ROOT-KNOT NEMATODE RESISTANCE IN COMMERCIAL AND PUBLIC COTTON CULTIVARS, 2012 PROGRESS

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Introduction

Host plant resistance is overall the most economical, practical, and environmentally sound method to provide crop protection against root-knot nematodes (RKN). Despite the widespread occurrence of RKN in most cotton production areas in the Southeast and that genetic resistance to RKN has existed since 1974 (Shepherd, 1974), private cultivar developers have exhibited minor interest in fulfilling this need.

However, now that it was announced in August, 2010 that the registered use of Temik is scheduled to be phased out by 2018 (High Plains Journal, 2010), RKN control in cotton has lost an important tool. Temik has been the most widely used nematicide in US cotton production and works well in controlling RKN, but it is already becoming difficult to find.

Previously, RKN resistance in commercial cotton cultivars has been garnered only through direct utilization by the commercial cotton breeding companies of cultivars developed by public cotton breeders. These include the RKN-resistant CPCSD Acala NemX and the tolerant ST LA887 and PM H1560 that have been distributed by commercial cotton seed companies; none of which were particularly developed for cotton production in the Southeast.

There are now four other cultivars that are directly touted in the websites of the three major commercial cotton breeders in the United States. Unbiased testing regarding the strength of the resistance offered to the cotton grower and the improvement of yield from this trait is needed to determine the value of RKN resistant cultivars in the Southeast. Additional testing of several newly released public cultivars is also needed to determine if any RKN resistance is available from these new public genetic resources. Altogether this will benefit United States producers by providing an evaluation of these cultivars for yield and decreased production costs.

Materials and Methods

Parallel yield tests of the four RKN tolerant commercial cultivars (PhytoGen PHY 367 WRF, Bayer CropScience ST 4288B2F and ST 5458B2RF, and Monsanto DP 174 RF) and four newly released public conventional cultivars (University of Georgia's GA 230, University of Arkansas' UA 48, and Louisiana State University's LA 17 and LA 35rs were planted with three checks (University of Georgia's GA 120R1B3, a resistant check; Acala NemX, a resistant check; and Monsanto's DP 0935 B2RF, a susceptible check) in soils with and without high populations of root-knot nematodes over a two year span at the Gibbs Farm of the University of Georgia-Tifton Campus. The tests use standard agronomic practices promulgated by UGA Extension.

The test in the infested field for 2011 had 8 replications to cover an expected biological variability of the RKN infestation of the cotton roots. In 2012, 6 replications were considered adequate. The test without high nematode populations had 4 replications in 2011 and 5 replications in 2012. We used granular, gypsum-based Temik insecticide banded in at planting at 5 pounds/acre which is generally considered a nematicidal rate. The seed was treated with Baytan, Thiram, and Allegiance for fungal control as labeled. We have found no nematicidal

effects reported by others using this seed treatment. In addition to yield, lint percentage and fiber quality data were also collected.

Results and Discussion

In 2011, the data of the nematode counts indicate that the four touted commercial cultivars are definitely not extremely susceptible to RKN, but nothing is as resistant as the two resistant checks, GA 120R1B3 and NemX (Fig. 1). In comparing the resistant checks, GA 120R1B3 is significantly better than NemX or any other cultivar. One conventional cultivar LA 17 appears to have a level of RKN resistance that is essentially equivalent with the commercial cultivars. All of the commercial cultivars along with LA 17 seem to cluster between the resistant checks and the susceptible check. The other conventional cultivars cluster with the susceptible check as would be expected if they are indeed susceptible. In 2012, we had very low gall ratings and the nematode count data did not match what we expected. Root-Knot nematode, as a biological entity, is difficult to clearly understand its relationship with the environment. Further effort is needed to have clear understanding how these cultivars react to infested and clean conditions.

