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Pest Management Practices of Crop Consultants in the Midwestern USA

Robert J. Wright,* Terry A. DeVries, and Shripat T. Kamble

A mail survey was conducted of independent crop consultants in 12 midwestern U.S. states working in corn (*Zea mays* L.), soybeans [*Glycine max* (L.) Merrill], wheat (*Triticum aestivum* L.), and grain sorghum (*Sorghum bicolor* L. Moench.) during 1993. The survey was conducted to document the acreage of crops monitored by crop consultants, and some of their operational characteristics. Kansas and Nebraska had the greatest reported acreage of crops scouted, over 3 million and 1 million acres, respectively. Total acres scouted were highest for corn, followed by soybeans, wheat, alfalfa (*Medicago sativa* L.), and sorghum. Acres contracted with crop consultants varied from 0.4 to 40.0% of the total 1993 harvested acres, depending on state and crop. The most common interval reported between field visits was once a week. Averaged over all states, the highest consulting fees were charged for alfalfa (\$4.80), with less charged for corn (\$4.31), sorghum (\$4.26), soybeans (\$4.07), and wheat (\$3.74). There was a great range in fees within crops across the region (e.g., corn fees varied from \$3.21–6.13/acre). Planting time application of insecticides was the most commonly used corn rootworm (*Diabrotica virgifera virgifera* LeConte and *D. barberi* Smith & Lawrence) control. Postemergence applications of insecticides for larval rootworms (cultivation time applications and chemigation) were used primarily in Kansas and Nebraska. Foliar sprays for adult corn rootworm control were also most common in these states. Use of crop rotation varied greatly across the region (23.8–83.7% of acres were corn after another crop). Additionally, across all states except Missouri, there was a significant correlation between frequency of rotation in corn and insecticide use against corn rootworms; i.e., states with higher frequencies of rotated corn treated a lower percentage of corn acreage for corn rootworm control. The diversity of crop consultant activity across the region has implications for future adoption of IPM practices on midwestern field crops.

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INTEGRATED PEST MANAGEMENT (IPM) has various definitions, but most emphasize use of regular monitoring (scouting) of crops for pest activity and use of economic thresholds for pest management decision making (Cate and Hinkle, 1994). Since the Clinton administration announced the goal of having 75% of crop acreage under IPM systems by the year 2000 (Browner et al., 1993), there has been increased interest in quantifying the extent of IPM adoption.

Vandeman et al. (1994) conducted a survey of growers to assess levels of IPM adoption in U.S. fruits, vegetables, and major field crops, including corn and soybeans. They reported that in 1993, 65% of corn acres and 69% of soybean acres were scouted for all pests (weeds, insects, diseases). Growers used economic thresholds to make pesticide use decisions 29% of the time for corn insecticides, 53% of the time for corn herbicides, and 59% of the time for soybean herbicides. Based on a mail survey from eight counties in central Illinois (primarily corn and soybean cropping systems) Czapar et al. (1995) reported that 41% of growers scouted their field weekly for insects, diseases, weeds, or other crop problems. They note that it is difficult to interpret the intensity of scouting reported by growers: "For some farmers, crop scouting involves detailed field monitoring and record keeping, while others consider cursory field visits or 'windshield surveys' to be sufficient."

An alternate approach to measure IPM adoption is to quantify the impact of professional crop consultants who provide regular scouting services and recommendations on control measures to farmers. As noted by Lambur et al. (1989), crop consultants have become increasingly important in implementation of IPM. Data from USDA-ERS for 1993 indicate that in 10 midwestern states from 1.9% to 29.9% of corn acres were scouted by crop consultants who charged fees from \$2.89 to 5.50/acre (USDA-ERS, 1994).

A mail survey was conducted to quantify the activities of crop consultants in 12 midwestern U.S. states based on responses of crop consultants working on corn, grain sorghum, soybeans, and wheat during 1993. Selected data related to crop consultant practices and insect management are reported here.

Table 1. Survey questions associated with data reported in this paper.

