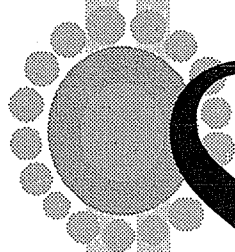


Extension Report No. 12



S 1991 G SUNFLOWER TROWER SURVEY

OF PEST PROBLEMS
AND PESTICIDE USE IN
KANSAS, MINNESOTA
AND NORTH DAKOTA

H. A. Lamey, M. P. McMullen, D. R. Berglund,
J. L. Luecke, D. K. McBride, and R. K. Zollinger



NDSU EXTENSION SERVICE

North Dakota State University, Fargo, ND 58105

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PROCEDURES

Sunflower growers in Kansas, Minnesota and North Dakota were surveyed about pest problems and pesticide use in 1991. A similar survey of North Dakota sunflower growers was conducted at the end of the 1990 crop season (1). A single page survey form (Figure 1) was sent on November 15, 1991 to selected names from the mailing list of the National Sunflower Association's magazine *The Sunflower*. The survey form was sent to all 1,291 growers listed from Kansas and all 1,419 growers from Minnesota, while every fifth name was selected from the list of over 13,000 growers in North Dakota (2,655 growers). A total of 5,365 forms was mailed. A self-addressed stamped envelope was enclosed for returning the survey form.

Survey respondents were asked to identify the county and state where their sunflower crop was grown; acres of oilseed and confection hybrids grown under irrigation and under dryland conditions; major production problems encountered; major insect, disease and weed problems; percent bird damage and bird species causing damage; pesticides used; crop injury and weed control from the use of herbicides and other weed control practices; crop rotation practices used; number of years since sunflower had been grown on that land; and use of integrated pest management (IPM) and other alternative pest management practices.

RESULTS

Twenty percent (1,077 forms) of the surveys were returned. Of these, 770 (14%) were usable while 425 (6%) were not usable because the respondent had not grown sunflower in 1991, had retired, had sold the farm or was deceased. Number of respondents and percent response for each state were Kansas, 134 or 10%; Minnesota, 220 or 16%; and North Dakota, 416 or 16% (Table 1).

Respondents in the three states planted 235,415 acres, or 11% of the 2,105,000 acres planted by all growers in these states (2). Kansas respondents planted 21,658 acres, or 21% of Kansas' total sunflower acres of 105,000; Minnesota respondents planted 67,869 acres, or 23% of 290,000 Minnesota acres; and North Dakota respondents planted 145,888 acres, or 9% of North Dakota's 1,710,000 acres. The North Dakota acreage represented in the survey is good since only 20% of growers received the survey form.

Confection sunflower planted by respondents was 22%, 26%, and 20% of respondents' total sunflower acres in Kansas, Minnesota and North Dakota, respectively. Almost all respondents' irrigated acres were in Kansas, where 45% of confection and 15% of oilseed acres were irrigated.

Major Sunflower Producing Counties. The top sunflower producing counties for Kansas respondents were Cheyenne, Sherman, Decatur, Ford and Gray; the top counties for Minnesota respondents were Polk, Pennington, Roseau, Marshall, Red Lake, Kittson, Big Stone, and Norman; and the top counties for North Dakota respondents were Barnes, Stutsman, LaMoure, Cass, Wells, and Nelson (Table 2). By comparison, the top counties in North Dakota for all sunflower growers (not just respondents) were Stutsman, Barnes, LaMoure, Wells, Cass and Benson (2).

Table 1. Sunflower acres planted and harvested by respondents in Kansas, Minnesota and North Dakota in 1991.

Sunflower Class	KANSAS		MINNESOTA		NORTH DAKOTA		THREE STATE TOTAL	
	Respondents	Acres	Respondents	Acres	Respondents	Acres	Respondents	Acres
Dryland Oilseed	101	14,453	185	50,262	366	116,005	652	180,720
Dryland Confection	26	2,614	70	17,507	101	29,883	197	50,004
Irrigated Oilseed	20	2,493	0	0	0	0	20	2,493
Irrigated Confection	14	2,098	1	100	0	0	15	2,198
Total Planted	134	21,658	220	67,869	416	145,888	770	235,415
Total Harvested	132	20,840	220	67,752	413	143,863	765	232,455

PLEASE CIRCLE OR FILL IN THE REQUESTED INFORMATION ON PEST PROBLEMS AND PESTICIDE USE ON YOUR 1991 SUNFLOWER CROP.

Total acres planted in 1991 _____
 Total acres harvested _____

ACRES PLANTED BY CATEGORY	Acres	Seeding Date
Dryland: oilseed hybrids	_____	_____
Dryland: confection hybrids	_____	_____
Irrigated: oilseed hybrids	_____	_____
Irrigated: confection hybrids	_____	_____

(If sunflower grown in more than one county, list each county and acres)

STATE AND COUNTY WHERE GROWN		
State	County	Acres
KS	_____	_____
MN	_____	_____
ND	_____	_____

Greatest Production Problem In Sunflower In 1991 (circle one)
None
Weeds
Emergence/Stand
Insects
Diseases
Herbicide drift
Bird damage
Other (specify)

Worst Disease Problems In 1991 (Rank 1-3, 1 = Worst)
None
Sclerotinia wilt
Sclerotinia head rot
Rust
Phoma black stem
Downy mildew
Charcoal rot
Rhizopus head rot
Other (specify)

Worst Weed Problems In 1991 (Rank 1-3, 1 = Worst)
None
Kochia
Russian thistle
Foxtail (Pigeon grass)
Wild buckwheat
Wild mustard
Redroot pigweed
Wild oats
Volunteer wheat
Large crabgrass
Other (specify)

Worst Insect Problems In 1991 (Rank 1-3, 1 = Worst)
None
Seed weevil
Banded sunflower moth
Stem weevil
Sunflower beetle
Sunflower head moth
Sunflower midge
Grasshopper
Other (specify)

Insecticide(s) Used on Sunflower in 1991:		
Insecticide	No. Acres Treated	No. of Applications
ethyl parathion	_____	_____
methyl parathion	_____	_____
6-3 parathion	_____	_____
Asana XL	_____	_____
Lorsban 4E	_____	_____
Furadan 4F	_____	_____
Sevin XLR	_____	_____
Furadan 15G	_____	_____
Lindane/Maneb (seed treatment)	_____	_____
Other (specify)	_____	_____

Bird Problems and Losses
Mark which best fits (% yield loss)
0-5%
5-10%
10-25%
25-50%
50-100 %
Species of Bird:
Blackbirds
Finches
Sparrows
Other
(specify)

OTHER COMMENTS _____

EVALUATE WEED CONTROL AND SUNFLOWER INJURY

Mark weed control used and indicate acres treated for each item. Count double application, double cultivation, etc., as double acres.

