Extension Report No. 46

1997 Sunflower Grower Survey

of Pest Problems and Pesticide Use in Kansas, Minnesota, North Dakota and South Dakota

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PROCEDURES

Sunflower growers in Kansas (KS), Minnesota (MN), North Dakota (ND) and South Dakota (SD) were surveyed by mail about pest problems and pesticide use in 1997. The survey was similar to previous surveys (1, 2, 3, 4).

A four-page survey form (Figure 1) was mailed on November 15, 1997 to 8,114 selected growers on the mailing list of the National Sunflower Association's magazine *The Sunflower*. The survey form was mailed to all 2,400 KS growers, all 1,400 MN growers, 25% of the 9,459 ND growers (2,364 contacted), and 75% of the 2,600 SD growers (1,950 contacted). 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 non-irrigated acres; planting dates; major production problems encountered; major insect, disease and weed problems encountered; percent bird damage, bird species causing damage, amount of money and time spent on attempts to control bird depredation; pesticides used, rates of pesticide used, degree of control experienced with each pesticide and targeted pests for each pesticide; weed control from herbicide use and other weed control practices; use of Folicur fungicide in KS and ND; and non-chemical disease management.

A major objective of the survey was to provide data on pesticide use, use rates and targeted pests for pesticides to be regulated or reregistered by the Environmental Protection Agency (EPA). This included the insecticides Furadan (carbofuran), Lorsban (chloropyrifos), and the parathions (ethyl, methyl and 6-3 ethyl methyl) and the herbicides Eptam (EPTC) and Poast (sethoxydim). Respondents were asked the targeted pests for various pesticides used, the rates used and their efficacy.

Ranking of Sunflower Production of States Surveyed

North Dakota was first nationally in 1997 in all sunflower production, oilseed sunflower production and confection sunflower production. North Dakota had 51% of all, 50% of oilseed and 56% of the nation's confection acreage. North Dakota had 1,470,000 sunflower acres planted in 1997 and 1,410,000 acres harvested, with a yield of 1,321 lb/A and production of 1,862,900,000 lb. The value of the 1996 North Dakota crop, when 1,165,000 acres were harvested, was $206,524,000. South Dakota ranked second in all sunflower, oilseed sunflower and confection sunflower production. Kansas ranked third in all sunflower and in oilseed sunflower production and Minnesota ranked fourth in all sunflower and oilseed sunflower production. Texas and Nebraska ranked third and fourth, respectively, in confection sunflower production (5, 6).

Total planted acreage in the four states surveyed was 2,665,000 acres, or 91% of the nation's 2,920,000 planted acres. Planted oilseed acreage in these four states was 2,160,000 acres, or 94% of the nation's 2,292,000 planted oilseed acres. Planted confection acreage in these four states was 505,000 acres, or 80% of the nation's 628,000 planted confection acres (6).

RESULTS

Responses

Six hundred and ten usable forms were returned, amounting to 7.5% of forms mailed, considerably less than the 14% usable forms returned in 1994 (4). The respondents and percent responses for each state in 1997 were : KS, 103 or 4.3%; MN, 83 or 5.9%; ND, 261 or 11.0%; and SD, 163 or 8.4% (Table 1).

Acres Planted By Respondents

Respondents in the four states planted 216,594 acres or 8% of the 2,665,000 acres planted by all growers in these states (6). KS respondents planted 24,615 acres, or 12% of the KS total sunflower acres of 230,000; MN respondents planted 22,646 acres, or 22% of the MN total of 105,000 acres; ND respondents planted 92,873 acres, or 6% of the ND total of 1,500,000 acres; SD respondents planted 76,460 acres, or 9% of the SD total of 830,000 acres (Table 2). The ND acreage represented in the survey is a significant number since only 25% of ND growers received the survey form. The percentage of total acres represented by respondents' acres was 8%, down from 12% in 1994 (4). The respondents' planted acres represented 7% of the total 2,920,000 sunflower acres planted in the United States.

Confection sunflower planted by respondents was 7% of respondents' total sunflower crop in KS, 35% in MN, 25% in ND and 2% in SD (Tables 3 and 4). The percent of respondents' acres planted to confection sunflower

Figure 1. Survey form.

NDSU EXTENSION SERVICE

PLANT SCIENCE – PLANT PATHOLOGY

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November 15, 1997

To: Selected Sunflower Growers in Kansas, Minnesota, North Dakota and South Dakota

From: Art Lamey
Extension Plant Pathologist
North Dakota State University

Subject: *Survey of Sunflower Pest Problems and Pesticide Use in 1997*

Please see the reverse side for the survey of sunflower pest problems and pesticide use for the 1997 growing season. This survey has been mailed to randomly selected sunflower growers in Kansas, Minnesota, North Dakota, and South Dakota from a list provided by the National Sunflower Association.

This survey was designed by research and extension specialists from all four states with suggestions from the National Sunflower Association board of directors. It is designed to provide information on pest problems and pesticide use in each state covered by the survey and to provide specific information on use of certain pesticides that will be reviewed soon by the Environmental Protection Agency (EPA). ***Information gained from this survey may provide data useful for defending the continued need of these products.*** It also will be invaluable in helping to determine the direction of research and extension programs, and in providing useful information on needs for retaining the use of selected pesticides.

Please take the time to complete the survey and return it in the enclosed envelope, which is addressed with postage paid. Your reply is important and will impact the future of the sunflower industry. Answer questions as completely as possible, and **be sure to provide information on acres treated or planted** whenever this question is asked. Accurate information will help us the most. Please feel free to add explanations or written comments that clarify your practices or express your concerns. We have deliberately kept this survey anonymous so that you may feel free to give completely frank answers.

Results will be published in future issues of The Sunflower and will also be available at the office of the National Sunflower Association.

May we have your reply please by **December 15, 1997.**

The selection of your name was derived from *The Sunflower* magazine mailing list. If you no longer wish to receive the magazine or would like to notify the editors of address changes, please include the mailing label from this packet or include your name and your old and new address, including zip code. Your request will be sorted and handled before the surveys are tabulated.

County Commissions, North Dakota State University and U.S. Department of Agriculture Cooperating
NDSU is an equal opportunity institution

Please circle the appropriate response or fill in the requested information on pest problems and pesticide use on your 1997 sunflower crop.

Category	Acres/ Seeding Date		Acres/ Seeding Date	
Dryland: oilseed hybrids				
Dryland: confection hybrids				
Irrigated: oilseed hybrids				
Irrigated: confection hybrids				

Total sunflower acres planted in 1997	
Total acres harvested	
Yield, cwt per acre	
Acres with frost damage	

State and County where grown:

(If sunflower is grown in more than one county, please list each county and how many acres in each.)

State	County	No. of Acres
Kansas		
Minnesota		
North Dakota		
South Dakota		

Worst Production Problems in Sunflower in 1997

(Choose only 3, ranking 1-3; 1=worst)

Problem	Rating	Problem	Rating
Bird damage		Herbicide Drift	
Diseases		Insects	
Emergence/stand		Weeds	
Harvesting		None	

Worst Weed Problems in 1997

(Choose only 3, ranking 1-3; 1=worst)

Weed	Rating	Weed	Rating
Canada thistle		Russian thistle	
Cocklebur		Volunteer cereals	
Common Lambsquarters		Wild buckwheat	
Foxtail (Pigeongrass)		Wild mustard	
Kochia		Wild oat	
Large crabgrass		None	
Quackgass		Other (specify)	
Pigweed species			

Non-Chemical Weed Management

Practice	Acres Treated	No. of cultivations
Rowcrop Cultivation		
Crop rotation		
Rotary hoe		
Other		

Worst Insect Problems in 1997

(Choose only 3, ranking 1-3; 1=worst)

Insect	Rating	Insect	Rating
None		Sunflower head moth	
Seed weevil		Sunflower midge	
Banded sunflower moth		Grasshoppers	
Stem weevil		Other (specify)	
Sunflower beetle			

Non-Chemical Insect Management

Practice	Acres Used	Practice	Acres Used
Crop rotation		Hybrid selection	
Tillage		Other (specify)	

Worst Disease Problems in 1997

(Choose only 3, ranking 1-3; 1=worst)

Disease	Rating	Disease	Rating
Charcoal rot		Sclerotinia wilt	
Downy mildew		White rust	
Phoma black stem		Rhizopus head rot	
Rust		Phomopsis	
Sclerotinia Head Rot		None	

	Acres Affected	Percent lodging or head rot
Lodging due to Sclerotina		
Lodging due to Phoma		
Sclerotinia Head Rot		

Hybrid affected by Sclerotinia Head Rot	
Acres treated with Apron seed treatment	

Non-Chemical Disease Management

Practice	Acres Used	Practice	Acres Used
Crop Rotation		Resistant hybrid	
Tillage		Other (specify)	

Insecticides used on sunflower in 1997 (NOTE: Please be as accurate as possible when recording rates.)