Questions	Possible responses
1. Did you contract to be a crop consultant on any of the following crops in 1993: corn, sorghum, soybeans, wheat?	Yes/No; if no, please return the questionnaire
2. List the acreage of crops that you contracted to scout in 1993:	Acres of corn, grain sorghum, soybeans, wheat, other (specify).
3. On an average, how frequently were contracted fields visited during the growing season?	More than once a week; once a week; every 7–10 d; every 10–14 d; every 2 weeks or more.
4. How much did you charge per acre for your services? (Please indicate if fee varied for crop or services)	Corn; sorghum; soybeans; wheat; other crops.
5. Of corn acreage you scouted in 1993, list estimated acreage treated for corn rootworms in the following ways:	No treatment; soil insecticide at planting; soil insecticide applied postplanting (cultivation or rescue); chemigation treatment for larval control; foliar spray for adult beetle control.
6. Of corn acreage you scouted in 1993, list estimated acreage in the following crop rotations;	Corn after corn; corn after other crop or fallow.

Table 2. Survey population.

State	No. surveys mailed	No. surveys returned	% returned
Illinois	24	21	87.5
Indiana	36	7	19.4
Iowa	36	21	58.3
Kansas	179	61	34.1
Michigan	9	4	44.4
Minnesota	21	15	71.4
Missouri	58	28	48.3
Nebraska	77	54	70.1
North Dakota	39	18	46.2
Ohio	24	8	33.3
South Dakota	19	16	84.2
Wisconsin	49	35	71.4
Not determined	—	6	—
All states	571	294	51.5

MATERIALS AND METHODS

The study population for this survey was crop consultants working on corn, soybeans, sorghum, and wheat in 12 midwestern U.S. states (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin). Crop consultants were identified from membership lists of state crop consultant organizations, the National Alliance for Independent Crop Consultants, and other lists obtained from university extension specialists in the North Central region. These lists primarily contained individuals who would be classified as "independent" crop consultants, i.e., they do not derive income from sale of farm chemicals (fertilizers, pesticides). This group excludes some other individuals who provide pest management advice and scouting services to farmers, but who are employed by fertilizer and pesticide dealers and applicators. Although independent crop consultants are not responsible for all crop scouting, they are an important group that has often been studied separately in other surveys (Lambur et al., 1989; USDA-ERS, 1995).

This study paralleled that of Pike et al. (1997) which surveyed farmers in the same 12 states. A total of 12 multiple-choice or fill-in-the-blank questions were asked. For reasons of space, only the first six questions (Table 1) will be covered in this paper. Other questions not reported here concerned rating of severity of specific pest species (insects, weeds, and diseases) on these crops, listing the three most frequently used herbicides and insecticides on these crops, listing alternatives to these pesticides and potential yield loss if these pesticides were lost, and incidence of control failures thought to be due to pest resistance to pesticides.

A total of 571 questionnaires was mailed on 25 July 1994. The mailing included the survey questionnaire form

with a cover letter and the questions, and a prepaid pre-addressed envelope for return of the completed questionnaire. A second complete mailing was sent to all addresses on 15 Sept. 1994, with a note thanking them if they had responded to the first mailing, and requesting their response if they had not. Questionnaires sent in the first mailing were not coded by state, but those in the second mailing were individually coded. The questionnaires returned from the first mailing were identified based on postal cancellations. Only six questionnaires from the first mailing could not be identified to state; results from those surveys were not included in the individual state summaries but were included in the totals.

A total of 294 usable questionnaires were returned for an overall return rate of 51.5% (Table 2). Return rates for individual states varied from 19.4% (Indiana) to 87.5% (Illinois). A usable survey was one returned by an individual who contracted to provide crop consultant services on one or more of the target crops (corn, soybeans, sorghum, or wheat) in 1993, and who answered at least one of the survey questions. Not all usable surveys were completely filled out, so the number of respondents for individual questions was sometimes lower than indicated by the numbers reported in Table 2. One exception to this was Table 4; some individuals checked more than one response, and all responses were included in the totals. Responses for Table 5 sometimes listed a range of fees; the midpoint of the range was recorded.

