Photo: Andrew Friskop

Left: A sunflower plant leaf with a rust severity rating of 1%.

Managing Sunflower Rust With Fungicides

By Andrew Friskop, Sam Markell & Robert Harveson*

The Problem

Sunflower rust has become a common topic of conversation for producers in recent years. Prior to 2008, rust usually appeared in North Dakota during the late reproductive stages of sunflower development and in severities rarely resulting in economic damage.

During the 2008 growing season, however, the sexual recombination stage for the pathogen (yellow-orange aecial cup) was detected and disease onset occurred earlier than normal, *i.e.*, in late June. The effects of this event were two-fold: (1) the sexual recombination stage may have signaled the onset of new race development in the state, and (2) the early onset of cinnamon-brown pustules (uredinia) resulted in substantial yield loss in localized areas in North Dakota.

New race development could make resistant hybrids vulnerable to sunflower rust, and the early development of rust can initiate multiple cycles of spore production causing several plant infections. Recognizing the importance of the situation in 2008, sunflower growers applied fungicides to protect against yield loss. Additionally, fungicide efficacy and timing trials were initiated to provide answers on rust management and in an attempt to develop a threshold for applications.

The Response

For the past four years, North Dakota State University and the University of Nebraska have conducted a series of fungicide trials. With the help of both universities' research extension centers, Cenex Harvest States (CHS) and USDA-ARS, a total of 22 trials were conducted in the last four years. In 2008 and 2009, trials were designed to determine the best fungicide and fungicide timing when rust onset occurred "normally" (early August). To investigate this, two types of trials were conducted: (1) timing trials, which were designed to determine the best spray timing, and (2) evaluation trials, which were designed to determine which fungicide(s) worked best.

In the timing trials, two fungicides (Headline® and Tebuzol®) were applied singularly and/or in sequence at R3.5-4, R5.2-5.5 and R6 sunflower growth stages (equating to bud opening, early bloom and late flowering, respectively). In the fungicide evaluation trials, six to 11 fungicides were tested at R5.

The 2010 and 2011 trials focused on management of rust during early disease onsets in early reproductive stages. Fungicides were evaluated at V8-12, R1, and R5 (eight- to 12-true-leaf stage, bud formation and early flowering, respectively) in singular or sequential applications. Additionally, spraying programs were constructed rotating fungicide chemistries at R1 and R5 applications.

Trials were completed at the NDSU research extension centers in Langdon and Carrington, as well as in Bottineau, N.D. (former Vision Research Park), Casselton, N.D. (Cenex Harvest States), Grandin, N.D. (Cenex Harvest States), and Scottsbluff, Neb. Most trials were artificially inoculated with rust to facilitate disease pressure. Disease was evaluated as the average percent leaf area covered by pustules, with the aid of assessment diagrams found in the North Dakota State University Extension publication "Sunflower Rust."

The Results

Results of the 2008 and 2009 trials produced a reoccurring theme: the *timing* of a fungicide application was more important than the *type* of fungicide used. Both labeled fungicide chemistries (strobilurins and triazoles) were equally effective in reducing disease.

With regard to fungicide timing, applications made at R5.0-5.9 (bloom) when pustule coverage on the upper four leaves was about 1% resulted in lower disease and protected both yield and test weight loss when compared to non-treated control plots. Additionally, data indicated that single fungicide applications at R5.0-5.9 often resulted in disease values statistically the same to multiple applications of fungicides. Some locations suggest that applications made at R6 do not significantly reduce disease pressure and therefore may be cost inefficient.

In the 2010 and 2011 trials, disease pressure was apparent early in the growing season, but it did not reach high severity levels at season's end. However, more information was obtained in regard to timing of fungicide applications. In agreement with 2008 and 2009 data, the R5 growth stage was important for fungicide application. Some trials demonstrated a singular

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application at V8-12 was less effective at managing disease than later applications. When sequential applications of different fungicide chemistries (spraying programs) were used, disease pressure was lower than that of the non-treated control plot, but statistically the same to each other.

In general, our data showed that when rust is present, a well-timed fungicide application limited disease progression; and when severity was high enough to damage the crop, that same well-timed application often protected both yield and test weight.

Yield and test weight increases were not observed in all 22 trials, of course; but under the right conditions, it is clear that fungicides worked very well. Figure 1 *(below)* is an example of a tebuconazole application being made when rust severity approached 1% at R5, and disease severity, yield loss and test weight loss were all limited. This trend was also observed for other fungicides applied at this time.

New Management Recommendations

Fungicide work conducted in Israel during the 1990s determined a fungicide action threshold of 3% rust severity on the upper four leaves at mid-R5. However, these trials were conducted in a sunflower growing region vastly different from the Northern Great Plains.

Prior to 2008, specific sunflower rust fungicide recommendations for U.S. growing regions were not well defined. Our data support a fungicide action threshold at 1% severity on the upper four leaves at R5.0-5.9. It should be noted that if rust severity is at or above 1% on the upper four leaves before R5, multiple fungicide applications may be warranted and are likely suggested. Additionally, the 2008 epidemic signaled the labeling of another fungicide chemistry: tebuconazole.

When it comes to managing sunflower rust, both long-term and short-term goals are needed. The long-term goal is using rust-resistant hybrids. Host resistance is often the cost-effective way of managing disease, but it may not always be available. The short-term goal is using fungicides appropriately. As indicated in 2008, fungicides serve as a very important management tool for sunflower growers.

Rust infections vary from year to year and are unpredictable. But a few important guidelines can be followed in a rust year:

- If rust is detected early in the growing season, producers should scout their fields to observe the canopy location of rust.
- Special attention should be given to the upper four leaves of the sunflower plant with respect to growth stage.
- Being aware of the rust progression in a field will determine the opportune time to make a fungicide application. ■

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Figure 1: Carrington REC - Disease Progression - Rust Severity, 2009