Insecticide	Product Rate per acre (list oz, lb, pt, or qt for each application†)	Targeted Insects[a]	Acres Treated	No. of Appl.	Method of Application[b]		Insect Control			
							Exc.	Good	Fair	Poor
Asana XL					G	A				
Baythroid					G	A				
Furadan 4F					G	A				
Lindane/Maneb (seed treatment)					G	A				
Lorsban					G	A				
ethyl parathion					G	A				
methyl parathion					G	A				
6-3 parathion					G	A				
Phaser, Thiodan					G	A				
Scout X-TRA					G	A				
Sevin					G	A				
Warrior					G	A				
Other (specify)					G	A				

[a] SDW=seed weevil; BSM=banded sunflower moth; STW=stem weevil; SB=sunflower beetle; SHM=sunflower head moth; SM=sunflower midge; GH=grasshoppers
[b] G=ground; A=air (circle one)

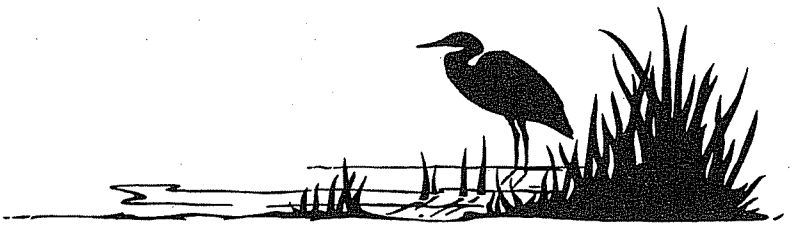
Evaluate herbicides used on sunflower in 1997 (NOTE: Please be as accurate as possible when recording rates.)

Herbicide Used	Product Rate per acre (list oz, lb, pt, or qt for each application†)	Targeted Weeds[a]	Acres Treated	No. of Appl.	Method of Application[b]		Weed Control			
							Exc.	Good	Fair	Poor
None										
Assert					G	A				
Eptam (fall)					G	A				
Eptam (spring)					G	A				
Gramoxone, pre-emerge					G	A				
Poast					G	A				
Prowl (fall)					G	A				
Prowl (spring)					G	A				
Roundup, pre-emerge					G	A				
Sonalan (fall)					G	A				
Sonalan (spring)					G	A				
Sonalan + Eptam					G	A				
*Trifluralin (fall)					G	A				
Trifluralin (spring)					G	A				
Trifluralin + Eptam					G	A				
DESICCANTS										
Gramoxone Extra					G	A				
Leafex-3, Defol					G	A				

[a] G=grasses; AB=annual broadleaf; P=perennial
[b] G=ground; A=air (circle one)
* Treflan or trifluralin generics

Folicur fungicide use for rust control (KS and ND Only)

		Rust Control			
No. of acres treated	No. of applications	Excellent	Good	Fair	Poor



Bird problems and losses

% Yield Loss	Species
☐ 0-5%	☐ Blackbird
☐ 5-10%	☐ Sparrows
☐ 10-25%	☐ Other (specify)
☐ 25-50%	_____
☐ 50-100%	_____

Costs for bird control

$	Cattail control
$	Exploder/alarm devices
$	Gasoline
$	Shells
	Time (hrs.)

Comments:

Results of this survey will be published in ***The Sunflower***

☞ **PLEASE RETURN BY DECEMBER 15, 1997** ☜

THANK YOU!

Art Lamey, Extension Plant Pathologist, NDSU

was lower in KS than in 1994, higher in MN, and slightly higher in ND and SD (4). The percent of planted acres harvested was 98% in KS, 94% in SD, 93% in ND, and 89% in MN (Table 3). Most irrigated sunflower was grown in KS, where 17% of KS respondents' acres were planted (Tables 3 and 5). Irrigated acreage was very small in the other three states. The majority of irrigated acres in KS were planted to oilseed sunflower (Table 3), as in 1994.

Major Sunflower Producing Counties Represented by Survey

KS counties with the largest number of acres reported by respondents were Sherman, Cheyenne and Wallace. MN counties with the largest number of acres reported by respondents were Kittson, Polk, Marshall, Pennington, Roseau, Red Lake and Clay. ND counties with the largest number of acres reported by respondents were Barnes, Stutsman, La Moure, Wells, Foster and Benson. These data contrast to total acres planted, according to the North Dakota Agricultural Statistics Service, with the largest number of acres planted in

Table 1. Growers contacted and responses in 1997.

State	Total Growers	Growers Contacted	- - Responses - - Useable	%
Kansas	2,400	2,400	103	4.3
Minnesota	1,400	1,400	83	5.9
North Dakota	9,459	2,364	261	11.0
South Dakota	2,600	1,950	63	8.4
Total	15,859	8,114	610	7.5

Table 2. Total acres planted and acres planted by respondents in 1997.

State	Total Acres Planted	Respondents' Acres	Respondents' Acres as % of Total
Kansas	230,000	24,615	11.9
Minnesota	105,000	22,646	21.6
North Dakota	1,500,000	92,873	6.2[a]
South Dakota	830,000	76,460	9.2[b]
Four State Total	2,665,000	216,594	8.1
U.S. Total	2,920,000		7.4

[a] Only 25% of growers were contacted by survey.
[b] Only 75% of growers were contacted by survey.

Table 3. Sunflower acres planted and harvested by respondents in 1997.

	Kansas		Minnesota		North Dakota		South Dakota	
Sunflower Class	Resp.	Acres	Resp.	Acres	Resp.	Acres	Resp.	Acres
Non-irrigated oilseed	96	19,053	82	14,679	258	69,848	182	74,824
Non-irrigated confection	11	1,500	27	7,967	67	22,549	6	1,395
Irrigated oilseed	15	3,926	0	0	2	132	3	241
Irrigated confection	3	136	0	0	1	344	0	0
Total planted	103	24,615	83	22,646	261	92,873	163	76,460
Total harvested		24,120		20,091		86,787		72,166
% acres harvested		98.0		88.7		93.4		94.4

Table 4. Confection sunflower acres planted by respondents in 1997 (data derived from Table 3).

State	Respondents' Total Acres	Respondents' Confection Acres	% Confection Acres
Kansas	24,615	1,636	6.6
Minnesota	22,646	7,967	35.2
North Dakota	92,873	22,893	24.6
South Dakota	76,460	1,395	1.8

Table 5. Irrigated acres of sunflower in 1997.

State	Respondents' Total Acres	Respondents' Irrigated Acres	% Acres Irrigated
Kansas	24,615	4,062	16.5
Minnesota	22,646	0	0.0
North Dakota	92,873	476	0.5
South Dakota	76,460	241	0.3

Stutsman, Barnes, La Moure, Dickey, Nelson, Ramsey, Benson and Foster (5). Thus, Dickey, Nelson and Ramsey were under-represented in the survey. On the other hand, the three counties with the largest number of acres in the survey were also the counties with the largest number of acres planted, according to the North Dakota Agricultural Statistics Service. SD counties with the largest number of acres reported by respondents were Beadle, Edmunds, Sully, Brown, Hand and Faulk (Table 6). Many of these are the same counties that were leading sunflower producing counties in 1994. The majority of irrigated acres reported was in Sherman County, KS.

Sunflower Planting Dates

KS respondents planted sunflower from before May 1 to after July 31, but the majority was planted in June and early July (Table 7). Some of the late planting dates in KS may be due to double cropping following winter wheat harvest. Sunflower was planted earlier in the northern states than in KS. MN respondents planted most of their acreage in the period May 11 to June 10, with over half of total acres planted May 21-30. ND respondents planted most of their acreage in the period May 21-June 10. SD respondents planted most of their acreage in the period May 11-June 10, with the greatest percentage planted in the period June 1-10.

Sunflower Yields

Yields varied among and within the states. Over half of KS respondents reported yields of 751-1,250 lb/A. In MN, over half of respondents reported yields of 751-1,500 lb/A. In ND, over half of respondents reported yields of 1,001-1,500 lb/A. In SD, over two thirds of respondents reported yields of 1,251-2,000 lb/A. Yields over 2,000 lb/A were rare in all four states (Table 8).

Production Problems

Diseases were rated as the worst production problem on 30% of KS respondents' acres, followed by weeds on 20%. Diseases were the worst production problem on 39% of MN respondents' acres, followed by insects on 32%. Bird damage was the worst production problem on 23% of ND respondents' acres, followed by insects on 20%. Emergence and stand establishment was the worst production problem on 31% of SD respondents' acres, followed by weeds on 20% (Table 9).

