

Production Problems and Practices of Northarvest Dry Bean Growers in 1989

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An annual survey of production and pest problems, pesticide use and grower practices of Northarvest dry bean growers was begun in 1987. The Northarvest Bean Growers Association comprises the dry edible bean growers of North Dakota and Minnesota.

The survey form was mailed to each of 3,975 growers on the mailing list of the Northarvest Bean Growers Association. Questionnaires were identified only by district, otherwise it was an anonymous survey. The 10 Northarvest districts are shown in Figure 1. To simplify the discussion, Minnesota districts 1, 2, 3, 4, and 5 will be referred to as MN 1, MN 2, MN 3, MN 4, and MN 5; similarly the five North Dakota districts will be designated as ND 1, ND 2, ND 3, ND 4, and ND 5.

Results of the 1987 and 1988 surveys and preliminary results of the 1989 survey have been published (1, 2, 3). Results presented in this report are from actual survey data. None of the values have been adjusted to represent the total bean crop except where noted.

RESULTS AND DISCUSSION

There were 917 forms returned, or 23 percent of those mailed out. There were 101 respondents who did not grow dry beans in 1989. The 816 usable forms represented 20.5 percent of growers contacted. There were 644 usable responses from North Dakota, 171 from Minnesota and one from South Dakota.

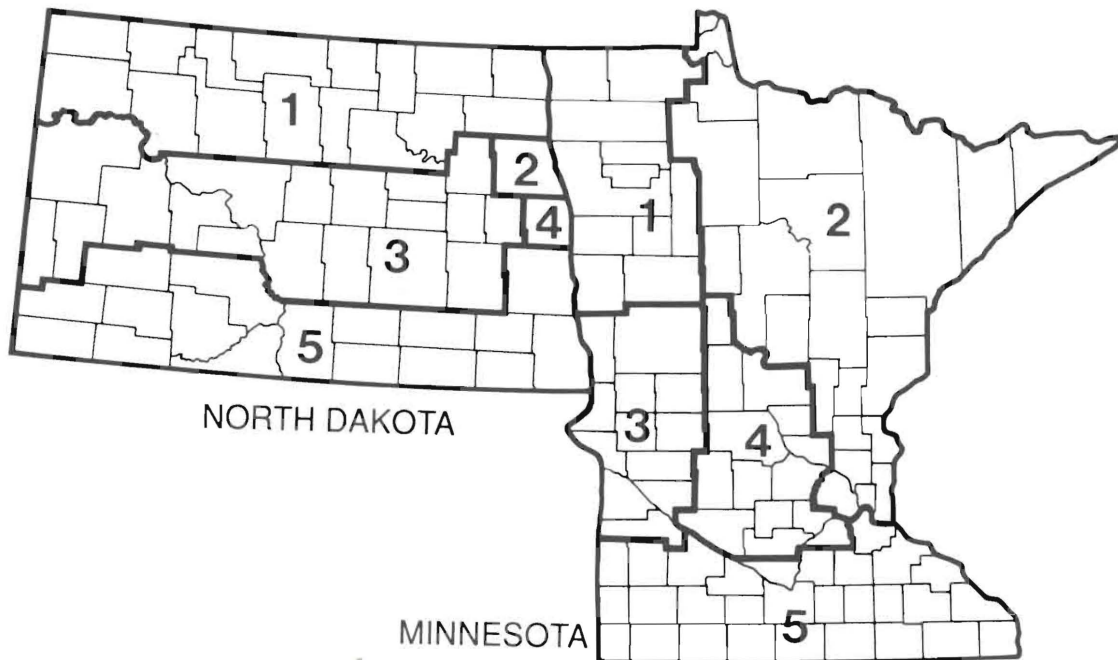


Figure 1. Northarvest districts.

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The 815 responses from North Dakota and Minnesota represented 196,751.6 acres. This is 34.5 percent of the 570,000 planted acres in the two states. The survey represented 31,364.4 acres in Minnesota or 44.8 percent of the 70,000 total planted acres, and 165,387.2 acres in North Dakota, or 33.1 percent of the 500,000 planted acres, based on USDA crop reports. There were 120 acres reported from South Dakota.