RESULTS AND DISCUSSION

The number of crop consultants identified from our mailing lists in each state varied greatly, from nine (Michigan) to 179 (Kansas) (Table 2). The most crop consultants were identified in Kansas and Nebraska, with fewer crop consultants per state elsewhere. It is likely that the actual population of crop consultants is larger than identified by our mailing lists; some consultants in each state are not members of the organizations from which our lists were obtained. Caution should be exercised in interpreting data from individual states, especially in states with a low return rate or where data were based on few responses.

Kansas and Nebraska had the greatest acreage of crops scouted, based on respondents reports (Table 3). Over the whole region, the greatest acreage scouted was of corn, followed by soybeans, wheat, alfalfa, and sorghum. These acres represented a variable percentage of the total crop production in each state (0.4–40.0%); this is similar to the results of the USDA-ERS survey for 1993, which found that in 10 midwestern states from 1.9% to 29.9% of corn acres

Table 3. Acres contracted with crop consultants during 1993 in midwestern USA based on responses to a mail survey and % of acres harvested in 1993 (data on acres harvested from USDA-NASS, 1994).

State	Corn (% of total)	Sorghum (% of total)	Soybean (% of total)	Wheat (% of total)	Alfalfa†	Other	Total
IL	305 000 (3.1)	2 500 (1.2)	161 000 (1.8)	24 400 (6.4)	300	2 003	495 203
IN	57 010 (1.1)	0	32 323 (0.7)	6135 (0.9)	1 500	1 173	98 141
IA	156 425 (1.4)	0	86 900 (1.0)	0	8 060	5 500	256 885
KS	721 209 (40.0)	69 263 (2.5)	71 450 (3.8)	153 192 (1.4)	20 220	13 240	1 048 574
MN	70 317 (1.5)	0	71 711 (1.4)	49 895 (2.2)	6 200	26 213	224 336
MI	7732 (0.4)	0	3017 (0.2)	3473 (0.6)	200	0	14 422
MO	23 330 (1.3)	1 900 (0.4)	23 310 (0.6)	11 100 (0.8)	1 310	20 900	81 850
NE	711 245 (9.4)	6 250 (0.5)	67 350 (2.7)	9034 (0.4)	10 840	34 416	839 135
ND	17 720 (4.9)	0	43 500 (8.0)	127 850 (1.2)	0	90 700	279 770
OH	57 500 (1.8)	0	51 500 (1.3)	19 000 (1.7)	1 000	27 700	156 700
SD	142 343 (5.6)	4 292 (2.0)	111 049 (6.3)	84 849 (2.4)	2 566	38 387	383 486
WI	87 900 (3.7)	70†	38 350 (6.5)	11 675 (9.3)	63 220	26 900	228 115
TOTAL	2 357 731	84 275	761 460	500 603	115 416	287 132	4 106 617

† Acreage for alfalfa is underreported; if respondents did not contract on corn, sorghum, soybeans, or wheat, they were instructed in the first question (Table 2) to stop and return survey. Alfalfa acreage is based on responding crop consultants who specified alfalfa under "other."

† No harvested acres reported by USDA-NASS (1994) for Wisconsin.

Table 4. Average frequency of field visits by midwestern USA crop consultants, 1993.

Frequency of visits	IL	IN	IA	KS	MN	MI	MO	NE	ND	OH	SD	WI	Totals
> 1/7 d	1	0	0	4	2	0	3	6	0	0	1	0	17
1/7 d	5	1	3	55	4	0	5	47	10	1	8	4	143
1/7-10 d	3	1	2	1	2	0	2	4	2	0	1	7	25
1/10-14 d	3	0	8	0	3	1	0	0	1	1	5	4	26
1/ >14 d	1	5	0	1	4	1	0	1	0	6	3	2	24

Table 5. Average fees charged per acre (\$) by midwestern USA crop consultants, 1993.

