

Distribution and Economic Impacts of Leafy Spurge in North Dakota

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Leafy spurge was observed in North Dakota as early as 1909 (2). Early collections of leafy spurge from 1910 through 1920 in the North Dakota State University Herbarium came from Cass, Cavalier, Eddy, Emmons, Richland, and Williams counties. A note on a sample collected in 1930 in Mercer County includes the comment from farmer Elvis Berg that leafy spurge "has been on my farm for 20 years." The wide distribution of leafy spurge from the east to west and north to south borders around North Dakota in such a brief time suggests that the weed seed was spread as a contaminate in seed or hay. Leafy spurge apparently was introduced in southwestern Minnesota in a bushel of oats brought from southern Russia in 1890 (2). A note on an NDSU Herbarium specimen collected in 1934 in Stark County indicates "believed to have come from Russia in clover." Early establishment of leafy spurge in Manitoba occurred in settlements of Russian Mennonites who may have brought the seed with them as a contaminate in crop seed (2).

DISTRIBUTION IN NORTH AMERICA

Hanson and Rudd (2) reported the distribution of leafy spurge in the United States in 1933 (Figure 1). Leafy spurge was most prevalent in Minnesota and North Dakota, but Hanson and Rudd "expected that sooner or later leafy spurge will appear in middle-western and western states adjoining the states that now show infestations." The westward spread of leafy spurge has occurred as predicted (Figure 2), as reported in 1979 by Noble et al. (5) and Dunn (1). North Dakota and Montana have the most infested acreage, but the problem is increasing in the Great Plains and Intermountain states to the south and west. Leafy spurge was introduced as early as 1827 in Massachusetts (2), but it has not developed into an economic weed problem in the Northeastern States. Minnesota has leafy spurge throughout the state, but it is perceived as an economic weed only in a few northwestern counties (Figure 2).

Leafy spurge was found in every province of Canada except Newfoundland by 1950 (7), and its introduction and spread across Canada seems to closely parallel the

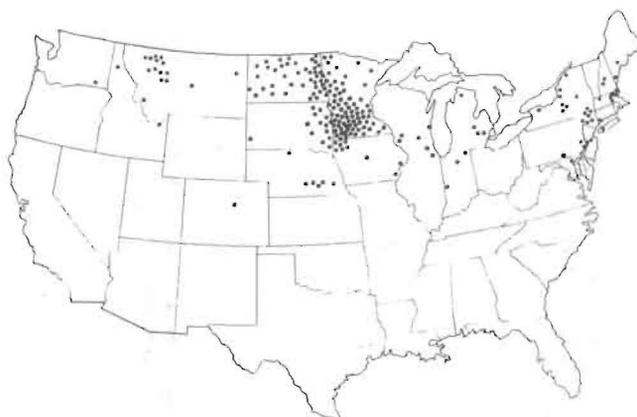


Figure 1. Distribution of leafy spurge in the United States in 1933 (from Hanson and Rudd).

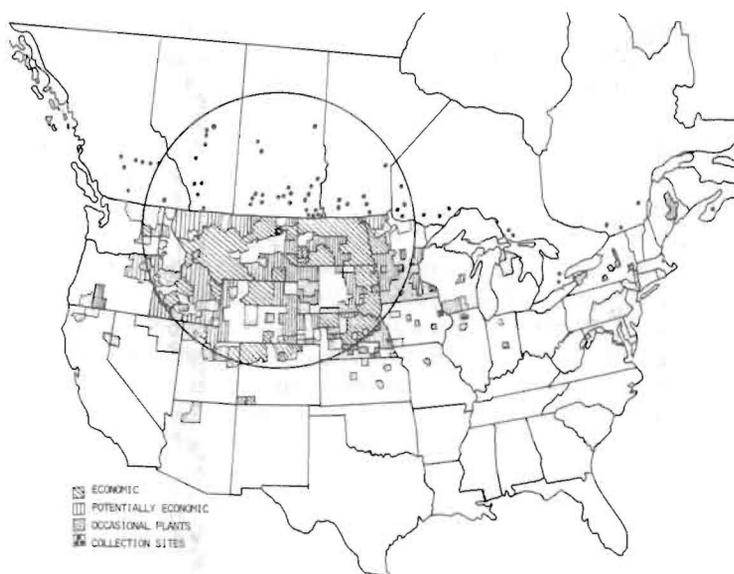


Figure 1. A concentration area covering approximately 90% of leafy spurge in North America is defined in a 1,200-mile diameter circle centered near Wolf Point, Mont. — 106° W. Long, 48° N. Lat. (Dunn 1979, Moore 1958, Moore and Frankton 1969, Selleck et al., 1962).