Of the 196,751.6 acres planted, 167,273.4 acres (85.0 percent) were harvested. Planted acreage that was harvested varied with the districts, from a high of 98.0 percent in MN 4 to a low of 71.7 percent in ND 3.

Varieties. Table 1 lists varieties grown on at least 2,000 acres by respondents. The most commonly grown varieties and percent of total acres planted by Northharvest respondents were Upland, 24 percent; Topaz, 19 percent; Fiesta, 8 percent; Othello, 7 percent; Nodak, 6 percent; and Olathe, 5 percent.

Upland was the leading variety in 1987, 1988 and again in 1989. Topaz was the second most widely grown variety in all three years. Acreages of Fiesta and Othello were higher in 1989 than in 1988. Acreages of Nodak declined each year.

The most commonly grown varieties in 1989 in North Dakota were Upland, Topaz, Fiesta, Othello, and Nodak (Table 2). In Minnesota the most commonly grown varieties were Upland, Montcalm, Topaz, Fiesta, and Agri 1. Montcalm dark red kidney was the predominant variety in MN 2, MN 3 and MN 4. These are districts with a high percentage of irrigated acres.

Irrigated Acres. Respondents reported that 13,360 acres or 6.8 percent were irrigated (Table 3). The percent irrigated acres ranged from 0 in MN 1 and MN 5 to 12.5 percent in ND 5, 30.0 percent in MN 3, 34.2 percent in MN 4 and 88.1 percent in MN 2. Irrigation influenced variety choice, disease problems, weed problems, and herbicide practices.

Chemigation. Application of chemicals through an irrigation system is called *chemigation*. Surprisingly, respondents reported chemigation on only 1,417 acres, or 10.6 percent of the acreage that was irrigated. Nitrogen was applied through an irrigation system on 997 acres and Topsin on 420 acres.

Seed Source. Bagged and tagged seed was used by 95.5 percent of respondents on 90.3 percent of their acres, bin run

Table 1. Dry bean varieties planted on 2,000 or more acres in Minnesota and North Dakota by survey respondents in 1989.

Variety	Northharvest Total		MN		ND	
	# A	% A	# A	% A	# A	% A
Agri 1	2,482	1.3	1,413	4.5	1,069	0.7
C-20	8,286	4.2	1,027	3.3	7,259	4.4
Fiesta	15,402	7.8	2,231	7.1	13,171	8.0
Fleetwood	3,655	1.9	815	2.6	2,840	1.7
Hyden	3,267	1.7	480	1.5	2,787	1.7
Midland	2,893	1.5	1,022	3.3	339	0.2
Montcalm	6,908	3.5	4,928	15.7	1,980	1.2
Nodak	12,297	6.3	110	0.4	12,187	7.4
Olathe	9,130	4.6	240	0.8	8,890	5.4
Othello	12,819	6.5	240	0.8	12,579	7.6
Pearls	2,332	1.2	250	0.8	2,082	1.3
RS 101	2,593	1.3	305	1.0	2,288	1.4
Stinger	2,856	1.5	472	1.5	2,384	1.4
Topaz	37,313	19.0	3,535	11.3	33,778	20.4
Upland	47,949	24.4	8,495	27.1	39,334	23.8

Table 3. Irrigated and total acres planted by survey respondents in 1989 in Minnesota and North Dakota.

District	Irrigated Acres	Total Acres	% Irrigated
MN 1	0	11,796	0
MN 2	4,160	4,724	88.1
MN 3	2,583	8,610	30.0
MN 4	1,878	5,495	34.2
MN 5	0	739	0
MN State	8,621	31,364	27.5
ND 1	57	38,860	0.1
ND 2	30	33,103	0.1
ND 3	448	32,061	1.4
ND 4	200	29,289	0.8
ND 5	4,004	32,074	12.5
ND State	4,739	165,387	2.9
SD		120	
Northharvest	13,360	196,871	6.8

Table 2. Five varieties most commonly grown by survey respondents in 1989 in Minnesota and North Dakota.