State	Corn	Sorghum	Soybean	Wheat	Alfalfa
IL	4.75	5.10	4.69	4.66	—
IN	3.21	5.00	3.21	2.89	3.10
IA	3.90	4.00	3.89	4.00	4.50
KS	6.13	5.30	5.72	3.82	5.61
MN	3.99	3.00	3.69	3.50	—
MI	4.38	—	4.00	4.63	—
MO	3.15	2.88	2.92	2.00	5.00
NE	5.50	4.94	4.69	3.87	4.60
ND	3.14	1.80	2.51	2.23	—
OH	3.83	—	3.83	3.66	—
SD	3.95	3.75	3.81	3.77	—
WI	5.81	6.88	5.89	5.81	6.00
AVG	4.31	4.26	4.07	3.74	4.80

Table 6. Corn acres contracted with crop consultants and treated for corn rootworms in midwestern USA, 1993.†

State	At planting	Post emergence	Chemigation	Foliar spray	Total treated acres	Not treated
IL	64 500	2 500	0	35 750	102 750	197 250
IN	22 547	500	0	5 400	28 447	23 263
IA	57 887	0	0	4 325	62 212	73 750
KS	335 175	56 655	30 434	116 089	538 353	183 538
MN	14 300	800	0	1 000	16 100	46 617
MI	1 273	0	0	0	1 273	6 500
MO	3 006	6	0	0	3 012	18
NE	203 850	74 580	14 645	220 418	513 493	177 752
ND	2 500	0	0	0	2 500	9 600
OH	22 250	2 000	0	0	24 250	32 950
SD	14 609	1 010	1 000	0	16 619	99 649
WI	25 684	1 290	0	0	26 974	54 606
TOTALS	767 581	139 341	46 079	382 982	1 335 983	905 493

† All application methods except foliar sprays are directed at larval stage; foliar sprays are directed at adult beetles.

are scouted by crop consultants (USDA-ERS, 1994). It should be noted that alfalfa acreage is undoubtedly underreported; if respondents did not contract on corn, sorghum, soybeans, or wheat, they were instructed in the first question (Table 1) to stop and return the survey. Alfalfa acreage is based on responding crop consultants who specified alfalfa under "other," but would not include crop consultants working on alfalfa, but not on corn, soybeans, sorghum, or wheat.

The most common scouting interval reported was once a week; 68% reported making visits once a week or more frequently (Table 4). States where insect scouting is commonly a component of crop consultant services (e.g., Kansas and Nebraska [1994, unpublished data]) rarely reported scouting less frequently than once a week. Other states, where insect scouting was less commonly offered as a service, were more likely to report scouting intervals greater than once a week.

Scouting fees charged per acre varied with crops (Table 5). Averaged over all states, the highest fees were charged for alfalfa (\$4.80), with less charged for corn (\$4.31), sorghum (\$4.26), soybeans (\$4.07), and wheat (\$3.74). There was a great range in fees within crops across the

region, e.g., corn varied from \$3.21 to 6.13 per acre in different states. This variation is probably related to the frequency of visits and the range of services offered (from comprehensive integrated crop management to less comprehensive agronomic only [no IPM] services) in different states. The range of corn fees is similar to that reported for 1993 by the USDA-ERS national independent crop consultant survey (\$1.63–5.50; USDA-ERS, 1994).

Several questions dealt with management of corn rootworms, the most important corn insect pest in the midwestern USA and responsible for the greatest amount of insecticide use on corn (Bergman et al., 1985 a, b). Of several corn rootworm chemical control options in the Midwest, planting time application of insecticides was the most commonly used practice (Table 6). Other practices varied widely across states in their frequency of use. Postemergence applications of insecticides directed at larval rootworms (cultivation time applications and chemigation) were used primarily in Kansas, Nebraska, and South Dakota. Foliar sprays for adult

Table 7. Corn rotation practices on fields contracted with crop consultants in midwestern USA, 1993.

