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Early Maturing Varieties and Soybean Cyst Nematodes: Will This Marriage Work?

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EARLY MATURING VARIETIES AND SOYBEAN CYST NEMATODES: WILL THIS MARRIAGE WORK?

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INTRODUCTION

Soybean cyst nematode (SCN) is widely distributed in Kentucky's soybean growing areas. The use of SCN-resistant varieties has long been a recommended production practice for infested fields. However, continuous use of such varieties can result in a shift to a race of SCN which is able to vigorously attack previously resistant varieties. For this reason, many states recommend that producers periodically grow a crop of SCN-susceptible soybeans within a crop rotation when SCN populations are at minimal levels (causing less than a 5% loss in yield). The UK Plant Pathology Department recommends a four year rotation in SCN-infested fields [PPA3; "Wanted: Soybean Cyst Nematode" (video)]. Year one should be a nonhost crop (like corn), followed by an SCN-resistant soybean variety, then another nonhost crop (corn or milo). Producers would grow an SCN-susceptible soybean variety in the fourth year of this rotation. This is, of course, provided that the three previous years have brought SCN populations down to a safe level.

In the 1990s, some Kentucky producers reported good yields from SCN-susceptible Maturity Group (MG) II varieties in infested fields. Perhaps, earlier maturing varieties sustain less damage from SCN because the nematodes simply have less time to inflict that damage. If this turned out to be true, the use of SCN-susceptible MG II varieties would give soybean producers another option in their effort to manage SCN. Thus, the goal of this research was to determine if SCN-susceptible MG II varieties could produce better yields than MG IV, SCN-susceptible varieties under SCN pressure in Kentucky fields. This test was supported by the Kentucky Soybean Promotion Board.

MATERIALS AND METHODS

We planted four high-yielding varieties from each of the following classes: 1) MG II, SCN-resistant 2) MG II, SCN-susceptible 3) MG IV, SCN-resistant, and 4) MG IV, SCN-susceptible.

These 16 varieties were planted on May 31 and June 20, 1995 and on May 20 and June 17, 1996 on the Darren Luttrell farm in Ohio County. For the 1995 test, the soil was a Melvin/Newark intergrade; for the 1996 test, the soil was a Newark. Both test sites had been planted to corn in the previous season with a history of high SCN levels in earlier seasons. Conventional tillage was done prior to each planting date. Plots were six, 15-inch wide rows by 20 feet long. Initial SCN egg counts were determined from seven samples of the surface six inches of soil taken between the two middle rows of each plot immediately after planting.

The nematicide aldicarb (Temik) was applied on the date of planting at a broadcast rate of 20 pounds/A on one-half of the SCN-susceptible plots. Thus, each susceptible variety was present in each of the four replications both with and without Temik. This treatment is labeled for band application in both Kentucky and Ohio. We broadcasted Temik in an effort to document that SCN was, in fact, responsible for measurable yield losses of SCN-susceptible varieties. Note: we did not apply Temik to any plots of SCN-resistant varieties. Weed control was accomplished both years using a post emergence treatment of bentazon, fluazifop, and fomesafen.

We measured canopy closure at both R1 (beginning flowering) and R5 (beginning seed fill), mature plant height, and lodging. The four central rows of each plot were harvested with a small plot combine as each MG dried down. After harvest, we took a final SCN egg count (using the same techniques as for the initial count). Egg count data are shown as final:initial (f/i) ratios to make clear the change in SCN activity as the growing season progressed (Tables 1 & 2). A final:initial egg count ratio greater than 1 indicates that SCN were multiplying during the season, whereas, a finial:initial egg count ratio less than one indicates that SCN numbers actually declined during the season.

In 1996, the same 16 varieties were planted on May 14 and June 14 in Fayette County on a Maury soil site which had no detectable nematodes in samples taken prior to planting. The same procedures were employed as in the Ohio County tests except that alachlor, imazaquin, and quizalofop were used to control weeds and no SCN samples were taken during the season. Temik was not applied in Fayette County. The purpose of this test was to determine how well the varieties would perform in the absence of nematodes.

All three tests were statistically analyzed as follows: the 16 resistant and susceptible varieties were compared without Temik (using a split plot analysis with planting dates as whole plots and varieties as split plots). Then, for the two Ohio County tests, the 8 susceptible varieties were compared, both with and without Temik (using a split plot analysis with planting dates as whole plots and combinations of susceptible varieties and Temik treatments as split plots).

