Extension Report No. 9

1990 Sunflower Grower Survey of Pest Problems and Pesticide Use in North Dakota

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Procedures

This is the first survey of North Dakota sunflower grower pest problems and pesticide use. A single page survey form was designed with questions on pest problems, pesticide use, and alternative or non-chemical control practices (Figure 1). Every third name was selected from a grower mailing list of over 12,000 North Dakota sunflower growers. Survey forms were mailed on November 9, 1990 to 4,288 sunflower growers. A self-addressed stamped envelope was enclosed for returning the survey form. The survey asked respondents to identify: county where sunflowers grown; acres of oilseed and/or confection hybrids planted; major production problems encountered; major insect, disease and weed problems; percent bird damage; pesticides used; injury and control from the use of herbicides; and use of integrated pest management (IPM) and other alternative pest control techniques.

Identification of counties where production occurred was used to apportion the data among the nine reporting districts of the North Dakota Agricultural Statistics Service (1), as shown in Figure 2.

Results

Approximately one fourth (1,015) of the mailed forms were returned. Of those returned, 363 had no data; the other 652, or 15%, had useable data. These 652 growers planted 189,204 acres, which is 14% of the total of 1,370,000 acres planted in North Dakota (1). Respondents planted 122,636 acres of oilseed hybrids, or 13% of the 980,000 acres planted statewide, and 66,568 acres of confection hybrids, or 17% of the 390,000 acres planted statewide.

Counties Leading in Sunflower Acreage. The eight leading counties among the respondents and the percent of respondents' acres planted in each were: Stutsman, 12%; Barnes, 9%; Wells, 6%; LaMoure, 6%; Cass, 6%; Foster, 5%; Ransom, 5%; and Benson, 5%. These eight counties accounted for 53% of the total acres planted by respondents (Table 1).

Production Problems. Insects were the worst production problem for 23% of respondents, diseases for 19%, weather for 17%, bird damage for 16%, and weeds for 12% (Table 2). No differences were reported

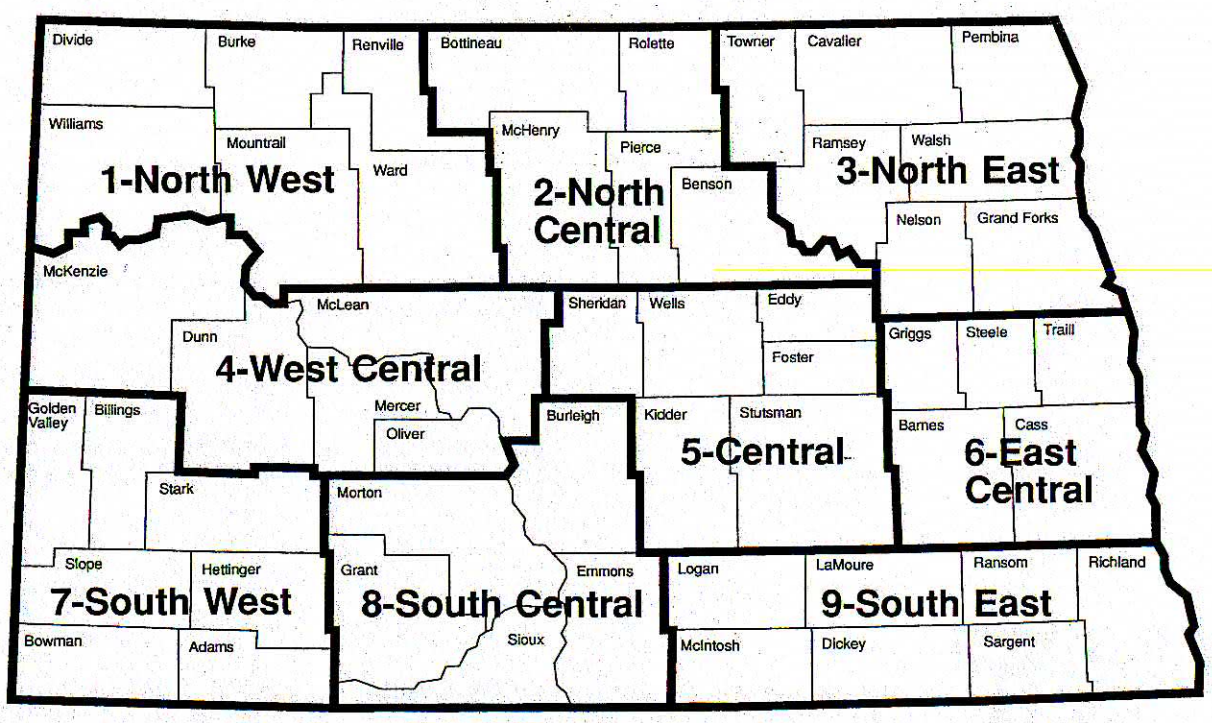

Figure 2. Crop reporting districts of the North Dakota Agricultural Statistics Service.

