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Assessment of Iowa Soybean Growers for Insect Pest Management Practices

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Abstract: *In 2009, Iowa soybean growers were surveyed about current insect pest management practices. The purpose was to better understand how often growers were scouting and what they perceived as the primary pests in Iowa soybean. Soybean aphid is the primary pest throughout the state. There was a 1423% increase of insecticides applied to soybean since 2000. Respondents indicated they are regularly scouting for soybean insects to make treatment decisions. Iowa growers are getting pest management information via Extension and industry.*

The soybean aphid is the most economically important soybean pest in the North Central Region (Ragsdale et al., 2007). This aphid is an invasive species first confirmed in North America in 2000 and now has the potential to infest 80% of the total U.S. crop each year because of its migratory potential and adaption to North American soybean (Venette & Ragsdale, 2004). During outbreaks, soybean aphid can cause more than 40% yield reduction in soybean (Ragsdale et al., 2007); however, the population dynamics of this aphid have been highly variable between fields and years. An economic threshold based on estimating aphids per plant has been determined to be 250 from bloom through seed set and is widely adopted throughout the North Central Region (Ragsdale et al., 2007). To protect yield and increase overall production profits, growers could incorporate regular scouting and make timely treatment decisions (Johnson et al., 2009). Alternatively, a binomial sequential sampling plan, Speed Scouting for Soybean Aphid, can make treatment decisions (Hodgson et al., 2007).

There were only occasional pest issues in soybean in the North Central Region before 2000 and less than 0.1% of soybean fields treated with insecticides (USDA-NASS). But the damage potential of soybean aphid has resulted in a 130-fold increase of insecticide applications in less than a decade (Ragsdale, Landis, Brodeur, Heimpel, & Desneux, 2011). Most commercial applications are based on the presence of aphids and are necessary to regulate outbreaks, but some are used in a prophylactic manner to reduce the risk of yield loss. Needless applications reduce overall profit, increase exposure to non-target organisms, and can accelerate genetic resistance to major insecticide classes (Pedigo & Rice, 2009).

Soybean pest management in the North Central Region has dramatically changed with the arrival of soybean aphid. Our objective was to evaluate Iowa soybean growers' current pest

management practices and better understand how stakeholders are getting information. Our goal was to identify knowledge gaps in sustainable soybean management. We asked growers which specific soybean insects they encounter, how often they are sampling for pests, and how they receive information. The results of the study reported here will 1) help direct useful insect management extension programming in Iowa and 2) help to produce high-quality research that is directly applicable to soybean growers.

Methodology

The survey was developed and conducted by researchers at Iowa State University. Participants were recruited for the study through their membership in the Iowa Soybean Association. Every person who sells soybean in Iowa automatically contributes to the soybean check-off through the Iowa Soybean Association. The population of 4,900 members was mailed the survey on 7 April 2010. Members also received a return envelope and a letter inviting them to participate and informing them of the consent components.

Of those contacted, 918 responded between 12 April 2010 and 12 May 2010, resulting in an initial response rate of 18.7%. The response rate was disappointing but anticipated, given that the survey was mailed and the timing of distribution corresponded with growers preparing or planting crops. Of the 918 respondents, 13 simply noted that they were retired, and two more indicated that they were cash rent landowners. None of these 15 people responded to any questions, so their data were not included in the summary results. Useable surveys were received from 903 respondents, for an 18.5% response rate. Participants indicated what county they were associated with, and we grouped the 99 Iowa counties into nine regions (Table 1). Respondents were asked to provide information about the number of soybean acres they grew and treated for insects, what types of insects they encountered, and what scouting methods they preferred. The participants were also asked to rate how helpful various sources of information were for making insect management decisions.