Table 6. Major sunflower producing counties represented by 1997 survey.[a]

State	County	Total Reported	Nonirrigated Oilseed	Nonirrigated Confection	Irrigated Oilseed	Irrigated Confection
		acres in each class				
KS	Sherman	10,199	7,479	0	2,584	136
	Cheyenne	1,897	1,699	78	120	0
	Wallace	1,376	1,176	0	200	0
MN	Kittson	6,139	2,280	3,859	0	0
	Polk	3,783	2,693	1,090	0	0
	Marshall	3,167	2,237	930	0	0
	Pennington	2,797	1,834	960	0	0
	Roseau	2,790	2,090	700	0	0
	Red Lake	1,748	1,460	288	0	0
	Clay	1,304	1,164	140	0	0
ND	Barnes	9,964	9,434	530	0	0
	Stutsman	9,049	7,356	1,693	0	0
	La Moure	7,127	5,277	1,850	0	0
	Wells	5,763	3,004	2,759	0	0
	Foster	5,644	2,540	2,760	0	344
	Benson	5,104	2,986	2,119	0	0
SD	Beadle	16,804	16,408	0	0	0
	Edmunds	8,603	8,603	0	0	0
	Sully	4,905	4,905	0	0	0
	Brown	4,817	4,817	0	0	0
	Hand	4,802	4,057	745	0	0
	Faulk	4,477	4,477	0	0	0

[a] Counties with over 5% of reported acres for each state, or 1,231 in Kansas, 1,132 in Minnesota, 4,644 in North Dakota and 3,823 in South Dakota.

Table 7. Sunflower planting dates in 1997.

State	SF 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	After July 31
		% of respondents that planted for each class										
KS	Nonirrigated oilseed	2.2	7.9	9.0	6.7	24.7	15.7	10.1	14.6	6.7	2.2	0.0
	Nonirrigated confection	0.0	0.0	0.0	0.0	27.3	18.2	27.3	27.3	0.0	0.0	0.0
	Irrigated oilseed	0.0	0.0	0.0	0.0	40.0	13.3	0.0	20.0	20.0	0.0	6.7
	Irrigated confection	0.0	0.0	33.3	0.0	0.0	66.7	0.0	0.0	0.0	0.0	0.0
MN	Nonirrigated oilseed	0.0	2.5	19.8	53.1	21.0	3.7	0.0	0.0	0.0	0.0	0.0
	Nonirrigated confection	0.0	7.7	15.4	65.4	11.5	0.0	0.0	0.0	0.0	0.0	0.0
ND	Nonirrigated oilseed	1.2	2.0	13.2	39.6	39.2	4.0	0.8	0.0	0.0	0.0	0.0
	Nonirrigated confection	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0
	Irrigated confection	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
SD	Nonirrigated oilseed	0.0	1.8	8.2	25.3	42.4	15.3	6.5	0.6	0.0	0.0	0.0
	Nonirrigated confection	0.0	16.7	16.7	0.0	50.0	16.7	0.0	0.0	0.0	0.0	0.0
	Irrigated oilseed	0.0	0.0	33.3	0.0	66.7	0.0	0.0	0.0	0.0	0.0	0.0

Problems ranked among the three worst production problems in KS were insects, on 67% of respondents' acres, followed by weeds on 50%, harvesting on 46% and diseases on 40%. Diseases were ranked among the three worst production problems on 79% of MN respondents' acres, followed by insects on 64% and weeds on 55%. Weeds were ranked among the three worst production problems on 68% of ND respondents' acres, followed by bird damage and insects each on 51% and emergence and stand establishment on 41%. Weeds were ranked among the three worst production problems on 63% of SD respondents' acres, followed by insects on 54% and emergence and stand establishment on 45% (Table 9).

Table 8. Sunflower yields in 1997.

Yield	Kansas	Minnesota	North Dakota	South Dakota
lb/A	% of respondents' acres			
<500	2.6	2.4	1.7	2.9
501-750	5.0	9.2	3.8	4.3
751-1000	31.2	23.2	8.9	5.7
1001-1250	23.3	13.9	21.7	10.0
1251-1500	13.5	14.5	34.5	32.9
1501-1750	15.0	8.2	17.0	16.4
1751-2000	2.9	7.3	10.6	21.4
>2000	4.1	2.0	1.7	6.4

Table 9. Worst production problems in 1997.

Production Problem	Kansas		Minnesota		North Dakota		South Dakota	
	Worst Problem	One of Three Worst Problems	Worst Problem	One of Three Worst Problems	Worst Problem	One of Three Worst Problems	Worst Problem	One of Three Worst Problems
	% of respondents' acres							
Bird damage	10.0	15.5	2.2	16.4	23.4	50.8	8.9	35.7
Diseases	30.0	40.2	39.2	78.8	12.0	39.6	13.1	24.3
Emergence/stand	5.7	24.3	1.3	13.1	18.7	41.1	31.2	45.1
Harvesting	12.8	46.2	3.5	10.6	1.9	9.9	1.6	30.4
Herbicide drift	1.6	2.3	0.0	1.9	0.5	3.8	0.4	1.8
Insects	11.5	66.9	32.3	64.4	20.0	50.6	15.8	53.5
Weeds	20.0	50.3	5.9	54.5	16.8	67.6	20.1	63.0
Weather	0.0	0.0	5.8	8.0	3.5	4.4	4.2	4.9
None	3.5	3.5	0.8	0.8	1.0	1.0	3.4	3.4

Asana XL was the insecticide used to control sunflower beetle by 100% of MN, 76% of ND and 56% of SD respondents who used it. It also was used against grasshoppers and seed weevil, as reported by 18% of SD respondents (Table 17).

Asana XL was aerially applied by 46% of MN, 69% of ND and 68% of SD respondents, respectively (Table 18). The Section 3 Asana XL label is for use at 2.9-5.8 fl oz/A for control of sunflower beetles, and at 5.8-9.6 fl oz/A for grasshoppers and seed weevils. In 1997, a Section 2(ee) label was issued for ND, SD, MN and MT for control of sunflower beetles with a low use rate of 1.45 fl oz/A. Asana XL was applied at rates below 1 fl oz/A by 48% of MN and 8% of ND respondents. Rates between 1.0 and 1.45 fl oz/A were used by 14% of MN, 24% of ND and 7% of SD respondents. It was used at the Section 2(ee) label rate of 1.45-2.8 fl oz/A by 29% of MN, 34% of ND and 27% of SD respondents. It was used at Section 3 label rates of 2.9-5.8 fl oz/A by 10% of MN, 28% of ND and 45% of SD respondents. It was used at Section 3 label rates of 5.9-9.6 fl oz/A (rate for insects other than the sunflower beetle) by 4% of ND and 18% of SD respondents (Table 19).

In spite of frequent low use rates, including below-label rates, for Asana XL in MN and ND, 66% of MN, 63% of ND and 42% of SD respondents reported excellent insect control; another 29% of MN, 35% of ND and 52% of SD respondents reported good insect control (Table 20). The greatest use of low rates was in MN, where 100% of respondents used Asana XL for sunflower beetle control; the least use of low rates was in SD, where only 56% of respondents used Asana XL for sunflower beetle control: the data for ND were intermediate to the other two states.

Table 17. Targeted insect species for Asana XL used on sunflower in 1997[a].

Targeted Insect	Minnesota	North Dakota	South Dakota
	— % respondents answering question —		
Banded Sunflower Moth	0.0	2.1	1.8
Grasshopper	0.0	7.2	18.2
Seed Weevil	0.0	6.2	18.2
Stem Weevil	0.0	4.1	0.0
Sunflower Beetle	100.0	76.3	56.4
Sunflower Head Moth	0.0	1.0	5.5
Sunflower Midge	0.0	1.0	0.0

[a] Insufficient data for Kansas

Table 18. Method of Asana XL application on sunflower in 1997[a].

Method of Application	Minnesota	North Dakota	South Dakota
	------ % responding to question ------		
Ground	53.8	30.8	31.7
Air	46.2	69.2	68.3

[a] Insufficient data for Kansas (9 responded to question).

Table 19. Asana XL rates used on sunflower in 1997.

	Minnesota	North Dakota	South Dakota
Fluid ounces/A[a]	------ % respondents using rate ------		
0.07-0.9	47.7	7.7	0.0
1.0-1.44	14.3	24.2	6.7
1.45-2.8	28.7	34.3	26.6
2.9-3.9[b]	0.0	17.8	15.6
4.0-5.8[b]	9.6	10.2	28.9
5.9-7.9[c]	0.0	1.3	13.3
8.0[c]	0.0	2.5	4.4
12	0.0	0.0	2.2
16	0.0	1.3	2.2
32	0.0	1.3	0.0

[a] Fluid ounces of formulated product; insufficient data for Kansas.
[b] Label rate for sunflower beetle.
[c] Label rate of 5.8-9.6 fl oz/A for grasshoppers and seed weevil.

Table 20. Insect control ratings for insecticides used on sunflowers in 1997.