PLEASE CIRCLE OR FILL IN THE REQUESTED INFORMATION ON PEST PROBLEMS AND PESTICIDE USE ON YOUR 1990 SUNFLOWER CROP.

Total acres planted in 1990 _____
Total acres harvested _____
Acres planted to oilseed hybrids _____
Acres planted to confection hybrids _____

County where grown _____ Acres _____

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

GREATEST PRODUCTION PROBLEM IN SUNFLOWER IN 1990 (circle one):
None
Weeds
Emergence/Stand
Insects
Diseases
Herbicide drift
Bird damage
Other (specify) _____

WORST DISEASE PROBLEMS IN 1990 (RANK 1-3, 1 = WORST)
___None
___Sclerotinia wilt
___Sclerotinia head rot
___Rust
___Phoma black stem
___Downy mildew
___Other (specify) _____

WORST WEED PROBLEMS IN 1990 (RANK 1-3, 1 = WORST)
____None
____Kochia
____Russian thistle
____Foxtail (Pigeon grass)
____Wild buckwheat
____Wild mustard
____Redroot pigweed
____Wild oats
____Other (specify) _____

WORST INSECT PROBLEMS IN 1990 (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 1990:

Insecticide	No. Acres Treated	No. of Sprays
ethyl parathion		
methyl parathion		
6-3 parathion		
Asana XL		
Lorsban 4E		
Furadan 4F		
Sevin XLR plus		
Furadan 15G		
Lindane/Maneb (seed treatment)		
None used (list acres)		
Other (specify)		

BIRD PROBLEMS AND LOSSES:
Mark which best fits (% yield loss)
___0-5%
___5-10%
___10-25%
___25-50%
___50-100%

FUNGICIDES USED ON SUNFLOWER IN 1990:

Fungicide	No. Acres Treated	No. of Sprays
Dithane		
Apron (seed treatment)		
None used (list acres)		
Other (specify)		

EVALUATE WEED CONTROL AND SUNFLOWER INJURY
Mark weed control used and indicate acres treated for each item. Count double application, double cultivation, etc., as double acres.

WEED CONTROL: 1=Excellent 2=Good 3=Fair 4=Poor
SUNFLOWER INJURY: 1=None 2=Slight 3=Moderate 4=Severe

Weed control used	Acres treated	Weed control	Sunflower injury
1. Roundup (Preplant)		1 2 3 4	1 2 3 4
2. Eptam/Genep (fall)		1 2 3 4	1 2 3 4
3. Eptam/Genep (spring)		1 2 3 4	1 2 3 4
4. Sonalan		1 2 3 4	1 2 3 4
5. Sonalan + Eptam/Genep		1 2 3 4	1 2 3 4
6. Prowl (fall)		1 2 3 4	1 2 3 4
7. Prowl (spring)		1 2 3 4	1 2 3 4
8. Treflan (fall)		1 2 3 4	1 2 3 4
9. Treflan (spring)		1 2 3 4	1 2 3 4
10. Treflan + Eptam/Genep		1 2 3 4	1 2 3 4
11. Lasso		1 2 3 4	1 2 3 4
12. Poast		1 2 3 4	1 2 3 4
13. Assert		1 2 3 4	1 2 3 4
14. Gramoxone Extra		1 2 3 4	1 2 3 4
15. Leafex-3/Defol		1 2 3 4	1 2 3 4
16. No herbicide used		1 2 3 4	1 2 3 4
17. Cultivation		1 2 3 4	1 2 3 4
18. Hand weeding		1 2 3 4	1 2 3 4
19. Others (specify)		1 2 3 4	1 2 3 4
		1 2 3 4	1 2 3 4
		1 2 3 4	1 2 3 4

INTEGRATED PEST MANAGEMENT
Did you hire a consultant to scout sunflower? ___yes ___no
If yes, how many acres? _____
If yes, estimate economic return from using consultant:
___$20 + /acre
___$15-20/acre
___$10-15/acre
___$5-10/acre
___$0-5/acre
___$0
___other

Practices other than pesticides:
Crop rotation ____acres
Preceding crop _____
How long since previous sunflower? _____
Cultivation _____(No. of times)
Resistant Variety _____acres
Other (specify) _____acres

Results of survey will be published in *The Sunflower*
Thank you. Please return by November 25, 1990

Arthur Lamey
Extension Plant Pathologist

OTHER COMMENTS:

Figure 1. The survey form.

between oilseed and confection hybrids with regard to problems experienced, except that fewer disease problems were reported for oilseed than for confection hybrids. Worst production problems varied somewhat among the districts. The West Central and North West had more insect problems than other areas. By contrast, disease was more common in the North East and East Central districts (Table 3).

