# YIELD LOSS OF TEN COTTON CULTIVARS DUE TO THE ROOT-KNOT NEMATODE AND THE ADDED BENEFIT OF VELUM TOTAL

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## Abstract

In 2015 alone, 215,500 bales were lost in the U.S. due to the root-knot nematode, *Meloidogyne incognita.* This represents 1.8% of total yield loss pertaining to cotton diseases. In 2016, cotton production increased in the U.S. and an estimated 457,000 bales were lost due to root-knot; however, it still contributed to a 1.8% total yield loss in cotton (Lawrence, et al 2016). The objective of this research was to determine the yield loss of ten cotton cultivars commonly grown in the Southeast due to the root-knot nematode as well as the efficacy of Velum Total in reducing yield loss. Two different fields were utilized in Fairhope, AL at the Gulf Coast Research and Extension Center. One field being artificially infested, and one field being absent of the root-knot nematode. Cultivars in the root-knot infested field were evaluated both with and without the application of Velum Total. Yield loss due to the root-knot nematode in 2016 was determined to be an average 18% reduction across all cultivars. With the application of Velum Total, only a 7% reduction in yield occurred due to root-knot. This translated to an average 15% increase in yield. Velum Total was able to decrease root-knot eggs per gram of root by an average of 45% or 1,866 eggs per gram of root.

## Introduction

Cotton is currently grown in more than 70 countries throughout the world, and the U.S. is the third leading producer behind India and China. In 2016, acres harvested, total cotton production, and yield increased respectively by 18%, 32%, and by 89 lbs/A in the U.S. (USDA, 2017). Regardless of the increase in cotton production and yield, the southern root-knot nematode, *Meloidogyne incognita,* still made an impact. In 2016, no single pathogen caused more yield loss to cotton than did the root-knot nematode, which caused a loss of 457,500 bales (Lawrence, et al 2016). Yield loss can be attributed to galling induced by the nematode along the taproot and secondary roots of the cotton plant. This results in a reduced effectiveness in the ability of the roots to take up essential water and nutrients. In Alabama, root-knot was second to the reniform nematode, *Rotylenchulus reniformis,* in the amount of bales lost due to disease. Some states – or certain areas within states – may differ between the severities of these nematodes due to their differing environmental habitats. Root-knot thrives in course-textured soils, whereas reniform prefers finer soils such as that of the silt and clay texture. Root-knot has been found in every state across the cotton belt. This can be attributed to its very wide host range. Perry et al. in 2009 reported that root-knot was able to reproduce on over 700 different host plants. This makes management with crop rotations very difficult. However, rotation with peanuts, grain sorghum, and resistant varieties of soybean can be successful. Besides crop rotation or other cultural management strategies, resistant varieties and the use of nematicides are two common ways producers can manage root-knot. This research will investigate cultivar selection coupled with Bayer CropScience's Velum Total nematicide in their ability to increase yields in root-knot nematode infested fields.

## Materials and Methods

Ten commonly grown upland cotton cultivars were evaluated for their performance in both the presence and absence of *Meloidogyne incognita*. Additionally, Velum Total (Imidacloprid + Fluopyram), was applied in-furrow at a rate of 14 oz/A and evaluated for added yield benefit and a decrease in root-knot egg proliferation. The cotton cultivars

(listed in Table 1) were planted on May 12 at the Gulf Coast Research and Extension Center in Fairhope, AL. Here, two fields were utilized: One without root-knot and one that has been artificially infested since 2013. These two fields are adjacent to one another but are separated by a grass strip buffer. During the growing season, precautions were taken during field maintenance to prevent field-to-field contamination. Both fields are identical in regards to soil texture being Malbis sandy loam (59% sand; 31% silt; 10% clay). Lateral irrigation was utilized to ensure a closely identical water supplement between the two fields. The tests were arranged in a randomized complete block design with five replications. The plots in the root-knot infested field were laid out as four, 25-foot long rows with 36 inch row spacing. The four row plots were split into two rows serving as checks and two rows where the Velum Total in-furrow spray was applied. Each replication was separated by a twenty-foot wide alley. Data assessments were made by taking four randomly selected plants from each plot at 45 days after planting for root-knot eggs per gram of root. Eggs per gram of root were calculated by taking the ratio of root fresh weight and total eggs per plot. Plants were mechanically harvested at 173 days after planting (Oct. 31, 2016) for seed cotton yield. Data was analyzed in SAS 9.4 (SAS Institute, INC., Cary, NC) by ANOVA using the PROC GLIMMIX procedure and means were separated using Tukey's HSD test at the $\alpha \leq 0.10$ level.