Insecticide	Kansas				Minnesota				North Dakota				South Dakota			
	E	G	F	P	E	G	F	P	E	G	F	P	E	G	F	P
	---------- % of rankings for each class[a] ----------															
Asana XL	—	—	—	—	66.7	29.3	3.7	0.0	62.8	34.5	2.7	0.0	41.7	51.7	6.7	0.0
Methyl Parathion	18.2	36.4	36.4	9.1	—	—	—	—	—	—	—	—	—	—	—	—
Warrior	42.1	57.9	0.0	0.0	—	—	—	—	63.4	29.3	7.3	0.0	—	—	—	—

[a] Rankings given only when at least 10 respondents in a state ranked that insecticide: E=excellent, G=good, F=fair, P=poor.

The sunflower head moth was the targeted insect for methyl parathion use by 73% of KS respondents who used it, followed by the banded sunflower moth by 18% and the seed weevil by 9%. The sunflower head moth was the targeted insect for all parathion use by 81% of KS, respondents, followed by the banded sunflower moth by 14% and the seed weevil by 5% (Table 21). Parathion was applied by air by all reporting respondents in KS and SD (Table 22).

Methyl parathion was used at 1-4 fl oz/A by 39% of KS respondents, at 8 fl oz by 23%, at 16 fl oz by 15% and above 16 fl oz by 23% (Table 23). Eight percent of respondents reported using methyl parathion at a rate of 32 fl oz/A. Parathion efficacy was reported to be excellent by 18%, good by 36%, fair by 36% and poor by 9% of KS reporting respondents (Table 20). Labeled rates for methyl parathion 8EC were 8 to 16 fl oz/A, and for methyl parathion 4EC was 32 fl oz/A. Only the 8 pound formulation is now available.

The sunflower head moth was the targeted insect for Warrior use by 69% of KS respondents who used it, followed by the stem weevil by 13%. The sunflower beetle was the targeted insect for Warrior use by 67% of ND respondents who used it, followed by the stem weevil for 19% and the seed weevil by 8% (Table 24). Warrior was applied by air by 90% of KS, 71% of ND and 71% of SD respondents (Table 25).

Warrior is labeled for use at 1.28-2.56 fl oz/A for control of sunflower beetle and at 2.56-3.84 fl oz/A for control of stem weevil and head moth. It was used at less than 1 fl oz/A by 27% of ND respondents and at 1.0-1.27 fl oz by 23% of ND respondents (Table 26).

Table 21. Targeted insect species for parathion used on sunflower in Kansas in 1997.

Targeted Insect	Methyl Parathion	All Parathion[a]
Banded Sunflower Moth	18.2	14.3
Seed Weevil	9.1	4.8
Sunflower Head Moth	72.7	81.0

[a] ethyl, methyl and 6-3 parathion; less than 10 respondents for ethyl or 6-3 parathion, so data not reported separately.

Table 22. Method of parathion[a] application on sunflower in 1997.

Method of Application	Kansas	South Dakota
	--- % responding to question ---	
Air	100	100

[a] ethyl, methyl and 6-3 parathion

Table 23. Methyl parathion rates used on sunflower in Kansas in 1997.

Fluid ounces/A[a]	% Respondents using rate
1-3.5	15.4
4	23.1
8	23.1
16	15.4
17-23	7.7
24	7.7
32	7.7

[a] Fluid ounces of formulated product.

Table 24. Targeted insect species for Warrior used on sunflower in Kansas and North Dakota in 1997.

Targeted Insect	Kansas	North Dakota
	– % respondents answering question –	
Grasshopper	6.3	2.8
Seed Weevil	6.3	8.3
Stem Weevil	12.5	19.4
Sunflower Beetle	0.0	66.7
Sunflower Head Moth	68.8	0.0

Table 25. Method of Warrior application to sunflower in 1997[a].

Method of Application	Kansas	North Dakota	South Dakota
	– % of respondents answering question –		
Ground	10.5	29.3	28.6
Air	89.5	70.7	71.4

[a] Insufficient data for Minnesota

Table 26. Warrior rates used on sunflower in Kansas and North Dakota in 1997.

	Kansas	North Dakota
Fluid ounces/A[a]	---- % Respondents using rate ----	
0.5-0.9	0.0	27.1
1.0-1.27	0.0	23.0
1.28-2.56	23.0	41.0
2.57-3.84	62.0	4.5
16	15.4	4.5

[a] Fluid ounces of formulated product.

Thus, 50% of ND respondents used Warrior at below-label rates. Warrior was used at the label rates for sunflower beetle of 1.28-2.56 fl oz/A by 23% of KS and 41% of ND respondents; it was used at the 2.57-3.84 fl oz rate for other sunflower insects by 62% of KS and 5% of ND respondents. These differences in use patterns between KS and ND reflect the differences in pest problems, with 67% of ND respondents using Warrior for the sunflower beetle. In spite of low use rates, Warrior efficacy was rated excellent by 42% of KS and 63% of ND respondents and good by 58% of KS and 29% of ND respondents. It was rated as fair by only 7% of ND respondents (Table 20).

Respondents in all four states reported using crop rotation as a means of non-chemical insect management. This practice was reportedly used on 41% of KS, 74% of MN, 59% of ND and 75% of SD respondents' acres. Tillage was reported as a means of non-chemical insect management on 14% of KS, 22% of MN, 30% of ND and 41% of SD respondents' acres. Hybrid selection was reported as a means of non-chemical insect management on 3% of KS, 23% of MN, 10% of ND and 26% of SD respondents' acres (Table 27). The use of crop rotation is similar to use patterns in 1994, but the use of tillage was higher in 1997 than in 1994 in MN and SD (4).

Table 27. Use of non-chemical insect control in 1997.

Practice	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents' acres			
Crop Rotation	41.3	73.7	58.5	75.4
Tillage	13.8	22.2	30.1	41.2
Hybrid Selection	2.9	23.0	9.9	26.2
Other	1.8	1.1	0	1.3

Weed Problems

Pigweed species was the worst weed problem in KS, but foxtail was the worst weed problem in MN, ND and SD. Other common weed problems included Russian thistle in KS, Canada thistle in MN and ND, and wild mustard in MN and ND (Table 28).

Pigweed species was the worst weed problem on 26% of KS respondents' acres, followed by Russian thistle on 24% and kochia on 18%. Kochia was one of the three worst weeds by 64% of KS respondents' acres, followed by pigweed species on 47%, Russian thistle on 38% and foxtail on 35% (Table 28).

Table 28. Worst weed problem in 1997.

Weed	Kansas		Minnesota		North Dakota		South Dakota	
	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							
Canada Thistle	2.1	5.3	18.7	38.5	19.0	49.8	8.7	46.9
Common Cocklebur	1.9	6.5	0.0	0.4	8.9	22.8	4.4	15.5
Com. Lambsquarters	0.0	2.2	0.4	14.3	0.5	5.4	0.7	2.3
Foxtail (Pigeongrass)	3.3	35.3	34.5	58.9	28.8	53.6	58.0	68.8
Kochia	17.5	64.3	1.2	2.8	5.5	28.2	6.5	44.8
Large Crab Grass	4.1	11.1	0.0	0.0	0.6	0.6	0.0	0.7
Nightshade	0.0	0.0	0.0	0.0	1.9	5.6	0.9	7.0
Quackgrass	0.2	1.4	0.8	28.9	2.9	18.1	1.7	3.7
Pigweed species	26.1	47.0	0.9	6.8	3.3	10.9	3.7	23.0
Russian thistle	24.4	38.2	0.0	1.1	2.6	7.1	0.0	1.2
Volunteer cereals	2.3	3.2	0.0	2.2	0.0	1.8	0.2	4.6
Wild buckwheat	0.0	0.1	0.7	9.6	0.7	3.0	2.0	8.4
Wild mustard	0.0	0.0	17.6	51.0	19.1	50.5	0.0	6.3
Wild oat	0.0	0.0	7.3	26.9	1.6	9.1	1.3	5.8
None	6.8	6.8	2.8	2.8	0.5	0.5	4.3	4.3
Other	10.1	30.5	6.0	8.7	1.6	6.0	5.4	10.0

Foxtail was the worst weed problem on 35% of MN respondents' acres, followed by Canada thistle on 19% and wild mustard on 18%. Foxtail was one of the three worst weeds on 59% of MN respondents' acres, followed by wild mustard on 51%, Canada thistle on 39%, quackgrass on 29% and wild oat on 27% (Table 28).

Foxtail was the worst weed problem on 29% of ND respondents' acres, followed by wild mustard and Canada thistle, each on 19%. Foxtail was one of the three worst weeds on 58% of ND respondents' acres, followed by wild mustard on 51%, Canada thistle on 50% and kochia on 28% (Table 28).

Foxtail was the worst weed problem on 58% of SD respondents' acres. It was one of the three worst weeds on 69% of SD respondents' acres, followed by Canada thistle on 47%, kochia on 45% and pigweed species on 23% (Table 28).

Herbicide Use and Other Weed Management Practices

Weed control practices included use of herbicides, cultivation and use of rotary hoe. KS respondents used spring-applied Prowl on 45% of their acres, followed by spring-applied trifluralin on 14% of their acres (Table 29). These use figures are similar to 1994 (4).