Table 1. Ranking of counties according to acres planted by respondents in 1990.

County	% of Respondents' Acres[a]	County	% of Respondents' Acres
Stutsman	11.7[b]	McLean	2.0
Barnes	8.8[b]	Eddy	1.9
Wells	6.2[b]	Ward	1.9
LaMoure	6.1[b]	Steele	1.7
Cass	5.6[b]	McHenry	1.7
Foster	4.8[b]	Bottineau	1.5
Ransom	4.8[b]	Dickey	1.5
Benson	4.5[b]	Grant	1.5
Ramsey	3.9	Morton	1.4
Pierce	3.0	Renville	1.3
Nelson	2.8	Towner	1.3
Cavalier	2.8	Griggs	1.2
Grand Forks	2.2	All others, and	
Sargent	2.1	no response	11.8

[a]Total acres planted by respondents=189,204
[b]Top 8 counties account for 52.5% of acres planted by respondents.

Insect Problems and Insecticide Use. Seed weevil was reported to be the No. 1 insect problem by 52% of respondents (Table 4). A higher percentage of confection growers, 66%, considered seed weevil to be the worst insect problem, as compared to 49% of oilseed growers. When the frequencies with which seed weevil was ranked No. 1, No. 2, and No. 3 were combined, seed weevil was reported to be one of the three worst insect problems by 76% of all respondents, 86% of confection growers and 74% of oilseed growers. Grasshoppers were cited as the worst insect problem by 25% of all respondents, 26% of oilseed growers and 19% of confection growers. Grasshoppers were one of the three worst insect problems for 61% of all respondents. Stem weevil was the third most commonly cited problem; it was the worst insect problem for 10% of all

Table 2. Worst sunflower production problem in 1990.

Problem	Oil Seed	Confection	All Sunflower
	- - - - % of respondents - - - -		
Insects	22.1	22.9	22.6
Diseases	18.6	21.5	19.3
Weather	18.1	15.2	16.6
Bird Damage	16.9	15.7	16.3
Weeds	12.4	10.8	12.0
Emergence/Stand	4.1	6.7	4.9
Other	1.2	2.2	1.8
None	6.6	4.9	6.5

Table 3. Worst production problem in 1990, as ranked by respondents in each district.[a]

Problem	State-wide	North West	North Central	North East	West Central	Central	East Central	South[b] West	South[b] Central	South East
	- % of respondents -									
Insects	22.6	29.7	26.4	12.1	54.2	27.1	16.9	60.0	13.3	21.8
Diseases	19.3	8.1	15.3	25.0	-	18.6	24.2	-	6.7	21.8
Weather	16.6	24.3	20.8	22.6	29.2	9.3	11.3	20.0	53.3	11.5
Bird Damage	16.3	-	16.7	11.3	4.2	26.4	15.3	-	13.3	20.7
Weeds	12.0	29.7	15.3	15.3	4.2	7.8	10.5	20.0	13.3	6.9
Emergence/Stand	4.9	-	4.2	2.4	8.3	4.7	6.5	-	-	10.3
Other	1.8	5.4	-	4.8	-	1.6	0.8	-	-	-
None	6.5	2.7	1.4	6.5	-	4.7	14.5	-	-	6.9

[a]Districts as defined by the North Dakota Agricultural Statistical Service.
[b]Less than 20 respondents

respondents and one of the three worst insect problems for 39% of all respondents. Stem weevil was more frequently cited as the worst insect problem by oilseed growers (11%) than by confection growers (3%). No major insect problem was reported by 8% of respondents. Any other insect listed was of major importance to less than 2% of respondents.

Respondents in all districts ranked the seed weevil as the worst insect problem (Table 5). However, grasshoppers were considered to be nearly as great a problem as the seed weevil in the North East. Stem weevils were considered to be fairly important in the West Central, South Central and South East districts. The seed weevil was also ranked as one of the three worst insect problems by growers in all districts but the North East, where grasshoppers were listed as one of the three worst insect problems (Table 6). Grasshoppers were almost as frequently listed as one of the worst three insect problems as seed weevils in the North Central district. Stem weevils were also considered to be very important insect pests in the West Central, South West, and South Central districts.