Northharvest Total			MN			ND		
Variety	# A	% A	Variety	# A	% A	Variety	# A	% A
Upland	47,949	24.4	Upland	8,495	27.1	Upland	39,334	23.8
Topaz	37,313	19.0	Montcalm	4,928	15.7	Topaz	33,778	20.4
Fiesta	15,402	7.8	Topaz	3,535	11.3	Fiesta	13,171	8.0
Othello	12,819	6.5	Fiesta	2,231	7.1	Othello	12,579	7.6
Nodak	12,297	6.3	Agri 1	1,413	4.5	Nodak	12,187	7.4

seed was used by 7.1 percent of respondents on 5.8 percent of their acres, and the seed source was not designated on the rest. Minnesota respondents planted 94.2 percent of their acres with bagged and tagged seed and North Dakota respondents planted 89.6 percent of acres with bagged and tagged seed.

The questionnaire deliberately lumped together various types of seed tags. There are several types of seed tags in the dry bean industry: certified (blue tag), tags indicating some form of inspection other than certification (green tags, yellow tags, etc.), and tags issued by private seed companies. Our lumping does not imply that the different tags represent equivalent quality; rather it is an admission of the difficulty in sorting the types of tagged seed used by growers. The use of bagged and tagged seed remained relatively constant in 1987, 1988, and 1989. There appears to be a continued commitment on the part of dry bean growers to use high quality seed.

Soil Type. Over half of all acres planted by respondents were on medium textured soils in both 1989 and 1988. There were fewer acres planted on light or heavy soils, and very low acreages planted on very heavy soils (Table 4). There were major differences in predominant soil type by state and by district. Only 9.7 percent of North Dakota respondents' dry bean acres were on light textured soils, but 30.9 percent of Minnesota acres were on light textured soils. Nearly half the acres in MN 4 and all acres in MN 2 were light textured. Only 19.2 percent of Northarvest respondents' dry bean acres were on heavy soils. Respondents in MN 1 and MN 5 planted over half of their acres on heavy or very heavy soils.

Land Preparation. Nearly two thirds of all acres planted by respondents were chisel plowed, 14 percent received conservation tillage, and 16 percent were moldboard plowed (Table 5). Use of the chisel plow increased and moldboard plowing

Table 4. Soil types planted to dry beans in 1989 by survey respondents in Minnesota and North Dakota.

District	% Acres			
	Very Heavy	Heavy	Medium	Light
MN 1	21.9	39.1	29.3	9.6
MN 2	0	0	0	100.0
MN 3	9.1	21.0	34.2	20.6
MN 4	11.5	29.4	15.5	40.7
MN 5	26.5	41.8	31.8	0
MN State	12.4	25.0	27.3	30.9
ND 1	2.3	18.4	63.1	10.5
ND 2	3.1	19.2	66.8	8.1
ND 3	0.8	18.7	68.3	5.8
ND 4	2.3	14.5	63.4	13.6
ND 5	1.5	19.1	60.0	10.8
ND State	2.3	18.0	64.1	9.7
Northarvest	3.9	19.2	58.2	13.1

decreased from 1988 to 1989. Increased use of the chisel plow was most dramatic in MN 4, ND 1 and ND 4, where the percentage of chisel plowed acres increased from 11 percent to 44 percent, 47 percent to 69 percent, and 66 percent to 85 percent, respectively. There did not appear to be any relationship between the use of conservation tillage and the amount of light textured soil in a district.

Weather and Production Problems. In 1989 drought was considered the greatest weather problem by 90 percent of respondents, with 91 percent of acres affected (Table 6). These figures are slightly higher than those for 1988. In both years heat was the next greatest problem, followed by wind. Hail was regarded as the greatest weather problem on only 4,788 acres, or 2.4 percent, even though there were 12,674 hailed acres. Apparently hail was not considered the greatest weather problem on two thirds of the hailed acres.

Table 5. Land preparation methods used by survey respondents in 1989 in Minnesota and North Dakota.