MN respondents used Assert on 28% of their acres, followed by spring-applied Prowl on 24%, spring-applied Sonalan on 22%, Poast on 20% and spring-applied trifluralin on 15% (Table 29). These data represent a shift to considerably less use of trifluralin than in 1994 and to a slight increase in Prowl use (4).

ND respondents used spring-applied Sonalan on 43% of their acres and spring-applied trifluralin on 31% (Table 29). These data are similar to those for 1994 (4).

SD respondents used spring-applied trifluralin on 31% of their acres, followed by spring-applied Sonalan on 29%, Poast on 14% and spring-applied Prowl on 13% (Table 29). These data represent a shift since 1994 with less use of trifluralin and greater use of other dinitroanaline herbicides and a slight increase in the use of Poast (4).

Desiccant use was minimal in all four states (Table 30). KS and MN respondents used desiccant on 2% of their acres. ND and SD respondents used desiccant on less than 1% of their acres.

Most respondents used a single herbicide application. Only a few respondents in ND and SD used two applications (Table 31). Over 90% of respondents in all four states reported that herbicide application was by ground (Table 32).

Table 29. Herbicide use on sunflower in 1997.

Herbicide	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents' acres treated			
Assert	0.0	28.2	9.7	0.7
Eptam (spring)	0.3	0.0	2.1	0.1
Gramoxone	0.2	0.0	0.0	0.0
Poast	3.0	19.8	9.5	14.4
Prowl (fall)	2.4	0.0	0.4	0.2
Prowl (spring)	45.2	23.5	0.0	12.7
Roundup (pre)	4.9	0.5	5.4	11.2
Sonalan (fall)	0.0	3.0	1.2	0.7
Sonalan (spring)	4.7	22.2	42.7	28.7
Sonalan + Eptam	0.0	0.4	1.3	0.0
Trifluralin (fall)	0.0	3.5	4.7	2.2
Trifluralin (spring)	14.3	15.4	30.5	31.2
Trifluralin + Eptam	2.2	0.0	3.1	0.0

Table 30. Desiccant use on sunflower in 1997.

Desiccant	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents' acres treated			
Gramoxone	2.3	0.7	0.0	0.6
Leafex-3 Defol	0.0	1.3	0.6	0.0

Table 31. Number of herbicide applications used on sunflower in 1997.

Number of Applications	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents			
1	100.0	100.0	99.4	99.8
2	0.0	0.0	0.6	0.2

Table 32. Method of herbicide application to sunflower in 1997.

Method of Application	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents			
Ground	93.0	91.0	96.7	95.6
Air	7.0	9.0	3.3	4.4

Grass weeds were the targeted weeds by 34% of KS, 50% of MN, 56% of ND and 62% of SD respondents. Broadleaf weeds were the targeted weeds by 19% of KS, 27% of MN, 12% of ND and 3% of SD respondents. Grass and broadleaf weeds were the targeted weeds by 47% of KS, 23% of MN, 30% of ND and 32% of SD respondents (Table 33).

Assert was used for wild mustard control by 88% of MN and 89% of ND respondents, followed by wild oat and wild mustard control by 8% of MN and and 6% of ND respondents, respectively (Table 34). Assert was applied by ground by 86% of MN and 85 % of ND respondents (Table 35).

Assert was used at less than 0.1 lb ai/A by 15% of MN and 4% of ND respondents, and from 0.1 to 0.18 lb ai/A by 20% of MN and 34% of ND respondents. Since the label rate for Assert is 0.19-0.25 lb ai/A, below-label rates were used by 35% of MN and 38% of ND respondents. Assert was used at the label rate of 0.19-0.25 lb ai/A by 40% of MN and 46% of ND respondents, and was used at above-label rates of 0.26-0.70 lb ai/A by 25% of MN and 15% of ND respondents (Table 36). Assert was reported to give excellent weed control by 36% of MN and 51% of ND respondents, and to give good control by 52% of MN and 36% of ND respondents (Table 37).

Table 33. Weed species targeted by herbicides used on sunflower in 1997.

Weed Species	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents			
Grass	34.2	50.0	55.6	62.3
Broadleaf	19.2	27.1	11.8	2.5
Perennial	0.0	0.0	2.8	3.1
Grass & Broadleaf	46.6	22.9	29.9	32.1

Table 34. Weed species targeted by Assert used on sunflower in Minnesota and North Dakota in 1997.

Weed Species	Minnesota	North Dakota
	% responding to question	
Grass	4.2	2.9
Broadleaf	87.5	88.6
Perennial	0.0	2.9
Grass and Broadleaf	8.3	5.7

Table 35. Method of application of Assert to sunflower in Minnesota and North Dakota in 1997[a].

Method of Application	Minnesota	North Dakota
	% of respondents	
Ground	85.7	84.6
Air	14.3	15.4

[a] Insufficient data from Kansas and South Dakota.

Table 36. Assert rates used on sunflower in Minnesota and North Dakota in 1997[a].

	Minnesota	North Dakota
lb ai/A	% respondents using rate	
0.01 - 0.09	15.0	3.8
0.1 - 0.18	20.0	34.4
0.19 - 0.25[b]	40.0	46.1
0.26-0.70	25.0	15.2

[a] Insufficient data for Kansas and South Dakota.
[b] Label rate.

Table 37. Effectiveness of herbicides[a] on weed control in sunflower in 1997.

	Kansas				Minnesota				North Dakota				South Dakota			
Herbicide	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor	Excel.	Good	Fair	Poor
	% repondents															
Assert	—	—	—	—	36.0	52.0	12.0	0.0	51.3	35.9	12.8	0.0	—	—	—	—
Poast	—	—	—	—	18.2	54.5	27.3	0.0	37.0	55.6	7.4	0.0	55.6	40.7	0.0	3.7
Prowl (spring)	13.9	38.9	16.7	30.6	25.0	58.3	8.3	8.3	—	—	—	—	18.8	50.0	18.8	12.5
Roundup (pre)	36.4	54.5	0.0	9.1	—	—	—	—	47.6	38.1	14.3	0.0	40.0	36.0	16.0	8.0
Sonalan (spring)	—	—	—	—	28.6	47.6	23.8	0.0	25.6	49.6	22.5	2.3	34.2	31.6	21.1	13.2
Trifluralin (fall)	—	—	—	—	—	—	—	—	33.3	33.3	20.0	13.3	—	—	—	—
Trifluralin (spring)	23.8	52.4	19.0	4.8	18.8	43.8	37.5	0.0	16.8	40.0	29.5	13.7	25.4	34.3	28.4	11.9

[a] Includes all herbicides with 10 or more responses.

Grass weeds were the targeted weeds for Poast use by 100% of MN, 100% of ND and 92% of SD respondents (Table 38). Poast was applied by ground by 85% of MN, 96% of ND and 92% of SD respondents (Table 39).

Poast was used at rates of 0.10 to 0.19 lb ai/A by 50% of MN and 67% of ND respondents, and at 0.2-0.30 lb ai/A by 25% of MN and 28% of ND respondents (Table 40). Since 0.1 to 0.3 lb ai/A is the label rate, 75% of MN and 95% of ND respondents used Poast at the label rate. Poast was used at above-label rates of 0.3-0.39 lb ai/A by 25% of MN and 6% of ND respondents.

Poast was reported to give excellent control by 18% of MN, 37% of ND and 56% of SD respondents. It was reported to give good control by 55% of MN, 56% of ND and 41% of SD respondents (Table 37).

Grass weeds were the targeted weeds for spring-applied Prowl use by 32% of KS and 50% of SD respondents (Table 41). Grass weeds and broadleaf weeds were the targeted weeds for spring-applied Prowl use by 54% of KS and 42% of SD respondents. Broadleaf weeds were the targeted weeds by 14% of KS and 8% of SD respondents. Spring-applied Prowl was ground applied by 97% of KS, 92% of MN and 88% of ND respondents (Table 42).

Spring-applied Prowl was used at below-label rates of 0.4 to 0.99 lb ai/A by 22% of KS, 27% of MN and 38% of SD respondents (Table 43). It was used at label rates of

Table 38. Weed species targeted by Poast used on sunflower in 1997.

Weed Species	Minnesota	North Dakota	South Dakota
	% responding to question		
Grass	100.0	100.0	91.7
Perennial	0.0	0.0	4.2
Grass and Broadleaf	0.0	0.0	4.2

[a] Insufficient data from Kansas.

Table 39. Method of application of Poast to sunflower in 1997[a].

Method of Application	Minnesota	North Dakota	South Dakota
	% of respondents		
Ground	85.0	95.8	91.7
Air	15.0	4.2	8.3

[a] Insufficient data from Kansas.

Table 40. Poast rates used on sunflower in Minnesota and North Dakota in 1997[a].