Table 4. Worst insect problem in 1990

Insect	All Sunflower		Oil Seed		Confection	
	No. 1 Problem	No. 1,2, or 3 Problem	No. 1 Problem	No. 1,2, or 3 Problem	No. 1 Problem	No. 1,2, or 3 Problem
	% of respondents					
Seed weevil	51.8	75.7	48.8	74.1	65.6	85.5
Grasshopper	25.0	61.3	26.3	61.8	18.9	57.3
Stem weevil	9.6	39.1	11.3	43.2	3.1	32.2
Sunflower beetle	1.9	13.2	1.5	11.1	3.1	17.6
Sunflower head moth	1.6	5.5	1.2	5.4	2.2	6.6
Cutworm	1.4	3.6	1.7	3.6	1.3	4.4
Sunflower midge	0.6	3.1	0.8	3.3	0.4	3.1
Banded sunflower moth	0.3	1.6	0.2	1.2	0.4	2.6
None	7.7	7.7	8.3	8.3	4.8	4.8

Table 5. Worst insect problem in 1990, as ranked by respondents in each district.[a]

Insect	State-Wide	North West	North Central	North East	West Central	Central	East Central[b]	South West[b]	South Central	South East
	% of respondents									
Seed weevil	51.8	60.5	43.1	38.0	58.3	51.5	53.2	80.0	66.7	70.1
Grasshopper	25.0	23.7	36.1	37.2	20.8	26.2	22.6	20.0	6.7	3.4
Stem weevil	9.6	-	13.9	3.9	20.8	9.2	8.1	-	20.0	17.2
Sunflower beetle	1.9	-	1.4	6.2	-	0.8	0.8	-	-	-
Sunflower head moth	1.6	2.6	2.8	1.6	-	1.5	1.6	-	-	-
Cutworm	1.4	2.6	1.4	-	-	2.3	0.8	-	-	3.4
Sunflower midge	0.6	-	1.4	1.6	-	-	0.8	-	-	-
Banded sunflower moth	0.3	-	-	-	-	0.8	0.8	-	-	-
None	7.7	10.5	-	11.6	-	7.7	11.3	-	6.7	5.7

[a]Districts as defined by the North Dakota Agricultural Statistical Service.
[b]Less than 20 respondents

Table 6. Insects ranked as one of three worst insect problems in 1990, according to respondents in each district.[a]

Insect	State-Wide	North West	North Central	North East	West Central	Central	East Central	South West[b]	South Central[b]	South East
	% of respondents									
Seed weevil	75.7	78.9	76.4	61.2	83.3	78.5	72.6	100.0	93.3	88.5
Grasshopper	61.3	52.6	75.0	65.1	83.3	67.7	71.8	40.0	66.7	37.9
Stem weevil	39.1	44.7	40.3	14.0	70.8	45.4	36.3	60.0	66.7	55.2
Sunflower beetle	13.2	13.2	18.1	26.4	4.2	12.3	8.1	-	-	3.4
Sunflower head moth	5.5	5.3	8.3	6.2	-	6.2	5.6	-	-	2.3
Cutworm	3.6	2.6	6.9	-	-	6.2	1.6	-	6.7	6.9
Sunflower midge	3.1	2.6	4.2	3.1	-	-	4.8	-	-	4.6
Banded sunflower moth	1.6	-	-	2.3	-	2.3	1.6	-	-	1.1
None	7.7	10.5	-	11.6	-	7.7	11.3	-	6.7	5.7

[a]Districts as defined by the North Dakota Agricultural Statistical Service.
[b]Less than 20 respondents

Parathion was the most commonly used insecticide. When data for all types of parathion (methyl, 6-3, and ethyl) were combined, parathion was sprayed on 64% of respondents' acres (Table 7). A greater percentage of confection acres than oilseed acres was sprayed with insecticide. Asana XL was the second most commonly used insecticide, applied on 15% of respondents' acres, followed by Furadan (15G and 4F), applied on 7% of respondents' acres. Less than 2% of respondents' acres were treated with any other insecticide.

Respondents did not treat 29% of their oilseed acres or 9% of their confection acres.

Disease Problems and Fungicide Use. Sclerotinia wilt was the worst disease problem for 35% of respondents and it was one of the three worst disease problems for 49% of respondents (Table 8). No disease problem was reported by 32% of respondents. Phoma black stem was cited as the worst disease problem by 13% of respondents and as one of the three worst disease problems by 27% of respondents. Sclerotinia head rot, downy mildew and rust were also mentioned frequently as major disease problems; they were cited as one of the three worst disease problems by 27%, 17% and 21% of respondents respectively. Most disease problems were equally prevalent on both oilseed and confection hybrids; however, Phoma black stem was cited as the worst disease problem affecting oilseed hybrids by 15% of respondents and for confection hybrids by only 10% of respondents. Rust was more frequently cited as the worst or one of the three worst disease problems affecting confection hybrids (12% and 37% of respondents) than for oilseed hybrids (3% and 17% of respondents).