District	% acres		
	chisel plow	conservation tillage	moldboard plow
MN 1	53.1	17.9	25.4
MN 2	88.2	8.0	3.8
MN 3	69.2	4.9	25.7
MN 4	44.4	8.9	40.1
MN 5	66.1	0	33.9
MN State	64.1	10.5	23.0
ND 1	69.1	21.1	7.1
ND 2	67.4	9.8	19.9
ND 3	57.4	21.9	16.0
ND 4	84.6	4.7	9.4
ND 5	56.4	12.8	19.3
ND State	66.8	14.4	14.2
Northarvest	66.4	13.8	15.6

Table 6. Greatest weather problem reported by survey respondents in 1989 in Minnesota and North Dakota.

Problem	growers		acres	
	#	%	#	%
Drought	732	89.7	179,847	91.4
Heat	28	2.5	4,837	2.5
Wind	19	1.9	3,787	1.9
Hail*	15	2.4	4,788	2.4
Frost	9	0.9	1,771	0.9

*Total hailed acres was 12,674.

Disease Problems. Few growers ranked any disease as a major production problem in the second consecutive year of drought. However, white mold was ranked as the worst disease problem by over 6 percent of respondents and the disease affected over 10 percent of planted acres. It was ranked as one of the worst three disease problems by nearly 9 percent of respondents and affected over 13 percent of planted acres (Table 7). The percentage of respondents reporting disease problems was low since those who had no major disease problem did not rank any disease. White mold was perceived to be a problem on a much higher percentage of Minnesota acres than North Dakota acres. The perceived importance of white mold was much less in 1988 and 1989 than it was in 1987, when white mold was ranked as the worst disease problem on nearly 68 percent of planted acres and as one of the three worst disease problems on over 81 percent of planted acres. Bacterial blight and root rot were the other problems most frequently mentioned by respondents.

Some of the greatest disease problems in Minnesota were in the heavily irrigated district MN 2 (Table 8). White mold was ranked the worst disease problem on over 96 percent of respondents' acres in MN 2. In 1989 white mold was ranked as the worst disease problem on a higher percent of MN 2 acres than in 1988, but was ranked as one of the three worst disease problems on about the same percent of MN 2 acres in both years. Rust was ranked one of the three worst disease problems on 23 percent of respondents' acres in MN 2. Bacterial blight was ranked as one of the three worst disease problems on 23 percent of respondents' acres in MN 4.

Fungicide Use. Fungicide use correlated with major reported disease problems. The benzimidazole fungicides Benlate and Topsin M, which are used for white mold control, were used on over 86 percent of respondents' acres in MN 2 where white mold was one of the three worst disease problems on almost all acres. These data are almost identical to the 1988 data. The benzimidazole fungicides were also used on over 15 percent of respondents' acres in MN 4, where white mold was one of the three worst disease problems on 29 percent of respondents' acres. In contrast, only 4 percent of acres in ND 5 were sprayed with benzimidazole fungicides even though white mold was reported as one of the three worst diseases on nearly 29 percent of planted acres.

Nearly one third of the acres sprayed with benzimidazole fungicides were band applied; the rest were broadcast. In North Dakota, over half of benzimidazole fungicides were band applied, but in Minnesota over 90 percent were broadcast (Table 9). Interest in band application seems to have waned with fewer acres being sprayed for white mold in 1989.

Maneb was used for rust control on 2.6 percent of Northharvest respondents' acres in 1989 (Table 9). Rust was one of the three worst disease problems on 4.4 percent of planted acres (Table 7).

Production Problems. Forty-six percent of the survey respondents indicated that they had no particular "biggest production problem" in dry beans in 1989 (Table 10). Weeds were

indicated as the biggest problem by 20 percent of the respondents while insects were reported by 19 percent. In comparison to the 1988 survey, response to "insects" increased from 8 percent to 19 percent. Percent of growers reporting "weeds" as a problem declined for both states; Minnesota showed the greatest decrease from 40 percent to 19 percent. Total percentage of growers reporting "emergence" as a problem also declined. "Disease," "aborted blossoms" and "dry down" changed little.

