



Innovation Never Stops:

THE REVYSOL STORY

Part 2 University Testing: Where the Rubber Meets the Road *By Pat Jones*

(Editor's Note: This year, BASF and GCI are working together to tell the story of how a new active ingredient is coming to life for the golf market. The idea is to help you learn the scope of the R&D, testing, investment and plain hard work that goes on behind the scenes of product development. The specific formulations are not yet approved by EPA but indications are they will be available in 2019. The products discussed in this article are not registered and not available for sale, this article is provided for informational purposes only and not intended to promote the sale of the products. This is part 2 of a 4-part series on the remarkable process of bringing new chemistry to your golf course.)

If you've been around the golf course business more than a minute or two you've probably been to a field day. They are turf nerd heaven. You get the chance to eyeball new plant species, compare how different cultivation practices impact turf quality and, most of all, see side-by-side comparisons of how many of the insecticides, herbicides and fungicides in the market perform in your area.

Yet, there are also tests going on around you at those field days that aren't part of the tour. They are the experimental products, the yet unnamed actives and compounds that industry com-

panies feel have promise on turf. In many cases, they are products being transplanted from ag. For example, many of today's strobilurin fungicides came from the rice fields of the South.

But, in rarer cases those "Product X" plots contain an active ingredient that's coming to turf on a parallel testing program with ag. Revysol® fungicide, BASF's newest disease management technology, is one of those rare compounds that is being simultaneously developed for ag and turf. And, for the past 5-6 years, you've probably been walking right by it at your local field day.

Recently, the experimental

versions of Revysol fungicide (trade name for the new active ingredient) under your feet at those field days got product names: Maxtima® fungicide – the standalone version – and Navicon® Intrinsic® brand fungicide® – a combo with BASF's strobilurin Insignia® Intrinsic® brand fungicide. And, according to some of the best plant pathologists in the world, their performance in university testing is exceptional.

We talked with several scientists who've been heavily involved in the field trials process about what they did and what they saw. Here's what we learned

from Dr. Jim Kerns of North Carolina State University, Dr. Bruce Martin of Clemson, Dr. Rick Latin of Purdue and Dr. Bruce Clarke from Rutgers (see sidebar).

First, from the transition zone, Dr. Jim Kerns:

We have worked with Revysol – without knowing what it was – since 2013 or 2014. Initially we worked with the products as numbered compounds and the first diseases we tested were dollar spot, brown patch and anthracnose. Our first observations were strong in that the products provided excellent control of these three diseases. We continued to work with these diseases and started expanding into other diseases such as spring dead spot, fairy ring and take-all root rot of ultradwarf bermudagrasses.

When we finally learned it was a DMI, we were shocked. We had applied this material to creeping bentgrass and ultradwarf bermudagrass greens during periods of the year where other DMIs are usually phytotoxic but we hadn't observed any phyto damage. Honestly, with the flush of new SDHIs, we were happy that a new DMI was being introduced especially one that did not result in phytotoxicity because many supers were moving away from DMIs in general.

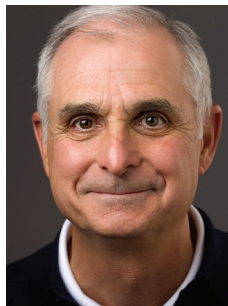
We have a unique system here at NC State where we develop testing protocols specific to what the companies tell us about the product and they vary widely for each disease. In this case we typically made 4 to 6 applications of Maxtima or Navicon for diseases like dollar spot or anthracnose, but only two to three applications



Jim Kerns



Bruce Martin



Richard Latin

for diseases such as spring dead spot or take-all root rot. We also varied how the products are applied based on the disease. For example, we irrigate fungicides in immediately after application when targeting diseases that affect the roots and stems like spring dead spot, fairy ring and take-all root rot.

We have found that Maxtima is an excellent fungicide for dollar spot, anthracnose, fairy ring, spring dead spot and take-all root rot. Navicon is also excellent on these diseases but brings better brown patch and summer patch control to the table with the addition of

Bruce Clarke on the field testing process

If plant pathologists are the rockstars of the turfgrass management business then Bruce Clarke is our version of Paul McCartney.

