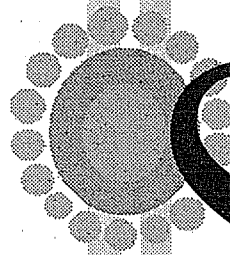


Extension Report No. 14



1992 SUNFLOWER GROWER SURVEY

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

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PROCEDURES

Sunflower growers in Kansas, Minnesota and North Dakota were surveyed about pest problems and pesticide use in 1992. There was a similar survey in 1991 and a survey limited to North Dakota in 1990 (1, 2). A single page survey form (Figure 1) was mailed on November 15, 1992 to 5,072 selected growers on the mailing list of the National Sunflower Association's magazine *The Sunflower*. The survey form was mailed to all 1,296 Kansas growers, all 1,243 Minnesota growers, and to 20% of the 12,663 North Dakota growers, or 2,533. Responses to the survey were confidential and a self-addressed stamped envelope was enclosed for returning the completed survey form.

Survey respondents identified the county and state where they grew sunflower; acres planted to oilseed and confection sunflower, irrigated and dryland acres; major production problems encountered; major insect, disease and weed problems; percent bird damage, bird species causing damage, amount of money and time spent on attempts to control bird depredation; pesticides used; crop injury and weed control from the use of herbicides and other weed control practices; crop rotations; 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

Responses. Twenty three percent (1,171 forms) of the survey forms were returned. Of these, 548 (11%) were usable while 623 (12%) were not usable because the respondent had not grown sunflower in 1992, had retired, had sold the farm, had cash rented the farm, had placed the entire farm in CRP or was deceased. The respondents and percent response for each state were: Kansas, 92 or 7%; Minnesota, 140 or 13%; and North Dakota, 289 or 11% (Table 1). The total response rate was slightly higher than that for 1991 (2), but the percentage of usable responses was down due to the number of respondents who did not plant sunflower in 1992 (3).

Acres Planted By Respondents. Respondents in the three states planted 147,932 acres, or 9% of the 1,600,000 acres planted by all growers in these states (3). Kansas respondents planted 15,752 acres, or 10% of Kansas' total sunflower acres of 152,000; Minnesota respondents planted 46,986 acres, or 22% of Minnesota's 215,000 acres; and North Dakota respondents planted 85,194 acres, or 7% of North Dakota's 1,225,000 acres (Table 1). The North Dakota acreage represented in the survey is a significant number since only 20% of North Dakota growers received the survey form. The percentage of total acres represented by respondents' acres was down slightly from 1991 (2).

Confection sunflower planted by respondents was 23%, 21%, and 13% of respondents' total sunflower acres in Kansas, Minnesota and North Dakota, respectively. Almost all respondents' irrigated acres were in Kansas, where 72% of confection and 8% of oilseed acres were irrigated. North Dakota respondents planted 11,074 acres of dryland confection hybrids in 1992, down markedly from 29,883 in 1991 (2).

Major Sunflower Producing Counties Represented by Survey. Kansas respondents planted the most acres of sunflower in Sherman, Cheyenne, Rawlins, Thomas and Grant counties; Minnesota respondents planted the most acres in Marshall, Polk, Kittson, Red Lake, Pennington, Roseau and Norman counties; and North

Table 1. Sunflower acres planted and harvested by respondents in Kansas, Minnesota and North Dakota in 1992.

Sunflower Class	Kansas		Minnesota		North Dakota		Three State Total	
	Respondents	Acres	Respondents	Acres	Respondents	Acres	Respondents	Acres
Dryland Oilseed	72	11,162	140	37,131	258	74,120	470	122,413
Dryland Confection	12	1,014	47	9,795	52	11,074	111	21,883
Irrigated Oilseed	10	910	1	60	0	0	11	970
Irrigated Confection	16	2,666	0	0	0	0	16	2,666
Total Planted	92	15,752	167	46,986	289	85,194	548	147,932
Total Harvested	92	14,757	167	44,129	289	76,525	548	135,411

Please circle or fill in the requested information on pest problems and pesticide use on your 1992 sunflower crop.

Total acres planted in 1992 _____
 Total acres harvested _____
 Acres with frost damage _____

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:

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 PROBLEMS IN SUNFLOWER IN 1992 (CIRCLE ONE)

None _____
 Weeds _____
 Emergence/Stand _____
 Insects _____
 Diseases _____
 Herbicide drift _____
 Bird damage _____
 Harvesting _____
 Other (specify) _____

WORST DISEASE PROBLEMS IN 1992 (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 1992 (RANK 1-3, 1 = WORST)

None _____
 Kochia _____
 Russian thistle _____
 Foxtail (Pigeongrass) _____
 Wild buckwheat _____
 Redroot pigweed _____
 Wild oats _____
 Wild Mustard _____
 Volunteer wheat _____
 Large crabgrass _____
 Other (specify) _____

WORST INSECT PROBLEMS IN 1992 (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 1992:

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) _____

FUNGICIDES USED ON SUNFLOWER IN 1992:

Fungicide	No. of Acres Treated
Apron (seed treatments)	_____

COSTS FOR BIRD CONTROL:

Shells (\$) _____
 Gasoline (\$) _____
 Exploders/Alarm Devices (\$) _____
 Time (hr.) _____
 Other (\$) _____

OTHER COMMENTS:

Weed Control Used	Acres treated	WEED CONTROL 1 = Excellent 2 = Good 3 = Fair 4 = Poor	SUNFLOWER INJURY 1 = None 2 = Slight 3 = Moderate 4 = Severe
Roundup (Preplant)	_____	1 2 3 4	1 2 3 4
Eptam (fall)	_____	1 2 3 4	1 2 3 4
Eptam (spring)	_____	1 2 3 4	1 2 3 4
Sonalan (fall)	_____	1 2 3 4	1 2 3 4
Sonalan (spring)	_____	1 2 3 4	1 2 3 4
Sonalan + Eptam	_____	1 2 3 4	1 2 3 4
Prowl (fall)	_____	1 2 3 4	1 2 3 4
Prowl (spring)	_____	1 2 3 4	1 2 3 4
Trifluralin (fall)	_____	1 2 3 4	1 2 3 4
Trifluralin (spring)	_____	1 2 3 4	1 2 3 4
Trifluralin + Eptam	_____	1 2 3 4	1 2 3 4
Alachlor/Lasso	_____	1 2 3 4	1 2 3 4
Poast	_____	1 2 3 4	1 2 3 4
Assert	_____	1 2 3 4	1 2 3 4
No herbicide used	_____	1 2 3 4	1 2 3 4
Cultivation	_____	1 2 3 4	1 2 3 4
Rotary Hoe	_____	1 2 3 4	1 2 3 4
Hand Weeding	_____	1 2 3 4	1 2 3 4
Other	_____	1 2 3 4	1 2 3 4

DESICCANTS:

Gramoxone Extra _____ 1 2 3 4
 Leafex-3/Defol _____ 1 2 3 4

INTEGRATED PEST MANAGEMENT

Did you hire a consultant to scout sunflowers?