	Minnesota	North Dakota
lb ai/A	% respondents using rate	
0.10-0.19[b]	50.0	66.8
0.20-0.30[b]	24.9	27.8
0.31-0.39	25.0	5.6

[a] Insufficient data from Kansas and South Dakota.
[b] Label rate.

Table 41. Weed species targeted by spring-applied Prowl used in Kansas and South Dakota on sunflower in 1997[a].

Weed Species	Kansas	South Dakota
	% responding to question	
Grass	32.1	50.0
Broadleaf	14.3	8.3
Grass and Broadleaf	53.6	41.7

[a] Insufficient data from Minnesota and North Dakota.

Table 42. Method of application of spring applied Prowl to sunflower in 1997[a].

Method of Application	Kansas	Minnesota	South Dakota
	% of respondents		
Ground	97.1	91.7	88.2
Air	2.9	8.3	11.8

[a] Insufficient data from North Dakota.

Table 43. Spring-applied Prowl rates used on sunflower in 1997[a].

	Kansas	Minnesota	South Dakota
lb. ai/A	% respondents using rate		
0.40-0.74	4.3	0.0	7.7
0.75-0.99	17.3	27.3	30.8
1.00-1.24[b]	60.8	54.6	46.2
1.25-1.50[b]	8.7	18.2	7.7
1.51-2.49	8.7	0.0	7.7

[a] Insufficient data from North Dakota.
[b] Label rates.

1.0-1.5 lb ai/A by 69% of KS, 73% of MN and 54% of SD respondents. It was used at above label rates by only 9% of KS and 8% of SD respondents. Spring-applied Prowl was reported to provide excellent weed control by 14% of KS, 25% of MN and 19% of SD respondents, and to provide good weed control by 39% of KS, 58% of MN and 50% of SD respondents (Table 37).

Grass weeds were the targeted weeds for pre-plant Roundup use by 41% of ND and 10% of SD respondents. Perennial weeds were targeted for pre-plant Roundup use by 35% of ND and 15% of SD respondents. Grass weeds and broadleaf weeds were targeted for pre-plant Roundup use by 24% of ND and 75% of SD respondents (Table 44). Pre-plant Roundup was ground-applied by 100% of KS, 79% of ND and 92% of SD respondents (Table 45).

Pre-plant Roundup was used at 0.19-0.29 lb ai/A by 6% of ND and 20% of SD respondents, at 0.30-0.39 lb ai/A by 25% of ND and 30% of SD respondents, at 0.40-0.59 lb ai/A by 13% of ND and 10% of SD respondents and at 0.75 lb ai/A by 56% of ND and 30% of SD respondents (Table 46). Since the label rate is 0.19-0.75 lb ai/A, all ND and 90% of SD respondents used the label rate. Only 10% of SD respondents used above-label rates of 1.00-1.15 lb ai/A.

Pre-plant Roundup was reported to give excellent weed control by 36% of KS, 48% of ND and 40% of SD respondents. It was reported to give good weed control by 55% of KS, 38% of MN and 36% of SD respondents (Table 37).

Grass weeds were the targeted weeds for spring-applied Sonalan use by 42% of KS, 45% of ND and 74% of SD respondents. Broadleaf weeds were the targeted weeds for spring-applied Sonalan use by 16% of MN, 2% of ND and 3% of SD respondents. Grass and broadleaf weeds were the targeted weeds by 42% of MN, 53% of ND and 23% of SD respondents (Table 47). Spring-applied Sonalan was ground applied by 96% of MN, 100% of ND and 97% of SD respondents (Table 48).

Table 46. Pre-plant Roundup rates used on sunflower in North and South Dakota in 1997[a].

	North Dakota	South Dakota
lb ai/A	% respondents using rate	
0.19-0.29[b]	6.3	20.0
0.30-0.39[b]	25.0	30.0
0.40-0.49[b]	6.3	10.0
0.50-0.59[b]	6.3	0.0
0.75[b]	56.3	30.0
1.00-1.15	0.0	10.0

[a] Insufficient data for Kansas and Minnesota.
[b] Label rates.

Table 44. Weed species targeted by pre-plant Roundup used on sunflower in North and South Dakota in 1997[a].

Weed Species	North Dakota	South Dakota
	% responding to question	
Grass	41.2	10.0
Perennial	35.3	15.0
Grass and Broadleaf	23.5	75.0

[a] Insufficient data from Kansas and Minnesota.

Table 47. Weed species targeted by spring-applied Sonalan used on sunflower in 1997[a].

Weed Species	Minnesota	North Dakota	South Dakota
	% responding to question		
Grass	42.1	45.3	74.2
Broadleaf	15.8	1.9	3.2
Grass and Broadleaf	42.1	52.8	22.6

[a] Insufficient data from Kansas

Table 45. Method of application of pre-plant Roundup to sunflower in 1997[a].

Method of Application	Kansas	North Dakota	South Dakota
	% of respondents		
Ground	100.0	78.9	92.3
Air	0.0	21.1	7.7

[a] Insufficient data from Minnesota.

Table 48. Method of application of spring-applied Sonalan to sunflower in 1997[a].

Method of Application	Minnesota	North Dakota	South Dakota
	% of respondents		
Ground	95.5	100.0	97.2
Air	4.5	0.0	2.8

[a] Insufficient data from Kansas.

Spring-applied Sonalan was applied at below label rates of 0.19-0.54 lb ai/A by 5% of MN, 1% of ND and 4% of SD respondents. It was applied at label rates of 0.55-0.99 lb ai/A by 53% of MN, 40% of ND and 58% of SD respondents and at 1.00-1.25 lb ai/A by 37% of MN, 55% of ND and 33% of SD respondents (Table 49). Thus, label rates were used by 90% of MN, 95% of ND and 91% of SD respondents. Only 5% of MN, 4% of ND and 4% of SD respondents used above-label rates.

Spring-applied Sonalan was reported to give excellent weed control by 29% of MN, 26% of ND and 34% of SD respondents. It was reported to give good weed control by 48% of MN, 50% of ND and 32% of SD respondents (Table 37).

Grass weeds were the targeted weeds for fall-applied trifluralin use by 82% of ND respondents and grass and broadleaf weeds by 18% (Table 50). Fall-applied trifluralin was ground-applied by 100% of ND respondents (Table 51).

Fall-applied trifluralin was used at 0.5 lb ai/A by 20% of ND respondents, at 0.75 lb ai/A by 7% of ND respondents and at 0.9-1.0 lb ai/A by 53% of ND respondents (Table 52). Since these are all label rates, 80% of ND respondents used fall-applied trifluralin at label rates. The remaining 20% used fall-applied trifluralin at above label rates of 1.1-2.5 lb ai/A. Fall-applied trifluralin was reported to give excellent weed control by 33% of ND respondents and good weed control by another 33% of ND respondents (Table 37).

Grass weeds were the targeted weeds for spring-applied trifluralin use by 16% of KS, 64% of MN, 83% of ND and 68% of SD respondents. Broadleaf weeds were targeted for spring-applied trifluralin use by 26% of KS, 1% of ND and 2% of SD respondents. Grass and broadleaf weeds were targeted for spring-applied trifluralin use by 58% of KS, 36% of MN, 16% of ND and 30% of SD respondents (Table 53). Spring-applied trifluralin was ground applied by 90% of KS, 100% of MN, 100% of ND and 98% of SD respondents (Table 54).

Table 51. Method of application of fall-applied trifluralin to sunflower in North Dakota in 1997.

Method of Application	North Dakota
	– % of respondents –
Ground	100.0
Air	0.0

Table 49. Spring-applied Sonalan rates used on sunflower in 1997[a].

	Minnesota	North Dakota	South Dakota
lb ai/A	------ % respondents using rate ------		
0.19-0.54	5.3	0.9	4.2
0.55-0.74[b]	5.3	3.6	0.0
0.75-0.99[b]	47.5	36.7	58.4
1.00-1.25[b]	37.0	54.9	33.4
1.26-1.49	0.0	2.8	0.0
1.50	0.0	0.9	0.0
2.63-3.75	5.3	0.0	4.2

[a] Insufficent data from Kansas.

[b] Label rates (1.15-1.25 for foxtail only).

Table 52. Fall-applied trifluralin rates used on sunflower in North Dakota in 1997.

lb ai/A	% respondents using rate
0.5[a]	20.0
0.75[a]	6.7
0.9-1.0[a]	46.7
1.1-1.2	13.4
2.0	6.7
2.5	6.7

[a] Label rates.

Table 50. Weed species targeted by fall-applied trifluralin used on sunflower in North Dakota in 1997.

Weed Species	% responding to question
Grass	81.8
Grass and Broadleaf	18.2

Table 53. Weed species targeted by spring-applied trifluralin used on sunflower in 1997.