He started his formidable tenure at Rutgers in 1981. For four decades, he's been one of the very best in the field. Why? Because he doesn't do anything halfway. I asked him to give us a better understanding of the process and how it has and hasn't evolved over the years.



Bruce Clarke

Is testing fungicides different today than in 1981?

The process itself has not changed much for us. We get materials as experimental products 5 or 6 years before they are released to the market. We evaluate them based on a lot of factors including the number of diseases they might control, rates for specific diseases, compatibility, etc.

Most superintendents go to field days and hear presentations on various research programs but there are always those double-secret plots tucked away with no names on them. Revysol was one of those up until recently. What's the deal with those?

When I first came to Rutgers, there were very few unnamed experimental products or "RU" plots as we call them. Supers see them and ask about them but they often aren't the final products that will be released. So we can't divulge anything about the experiments because we're looking at how various versions of the "RU" products work at various rates. That's fundamentally what our research is all about.

What did you see from the process of examining Revysol?

We looked at the product and found it was quite effective for a number of diseases. It also worked at fairly low use rates which is important these days. Remember, we didn't know what the chemistry was – we often don't – so we're just working off what we see. The other thing we noticed that was it didn't have much if any phytotoxicity (yellowing) on *Poa annua*. We didn't see that with either product (Maxtima or Navicon fungicides) we were testing.

So how do those observations become a recommendation for use?

When we make recommendations, we look at the bulk of research that we've done plus all the published literature and plant management disease reports. We also check around with colleagues to see what they've found. We often publish the field-trial results (at turf.rutgers.edu) to get feedback and discussion from outside. Must have at least 10 reports from unbiased sources. We will be very conservative and cautious about how we do those rankings. Then, I distill the results and come up with an average efficacy rating of 1-4 and only then do we make our recommendations.

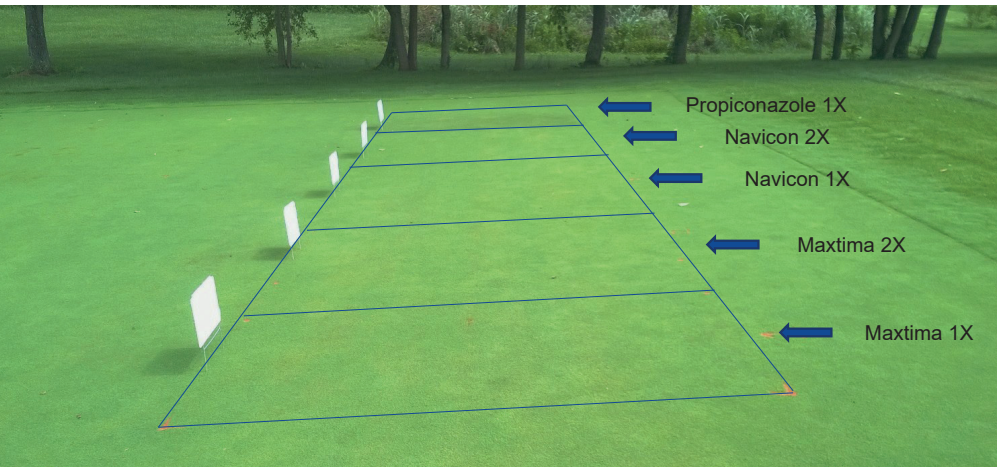
Insignia to Maxtima fungicide. The major observation is we did not see any phytotoxicity associated with Maxtima applications in any scenario we used. We applied the fungicide in fall, winter, spring and during the extreme heat of summer and observed no adverse effects.

I think these products will provide an excellent tool to complement the current suite of SDHIs and other products. These products have a broad

spectrum of activity and can be inserted into programs easily and offer flexibility as we have not observed phytotoxicity with Maxtima like we have with other DMIs. These two fungicides should give superintendents options to manage difficult diseases well.

