

2000
SUNFLOWER
Disease and Midge Survey

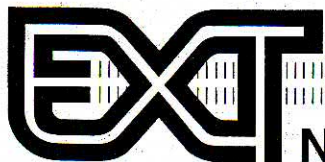


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*A field survey evaluated the incidence
(percent infected plants) of downy mildew,
Sclerotinia wilt, Sclerotinia head rot,
Phoma black stem, Phomopsis and
sunflower midge damage.*

*It also evaluated rust severity
(percent infected leaf area).*



NDSU EXTENSION SERVICE

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Materials and Methods

Downy mildew incidence was determined in 90 fields in a June survey, with 50 plants examined at each of four locations for a total of 200 plants. The percent of downy mildew was determined in each field.

The main survey was conducted in late August and September, when the upper leaves and stalks were still green. Surveyors examined 221 fields in 20 counties: 50 plants were examined in each field in groups of 13, 12, 13, and 12 plants at four random locations. Market type (oilseed or confection) and row width was recorded for each field. The percent of plants with *Sclerotinia* wilt, *Sclerotinia* head rot, *Phoma* black stem and *Phomopsis* was determined in August-September and the incidence calculated. The upper four leaves were examined in August-September for rust and the severity determined using a published assessment key (Gulya *et al.*). Ten to 20 heads along the edge and 50 heads within the field were examined in August-September for clubbed heads and/or the bracts pulled back to determine the presence of sunflower midge tunneling. The percent infested heads was considered to be the incidence and to be representative of the field infestation.

Counties surveyed were selected based on acreage in 1998 and 1999. Counties with an average of over 50,000 acres total sunflower in the previous two years were included in the survey. An attempt was made to visit at least 10 fields in any county surveyed so there would be an adequate sample size to compare results among counties. In an attempt

to survey one field for each 5,000 acres, more than 10 fields were randomly surveyed in counties with acreage considerably greater than 50,000 acres.

Results and Discussion, Downy Mildew Survey

Downy mildew was present in 37 of 90 fields, or 41% of fields surveyed. Average percent infection across all fields was 4.3%. Average percent infection was 14.1% in the southwest part of the state, 1.3% in the northeast, 0.7% in the north central and 0.2% in the south central.

Downy mildew incidence was low in most parts of North Dakota in 2000, with an average incidence (percent of infected plants) of only 0.23% in the south central portion of the state, represented by the average of Barnes, Benson, Burleigh, Dickey, Eddy, Emmons, Foster, Kidder,

LaMoure, Logan, McIntosh, Sheridan, Stutsman and Wells counties. Downy mildew incidence was only 0.69% in the northwestern part of the state, represented by the average of Bottineau, Burke, McHenry, McLean, Mountrail, Pierce, Renville, Rolette, Ward and Divide counties. Downy mildew incidence was 1.25% in the northeastern part of the state, represented by the average of Benson, Cavalier, Griggs, Nelson, Ramsey and Towner counties (Table 1).

In contrast, downy mildew incidence was 14.1% in the southwestern part of the state, represented by the average of Adams, Bowman, Dunn, Golden Valley, Grant, Hettinger, Morton, Oliver, Sioux, Slope and Stark counties. Since only two fields were sampled in most counties, the incidences among individual counties could not be compared. However, when data from

Table 1. Downy mildew incidence in 2000.