1992 prior to 1992

a) yes a) yes
 b) no b) no

Pesticide Use in 1992 Was:

a) less b) more c) same

If less or more, _____% increase or decrease

If less pesticides used in 1992, 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 chemical with lower use rates
- e) not economically feasible
- f) used alternative pest management practices

(Please specify below).

1. Crop rotation _____ #acres
2. Preceding crop _____
 how long since previous sunflowers? _____ # years
3. Cultivation _____ # times _____ # acres
4. Resistant Variety _____ # acres
5. Water Management (irrigators) _____ # acres
6. Other (specify) _____ # acres _____ # acres

Results of survey will be published in THE SUNFLOWER.
 THANK YOU. Please return by December 15, 1992.
 Arthur Lamey, Extension Plant Pathologist

Figure 1. The survey form.

Dakota respondents planted the most acres in Stutsman, Barnes and Foster counties (Table 2). Grant County Kansas respondents planted the most irrigated sunflower acres, followed by Sherman and Cheyenne counties in Kansas.

Sunflower Planting Dates and Harvest Information.

Sunflowers were planted in Kansas from May 1 to the end of July, but over half the acreage was planted between June 11 and June 30, with a significant portion of the crop also planted in early July (Table 3). Minnesota respondents planted over half of their sunflower between May 11 and May 20. North Dakota respondents planted over half of their sunflower between May 21 and May 30.

Minnesota respondents harvested 94% of their acres but North Dakota respondents harvested only 90% (data not shown). In Minnesota 91% of all confection acres were harvested compared to 80% for North Dakota (data not shown). Some confection acres in both states were damaged by frost. Minnesota respondents reported that 23% of their acres were damaged by frost, compared to 25% for North Dakota (data not shown). However, the data does not indicate the severity of frost. Since Minnesota respondents planted earlier than North Dakota respondents, it is possible that frost damage was not as severe in Minnesota as in North Dakota.

Production Problems. Weeds were rated the worst production problem by 29%, 26% and 24% of respondents in Kansas, Minnesota and North Dakota, respectively (Table 4). These data differ somewhat from 1991 when weeds were the worst production problem only in Minnesota (2). After weeds, emergence and stand, harvesting and weather were the next most serious production problems reported by Kansas respondents in 1992. Minnesota respondents reported that weather and diseases were the next most serious production problems

in 1992. North Dakota respondents reported that weather, birds, insects and harvesting were the next most serious production problems in 1992.

Insect Problems. Sunflower head moth was the worst insect problem on 44% of Kansas respondents' acres, followed by the seed weevil on 9% (Table 5). The sunflower head moth was almost no problem in Minnesota and North Dakota.

Table 2. Major sunflower producing counties represented by 1992 survey.^a

State	County	Acres Reported	Acres in Each Class			
			Dryland Oilseed	Dryland Confection	Irrigated Oilseed	Irrigated Confection
KS	Sherman	3,876	2,733	447	132	564
	Cheyenne	2,631	2,296	0	40	295
	Rawlins	1,549	1,294	55	200	0
	Thomas	1,509	1,094	200	10	205
	Grant	940	160	25	31	724
MN	Marshall	9,597	9,137	460	0	0
	Polk	6,280	4,569	1,711	0	0
	Kittson	5,379	3,846	1,533	0	0
	Red Lake	5,267	2,997	2,270	0	0
	Pennington	5,193	4,943	250	0	0
	Roseau	4,122	2,965	1,157	0	0
	Norman	3,215	1,449	1,766	0	0
ND	Stutsman	10,289	10,162	127	0	0
	Barnes	9,030	7,991	1,039	0	0
	Foster	7,636	5,198	2,438	0	0

^aCounties with over 5% of reported acres for each state, or 900 in Kansas, 2,500 in Minnesota and 6,000 in North Dakota.

Table 3. Sunflower planting dates in Kansas, Minnesota and North Dakota in 1992.

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	0	0	3.0	9.0	35.8	23.9	13.4	10.4	4.5
	Dryland Confection	0	0	5.0	0	0	54.5	18.2	27.3	0	0
	Irrigated Oilseed	0	0	0	0	0	50.0	20.0	30.0	0	0
	Irrigated Confection	0	7.1	0	0	7.1	28.6	14.3	35.7	7.1	0
MN	Dryland Oilseed	0	10.6	50.4	31.7	6.5	0.8	0	0	0	0
	Dryland Confection	0	17.9	56.4	25.6	0	0	0	0	0	0
	Irrigated Oilseed	0	0	100.0	0	0	0	0	0	0	0
ND	Dryland Oilseed	1.2	1.6	21.1	54.9	17.1	3.3	0.8	0	0	0
	Dryland Confection	2.3	2.3	25.0	54.5	15.9	0	0	0	0	0

Table 4. Worst sunflower production problem in Kansas, Minnesota and North Dakota, 1992.

Production Problem	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
Bird Damage	7.1	8.3	14.8
Diseases	0	14.7	3.7
Emergence/Stand	17.6	5.1	6.7
Harvesting	12.9	8.3	10.0
Insects	3.5	2.6	11.5
Weather	10.6	19.2	21.5
Weeds	29.4	26.3	24.1
Other	2.4	2.6	0.4
None	16.5	12.8	7.4

Table 5. Worst sunflower insect problem in Kansas, Minnesota and North Dakota, 1992.