Weed Control Used	Acres treated	WEED CONTROL		SUNFLOWER INJURY	
		1 = Excellent	2 = Good	1 = None	2 = Slight
Roundup (Preplant)	_____	1	2	3	4
Eptam (fall)	_____	1	2	3	4
Eptam (spring)	_____	1	2	3	4
Sonalan (fall)	_____	1	2	3	4
Sonalan (spring)	_____	1	2	3	4
Sonalan + Eptam	_____	1	2	3	4
Prowl (fall)	_____	1	2	3	4
Prowl (spring)	_____	1	2	3	4
Treflan (fall)	_____	1	2	3	4
Treflan (spring)	_____	1	2	3	4
Treflan + Eptam	_____	1	2	3	4
Lasso	_____	1	2	3	4
Poast	_____	1	2	3	4
Assert	_____	1	2	3	4
No herbicide used	_____	1	2	3	4
Cultivation	_____	1	2	3	4
Rotary Hoe	_____	1	2	3	4
Hand weeding	_____	1	2	3	4
Other (specify)	_____	1	2	3	4

DESICCANTS:		1		2		3		4	
Gramoxone Extra	_____	1	2	3	4	1	2	3	4
Leaflex-3/Defol	_____	1	2	3	4	1	2	3	4

INTEGRATED PEST MANAGEMENT

Did you hire a consultant to scout sunflowers?

- 1991 prior to 1991
 a) yes a) yes
 b) no b) no

Pesticide Use in 1991 Was:

- a) less b) more c) same

If less or more, _____% increase or decrease

If less pesticides used in 1991, was due to (please circle one or more):

- a) fewer pests
 b) better application techniques
 c) better scouting for timely application
 d) use of different chemicals with lower use rates
 e) not economically feasible
 f) used alternative pest management practices (Please specify below).

- Crop rotation _____ #acres
- Preceding crop _____
 how long since previous sunflowers? _____ # years
- Cultivation _____ # times _____ # acres
- Resistant Variety _____ # acres
- Water Management (irrigators) _____ # acres
- Other (specify) _____ # acres

FUNGICIDES USED ON SUNFLOWER IN 1991:

Fungicide	No. Acres Treated	No. of Applications
Dithane	_____	_____
Apron (seed treatment)	_____	_____
Other (specify)	_____	_____

Results of survey will be published in THE SUNFLOWER.
 Thank you. Please return by December 15, 1991.

Arthur Lamey, Extension Plant Pathologist

Figure 1. The survey form.

Sherman County Kansas respondents reported the most irrigated sunflower acres, followed by Cheyenne and Decatur counties in Kansas.

Sunflower Planting Dates. There was a wide range of planting dates in Kansas from before May 1 to the end of July. The majority of sunflower in Kansas was planted in June, but a significant portion of the oilseed crop was planted in early July (Table 3). The majority of sunflower in Minnesota was planted between May 1 and May 20. In North Dakota the majority of oilseed sunflower was planted between May 11 and June 10 and the majority of confection sunflower was planted between May 11 and May 31.

Production Problems. The worst production problem in Kansas was emergence, followed by weather, "no problem", weeds and insects (Table 4). In Minnesota "no problem" was the most frequent response, followed by weather, weeds, and bird damage. Over 40% of North Dakota respondents reported insects to be the worst production problem, and nearly 20% reported bird damage to be the worst production problem.

Insect Problems and Insecticide Use. Sunflower head moth was the worst insect problem for 50% of Kansas respondents, followed by the seed weevil for 21% (Table 5). In all three states the seed weevil was more frequently reported as the worst insect problem on confection sunflower than on oilseed sunflower (Tables 6 and 7). Nearly 40% of Minnesota respondents reported no insect problem but over 30% reported the seed weevil as the worst insect problem. Nearly 50% of North Dakota respondents reported the seed weevil as the worst insect problem, followed by grasshoppers by 25% and stem weevil by 15%. In North

Table 2. Top sunflower producing counties in Kansas, Minnesota and North Dakota in 1991.^a

State	County	Acres Reported	Acres in Each Class			
			Dryland Oilseed	Dryland Confection	Irrigated Oilseed	Irrigated Confection
KS	Cheyenne	4,343	3,043	650	140	510
	Sherman	3,681	999	1,373	465	844
	Decatur	1,765	1,377	283	105	0
	Ford	1,280	1,280	0	0	0
	Gray	1,040	1,040	0	0	0
MN	Polk	12,100	7,476	4,524	0	0
	Pennington	8,907	7,724	1,183	0	0
	Roseau	8,867	7,067	1,800	0	0
	Marshall	8,011	7,256	755	0	0
	Red Lake	7,482	4,332	3,150	0	0
	Kittson	5,417	3,059	2,358	0	0
	Big Stone	4,480	4,480	0	0	0
	Norman	4,243	1,989	2,254	0	0
ND	Barnes	14,276	12,358	1,918	0	0
	Stutsman	13,590	12,192	1,398	0	0
	La Moure	11,802	11,042	760	0	0
	Cass	7,813	5,698	2,115	0	0
	Wells	7,416	6,746	670	0	0
	Nelson	7,380	3,125	4,255	0	0

^aCounties with over 5% of reported acres for each state, or 1,000 in Kansas, 3,000 in Minnesota and 7,000 in North Dakota.

Table 3. Planting dates of sunflower in Kansas, Minnesota and North Dakota in 1991.

State	Sunflower Class	Planting Date									
		Before May 1	May 1-10	May 11-20	May 21-31	June 1-10	June 11-20	June 21-30	July 1-10	July 11-20	July 21-31
----- % of Fields -----											
KS	Dryland Oilseed	0	1.1	0	3.3	13.0	21.7	25.0	25.0	9.8	1.1
	Dryland Confection	0	0	5.0	0	20.0	60.0	15.0	0	0	0
	Irrigated Oilseed	5.9	0	0	11.8	17.6	11.8	23.5	17.6	11.8	0
	Irrigated Confection	0	0	8.3	0	25.0	41.7	16.7	8.3	0	0
MN	Dryland Oilseed	4.1	28.1	49.1	15.2	2.9	0.6	0	0	0	0
	Dryland Confection	4.8	38.7	43.5	6.5	1.6	3.2	1.6	0	0	0
ND	Dryland Oilseed	0.3	2.9	20.3	48.1	25.2	2.6	0.6	0	0	0
	Dryland Confection	2.2	0	35.9	47.8	10.9	2.2	1.1	0	0	0

Table 4. Worst production problem of sunflower in Kansas, Minnesota and North Dakota in 1991.

