NEMATODE CONTROL IN COTTON WITH PLANTING AND POST-PLANTING APPLICATIONS OF NEMOUTTM (PAECILOMYCES LILACINUS STRAIN 251)

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Abstract

NemOut™ is a new nematicide in development for use on cotton and peanuts. NemOut contains an EPA registered bio-rational fungal nematicide formulated for applications at planting, side dressing and through overhead irrigation. This new product, based on Paecilomyces lilacinus strain 251; is being evaluated by public researchers throughout the mid-south and southeast and is being commercially introduced by Plato Industries of Houston, Texas. The active ingredient in NemOut has been developed and is produced by ProPhyta GmbH of Germany and is presently labeled for use on a variety of vegetable crops and for turf use. The registration process for cotton and peanuts is underway and registration was received in late 2007. NemOut has activity against reniform, root knot and lance types of nematodes. Field tests were conducted in 2006 and 2007 to evaluate different application strategies for NemOut. Application in cotton using liquid fertilizer equipment and timed during the 4-7 leaf growth stage consistently increased cotton yields compared to no treatment of when applied following the use of a nematicidal seed treatment.

Introduction

Reniform and root knot nematodes are chronic pests of cotton and peanuts throughout the southern United States. Because of their microscopic size and soil-dwelling habits, nematode management can be more difficult than managing either insects or weeds. In addition, chemical options for managing nematodes are limited in number and in duration of effectiveness. Plato Industries, Ltd. has initiated the development of a parasitic fungal-based control product for control of reniform and root knot nematodes in cotton and peanuts under the trade name NemOut. NemOut is based upon *Paecilomyces lilacinus* strain 251 and is produced by ProPhyta GmbH of Poel, Germany. *P. lilacinus* controls nematodes by infecting and killing nematode eggs, juveniles and adult nematodes. Field trials conducted on cotton in 2006 indicated a potential role for NemOut in managing nematode pests in cotton and peanuts. Trials in 2007 focused on determining effective rates and application techniques. Data obtained in 2007 demonstrated promising results for the use of NemOut for nematode control in cotton when applied through liquid fertilizer equipment around the pinhead square stage of growth. Plato Industries anticipates EPA registration for NemOut prior to the 2008 season.

Materials and Methods

Small plot – seven small plot replicated field studies were conducted in cooperation with university research and extension plant pathologists and nematologists in LA, AR, MS, AL, GA, VA, and FL. The general objectives were to evaluate a sprayable powder formulation of NemOut containing 1 x 1011 conidia per gram applied at 0.15 lbs / acre in-furrow at planting time (equivalent to 500 million conidia per row-foot or 16.2 million conidia per row-cm based on 38 inch row spacing) and as a post-harvest application around pinhead square. Pinhead square applications followed the use of a seed treatment of AVICTA® Complete Pak or Aeris ® or an in-furrow application of Temik ® 15G at 5 lbs. / acre. Pinhead square applications of NemOut were applied as either a plant-base directed spray followed by irrigation or applied behind a coulter/knife such as that used for applying liquid fertilizer.

Large plot - In addition to small plot trials, large scale trials with commercial-scale application equipment were conducted in Louisiana and Mississippi. In Louisiana, one trial (conducted by Pest Management Enterprises) was replicated using the plant-base directed spray while another trial (conducted by Reyold Minsky) was an un-replicated comparison of NemOut applied with liquid fertilizer equipment following AVICTA Complete Pak compared to AVICTA alone. In Mississippi, John Kimbrough III and Tucker Miller III conducted trials at two locations comparing NemOut applied with liquid fertilizer equipment following a seed treatment compared to the seed treatment alone. NemOut was applied at 0.15 lbs / acre and in 35-40 gallons water per acre when fertilizer equipment was used. A surfactant designed to aid soil penetration was used with the NemOut applications.

Liquid fertilizer applicator with one coulter and knife per row applying NemOut.

Liquid fertilizer applicator with two coulter/knife sets per row applying NemOut.

Results

The success of field experimentation is always dependent upon weather being conducive to good crop growth. The extensive drought in the southeastern U.S. resulted in no data from the small plot trial in Georgia but data was gathered in all other locations.

Large plots – In comparisons conducted in a cotton field near Greenwood, MS, plots treated with an application of NemOut through liquid fertilizer equipment consistently showed a numerical yield increase (Figure 1). Compared to no seed treatment, the application of NemOut increased cotton yields by 87 lbs. (6.6%). When NemOut was applied following the use of Aeris seed treatment and AVICTA seed treatment, yields were increased by 63 lbs. (5.3%) and 35 lbs. (2.9%), respectively.