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' acres -----					
Banded Sunflower Moth	0	1.2	1.5	7.4	0.3	1.2
Grasshopper	3.7	12.3	7.9	16.2	11.0	37.1
Seed Weevil	8.5	31.2	23.0	32.1	55.0	70.5
Sunflower Beetle	2.1	10.4	4.2	11.4	3.7	19.9
Sunflower Head Moth	44.2	51.7	1.4	8.3	0.5	6.5
Sunflower Midge	0	0.7	1.3	4.3	2.0	3.7
Stem Weevil	3.9	8.3	8.7	15.9	9.0	40.7
Others	1.0	1.0	3.1	3.6	0.4	2.0
None	28.6	28.6	44.8	44.8	12.0	12.0

Table 6. Worst sunflower insect problem in Kansas, 1992.

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' acres (total acres for seed type) -----							
Banded Sunflower Moth	0	0.7	0	10.8	0	0	0	0
Grasshopper	5.3	16.2	0	0	0	13.8	0	0
Seed Weevil	7.8	24.5	41.8	64.0	0	12.2	1.7	53.3
Sunflower Beetle	1.8	5.2	0	2.5	0	17.1	4.9	33.0
Sunflower Head Moth	37.9	42.0	47.8	64.1	68.7	68.7	61.0	81.8
Sunflower Midge	0	0	0	10.8	0	0	0	0
Stem Weevil	1.9	4.9	0	19.7	0	0	15.2	21.3
Others	1.5	1.5	0	0	0	0	0	0
None	34.2	34.2	5.4	5.4	31.3	31.3	13.2	13.2

Respondents in Minnesota and North Dakota reported that the seed weevil was the worst insect problem on 23% of their Minnesota acres and 55% of their North Dakota acres. Respondents reported that it was one of the three worst insect problems on 31%, 32% and 71% of their acres in Kansas, Minnesota and North Dakota, respectively (Table 5).

Minnesota respondents reported that after the seed weevil, the stem weevil was the worst insect problem on 9% of their acres and one of the three worst insect problems on 16% of their acres. Grasshoppers were the worst insect problem on 8% of their acres and one of the three worst insect problems on 16% (Table 5).

North Dakota respondents reported that after the seed weevil, grasshoppers were the worst insect problem on 11% of their acres and one of the three worst insect problems on 37%. They reported that the stem weevil was the worst insect problem on 9% of their acres and one of the three worst insect problems on 41% (Table 5).

The sunflower head moth was the worst insect problem on over 60% of Kansas respondents' irrigated oilseed and irrigated confection acres, on 48% of their dryland confection acres and on 38% of their dryland oilseed acres. The seed weevil was the worst insect problem on 42% of their dryland confection acres and a lesser problem on their irrigated confection acres (Table 6).

The seed weevil was the worst insect problem and also one of the three worst insect problems on North Dakota and Minnesota respondents' acres. The seed weevil was considered a greater problem on confection hybrids; it was the worst insect problem on 32% of Minnesota and 61% of North Dakota respondents' confection acres (Table 7).

Table 7. Worst sunflower insect problem in Minnesota and North Dakota, 1992.

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' acres (total acres for seed type) -----							
Banded Sunflower Moth	1.4	4.0	1.8	20.6	0	1.0	2.4	2.4
Grasshopper	10.1	19.4	0	3.8	12.5	38.3	0.9	29.1
Seed Weevil	20.6	29.2	32.3	43.3	54.1	69.5	60.6	77.1
Sunflower Beetle	3.4	11.2	7.4	12.0	2.7	18.7	10.4	28.0
Sunflower Head Moth	1.0	8.7	2.9	7.2	0.6	6.3	0.4	7.3
Sunflower Midge	1.7	4.2	0	4.8	1.1	2.8	8.1	10.0
Stem Weevil	9.7	16.3	5.3	14.3	10.2	39.6	1.1	48.4
Others	3.7	4.3	0.9	1.1	0.5	1.6	0	4.5
None	43.5	43.5	49.5	49.5	11.9	11.9	12.6	12.6

Grasshoppers were one of the three worst insect problems on 19% of Minnesota respondents' oilseed acres, followed by the stem weevil. Grasshoppers were one of the three worst insect problems on 38% of North Dakota respondents' oilseed acres and 29% of their confection acres (Table 7).

North Dakota respondents also reported that the stem weevil was one of the three worst insects on 40% of their oilseed acres and 48% of their confection acres. The sunflower beetle was one of the three worst insects on 28% of their confection acres (Table 7).

Minnesota and North Dakota respondents reported grasshoppers and stem weevil problems less frequently in 1992 than in 1991 (2). Minnesota respondents also reported seed weevil problems less frequently in 1992 than in 1991.

Insecticide Use. Respondents in all three states used insecticides less frequently in 1992 than in 1991 (2). North Dakota respondents treated 59% of their acres with an insecticide, down from 89% in 1991. Kansas respondents treated 37% of their acres, down from 61% and Minnesota respondents treated 15%, down from 31% (Table 8).

Although parathion (combined data for methyl, ethyl and 6-3 ethyl/methyl parathion) was the most commonly used insecticide in all three states in 1991 (2), it was the most common insecticide only in North Dakota in 1992. Ethyl parathion was the most common form of parathion used in Kansas while methyl parathion was the most common form in North Dakota and Minnesota (Table 8).

Table 8. Insecticide use on sunflower in Kansas, Minnesota and North Dakota, 1992.

Insecticide	Kansas	Minnesota	North Dakota
	% of respondents' acres treated		
Asana XL	19.5	6.3	21.7
Furadan 4F	0.2	0.3	1.6
Furadan 15G	2.2	0.1	1.3
Lindane/Maneb	0	1.5	2.5
Lorsban 4E	1.6	0.5	1.2
Ethyl Parathion	8.7	0.4	8.3
Methyl Parathion	3.8	4.1	17.0
6-3 Parathion	0.4	1.3	4.6
Sevin XLR	0.8	0	0.8
Other	0	0.7	0
Total Parathion	12.9	5.8	29.9
Total Treated	37.2	15.2	59.0

Asana XL (esfenvalerate) was used on over 22% of respondents' acres in North Dakota, on 20% in Kansas and on 6% in Minnesota. It was the most commonly used insecticide in Kansas and Minnesota and the second most commonly used one in North Dakota. Lindane/maneb seed treatment was used on 3% of North Dakota respondents' acres and 2% of Minnesota respondents' acres (Table 8).