Table 7. Worst disease problem reported by survey respondents in 1989 in Minnesota and North Dakota.

	Northharvest		% Acres	
	% growers	% Acres	MN	ND
White Mold				
# 1 (Worst)	6.5	10.6	24.5	8.0
# 1, 2, & 3	8.8	13.1	28.3	10.2
Rust				
# 1	1.0	0.6	0.5	0.6
# 1, 2, & 3	4.2	4.4	10.8	3.2
Bacterial Blight				
# 1	2.8	3.8	2.7	4.0
# 1, 2, & 3	6.3	8.1	5.8	8.4
Alternaria				
#	0.3	0.2	0	0.2
# 1, 2, & 3	1.5	2.4	0	2.8
Root Rot				
# 1	3.9	4.3	3.8	4.4
# 1, 2, & 3	7.0	8.0	6.4	8.3

Table 8. Selected districts in Minnesota and North Dakota where disease problems were reported to be above the Northharvest average in 1989.

Disease	District	%A Ranked	
		#1	#1,2,3
White Mold	MN 2	96.2	96.2
	MN 4	27.4	38.8
	ND 5	25.1	28.7
	(Northharvest)	10.6	13.1
Rust	MN 2	0	22.9
	MN 3	1.9	15.6
	MN 4	0	14.5
	(Northharvest)	0.6	4.4
Bacterial Blight	MN 4	16.8	23.1
	(Northharvest)	3.8	8.1
Root Rot	MN 3	6.8	16.9
	(Northharvest)	4.3	8.0

Weed Problems. Wild mustard was ranked as the worst weed problem on 24 percent of the dry bean acreage and was ranked as one of the three worst problems on 48 percent of the acreage (Table 11). Kochia was the second most frequently listed weed problem followed by foxtail species, redroot pigweed, wild oats, common cocklebur, common lambsquarters, and eastern black nightshade. In comparison to the 1988 survey, response to foxtails increased and redroot pigweed decreased to the level that foxtails outranked redroot pigweed in importance. Response to common lambsquarters also decreased and common lambsquarters fell in standing and importance. Kochia remained relatively more important in North Dakota than in Minnesota. Redroot pigweed, common lambsquarters and eastern black nightshade were relatively more important in Minnesota than in

North Dakota. Kochia is more competitive in dry conditions. The lower average rainfall in North Dakota compared to Minnesota may explain the greater kochia problem in North Dakota. Minnesota has more soybean and other row crop acreage than North Dakota. Redroot pigweed, common lambsquarters and eastern black nightshade are more competitive and more difficult to control in soybeans and other row crops than they are in small grains. This may explain why these weeds were more severe in Minnesota than in North Dakota.

Sulfonylurea herbicides are used for weed control in other crops (Harmony Extra, Express and Ally can be applied in small grains; Pinnacle, Classic and premixes containing the active ingredient of Classic can be applied in soybeans and Accent and Beacon can be applied in corn). Potential wide use of sulfonylurea herbicides and weak activity of these herbicides on eastern black nightshade are concerns for potential build up of eastern black nightshade and may help to explain the increase in importance from the 1988 survey.

Table 9. Fungicides used by survey respondents in 1989 in Minnesota and North Dakota.

District	% acres treated			
	maneb	benzimidazoles (Benlate, Topsin, Mertect)		
		band	broadcast	total
MN 1	1.7	0	0	0
MN 2	0	6.8	79.9	86.7
MN 3	0	0.5	0	0.5
MN 4	0	0	15.5	15.5
MN 5	0	0	0	0
MN State	0.6	1.2	14.4	15.6
ND 1	3.3	4.4	3.5	7.9
ND 2	9.2	4.2	2.8	7.0
ND 3	0.4	0.2	0.2	0.4
ND 4	0.2	0	0.7	0.7
ND 5	1.0	2.2	2.2	4.4
ND State	2.9	2.3	2.0	4.3
Northharvest	2.6	2.1	4.0	6.1