Table 1.
Iowa Counties Reporting in the 2010 Survey

Region	Counties included	N	%
Overall	All	903	100.0
Northwest	Buena Vista, Cherokee, Clay, Dickinson, Emmet, Lyon, O'Brien, Osceola, Palo Alto, Plymouth, Pocahontas, Sioux	139	15.9
North Central	Butler, Cerro Gordo, Floyd, Franklin, Hancock, Humboldt, Kossuth, Mitchell, Winnebago, Worth, Wright,	133	15.2
Northeast	Allamakee, Black Hawk, Bremer, Buchanan, Chickasaw, Clayton, Delaware, Dubuque, Fayette, Howard, Winneshiek	139	15.9
West Central	Audubon, Calhoun, Carroll, Crawford, Greene, Guthrie, Harrison, Ida, Monona, Sac, Shelby, Woodbury	79	9.0
Central	Boone, Dallas, Grundy, Hamilton, Hardin, Jasper, Marshall, Polk, Poweshiek, Story, Tama, Webster	153	17.5
East Central	Benton, Cedar, Clinton, Iowa, Jackson, Johnson, Jones, Linn, Muscatine, Scott	112	12.8
Southwest	Adair, Adams, Cass, Fremont, Mills, Montgomery, Page, Pottawattamie, Taylor	43	4.9
South Central	Appanoose, Clarke, Decatur, Lucas, Madison, Marion, Monroe, Ringgold, Union, Warren, Wayne	23	2.6

Southeast	Davis, Des Moines, Henry, Jefferson, Keokuk, Lee, Louisa, Mahaska, Van Buren, Wapello, Washington	53	6.1
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Findings

Insecticide Use

In Iowa, there were 1,100,000 fewer acres of soybean planted in 2009 (9,600,000) than in 2000 (USDA-NASS). Participants represent 405,461 soybean acres (Table 2), or about 24% of the total acres grown in Iowa. Between 2000 and 2009, they reported that, in sum, foliar insecticide use rose exponentially, particularly in North Central and Northwestern Iowa (Figure 1). Soybean aphid populations are generally more abundant and economically important in northern Iowa, and the increased use of insecticides reflects aphid pressure in those geographic regions. Respondents indicated that in 2000, just 19,457 acres were treated with insecticides, compared with 296,381 acres in 2009—a dramatic statewide 1,423% increase. Insecticidal seed treatments were not commonly used before 2000 because insect pressure was low, but approximately 73% of the soybean planted in Iowa had an insecticidal seed treatment in 2009 (Table 3).

In 2010, host plant resistance for soybean aphid became commercially available. We were curious if growers had heard of this new management tool and would be willing to incorporate it into their production. Only 42.8% of respondents indicated they would be willing to incorporate host plant resistance to regulate soybean aphid, and nearly 20% said they have not heard of this new management tool. The survey did not ask them why they would not be willing to use host plant resistance.

Table 2.
Soybean Acres Grown in 2009

Counties	N	Mean \pm SEM ¹	Range	Sum
Overall	889	456.09 \pm 16.72	0 - 10,000	405,461
Northwest	139	435.64 \pm 28.99	0 - 2,250	60,554
North Central	131	436.21 \pm 25.13	0 - 1,200	57,143
Northeast	138	444.05 \pm 76.47	4 - 10,000	61,278
West Central	77	521.90 \pm 60.50	60 - 5,000	40,186
Central	151	529.36 \pm 34.50	0 - 2,683	79,934
East Central	112	418.48 \pm 34.35	41 - 2,700	46,870
Southwest	42	500.81 \pm 61.36	26 - 1,650	21,034
South Central	22	540.77 \pm 128.50	42 - 2,631	11,897
Southeast	52	334.81 \pm 30.26	0 - 1,200	17,410
1 Standard error of the mean.				

Figure 1.

Regional Percent Increase of Soybean Acres Exposed to Foliar Insecticides in Iowa from 2000 to 2009