State	Acres of corn planted after corn (% of total)	Acres of corn planted after another crop (% of total)	Total
IL	107 750 (45.3)	130 250 (54.7)	238 000
IN	30 956 (54.8)	25 554 (45.2)	56 510
IA	58 260 (37.1)	98 640 (62.9)	156 900
KS	558 195 (77.3)	164 164 (22.7)	722 359
MN	17 700 (27.9)	45 717 (72.1)	63 417
MI	2 000 (25.9)	5 732 (74.1)	7 732
MO	3 309 (16.3)	17 021 (83.7)	20 330
NE	506 715 (76.2)	158 405 (23.8)	665 120
ND	3 815 (28.1)	9 745 (71.9)	13 560
OH	17 200 (29.9)	40 300 (70.1)	57 500
SD	32 759 (24.4)	101 284 (75.6)	134 043
WI	33 613 (36.5)	58 467 (63.5)	92 080
TOTALS	1 372 272 (61.6)	855 279 (38.4)	2 227 551

corn rootworm control were also most common in Kansas and Nebraska but some use occurred further east also.

Crop rotation is an important nonchemical control option for corn rootworms. Use of crop rotation varied greatly across the region (23.8%–83.7%) (Table 7) which is similar to other reports (USDA-ERS, 1994). Excluding data from Missouri, across all remaining states there was a significant negative correlation ($r = -0.94$, 10 d.f., $P < 0.01$) between the frequency of corn grown after another crop and insecticide use against corn rootworms (Fig. 1); i.e., states with higher frequencies of corn planted after another crop tended to treat a lower percentage of corn acreage for corn rootworm control. Excluding data from Missouri from the analysis as an outlier can be justified because the data for acres treated were based on responses from only four crop consultants reporting 3012 acres treated (Table 7). With data from Missouri included, the correlation was not statistically significant ($r = -0.48$, 11 d.f., $P > 0.05$).

This study provides a snapshot of the activity of crop consultants on field crops in 12 midwestern U.S. states during 1993. This study has directly documented ~2.3 million acres of crops contracted by crop consultants, which is one

Fig. 1. Relationship between percentage of acres treated with insecticides for corn rootworm control and percentage of corn acres planted after another crop, 1993. Excluding data from Missouri, among all remaining states there was a significant negative correlation ($r = -0.94$, 10 d.f., $P < 0.01$).

measure of IPM adoption. However, crop consultants are not the only individuals involved in implementing IPM. Farmers report that they scout a high proportion of fields (USDA-ERS, 1994; Czapar et al., 1995), although it may be difficult to interpret the significance of their activity. Additionally, there are other commercial groups not included in these surveys (e.g., coop dealers, fertilizer and pesticide dealers, aerial applicators, other agribusinesses), who often provide advice and check fields for their grower clients.

There is great diversity in the acreage of field crops contracted with crop consultants across the midwestern USA. This is probably due to differences in cropping systems, crop value, and farm size across the region. Some states, such as Kansas and Nebraska, have high numbers of crop consultants who influence large numbers of acres. Many of the crop consultants in Nebraska and Kansas work in areas with high yielding, irrigated corn production (Miller et al., 1996), which is often continuously cropped (both states had over 75% continuous corn reported; Table 7). There may be greater demand for crop consultants in these areas because they provide needed services, such as irrigation scheduling and insect scouting, which are less in demand in other states where rainfed, rotated corn production systems are more common. Also, the greater value of corn production in these areas may make crop consultants more affordable. In the other states in the region, crop consultants working on field crops are much less abundant and influence many fewer acres.

The distribution of crop consultants in the midwestern USA has implications for IPM educational programming in field crops. Educational activities have to be tailored to meet the needs of people making IPM decisions. Crop consultants, many of whom have graduate training in agronomy and pest management and are relatively more specialized than farmers, may require more advanced training and educational materials with more technical detail. Areas with fewer crop consultants may have to target IPM education programs directly to farmers as well as other providers of IPM services.

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