Herbicide Use. Sonalan was used on 54 percent of the dry bean acreage, which was more than any other herbicide and was up from 47 percent in the 1988 survey (Table 12). Trifluralin, fall or spring applied, was used on 39 percent of the acreage and bentazon was used on 37 percent of the acreage. All other herbicides were used on less than 10 percent of the dry bean acreage. Greater broadleaf weed control from Sonalan may be a factor in more product use over trifluralin despite greater cost on an acre basis. A federal label allowing use of a granular formulation of Sonalan (Sonalan 10G) on dry beans in North Dakota only may be another reason for the disproportional use of Sonalan in North Dakota as compared to Minnesota (57 percent of acres in North Dakota, 35 percent of acres in Minnesota). Sonalan use was up, however, for both states.

Amiben and alachlor were used on more acreage in Minnesota than in North Dakota. Since eastern black nightshade was reported as the "worst weed" more frequently in Minnesota than in North Dakota (Table 11), the greater usage of alachlor and Amiben in Minnesota than North Dakota may have been for control of eastern black nightshade.

Table 10. Biggest production problem in dry beans in North Dakota and Minnesota given by survey respondents in 1989.

Problem	North Dakota		Minnesota		Total		
	Growers		Growers		Acres No.	Growers	
	Acres No.	Reporting %	Acres No.	Reporting %		Reporting No.	Reporting %
None	75,854	48	10,960	39	86,814	378	46
Weeds	33,466	21	4,983	19	38,449	166	20
Insects	31,271	17	6,334	20	37,725	151	19
Emergence	10,651	8	1,514	7	12,165	61	7
Disease	8,091	2	5,655	6	13,746	23	3
Aborted blossoms	2,994	2	210	2	3,204	17	2
Dry down	1,380	1	1,059	4	2,439	11	1

Post-plant cultivation was used for weed control by 53 percent of the survey respondents. Respondents who used cultivation averaged 1.6 cultivations per acre. Hand weeding was utilized for weed control by 17 percent of the survey respondents on 6 percent of the acreage.

Hand weeding was evaluated as giving excellent or good weed control by 72 percent of respondents who used handweeding (Table 13). All herbicide treatments except bentazon and alachlor had a greater percentage of excellent and good evaluations than

hand weeding. Bentazon, alachlor and Prowl had the greatest percentage of fair or poor weed control responses. The most common reason for poor weed control from alachlor is lack of rainfall for activation shortly after application. Incorporation improves the consistency of weed control from alachlor. A common reason for poor weed control from bentazon is application to weeds that are too large. Dry beans should be in the first trifoliate stage or slightly larger when bentazon applications begin. Broadleaf weeds should be in the seedling stage. An oil additive often will improve weed control from bentazon. Envi-

Table 11. Worst weed problem in dry beans in North Dakota and Minnesota given by survey respondents in 1989.

Weed Species	North Dakota		Minnesota		Total	
	Ranked 1st	Ranked 1st, 2nd or 3rd	Ranked 1st	Ranked 1st, 2nd or 3rd	Ranked 1st	Ranked 1st, 2nd or 3rd
	----- (Percent of Acres) -----					
Wild mustard	27	51	8	26	24	48
Kochia	21	49	4	12	18	43
Foxtail spp. (pigeongrass)	11	33	18	33	12	33
Redroot pigweed	5	22	14	48	7	26
Wild oats	4	22	5	17	4	21
Common cocklebur	4	18	7	19	4	17
Common lambsquarters	1	8	6	39	2	13
Eastern black nightshade	3	11	17	31	5	14
Canada thistle	4	7	1	1	3	5
Russian thistle	3	4	0	0	3	4
Common ragweed	1	1	5	8	2	3
Sunflower (volunteer and wild)	<1	1	1	1	<1	1
Common milkweed	<1	1	0	0	<1	1

Table 12. Weed control practices used in dry beans in North Dakota and Minnesota in 1989.