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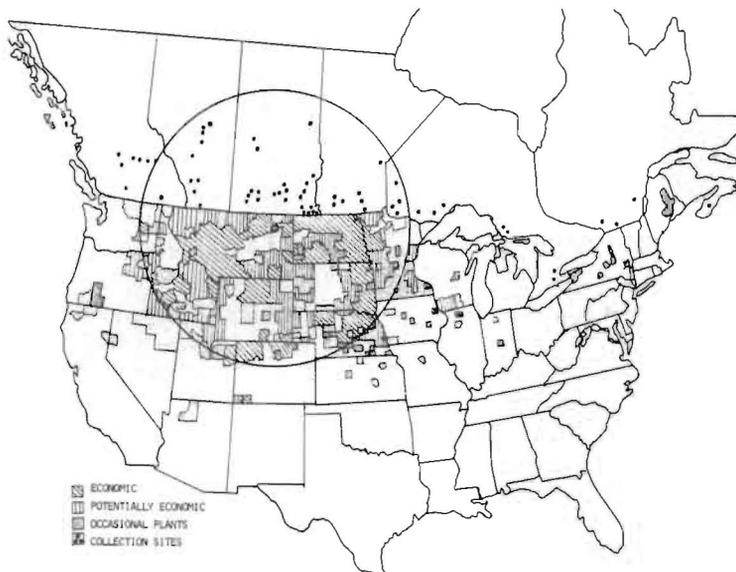


Figure 2. Distribution of leafy spurge in the United States and Canada in 1979. The area covering approximately 90% of leafy spurge in North America is defined in a 1,200-mile diameter circle centered near Wolf Point, Mont. (from Noble, Dunn, and Andres).

pattern in the United States. Leafy spurge is most important economically in the Prairie Provinces of Manitoba, Saskatchewan, and Alberta (Figure 2). However, Canada has only 125,000 acres of leafy spurge as compared to at least 2.3 million acres in the United States (5). Probably an active federal program for research and control in Canada for the past 20 to 30 years has limited the spread of the weed.

DISTRIBUTION IN NORTH DAKOTA

The North Dakota Department of Agriculture conducted surveys in 1973, 1981 and 1982 to estimate the acreage of leafy spurge in North Dakota (Table 1). The information was obtained from agricultural leaders in each county such as the county weed control officer or county agent. The dramatic increases or decreases of leafy spurge infested acreages reported for some counties probably are due more to differences in completeness of local surveys and the perception of the individual respondent than to true changes within the county. However, the total acreage for the state probably is a reasonable estimate of the total leafy spurge infestation and the change in acreage that has occurred from 1973 to 1982.

The survey indicates a total of 861,823 acres infested with leafy spurge in 1982 compared to 423,425 acres in 1973 (Table 1). The acreage infested with leafy spurge doubled during the 1973 to 1982 period. The 861,823 acres infested with leafy spurge represents nearly 2.0 percent of the 43,482,685 acres in North Dakota. North Dakota has 13,096,468 acres of untilled land on farms such as pastures, range, woodland, roads, farmsteads, and houselots. Since leafy spurge is found primarily on untilled land, the infestation of 861,823 acres represents

