Can aldicarb be used to manage SCN in Iowa?

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Introduction

Soybean cyst nematode (*Heterodera glycines*; SCN) causes the greatest yield losses of all diseases on soybeans [*Glycine max* (L.) Merr.] in Iowa . Growing SCN-resistant varieties in rotation with non-host crops and SCN-susceptible varieties is the current SCN management recommendation in Iowa (Anonymous, 2003).

Resistant soybean varieties to SCN are one of the most effective strategy for managing the disease. However, an interaction between SCN and soil pH (Tylka et al., 1988) may be threatening the effectiveness of this strategy. On-going research in IA and WI have shown that SCN population densities are positively correlated with soil pH. The correlation may reduce the efficacy of the current SCN management recommendation in northern and central Iowa, which is located in the Des Moines lobe, a calcareous soil area with high pH soils.

Nematicide is not part of the SCN management in Iowa since it adds significant costs to the production. The hypothesis for this research is that additional management strategies, such as the use of a nematicide (aldicarb), may need to be added to the current SCN management recommendations in Iowa.

Objective

The objective of this research was to evaluate effect of the nematicide (aldicarb) on soybean grain yield and SCN population densities at four locations in Iowa.

Materials and Methods

The study was conducted from 2004 to 2005 at 4 locations in Iowa (Figure A). Experimental design was a randomized complete block in a split-split-plot arrangement with four replications. Main plots were 2 planting dates. Sub-plots were 4 rates of aldicarb (0.0, 0.8, 1.7 and 2.5 kg a.i. ha^{-1}) (Figure B). Sub-subplots were 10 glyphosate-resistant soybean varieties with different reactions to SCN. Data from the planting date and variety effects are not presented in the poster.

Soil samples were collected prior to planting and after harvest to determine SCN initial (Pi) and final (Pf) population densities, as number of eggs 100 cm^{-3} of soil (Figure C). A soil sample (composite sample) consisted of ten 2.5-cm diameter, 15 to 20-cm deep soil cores from each plot that was used for soil pH analysis and for SCN extraction and counting procedures (Figure D).

Data were analyzed using PROC MIXED of SAS. Mean comparisons were done using Fisher's protected LSD test ($P \leq 0.05$). Data from the two northern locations were combined due to homogeneity of variance whereas the two southern locations were analyzed separately.

Results

Table 1. Effect of nematicide on grain yield and SCN final population (Pf) densities at two locations in the northern region (Bancroft and Mason City), Nevada, and Crawfordsville, IA in 2004 and 2005.

	Northern region				Nevada				Crawfordsville			
	Grain yield		SCN Pf		Grain yield		SCN Pf		Grain yield		SCN Pf	
Main effect	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	Mg ha^{-1}		eggs 100 cm^{-3}		Mg ha^{-1}		eggs 100 cm^{-3}		Mg ha^{-1}		eggs 100 cm^{-3}	
0.0 kg a.i ha^{-1}	3.9	5.2	1538	3309	4.6	4.6	1745	1111	4.4	3.6	170	225
0.8 kg a.i ha^{-1}	3.9	5.2	1565	3559	4.5	4.6	2106	1254	4.2	3.5	118	131
1.7 kg a.i ha^{-1}	3.9	5.2	1536	3846	4.6	4.6	1816	1415	4.2	3.3	84	259
2.5 kg a.i ha^{-1}	3.9	5.1	1569	3569	4.5	4.6	1946	1329	4.2	3.3	79	266
LSD (0.05)	NS†	NS	NS	NS	NS	NS	NS	NS	NS	0.1	66	NS

† NS, no significant differences at $P \leq 0.05$.

Table 2. Effect of nematicide on seed size and plant height at two locations in the northern region (Bancroft and Mason City), Nevada, and Crawfordsville, IA in 2004 and 2005.

	Northern region				Nevada				Crawfordsville			
	Seed size		Plant height		Seed size		Plant height		Seed size		Plant height	
Main effect	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
	g 100 $seed^{-1}$		cm		g 100 $seed^{-1}$		cm		g 100 $seed^{-1}$		cm	
0.0 kg a.i ha^{-1}	14.1	15.5	79.1	87.5	15.5	13.8	86.2	99.7	15.1	13.8	87.9	80.3
0.8 kg a.i ha^{-1}	14.3	15.6	80.6	89.3	15.5	14.0	91.1	102.3	14.8	14.0	87.5	80.4
1.7 kg a.i ha^{-1}	14.3	15.8	80.7	91.0	15.3	14.2	90.4	103.2	15.0	13.8	88.6	79.9
2.5 kg a.i ha^{-1}	14.3	15.8	81.7	92.3	15.4	14.1	88.8	104.5	15.0	13.6	88.3	80.0
LSD (0.05)	NS†	0.2	2.0	1.5	NS	NS	NS	3.2	NS	0.2	NS	NS

† NS, no significant differences at $P \leq 0.05$.

Figure A. Experimental locations, IA.

Figure B. Nematicide application.

Figure C. Soil sampling.

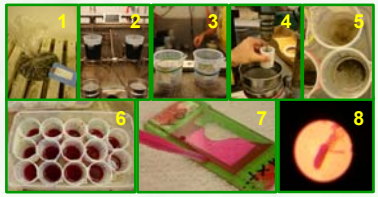

Figure D. SCN extraction, staining, and egg counting.

Summary

Nematicide did not affect grain or SCN Pf in the northern region or at Nevada in either 2004 or 2005. No yield response was found in Crawfordsville in 2004, however in 2005, grain yield decreased as nematicide rate increased. In 2005, the precipitation at Crawfordsville was significantly lower than the 20-year average. It may have favored plant absorption of aldicarb by reducing leaching. Phytotoxicity was observed and it is speculated that this inhibition in growth may be the reason why 0.0 kg a.i. ha^{-1} had greater yield than any other rate of aldicarb. Soybean cyst nematode Pf population densities varied at Crawfordsville, and were not consistent with grain yield response. In 2004, SCN Pf decreased as nematicide rate increased, whereas no effect of nematicide was observed on SCN Pf in 2005.

Inconsistent results were observed on the effect of nematicide on both seed size and plant height, which may be a result of environmental conditions rather than the effect of the nematicide.

Conclusion

Overall, neither soybean grain yield nor SCN final population densities were influenced by the nematicide. The inconsistent seed size and plant height response to aldicarb may be a function of soil type and environmental conditions.

It was concluded that crop rotation and use of SCN-resistant varieties are still the optimum SCN management in Iowa, even at high pH soils. Use of a nematicide in Iowa is therefore not recommended as an additional SCN management strategy because of its cost and ineffective control of SCN population densities.

References

Anonymous. 2003. Iowa State University Plant Disease Clinic. Soybean Cyst Nematode (SCN) management recommendations. Iowa State University Extension Publication IPM 63. 2pp.

Tylka, G.L., C. Sanogo, and S.K. Souhrada. 1998. Relationships among *Heterodera glycines* population densities, soybean yields, and soil pH. J. Nematol. 30:519-520.

Acknowledgement

The authors acknowledge the Iowa Soybean Association and Bayer CropScience for supporting this project.

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