Production Problem	Kansas	Minnesota	North Dakota
	----- % of Respondents -----		
Insects	13.8	8.8	40.9
Diseases	3.1	8.4	9.1
Weeds	13.8	17.2	8.6
Emergence/Stand	27.7	8.4	5.4
Bird Damage	7.7	12.6	19.9
Weather	16.9	19.1	6.9
Herbicide Drift	0	2.3	1.5
Other	0.8	2.8	0.2
None	16.2	20.5	7.6

Table 5. Worst insect problem in sunflower in Kansas, Minnesota and North Dakota in 1991.

Insect	Kansas		Minnesota		North Dakota	
	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects
----- % of Respondents -----						
Banded Sunflower Moth	2.3	3.1	1.0	7.8	0.2	2.7
Cutworm	0	0.8	1.0	1.5	2.7	6.7
Grasshopper	5.5	14.1	13.6	29.1	24.6	66.0
Seed Weevil	21.1	42.2	31.6	40.3	49.3	80.0
Sunflower Beetle	2.3	4.7	3.4	7.8	2.7	14.8
Sunflower Head Moth	50.0	65.6	1.5	8.3	1.0	4.9
Sunflower Midge	0.8	1.6	0.5	1.5	0	1.5
Stem Weevil	0.8	11.7	6.8	17.5	14.8	48.8
Others	0	2.3	1.0	1.0	0.7	1.5
None	17.2	17.2	39.8	39.8	3.9	4.2

Table 6. Worst insect problem in sunflower in Kansas in 1991.

Insect	Dryland Oilseed		Dryland Confection		Irrigated Oilseed		Irrigated Confection	
	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects
----- % of Respondents -----								
Banded Sunflower Moth	2.1	2.1	0	3.8	10.5	10.5	0	0
Cutworm	0	1.1	0	0	0	0	0	0
Grasshopper	5.3	13.7	7.7	19.2	0	10.5	7.1	14.3
Seed Weevil	14.7	33.7	50.0	76.9	26.3	31.6	35.7	64.3
Sunflower Beetle	3.2	6.3	3.8	3.8	0	0	0	0
Sunflower Head Moth	50.5	62.1	38.5	73.1	52.6	63.1	57.1	78.6
Sunflower Midge	1.1	2.1	0	3.8	0	0	0	7.1
Stem Weevil	1.1	10.5	0	15.4	0	5.3	0	14.3
Others	0	2.1	0	0	0	5.3	0	0
None	22.1	22.1	0	0	10.5	10.5	0	0

Table 7. Worst insect problem of sunflower in Minnesota and North Dakota in 1991.

Insect	MINNESOTA				NORTH DAKOTA			
	Dryland Oilseed		Dryland Confection		Dryland Oilseed		Dryland Confection	
	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects	Worst Insect	One of Three Worst Insects
----- % of respondents -----								
Banded Sunflower Moth	1.2	5.8	1.4	18.6	0.3	2.2	0	6.1
Cutworm	1.2	1.8	0	0	2.8	6.4	3.0	11.0
Grasshopper	14.6	26.3	4.3	34.3	26.6	67.2	19.2	66.7
Seed Weevil	24.0	32.7	61.4	72.9	46.2	78.4	58.6	92.9
Sunflower Beetle	2.9	7.0	4.3	11.4	2.5	12.6	3.0	25.3
Sunflower Head Moth	1.8	7.0	1.4	14.3	1.1	4.8	1.0	5.1
Sunflower Midge	0.6	1.8	1.4	1.4	0	1.7	0	1.0
Stem Weevil	7.6	15.8	7.1	24.3	16.0	51.3	11.1	44.4
Others	0.6	0.6	1.4	1.4	0.3	0.8	3.0	4.0
None	45.6	45.6	17.1	17.1	4.2	4.2	1.0	2.0

Dakota 80% of respondents reported the seed weevil to be one of the three worst insect problems and nearly 93% of North Dakota confection growers reported the seed weevil to be one of the three worst insect problems.

The sunflower head moth was reported to be the worst insect problem by over 50% of Kansas respondents growing dryland oilseed, irrigated oilseed and irrigated confection sunflower; the seed weevil was the next most frequently reported insect problem (Table 6). In dryland confection sunflower, Kansas respondents most frequently reported the seed weevil as the worst insect problem, followed by the head moth.

North Dakota respondents most frequently reported the seed weevil to be the worst insect problem as well as one of the three worst insect problems; the grasshopper was second, and frequently was reported as one of the three worst insect problems (Table 7). The grasshopper was frequently reported as one of the three worst insect problems in Minnesota as well.

North Dakota respondents treated 89% of their acres with an insecticide, while respondents in Kansas treated 61% and Minnesota respondents treated 31% (Table 8). Parathion (all forms) was the most commonly used insecticide in all three states; ethyl parathion was the most common in Kansas while methyl parathion was most common in North Dakota. Asana XL (esfenvalerate) was used on over 25% of North Dakota respondents' acres, compared to 9% and 8% in Kansas and Minnesota, respectively. Lindane/maneb seed treatment was used on nearly 10% of Minnesota respondents' acres, compared to 1% and 2% in Kansas and North Dakota, respectively.

Kansas respondents used more insecticides on confection sunflower than on oilseed sunflower; they also used more insecticides on irrigated sunflower than on dryland sunflower (Table 9). Ethyl parathion was the most commonly used insecticide for both confection and oilseed sunflower grown under irrigation as well as under dryland conditions. Over 100% of respondents' dryland confection (164%), irrigated oilseed (139%) and irrigated confection (181%) acres were treated, indicating that more than one application was made by many respondents. Asana XL was the second most commonly used insecticide, applied on 32% of dryland confection acres, 25% of irrigated confection acres and less than 10% of oilseed acres. Furadan use was minimal except on dryland confection acres, where Furadan (4F and 15G combined) was used on 22% of respondents' acres.

