✓ *Leaf area (cm^2)*
- ✓ *Shoot Dry Weight (g)*
- ✓ *Root Dry weight (g)*

Root Parameters (6303 cm^3 soil volume)

- ✓ *Root Length Density (cm/cm^3)*
- ✓ *Surface Area Density (cm^2/cm^3)*
- ✓ *Average Diameter (mm)*
- ✓ *Root Volume Density (cm^3/cm^3)*

Data Analysis: One-Way Mixed effect ANOVA was used to analyze results using JMP Pro. 14 software. Post hoc mean separation was conducted using Fisher's LSD at 10% probability.

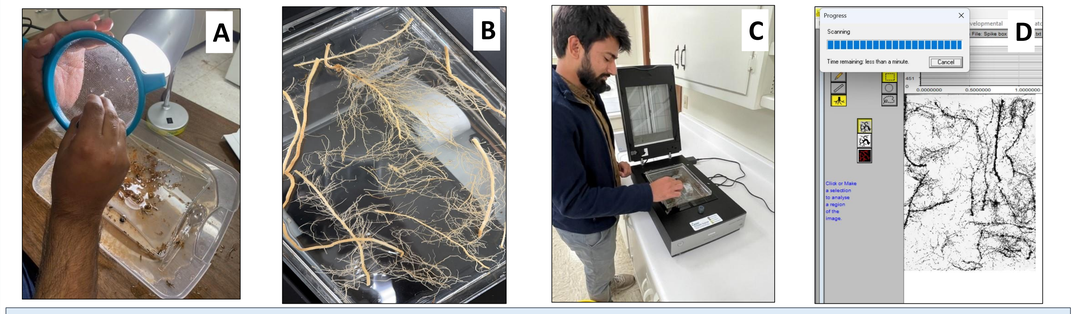

Figure 1: Images showing cotton root washing and analyzing process steps using WinRhizo software, Cotton root collection after washing (A), Image of roots spread on scanning tray with water (B) WinRhizo Root scanner (C) and the process off analysis of scanned images using WinRhizo software for various parameters (D).

Results

Table 1: Analysis of variance (ANOVA) results for the effect of treatments on various measured growth parameters including above (shoot) and below ground (root) biomass, root length density, average root diameter, projected area, surface area, and root volume density. Treatments are significantly different if P < 0.1. N.S indicates no significant differences.

Parameter	P-Value	
	Sampling 1	*Sampling 2*
Shoot Dry Weight	0.0015	NS
Root Dry Weight	NS	0.0043
Root Length Density	0.0047	0.0797
Average Diameter	0.0033	NS
Projected Area	0.0593	NS
Surface Area	0.0593	NS
Root Volume Density	NS	NS

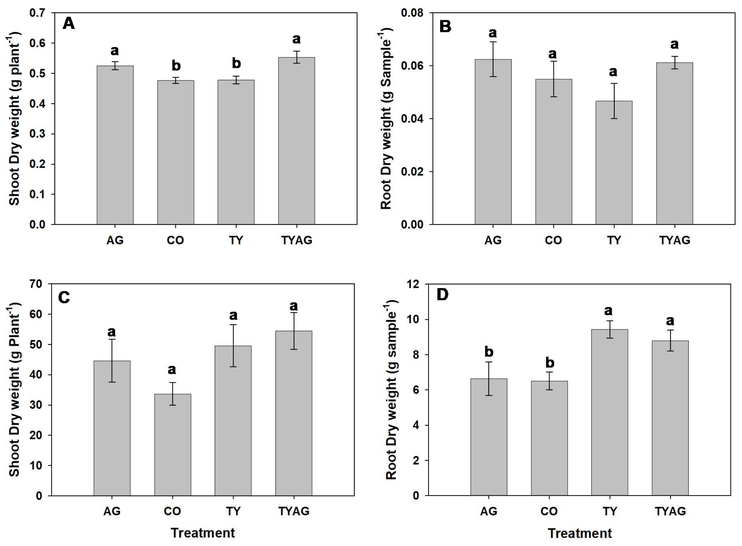

Figure 3: Treatment means for above ground (shoot) weight per plant (A, C) and below ground (root) dry weights per soil sample collected (B, D) at 3 weeks after planting (sampling 1) and at peak flowering (sampling 2). Values are means for the 2023 growing season in Tifton (n=6 to 10).

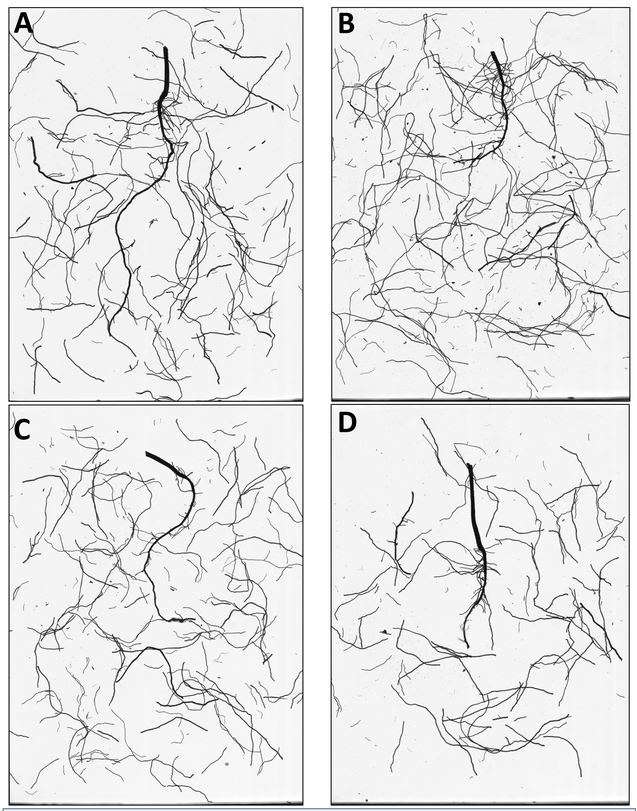

Figure 2: Images of scanned 3 week root subsamples from four different treatments used in the study (ThryvOn, A; AgLogic, B; ThryvOn + AgLogic, C and Control, D).

Table 2: Treatment means for root length density at 3 weeks after planting (sampling 1) and peak flowering (sampling 2). Values are means for the 2023 season in Tifton (n=6 to 10).

Treatment	Root Length Density x 10^{-2} (cm/cm^3)	
	Sampling 1	Sampling 2
ThryvOn	5.13^{b}	31.6^{ab}
AgLogic	7.71^{a}	39.9^{a}
ThryvOn + AgLogic	7.45^{a}	27.8^{b}
Control	5.03^{b}	32.0^{ab}

Summary

- ✓ **Significant treatments differences observed in above ground shoot biomass at 3 weeks after planting (early season growth) with AgLogic and ThryvOn + AgLogic resulting in vigorous above ground growth (Table 1 and Figure 3 A and C).**
- ✓ **No significant differences observed in below ground root biomass early in the season. However, at peak flowering where cotton is known to have maximum root growth, significant treatment differences were observed (Table 1 and Figure 3 B and D).**
- ✓ **Significant treatment differences were observed for root morphological traits with AgLogic, and ThryvOn + AgLogic treatment resulting in highest values (Table 1, and 2).**
- ✓ ***Future Research:* This study will be conducting in 2024 growing season again to verify the effect of ThryvOn and AgLogic on cotton shoot and root growth.**

References

- Ellsworth et al., 2021. Repository.arizona.edu
- Oosterhuis and Jernstedt, 1999. Morphology and anatomy of the cotton plant. Pp 175-203.

Acknowledgement

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