Area	County	No. of Fields	Incidence Downy Mildew %
South West	Bowman	7	35.0
	Golden Valley		
	Slope		
	Morton and Oliver	6	10.1
	Adams and Dunn	12	3.8
	Grant and Hettinger		
	Sioux and Stark		
	Total/Avg	25	14.1
North West	Bottineau and Burke	29	0.7
	Divide, McHenry and Mountrail		
	McLean and Pierce		
	Renville, Rolette and Ward		
South Central	Barnes and Benson	26	0.2
	Burleigh, Dickey and Eddy		
	Emmons and Foster		
	Kidder, LaMoure and Logan		
	McIntosh and Sheridan		
	Stutsman and Wells		
North East	Cavalier	10	1.3
	Nelson, Ramsey and Towner		
North Dakota	Total/Avg	90	4.3

several counties were combined, the incidence for Bowman, Golden Valley and Slope counties was 35.0% (average of 7 fields). The incidence for Morton and Oliver counties was 10.1% (average of 6 fields) and the incidence for the other six southwestern counties (Adams, Dunn, Grant, Hettinger, Sioux and Stark counties) was 3.8% (Table 1 and Figure 1).

Results and Discussion, Main Survey

Fields Surveyed. There were 221 fields surveyed in 22 counties. Although 10 fields were surveyed in most counties, 11 were surveyed in Dickey, 15 in Wells, 16 in LaMoure, 18 in Barnes and 22 in Stutsman counties (Table 2). The larger number of fields surveyed related directly to high sunflower acreages in those counties.

Market class. Confection hybrids accounted for 29% of sunflower acres surveyed and oilseed hybrids accounted for 71%. However, the percent of fields planted to oilseed sunflower varied from as low as 46% in the northeastern part of the state to 62% in the central, 77% in the south central, 84% in the north central, to as high as 91% in the southwest. In contrast, the percent of fields planted to confection sunflower varied from as low as 9% in the southwest, 16% in the north central, 23% in the south central, 38% in the central and 54% in the north eastern part of the state (Table 2).

Row width. There were fewer solid seeded fields (28%) than fields planted in rows (72%). However, solid seeding varied by area from as low as 14% of fields planted in the northeast, 16% in the north central, 18% in the central, 30% in the south

central and 69% in the southwest. Sunflower planted in rows varied from as low as 31% of fields planted in the southwest, 70% in the south central, 82% in the central, 84% in the north central and 86% of fields planted in the northeast (Table 2).

Sclerotinia wilt average incidence was 3.8%. There was relatively little variation in *Sclerotinia* wilt among the various areas, except that wilt was lowest (0.4%) in the southwest (Table 3 and Figure 2). Wilt was highest in Cavalier and LaMoure Counties with 8.0 and 8.1%, respectively. In five contiguous counties (Dickey, LaMoure, Barnes, Stutsman and Wells counties) where *Sclerotinia* wilt was common and there were both solid seeded and rowed fields, there was little difference in incidence: 4.4% in 14 solid seeded fields and 5.5% in 68 rowed fields.

Sclerotinia head rot average incidence was 4.3% in early September. Rainfall in mid-September resulted in some additional head rot. Pockets of increased head rot were found in the northeast. Many fields in the central and the south central areas were revisited in late September and early October. There was a significant increase in head rot in Stutsman and Barnes Counties. The highest *Sclerotinia* head rot, based on final figures, was 16.4% in Stutsman County, 13.5% in Wells County, 8.8% in Foster County and 7.5% in Barnes County, with an average of 10.9% head rot in the central part of the state, namely Barnes, Foster, Stutsman and Wells counties (Table 3 and Figure 2).