## Results and Discussion

Table 1. Cultivar and nematicidal effect on root-knot eggs per gram of root and seed cotton yield, and performance of the same cultivars in the absence of root-knot

| Cultivar | Root-knot eggs/g root | | Yield lbs/A seed cotton | | |
|---|---|---|---|---|---|
| | No nematicide | with nematicide | No nematicide | with nematicide | No root-knot |
| CR 3885 B2XF | 2076 b[z] | 672 bc | 2628 ab | 3557 a | 3572 ab |
| DP 1538 B2XF | 3533 ab | 953 abc | 2802 ab | 3165 a | 2860 b |
| DP 1555 B2XF | 6777 a | 1952 a | 2802 ab | 3514 a | 4095 a |
| DP 1558 NR B2RF | 1363 b | 983 abc | 3412 a | 3354 a | 3064 b |
| DP 1646 B2XF | 2943 ab | 663 abc | 3093 ab | 3485 a | 3528 ab |
| PHY 333 WRF | 1660 ab | 1324 abc | 2802 ab | 2643 ab | 2991 b |
| PHY 444 WRF | 5216 a | 1298 abc | 1902 b | 2715 ab | 3267 ab |
| PHY 552 WRF | 5926 a | 2674 ab | 2105 ab | 1873 b | 3049 b |
| ST 4848 GLT | 1463 b | 1614 c | 2193 ab | 2860 a | 3209 b |
| ST 6182 GLT | 1559 ab | 1725 abc | 2585 ab | 2817 ab | 2759 b |

[z]Observations followed by same letter within a column are not significantly different according to Tukey's HSD test at the $\alpha \leq 0.10$ level.

The application of Velum Total resulted in an average 45% decrease in root-knot eggs/g of root when compared to root-knot eggs/g of root without Velum Total (Table 1). This ranged from as high as a 77% decrease as seen with DP 1646 B2XF to as low as -11% as seen with ST 6182 GLT. The resistant DP 1558 NR B2RF supported the numerically fewest root-knot eggs/g of root without the application of Velum Total and was statistically less than DP 1555 B2XF, PHY 444 WRF, and PHY 552 WFR. When comparing the yields of the cultivars in the absent root-knot field to the yields in the root-knot field without the application of Velum Total, it can be determined that the presence of root-knot reduced yield by an average of 18%. This ranged from as high as a 42% decrease as seen in PHY 444 WRF to as low as -11% as seen in the resistant DP 1558 NR B2RF. The latter saw the greatest yield in the root-knot field without the application of Velum Total. The Velum Total application increased yield by an average of 15% when comparing the yields of the same cultivars without the application. In conclusion, with the use of Velum Total, root-knot was only able to decrease yields by an average of 7% as opposed to 18% without Velum Total.

## Summary

Root-knot pressure at the Gulf Coast Research and Extension Center field site ranged from moderate to heavy. This infestation was able to give the researchers an idea on the yield loss that can occur due to the root-knot nematode. Root-knot decreased yield by an average of 243 lbs/A lint cotton which is a $175/A loss on $0.72 cotton. If Velum

Total was applied, only an average of 96 lbs/A lint cotton was lost or $69/A. Velum Total decreased root-knot eggs/g of root by 45% or 1,866 eggs/g of root which resulted in a 146 lbs/A increase in lint cotton or a $105/A gross gain.

## References

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