Kansas respondents used insecticides most frequently on dryland confection sunflower, followed by irrigated oilseed sunflower. Approximately 200% of their dryland confection (223%) and irrigated oilseed (198%) acres were treated, indicating that many respondents made

more than one application. They used insecticides less frequently on dryland oilseed sunflower, but the total number of acres treated was greatest, because dryland oilseed had the largest acreage planted (Table 9).

Asana XL was the most commonly used insecticide on all classes of sunflower in Kansas (Table 9). Ethyl parathion was the second most commonly used insecticide on dryland oilseed sunflower. Furadan 15G was the second most commonly used insecticide on dryland confection sunflower, followed by methyl parathion. Methyl parathion was the second most commonly used insecticide on irrigated oilseed sunflower, followed by Lorsban 4E.

Minnesota and North Dakota respondents treated confection sunflowers more often with insecticides than they did their oilseed sunflowers (Table 10). Insecticides were used on 162% of respondents' confection sunflower acres in North Dakota, down from 216% in 1991 (2). Methyl parathion was the most commonly used insecticide on confection sunflower in both states, and parathion (combined data for methyl, ethyl and 6-3 ethyl/methyl parathion) was the most commonly used insecticide on oilseed sunflower in North Dakota. Asana XL was the most commonly used insecticide on oilseed sunflower in Minnesota and the second most commonly used insecticide on oilseed sunflower in North Dakota.

Weed Problems. Redroot pigweed was the worst weed problem in Kansas while wild mustard was the worst weed problem in Minnesota and North Dakota (Table 11).

Redroot pigweed was the worst weed problem on 36% of Kansas respondents' acres and one of the three worst weed problems on 51% (Table 11). Kochia was the second worst weed problem on 14% of Kansas acres and one of the three worst weeds on 31%. Foxtail was the next most important weed, the worst weed on 8% of their acres and one of the three worst on 25%.

Wild mustard was the worst weed on 52% and 33% of Minnesota and North Dakota respondents' acres, respectively, and one of the three worst weeds on 75% and 47%,

Table 9. Insecticide use on class of sunflower in Kansas, 1992.

Insecticide	Dryland Oilseed	Dryland Confection	Irrigated Oilseed	Irrigated Confection
	--- % of respondents' acres treated ---			
Asana XL	20.9	172.6	126.3	53.7
Furadan 4F	0	0	0	1.1
Furadan 15G	3.0	33.5	0	0
Lindane/Maneb	0	0	0	0
Lorsban 4E	0	0	27.4	0
Ethyl Parathion	10.8	6.3	0	3.6
Methyl Parathion	4.3	10.8	43.9	0
6-3 Parathion	0	0	0	2.6
Sevin XLR	0	0	0	4.8
Other	0	0	0	0
Total Parathion	15.1	17.1	43.9	6.2
Total Treated	39.0	223.2	197.6	65.8

Table 10. Insecticide use on different classes of sunflower in Minnesota and North Dakota, 1992.

Insecticide	Minnesota			North Dakota		
	All Sunflower	Dryland Oilseed	Dryland Confection	All Sunflower	Dryland Oilseed	Dryland Confection
----- % of respondents' acres treated -----						
Asana XL	6.3	6.8	9.1	21.7	22.6	22.6
Furadan 4F	0.3	0.4	0	1.6	1.7	0.7
Furadan 15G	0.1	<0.1	0	1.3	1.5	2.1
Lindane/Maneb	1.5	0.8	3.7	2.5	2.5	10.8
Lorsban 4E	0.5	0.2	1.7	1.2	1.3	9.0
Ethyl Parathion	0.4	0.5	0	8.3	8.8	31.6
Methyl Parathion	4.1	2.6	13.3	17.0	15.0	61.7
6-3 Parathion	1.3	0.5	6.2	4.6	3.6	23.1
Sevin XLR	0	0	0	0.8	0.8	1.3
Other	0.7	0.6	1.1	0	0	0
Total Parathion	5.8	3.6	19.5	29.9	27.4	116.4
Total Treated	15.2	12.5	35.1	59.0	57.8	162.9

respectively (Table 11). Foxtail was the second worst weed on 14% of Minnesota respondents' acres and one of the three worst weeds on 44%. Wild oats was the worst weed on 8% and one of the three worst weeds on 41% of Minnesota respondents' acres.

North Dakota respondents reported foxtail as the second worst weed, on 16% of their acres, and one of the three worst weeds on 39%. Kochia was the worst weed on 14% of their acres, and one of the three worst weeds on 48% (Table 11).

Weeds were not a problem on 15% of Kansas respondents' acres, 11% of North Dakota respondents' acres and 7% of Minnesota respondents' acres (Table 11). Weed problems in 1992 were ranked similarly to those in 1991 (2).

Kansas respondents reported that redroot pigweed was the worst weed problem on both dryland and irrigated acres and on both classes of sunflower (Table 12). Kochia was the next worst weed on irrigated oilseed and irrigated confection acres and foxtail was the next worst weed on dryland oilseed and dryland confection acres. Shattercane was a common problem on irrigated confection acres.

Herbicide Use and Other Weed Management Practices. Weed control practices included use of herbicides, cultivation, use of rotary hoe and hand weeding. Kansas respondents used spring applied trifluralin on 28% of their acres, spring applied Prowl on 26% and Poast on 7% (Table 13). Minnesota respondents used spring

applied trifluralin on 35% of their acres, spring applied Sonalan on 28%, Assert on 15%, Poast on 14% and spring applied Prowl on 10%. North Dakota respondents used spring applied Sonalan on 46% of their acres and spring applied trifluralin on 40%. Herbicide use in 1992 was similar to that in 1991 except that Kansas respondents used slightly more Prowl in 1992 than in 1991 (2).

Cultivation was used by 96%, 95%, and 94% of respondents in Kansas, Minnesota and North Dakota (Table 13). Minnesota respondents used cultivation on 146% of their acres, followed by Kansas with 118% and North Dakota with 115%, indicating that some respondents made more than one cultivation (see Table 30).

A rotary hoe was used by 4% of Kansas respondents on 4% of their acres, by 5% of Minnesota respondents on 4% of their acres, and by 4% of North Dakota respondents on 3% of their acres (Table 13).