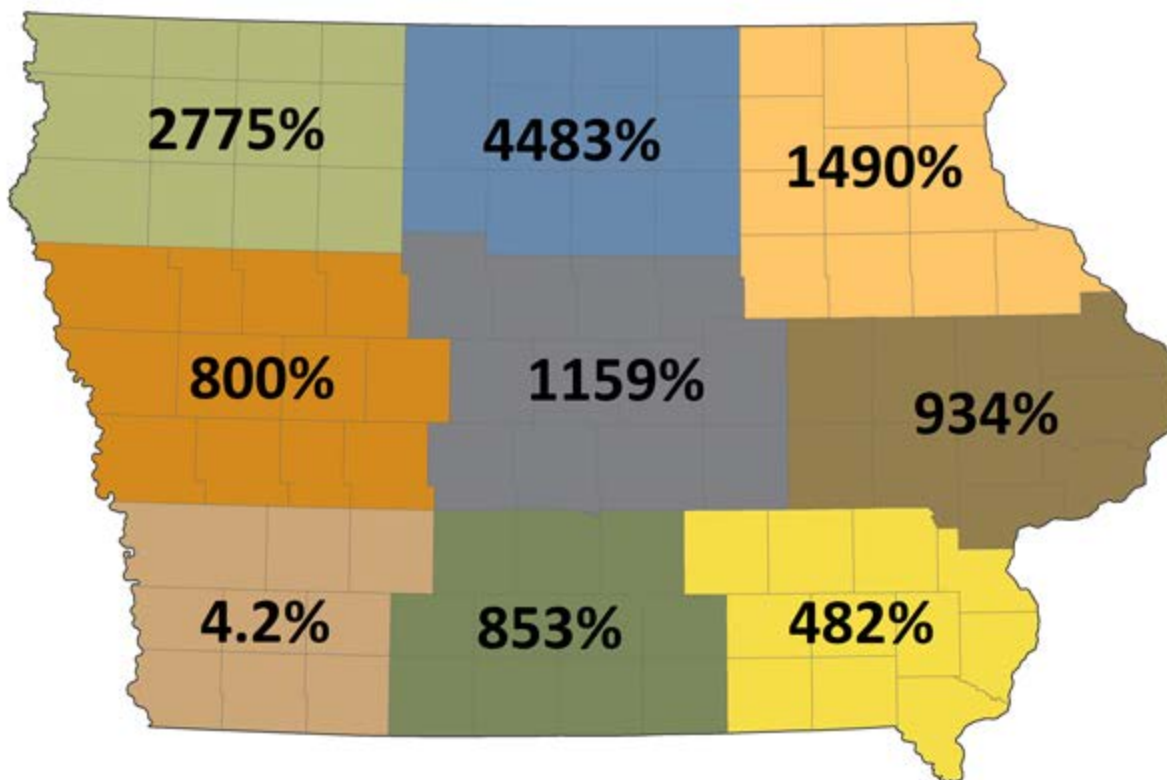


Table 3.
Soybean Acres Planted with an Insecticidal Seed Treatment in 2009

Counties	N	Mean ± SEM1	Range	Sum
Overall	875	247.27 ± 13.20	0 - 6,500	216,361
Northwest	133	238.51 ± 28.49	0 - 1,900	31,722
North Central	132	179.72 ± 21.97	0 - 1,093	23,723
Northeast	136	263.14 ± 55.31	0 - 6,500	35,787
West Central	76	289.82 ± 30.78	0 - 1,000	22,026
Central	148	340.72 ± 30.62	0 - 2,000	50,427
East Central	109	200.36 ± 27.37	0 - 1,500	21,839
Southwest	42	287.90 ± 54.50	0 - 1,500	12,092
South Central	23	363.17 ± 129.68	0 - 2,631	8,353
Southeast	51	133.78 ± 24.89	0 - 620	6,823
1 Standard error of the mean.				

Primary Pest

Soybean aphid was the dominant pest of Iowa soybean in 2009. Nearly 94% of growers surveyed said soybean aphid was their main pest, and nearly 98% had encountered soybean aphid (Table 4). Only 5% said bean leaf beetle was their primary pest (mainly South Central and Southeast Iowa), but 63% had encountered this species (Table 4). Several other pests were identified as being encountered in soybean, including spider mites, Japanese beetle, stink bugs, and potato leafhopper.

Table 4.
Soybean Pests Encountered in 2009

Overall counties	Primary pest	% Primary pest	Encountered	% Encountered
Soybean aphid	625	93.8	864	97.6
Bean leaf beetle	33	5.0	557	63.0
Stink bugs	0	0.0	64	7.2
Japanese beetle	4	0.6	158	17.9
Potato leafhopper	1	0.2	62	7.0
Thrips	0	0.0	8	0.9
Spider mites	2	0.3	256	28.9
Caterpillars	0	0.0	25	2.9
Other1	1	0.2	20	2.3
1 Others included grasshoppers (n=10), soybean cyst nematode (n=6), Northern corn rootworm (n=2), and Asian beetles (n=2).				