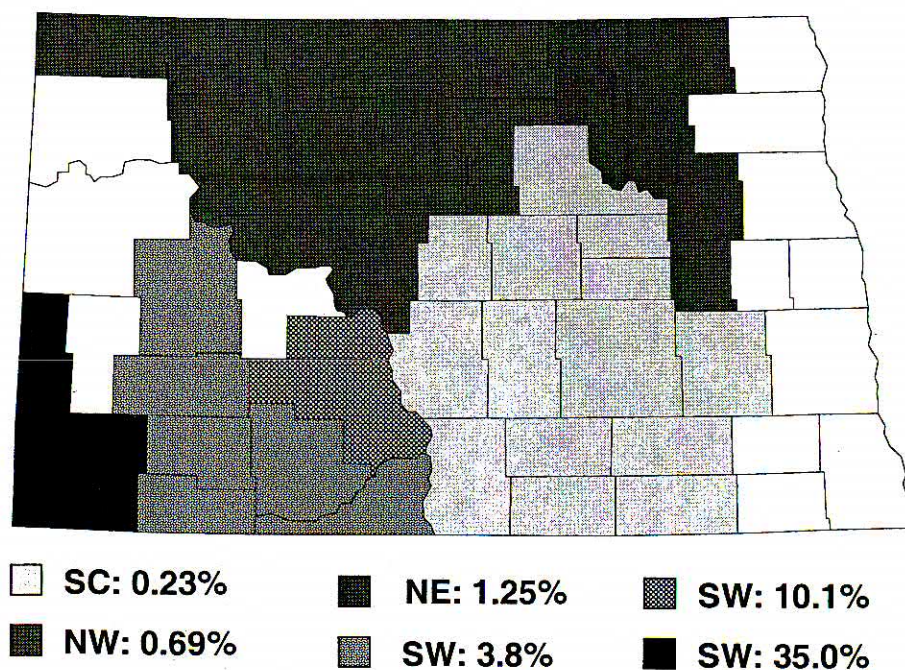


Figure 1. Downy mildew incidence in 2000.

Table 2. Main survey: fields surveyed, market class and row spacing in 2000.

Area	County	No. of Fields	Market Class %			Row Spacing %		
			Oil %	— Confection — No.	%	Row Spacing %	— Solid Seeded — No.	%
South West	Adams	10	100	0	0	10	9	90
	Hettinger	10	100	0	0	40	6	60
	Morton	10	80	2	20	30	7	70
	Stark	5	80	1	20	60	2	40
	Total/Avg	35	91	3	9	46	19	54
North Central	Bottineau	10	60	4	40	0	2	0
	McHenry	10	90	1	10	100	0	0
	Pierce	8	88	1	12	88	1	12
	Ward	9	100	0	0	67	3	33
	Total/Avg	37	84	6	16	84	6	16
Central	Barnes	18	83	3	17	89	2	11
	Foster	10	40	6	60	80	2	20
	Stutsman	22	55	10	45	91	2	9
	Wells	15	60	6	40	60	6	40
	Total/Avg	65	62	25	38	82	12	18
South Central	Emmons	10	60	4	40	30	7	70
	Dickey	11	91	1	9	91	1	9
	LaMoure	16	81	3	19	81	3	19
	McIntosh	10	70	3	30	70	3	30
	Total/Avg	47	77	11	23	70	14	30
North East	Benson	7	57	3	43	57	3	43
	Cavalier	10	20	8	80	100	0	0
	Nelson	10	60	4	40	80	2	20
	Ramsey	10	50	5	50	100	0	0
	Total/Avg	37	46	20	54	86	5	14
North Dakota	Total/Avg	221	71	65	29	75	56	25