Minnesota and North Dakota respondents used more insecticides on confection sunflower than on oilseed sunflower (Table 10). Insecticides were used on 216% of respondents' confection sunflower acres in North Dakota. The most common insecticide treatment on oilseed sunflower in Minnesota was lindane/maneb seed treatment, but parathion was the most common on confection sunflower in Minnesota and all sunflower in North Dakota. Asana XL was used on 62% of respondents' confection and 27% of respondents' oilseed acres in North Dakota, and 15% of respondents' confection and 8% of respondents' oilseed acres in Minnesota.

Table 8. Use of insecticides on sunflower in Kansas, Minnesota and North Dakota in 1991.

Insecticide	Kansas	Minnesota	North Dakota	% of respondents acres treated			
Asana XL	9.2	7.9	25.6				
Furadan 4F	2.3	0.4	3.3				
Furadan 15G	1.5	0.8	2.1				
Lindane/Maneb	0.1	9.8	3.1				
Lorsban 4E	1.2	0.1	1.5				
Ethyl Parathion	31.6	3.4	7.0				
Methyl Parathion	8.8	4.2	26.3				
6-3 Parathion	5.7	3.5	16.1				
Sevin XLR	0	0.2	3.1				
Other	0.9	0.4	0.5				
Total Parathion	46.1	11.1	49.4				
Total Treated	61.3	30.6	88.5				

Table 9. Use of insecticides on class of sunflowers in Kansas in 1991.

Insecticide	Dryland		Irrigated	
	Oilseed	Confection	Oilseed	Confection
	% of respondents acres treated			
Asana XL	8.4	31.9	9.5	24.7
Furadan 4F	1.4	11.1	2.2	0
Furadan 15G	1.4	10.7	0	1.7
Lindane/Maneb	1.8	0	0	0
Lorsban 4E	<0.1	0	10.0	0
Ethyl Parathion	23.5	73.7	110.2	139.6
Methyl Parathion	7.1	33.3	5.4	11.9
6-3 Parathion	7.7	3.4	0	1.7
Sevin XLR	0	0	0	0
Other	0.9	0	1.2	1.7
Total Parathion	38.3	110.4	115.6	153.2
Total Treated	50.7	164.3	138.6	181.3

Weed Problems and Herbicide Use. The worst weed problem was different for each state (Table 11). The worst weed problem for Kansas respondents was redroot pigweed (23% of respondents) followed by kochia (10% of respondents). Minnesota respondents indicated foxtail (26%) was the worst weed followed by wild mustard (14%); North Dakota respondents reported kochia (26%) was the worst weed followed by foxtail (20%). A number of respondents indicated that weeds weren't a problem: 30% of Kansas respondents, 23%

of Minnesota respondents and 19% of North Dakota respondents.

Redroot pigweed was the worst weed problem reported in Kansas on both dryland and irrigated acres and on both oilseed and confection sunflower (Table 12). The second worst weed problem was kochia on dryland oilseed sunflower; foxtail, kochia and Russian thistle on dryland confection; kochia on irrigated oilseed; and kochia and shattercane on irrigated confection sunflower.

Table 10. Use of insecticides on different classes of sunflower in Minnesota and North Dakota in 1991.

Insecticide	MINNESOTA			NORTH DAKOTA		
	All Sunflower	Dryland Oilseed	Dryland Confection	All Sunflower	Dryland Oilseed	Dryland Confection
----- % of respondents acres treated -----						
Asana XL	7.9	7.8	15.3	25.6	26.6	62.2
Furadan 4F	0.4	0.5	1.0	3.3	3.1	4.6
Furadan 15G	0.8	0.9	0.5	2.1	2.2	4.6
Lindane/Maneb	9.8	13.2	20.5	3.1	3.7	4.1
Lorsban 4E	0.1	0	0.3	1.5	1.5	3.0
Ethyl Parathion	3.4	1.5	12.9	7.0	8.1	6.2
Methyl Parathion	4.2	1.7	13.8	26.3	24.8	74.1
6-3 Parathion	3.5	1.3	13.1	16.1	15.4	55.5
Sevin XLR	0.2	0.2	0.6	3.1	3.8	1.4
Other	0.4	0.4	1.7	0.5	0.6	0
Total Parathion	11.1	4.5	39.8	49.4	48.3	135.8
Total Treated	30.6	27.6	79.5	88.5	89.7	215.7

Table 11. Worst weed problem in sunflower in Kansas, Minnesota and North Dakota in 1991.

WEED	KANSAS		MINNESOTA		NORTH DAKOTA	
	Worst Weed	One of Three Worst Weeds	Worst Weed	One of Three Worst Weeds	Worst Weed	One of Three Worst Weeds
----- % of respondents -----						
Canada Thistle	0	0.8	3.7	6.0	2.5	3.9
Cocklebur	1.5	1.5	3.7	4.1	3.7	4.4
Large Crabgrass	2.3	6.9	0	0	0	0.5
Foxtail (Pigeongrass)	7.7	19.2	25.8	49.3	20.0	39.4
Kochia	10.0	27.7	10.1	17.5	25.9	53.0
Redroot Pigweed	23.1	33.8	3.7	11.1	1.0	5.9
Russian Thistle	6.9	23.1	2.8	9.2	6.4	24.4
Shattercane	3.8	4.6	0	0	0	0
Volunteer Wheat	5.4	7.7	0.5	1.8	0	0.7
Wild Buckwheat	0	0.8	0.9	9.2	1.2	4.7
Wild Mustard	0	0	13.8	38.2	17.5	36.5
Wild Oats	0	0.8	9.7	32.3	1.5	8.4
Other	9.2	13.8	2.8	5.5	1.5	4.7
None	30.0	30.8	22.6	22.6	19.0	19.2

Table 12. Worst weed problem in sunflower in Kansas in 1991.

WEED	Dryland Oilseed		Dryland Confection		Irrigated Oilseed		Irrigated Confection	
	Worst Weed	One of Three Worst Weeds	Worst Weed	One of Three Worst Weeds	Worst Weed	One of Three Worst Weeds	Worst Weed	One of Three Worst Weeds
----- % of respondents -----								
Canada Thistle	0	0	0	3.8	0	0	0	0
Cocklebur	2.1	2.1	0	0	0	0	0	0
Large Crabgrass	3.1	9.3	0	0	5.3	5.3	0	0
Foxtail (Pigeongrass)	7.2	20.6	11.5	23.1	5.3	5.3	7.1	7.1
Kochia	9.3	27.8	11.5	26.9	10.5	36.8	14.3	28.6
Redroot Pigweed	25.8	35.1	23.1	34.6	26.3	36.8	21.4	50.0
Russian Thistle	7.2	22.7	11.5	30.8	5.3	26.3	7.1	42.9
Shattercane	1.0	2.1	3.8	3.8	5.3	10.5	14.3	14.3
Volunteer Wheat	7.2	10.3	0	0	5.3	5.3	0	0
Wild Buckwheat	0	1.0	0	0	0	0	0	0
Wild Mustard	0	0	0	0	0	0	0	0
Wild Oats	0	1.0	0	0	0	0	0	0
Other	8.2	14.4	7.7	11.5	5.3	5.3	14.3	14.3
None	28.9	30.0	30.8	30.8	31.6	36.8	21.4	21.4

Table 13. Use of herbicides, alternate weed control methods and a desiccant on sunflower in Kansas, Minnesota and North Dakota in 1991.

