

Problems and Practices of Northarvest Dry Bean Growers in 1988

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An annual survey of production and pest problems, pesticide use and grower practices of dry bean growers in Minnesota and North Dakota was begun in 1987. Questionnaires were addressed by the Northarvest Bean Growers Association, which comprises dry edible bean growers of North Dakota and Minnesota. The single-page questionnaires were anonymous. Results of the first survey, published in *North Dakota Farm Research* (2), have been useful in establishing research priorities and in providing quality data to governmental agencies and others in the dry bean industry.

Questionnaires for the 1988 growing season were coded by Northarvest district and mailed in March 1989 to 3,702 growers on the mailing list of Northarvest Bean Growers Association. The 10 Northarvest districts are shown in Figure 1. The Minnesota districts are designated as MN 1 to MN 5, and the North Dakota districts are designated as ND 1 to ND 5.

RESULTS AND DISCUSSION

There were 938 forms returned, or 25 percent of those mailed. Some respondents did not grow dry beans in 1988 and a few responses were so incomplete that they were unusable. There were 812 forms (22 percent) with usable data. Forms received/sent were 151/864 in Minnesota, for a 17.5 percent reply rate, and 660/2,828 in North Dakota, for a 23 percent reply rate. One form was returned from South Dakota.

The 811 responses from North Dakota and Minnesota represented 173,471 acres; 27,287 acres in Minnesota or 42.0 percent of the 65,000 total planted acres, and 146,104 acres in North Dakota, or 36.5 percent of the 400,000 planted acres. Total planted acres for each state are based on USDA estimates. There were 80 acres reported in South Dakota. Acres grown by the 811 respon-

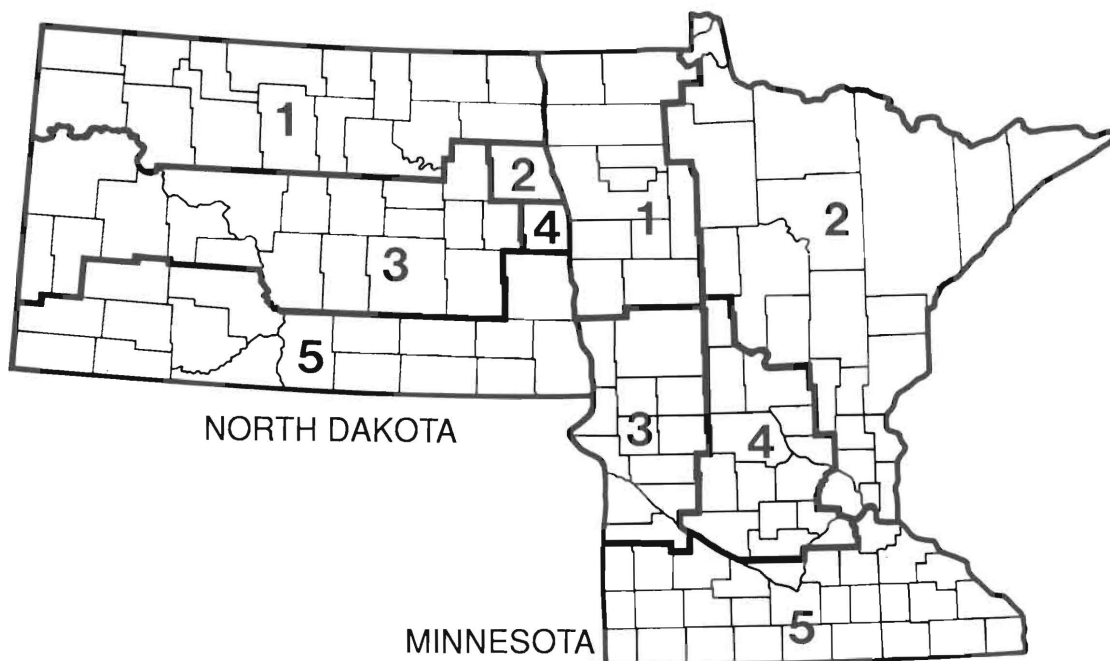


Figure 1. Northarvest districts.

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dants represented 37 percent of the total Northarvest bi-state acreage of 465,000. Preliminary reports on the results were published earlier (1,3).

Varieties. Table 1 lists varieties grown on at least 2,000 acres by respondents. The most common varieties and percent of acres were Upland, 24 percent; Topaz, 24 percent; Nodak, 8 percent; Fiesta, 6 percent; and Olathe, 5 percent (Table 2). The most common varieties in North Dakota were Topaz, Upland, Nodak, Olathe, and Fiesta. In Minnesota the most common varieties were Upland, Montcalm, Topaz, Fiesta, and Sno-bunting. Montcalm dark red kidney was widely planted in MN 2, MN 3 and MN 4, all districts with a high percentage of irrigated acres.