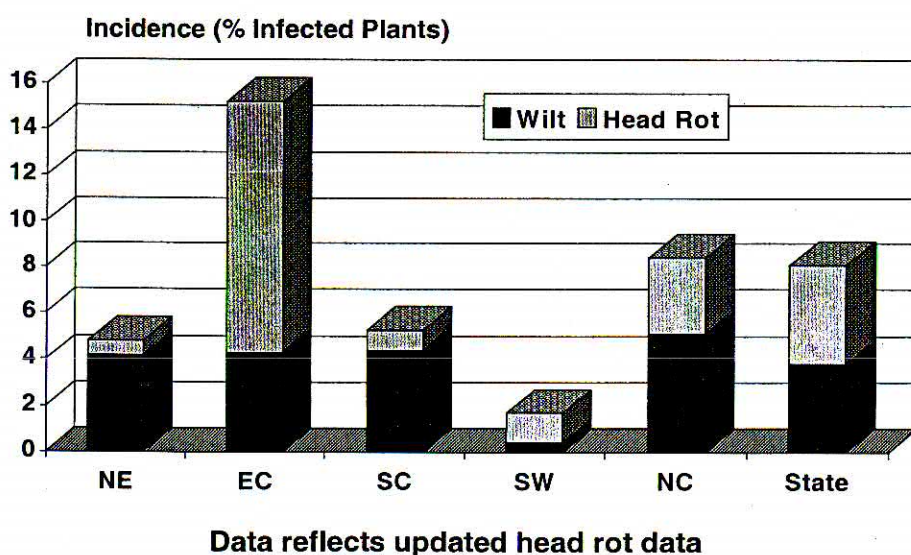


Figure 2. Sclerontinia on sunflower in 2000.

Total Sclerotinia (Wilt + Head Rot) average incidence was 8.1%. The counties with the highest total incidence included 20.6% in Stutsman, 16.5% in Wells, 13.3% in Barnes, 12.6% in Foster, 10.1% in LaMoure and 9.1% in Ward counties (Table 3 and Figure 3). Total Sclerotinia ranged from 1.7% in the southwest, 4.8 in the northeast, 5.3% in the south central, 8.4% in the north central to 15.2% in the central part of the state (Table 3 and Figure 2). Since either Sclerotinia wilt or head rot can destroy the plant, yield losses may be similar to the percent of infected plants, or approximately 15% in the central area and 20% in Stutsman County.

Table 3. Sclerotinia wilt and head rot incidences in 2000.

Area	County	No. of Fields	Sclerotinia Wilt	Sclerotinia Head Rot	Total Sclerotinia
			%	%	%
South West	Adams	10	.4	1.2	1.6
	Hettinger	10	.4	2.6	3.0
	Morton	10	0	0	0
	Stark	5	1.2	1.6	2.8
	Total/Avg	35	0.4	1.3	1.7
North Central	Bottineau	10	5.8	1.2	7.0
	McHenry	10	5.2	4.4	9.6
	Pierce	8	5.3	2.4	7.6
	Ward	9	4.0	5.1	9.1
	Total/Avg	37	5.1	3.3	8.4
Central	Barnes	18	5.8	7.5	13.3
	Foster	10	3.8	8.8	12.6
	Stutsman	22	4.2	16.4	20.6
	Wells	15	3.1	13.5	16.5
	Total/Avg	65	4.3	10.9	15.2
South Central	Emmons	10	.8	0	0.8
	Dickey	11	5.8	1.5	7.3
	LaMoure	16	8.1	2.0	10.1
	McIntosh	10	0.5	0	0.5
	Total/Avg	47	4.4	0.9	5.3
North East	Benson	7	2.0	0	2.0
	Cavalier	10	8.0	.4	8.4
	Nelson	10	2.4	.8	3.2
	Ramsey	10	3.6	1.0	4.6
	Total/Avg	37	4.2	0.6	4.8
North Dakota	Total/Avg	221	3.8	4.3	8.1