Herbicide use in Kansas varied somewhat with sunflower class and with irrigation. Kansas respondents used no herbicide on 14% of their dryland oilseed acres, 37% of their dryland confection acres, 45% of their irrigated oilseed acres and 15% of their irrigated confection acres (Table 14). They reported that spring-applied trifluralin was the most commonly used herbicide on dryland and irrigated oilseed and on dryland confection sunflower, and second to Poast on irrigated confection sunflower. Trifluralin use varied considerably with sunflower class; Kansas respondents used it on 32% of their dryland

Table 11. Worst weed problem in sunflower in Kansas, Minnesota and North Dakota, 1992.

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' acres -----					
Canada Thistle	0	0	0.7	2.7	0.8	4.1
Cocklebur	0.8	3.4	2.1	2.6	6.8	10.0
Crabgrass, Large	3.6	9.7	0	0.9	0	0.5
Foxtail	8.4	24.5	14.0	43.9	16.3	39.3
Kochia	13.6	30.5	8.0	18.4	13.6	48.1
Redroot Pigweed	36.4	51.0	3.4	19.5	1.2	6.8
Russian Thistle	5.8	10.2	0	5.9	5.3	21.8
Shattercane	1.5	8.0	0	0	0	0
Volunteer Wheat	2.9	3.8	0	0.9	1.3	2.2
Wild Buckwheat	0	0	0.2	6.2	0.5	2.3
Wild Mustard	0	1.8	51.7	75.1	32.7	46.7
Wild Oats	0	0	8.1	40.6	7.3	21.9
Other	9.2	17.6	3.1	10.3	1.3	6.2
None	15.0	15.0	6.9	6.9	10.9	10.9

Table 12. Worst weed problem in sunflower in Kansas, 1992.

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' acres (total acres of seed type) -----								
Cocklebur	1.1	1.1	0	0	0	0	0	15.2
Crabgrass, Large	5.1	11.9	0	19.7	0	0	0	0
Foxtail	10.0	23.6	13.0	13.0	8.8	50.0	0	24.0
Kochia	9.8	26.9	8.9	45.1	13.0	32.4	31.3	39.5
Redroot Pigweed	36.8	44.6	39.9	62.0	18.7	49.6	39.3	74.0
Russian Thistle	6.6	12.6	0	3.2	0	0	6.8	6.8
Shattercane	0	1.4	0	8.9	0	3.4	9.0	36.9
Volunteer Wheat	3.6	4.9	4.9	4.9	0	0	0	0
Wild Mustard	2.0	0	0	0	0	5.7	0	0
Other	8.2	16.9	22.4	44.6	33.2	33.2	0	4.9
None	15.8	15.8	10.8	10.8	26.4	26.4	9.5	9.5

Table 13. Herbicides use and alternate weed control methods on sunflower in Kansas, Minnesota and North Dakota in 1992.

Herbicide	Kansas		Minnesota		North Dakota	
----- % of respondents' acres treated -----						
Alachlor	0.1		0.1		0.3	
Assert	0		15.2		3.1	
Glyphosate (preplant)	2.6		1.2		3.2	
Poast	7.4		13.6		3.5	
Prowl (fall)	0		0		0	
Prowl (spring)	25.5		10.3		1.1	
Sonalan (fall)	0		0.3		1.7	
Sonalan (spring)	2.5		28.4		45.6	
Sonalan + Eptam	0		0		0.2	
Trifluralin (fall)	0		7.7		7.2	
Trifluralin (spring)	27.8		34.9		39.7	
Trifluralin + Eptam	0		0		0.3	
Other	3.4		2.9		1.1	
No Herbicide	0		0		0	
Alternate Control Measures						
	% acres	% resp.	% acres	% resp.	% acres	% resp.
Cultivation	118.0	95.7	145.6	94.6	115.4	94.2
Rotary Hoe	3.8	4.3	4.0	5.4	3.3	4.2
Hand Weeding	0	0	0	0	1.2	1.5

Table 14. Herbicides use and alternate weed control methods on different classes of sunflower in Kansas, 1992.

Herbicide	Dryland Oilseed	Dryland Confection	Irrigated Oilseed	Irrigated Confection
	----- % of respondents' acres treated -----			
Alachlor	0.1	0	0	0
Glyphosate (preplant)	3.6	0	7.1	0
Poast	4.0	0	64.8	26.4
Prowl (spring)	30.9	0	7.6	20.9
Sonalan (spring)	2.6	3.7	0	2.2
Trifluralin (spring)	32.3	123.8	144.7	24.3
Other	0.5	10.8	20.8	13.5
No Herbicide	14.1	36.9	44.7	15.3

Alternate Control Methods	% acres % resp.		% acres % resp.		% acres % resp.		% acres % resp.	
	% acres	% resp.	% acres	% resp.	% acres	% resp.	% acres	% resp.
Cultivation	144.1	73.6	120.8	66.6	499.3	70.0	87.2	62.5
Rotary Hoe	4.2	2.7	12.3	8.3	0	0	0	0

oilseed acres, 124% of their dryland confection acres, 144% of their irrigated oilseed acres, but only 24% of their irrigated confection acres. They used spring-applied Prowl on 31% of their dryland oilseed sunflower and 21% of their irrigated confection sunflower acres.

Use of Poast in Kansas increased from 1991, with 65% of respondents' irrigated oilseed acres treated in 1992 and 26% of their irrigated confection acres treated (Table 14), up from 1% and 19% in 1991 (2). Some use of Poast in 1992 may have been in response to the shattercane problems reported in irrigated sunflower.

Kansas respondents used cultivation on 499% of their irrigated oilseed acres, 144% of their dryland oilseed acres, 121% of their dryland confection acres and 87% of their irrigated confection acres (Table 14).

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 bird damage, with 22% reporting 5-10% yield loss and 16% reporting more than 10% yield loss (Table 17). In contrast, 15% of Kansas respondents and 20% of Minnesota respondents reported 5-10% yield losses and 3% of Kansas and 6% of Minnesota respondents reported more than 10% loss. These figures are similar to those for 1991 except for Minnesota, which had more bird damage in 1992 when 25% of respondents reported losses of 5% or more compared to 18% in 1991 (2).

Blackbirds were the most damaging bird species, as reported by 98% of North Dakota, 91% of Minnesota and 80% of Kansas respondents who answered this question (Table 18). Sparrows were the second most frequently cited damaging bird species, by 18% of Kansas, 6% of Minnesota and 2% of North Dakota respondents. These responses on bird species are similar to those for 1991 (2).