Weed Species	Kansas	Minnesota	North Dakota	South Dakota
	--------- % responding to question ---------			
Grass	15.8	64.3	82.6	68.4
Broadleaf	26.3	0.0	1.4	1.8
Grass and Broadleaf	57.9	35.7	15.9	29.8

Spring-applied trifluralin was used at 0.50-0.80 lb ai/A by 53% of KS, 37% of MN, 29% of ND and 9% of SD respondents. It was applied at 0.81-1.00 lb ai/A by 47% of KS, 63% of MN, 61% of ND and 83% of SD respondents (Table 55). Since both rates are label rates, 100% of KS, 100% of MN, 90% of ND and 92% of SD respondents used label rates. Above label rates of 1.01-16.00 lb ai/A were used by 9% of ND and 7% of SD respondents. The reported rate of 16 lb ai/A may represent an entry error by the respondent.

Spring-applied trifluralin was reported to give excellent weed control by 24% of KS, 19% of MN, 17% of ND and 25% of SD respondents. It was reported to give good weed control by 52% of KS, 44% of MN, 40% of ND and 34% of SD respondents (Table 37). Spring-applied trifluralin provided only fair weed control for 38% of MN, 30% of ND and 28% of SD respondents.

Row-crop cultivation was used on 41% of KS, 78% of MN, 64% of ND and 48% of SD respondents' acres. Rotary hoe was used on 2% of KS, 4% of MN, 3% of ND and 3% of SD respondents's acres (Table 56). Most respondents used a single cultivation: 93% of KS, 55% of MN, 85% of ND and 77% of SD respondents; two row-crop cultivations were used by 7% of KS, 39% of MN, 13% of ND and 22% of SD respondents (Table 57). Rotary hoe was used in a single cultivation by 100% of KS, MN and ND respondents, and by 86% of SD respondents who answered the question.

Disease Problems

Phoma black stem was the worst disease problem for KS respondents. Sclerotinia head rot was the worst disease problem for MN and ND respondents and downy mildew was the worst disease problem for SD respondents. Phoma black stem was the worst disease problem on 26% of KS, 10% of MN, 14% of ND and 7% of SD respondents' acres. Sclerotinia head rot was the worst disease problem on 10% of KS, 36% of MN, 27% of ND and 11% of SD respondents' acres (Table 58). The percent of respondents' acres affected by Sclerotinia head rot was approximately half the amount reported for each state in 1994 (4). Downy mildew was the worst disease problem in 1997 on 2% of KS, 1% of MN, 2% of ND and 22% of SD respondents' acres. Phomopsis was the worst disease problem on 25% of MN respondents' acres and of little consequence for respondents in other states. Rhizopus head rot was the worst disease problem on 13% of KS, 1% of MN, 1% of ND and 1% of SD respondents' acres.

Table 54. Method of application of spring-applied trifluralin to sunflower in 1997.

Method of Application	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents			
Ground	90.0	100.0	100.0	98.4
Air	10.0	0.0	0.0	1.6

Table 55. Spring-applied trifluralin rates used on sunflower in 1997.

	Kansas	Minnesota	North Dakota	South Dakota
lb ai/A	% respondents using rate			
0.25	0.0	0.0	1.3	0.0
0.5-0.74[a]	13.4	18.9	7.9	2.4
0.75-0.80[a]	40.0	18.8	21.1	7.1
0.81-1.00[a]	46.7	62.5	60.5	83.4
1.01-1.24	0.0	0.0	5.2	0.0
1.5-2.5	0.0	0.0	3.9	4.8
16.0	0.0	0.0	0.0	2.4

[a] Label rates.

Table 56. Acres cultivated in 1997.

	Row Crop Cultivation		Rotary Hoe	
State	Acres treated	% respondents' acres	Acres treated	% respondents' acres
Kansas	10,102	41.0	368	1.5
Minnesota	17,656	78.0	900	4.0
North Dakota	59,363	63.9	2,334	2.5
South Dakota	36,970	48.4	2,198	2.9

Table 57. Number of cultivations used on sunflower in 1997.

	Number of Row Crop Cultivations			Number of Rotary Hoe Cultivations	
State	1	2	3	1	2
	% of respondents[a]				
Kansas	93.2	6.8	0.0	100.0	0.0
Minnesota	55.2	38.8	6.0	100.0	0.0
North Dakota	85.1	13.3	1.6	100.0	0.0
South Dakota	77.3	21.6	1.0	85.7	14.3

[a] Percent of respondents who answered question.

Table 58. Worst disease problem in 1997.

Disease	Kansas		Minnesota		North Dakota		South Dakota	
	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							
Charcoal Rot	2.6	8.5	0	1.1	0	2.7	1.9	2.1
Downy Mildew	2.3	3.5	0.7	11.6	2.3	10.8	21.8	23.3
Phoma Black Stem	25.5	32.5	10.0	26.2	13.6	35.9	7.4	15.9
Phomopsis	0	0.3	25.4	35.5	0.9	3.6	0	6.9
Rizopus Head Rot	12.8	43.6	1.3	8.3	0.6	2.0	1.2	1.9
Rust	4.7	33.2	1.1	1.1	4.3	8.0	0.7	4.3
Sclerotinia Head Rot	10.1	17.7	36.2	70.0	27.1	56.1	11.4	43.6
Sclerotinia Wilt	0.2	0.2	10.5	48.5	21.8	50.4	9.3	39.9
White Rust	0	0.5	0	1.0	0	1.2	0.2	2.4
None	28.7	28.7	4.3	4.3	21.8	21.8	33.5	33.5

Rhizopus head rot was one of the three the worst disease problems on 44% of KS, 8% of MN, 2% of ND and 2% of SD respondents' acres. Phoma black stem was one of the three worst diseases on 33% of KS, 26% of MN, 36% of ND and 16% of SD respondents' acres. Sclerotinia head rot was one of the three worst diseases on 18% of KS, 70% of MN, 56% of ND and 44% of SD respondents' acres. Sclerotinia wilt was one of the three worst diseases on 0.2% of KS, 49% of MN, 50% of ND and 40% of SD respondents' acres. Phomopsis was one of the three worst disease problems on 0.3% of KS, 46% of MN, 4% of ND and 7% SD respondents' acres. Downy mildew was one of the three worst disease problems on 4% of KS, 12% of MN, 11% of ND and 23% of SD respondents' acres (Table 58).

Most respondents reported less than 10% lodging due to Sclerotinia. Sclerotinia-induced lodging of 11-20% was reported by 29% of KS, 16% of MN, 18% of ND and 20% of SD respondents. Sclerotinia-induced lodging of 21-40% was reported by 11% of MN, 8% of ND and 20% of SD respondents; and 41-90% was reported by 3% of MN and 4% of ND respondents (Table 59).

Many respondents reported less than 10% Sclerotinia head rot. Sclerotinia head rot of 11-20% was reported by 19% of MN, 9% of ND and 23% of SD respondents. Head rot of 21-30% was reported by 18% of KS, 9% of MN and 6% of ND respondents. Head rot of 31-90% was reported by 18% of KS, 6% of MN, 4% of ND and 5% of SD respondents (Table 60).

Many respondents reported less than 10% lodging due to Phoma black stem. Phoma-induced lodging of 11-20% was reported by 25% of KS, 25% of MN, 8% of ND and 8% of SD respondents who answered the question. Phoma-induced lodging of 21-40% was reported by 25% of KS, 11% of MN, 14% of ND and 8% of SD respondents. Phoma-induced lodging of 41-70% was reported by 18% of MN, 3% of ND and 8% of SD respondents (Table 61). Since Sclerotinia and Phoma may occur in the same field, there may be some crossover of lodging data between the two diseases. Evidently, disease-induced lodging was a common problem for sunflower producers.

Table 59. Percent lodging due to Sclerotinia in 1997.

Percent Lodging	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents' acres			
<10	71.4	70.3	69.7	60.0
11-20	28.6	16.2	18.0	20.0
21-30	0	8.1	5.6	16.0
31-40	0	2.7	2.2	4.0
41-50	0	2.7	0	0
51-60	0	0	1.1	0
61-70	0	0	1.1	0
71-80	0	0	1.1	0
81-90	0	0	1.1	0

Table 60. Percent Sclerotinia head rot in 1997.

Percent Sclerotinia Head Rot	Kansas	Minnesota	North Dakota	South Dakota
	% respondents			
<10	63.6	65.6	80.9	72.7
11-20	0	18.8	8.8	22.7
21-30	18.2	9.4	5.9	0
31-40	9.1	0	4.4	0
41-50	0	6.3	0	4.5
51-60	0	0	0	0
61-70	0	0	0	0
71-80	0	0	0	0
81-90	9.1	0	0	0

Fungicide Use and Other Disease Management Practices

Apron-treated seed was reportedly used on 9% of KS, 56% of MN, 51% of ND and 19% of SD respondents' acres (Table 62). Since much seed is sold pretreated, it is possible that some respondents did not know if the seed had been treated. The differences reported between SD and MN and ND are noteworthy in that no seed plants are located in SD, and most seed for SD is processed in MN or ND.