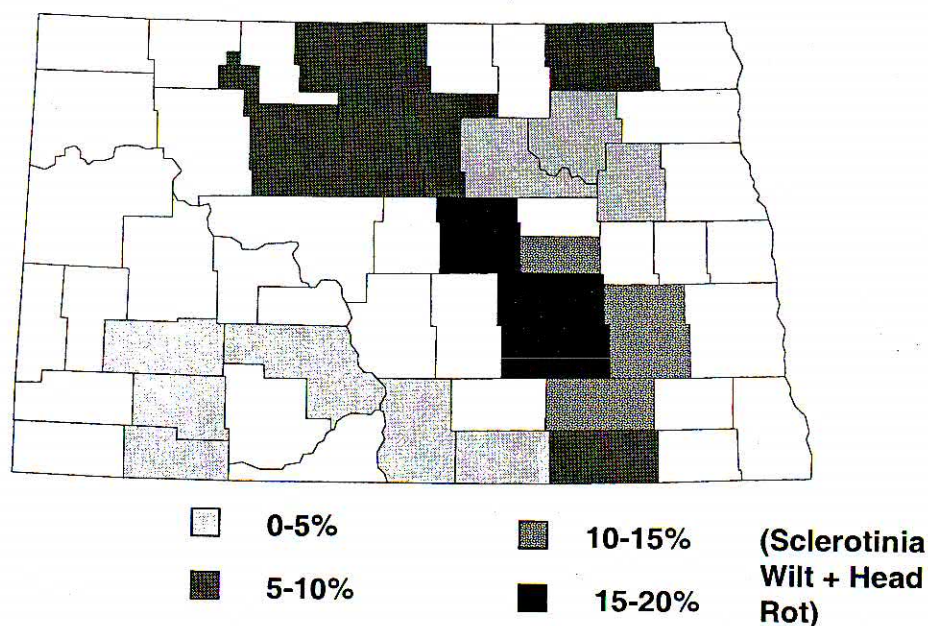


Figure 3. Sclerontinia incidence in 2000.

Phoma black stem was the most prevalent disease in the survey, with an average incidence of 37.9%. The highest incidences were in the north central and central areas with 70.2% in the north central and 59.4% in the central area. Average incidence in other areas were 21.5% in the south central, 16.6 in the south-west and 10.6% in the northeast. Individual county incidences were 77.5% in McHenry, 74.0% in Bottineau, 68.8% in Pierce, 66.9% in Wells, 63.6% in Foster, 62.5% in Stutsman, 59.3% in Ward and 47.1% in Barnes counties (Table 4 and Figure 4). Although *Phoma* incidences were greater than those of *Sclerotinia*, losses may well have been less than those from *Sclerotinia* since *Phoma* does not destroy the plant and its yield unless infection occurs early.

Phomopsis average incidence was only 0.8%. Incidence was highest in the central area, with 1.6% average incidence followed by 1.3% in the southwest. Highest incidence in individual counties was 2.2% in Barnes, 2.0% in Morton, 1.9% in Wells, 1.4% in Adams and 1.2% in Stutsman counties (Table 4).

Rust severity averaged 0.13%. The highest severity was in the northeast with 0.23%. This is well below the 3% level before ray petal wilt that is considered to be economic for use of a fungicide (Gulya *et al.*). Average rust severity was only 0.14% in the central, 0.12% in the north central, 0.11% in the south central and 0.04% in the southwest (Table 5). Comparison of rust severities between confection and oilseed hybrids was not possible in many areas.