Table 7. Insecticide use on sunflower in 1990.

Insecticide	All Sunflower	Oil Seed	Confection
	% of respondents' acres		
Methyl parathion	34.9	35.0	70.3
6-3 parathion	16.9	15.1	41.1
Asana XL	14.1	18.8	23.8
Ethyl parathion	12.3	13.7	26.7
Furadan 15G	4.1	4.6	5.9
Furadan 4F	2.4	3.0	4.1
Lindane/maneb	1.4	2.0	0.9
Others	0.9	1.2	1.0
Sevin XLR Plus	0.9	1.3	0.7
Lorban 4E	0.3	0.2	0.8
None used	21.1	29.4	9.3
Total parathion	64.1	63.8	138.1
Total Furadan	6.5	7.6	10.0

Sclerotinia wilt was most frequently ranked as the worst disease problem by respondents in most cropping districts, but it was more frequently cited as a problem in the North East, Central, and East Central

districts (Table 9). Sclerotinia wilt was also cited as one of the three worst disease problems by respondents in many cropping districts, but Phoma black stem and Sclerotinia head rot also were frequently cited (Table 10). Phoma black stem was cited as one of the three worst disease problems by over 30% of respondents in the North Central and Central districts.

The most frequently used fungicide was Apron seed treatment, used on 49% of all respondents' acres (Table 11). Dithane fungicide was used for rust control on 1% of all of respondents' acres; however it was used on only 0.3% of respondents' oilseed acres and on 3.3% of respondents' confection acres.

Bird Damage. Approximately two-thirds of all respondents estimated that they had 0-5% loss from birds; the other one-third had more than 5% as follows: 19% claimed losses of 5-10% and 14% estimated losses to be greater than 10% (Table 12). Bird losses appeared to be higher than the statewide average in the North Central and Central cropping districts, where over 22% of respondents reported losses in excess of 10% (Table 13). Bird losses were approximately the same in oilseed and confection hybrids.

Table 8. Worst disease problem in 1990.

Disease	All Sunflower		Oil Seed		Confection	
	No. 1 Problem	No. 1,2, or 3 Problem	No. 1 Problem	No. 1,2, or 3 Problem	No. 1 Problem	No. 1,2, or 3 Problem
	% of respondents					
Sclerotinia wilt	34.8	49.3	32.5	47.1	43.3	58.7
Phoma black stem	13.1	26.5	15.4	28.1	9.6	30.3
Sclerotinia head rot	7.5	26.6	8.1	27.3	6.3	27.9
Downy mildew	6.3	16.6	6.3	16.0	5.3	15.4
Rust	5.8	20.6	3.3	16.7	12.0	37.0
Other	0.9	1.5	1.0	1.9	0.5	1.0
None	31.6	31.6	33.3	33.3	23.1	23.1
Sclerotinia TOTAL	42.3	75.9	40.6	74.4	49.6	86.6

Table 9. Worst disease problem in 1990, as ranked by repondents in each district.[a]

Disease	State-Wide	North West	North Central	North East	West Central	Central	East Central	South West[b]	South Central[b]	South East
	% of respondents									
Sclerotinia wilt	34.8	16.1	28.4	40.8	10.0	41.0	40.5	20.0	-	32.5
Phoma black stem	13.1	9.7	20.9	4.2	10.0	19.7	5.0	-	15.4	23.4
Sclerotinia head rot	7.5	6.5	6.0	10.0	-	6.6	8.3	-	15.4	6.5
Downy mildew	6.3	-	6.0	9.2	-	6.6	7.4	-	7.7	5.2
Rust	5.8	3.2	7.5	10.8	5.0	3.3	5.8	-	-	3.9
Other	0.9	-	-	-	5.0	0.8	0.8	-	-	2.6
None	31.6	64.5	31.3	25.0	70.0	22.1	32.2	80.0	61.5	26.0
Sclerotina TOTAL	42.3	22.6	34.4	50.8	10.0	47.6	48.8	20.0	15.4	39.0

[a]Districts as defined by the North Dakota Agricultural Statistics Service.
[b]Less than 20 respondents

Table 10. Diseases ranked as one of three worst disease problems in 1990, according to respondents in each district.[a]