North Dakota respondents made the greatest expenditures on bird control; \$12,804 for shotgun shells, \$8,918 for gasoline, \$8,790 for exploders, \$5,108 for other expenditures and 4,376 hours for bird control (Table 19). If hourly costs are calculated at \$5.00/hr, the cost in time represents \$21,880, and total costs for North Dakota

Table 15. Effectiveness of herbicides and alternate weed control methods on sunflower in Kansas, Minnesota and North Dakota, 1992.

Herbicide	Kansas				Minnesota				North Dakota			
	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor
----- % of respondents -----												
Alachlor	-	-	100.0	-	-	-	-	100.0	100.0	-	-	-
Assert	-	-	-	-	64.3	21.4	9.5	4.8	31.6	31.6	21.1	15.8
Glyphosate (preplant)	75.0	25.0	-	-	80.0	20.0	-	-	61.8	26.5	8.8	2.9
Poast	50.0	50.0	-	-	50.0	38.9	5.6	5.6	54.5	31.8	9.1	4.5
Prowl (fall)	33.3	33.3	33.3	-	-	-	-	-	-	-	-	-
Prowl (spring)	28.6	33.3	23.8	14.3	43.5	56.5	-	-	33.3	66.7	-	-
Sonalan (fall)	-	-	-	-	100.0	-	-	-	40.0	40.0	-	20.0
Sonalan (spring)	80.0	-	20.0	-	37.5	46.4	12.5	3.6	37.5	38.8	16.4	7.2
Sonalan + Eptam	-	-	-	-	-	-	-	-	50.0	-	50.0	-
Trifluralin (fall)	33.3	33.3	33.3	-	29.4	47.1	23.5	-	27.8	33.3	27.8	11.1
Trifluralin (spring)	34.5	34.5	24.1	6.9	36.8	45.6	17.5	-	31.6	40.6	21.1	6.8
Trifluralin + Eptam	-	-	-	-	-	-	-	-	-	50.0	50.0	-
Alternate Control Methods												
Cultivation	17.1	65.7	14.3	2.9	21.2	54.5	20.2	4.0	22.5	50.7	23.9	2.8
Rotary Hoe	50.0	50.0	-	-	-	28.6	57.1	14.3	11.1	77.8	11.1	-
Hand Weeding	-	50.0	-	-	-	-	-	-	75.0	25.0	-	-

Table 16. Injury from herbicides and alternate weed control methods on sunflower in Kansas, Minnesota and North Dakota, 1992.

Herbicide	Kansas				Minnesota				North Dakota			
	None	Slight	Moderate	Severe	None	Slight	Moderate	Severe	None	Slight	Moderate	Severe
----- % of respondents -----												
Alachlor	100.0	-	-	-	-	-	100.0	-	100.0	-	-	-
Assert	-	-	-	-	63.2	34.2	2.6	-	52.9	41.2	5.9	-
Glyphosate (preplant)	66.7	33.3	-	-	100.0	-	-	-	96.6	3.4	-	-
Poast	100.0	-	-	-	70.0	30.0	-	-	66.7	14.3	9.5	9.5
Prowl (fall)	66.7	33.3	-	-	-	-	-	-	-	-	-	-
Prowl (spring)	94.1	5.9	-	-	95.5	4.5	-	-	100.0	-	-	-
Sonalan (fall)	-	-	-	-	100.0	-	-	-	80.0	20.0	-	-
Sonalan (spring)	100.0	-	-	-	80.4	19.6	-	-	91.0	7.5	1.5	-
Sonalan + Eptam	-	-	-	-	-	-	-	-	100.0	-	-	-
Trifluralin (fall)	100.0	-	-	-	88.2	11.8	-	-	86.7	13.3	-	-
Trifluralin (spring)	100.0	-	-	-	92.5	7.5	-	-	86.6	8.9	3.6	0.9
Trifluralin + Eptam	-	-	-	-	-	-	-	-	100.0	-	-	-
Alternate Control Methods												
Cultivation	17.1	65.7	14.3	2.9	52.8	42.7	4.5	-	37.4	57.7	4.1	0.8
Rotary Hoe	50.0	50.0	-	-	71.4	28.6	-	-	-	100.0	-	-
Hand Weeding	-	-	-	-	-	-	-	-	75.0	-	-	25.0

respondents were \$57,500 for 289 respondents and 85,194 acres.

Minnesota respondents spent \$2,085 for shells, \$1,205 for gasoline, \$2,635 for exploders, \$500 for other expenditures and 644 hours for bird control. The cost in time, calculated at \$5.00/hr was \$3,220 and total costs were \$9,645 for 167 respondents and 46,986 acres.

Kansas respondents spent only \$455 for shells for 92 respondents and 15,752 acres. No estimate of time spent was given by Kansas respondents.

Table 17. Sunflower yield loss due to bird damage in Kansas, Minnesota and North Dakota, 1992.

Bird Damage: % Yield Loss	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
0-5%	82.7	74.5	61.8
5-10%	14.7	19.9	22.3
10-25%	2.7	4.3	10.8
25-50%	0	0.7	3.6
50-100%	0	0.7	1.5

Table 18. Bird species causing sunflower damage in Kansas, Minnesota and North Dakota, 1992.

Bird Species	Kansas	Minnesota	North Dakota
	----- % of respondents ^a -----		
Blackbirds	80.4	90.5	97.8
Finches	0	0.8	0
Sparrows	17.9	6.3	2.2
Other	1.8	2.4	0

^aPercent of those respondents who answered this question.

Table 19. Bird control costs in Kansas, Minnesota and North Dakota, 1992.

Control Method	Kansas	Minnesota	North Dakota
	--- amount spent by respondents ^a ---		
Shells	\$455	\$2,085	\$12,804
Gasoline	0	\$1,205	\$ 8,918
Exploder	0	\$2,635	\$ 8,790
Other	0	\$ 500	\$ 5,108
Hours	0	644 hr	4,376 hr

Costs for bird control, including estimated costs for time, were \$0.67/A in North Dakota, \$0.21/A in Minnesota and \$0.03/A in Kansas.