Herbicide	Kansas		Minnesota		North Dakota	
----- % of respondents' acres treated -----						
Assert	0		9.7		0.3	
Eptam (spring)	0		0.5		0.2	
Lasso	1.4		0.2		0.1	
Poast	2.0		8.7		0.4	
Prowl (fall)	1.8		0.1		0	
Prowl (spring)	20.6		13.8		0.9	
Roundup (preplant)	5.2		0.5		1.1	
Sonalan (fall)	0		1.5		0.2	
Sonalan (spring)	2.8		21.8		50.2	
Sonalan + Eptam	0		0.1		>0.1	
Trifluralin (fall)	1.5		8.1		8.0	
Trifluralin (spring)	36.1		35.5		40.1	
Trifluralin + Eptam	0		0.4		0.4	
Other	0.8		1.0		0.1	
No Herbicide	23.7		4.1		0.8	
Alternate Control Measures						
	% acres	% resp.	% acres	% rest.	% acres	% resp.
Cultivation	29.3	81.4	85.0	95.8	47.3	93.6
Rotary Hoe	2.8	13.6	1.0	2.8	2.8	4.6
Hand Weeding	2.0	5.1	0.3	1.4	0.1	1.8
Desiccant						
Gramoxone Extra	0		2.9		0	

Weed control practices included herbicides, no herbicide, cultivation, use of rotary hoe and hand weeding. Herbicides were not used on 24% of respondents' acres in Kansas, but only 4% in Minnesota and 1% in North Dakota (Table 13). Spring applied trifluralin was used on 36% of Kansas respondents' acres, followed by spring applied Prowl on 21%. Spring applied trifluralin was used on 36% of Minnesota respondents' acres, followed by spring applied Sonalan on 22%, spring applied Prowl on 14% and Assert on 10%. Spring applied Sonalan was used on 50% of North Dakota respondents' acres, followed by spring applied trifluralin on 40%.

Respondents were asked about cultivation twice on the survey form (Figure 1). Where cultivation was listed as a weed control method, 85% of respondents' acres from Minnesota were cultivated. This was followed by 47% of North Dakota and 29% of Kansas respondents' acres (Table 13). However, when percent of respondents was tabulated for the same question, cultivation was used by 96%, 94% and 81% of respondents in these same states. One conclusion that may be made from these two sets of data is that respondents did not cultivate their entire acreage. Another reason which may have contributed to the inconsistencies between the two categories may be from where the topic of

cultivation was placed in the table under weed control used (Figure 1). The first several choices in the table refer to herbicide treatments followed by nonchemical options such as cultivation, rotary hoe, and hand weeding. Some respondents may have quickly indicated their principal herbicide treatment and moved on to the next section without indicating any non-herbicide methods. However, based on overall cultivation use (Table 29) and lack of wide spectrum broadleaf weed control options, cultivation is a major weed control component.

Use of a rotary hoe was reported by 14% of Kansas respondents, yet they reported use on only 3% of their acres. Use of a rotary hoe was reported on 3% of respondents' acres in North Dakota and 1% in Minnesota. Hand weeding was used on 2% of Kansas respondents' acres and less than 1% in the other two states.

The desiccant Gramoxone Extra was used on 3% of Minnesota respondents' acres, and none of respondents' acres in the other two states (Table 13).

Herbicide use in Kansas varied somewhat with class and irrigation. No herbicide was used on 26% of respondents' dryland confection acres, 34% of dryland oilseed acres, 47% of irrigated confection acres and 52% of irrigated oilseed acres (Table 14). Spring-

Table 14. Use of herbicides and alternate weed control methods on different classes of sunflower in Kansas in 1991.

Herbicide	Dryland Oilseed		Dryland Confection		Irrigated Oilseed		Irrigated Confection	
	% acres	% resp.	% acres	% resp.	% acres	% resp.	% acres	% resp.
----- % of respondents' acres treated -----								
Assert	0		0		0		0	
Eptam (spring)	0		0		0		0	
Lasso	2.0		0		0		0	
Poast	0		0		1.2		18.8	
Prowl (fall)	1.0		0		0		11.9	
Prowl (spring)	22.7		52.7		12.0		48.8	
Roundup (preplant)	7.8		1.0		4.3		0	
Sonalan (fall)	0		0		0		0	
Sonalan (spring)	3.2		0		14.8		0	
Sonalan + Eptam	0		0		0		0	
Trifluralin (fall)	2.2		0		4.3		0	
Trifluralin (spring)	34.8		90.8		57.5		77.5	
Trifluralin + Eptam	0		0		0		0	
Other	1.2		0		0		0	
No Herbicide	34.4		25.9		51.9		46.6	
Alternate Control Methods	% acres	% resp.	% acres	% resp.	% acres	% resp.	% acres	% resp.
Cultivation	37.4	78.4	51.4	76.9	75.2	87.5	59.5	60.0
Rotary Hoe	4.2	15.4	4.3	15.4	0	0	3.7	20.0
Hand Weeding	3.1	5.9	15.3	7.7	1.6	12.5	1.9	20.0

applied trifluralin was the most commonly used herbicide on oilseed and confection sunflower, both irrigated and dryland. Trifluralin use varied considerably with sunflower class; it was used on 35% of respondents' dryland oilseed acres, 91% of dryland confection acres, 58% of irrigated oilseed acres, and 78% of irrigated confection acres. Spring-applied Sonalan was used on 15% of irrigated oilseed acres. Except for irrigated oilseed sunflower, Prowl was the second most commonly used herbicide, with 23% of respondents' dryland oilseed acres treated, 53% of dryland confection acres, 12% of irrigated oilseed acres, and 49% of irrigated confection acres. Fall-applied Prowl was used on 12% of respondents' irrigated confection acres. Poast was used of 19% of respondents' irrigated confection acres; this may be in response to the shattercane problem noted by respondents in irrigated confection sunflower.