Treatment	North Dakota		Minnesota		Total		Growers reporting	
	Acres treated (No.)	(%)	Acres treated (No.)	(%)	Acres treated (No.)	(%)	(No.)	(%)
Post-plant cultivation*	141,469	86	21,165	68	162,755	83	428	53
Sonalan	94,134	57	11,087	35	105,221	54	457	56
Bentazon	63,904	39	9,286	30	73,190	37	397	49
Trifluralin (spring)	51,788	31	10,587	34	62,494	32	318	39
Trifluralin (fall)	12,881	8	525	2	13,406	7	57	7
Hand weeding	8,057	5	3,460	11	11,597	6	137	17
Amiben	835	<1	8,853	28	9,688	5	47	6
Alachlor	995	<1	3,969	13	4,964	3	28	3
Eptam	4,735	3	1,250	4	5,985	3	26	3
Sodium chlorate	1,467	1	1,858	6	3,445	2	28	3
Trifluralin + Eptam	3,423	2	360	1	3,782	2	18	2
Prowl	1,133	1	2,040	7	3,174	2	14	2
Rotary hoe	323	<1	424	1	1,586	1	8	1

*Acres include multiple cultivations per acre. Growers who cultivated averaged 1.6 cultivations.

ronmental concerns, including reduced pesticide use, are important issues. Alternative methods of weed control are being more widely used. Response to weed control by rotary hoe increased from the 1988 survey.

Dry bean injury from weed control treatments generally was minor (Table 14). Only bentazon, Amiben, fall-applied trifluralin, and Prowl had more than 1 percent of the respondents indicate moderate or severe injury. Prowl had the highest percentage of evaluations of severe injury and rotary hoe had the highest percentage in the moderate category. Weed control treatments caused little serious dry bean injury in 1989.

Insect Problems. According to the 1989 survey, respondents in Minnesota ranked insects slightly higher than weeds as a production problem. In North Dakota, insects ran a close second to weeds (Table 10). When production problems for the two states are combined, 19 percent of growers reported insects as being a problem on 37,725 acres with weeds reported by 20 percent of growers as a problem on 38,449 acres. Table 15 lists the greatest insect problems in 1989. The majority of respondents experienced no insect problem (60.5 percent of growers on 57.2 percent of acres). Grasshoppers were the number one insect problem for 36.9 percent of growers (41.0 percent of the total acres). The second greatest problem was spider mites but, only 1.1 percent of respondents reported this problem. By acreage, the second greatest problem was seed corn maggots on only 0.4 percent of the total acres. Miscellaneous insect problems (cutworms, leafhoppers, crickets) were reported as problems by 1.47 percent of growers on 1.43 percent of total acres.

Insecticide Use. Of the farmers that used an insecticide, the majority sprayed for grasshoppers, which was expected, as this was the primary insect problem in 1989, Table 16 lists the insecticides used for grasshopper control and the amount of acres treated with each product. Use of different insecticides on dry beans varied greatly (Table 17). A total of 187 respondents used insecticides on 18,071 acres. The most popular sprays were Asana (7.48 percent of growers), Furadan (3.3 percent), and Sevin (2.7 percent). The chemicals that covered the most acreage were Asana (3.52 percent of all acres), unknown insecticides (1.8 percent), and Sevin (1.2 percent). Table 18 provides state insecticide use statistics.

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Table 13. Evaluation of weed control by survey respondents in 1989.

Treatment	No. of Respondents	Evaluation of weed control				
		No Answer	Excellent	Good	Fair	Poor
----- (% of respondents) -----						
Post-plant cultivation	429	21	28	42	9	1
Sonalan	457	2	43	41	11	3
Trifluralin (spring)	318	4	41	43	10	2
Bentazon	397	6	23	45	22	4
Trifluralin (fall)	57	5	39	42	5	9
Hand weeding	137	23	54	18	3	3
Amiben	47	0	32	49	15	4
Alachlor	28	0	25	43	32	0
Trifluralin + Eptam	18	0	22	72	6	0
Eptam	26	4	27	54	15	0
Rotary hoe	8	25	13	25	38	0
Prowl	14	0	7	43	36	14

Table 14. Dry bean injury in 1989 reported by survey respondents in Minnesota and North Dakota.