Disease Problems and Fungicide Use. Sclerotinia was the worst disease problem in both Minnesota and North Dakota. Sclerotinia head rot was the worst disease problem on 46% of Minnesota respondents' acres and one of the three worst on 59%; Sclerotinia wilt was the worst disease problem on 9% and one of the three worst on 37% (Table 20). North Dakota respondents reported that Sclerotinia wilt was the worst disease problem on 19% of their acres and one of the worst on 27%; Sclerotinia head rot was the worst disease problem on 13% and one of the three worst on 28%. There was "no disease" problem on 57% of Kansas respondents' acres, 22% of Minnesota respondents' acres and 45% of North Dakota respondents' acres.

Kansas respondents reported that charcoal rot was the worst disease on 7% of their acres (Table 20). Rhizopus head rot was the worst disease on only 5% of their acres, and one of the three worst diseases on 14%. This is down from 1991 (2) when Rhizopus was the worst disease for 19% of Kansas respondents (affected acres were not reported for 1991).

Table 20. Worst sunflower disease problem in Kansas, Minnesota and North Dakota, 1992.

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' acres -----					
Charcoal Rot	6.6	6.6	0.4	2.6	1.1	1.3
Downy Mildew	0.4	3.9	1.2	9.7	2.7	10.8
Phoma Black Stem	0	2.6	3.1	8.6	5.3	13.7
Rhizopus Head Rot	4.9	13.5	1.9	10.9	1.5	2.7
Rust	0.9	5.2	3.8	9.2	2.4	5.3
Sclerotinia Head Rot	0	1.3	45.9	59.0	12.8	27.5
Sclerotinia Wilt	2.7	3.4	9.3	36.9	18.7	26.6
Other	1.5	1.5	1.7	2.2	0	0
None	57.4	57.4	21.5	21.5	44.5	44.5

Rust was the worst disease problem on only 4% of Minnesota respondents' acres and 2% of North Dakota respondents' acres. Cool weather and fewer acres of confection sunflower may have reduced rust severity in Minnesota and North Dakota in 1992. Phoma black stem was the worst disease problem on only 5% of North Dakota, 3% of Minnesota and none of Kansas respondents' acres (Table 20).

Sclerotinia was a much more severe problem in Minnesota in 1992 than in 1991, and was a somewhat more severe problem in North Dakota in 1992 than in 1991 (2). Most other diseases in Minnesota and North Dakota were less severe in 1992 than in 1991. In 1992, Sclerotinia head rot and wilt (combined data) was one of the three worst diseases on 96% of Minnesota respondents' acres and 54% of North Dakota respondents' acres but only 5% of Kansas respondents' acres (Table 20).

Rhizopus head rot was one of the three worst diseases on 14% of Kansas respondents' acres, 11% of Minnesota respondents' acres, but only 3% of North Dakota respondents' acres. Phoma black stem was one of the three worst diseases on 14% of North Dakota respondents' acres, 9% of Minnesota respondents' acres and only 3% of Kansas respondents' acres. Downy mildew was one of the three worst diseases on 11% of North Dakota respondents' acres, 10% of Minnesota and only 4% of Kansas respondents' acres (Table 20).

Rhizopus head rot was the worst disease problem on Kansas respondents' dryland confection sunflower acres (Table 21), even though the level of infection was only about one third that of 1991. Rust was the worst disease problem on 13% of Kansas respondents' dryland confection acres and one of the three worst disease problems on 23% of their acres. Sclerotinia wilt was rarely a problem. These data suggest that many fields in Kansas are not yet severely infested with the Sclerotinia fungus.

Table 21. Worst sunflower disease problem in Kansas, 1992.

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' acres (total acres for seed type) -----								
Charcoal Rot	5.6	5.6	0	0	0	0	15.2	15.2
Downy Mildew	0	4.9	0	0	0	0	2.5	2.5
Phoma Black Stem	0	0	0	0	0	0	0	15.2
Rhizopus Head Rot	5.1	12.9	20.7	20.7	0	8.8	0	15.2
Rust	0	3.9	13.2	23.1	0	8.8	0	2.5
Sclerotinia Head Rot	0	1.1	0	9.9	0	0	0	0
Sclerotinia Wilt	2.9	2.9	3.2	14.0	8.8	8.8	0	0
Other	2.1	2.1	0	0	0	0	0	0
None	63.4	63.4	28.9	28.9	82.1	82.1	34.5	34.5

Table 22. Worst sunflower disease problem in Minnesota and North Dakota, 1992.

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' acres (total acres for seed type) -----								
Charcoal Rot	0	2.8	1.7	1.7	1.2	1.5	0	0
Downy Mildew	1.5	8.0	0	16.0	2.9	10.4	1.6	14.0
Phoma Black Stem	3.3	7.9	2.2	11.0	5.8	14.7	1.8	6.9
Rhizopus Head Rot	1.4	12.1	4.0	6.1	1.5	2.5	1.4	3.6
Rust	4.3	8.4	1.8	12.4	2.1	5.2	4.5	5.5
Sclerotinia Head Rot	48.2	60.8	37.4	52.3	11.0	24.2	25.0	49.8
Sclerotinia Wilt	7.9	36.6	14.9	38.3	17.3	23.6	28.2	46.8
None	19.7	19.7	27.6	27.6	46.7	46.7	30.0	30.0
Other	1.7	2.3	1.7	1.7	0	0	0	0

When diseases on oilseed sunflower are compared to those on confection sunflower, *Sclerotinia* head rot was the worst disease on 48% of Minnesota respondents' oilseed acres and 37% of their confection acres (Table 22). *Sclerotinia* wilt was the worst disease on 17% of North Dakota respondents' oilseed acres and 28% of their confection acres.

Sclerotinia head rot and wilt (combined data) was the worst disease problem on 56% of Minnesota respondents' oilseed acres, 52% of Minnesota respondents' confection acres, 27% of North Dakota respondents' oilseed acres, and 53% of North Dakota respondents' confection acres (Table 22). In addition, *Sclerotinia* head rot and wilt (combined data) was one of the three worst disease problems on 97% of Minnesota respondents' oilseed acres, 91% of Minnesota respondents' confection acres, 48% of North Dakota respondents' oilseed acres and 97% of North Dakota respondents' confection acres.

Apron seed treatment was used on 57% of Minnesota, 32% of North Dakota, and 1% of Kansas respondents' acres (Table 23). Respondents used Apron seed treatment on 84% of Minnesota and 85% of North Dakota respondents' confection acres (data not shown).

Table 23. Fungicide use on sunflower in Kansas, Minnesota and North Dakota, 1992..