Cultivation was used more frequently in Kansas on irrigated sunflower than dryland: 75% of respondents' irrigated oilseed acres, 60% of irrigated confection acres, 37% of dryland oilseed acres and 51% of

dryland confection acres (Table 14). Rotary hoe was used on 4% of respondents' dryland oilseed, dryland confection and irrigated confection acres. Hand weeding was used very little except on dryland confection acres, where respondents reported using it on 15% of acres.

Most herbicides gave good to excellent control in all three states (Table 15). Cultivation, rotary hoe and hand weeding generally gave good to excellent control also.

Most herbicides caused no injury or slight injury, as ranked by respondents in all three states (Table 16). Cultivation and use of the rotary hoe also caused slight or no injury.

Bird Damage. Respondents in North Dakota reported the most severe bird damage, with 26% reporting 5-10% yield loss and 15% reporting more than 10% loss (Table 17). In contrast, 13% of Kansas respondents and 14% of Minnesota respondents reported 5-10% losses and 4% in both states reported more than 10% loss.

Table 15. Effectiveness of herbicides, alternate weed control methods and a desiccant on sunflower in Kansas, Minnesota and North Dakota in 1991.

HERBICIDE	KANSAS				MINNESOTA				NORTH DAKOTA			
	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor
	----- % of respondents -----											
Assert	-	-	-	-	54.5	33.3	12.1	-	75.0	25.0	-	-
Eptam (spring)	-	-	-	-	50.0	50.0	-	-	-	-	100.0	-
Lasso	-	50.0	-	50.0	-	100.0	-	-	50.0	50.0	-	-
Poast	25.0	50.0	25.0	-	66.7	22.2	11.1	-	42.9	42.9	14.3	-
Prowl (fall)	33.3	33.3	33.3	-	100.0	-	-	-	-	-	-	-
Prowl (spring)	34.4	40.6	15.6	9.4	56.5	34.8	8.7	-	60.0	40.0	-	-
Roundup (preplant)	50.0	-	-	50.0	42.9	42.9	14.3	-	69.2	19.2	7.7	3.8
Sonalan (fall)	-	-	-	-	75.0	25.0	-	-	-	-	-	-
Sonalan (spring)	50.0	50.0	-	-	57.8	34.4	4.7	3.1	52.4	41.0	5.7	0.9
Sonalan + Eptam	-	-	-	-	100.0	-	-	-	100.0	-	-	-
Trifluralin (fall)	33.3	33.3	33.3	-	65.0	35.0	-	-	53.7	36.6	7.3	2.4
Trifluralin (spring)	50.0	25.0	18.2	6.8	57.7	34.0	6.2	2.1	38.3	47.9	11.2	2.7
Trifluralin + Eptam	-	-	-	-	50.0	50.0	-	-	-	100.0	-	-
No herbicide	18.2	45.5	18.2	18.2	-	81.8	9.1	9.1	25.0	25.0	25.0	25.0
Alternate Control Methods												
Cultivation	28.6	42.9	21.4	7.1	31.4	57.0	10.7	0.8	33.2	47.6	19.3	-
Rotary Hoe	16.7	33.3	50.0	-	25.0	75.0	-	-	25.0	25.0	50.0	-
Hand Weeding	-	50.0	50.0	-	100.0	-	-	-	75.0	25.0	-	-
Desiccant												
Gramoxone Extra	-	-	-	-	75.0	25.0	-	-	-	-	-	-

Table 16. Injury from herbicides and alternate weed control methods on sunflower in Kansas, Minnesota and North Dakota in 1991.

HERBICIDE	KANSAS				MINNESOTA				NORTH DAKOTA			
	None	Slight	Moderate	Severe	None	Slight	Moderate	Severe	None	Slight	Moderate	Severe
	----- % of respondents -----											
Assert	-	-	-	-	66.7	23.3	10.0	-	100.0	-	-	-
Eptam (spring)	100.0	-	-	-	50.0	50.0	-	-	-	-	-	-
Lasso	100.0	-	-	-	100.0	-	-	-	100.0	-	-	-
Poast	75.0	25.0	-	-	84.0	12.0	4.0	-	57.1	42.9	-	-
Prowl (fall)	66.7	33.3	-	-	100.0	-	-	-	-	-	-	-
Prowl (spring)	81.5	14.8	-	3.7	85.7	4.8	9.5	-	100.0	-	-	-
Roundup (preplant)	-	-	-	-	100.0	-	-	-	100.0	-	-	-
Sonalan (fall)	-	-	-	-	100.0	-	-	-	-	-	-	-
Sonalan (spring)	75.0	25.0	-	-	86.9	9.8	3.3	-	87.1	11.4	1.0	0.5
Sonalan + Eptam	-	-	-	-	100.0	-	-	-	100.0	-	-	-
Trifluralin (fall)	100.0	-	-	-	100.0	-	-	-	94.1	5.9	-	-
Trifluralin (spring)	92.9	7.1	-	-	92.5	7.5	-	-	91.8	7.6	0.6	-
Trifluralin + Eptam	-	-	-	-	100.0	-	-	-	-	-	-	-
No herbicide	90.0	-	10.0	-	77.8	22.2	-	-	66.7	-	-	33.3
Alternate Control Methods												
Cultivation	37.5	56.3	6.3	-	50.9	47.3	1.8	-	32.9	64.6	2.5	-
Rotary Hoe	-	100.0	-	-	75.0	25.0	-	-	22.2	77.8	-	-
Hand Weeding	66.7	-	33.3	-	100.0	-	-	-	100.0	-	-	-

Blackbirds were cited as the primary bird species causing damage by 94% of North Dakota, 89% of Minnesota and 70% of Kansas respondents (Table 18). Sparrows also were cited by 5% of North Dakota and Minnesota but 22% of Kansas respondents.

Disease Problems and Fungicide Use. The worst disease problem was Sclerotinia in both Minnesota and North Dakota: 20% of Minnesota respondents reported Sclerotinia head rot to be the worst disease problem and 26% of North Dakota respondents reported Sclerotinia wilt to be the worst disease problem (Table 19). In contrast, 19% of Kansas respondents reported Rhizopus head rot to be the worst disease problem and 67% reported no disease problem. Rust was reported to be the worst disease problem by 13% of Minnesota respondents and 9% of North Dakota respondents. Phoma black stem was reported to be the worst disease problem by 15% of North Dakota respondents. No disease problem was reported by 46% of Minnesota respondents and 36% of North Dakota respondents.