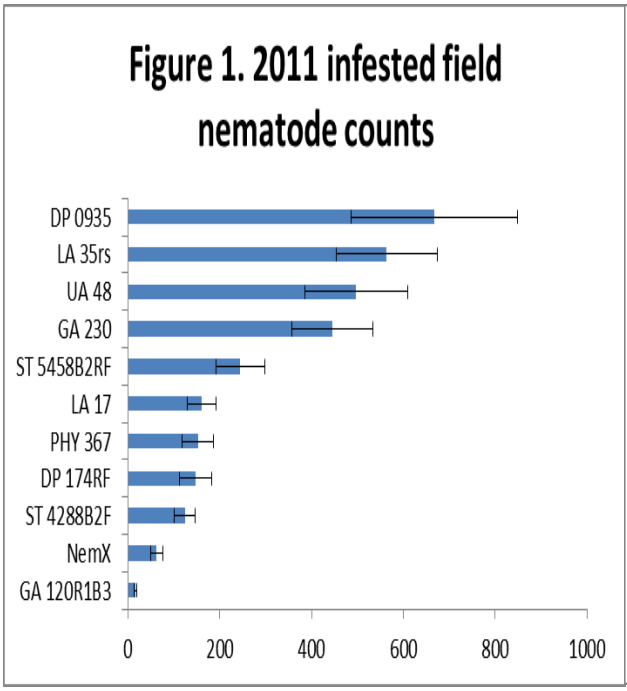

Figure 1. 2011 infested field nematode counts

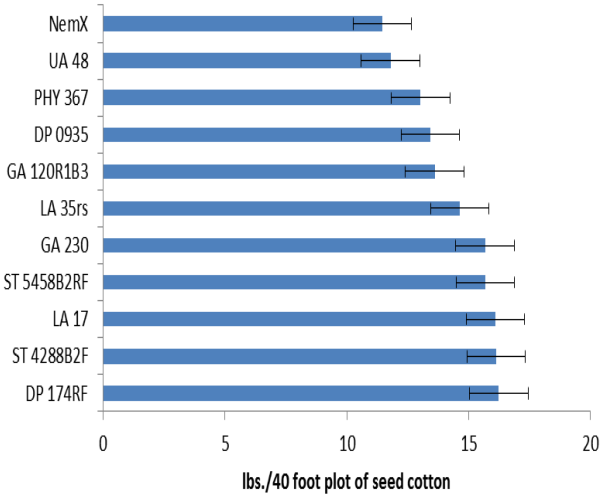

Figure 2. 2011 Nematode Infested Field Seed Cotton Yield

The best seed cotton yielder in the RKN infested field in 2011 was DP 174RF followed by two commercial cultivars and two public cultivars that were not significantly different (Fig. 2). In 2012, ST 5458B2RF was the top yielder with LA 17 and LA 35rs following (Fig. 3). The next three cultivars were the other three commercial cultivars ST 4288B2F, DP 174RF, and PHY 367 WRF. This generally followed the rankings in 2011 with the commercial lines doing better than their resistance levels would explain. The lowest yielding cultivar in 2011 was the resistant cultivar NemX while the lowest cultivar in 2012 was UA 48.

The rankings of the cultivars for seed cotton yield do not match the ranking of the cultivars for the nematode counts. This was not unexpected since the background genetics for the agronomic performance of the cultivars is unlikely to be correlated with the RKN resistance trait. For example, NemX is an Acala cotton that is not adapted to the Southeast. In 2011, the high RKN resistance of NemX could not completely compensate for the fact that NemX is not

adapted to the Southeast. The resistant check GA 120R1B3 yielded better than the NemX because it was developed in and for the Southeast and has two major genes of an elite RKN resistance. However, in 2012, GA 120R1B3 did not show that adaption as it yielded essentially the same as NemX.

