Management of Grain Sorghum Diseases in Arkansas(Year 1 of 3)

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Over 99% of U.S. sorghum acreage (approximately 8,000,000 acres) is grain sorghum, which is clustered in two geographically distinct regions: the Great Plains and the Southeast. Nearly 75% of U.S. sorghum acreage is in the Great Plains, which has low annual rainfall (15-25 inches/year) and nutrient-rich soils. The remaining 25% of grain sorghum production is located in the Southeast, and Arkansas is a leading sorghum-producing state in this region. Environmental conditions in Arkansas are distinct from the Great Plains and are highly conducive for many sorghum diseases. Specifically, the warm temperatures, abundant rainfall, and high humidity that typify Arkansas are ideal for head mold and foliar diseases of sorghum that are not typically problematic in the Plains states. Head mold is of particular concern because of the risk of mycotoxins accumulating in infected grain. Other sorghum diseases also cause a wide range of problems in Arkansas, such as poor stand establishment, stunting, defoliation, lodging, and premature plant death. In a single growing season, sorghum in Arkansas can simultaneously be challenged by several diseases that act synergistically to cause damage and reduce yields. Transient and chronic abiotic stresses such as drought and marginal soils can further increase disease pressure. Additionally, endemic populations of sorghum pathogens are sustained by the abundance of alternative hosts such as Johnson grass (*Sorghum halepense*).

The ultimate goal of this project is to determine which diseases pose the greatest threats to sorghum production and profitability in Arkansas and to develop management tools and recommendations specifically for growers in Arkansas. Our approach involves three main components. First, we are performing annual sorghum disease monitoring throughout Arkansas, which includes rating variety tests and evaluating growers' fields to isolate and identify problematic pathogens. In addition to providing a baseline of information about disease incidence and severity, these activities also allow us to identify trends of increasing or decreasing disease importance, identify new threats as they arise, and provide information about the way specific hybrids respond to specific diseases. Secondly, for diseases that threaten yields, we are evaluating the efficacy and profitability of various control methods, including fungicide selection and application. Finally, we are defining the diverse group of fungi associated with head mold in Arkansas, with a focus on determining the mycotoxigenic potential of head mold pathogens. For all of the activities mentioned above, we are evaluating white sorghum hybrids alongside red sorghum hybrids.

In previous, related research, we found that target leaf spot, zonate leaf spot, and anthracnose were the foliar diseases that most consistently affected Arkansas sorghum production, with other diseases such as sooty stripe making periodic appearances. Additionally, although the fungi most commonly associated with head mold in Arkansas do not produce mycotoxins, low levels of mycotoxigenic fungi are consistently found in grain from a wide variety of hybrids. Initial tests with foliar fungicides showed some yield increases, but not for all fungicides, and only when disease pressure was substantial (please refer to the final report for the 2008-2010 project titled Management of Grain Sorghum Diseases in Arkansas, by Rick Cartwright and Burt Bluhm). Although initial experiments with foliar fungicides did

not show a major impact on head mold fungi, head mold levels were low overall in 2010, however, and thus additional experiments are being performed.

Although this is the first year of a three-year project, we have made some important observations regarding sorghum diseases in Arkansas. First, we have found a low but consistent level of potentially mycotoxigenic fungi associated with sorghum grain in the state; typically between 0-10% of kernels were infected, regardless of hybrid. All of the mycotoxigenic fungi identified were species of *Fusarium*, which are capable of producing fumonisins, trichothecenes, and zearalenone under favorable conditions. This finding is consistent with the periodic reports received by the Division of Agriculture that zearalenone and other mycotoxins were found to be unacceptably high in Arkansas-grown sorghum. Interesting, when we tested the Fusarium-contaminated samples for mycotoxins, none were detected. Additionally, what was surprising about the *Fusarium* infections is that we found *Fusarium* to be just as likely to be associated with plump, visually healthy kernels as visibly discolored/damaged/shriveled kernels. These findings suggest that the fungi that cause mycotoxin problems in sorghum are probably present in grain year-in and year-out, but require a unique set of environmental conditions to proliferate and produce toxins. We will test this hypothesis with field and laboratory experiments in 2012 and 2013. Secondly, we evaluated grain sorghum varieties for resistance to foliar disease by planting tests at the Newport, AR, station and scoring plots in the Arkansas variety testing program. In 2011, sorghum diseases were low to moderate throughout much of the state, and very little disease was observed at the Newport station. However, a high incidence of target leaf spot at the Marianna station allowed us to score hybrid responses to this disease. No hybrid was resistant, and many were highly susceptible. However, at least one hybrid, Dyna-Gro 772B, showed a significantly higher level of resistance compared to other varieties. The full results of the test will be analyzed and provided to the variety testing program. Because of the frequency at which target leaf spot is observed in Arkansas, and the apparent lack of genetic resistance among commonly planted hybrids, we will place a high priority on this disease in 2012 and 2013 with additional experiments planned to quantify the impact of the disease on yield and identify cost-effective management strategies.

In sum, this project provides value to growers by providing specific recommendations about genetic resistance to common diseases in Arkansas among sorghum hybrids and the most cost-effective way to manage those diseases. Ongoing work is focused on developing and providing detailed up-to-date disease management recommendations specifically tailored for Arkansas sorghum production.

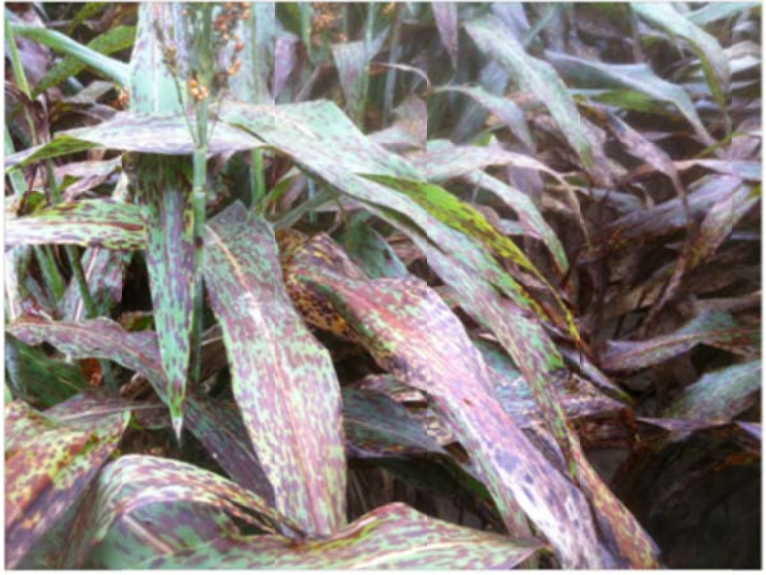

Figure 1. Target leaf spot (caused by *Bipolaris sorghicola*) outbreak on grain sorghum in Marianna, AR (August, 2011).

Figure 2. Evaluations of various sorghum hybrids revealed different levels of susceptibility to target leaf spot (a comparatively resistant hybrid can be seen on the right, with fewer foliar lesions than the susceptible hybrid on the left).