In addition to Sclerotinia, rust was reported as one of the three worst diseases by 27% of Minnesota

Table 17. Yield loss in sunflower due to bird damage in Kansas, Minnesota and North Dakota in 1991.

Bird Damage:	Kansas	Minnesota	North Dakota
% Yield Loss			
	----- % of respondents -----		
0-5%	83.2	82.1	59.8
5-10%	13.3	14.3	25.6
10-25%	1.8	3.6	11.5
25-50%	0	0	2.6
50-100%	1.8	0	0.5

Table 18. Bird species causing bird damage in sunflower in Kansas, Minnesota and North Dakota in 1991.

Bird Species	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
Blackbirds	69.9	89.3	94.4
Finches	1.1	1.7	0
Sparrows	21.5	5.1	4.7
Other	7.5	3.9	0.8

respondents and 20% of North Dakota respondents. Phoma black stem was reported as one of the three worst diseases by 24% of North Dakota respondents (Table 19).

Rhizopus head rot was ranked as the worst Kansas disease problem in both confection and oilseed sunflowers grown under irrigation as well as under dryland conditions (Table 20). It was ranked as the worst disease problem on 22% of respondents' irrigated confection acres, 15% of dryland confection acres, 19% of irrigated oilseed acres and 20% of dryland oilseed acres. Sclerotinia head rot was ranked as the worst disease problem on 11% of respondents' irrigated confection acres, 10% of dryland confection acres, 13% of irrigated oilseed acres and 6% of irrigated

oilseed acres. Sclerotinia wilt was rarely ranked as a worst disease in Kansas, which suggests that many fields are not yet severely infested with the Sclerotinia fungus. Rust was ranked as the worst disease problem on 10% of dryland confection acres, and as one of the three worst disease problems on 30% of dryland confection acres.

Minnesota respondents ranked Sclerotinia head rot about equally on oilseed and confection acres: it was the worst disease problem on 21% of oilseed and 19% of confection acres (Table 21). North Dakota respondents ranked Sclerotinia wilt as the worst disease problem on 26% of oilseed and 29% of confection acres. When data for Sclerotinia head rot and wilt are combined, Sclerotinia was reported to be the worst

Table 19. Worst disease problem of sunflower in Kansas, Minnesota and North Dakota in 1991.

DISEASE	KANSAS		MINNESOTA		NORTH DAKOTA	
	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases
----- % of respondents -----						
Charcoal Rot	1.9	3.8	0	1.5	1.1	1.9
Downy Mildew	0	2.8	3.0	9.4	5.3	15.3
Phoma Black Stem	2.8	3.8	4.5	10.4	14.7	24.4
Rhizopus Head Rot	18.9	25.5	1.5	5.0	0.3	1.7
Rust	1.9	7.5	13.4	26.7	8.9	20.0
Sclerotinia Head Rot	6.6	15.1	19.8	30.2	6.9	22.8
Sclerotinia Wilt	0.9	3.8	11.4	26.2	25.8	40.0
None	67.0	67.0	45.5	45.5	36.1	36.4

Table 20. Worst disease problem of sunflower in Kansas in 1991.

Disease	Dryland Oilseed		Dryland Confection		Irrigated Oilseed		Irrigated Confection	
	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases
----- % of respondents -----								
Charcoal Rot	2.5	3.7	0	5.0	6.3	12.5	0	22.2
Downy Mildew	0	3.7	0	0	0	0	0	0
Phoma Black Stem	3.7	4.9	0	0	0	0	0	0
Rhizopus Head Rot	19.8	25.9	15.0	25.0	18.8	25.0	22.2	22.2
Rust	1.2	6.2	10.0	30.0	0	0	0	11.1
Sclerotinia Head Rot	6.2	13.6	10.0	20.0	12.5	12.5	11.1	22.2
Sclerotinia Wilt	1.2	3.7	5.0	10.0	0	6.3	0	11.1
None	65.4	65.4	60.0	60.0	62.5	62.5	66.7	66.7

disease problem on 32% of Minnesota oilseed, 30% of Minnesota confection, 33% of North Dakota oilseed, and 40% of North Dakota confection acres. In addition, when Sclerotinia wilt and head rot data were combined, Sclerotinia was reported to be one of the three worst disease problems on 58% of Minnesota oilseed, 67% of Minnesota confection, 62% of North Dakota oilseed and 84% of North Dakota confection acres.

Rust was more frequently cited as the worst disease problem on confection than on oilseed acres in both northern states (Table 21). It was cited as one of the three worst disease problems on 39% of Minnesota and 44% of North Dakota confection acres.

Phoma black stem was reported to be the worst disease problem in North Dakota on 16% of respondents' oilseed acres and 9% of confection acres; it was ranked somewhat more frequently as one of the three worst disease problems (Table 21).

Apron seed treatment was used on only 1% of Kansas respondents' acres, but on 52% of Minnesota and 55% of North Dakota acres (Table 22). Respondents used Apron seed treatment on 86% of Minnesota and 95% of North Dakota respondents' confection acres. Dithane fungicide was available for use to control rust only in North Dakota in 1991 under a Specific Exemption (Section 18). North Dakota respondents reported using Dithane on 1% of their confection acres and none of their oilseed acres.

Table 21. Worst disease problem of sunflower in Minnesota and North Dakota in 1991.

DISEASE	MINNESOTA				NORTH DAKOTA			
	Dryland Oilseed		Dryland Confection		Dryland Oilseed		Dryland Confection	
	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases	Worst Disease	One of Three Worst Diseases
	----- % of respondents -----							
Charcoal Rot	0	1.2	0	4.5	1.3	2.2	0	1.1
Downy Mildew	2.9	8.8	3.0	13.4	5.4	15.2	3.3	15.4
Phoma Black Stem	4.7	10.6	4.5	13.4	15.6	25.4	8.8	19.8
Rhizopus Head Rot	1.2	4.7	3.0	6.0	0.3	1.6	1.1	2.2
Rust	10.0	22.9	23.9	38.8	6.3	16.5	23.1	44.0
Sclerotinia Head Rot	21.2	31.8	19.4	35.8	7.3	21.9	11.0	35.2
Sclerotinia Wilt	11.2	26.5	10.4	31.3	25.7	40.0	28.6	48.4
None	47.6	47.6	34.3	34.3	37.1	37.1	23.1	24.2

Table 22. Use of fungicides on sunflower in Kansas, Minnesota and North Dakota in 1991.