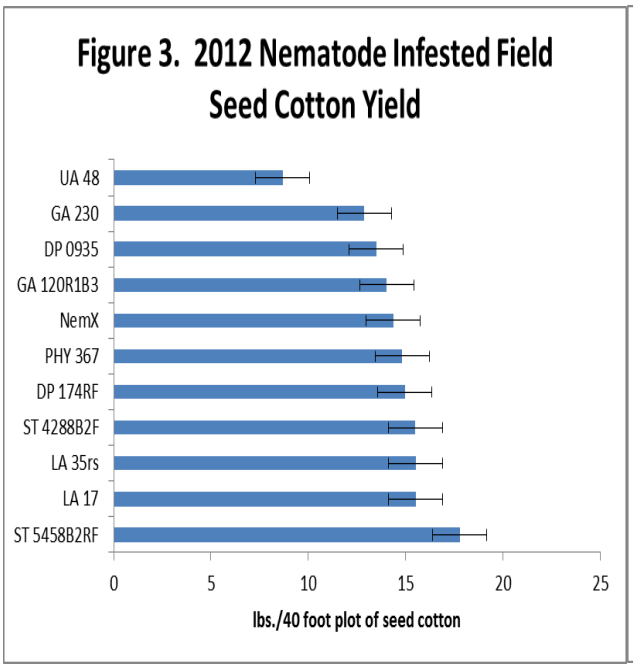

Figure 3. 2012 Nematode Infested Field Seed Cotton Yield

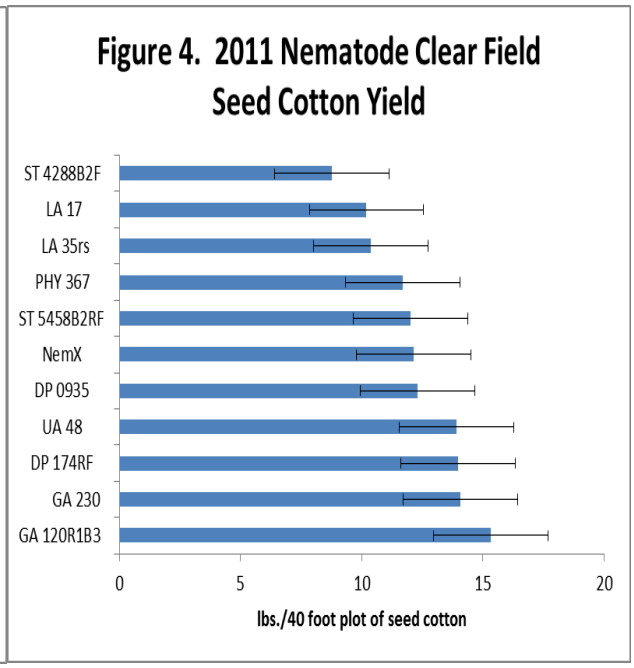

Figure 4. 2011 Nematode Clear Field Seed Cotton Yield

The top yielders in the nematode clear field in 2011 were GA 120R1B3 and GA 230 which were the only two cultivars developed in and for the Southeast (Fig. 4). In 2012, GA 120R1B3 was again in the top tier at #2 while GA 230 was in last place (Fig 5). As is demonstrated, one would expect that the RKN resistant cultivar GA 120R1B3 would rank high in both fields since it was developed for Georgia conditions. However, the same expectation would hold for GA 230 which

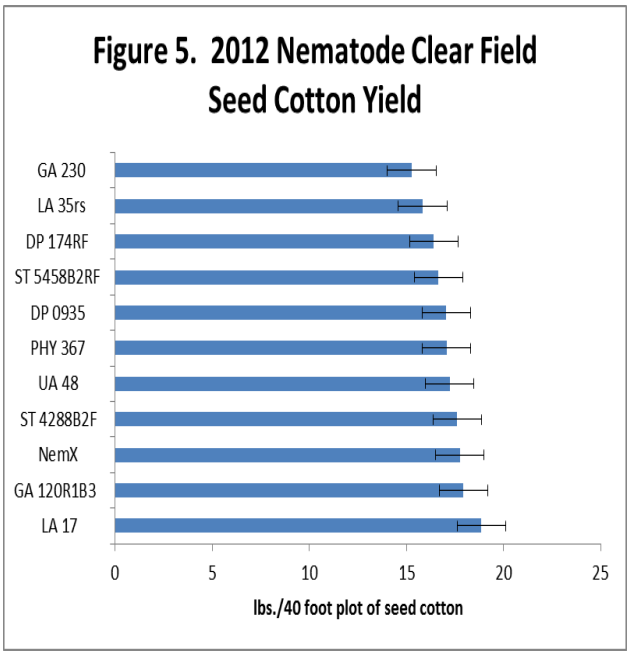

Figure 5. 2012 Nematode Clear Field Seed Cotton Yield

did not maintain its ranking in 2011 for the 2012 season. Again, the interactions between the yields of the infested field and the clear field are not completely evident. Another putative susceptible cultivar UA 48 with the susceptible check DP 0935 B2RF also did better in the clear field vs. the infested field. Neither of these occurrences is completely unexpected since we are unaware that they have any resistance genes. DP 174RF ranked high in both fields, but ST 4288B2F was on opposite ends of the rankings. Further research is needed to determine the nature of the interaction between the RKN resistance and traits required for adapted cultivars.

We will continue to look at these issues of high interaction effects in the next year of this research project, 2013. It appears that the variability of yields may have as much to do with the RKN resistance as year to year variability. Near-isogenic lines and better (more costly) experimental designs may be required to definitively extract the answer to the question of how beneficial can the RKN resistance genes be to the cotton industry.

Acknowledgements

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