Table 1. Dry bean varieties in 1988 on 2,000 or more acres by survey respondents in Minnesota and North Dakota.

Variety	Northarvest Total		MN		ND	
	# A	% A	# A	% A	# A	% A
C-20	6,212	3.6	547	2.0	5,665	3.9
Fiesta	10,644	6.1	2,629	9.6	8,015	5.5
Fleetwood	3,903	2.2	302	1.1	3,601	2.5
Montcalm	7,547	4.4	4,809	17.6	2,738	1.9
Nodak	13,982	8.1	0	0	13,982	9.6
Olathe	9,287	5.4	0	0	9,287	6.4
Othello	3,403	2.0	50	0.2	3,353	2.3
Pearls	2,108	1.2	0	0	2,108	1.4
RS 101	2,448	1.4	50	0.2	2,398	1.6
Sno-bunting	3,700	2.1	1,143	4.2	2,557	1.8
Topaz	40,976	23.6	2,802	10.3	38,174	26.1
Upland	41,073	23.7	6,338	23.2	34,655	23.7

Irrigated Acres. Respondants reported that 12,526 acres or 7.2 percent were irrigated (Table 3). The percent irrigated acres ranged from 0 in MN 5, ND 2, and ND 4 to 13 percent in ND 5, 49 percent in MN 3, 54 percent in MN 4, and 65 percent in MN 2. Percent irrigated acres was related to varieties grown, disease problems, weed problems, and herbicide practices.

Seed Source. Bagged and tagged seed was used on 90 percent of respondents' acres, bin run seed on 6.5 percent, and the seed source was not designated on the rest. Minnesota respondents planted 98 percent of their bean acreage and North Dakota respondents planted 89 percent with bagged and tagged seed. Since many types of seed tags are used in the dry bean industry, no effort was made to distinguish between certified seed tags (blue tags) and other seed

Table 3. Irrigated and total acres planted in 1988 by survey respondents in Minnesota and North Dakota.

District	Irrigated Acres	Total Acres	% Irrigated
MN 1	52	12,465	0.4
MN 2	3,455	5,284	65.4
MN 3	2,829	5,762	49.1
MN 4	1,899	3,535	53.7
MN 5	0	241	0
MN State	8,235	27,287	30.2
ND 1	219	34,029	0.6
ND 2	0	27,830	0
ND 3	170	25,935	0.7
ND 4	0	28,901	0
ND 5	3,902	29,409	13.3
ND State	4,291	146,104	2.9
South Dakota		80	
Northarvest	12,526	173,471	7.2

tags. Growers appear to recognize the importance of quality seed since only 7.5 percent of North Dakota acres and 0.7 percent of Minnesota acres were planted with bin run seed.

Soil Type. Over half of all acres were on medium textured soils, with lesser acreages planted on light or heavy soils and very low acreages planted on very heavy soils (Table 4). Predominant soil type varied greatly by state and by district. Only 10 percent of North Dakota dry beans were on light textured soils, but 38.5 percent of Minnesota acres were on light textured soils.

Land Preparation. Over half of all acres planted by respondents were on fields that had been chisel plowed, 14 percent had received conservation tillage, and 24 percent were moldboard plowed (Table 5). Conservation tillage was used very little in MN 5, MN 4, MN 3, and ND 4, but was used on nearly one-fourth of the acres in MN 2 and ND 3. Conservation tillage was not highest in districts with the lightest-textured soils, however. Chisel plowing was used in nearly 75 percent of the acres in MN 2, but only 11 percent in MN 4. Most districts had about 25 to 30 percent of acres moldboard plowed, but only 5 percent were plowed in MN 2 and 50 to 70 percent were plowed in MN 5 and MN 4.

Weather and Production Problems. Drought was ranked as the greatest weather problem by 83 percent of respondents, with 82 percent of acres affected (Table 6). Heat was the next greatest problem, followed by wind, hail

Table 2. Five most common varieties grown in 1988 by survey respondents in Minnesota and North Dakota.

Northarvest Total			MN			ND		
Variety	# A	% A	Variety	# A	% A	Variety	# A	% A
Upland	41,073	23.7	Upland	6,338	23.2	Topaz	38,174	26.1
Topaz	40,976	23.6	Montcalm	4,809	17.6	Upland	34,655	23.7
Nodak	13,982	8.1	Topaz	2,802	10.3	Nodak	13,982	9.6
Fiesta	10,644	6.1	Fiesta	2,629	9.6	Olathe	9,287	6.4
Olathe	9,287	5.4	Sno-bunting	1,143	4.2	Fiesta	8,015	5.5

Table 4. Soil types on which dry beans were planted in 1988 by survey respondents in Minnesota and North Dakota.

