INCIDENCE OF CROWN GALL UNDER VARIOUS CULTURAL PRACTICES L.D. Kahler J.E. Woodward Texas AgriLife Extension Service Lubbock, TX T. A. Wheeler J.P. Bordovsky Texas AgriLife Research Lubbock, TX

Abstract

The incidence of Crown gall, caused by *Agrobacterium tumefaciens*, was observed under various cultural practices including irrigation levels, rotation, and cultivars. Plants (n=10) were destructively sampled from each plot. The galls were rated numerically, and bacterial isolations were identified via colony morphology, and fatty acid profiles. Stoneville 5458B2F and Deltapine 104B2RF were observed although cultivar selection, and had no impact on galling. Disease incidence was highest under the continuous cotton rotation scheme. Lower irrigation levels caused higher incidence of galling on plants. The impact of this disease on production is not known.

Introduction

Crown gall, caused by *Agrobacterium tumefaciens*, is a ubiquitous pathogen. The bacterium is known to be seedborne (Bell, 2000). Infected plants appear stunted or wilted, and galling may occur on roots (Bell, 2000; Hillcocks, 2001). Crown gall has been reported throughout the United States; however, the disease has not been shown to impact yield (Hillcocks, 2001). Disease incidence was found to be 50-70% in several fields in Israel (Zutra and Orion, 1982). Crown gall is frequently observed on cotton roots in Texas (Woodward, personal observation). Large tumors were observed on cotton roots at a high frequency in fields during the 2009 growing season. The objectives of this study were to identify cultural practices that may influence Crown gall.

Methods and Materials

Field observations were made at the Texas AgriLife Research and Extension Center, Helms Farm, located in Halfway. Various cultural practices were observed. Irrigation observations included a base rate (B) which was approximately 80 % of evapotranspiration replacement, B - 50% and B + 50%. Two cultivars were observed, Stoneville 5458B2F and Deltapine 104B2RF. Three rotational practices were observed including cotton (2007), cotton (2008), cotton (2009) (C-C-C), cotton (2007), sorghum (2008), cotton (2009) (C-S-C), and sorghum (2007), cotton (2008), cotton (2009) (S-C-C) with 3 replications.

Disease incidence was rated in the field on July 15^{th} , and plants (n=10) were destructively sampled to determine the percentage of plants with galls. Bacterial cells were isolated from galls via streak plating technique onto potato dextrose agar (PDA). Fatty acid profiles were used for confirmation. Gall sizes were also categorized. Data were analyzed using Proc GLM in SAS version 9.1.

Results and Discussion

Root galls (Figure 1) were observed on approximately 45% of the plants examined (data not shown). This high frequency of infection is consistent with previous reports (Zutra and Orion, 1982). Pure bacterial colonies were obtained from infected roots (Figure 2), and fatty acid analysis identified the isolates as *A. tumefaciens* (data not shown). *A. tumefaciens* has been implicated in the Bronze wilt complex; however, the symptoms observed in this study were not characteristic of the disease (Bell, 2000). Both disease incidence and the number of plants exhibiting galls were affected by lower levels of irrigation (Table 1). Cultivar selection did not impact root galling caused by *A. tumefaciens*. Disease incidence, the number of galls per plant, and gall size were highest under the continuous cotton rotation scheme. Synergistic interactions between *A. tumefaciens*, *Rhizoctonia solani*, and *Meloidogyne incognita* have been observed (Bell, 2000). Field observations from the 2009 growing season indicate a similar interaction with *Rotylenchulus reniformis* may exist (Woodward, personal observation). While Crown gall is a minor disease of cotton, an increase in disease incidence may occur under stressful conditions.

References

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Figure 1. Characteristic galls associated with *Agrobacterium tumefaciens* on the tap root (left) and crown (right) of infected cotton plants



Figure 2. Colony characteristics of Agrobacterium tumefaciens

Factor, level	-	Disease incidence (%)	Symptomatic plants (%)	Galls / Plant (#)	Gall size (1-5 scale)
Irrigation level					
Low		4.0	52.2	4.0	1.4
Moderate		2.9	49.5	3.3	1.2
High		0.3	28.9	2.8	1.7
	LSD	3.1*	9.8‡	NS	NS
Cultivar					
ST 4554B2RF		2.2	40.7	3.3	1.4
DP 104B2RF		2.7	46.3	3.5	1.5
	LSD	NS	NS	NS	NS
Rotation Scheme					
C-C-C		5.2	22.8	4.4	1.8
C-S-C		1.6	21.7	2.5	1.3
S-C-C		0.5	20.8	3.3	1.2
	LSD	3.1†	NS	1.5*	0.4

Table 1. Effect of irrigation level, cultivar selection, and rotation scheme on Crown gall development

^a Galls were categorized based on size: 1 = < 3mm, 2 = 3 to 5 mm, 3 = 5 to 10 mm 4 = 10 to 20 mm, and 5 = > 20 mm. ^b Symbols *, †, ‡ denotes significance levels of $P \leq 0.10$, $P \leq 0.05$, and $P \leq 0.001$, respectively. NS = $P \geq 0.10$.