Disease	State-Wide	North West	North Central	North East	West Central	Central	East Central	South West[b]	South Central[b]	South East
	% of respondents									
Sclerotinia wilt	49.3	16.1	47.8	55.0	10.0	60.7	50.4	20.0	23.1	50.6
Phoma black stem	26.5	25.8	31.3	15.8	20.0	35.2	18.2	20.0	15.4	40.3
Sclerotinia head rot	26.6	22.6	16.4	25.0	10.0	30.3	30.6	-	30.8	30.0
Downy mildew	16.6	6.5	20.9	20.0	5.0	17.6	16.5	-	15.4	15.6
Rust	20.6	9.7	19.4	37.5	10.0	15.6	18.2	-	-	16.9
Other	1.5	-	-	0.8	5.0	2.5	1.7	-	-	2.6
None	31.6	64.5	31.3	25.0	70.0	22.1	32.2	80.0	61.5	26.0
Sclerotinia TOTAL:	75.9	38.7	64.2	80.0	20.0	91.0	81.0	20.0	53.9	80.6

[a]Districts as defined by the North Dakota Agricultural Statistics Service
[b]Less than 20 repondents

Table 11. Fungicide use on sunflower in 1990.

Fungicide	All Sunflower	Oil Seed	Confection
	% of respondents' acres		
Apron (seed treatment)	48.5	60.5	64.8
Dithane	1.3	0.3	3.3
Others	1.0	1.1	1.6
None	32.1	41.2	38.2

Table 12. Crop loss due to bird damage in 1990.

% Loss	All Sunflower	Oil Seed	Confection
	% of respondents		
0-5	66.3	65.4	65.2
5-10	19.3	19.7	20.1
10-25	10.2	10.5	10.3
25-50	3.5	3.5	4.5
50-100	0.2	0.8	-

Table 13. Crop loss due to bird damage in 1990, according to respondents in each district.[a]

% Loss	State-Wide	North West	North Central	North East	West Central	Central	East Central	South West[b]	South Central[b]	South East
	% of respondents									
0-5	66.3	73.7	50.7	79.2	73.9	53.5	75.4	40.0	61.5	60.9
5-10	19.3	13.2	26.8	16.0	26.1	22.8	15.1	60.0	23.1	19.5
10-25	10.2	7.9	16.9	4.0	-	15.0	7.1	-	15.4	13.8
25-50	3.5	5.3	2.8	0.8	-	7.9	2.4	-	-	4.6
50-100	0.2	-	2.8	-	-	0.8	-	-	-	1.1

[a]Districts as defined by the North Dakota Agricultural Statistics Service.
[b]Less than 20 respondents

Weed Problems and Herbicide Use. The four worst weed problems listed in order of severity were kochia, foxtail (pigeongrass), Russian thistle and wild mustard. Kochia was cited as the worst weed problem by 42% of respondents and as one of the three worst weed problems by 66% of respondents (Table 14). Foxtail was cited as the worst weed problem by 17% of respondents and one of the three worst weed problems by 41% of respondents. Russian thistle was cited as the worst weed problem by 9% of respondents and as one of the three worst weed problems by 30% of respondents. Wild mustard was cited as the worst weed problem by 6% of respondents and as one of the three worst weed problems by 21% of respondents. Most other weeds were cited by only a small percentage of respondents. Growers of both oilseed and confection hybrids ranked the weeds in the same order of importance.

Kochia was more frequently cited as the worst weed problem by respondents in the North Central and West Central districts, where it was cited by over 50% of respondents (Table 15). Russian thistle was cited as

Table 14. Worst weed problem in 1990.

Weed	All Sunflower		Oil Seed		Confection	
	No. 1 Problem	No. 1,2, or 3 Problem	No. 1 Problem	No.1,2, or 3 Problem	No. 1 Problem	No.1,2, or 3 Problem
	% of respondents					
Kochia	42.3	66.2	43.1	66.9	40.4	66.2
Foxtail (pigeongrass)	16.7	41.2	16.9	42.7	16.2	38.6
Russian thistle	9.1	30.1	9.8	30.5	6.1	28.5
Wild mustard	6.2	20.8	5.6	20.3	9.6	23.7
Others	2.5	4.5	2.4	4.5	2.6	5.3
Cocklebur	2.3	4.2	1.7	3.0	3.5	6.6
Canada thistle	2.3	3.4	2.1	3.2	4.4	6.1
Redroot pigweed	1.6	8.2	1.5	8.3	1.3	7.5
Wild oats	1.6	11.3	1.5	11.1	1.3	12.3
Wild buckwheat	0.8	3.3	0.6	3.4	0.9	3.1
None	14.6	14.6	14.7	14.7	13.6	13.6

Table 15. Worst weed problem in 1990, as ranked by respondents by district.[a]