approximately 6.6 percent of the farmland most likely to be infested with leafy spurge. The 1978 Census of Agriculture does not include approximately 2.3 million acres of nonfarmland such as highways, cities, parks, and lakes in North Dakota. Some of the nonfarmland is suitable for leafy spurge infestation, but the addition of nonfarmland suitable for leafy spurge infestation to the acreage of untilled farmland would not change the data dramatically. These estimates suggest that approximately 6 percent of the untilled land in North Dakota is infested with leafy spurge. A survey of two sample counties in 1979 by Nalewaja et al. (3) with support from the North Dakota Department of Agriculture found that leafy spurge occurred in 12 percent of the pastures in Stark and 8 percent in Foster counties. Leafy spurge was one of the most frequently occurring weeds on streams or river banks, roadsides, and railroad rights-of-way in both Stark and Foster counties. Stark and Foster counties have some of the largest acreages of leafy spurge, so it is consistent that leafy spurge occurred more frequently in these counties than the estimated 6 percent infestation on untilled land statewide.

Leafy spurge is found in all 53 counties of North Dakota (Table 1). Leafy spurge infests the highest percentage of land in the northern and eastern counties of North Dakota (Figure 3). Over 6 percent of the land is infested with leafy spurge in Benson, Foster, McHenry, Sargent, and Stark counties. Several counties with the greatest leafy spurge infestations are bisected by Highway 2 and railroads from Grand Forks to Williston which may suggest that man has been an important contributor to spread of the weed. Leafy spurge often occurs along waterways such as the Heart River in west central and the Souris River in north central North Dakota. Also, leafy spurge seems well adapted to the sandhills regions of southeastern North Dakota.

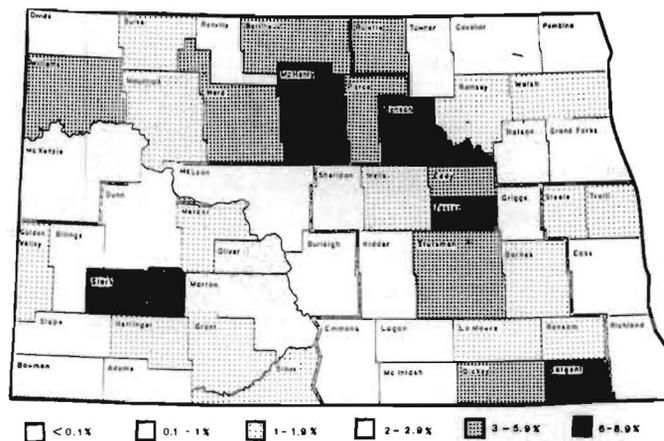


Figure 3. Distribution of leafy spurge in North Dakota expressed as a percentage of total acres in the county infested with leafy spurge.

On the positive side, leafy spurge infests 1 percent or less of the untilled land in 14 counties (Table 1). These 14 counties include 28.1 percent of the total area and

Table 1. Acres of leafy spurge in North Dakota in 1973, 1981 and 1982 according to surveys by the North Dakota Department of Agriculture.