Fungicide	Kansas	Minnesota	North Dakota
--- % of respondents' acres treated ---			
Aprn Seed Treatment	0.8	57.2	32.1

Table 24. Crop consultant use in sunflower in Kansas, Minnesota, and North Dakota, 1992..

Kansas	Minnesota	North Dakota
----- % of respondents -----		
26.4	11.3	10.8

INTEGRATED PEST MANAGEMENT (IPM).

Crop Consultants. Over 26% of Kansas respondents and 11% each of Minnesota and North Dakota respondents used a crop consultant in 1992 (Table 24). This is a slight increase for Kansas, almost no change for North Dakota and a significant drop for Minnesota compared to 1991, when 22% of Minnesota respondents used a crop consultant (2).

Pesticide Use. Approximately half of the respondents in all three states reported that pesticide use was the same as in previous years (Table 25). Nearly 40% of Minnesota and North Dakota respondents and over 40% of Kansas respondents reported less pesticide use. Only 6%, 6% and 8% reported increased pesticide use 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 26). Most increases were less than 50% but some of the decreases were as much as 100%.

The most common reasons for less pesticide use in 1992 were: fewer pests, reported by 60%, 54% and 53% of Kansas, Minnesota and North Dakota respondents, respectively; and not economically feasible, reported by 28%, 38% and 39% of respondents from the same states (Table 27). Use of alternative pest management practices

Table 25. Pesticide use on sunflower in 1992 compared to past years: Kansas, Minnesota, and North Dakota.

Use in 1992 Compared to Past Years	Kansas	Minnesota	North Dakota
----- % of respondents -----			
Less	44.3	36.9	39.5
More	5.7	6.4	7.7
Same	50.0	56.7	52.9

Table 26. Percent increase or decrease in pesticide use on sunflower by respondents reporting a use change in Kansas, Minnesota and North Dakota, 1992.

% Increase	Increase			% Decrease	Decrease		
	Kansas	Minnesota	North Dakota		Kansas	Minnesota	North Dakota
	% of respondents reporting an increase			% of respondents reporting a decrease			
1-25%	0	44.4	44.4	1-25%	5.6	17.6	23.9
26-50%	66.7	55.6	38.9	26-50%	27.8	41.2	25.4
51-75%	0	0	16.7	51-75%	5.6	8.8	4.5
76-100%	33.3	0	0	76-100%	61.1	32.4	46.3

Table 27. Reasons for less pesticide use on sunflower in Kansas, Minnesota, and North Dakota, 1992.

Reason	Kansas	Minnesota	North Dakota
	--- % of respondents ---		
Fewer Pests	60.0	54.2	53.3
Better Application Techniques	0	2.8	1.5
Better Scouting for Timely Application	2.5	4.2	5.1
Use of Different Chemical with Lower Use Rates	0	1.4	0.7
Not Economically Feasible	27.5	37.5	38.7
Used Alternate Pest Management Practices	7.5	0	0.7
Other	2.5	0	0

Table 28. Number of years since previous sunflower crop in Kansas, Minnesota, and North Dakota, 1992.

Years Since Previous Sunflower	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
0	0	0.6	0
1	5.9	0	0.4
2	5.9	0.6	5.0
3	22.1	9.1	24.9
4	19.1	28.6	39.8
5	10.3	20.1	15.3
6	2.9	8.4	4.2
7	0	6.5	1.1
8	0	4.5	2.7
9	0	1.3	0.4
10	0	13.6	3.1
15+	1.5	3.9	0.4
Never Before	32.4	2.6	2.7

was the reason for reduced pesticide use for 8% of Kansas respondents and 1% of North Dakota respondents. Better scouting for timely application was the reason for less pesticide use for 3%, 4% and 5% of Kansas, Minnesota and North Dakota respondents, respectively.

Crop Rotation. A three- or four-year crop rotation was used by 41% of Kansas and 65% of North Dakota respondents and a four- or five-year rotation was used by 49% of Minnesota respondents (Table 28). A five-year rotation was used by 10%, 20% and 15% of Kansas, Minnesota and North Dakota respondents, respectively. These figures are slightly higher than for 1991 (2), and may reflect the lower acreage of sunflower in 1992. Thirty-two percent of Kansas respondents had never planted sunflower previously on the land planted to sunflower in 1992.

Table 29. Crop preceding sunflower in Kansas, Minnesota, and North Dakota, 1992.

Preceding Crop	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
Alfalfa	0	0.7	0
Barley	0	20.0	25.4
Corn	12.0	2.0	5.1
Oats	1.2	0.7	0.4
Rye	0	0	0.4
Sorghum/Millet	8.4	0	0
Soybean	1.6	2.0	0.8
Summer Fallow	0	1.3	0.4
Sunflower	3.6	0	0
Wheat	71.1	72.7	67.2
Other	2.4	0.7	0.4

Wheat most commonly preceded sunflower in the crop rotation, as reported by about 70% of respondents in all three states (Table 29). The second most common crop to precede sunflower was corn in Kansas (12% of respondents) and barley in Minnesota (20%) and North Dakota (25%).

Cultivation. Most respondents used cultivation for weed control. Fields were cultivated once by 47% of Kansas, 40% of Minnesota and 60% of North Dakota respondents and twice by 12%, 47% and 18% of respondents in these same states (Table 30). Cultivation was not used by 27% of Kansas, 6% of Minnesota and 15% of North Dakota respondents.

Resistant Varieties. Respondents reported use of resistant varieties on 7% of their acres in Kansas, 21% in Minnesota and 15% in North Dakota (Table 31). Since the term "resistant variety" was not defined on the survey form, interpretation of this term was left to the individual respondent.

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Table 30. Number of cultivations used on sunflower in Kansas, Minnesota, and North Dakota, 1992.

Number of Cultivations	Kansas	Minnesota	North Dakota
	----- % of respondents -----		
0	27.2	6.0	14.5
1	46.7	39.5	59.5
2	12.0	47.3	18.3
3	5.4	6.6	6.2
4	3.3	0.6	1.4
5	3.3	0	0
6	2.2	0	0

Table 31. Use of resistant varieties by respondents in Kansas, Minnesota, and North Dakota, 1992.

	Kansas	Minnesota	North Dakota
	----- % of respondents' acres -----		
	7.1	21.2	15.1

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