Who Scouts Fields

A majority of survey respondents (55%) indicated scouting their soybean fields themselves, while 44% said an agribusiness entity scouted their fields (Table 5). Nearly one third of participants reported a professional crop consultant looked for insects (31.7%). Some respondents also noted they received scouting help from family (8.5%), or friends (3.6%).

Table 5.
Summary of How Soybean Fields Were Scouted for Insects in 2009

Counties	Agribusiness N (%)	Consultants N (%)	Myself N (%)	Friends N (%)	Family N (%)	Other N (%)
Overall	388 (43.9)	280 (31.7)	489 (55.4)	27 (3.6)	75 (8.5)	39 (4.4)

Scouting Frequency

Nearly 60% of respondents said their fields are scouted for insects at least once a week (Table 6). More than one-third (37%) reported scouting fields at least once every 2 or 3 weeks. Fewer than 4% of participants scout their fields less than once per month. The data also indicate that fields in the south (Southwest, South Central, and Southeast) are scouted less often than those fields in other parts of the state. Scouting variability throughout the state is likely due to a result of historical pest pressure (i.e., more persistent pests likely to cause economic damage in northern Iowa).

Nearly half (44%) of growers who responded said they had not heard of the Speed Scouting for Soybean Aphid method for making treatment decisions, contrasted with 17% who said they use it regularly. Of the remainder, 22% said they had heard of it but not tried it; 14% said they used the method occasionally; and just 3 % said they had tried the method but decided not to use it. Participants who do not prefer to use Speed Scouting for Soybean Aphid indicated they do not believe it is an accurate decision tool or aggressive enough for protecting yield, and the plan takes too long to make a decision.

Table 6.
How Often Were Soybean Fields Scouted for Insects in 2009

Counties	At least once per week N (%)	At least every two weeks N (%)	At least every three weeks N (%)	Once per month N (%)	Once during the summer N (%)	Never N (%)
Overall	518 (58.9)	303 (34.4)	27 (3.1)	23 (2.6)	8 (0.9)	1 (0.1)

Information Resources

There are several coordinated Extension programs for field crops at Iowa State University, including an online newsletter (*Integrated Crop Management News*) that is updated throughout the year, an annual meeting (Integrated Crop Management Conference) for professionals, and statewide workshops (Crop Advantage Series) for growers during the winter. These programs include all aspects of successful field crop production, including fertility, breeding, pest management, and economics. More information about these Extension programs can be found at <www.aep.iastate.edu>. More than half (63%) of respondents indicated using *ICM News*, and 75% found it mostly or very helpful (Table 7). Over 90% of respondents used agribusiness to get pest management information and 89% found it mostly or very helpful.

Table 7.
Sources of Insect Pest Management Information

Counties	N Used	% Used	% Not at all helpful	% A little helpful	% Mostly helpful	% Very helpful
ICM News	545	63.2	0.0	25.1	47.2	27.5
ICM Conference	234	27.2	3.0	38.9	39.3	18.8
CAS	357	41.5	3.1	26.6	45.1	25.2
ISU personnel	506	58.6	0.1	26.5	46.8	25.7
Agribusiness	782	90.5	0.3	10.6	49.0	40.0
Field days	544	63.1	4.0	40.3	43.9	11.8
Outside Iowa	238	27.6	17.2	49.2	28.6	5.0
Websites	497	57.8	1.8	34.4	46.7	17.1
Family, Friends	689	79.9	3.5	37.2	44.7	14.7
Other	46	5.55	2.2	6.5	19.6	71.7

Implications

Detection of soybean aphid in Iowa in 2000 had a dramatic change in soybean pest management. The potential for yield loss has forced growers to increase their overall production costs (e.g., scouting and applying insecticides) to protect yield. Most participants indicated they gathered information from different resources and found Extension programming useful. Future research and Extension efforts should continue to promote sustainable tactics like host plant resistance, scouting and timely insecticide applications.

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