County	Total acres	Acres of leafy spurge			Untilled land on farms ¹	
		1973	1981	1982	Acres	% Infested
Adams	645,120	2,800	1,200	1,160	242,798	0.5
Barnes	967,680	9,500	14,500	16,000	153,884	10.4
Benson	807,466	10,000	25,000	60,000 ²	179,493	33.4
Billings	740,000	— ¹	2,500	2,000	614,676	0.3
Bottineau	1,087,000	1,875	9,400	35,000	158,554	22.1
Bowman	670,337	1,500	1,878	2,000	373,925	0.5
Burke	691,200	1,000	9,000	8,000	168,981	4.7
Burleigh	1,040,192	150	3,000	2,500	417,917	0.6
Cass	1,071,163	1,440	1,700	1,850	97,447	1.9
Cavalier	967,680	3,300	2,100	2,100	109,885	1.9
Dickey	737,280	2,950	2,000	25,500	170,920	14.9
Divide	784,539	22	1,000	500	181,739	0.3
Dunn	1,419,371	400	2,360	1,000	935,396	0.1
Eddy	412,000	4,080	7,500	15,000 ²	102,370	14.7
Emmons	961,000	45	2,400	2,400	339,815	0.7
Foster	414,000	6,000	15,000	36,500	76,418	47.8
Golden Valley	643,400	2,200	7,500	7,000	286,526	2.4
Grand Forks	1,000,000	10,500	20,000	7,500	102,352	7.3
Grant	1,016,000	10,000	2,200	13,000	447,129	2.9
Griggs	457,600	9,000	1,300	1,300	83,918	1.5
Hettinger	731,520	1,000	7,000	7,600	175,039	4.3
Kidder	823,993	9,000	20,000	1,300	327,173	0.4
LaMoure	719,045	5,300	36,000	8,000	135,312	5.9
Logan	645,000	220	1,000	2,500	249,052	1.0
McHenry	1,128,233	125,000	80,000	90,000	340,041	26.5
McIntosh	579,720	2,100	1,500	1,800	202,640	0.9
McKenzie	1,175,941	0	500	300	684,916	0.1
McLean	1,400,000	90	1,000	1,100	303,399	0.4
Mercer	549,231	9,000	15,000	6,650	270,364	2.5
Morton	1,228,928	7,500	30,000	30,000	663,333	4.5
Mountrail	1,129,193	3,100	25,000	21,500	350,049	6.1
Nelson	650,000	7,500	10,000	15,000	112,847	13.3
Oliver	440,603	1,000	750	11,000	212,058	5.2
Pembina	703,133	300	5,000	600	74,122	0.8
Pierce	691,200	3,100	30,000	37,600	114,882	32.7
Ramsey	733,488	2,900	2,000	7,000	87,533	8.0
Ransom	496,332	6,200	14,890	8,674	171,793	5.0
Renville	572,160	41,000	4,000	4,000	71,145	5.6
Richland	927,000	6,200	45,000	3,000	111,698	2.7
Rolette	652,400	7,000	17,335	31,689	167,956	18.9
Sargent	547,200	1,500	54,720	43,776	110,874	39.5
Sheridan	645,120	110	50	84	169,971	0.1
Sioux	716,336	3,500	3,000	7,500	534,895	1.4
Slope	783,320	100	4,000	6,500	465,359	1.4
Stark	844,160	50,000 ¹	55,000	68,000	282,994	24.0
Steele	449,219	12,000	1,000	8,500	59,528	14.3
Stutsman	1,474,560	6,200	32,000	70,000	370,314	18.9
Towner	648,120	320	2,000	5,000	72,513	6.9
Traill	549,559	10,000	1,387	5,340	42,696	12.2
Walsh	823,680	6,000	700	16,000	96,910	16.5
Ward	1,313,280	3,968	40,000	40,000	251,968	15.9
Wells	794,303	455	5,000	8,500	144,539	5.9
Williams	1,383,680	15,000	45,000	53,000	424,412	12.5
TOTALS	43,482,685	423,425	721,370	861,823	13,096,468	6.6

¹Billings and Stark counties included in one total.

²Estimates because Benson Co. reported 250,000 acres and Eddy Co. reported 325,025 acres; the reports are greater than the acres of untilled land on farms in the county.

³Acres not in cropland, i.e., pastures, rangeland, woodland, houselots, roads, etc. according to the 1978 Census of Agriculture.

39.1 percent of the untilled land in North Dakota, but only 2.2 percent of the leafy spurge infested land. It would be good public policy to assure that leafy spurge does not spread in these counties where it is a relatively small problem today.

Economic Impact

The first impact of leafy spurge is the reduction of hay and livestock production in infested areas. Leafy spurge mostly reduces beef production, as the major

class of livestock in North Dakota, because cattle generally avoid grazing in leafy spurge infested areas. An estimate of the effect of leafy spurge competition on hay and beef cattle production in North Dakota farms is presented in Table 2. The total loss of hay and beef production is nearly \$7 million.

The second impact of leafy spurge is the cost of control, including chemical and application expenses (Table 3). A survey in 1978 indicated that nearly 292,000 acres of grazing and hay land were treated with herbicides,

Table 2. Impact of leafy spurge competition on hay and beef cattle production on North Dakota farms.