From the South, Dr. Bruce Martin:

I started evaluations on what turned out to be Revysol fungi-



▲ Jim Kerns of NCSU and his colleagues around the country tested the products extensively in turf field trials.

cide for dollar spot and brown patch in 2014. We also did an initial look at the growth regulation potential on ultradwarf Bermuda grass. Our later evaluations included efficacy for spring dead spot and take all root rot.

I thought that we needed a new DMI, especially for soilborne diseases that did not regulate growth of bent, bermudagrass or other turfgrasses, especially for putting greens, so it was a pleasant surprise to find out that's what we had.

Our trials were conducted on research greens or other turf swards (including zoysia) at the Pee Dee Research and Education Center. We induced high disease pressure on the plots by inoculation and other methods. We use very accurate sprayers to mimic conditions on golf courses and greens are maintained similarly to golf course conditions.

What we found was that the Revysol fungicide active ingredient is the best DMI I have evaluated for many turf diseases based on effectiveness against a wide range of important diseases and due to the lack of detrimental growth regulation. So, it has low environmental impact and is and effective.

I think it offers

superintendents many new options and flexibility for different diseases. So far these fungicides appear to work very well where DMI resistance has been documented for dollar spot with other products. And Maxtima and Navicon are excellent for spring dead spot and take-all root rot. Both appear to have very good efficacy for fairy ring. Last but not least, the lack of growth regulation means they can be timed best for disease control with no fear of detrimental effects to turf.”

And from the North, Dr. Rick Latin:

Dr. Renee Keese of BASF asked me to help look at a new technology (which turned out to be Revysol fungicide) so we included it in my fungicide research trials for several years, beginning in 2014 or 2015.

When I first learned that it is a DMI fungicide I was very interested because the DMI class is very broad spectrum and has efficacy against pathogens that regularly threaten cool-season grasses.

The research trials included replicated field plots at a state-of-the-art turf research center. Our trials were conducted on creeping bentgrass maintained at putting green and fairway height. Fungicides were applied as per protocols supplied by BASF. Some were applied preventatively and others curatively (after appearance of symptoms in plots). The plots are evaluated at regular intervals to assess fungicide efficacy (disease severity) and turf quality.

Our research trials were limited to

the evaluation of Revysol fungicide activity against dollar spot. Revysol performed very well in all trials conducted over the years—beginning when it was a numbered compound. Furthermore, we did not observe any of the PGR and phytotoxicity effects associated with current popular DMI fungicides, even when applied repeatedly to bentgrass greens during the heat of the summer.

Maxtima offers superintendents a potent third-generation DMI. It is broad spectrum, so it will cover a lot of bases, including dollar spot and anthracnose, without the negative effects of conventional DMIs during stressful summer conditions. By combining the Revysol fungicide active ingredient (mefentrifluconazole) with pyraclostrobin, Navicon will further broaden its activity, further improve dollar spot control, and provide plant health effects throughout the season.

Consensus:

As field tests wrapped up and Maxtima fungicide and Navicon Intrinsic brand fungicides head toward EPA for registration, the scientific consensus from some of the best disease researchers on the planet is pretty straightforward: Revysol fungicide can potentially be a much-needed new DMI with great activity on key cool-season and warm-season turf with no apparent phytotoxicity issues or PGR effect. Will it be approved for golf this year? We'll find out in our next installment.



We create chemistry

NEXT UP:

Part 3 of our series will focus on how the EPA reviews products.

Note: Any sale of the products after registration is obtained shall be solely on the basis of the EPA-approved label, and any claims regarding product safety and efficacy shall be addressed solely by the label.

Revysol at a Glance

- Proposed tradename for turf is Maxtima
- Active ingredient is mefentrifluconazole
- Class of chemistry is new chemistry class Isopropanol Azole
- Strong potential as a resistance management tool
- Primary diseases controlled: anthracnose, dollar spot, summer patch
- Targeted registration: 2019
- A second proposed turf product, Navicon, includes Insignia (pyraclostrobin)