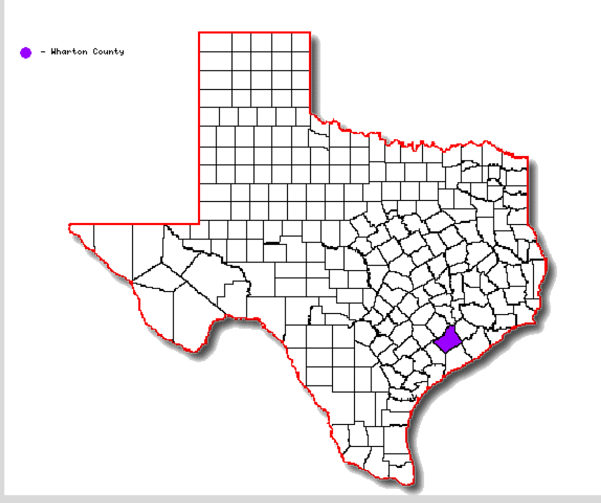

Evaluation of Fungicides Applications for Improved Plant Health in Grain Sorghum

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Abstract

Based on recommendations from fungicide manufacturers, producers are applying fungicides to grain sorghum to enhance plant health and to increase yields, even in the absence of foliar disease symptoms. To address this practice, two foliar fungicide trials were conducted in the Upper Gulf Coast Region of Texas. The objective of these two studies was to determine if there was a yield increase or economic benefit of applying a fungicide to grain sorghum in the absence of disease pressure. Foliar fungicide applications were made when grain sorghum reached 25% bloom. Fungicides evaluated in these studies included Headline® (pyraclostrobin), Quadris® (azoxystrobin), and Topguard® (flutriafol). Beginning at 25% bloom, leaf temperature and chlorophyll measurements were taken to determine if there were differences between the fungicide treatments. These measurements were taken on a weekly basis until grain sorghum reached physiological maturity. At harvest, percent lodging, percent grain moisture, bushel weight, and grain yield were measured. Following harvest, grain samples were evaluated to see if differences in surface grain mold, total nitrogen, and percent protein in the seed were evident. Foliar fungicide applications did not increase grain yields and no differences were found in the other variables that were measured with the exception of total nitrogen and percent crude protein being higher at one of the locations.

Introduction

The use of foliar fungicides on grain sorghum has increased greatly over the past 2-3 years in the Texas Upper Gulf Coast Region. Fungicides are typically used in grain sorghum to control foliar diseases when the potential for yield loss is significant. However, some suggest fungicides should be used to improve plant health regardless of the presence of disease. This preemptive application is thought to improve the physiological function of the plant, improve stress tolerance and standability of the crop. Modern hybrids with high yield potential and new fungicide active ingredients with effects on crop physiology have been given as possible motivations for increased fungicide application in corn (1). In particular, based on bioassays and studies conducted under controlled conditions, quinone outside inhibitor (QoI) fungicides have been show to induce physiological and developmental changes in plants, including retardation of senescence due reduced oxidative stress (2), increased photosynthetic capacity, transient inhibition of respiration, inhibition of ethylene biosynthesis (3), and reduction of stomatal aperture and water loss through transpiration (4,5). These changes are believed to translate into greater stress tolerance and higher yields . The actual benefits of these applications in commercial grain sorghum fields are uncertain and producers question if spending between $22.00 to $38.00 an acre + application costs for these fungicides is profitable.

Objectives

1. To determine if there was a yield increase or economic benefit of applying a fungicide to grain sorghum in the absence of disease pressure.
2. To determine if differences in plant health could be measured.

Materials/Methods

Two studies were implemented to evaluate the effect of foliar fungicide applications on grain sorghum yields and overall plant health in the Texas Upper Gulf Coast Region. Studies were planted on March 8, 2013. Both studies were located at the Michael Beard farm in Wharton County, Texas. Previous crop was cotton. Two different grain sorghum hybrids were planted. The hybrid planted at the east location was DKS 5400 and DKS 53-67 was planted at the west location. Seeding rates were 90,000 seed per acre. At planting, 2.4 pints of guardsman slider atz + 2.7 ounces of outlook was applied for preemerge weed control. Fertilizer was knifed in during the month of January at a rate of 112-39-15-7s -.3zn. Soil type was a Lake Charles clay. Both studies were grown under dryland conditions. Row spacing was 40 inches. Fungicide applications were made at the 25% bloom stage on May 31, 2013. Plot sizes were 4 rows by 40 feet in length. Experimental design was a randomized complete block. Number of replications was four. Fungicides evaluated included Headline® (pyraclostrobin) at 12 oz/acre, Topguard® (flutriafol) at 14 oz/acre, and Quadris® (azoxystrobin) at 14 oz + COC at 1% v/v. A Lee spider sprayer was utilized to apply the fungicides. Fungicides were applied in 15 GPA at 25 psi and 8003xr spray tips were used. Ground speed was 5 mph. Leaf temperature and chlorophyll measurements were taken on a weekly basis until grain sorghum reached physiological maturity. A Raytek ST Pro™ (laser point) temperature gun was used to record leaf temperatures. Chlorophyll measurements were recorded with a Spad 502 chlorophyll meter. On July 1, glyphosate was applied at 40 oz/acre for ease of threshing and faster dry down. Percent lodging ratings were made on the day prior to harvest. Harvest dates were July 9, 2013. Three sub-samples were hand-harvested from each plot. Each sub-sample was 1/1000th of an acre in size. Grain yield was determined by hand-harvesting the sorghum heads and then utilizing a mechanical thresher to remove the seed. Percent moisture and bushel weight were recorded after each sub-sample was threshed. Grain sorghum samples were assessed to determine if there were any differences in grain mold. Also, additional samples were to sent to the Texas A&M AgriLife Extension Service soils lab to determine total nitrogen and percent crude content of the seed. No disease pressure (leaf blight, anthracnose, zonate leaf spot, sooty stripe, target leaf spot, and rust) was observed throughout the duration of the two studies.