A. Basic assumptions

1. Acreage of leafy spurge: 861,823 acres
Hay land (10%) = 86,182 acres and grazing land (90%) = 775,641 acres
2. Forage yield loss from leafy spurge competition
1981 and 1982 average forage yield in NDSU leafy spurge control experiments including 60 treatments
6 treatments with lowest yields = 1041 lb/A
6 treatments with highest yields = 2064 lb/A
therefore, forage yields were reduced 49.6% in dense leafy spurge infestations
 - a. Forage loss on hay land: 24.8%
(Assume yield losses follow a standard curve, so average forage loss is 50% of losses in dense leafy spurge infestations)
 - b. Forage loss on grazing land: 31.2%
(Assumes forage yield loss as for hay land, plus reduced forage utilization where cattle do not graze in dense leafy spurge infestations)
3. Data obtained from other information sources
 - a. Forage yield on North Dakota native pasture and hay land: 1767 lb/A¹ (0.884 T/A)
 - b. Conversion of forage yield to pounds of beef²
—Animal unit days = forage yield in pounds divided by 40
—Pounds of beef = animal unit days (for low condition pastures)
 - c. Average price for hay = \$51.01/T³
 - d. Average price for all beef cattle (cows, steers, heifers, and calves inclusive) = \$0.562/lb³

B. Calculation of losses to North Dakota agriculture

1.	Loss of hay 86,182 acres × 0.884 T/A forage yield × 24.8% yield loss × \$51.01/T hay		\$ 963,775
2.	Loss of beef cattle production 775,641 acres × 1767 lb/A forage yield × 31.2% yield loss ÷ 40 lb forage/AUD (= pounds of beef) × \$0.562/lb cattle price		\$6,007,976
		Total	\$6,971,751

¹North Dakota Research Report 52. Table 3.25 Production of wild hay in North Dakota.

²Soil Conservation Service Technical Guide AS:411 Section II-K Pasture and hayland interpretation.

³North Dakota Ag Statistics No. 49 and 50, average price 1980, 1981 and 1982 for "other hay" (excludes alfalfa) and all beef cattle.

Table 3. Herbicide use and expenditures for leafy spurge control by North Dakota farmers.

Crop and herbicide	Acres treated	Leafy spurge control		Treatment rate	Herbicide cost	Total herbicide expenditure	Application cost
		As target weed	Total treated				
	(total)	(%)	(A)	(lb/A)	(\$/lb)	(\$)	(\$)
Alfalfa							
Picloram	67	100	67	1.50	45.00	4,522	151
Other hay							
2,4-D	7,000	83	5,810	0.75	2.40	10,458	13,072
Picloram	9,800	100	9,800	0.30	45.00	132,300	22,050
Pasture and rangeland							
2,4-D	49,300	51	25,143	1.00	2.40	60,343	56,572
2,4-D amine	82,900	93	77,097	1.44	2.19	243,133	173,468
2,4-D ester	40,400	14	5,656	1.25	2.87	20,291	12,726
Dicamba	13,200	33	4,356	0.65	9.62	27,238	9,801
Glyphosate	300	14	42	1.00	22.00	924	95
MCPA amine	2,100	100	2,100	0.60	3.75	4,725	4,725
MCPA ester	5,400	47	2,538	0.88	4.37	9,760	5,711
Picloram	81,200	97	78,764	0.99	45.00	3,508,936	177,219
TOTAL	291,667		211,373			4,022,630	475,590

¹From Nalewaja et al. 1980. Pesticide usage in major North Dakota crops, 1978. North Dakota State University Agronomy Report 1.

²Herbicide list price from 1981 informal survey of several pesticide dealers by NDSU Extension Specialists.

³\$2.25/A (weighted average) based on 75% ground application and 25% aerial application (from 1978 Pesticide usage in major North Dakota crops), and \$2.05/A ground application and \$2.86/A aerial application (from North Dakota Ag Statistics No. 50).

and leafy spurge was the target weed on most of the sprayed land (4). This converts to 211,000 acres sprayed where leafy spurge was the target weed, or 72 percent of the grazing and hay land sprayed with herbicides was treated primarily for leafy spurge control. The cost of leafy spurge control on the 211,000 acres was approximately \$4.5 million with just over \$4 million for herbicides and nearly \$0.5 million for application.