Folicur was available under a specific exemption (section 18) in KS and ND for rust control. Only one response was received from each state on its use. It was reported to provide excellent control by a KS respondent (Table 63). The ND respondent who reported using Folicur reported only 1 acre, suggesting that it may have been used to protect seed increase plots.

Non-chemical disease management practices used by respondents included crop rotation, tillage and use of resistant hybrids. Crop rotation was reported as a disease management practice on 44% of KS, 82% of MN, 61% of ND and 79% of SD respondents' acres. Tillage was reportedly used as a disease management practice on 12% of KS, 33% of MN, 26% of ND and 43% of SD respondents' acres. Use of resistant hybrids was reported as a disease management practice on 1% of KS, 21% of MN, 14% of ND and 25% of SD respondents' acres (Table 64).

Respondents were asked which hybrids were affected by Sclerotinia in 1997. A long list of hybrids was cited by respondents (Table 65). It is not clear from the data whether some hybrids were more susceptible or whether they were more frequently cited because they were more frequently planted. Thus, these data must be examined cautiously.

Table 61. Percent lodging due to Phoma in 1997.

Percent Lodging	Kansas	Minnesota	North Dakota	South Dakota
	% respondents			
<10	50.0	46.4	75.7	75.0
11-20	25.0	25.0	8.1	8.3
21-30	0	3.6	8.1	8.3
31-40	25.0	7.1	5.4	0
41-50	0	3.6	0	0
51-60	0	7.1	0	0
61-70	0	7.1	2.7	8.3

Table 63. Use of Folicur[a] fungicide on sunflower in Kansas and North Dakota in 1997.

State	No. of Responses	Acres Reported	Control[b]
Kansas	1	100	E
North Dakota	1	1	—

[a] Available on a sect. 18 in Kansas and North Dakota.

[b] E=Excellent

Table 62. Acres planted to Apron-treated seed in 1997.

Kansas		Minnesota		North Dakota		South Dakota	
Acres	% Respondents' Acres	Acres	% Respondents' Acres	Acres	% Respondents' Acres	Acres	% Respondents' Acres
2,324	9.4	12,747	56.3	47,079	50.7	14,867	19.4

Table 64. Non-chemical disease management in 1997.

Disease Management Practice	Kansas		Minnesota		North Dakota		South Dakota	
	Acres	Respondents' Acres	Acres	Respondents' Acres	Acres	Respondents' Acres	Acres	Respondents' Acres
		(%)		(%)		(%)		(%)
Crop Rotation	10,789	43.8	18,457	81.5	56,870	61.2	60,639	79.3
Tillage	2,994	12.2	7,398	32.7	24,186	26.0	32,541	42.6
Resistant Hybrid	271	1.1	4,743	20.9	12,975	14.0	19,052	24.9
Other	125	0.5	0	0	0	0	0	0

Bird Damage

Bird damage was most common in ND and SD with 46% of ND and 40% of SD respondents reporting more than 5% bird damage. Bird damage of 5-10% was reported by 24% of KS, 20% of MN, 26% of ND and 25% of SD respondents. Bird damage of 10-25% was reported by 4% of KS, 9% of MN, 15% of ND and 11% of SD respondents. Bird damage of 25-100% was reported by 4% of KS, 6% of ND and 4% of SD respondents (Table 66). A greater percentage of respondents in all four states reported bird damage in the higher loss categories in 1997 than in 1994 (4).

Blackbirds were the species most frequently causing damage, as reported by 78% of KS, 87% of MN, 96% of ND and 91% of SD respondents. Sparrows were the second most frequently reported bird species, cited by 15% of KS, 6% of MN, 4% of ND and 6% of SD respondents (Table 67). These data are similar to those for 1994 (4).

ND respondents spent the most on bird control: $13,129 for shotgun shells, $5,115 for exploders, $4,985 for gasoline, $5,150 for cattail control and 3,198 hours for bird control (Table 68). If hourly costs are calculated at $5.75/hr, the cost in time represents $18,389, and total costs were $46,768 for all 261 ND respondents. However, not all respondents answered this question, so costs per respondent answering the question are shown in Table 69. Each respondent who answered the question spent $515 for cattail control, $171 for exploders, $134 for shells, $87 for gasoline and 37 hours ($213).

SD respondents made the next largest expenditure on bird control: $6,560 for exploders, $3,322 for shotgun shells, $1,435 for gasoline and 2,787 hours for bird control (Table 68). Calculating $5.75/hr for bird control,

Table 65. Hybrids affected by Sclerotinia in 1997.

Hybrid	Kansas	Minnesota	North Dakota	South Dakota
	% respondents[a]			
Agway	0	4.5	0	0
Agway 3133	0	4.5	0	0
Agway 3733	0	0	5.4	0
Cargill	0	4.5	8.1	21.4
Cargill 187	0	0	0	28.6
Cargill 270	0	18.2	24.3	7.1
Cenex LOL	0	4.5	0	0
Croplan 83	0	4.5	0	0
Dekalb 3790	0	0	2.7	0
Dekalb 3868	0	0	2.7	0
Dekalb 3881	0	0	0	7.1
Interstate 3137	0	0	8.1	0
Interstate 5077	0	9.1	0	0
Interstate 5757	0	0	2.7	0
Interstate 6111	0	9.1	0	0
Kaystar	0	0	0	7.1
Mallard	0	4.5	2.7	0
Mycogen	0	0	5.4	0
Mycogen Capri	0	0	2.7	0
Mycogen High Ol	0	0	0	7.1
Mycogen 452	0	4.5	0	0
Mycogen 458	0	0	2.7	0
Mycogen 848	0	0	0	7.1
Mycogen 858	0	0	5.4	0
Mycogen 870	25.0	0	0	0
Mycogen 956	25.0	0	0	0
Mycogen 9338	0	0	8.1	0
NK 232	0	4.5	0	0
Novartis 259	0	0	0	7.1
Pioneer	0	9.1	8.1	0
Pioneer 6300	0	0	5.4	0
Pioneer 6339	0	9.1	0	0
Pioneer 6340	0	0	2.7	0
Pioneer 6451	0	0	0	7.1
Sigco 828	0	4.5	0	0
Trison 846	0	0	2.7	0
Triumph 520	50.0	0	0	0

[a] Percent of respondents answering question.

Table 66. Estimated sunflower yield loss due to bird damage in 1997.

Bird Damage	Kansas	Minnesota	North Dakota	South Dakota
% yield loss	% of respondents			
0-5	68.0	71.2	54.0	60.0
5-10	24.0	20.3	25.5	25.0
10-25	4.0	8.5	14.9	10.7
25-50	4.0	0	4.7	2.1
50-100	0	0	0.9	2.1

Table 67. Bird species causing sunflower yield loss in 1997.

Bird Species	Kansas	Minnesota	North Dakota	South Dakota
	% of respondents[a]			
Blackbirds	78.0	86.8	95.7	90.5
Sparrows	15.3	5.7	3.8	5.6
Other	6.8	7.5	0.5	4.0

[a] Percent of those respondents who answered this question.

Table 68. Bird control costs in 1997.

Control Method	Kansas	Minnesota	North Dakota	South Dakota
	amount spent by all respondents[a]			
Cattails	$0	$0	$5,150	$0
Exploder	$0	$10	$5,115	$6,560
Gasoline	$0	$20	$4,985	$1,435
Shells	$95	$970	$13,129	$3,322
Hours	3	5	3,198	2,787

[a] Respondents answering question.

the hourly cost was $16,025 and total costs for all 163 SD respondents were $27,342. Costs for each SD respondent who answered the question were $547 for exploders, $104 for shotgun shells, $110 for gasoline and 111 hours ($638), as shown in Table 69.

MN respondents reported expenditures of $970 for shotgun shells, $20 for gasoline, $10 for exploders and 5 hours for bird control (Table 68). Total costs for all 83 MN respondents, including $29 for hours spent, were $1,029. Costs per respondent who answered the question were $162 for shotgun shells, $20 for gasonline, $10 for exploders and 17 hours ($98), as shown in Table 69.

KS respondents reported expenditures of $95 for shotgun shells and 3 hours for bird control (Table 68). Total costs for all 103 KS respondents, including $17 for hours spent, were $112. Costs per respondent who answered the question were $48 for shotgun shells and 3 hours ($17), as shown in Table 69.

Table 69. Bird control costs per respondent in 1997.

Control Method	Kansas	Minnesota	North Dakota	South Dakota
	amount spent per respondent			
Cattails	$0	$0	$515	$0
Exploder	$0	$10	$171	$547
Gasoline	$0	$20	$87	$110
Shells	$48	$162	$134	$104
Hours	3	17	37	111

Bird control costs per respondent answering the question were slightly higher in ND and SD in 1997 than in 1994. They were lower in MN in 1997 than in 1994, and about the same both years in KS (4).

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