Results

Leaf temperature and chlorophyll measurements were not affected by the fungicide applications. At harvest, there were no differences in lodging. Yield, bushel weight, and percent moisture were not affected. There were no differences in grain mold ratings or no pre-harvest development of grain mold symptoms. At the east location, total nitrogen and percent crude protein were not different; however, fungicide applications increased total nitrogen and percent crude protein at the west location (Table 2).

Based on the results of these studies, only apply fungicides when disease is present and has crossed established agronomic and economic thresholds. Strobilium fungicides are very effective in controlling labeled diseases. Fungicides applied to improve plant health may result in a better looking crop; however, the applications are not justified if disease is not present and significant yield losses are not eminent.

Acknowledgements

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Table 1. Results for the east location, Michael Beard farm, Wharton, County, Texas.

Treatment	Oz./Acre	Leaf Temp.[2] (°F)		Chlorophyll[2]		% Lodging[3]		Seed (Total N)		Seed (%CP)		Grain Mold[4]		Moisture (%)		Bushel Weight		Yield[5] (lbs./acre)	
Headline	12	91.09	a	46.12	a	0.3	a	1.81	a	11.28	a	1	a	16.57	a	56.17	a	5493	a
Quadris[1]	14	91.11	a	44.16	a	0.0	a	1.89	a	11.80	a	1	a	16.53	a	56.13	a	5354	a
Topguard	14	91.25	a	45.74	a	0.0	a	1.76	a	10.99	a	1	a	16.58	a	56.21	a	5524	a
Untreated	---	92.16	a	45.87	a	0.3	a	1.84	a	11.50	a	1	a	16.05	a	56.54	a	5487	a
Mean	---	91.4		45.47		0.13		1.82		11.39		1.0		16.43		56.26		5464	
P>F	---	0.7708		0.2268		0.6310		0.1814		0.1868		1.0000		0.0597		0.7171		0.8982	
LSD (P=.05)	---	NS		NS		NS		NS		NS		NS		NS		NS		NS	
STD DEV	---	1.64558		1.3432		0.37		0.0791		.4847		0.00		0.27083587		0.5647		342.967	
CV%	---	1.8		2.95		298.14		4.34		4.26		0.0		1.65		1.0		6.28	

Means in a column followed by the same letter are not significantly different by ANOVA.
[1]A crop oil concentrate (1% v/v) was added to the Quadris treatment.
[2]Based on the average of a five week period. Readings were taken on a weekly basis.
[3]Percent lodging out of 100 plants.
[4]Grain mold ratings are based on 1-5 scale. 1=seed bright with no mold and discoloration, 5=seed was covered entirely with mold and is deteriorated and looks dead.
[5]Adjusted to 14% moisture

Table 2. Results for the west location, Michael Beard farm, Wharton, County, Texas.

Treatment	Oz./Acre	Leaf Temp.[2] (°F)		Chlorophyll[2]		% Lodging[3]		Seed (Total N)		Seed (%CP)		Grain Mold[4]		Moisture (%)		Bushel Weight		Yield[5] (lbs./acre)	
Headline	12	88.46	a	47.72	a	0.0	a	1.99	a	12.44	a	1	a	17.95	a	58.17	a	5915	a
Quadris[1]	14	88.90	a	47.62	a	0.0	a	1.95	ab	12.18	ab	1	a	17.80	a	58.17	a	5883	a
Topguard	14	88.37	a	47.53	a	0.0	a	1.91	b	11.93	bc	1	a	17.78	a	57.92	a	5872	a
Untreated	---	88.75	a	47.65	a	0.0	a	1.90	b	11.87	c	1	a	17.64	a	58.42	a	5918	a
Mean	---	88.62		47.63		0.0		1.94		12.11		0.0		17.79		58.17		5897	
P>F	---	0.9827		0.9959		1.0000		0.0127		0.0090		1.0000		0.7028		0.3764		0.9897	
LSD (P=.05)	---	NS		NS		NS		0.0515		0.3118		NS		NS		NS		NS	
STD DEV	---	2.13500		1.1133		0.00		0.0322		0.1949		0.00		0.3632		0.3754		238.17	
CV%	---	2.41		2.34		0.0		1.66		1.61		0.0		2.04				4.04	

Means in a column followed by the same letter are not significantly different by ANOVA.
[1]A crop oil concentrate (1% v/v) was added to the Quadris treatment.
[2]Based on the average of a five week period. Readings were taken on a weekly basis.
[3]Percent lodging out of 100 plants.
[4]Grain mold ratings are based on 1-5 scale. 1=seed bright with no mold and discoloration, 5=seed was covered entirely with mold and is deteriorated and looks dead.
[5]Adjusted to 14% moisture.