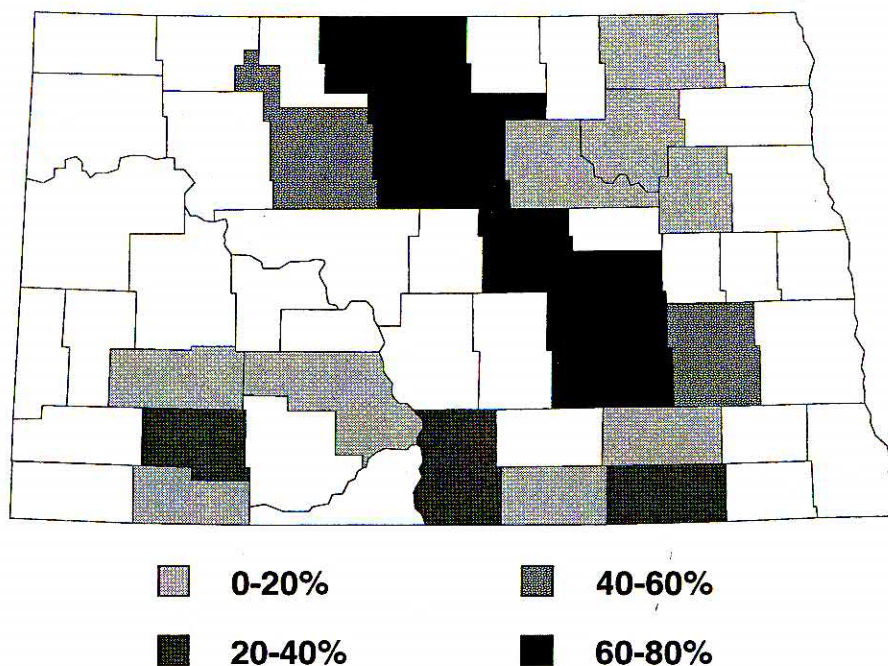


Figure 4. Phoma incidence in 2000.

However, the number of confection and oilseed fields surveyed was similar in Foster, Stutsman and Wells counties where rust severity was 0.42% in 22 confection fields and 0.02% in 25 oilseed fields. This is in agreement with observations that confection hybrids tend to be more susceptible to rust than oilseed hybrids.

Charcoal rot was observed in six of 35, or 17%, of fields in the southwest. The highest individual field incidences were 34% and 28%, both in Hettinger County.

Sunflower midge was present in 72.5% of fields surveyed.

Table 4. Phoma black stem and Phomopsis incidence in 2000

Area	County	No. of Fields	Phoma Black Stem	Phomopsis
			%	%
South West	Adams	10	6.0	1.4
	Hettinger	10	26.6	0.8
	Morton	10	18.2	2.0
	Stark	5	14.4	0.8
	Total/Avg	35	16.6	1.3
North Central	Bottineau	10	74.0	0
	McHenry	10	77.5	0.20
	Pierce	8	68.8	0.25
	Ward	9	59.3	0.44
	Total/Avg	37	70.2	0.22
Central	Barnes	18	47.1	2.2
	Foster	10	63.6	0.6
	Stutsman	22	62.5	1.2
	Wells	15	66.9	1.9
	Total/Avg	65	59.4	1.6
South Central	Emmons	10	26.6	0.2
	Dickey	11	21.5	0.9
	LaMoure	16	19.9	0
	McIntosh	10	19.0	0
	Total/Avg	47	21.5	0.3
North East	Benson	7	6.6	0
	Cavalier	10	14.0	0.20
	Nelson	10	10.6	0.40
	Ramsey	10	10.2	0.60
	Total/Avg	37	10.6	0.3
North Dakota	Total/Avg	221	37.9	0.8

Table 5. Rust severity in 2000.

Area	County	Rust Severity
		%
South West	Adams	0
	Hettinger	0
	Morton	0.026
	Stark	0.2
	Total/Avg	0.036
North Central	Bottineau	0.05
	McHenry	0
	Pierce	0.5
	Ward	0
	Total/Avg	0.12
Central	Barnes	0
	Foster	0.44
	Stutsman	0.05
	Wells	0.25
	Total/Avg	0.14
South Central	Emmons	0.115
	Dickey	0.007
	LaMoure	0.09
	McIntosh	0.25
	Total/Avg	0.109
North East	Benson	0.09
	Cavalier	0.2
	Nelson	0.2
	Ramsey	0.23
	Total/Avg	0.23
North Dakota	Total/Avg	0.13

The average incidence across all fields was 18.7% with the higher incidence of 23.5% being located in the field edge compared to 14.0% in the field. Average incidence ranked in order of highest to lowest by region is: 46.92% in the northeast, 29.56% in the south central, 20.89% in the central, 2.56% in the southwest, and 0% in the north central (Table 6 and Figure 5).

The "hot" spot was Ramsey County where the area north of Devils Lake recorded severe sunflower midge damage. Counties with a high average incidence, near 50%, also included Cavalier and LaMoure counties.

Very low levels (<10% average percent incidence) were recorded in the southwest (Adams, Hettinger, Morton, Stark Counties), parts of the central region (Wells county), and parts of the southcentral region (Emmons County). No sunflower midge was detected in the north central region.