Weed Control Treatment	No. of Respondents	Evaluation of Injury				
		No Answer	None	Slight	Moderate	Severe
----- (% of respondents) -----						
Post-plant cultivation	429	34	39	27	1	0
Sonalan	457	18	67	14	<1	<1
Trifluralin (spring)	318	20	67	11	<1	<1
Bentazon	397	21	39	36	3	<1
Trifluralin (fall)	57	23	63	14	0	0
Hand weeding	137	39	50	14	1	0
Amiben	48	19	69	8	0	0
Alachlor	28	29	43	25	4	0
Trifluralin + Eptam	18	17	72	11	0	0
Eptam	26	8	77	12	4	0
Rotary hoe	8	38	13	38	13	0
Prowl	14	7	64	21	0	7

Table 15. Insect problems in 1989 reported by survey respondents in Minnesota and North Dakota.

Insect Problem	Number of Respondents	% of Total Respondents	Number of Acres	% of Total Acres
Grasshopper	301	36.89	80,706.4	40.99
Spider mite	9	1.10	734.0	0.37
Misc. insects	12	1.47	2,816.5	1.43

Table 16. Insecticides used in 1989 for grasshopper control on beans in Minnesota and North Dakota.

Insecticide	Number of Respondents	% of Total Respondents	Number of Acres	% of Total Acres
Asana	56	6.87	6,889.0	3.50
Cygon	7	0.86	933.0	0.48
Furadan	26	3.19	1,412.0	0.72
Lorsban	10	1.23	245.0	0.12
Malathion	9	1.10	326.0	0.17
Methyl parathion	3	0.37	146.0	0.07
Parathion	7	0.86	535.0	0.27
Pydrin	8	0.98	715.0	0.36
Scout	1	0.12	145.0	0.07
Sevin	21	2.57	2,242.0	1.14
Unknown	21	2.57	3,492.0	1.77

Table 17. Total insecticide use on beans in Minnesota and North Dakota in 1989.

Insecticide	Number of Respondents	% of Total Respondents	Number of Acres	% of Total Acres
Asana	61	7.48	6,940.0	3.52
Cygon	11	1.35	1,093.0	0.56
Furadan	27	3.31	1,472.0	0.75
Lindane (seed treatment)	1	0.12	215.0	0.11
Lorsban	12	1.47	295.0	0.15
Malathion	10	1.23	406.0	0.21
Methyl parathion	3	0.37	146.0	0.07
Parathion	8	0.98	620.0	0.31
Pydrin	8	0.98	715.0	0.36
Scout	1	0.12	145.0	0.07
Sevin	22	2.70	2,257.0	1.15
Unknown	22	2.70	3,592.0	1.82
TOTAL OF ABOVE	187	23.16	18,071.0	9.18

Table 18. Insecticide use in Minnesota and North Dakota, 1989.

State	Insecticide	Number of Respondents	% of State Respondents	Number of Acres	% of State Acres
MN	Asana	24	14.04	2,681.0	8.54
	Cygon	6	3.50	411.0	1.31
	Lorsban	6	3.51	118.0	0.38
	Malathion	7	4.09	256.0	0.82
	Pydrin	2	1.17	200.0	0.64
	Sevin	9	5.26	475.0	1.51
	Unknown	7	4.09	1,295.0	4.13
ND	Asana	37	5.74	4,259.0	2.57
	Cygon	5	0.78	682.0	0.42
	Furadan	27	4.19	1,472.0	0.89
	Lindane (seed treatment)	1	0.16	215.0	0.13
	Lorsban	6	0.93	177.0	0.11
	Malathion	3	0.47	150.0	0.09
	Methyl parathion	3	0.47	146.0	0.09
	Parathion	8	1.24	620.0	0.37
	Pydrin	6	0.93	515.0	0.31
	Scout	1	0.16	145.0	0.09
	Sevin	13	2.02	1,782.0	1.08
	Unknown	15	2.33	2,297.0	1.39