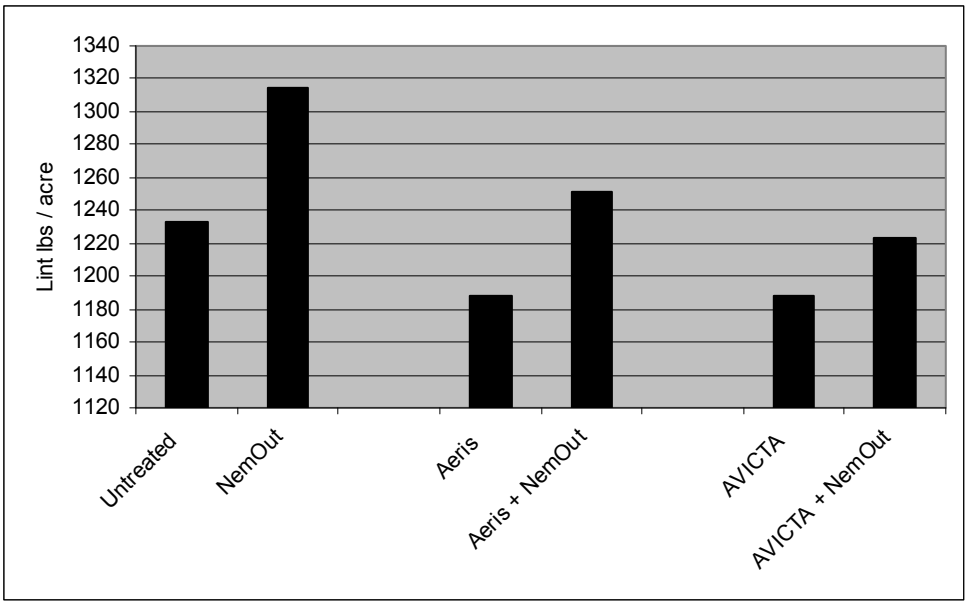

Figure 1. Cotton yields in plots treated with NemOut during pinhead square stage using a liquid fertilizer applicator at Sturdivant Farms, Greenwood, MS

A fourth comparison was conducted north of Lake Providence, LA where a six acre block of cotton within a larger 40 acre field that had been treated with AVICTA seed treatment received an additional pinhead square treatment of NemOut at 0.15 lb / acre. The lint yield in the six acre block exceeded the average yield in the remaining 34 acres by 111 lbs. / acre or 6.8% (Figure 2). In this trial, the NemOut was applied using liquid fertilizer equipment with two coulters/knives for each row.

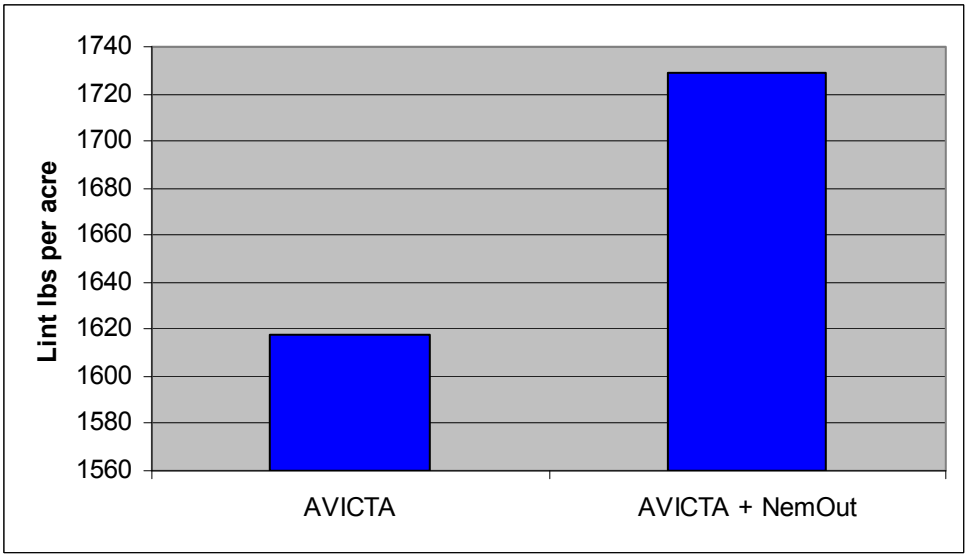

Figure 2. Cotton yields in a plot treated with NemOut during pinhead square stage using a liquid fertilizer applicator (2 coulters and knives per row) at the A. K. Amacker farm near Lake Providence, LA

A fifth trial near Lexington, MS compared AVICTA + NemOut to AVICTA alone. In this trial, four 24-row blocks approximately 300 yards in length were split between the two treatments with the NemOut applied using liquid fertilizer equipment with one coulter/knife per row in 20 gallons of water per acre. The NemOut treated cotton yielded an additional 40 lbs per acre (+2.5%) over cotton treated with AVICTA alone (Figure 3). This difference was not statistically significant.