The range of incidence was large indicating that there was variability field to field, or spotty infestations of sunflower midge across North Dakota in 2000.

Sunflower moth was observed in 16 of 35, or 45.7%, of fields surveyed in the southwest. The incidence ranged from 2 to 14% in fields where head moth was observed.

Banded sunflower moth was observed in six of 36, or 16.7%, of fields surveyed in the north central part of the state. It was common along the edges of fields.

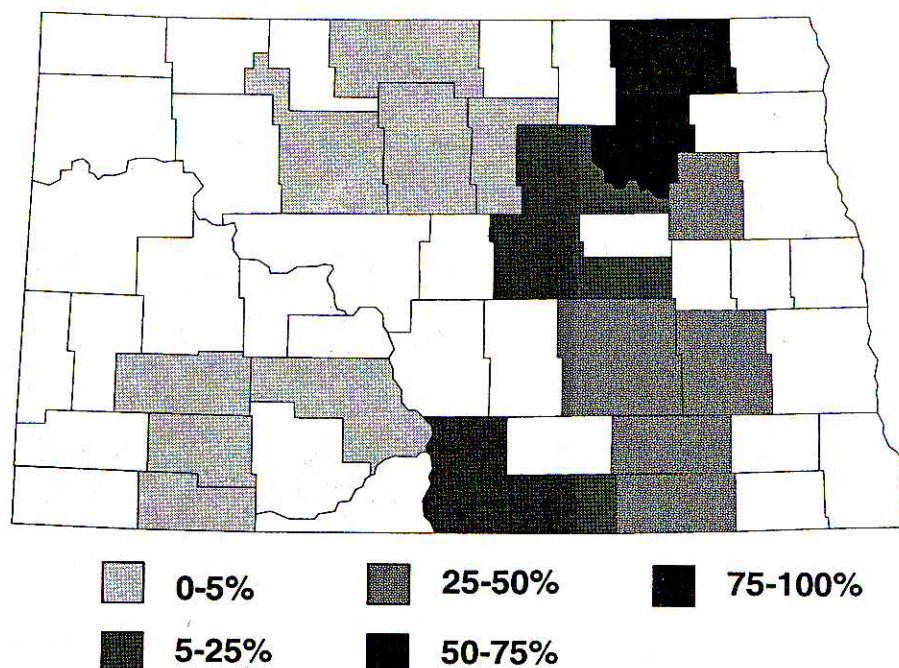


Figure 5. Sunflower midge incidence in 2000.

Table 6. Midge incidence in 2000.

Area	County	Midge Edge	Midge Field	Midge County Avg
		%	%	%
South West	Adams	6.00	2.50	4.25
	Hettinger	0.80	0.60	0.70
	Morton	3.80	3.00	3.40
	Stark	1.20	1.20	1.20
	Total/Avg	3.20	1.91	2.56
North Central	Bottineau	0	0	0
	McHenry	0	0	0
	Pierce	0	0	0
	Ward	0	0	0
	Total/Avg	0	0	0
Central	Barnes	43.33	8.67	26.00
	Foster	19.00	8.40	13.70
	Stutsman	40.00	19.27	29.64
	Wells	12.00	1.47	6.73
	Total/Avg	31.23	10.55	20.89
South Central	Emmons	16.50	1.40	8.95
	Dickey	59.09	9.27	34.18
	LaMoure	72.19	26.75	49.47
	McIntosh	20.50	6.00	13.25
	Total/Avg	46.28	12.85	29.56
North East	Benson	— ^a	12.57	12.57
	Cavalier	—	53.00	53.00
	Nelson	—	36.20	36.20
	Ramsey	—	75.60	75.60
	Total/Avg	—	46.92	46.92
North Dakota	Total/Avg	23.46	14.00	18.73

^a No data

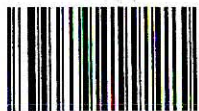
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