RESULTS

Table 1 shows results from the 1995 Ohio County tests. SCN f/i ratios and yields were averaged across the two planting dates. The averages of the 4 varieties from each MG x SCN reaction class are shown in italics. Initial egg counts averaged 2495 eggs/100cm^3 of soil in 1995. That corresponds to a cyst count of about 50 cysts/100cm^3, with an expected SCN damage to range between 15 and 20% yield reduction.

SCN f/i ratios were less than 1 for all 8 SCN resistant varieties but greater than 1 for all 8 susceptible varieties (Table 1). Wide variability in SCN f/i ratios was observed, making it hard to show very many statistically significant differences. Temik tended to reduce SCN f/i ratios of MG II susceptible varieties, but had no clear effect on those of MG IV susceptible varieties. Final egg counts

averaged 667 and 5188 for resistant and susceptible varieties, respectively.

MG IV varieties from both resistant and susceptible classes slightly out-yielded their counterpart varieties from MG II (Table 1). For both MGs, resistant classes yielded higher than did susceptible classes. Temik tended to have a small positive effect on yields of most of the susceptible varieties, but this effect was not statistically significant.

Table 2 shows the 1996 results from both Ohio and Fayette Counties. Initial egg counts averaged 2060 eggs/100 cm^3 of soil in 1996; SCN damage at that level of infestation would be expected to range between 15 and 20%. SCN f/i ratios and yields were again averaged across the two planting dates. Like 1995, SCN f/i ratios were less than 1 for all 8 susceptible varieties, but greated than 1 for all 8 resistant varieties. MG II susceptible varieties tended to have less SCN reproduction than did MG IV susceptible varieties, but this difference was not significant. Final egg counts averaged 687 and 4266 for resistant and susceptible varieties, respectively.

In the 1996 Ohio County test, MG II varieties from both susceptible and resistant groups out-yielded MG IV varieties (Table 2). For MG II, the trend was for greater yields for resistant varieties, but there was no consistent difference between MG IV susceptible and MG IV resistant varieties.

In the 1996 Fayette County tests, under no detectable SCN pressure and with excellent growing conditions, yields of the same 16 varieties were considerably higher than in Ohio County (Table 2). Interestingly, susceptible varieties in both MGs had a solid yield advantage over their resistant counterparts. Further, under these excellent growing conditions, MG IV varieties had an advantage over MG II varieties from either SCN reaction group.

Table 3 summarizes the yield information from the three tests we conducted. While MG IV varieties produced higher yields than MG II varieties in Ohio County in 1995, the reverse was true in the 1996 Ohio County test. As a result, our Ohio County data showed the choice of MG II or IV varieties to be a toss-up. In both MGs, resistant varieties did slightly better than susceptible varieties, when averaged across both SCN-infested tests. In Fayette County where there was no SCN infestation, the susceptible varieties out-performed the resistant varieties in both MGs, and the MG IV varieties had higher yields than did the MG II varieties.

CONCLUSIONS

We designed this study to learn if MG II susceptible varieties could produce greater yields than MG IV susceptible varieties. For the averages of the two tests conducted on SCN-infested fields in Ohio County, there were no yield differences between susceptible varieties from the two MGs. This indicates that growers could use susceptible MG II varieties as an alternate choice for susceptible MG IV varieties when rotations had SCN levels under control. Growers may want to consider planting susceptible MG II varieties since they can be harvested earlier in the fall. Growers should consider planting susceptible varieties in fields known to have low SCN levels in order to minimize race shifts. On the other hand, broadcast Temik applications had little effect on yields, and would seem not to be an economically rewarding management practice. In the state of Ohio, some producers are using a banded Temik treatment at 7 lbs/A; however, our study doesn't provide much support for this practice, since we found very little yield response to our broadcast treatment. Finally, careful variety selection is an important decision, no matter which MG or SCN reaction variety class a grower is considering.

Kenneth W. Wells

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Table 1. Response of SCN-resistant and SCN-susceptible MG II and IV soybean varieties to nematode pressure and Temik applications on Darren Luttrell's Ohio County farm in 1995.