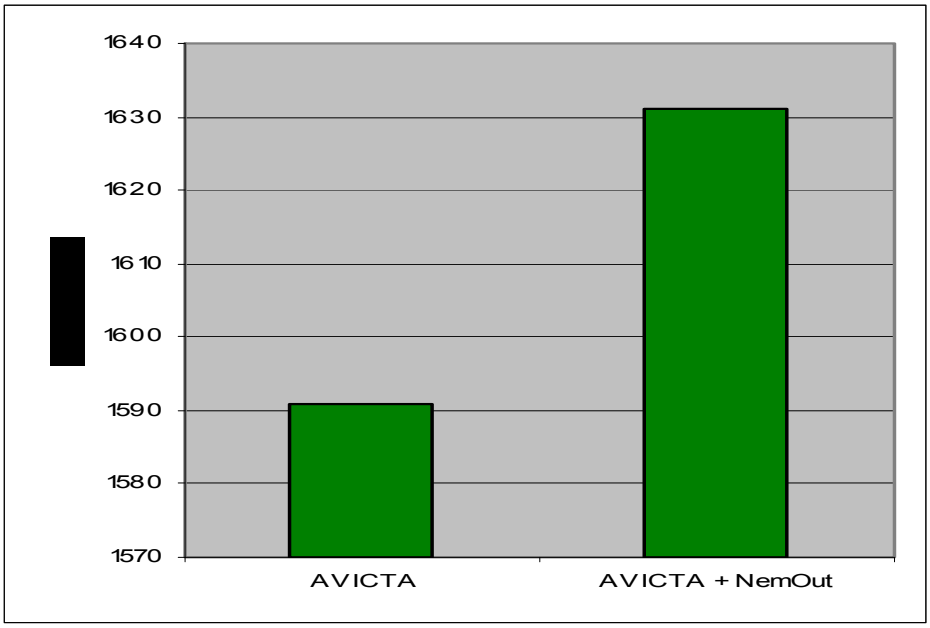

Figure 3. Cotton yields in a plot treated with NemOut during pinhead square stage using a liquid fertilizer applicator (1 coulter/knife per row) at the John Kimbrough farm near Lexington, MS

A sixth trial was conducted near Cheneyville, LA (Pest Management Enterprises, Grady Coburn crop consultant). This trial included four replications with the application methodology differing from the other trials. NemOut was applied as a spray directed towards the plant base followed immediately by 0.5" of natural rainfall. In the absence of rainfall, overhead irrigation equipment was available for use. Nematode counts were less in plots treated with AVICTA + NemOut compared to plots treated with AVICTA and Aeris alone (Figure 4). However, these numerical population differences were not reflected in lint cotton yields (Figure 5).