District	Very Heavy	Heavy	Medium	Light
	----- % Acres -----			
MN 1	11.3	36.1	34.9	12.4
MN 2	0	0.8	1.4	97.8
MN 3	0	20.1	34.9	34.3
MN 4	5.2	17.2	19.2	51.0
MN 5	27.4	60.2	12.4	0
MN State	6.1	23.6	26.2	38.5
ND 1	3.0	16.5	62.2	9.7
ND 2	1.8	17.5	59.4	12.0
ND 3	0.3	26.0	60.8	4.2
ND 4	1.6	14.2	61.0	10.1
ND 5	3.4	12.5	51.2	11.5
ND State	2.1	17.1	60.0	9.6
Northharvest	2.7	18.2	53.8	14.1

Table 5. Land preparation methods used in 1988 by survey respondents in Minnesota and North Dakota.

District	Chisel Plow	Conservation Tillage	Moldboard Plow
	----- % Acres -----		
MN 1	53.0	9.1	30.2
MN 2	72.9	22.2	4.8
MN 3	67.3	3.1	19.8
MN 4	10.7	2.1	68.0
MN 5	50.6	0	49.4
MN State	54.4	9.4	29.1
ND 1	47.4	19.0	28.0
ND 2	56.3	14.5	26.2
ND 3	48.6	23.7	21.9
ND 4	65.7	5.4	19.1
ND 5	62.9	13.7	21.8
ND State	56.1	15.2	23.6
Northharvest	55.8	14.3	24.4

Table 6. Greatest weather problem reported in 1988 by survey respondents in Minnesota and North Dakota.

Problem	Growers		Acres	
	#	%	#	%
Drought	676	83.3	142,808	82.3
Heat	41	5.0	12,121	7.0
Wind	34	4.2	7,754	4.5
Hail*	30	3.7	5,064	2.9
Frost	8	1.0	1,868	1.1

* Total hailed acres was 14,551

and frost. Hail was regarded as the greatest weather problem on only 5,064 acres, or 3 percent. In another survey question, respondents indicated that there was a total of 14,551 hailed acres. This suggests that hail was not the greatest weather problem in nearly two-thirds of the hailed acres.

Disease Problems and Fungicide Use. Even in a drought year, white mold was ranked as the worst disease problem by over 10 percent of respondents and as one of the worst three disease problems by nearly 15 percent (Table 7). Respondents who had no major disease problem did not rank diseases, so disease totals for 1988 were generally low. Bacterial blight was ranked as one of the three worst disease problems on 16 percent of acres, root rot on 8.5 percent, and rust on 8 percent. White mold was perceived to be a problem on a much higher percentage of Minnesota acres than North Dakota acres. Rust and root rot were ranked slightly higher in Minnesota than in North Dakota.

Some of the greatest disease problems in Minnesota were in the heavily irrigated districts MN 2 and MN 3 (Table 8). ND 5 also had somewhat greater disease problems than the average. White mold was ranked the worst disease problem on over 80 percent of respondents' acres in MN 2 and nearly 30 percent of respondents' acres in MN 1. Rust was ranked one of the three worst disease problems in 20 percent, 14 percent and 12 percent of acres in MN 1, ND 5, and MN 3. Bacterial blight was ranked as one of the three worst disease problems on 55 percent and 31 percent of acres in MN 2 and MN 3. Root rot was ranked as one of the three worst disease problems on 33 percent and 18 percent of respondents' acres in MN 3 and ND 5.

Some fungicide use was related to reported disease problems, and some was not (Table 9). The benzimidazole fungicides Benlate, Topsin M, and Mertect, which are used for white mold control, were used on over 85 percent of respondents' acres in MN 2 where white mold was one of the

Table 7. Worst disease problem ranked in 1988 by survey respondents in Minnesota and North Dakota.

Disease Ranking	Northharvest		MN	ND
	Growers	Acres		
	(%)	(%)	-- % Acres --	
White Mold				
#1 (Worst)	10.6	15.9	31.7	12.9
#1, 2, & 3	14.7	21.2	43.9	17.0
Rust				
#1	1.4	1.3	2.5	1.1
#1, 2, & 3	5.7	8.2	13.2	7.3
Bacterial Blight				
#1	4.1	5.5	1.5	6.3
#1, 2, & 3	8.9	16.3	19.1	15.8
Alternaria				
#1	0.5	0.9	0	1.0
#1, 2, & 3	1.6	2.3	2.0	2.4
Root Rot				
#1	2.2	3.3	7.0	2.6
#1, 2, & 3	5.9	8.5	12.1	7.9

Table 8. Selected districts in Minnesota and North Dakota where disease problems were reported to be above the Northarvest average in 1988.