The third impact of leafy spurge is expenditures on nonfarmland such as roads, railroads, public utilities and government land. Estimates are available from state and county governmental units concerning expenditures for perennial weed control (Table 4), but similar information is not readily available from private nonfarmland such as public utilities, industrial developments and military bases. Governmental agencies in North Dakota spent over \$280,000 for leafy spurge control, and the county weed control boards spent nearly \$1.2 million for leafy spurge control in 1982. Of the expenditures by governmental agencies, all of the \$175,000 by the Department of Agriculture and at least \$503,597 from the county weed control boards is specifically to implement the leafy spurge control program established by the 1981 North Dakota legislature (North Dakota Century Code Chapter 63-01.1). This program requires that landowners contribute at least 20 percent of the cost of the leafy spurge treatment program on their land.

A summary of the economic losses from leafy spurge in North Dakota indicates a total loss of approximately \$12.9 million annually (Table 5). These estimates are based on documented information whenever possible so most of the data comes from the 1978 to 1982 period which may underestimate the current impact of leafy spurge due to inflation and the spread of the weed. The loss of beef production and the cost of herbicides account for more than 75 percent of the total losses, so any changes that affect these two factors would cause the greatest change in the total loss from leafy spurge. For example, each 1 cent per pound change in cattle prices changes the beef cattle production estimate by approximately \$106,900. The cost of herbicides would in-

crease, because the most recent pesticide use survey was taken in 1978. Leafy spurge acreage has increased, and it seems apparent from observations of the authors that more landowners are spraying for leafy spurge. Conversely, the cost of picloram, the most expensive herbicide used on leafy spurge, was reduced by 10 to 20 percent during 1982 over 1981.

Table 5. Summary of economic losses from leafy spurge in North Dakota.

1. Loss of hay	\$ 963,775
2. Loss of beef cattle production	6,007,976
3. Cost of herbicides	4,022,630
4. Cost of application	475,590
5. Expenditures by state and county governments	1,444,290
TOTAL	\$12,914,261

It probably is easy to overestimate the impact of loss of beef production on areas infested with leafy spurge. To illustrate this point, assume that an 80-acre pasture has 40 patches of leafy spurge, each 0.5 acres in size. Most people would indicate that 80 acres are infested with leafy spurge, and probably the landowner would have to spray all 80 acres since leafy spurge seldom occurs in symmetrical patches. However, cattle could graze 60 of the 80 acres with minimal loss of forage production. Balancing the positive and negative factors that may affect these loss estimates, the authors feel that the estimated annual loss from leafy spurge in North Dakota of \$12.9 million is reasonable and may be conservative.

The \$12.9 million annual loss from leafy spurge can be put in perspective by comparing these losses with the income from other agricultural commodities in North Dakota. The \$12.9 million loss from leafy spurge is similar in range to the total cash receipts from oats, the sheep industry including meat animals and wool, the poultry and egg industry, and honey and beeswax. The loss is similar to one-half the cash receipts from flaxseed, hay, and soybean (6). Another important perspective is that the loss of \$12.9 million is occurring on only about 6 percent of the untilled land in North Dakota, so there is potential for large increases in annual losses if

Table 4. Expenditures for perennial weed control, especially leafy spurge, by North Dakota governmental agencies in 1982.

Governmental agency	Noxious weed control (\$)	Primarily for leafy spurge control (%)	Net for leafy spurge control (\$)
State agencies			
Dept. of Agriculture	175,000	100	175,000
Director of Institutions	1,500	33	500
Game and Fish Dept.	70,000	75	52,500
Highway Dept.	39,000	95	37,050
Land Dept.	9,440	100	9,440
Parks and Recreation Dept.	10,000	90	9,000
Sub-total	304,940		283,490
County Weed Control Boards	1,818,046¹	64	1,160,800¹
Total	2,122,986		1,444,290

¹Excess levy of 1 mill by 38 of the 53 North Dakota counties provides \$503,597 specifically for leafy spurge control, and assume 50% of the balance is used primarily for leafy spurge control.

the leafy spurge infested acreage is permitted to increase in the future. Leafy spurge is difficult to control, but future losses from leafy spurge can be minimized by persistent efforts to prevent further spread of the weed and to reduce present infestations.

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