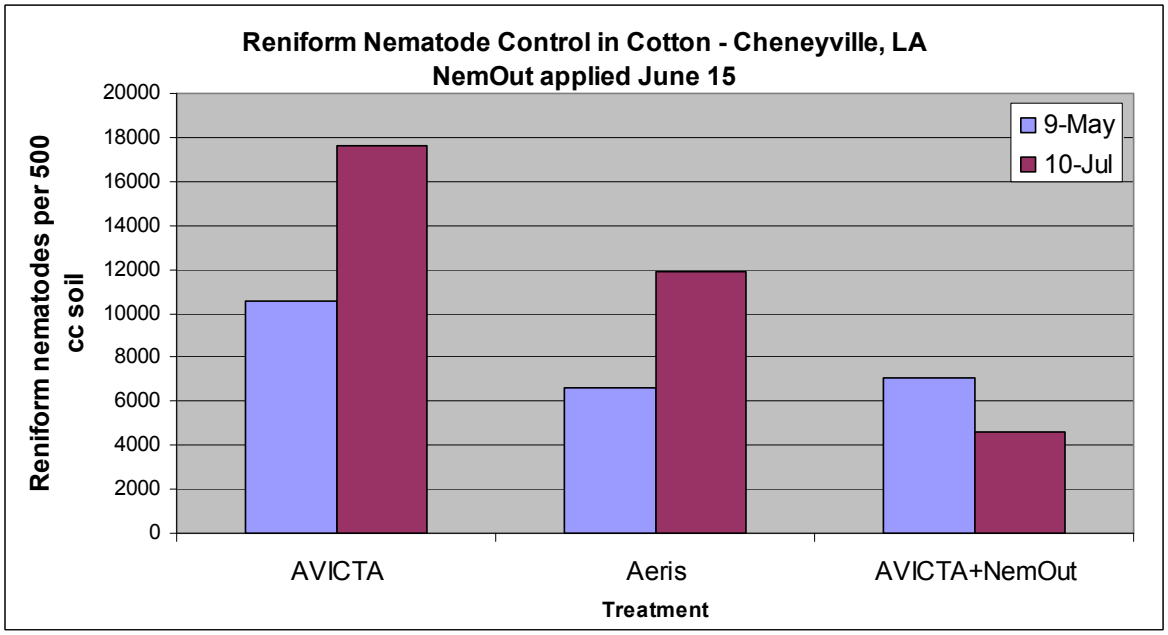

Figure 4. Reniform nematode counts in May and July following the application of planting time and pinhead square applications of seed treatments and NemOut bionematicide

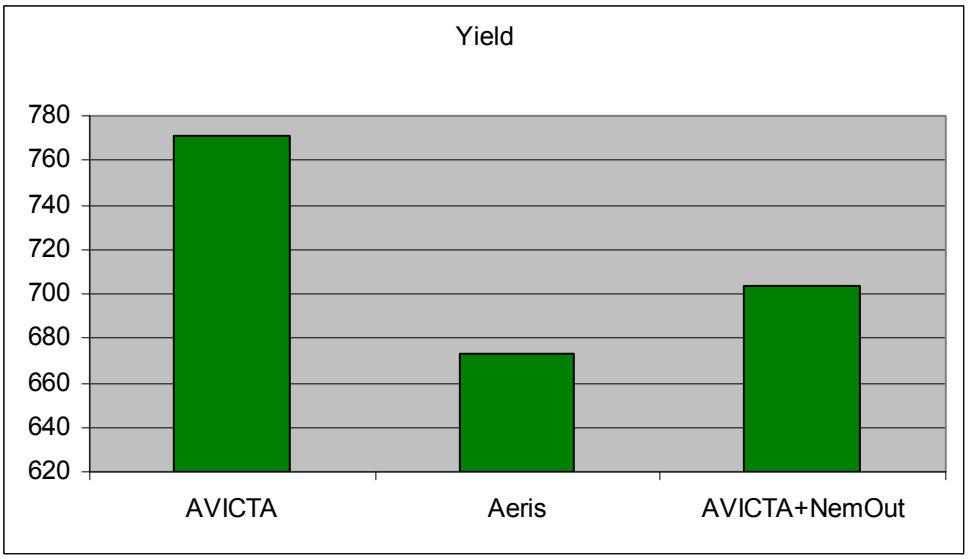

Figure 5. Cotton yields in plots treated with seed treatments and a pinhead square spray application of NemOut bionematicide

Discussion

Due to the uneven distribution and indirect feeding habits of plant-parasitic nematodes, demonstrating statistical improvements in crop yields in combination with reduced numbers of nematodes in soil samples is difficult and in practice seldom occurs. Evaluation of nematode management strategies requires observations over multiple sites.

In multiple locations, cotton treated with NemOut at 0.15 lbs / acre using liquid fertilizer equipment at the pinhead square stage of cotton growth, consistently yielded more lint cotton than was harvested in plots where NemOut was not applied. Applying NemOut at pinhead square using conventional spray equipment followed by rainfall (or irrigation) did not increase cotton yield in one large scale experiment. It is quite possible that environmental conditions in early June are too harsh for the survival of conidia on the soil surface for even a brief period prior to the application of rain or irrigation.

In 2008 Plato Industries, Ltd. intends to embark on a vigorous commercial launch for the application of NemOut as a post-emergence treatment into the soil profile as a means of extending the period of nematode control offered by soil-applied nematicides or seed-applied treatments. The EPA recently granted a registration for the NemOut formulation used in these evaluations and a label specifically addressing applications in cotton is pending and is expected prior to the next cotton growing season.

Acknowledgements

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