Weed	State-Wide	North West	North Central	North East	West Central	Central	East Central	South West[b]	South Central[b]	South East
	% of respondents									
Kochia	42.3	42.5	58.1	38.3	50.0	39.1	36.5	80.0	60.0	38.2
Foxtail (pigeongrass)	16.7	15.0	16.2	8.6	25.0	16.5	22.2	-	6.7	21.3
Russian thistle	9.1	22.5	6.8	8.6	8.3	12.8	3.2	-	13.3	10.1
Wild mustard	6.2	7.5	6.8	12.5	-	2.3	7.9	-	-	2.2
Others	2.5	2.5	-	2.3	-	3.8	3.2	-	6.7	2.2
Cocklebur	2.3	-	2.7	2.3	-	5.3	1.6	-	-	1.1
Canada thistle	2.3	5.0	1.4	4.7	-	1.5	0.8	-	-	3.4
Redroot pigweed	1.6	-	-	0.8	4.2	0.8	3.2	-	-	3.4
Wild oats	1.6	2.5	2.7	3.1	-	2.3	-	-	-	-
Wild buckwheat	0.8	-	1.4	-	4.2	1.5	0.8	-	-	-
None	14.6	2.5	4.1	18.8	8.3	14.3	20.6	20.0	13.3	18.0

[a]Districts as defined by the North Dakota Agricultural Statistics Service
[b]Less than 20 respondents

the worst weed problem by 23% of respondents in the North West district, well above the statewide average of 9%. Wild mustard was a more common weed problem in the North East, where it was cited by 13% of respondents, compared to 6% of respondents in the rest of the state. Kochia was cited as one of the three worst weed problems by over 80% of respondents in the North Central, South West and South Central districts (Table 16). Russian thistle was cited as one of the three worst weed problems by over 50% of the respondents in the North West and South Central districts.

The two dinitro analine herbicides Treflan and Sonalan accounted for the majority of herbicide use on sunflower (Table 17). The combined spring and fall application of Treflan plus application of Sonalan accounted for 96% of respondents' acres. Spring-applied Treflan accounted for 51% of respondents' acres, Sonalan for 36%, and fall-applied Treflan for 9%. Weed control methods other than chemicals used by respondents included cultivation and hand weeding. Cultivation was used by 89% of respondents. Most respondents used one cultivation, but a few used more than one (see discussion under alternative control measures).

Table 17. Use of herbicides and alternative control methods in 1990.

Herbicide	All Sunflower	
	% of respondents	% of respondents' acres
Treflan (spring)	58.7	51.2
Sonalan	43.3	36.2
Treflan (fall)	11.0	9.0
Roundup (preplant)	4.6	1.2
Assert	3.2	1.1
Poast	2.9	0.6
Prowl (spring)	1.7	0.8
Lasso	0.6	0.4
Treflan + Eptam/Genep	0.5	0.2
Sonalan + Eptam/Genep	0.3	0.3
Leafex-3/Defol	0.3	0.1
TOTAL:	127.1	101.1

Other Weed Control	All Sunflower	
	% of respondents	% of respondents' acres
Cultivation	88.8	115.4
Hand weeding	0.6	0.5
Other	1.4	0.9

Table 16. Weeds ranked as one of three worst weed problems in 1990, according to respondents in each district.[a]

Weed	State-Wide	North West	North Central	North East	West Central	Central	East Central	South West[b]	South Central[b]	South East
	% of respondents									
Kochia	66.2	67.5	81.1	63.3	66.7	65.4	59.5	80.0	80.0	62.9
Foxtail (pigeongrass)	41.2	37.5	40.5	25.0	66.7	42.1	41.3	60.0	46.7	51.7
Russian thistle	30.1	52.5	35.1	28.1	29.2	31.6	15.1	20.0	53.3	36.0
Wild mustard	20.8	15.0	25.7	28.1	8.3	21.1	22.2	-	20.0	12.4
Others	4.5	12.5	1.4	3.9	-	6.8	3.2	-	6.7	4.5
Cocklebur	4.2	-	2.7	5.5	-	8.2	4.0	-	-	2.2
Canada thistle	3.4	5.0	4.1	7.0	-	1.5	2.4	-	-	4.5
Redroot pigweed	8.2	5.0	5.4	6.3	8.3	6.8	14.3	-	6.7	9.0
Wild oats	11.3	20.0	6.8	14.8	8.3	9.8	15.9	20.0	-	2.2
Wild buckwheat	3.3	5.0	9.5	1.6	4.2	3.0	0.8	-	-	4.5
None	14.6	2.5	4.1	18.8	8.3	14.3	20.6	20.0	13.3	18.0

[a]Districts as defined by the North Dakota Agricultural Statistical Service.
[b]Less than 20 repondents

Respondents ranked most herbicides as providing good to excellent weed control (Table 18). Herbicides highly ranked included Treflan (spring and fall), Sonalan, Roundup (preplant), Assert, and Poast. Prowl (spring) and Lasso were less frequently ranked as giving good to excellent weed control. All herbicides except Prowl caused none to slight injury on sunflower; Prowl was cited by 22% of respondents as causing moderate sunflower injury. Cultivation was ranked as giving good to excellent weed control by 81% of respondents, but 25% of respondents cited cultivation as causing moderate sunflower injury.

