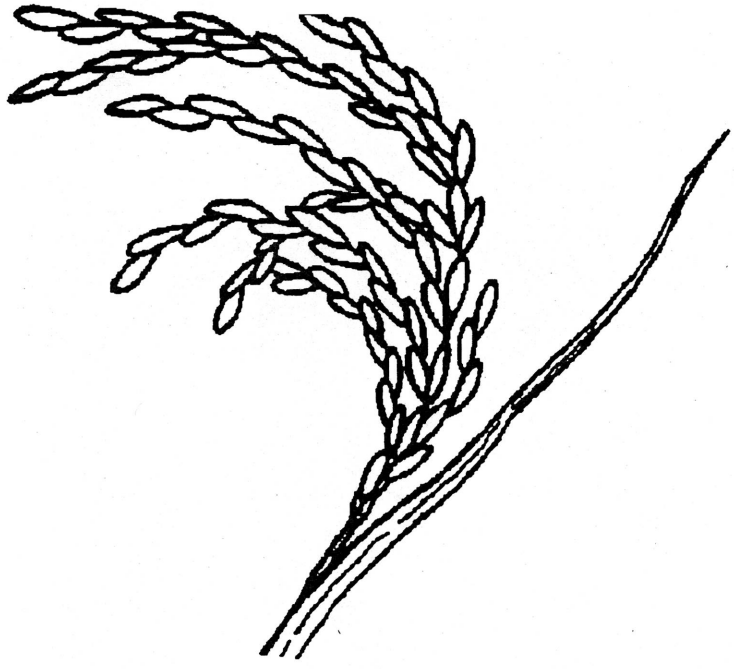
1997

Southern Small Grain Workers Conference



April 27-30, 1997

Hampton Inn Beachfront Resort

Orange Beach, AL

Effect of Crop Rotation on Take-all Root Rot of Wheat

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This research was funded by the Southern Region USDA SARE/ACE program.

Beginning in the 1970s wheat: soybean double cropping became a favored row crop farming system in the Southeast. As wheat production increased, take-all root rot, caused by *Gaeumannomyces graminis leaf* var. *tritici,* became a serious problem where wheat was grown for three or more consecutive years. Crop rotation is the main method to manage take-all. Research showed that fallow or oats in place of wheat were the only alternatives to wheat. Barley and rye are only mildly affected by the disease, but they maintain the fungus at a level that results in serious take-all damage when wheat is planted the next season. Soybean maintains the fungus at a high level also. Sorghum as a summer crop reduced take-all in the following wheat crop. A project was started in 1994 to investigate alternative rotational crops in the wheat:soybean system that would contribute to control of take-all and provide a profitable and sustainable farming system. As part of an interdisciplinary approach, twelve long-term rotation sequences were established in replicated plots at the Southwest Branch Station at Plains. A winter rye cover crop killed in early March or canola were alternatives to wheat and pearl millet for grain was grown in some rotations as an alternative to soybeans.

Methods

Soil was infested with the take-all fungus at the start of the project to simulate continuous wheat production that resulted in a buildup of severe take-all. Plots were 1200 sq ft. Wheat was planted in early November and harvested in late May. Wheat samples were removed from random locations in plots and rated for root rot at late milk to early dough stage (early May) when symptoms were most severe. The number of tillers per meter of row was counted about two weeks before harvest. Grain yield components were determined from grain harvested from a 1,000 sq ft area of each plot.

Results and Discussion

Results from the second year of the study are summarized here. Take-all caused severe damage and reduction in yield in rotations with continuous wheat (Table 1). However, a one-year rotation with canola resulted in about a 50% reduction in root disease severity score compared with continuous wheat. Results from assays of take-all

damage on wheat seedlings grown in soil collected from the field plots were similar. Wheat grain yield, test weight, and 1,000 kernel weight in rotations with canola were the same as yields from control plots where no take-all occurred. All yield components were greatly reduced in continuous wheat because of take-all damage (Table 1). Comparison of continuous wheat with soybeans or pearl millet as the summer crop did not show any differences in wheat yield components the first year. In the second season grain yield did not differ significantly, but test weight and 1,000 kernel weight were higher following millet (Table 1).