Variety name	MG	SCN resist.	Ratio (f/i) w/oTemik	Ratio (f/i) w/Temik	Yield (bu/A) w/oTemik	Yield (bu/A) w/Temik
MWS 210 CN	II	yes	0.43	--	41.1	--
Wilken 2571	II	yes	0.37	--	42.6	--
Callahan 892311-04N	II	yes	0.16	--	42.9	--
Jack	II	yes	0.23	--	50.9	--
Average of 4 MG II resistant varieties			*0.30*	--	*44.4*	--
Asgrow A2396	II	no	5.53	2.21	38.6	39.5
Ciba 3253	II	no	4.55	3.39	39.8	43.8
Pioneer 9273	II	no	1.94	1.84	47.2	44.1
Lynks 5298	II	no	6.99	1.30	42.1	43.1
Average of 4 MG II susceptible varieties			*4.75*	*2.19*	*41.9*	*42.6*
Delsoy 4210	IV	yes	0.50	--	45.4	--
Pioneer 9451	IV	yes	0.22	--	49.4	--
Asgrow A4715	IV	yes	0.83	--	48.9	--
Pioneer 9481	IV	yes	0.73	--	52.1	--
Average of 4 MG IV resistant varieties			*0.57*	--	*49.0*	--
SS FFR-439	IV	no	2.39	4.82	42.3	44.6
So. Cross Jacob	IV	no	7.10	3.05	45.1	46.1
So. Cross Joshua	IV	no	5.33	6.40	44.3	48.4
Caverndale Farm. 492	IV	no	3.93	7.53	46.1	49.4
Average of 4 MG IV susceptible varieties			*4.69*	*5.45*	*44.4*	*47.1*
LSD(0.10) for comparing varieties within a Temik treatment.			3.04	3.12	5.0	3.3

Note: Temik treatment did not significantly affect f/i ratio or yield of susceptible varieties.

Table 2. Response of SCN-resistant and SCN-susceptible MG II and IV soybean varieties to nematode pressure and Temik applications on Darren Luttrell's Ohio County farm in 1996 and to no nematode pressure in Fayette County in 1996.

			Ohio Co.		Ohio Co.		Fay. Co.
		SCN	Ratio (f/i)		Yield (bu/A)		Yield
Variety name	MG	resist.	w/oTemik	w/Temik	w/oTemik	w/Temik	(bu/A)
MWS 210 CN	II	yes	0.25	--	47.9	--	58.2
Wilken 2571	II	yes	0.26	--	54.7	--	72.4
Callahan 892311-04N	II	yes	0.42	--	51.8	--	67.0
Jack	II	yes	0.28	--	55.4	--	74.2
Average of 4 MG II resistant varieties			*0.33*	--	*52.4*	--	*68.0*
Asgrow A2396	II	no	2.33	1.48	45.2	48.2	75.4
Ciba 3253	II	no	3.09	1.20	51.3	51.5	69.7
Pioneer 9273	II	no	2.30	2.19	53.6	52.6	71.8
Lynks 5298	II	no	2.83	2.72	49.7	52.6	76.2
Average of 4 MG II susceptible varieties			*2.64*	*1.90*	*50.0*	*51.2*	*73.3*
Delsoy 4210	IV	yes	0.61	--	45.4	--	*78.6*
Pioneer 9451	IV	yes	0.62	--	41.5	--	*67.4*
Asgrow A4715	IV	yes	0.41	--	49.9	--	*75.2*
Pioneer 9481	IV	yes	0.41	--	50.8	--	*76.6*
Average of 4 MG IV resistant varieties			*0.51*	--	*46.9*	--	*74.4*
SS FFR-439	IV	no	4.72	4.27	51.5	48.9	86.2
So. Cross Jacob	IV	no	6.02	0.90	42.0	45.2	84.1
So. Cross Joshua	IV	no	2.56	1.66	48.7	48.1	85.8
Caverndale Farm. 492	IV	no	3.41	5.12	44.1	43.3	66.5
Average of 4 MG IV susceptible varieties			*4.18*	*2.99*	*46.6*	*46.4*	*80.6*
LSD(0.10) for comparing varieties within a Temik treatment.			3.05	NS	3.3	2.8	4.7

Note: Temik treatment did not significantly affect f/i ratio or yield of susceptible varieties.

Table 3. Average yield responses of SCN-resistant and SCN-susceptible MG II and IV soybean varieties at three Kentucky locations.

Maturity Group	SCN resist.	Ohio County 1995	Ohio County 1996	Ohio County 2-year Ave.	Fayette Co. 1996
II	yes	44.4	52.4	48.4	68.0
II	no	41.9	50.0	45.9	73.3
IV	yes	49.0	46.9	47.9	74.4
IV	no	44.4	46.6	45.5	80.6
LSD(0.10) to compare averages in that column.		3.3	2.1	2.0	3.2

Note: Ohio county data in this table are for plots which were not treated with Temik.

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