Fungicide	KANSAS					MINNESOTA			NORTH DAKOTA		
	All Sunflower	Dryland Oilseed	Dryland Confection	Irrigated Oilseed	Irrigated Confection	All Sunflower	Dryland Oilseed	Dryland Confection	All Sunflower	Dryland Oilseed	Dryland Confection
	----- % of Respondents' acres treated -----										
Apron Seed Treatment	0.8	1.2	0.5	0	0	51.8	61.0	85.7	55.1	62.6	94.9
Dithane*	0	0	0	0	0	0	0	0	0.2	0	1.0

*Dithane fungicide used in North Dakota under a Specific Exemption (Sect. 18) for 1991 only.

INTEGRATED PEST MANAGEMENT (IPM).

Crop Consultants. Over 20% of Kansas and Minnesota respondents used a crop consultant in 1991, compared with 10% for North Dakota (Table 23). Respondents indicated greater use of consultants prior to 1991.

Pesticide Use. Approximately two thirds of respondents reported pesticide use in all three states to be the same as in previous years (Table 24). One third of Minnesota respondents and 23% of Kansas and North Dakota respondents reported less pesticide use. In contrast, only 9%, 6% and 16% reported an increased use of pesticides in Kansas, Minnesota and North Dakota, respectively.

Respondents reporting a change in pesticide use in each state indicated increases or decreases from 1 to 100% (Table 25).

Table 23. Use of a crop consultant in sunflower in Kansas, Minnesota, and North Dakota in 1991.

Use of Consultant	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
In 1991	20.5	21.7	9.5
Prior to 1991	25.4	23.7	17.4

Table 24. Pesticide use on sunflower in 1991 compared to past years: Kansas, Minnesota, and North Dakota.

Use in 1991 Compared to Past Years	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
Less	22.5	32.6	23.0
More	8.8	6.1	16.3
Same	68.6	61.3	60.7

The most common reasons for use of less pesticide in 1991 were fewer pests, reported by 57%, 64% and 39% of Kansas, Minnesota and North Dakota respondents, respectively, and not economically feasible, reported by 36%, 26% and 44% of respondents from the same states (Table 26). Use of alternate pest management practices was reported as the reason for reduced pesticide use by 7%, 4% and 7% of Kansas, Minnesota and North Dakota respondents, respectively. Better scouting for timely application was reported as the reason for less pesticide use by 4% and 7% of Minnesota and North Dakota respondents, respectively.

Crop Rotation. A three- or four-year crop rotation was used by 40% of Kansas and Minnesota and 65% of North Dakota respondents (Table 27). A five-year rotation was reported by 7%, 15% and 13% of Kansas, Minnesota and North Dakota respondents, respectively. Thirty two percent of Kansas respondents reported that they had never planted sunflower previously on the land planted to sunflower in 1991.

Wheat most commonly preceded sunflower, as reported by about 70% of respondents in all three states (Table 28). The second most common crop to precede sunflower was corn in Kansas (17%) and Minnesota (19%) and barley (15%) in North Dakota.

Cultivation. Cultivation was commonly used by respondents. Fields were cultivated once by 64% of Kansas, 45% of Minnesota and 72% of North Dakota respondents; and twice by 13%, 43% and 14% of respondents in these same states, respectively (Table 29). Cultivation was not used by 19% of Kansas, 5% of Minnesota and 9% of North Dakota respondents.

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Table 25. Percent increase or decrease in pesticide use on sunflower by respondents reporting a use change in Kansas, Minnesota and North Dakota in 1991.

% Increase	Increase			% Decrease	Decrease		
	Kansas	Minnesota	North Dakota		Kansas	Minnesota	North Dakota
	% of respondents reporting an increase			% of respondents reporting a decrease			
1-25%	12.5	9.1	27.8	1-25%	21.4	19.4	18.3
26-50%	25.0	72.7	33.3	26-50%	28.6	38.7	45.0
51-75%	37.5	0	31.5	51-75%	0	6.5	5.0
76-100%	25.0	18.2	7.4	76-100%	50.0	35.5	30.0
over 100%	0	0	0	over 100%	0	0	1.7

Table 26. Reasons for less pesticide use on sunflower in Kansas, Minnesota, and North Dakota in 1991.

Reason	North Dakota		
	Kansas	Minnesota	Dakota
	--- % of respondents ---		
Fewer Pests	57.1	63.8	38.9
Better Application Techniques	0	0	1.9
Better Scouting for Timely Application	0	3.8	6.5
Use of Different Chemical with Lower Use Rates	0	2.5	0.9
Not Economically Feasible	35.7	26.3	44.4
Used Alternate Pest Management Practices	7.1	3.8	7.4

Table 27. Number of years since previous sunflower crop in Kansas, Minnesota, and North Dakota in 1991.

Years Since Previous Sunflower	North Dakota		
	Kansas	Minnesota	Dakota
	----- % of respondents -----		
0	2.6	0	0
1	2.6	0	0.9
2	9.2	0.7	6.6
3	22.4	10.3	30.3
4	17.1	29.7	34.6
5	6.6	15.2	13.2
6	3.9	7.6	5.3
7	0	6.9	1.8
8	0	8.3	0.4
9	0	3.4	0.9
10	2.6	10.3	3.1
11	0	0.7	0.4
12	0	2.8	0.4
15	0	0.7	0.9
25	1.3	0	0
Never Before	31.6	3.4	1.3

Table 28. Crop preceding sunflower in Kansas, Minnesota, and North Dakota in 1991.

Preceding Crop	North Dakota		
	Kansas	Minnesota	Dakota
	----- % of respondents -----		
Barley	0	19.0	14.7
Buckwheat	0	0	0.5
Corn	16.9	2.1	3.7
Dry Beans	1.3	0	0.5
Flax	0	0.7	1.4
Oats	0	1.4	1.8
Rye	0	0	0.9
Sorghum/Millet	6.5	0	1.4
Soybean	2.6	2.8	1.4
Summer Fallow	1.3	3.5	1.4
Sunflower	1.3	0	0
Wheat	70.1	69.7	71.9
Other	0	0.7	0.5

Table 29. Number of cultivations used on sunflower in Kansas, Minnesota, and North Dakota in 1991.

Number of Cultivations	North Dakota		
	Kansas	Minnesota	Dakota
	----- % of respondents -----		
0	18.7	5.3	9.2
1	64.0	44.7	71.6
2	13.3	42.7	13.8
3	1.3	6.7	3.7
4	0	0.7	0.9
5	1.3	0	0.9
6	0	0	0
7	0	0	0
8	1.3	0	0

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