The study is now in its third year. Results similar to the first two seasons will be needed to draw firm conclusions. However, the results for rotation with canola are encouraging. A one year rotation with canola may be sufficient to reduce take-all damage to a low level. Canola has the potential to be a more profitable winter crop than oats or rye cover crop. More data are needed to determine if pearl millet can reduce take-all when planted in place of soybeans.

Table 1. Wheat yield components and disease incidence and severity for Savannah wheat in response to crop rotation and -all root rot. Plains, GA 1995-96

Rotation	Yield bu/A	Test weight lb/bu	1,000 kernel weight (g)	No. tillers per m	% infected plants	Disease severity (0-4)[z]
1. W-S-W[w]	3.9 b[x]	42.4 c	15.1 a	23 c	100 a	3.6 a
3. C-S-W	46.8 a	55.4 a	27.6 a	61 a	72 ab	1.4 bc
8. C-M-W	41.8 a	56.0 a	29.2 a	54 a	54 b	1.2 bc
9. W-M-W	8.0 b	47.2 b	19.3 b	28 c	99 a	2.6 ab
10. W-M-R						0.6 c
I 1. R-M-R					46 b	0.5 c
Control I[y]	47.9 a	56.2 a	30.1 a	50 ab	13 c	0.1 d
Control 2[y]	44.5 a	55.6 a	27.9 a	47 b	9 c	0.1 d

[w]C = canola, M = pearl millet, S = soybean, and W = wheat. Canola and wheat are fall-planted crops; Pearl millet and soybean are summer crops.

[x]Means in columns followed by the same letter are not significantly different according to Duncan's New Multiple Range Test (P = 0.05).

[y]1 = Rotation 8 noninoculated control; 2 = rotation II noninoculated control

[z]0 = no disease; 4 = plants dead.

Table 2. Incidence and severity of take-all root rot on wheat seedlings grown in soil from plots with twelve crop rotation sequences. Plains, GA. 1994-96

	Rotation	% plants with take-all	Disease severity (0-4)[x]		Rotation	% plants with take-all	Disease severity (0-4)
1.	Wheat[y]	88 a[z]	1.6 b	7.	Wheat	99 a	1.7 a
	Soybean	98 a	1.6 b		Soybean	98 a	2.0 a
	Wheat	100 a	3.3 a		Canola	65 b	0.7 b
2.	Canola	17 b	0.2 b	8.	Canola	35 a	0.5 a
	Soybean	22 b	0.1 b		Millet	36 a	0.6 a
	Canola	60 a	0.7 a		Wheat	75 a	1.5 a
3.	Canola	29 b	0.4 b	9.	Wheat	99 a	1.9 b
	Soybean	25 b	0.3 b		Millet	100 a	1.9 b
	Wheat	80 a	1.7 a		Wheat	100 a	3.2 a
4.	Canola	37 a	0.6 a	10.	Wheat	78 a	1.3 b
	Millet	34 a	0.3 a		Millet	90 a	1.6 b
	Canola	41 a	0.4 a		Rye	100 a	2.7 a
5.	Wheat	100 a	1.9 a	11.	Canola	16 b	0.2 a
	Soybean	89 a	1.7 a		Soybean	22 b	1.1 a
	Canola	79 a	1.1 a		Wheat	86 a	1.9 a
6.	Rye	73 a	1.2 a	12.	Rye	53 a	0.9 b
	Soybean	76 a	1.3 a		Millet	55 a	0.6 b
	Canola	30 a	0.3 a		Rye	95 a	2.5 a

[x]0 = no disease, 4 = >75% of root system diseased.

[y]Soil collected from plots of the three crops in each group in March 14, 1995 (first line); August 30, 1995 (second line); and April 18, 1996 (third line).

[z]Means in columns within each rotation sequence followed by the same letter are not significantly different according to Duncan's New Multiple Range Test (P = 0.05).