Alternative Control Measures. *Crop Consultants.* Only 11% of respondents reported that they hired a crop consultant in 1990 (Table 19). Of the respondents who hired a crop consultant, 19% reported no economic gain from the use of a crop consultant, 33% reported an economic gain of less than $10/acre, and 48% reported an economic return of $10/acre or more: 38% reported an economic gain of $10-20/acre and 10% reported an economic gain of over $20/acre (Table 20).

Table 19. Use of a hired crop consultant in 1990.

Consultant	% of Respondents
YES	11.4
NO	88.6

Table 20. Economic return from using a crop consultant in 1990.

Economic Return	% of Respondents
$0/A	19.0
$0-5/A	17.5
$5-10/A	15.9
$10-15/A	25.4
$15-20/A	12.7
$20 +/A	9.5

Table 18. Effect of herbicides and alternative methods on weed control and injury in 1990.

Herbicide	Weed Control				Sunflower Injury			
	Excel.	Good	Fair	Poor	None	Slight	Moderate	Severe
	% of respondents							
Treflan (spring)	30	50	17	3	89	9	1	1
Sonalan	48	38	11	3	91	8	-	-
Treflan (fall)	25	48	18	9	93	7	-	-
Roundup (preplant)	48	41	10	-	100	-	-	-
Assert	63	32	5	-	56	44	-	-
Poast	63	26	11	-	93	7	-	-
Prowl (spring)	18	46	27	9	9	78	22	-
Lasso	25	25	25	25	75	25	-	-
Treflan + Eptam/Genep	67	-	33	-	100	-	-	-
Sonalan + Eptam/Genep	-	100	-	-	100	-	-	-
Leafex-3/Defol	-	100	-	-	100	-	-	-
Other weed Control Methods								
Cultivation	31	50	18	2	42	54	25	-
Hand weeding	50	25	25	-	25	50	25	-
No herbicide	-	50	-	50	50	-	50	-
Other	17	33	17	33	20	20	-	60

Crop Rotation was listed as an alternative pest control measure by 66% of respondents. Wheat was grown as the preceding crop by 71% of respondents, barley by 21% and oats by 3% (Table 21). Respondents commonly had grown sunflower three, four or five years prior to the 1990 sunflower crop (Table 22). Respondents indicated that four years elapsed since the previous sunflower crop in 36% of responses, three years in 29% of responses, and five years in 15% of responses. Only 6% of respondents indicated that sunflower had been grown 0, one, or two years prior to the 1990 sunflower crop.

Cultivation was used by most respondents. A single cultivation was used by 69% of respondents, two cultivations by 20%, three cultivations by 5% and four cultivations by 1% (Table 23).

Resistant Varieties were used by 29% of respondents on 27% of acres in 1990. Only 1% of respondents reported "other alternate control practices", which were used on <1% of acres in 1990.

Table 21. Crop rotation: previous crop grown in 1990.[a]

Preceding Crop	% of Respondents
Wheat	71.1
Barley	21.3
Oats	2.5
Corn	1.4
Flax	0.8
Summer fallow	0.6
Rye	0.6
Sunflower	0.6
Alfalfa	0.4
Soybeans	0.4
Navy beans	0.2
Buckwheat	0.2

[a]66.0% of respondents listed crop rotation as an alternative pest control measure; crop rotation was listed for 67.9% of respondents' acres.

Table 22. Crop rotation: in 1990: years since previous sunflower crop.

Years	% of Respondents
0	0.2
1	0.3
2	5.9
3	28.5
4	36.3
5	14.5
6	4.3
7	1.9
8	2.1
9	0.9
10	1.6
13	0.2
No previous sunflower crop	3.3

Table 23. Number of cultivations used in 1990.

No. of Cultivations	% of Respondents
0	4.4
1	68.8
2	20.1
3	5.4
4	1.3

Literature Cited

1. North Dakota Agricultural Statistics Service. 1991. North Dakota Agricultural Statistics. 1991. 101 p.

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