Disease	District	#1, 2, 3	
		#1	#1, 2, 3
		--- % A Ranked ---	
White mold	MN 1	28.8	34.9
	MN 2	81.9	97.8
	(Northarvest)	15.9	21.2)
Rust	MN 1	5.5	19.9
	MN 3	0	12.3
	ND 5	0.4	13.6
	(Northarvest)	1.3	8.2
Bacterial Blight	MN 2	7.8	55.2
	MN 3	0	30.7
	(Northarvest)	5.5	16.3)
Root Rot	MN 3	20.8	33.1
	ND 5	7.7	17.9
	(Northarvest)	3.3	8.5)

Table 9. Fungicides used in 1988 by survey respondents in Minnesota and North Dakota.

District	Maneb	Benzimidazoles (Benlate, Topsin, Mertect)		
		Band	Broadcast	Total
	----- % Acres Treated -----			
MN 1	4.8	4.1	6.8	10.7
MN 2	28.4	19.7	66.6	86.2
MN 3	0	0	0	0
MN 4	0	0	26.0	26.0
MN 5	0	0	0	0
MN State	7.7	5.7	19.4	25.0
ND 1	13.9	35.7	4.8	40.5
ND 2	10.6	7.9	2.0	9.8
ND 3	1.5	3.2	1.9	5.1
ND 4	3.9	1.0	3.9	4.9
ND 5	1.8	0	1.4	1.5
ND State	6.7	10.6	2.9	13.4
Northarvest	6.8	9.8	5.5	15.3

three worst disease problems on almost all acres. These fungicides also were used on over 10 percent of the bean acres in MN 1, where white mold was one of the three worst disease problems on 35 percent of the acres. In contrast, the benzimidazole fungicides were used on over 40 percent and 25 percent of acres in ND 1 and MN 4 where white mold was one of the three worst disease problems on only 7 percent of respondents' acres. The use of benzimidazole fungicides in ND 1 and MN 4 is difficult to rationalize. Perhaps the growers expected high yields and heavy disease pressure when the decision was made to spray at early blossom, but subsequent weather was unfavorable for white mold development.

Nearly one-third of benzimidazole sprayed acres received band application; the rest were broadcast. In North Dakota,

over three-fourths of benzimidazole fungicides were band applied, but in Minnesota about 80 percent were broadcast. Percent of benzimidazole treated acres that were band treated in North Dakota increased from 24 percent in 1987 to 79 percent in 1988. This indicates that band application of white mold fungicides is being used increasingly by North Dakota growers (Table 9, and reference 2). This is not surprising since the band application cuts fungicide costs in half yet provides adequate disease control.

Maneb was used for rust control on 28 percent of respondents' acres in MN 2, although rust was one of the three worst disease problems on only 3 percent of their acres (Table 9). Due to the high percentage of irrigated acres and the amount of spraying for white mold, growers may have tank mixed maneb with their benzimidazole fungicide and sprayed preventively for rust. Perceived importance of rust and maneb use in ND 1, ND 2, MN 1 and ND 5 are inversely related, with more maneb used in ND 1 and ND 2 where rust was perceived to be less of a problem than the other two districts.

Weed Problems and Herbicide Use. Forty-one percent of the respondents to the survey indicated that they had no particular "biggest production problem" in dry beans in 1988 (Table 10). Weeds were indicated as the biggest problem by 30 percent while emergence was given by 12 percent, insects by 8 percent, and disease by 4 percent of the respondents. Weeds were relatively more important in Minnesota than in North Dakota as 40 percent of the Minnesota respondents named weeds as the worst problem while 28 percent from North Dakota named weeds.

Wild mustard was ranked as the worst weed problem by survey respondents with 22 percent of the dry bean acreage and it was ranked as one of the three worst problems on 49 percent of the acreage (Table 11). Kochia was the second most frequently listed weed followed by redroot pigweed, foxtail species, wild oats, common lambsquarters, common cocklebur, and eastern black nightshade. Kochia was 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 why kochia is a greater problem in North Dakota. Minnesota has more soybean acreage 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 in small grains and

Table 10. Biggest production problem in 1988 in dry beans in North Dakota and Minnesota.

Problem	North Dakota		Minnesota		Total	
	Acres No.	Growers Reporting %	Acres No.	Growers Reporting %	Acres No.	Growers Reporting %
None	56,691	42	8,831	36	65,522	331 41
Weeds	45,475	28	9,465	40	55,020	246 30
Emergence	15,981	12	1,657	7	17,638	93 12
Insects	11,104	7	1,458	9	12,562	63 8
Disease	8,106	4	3,521	4	11,627	32 4
Dry down	2,427	1	450	1	2,877	10 1
Aborted blossoms	2,125	2	0	0	2,125	11 1

this may explain why these species were more severe in Minnesota than in North Dakota.

Post-plant cultivation was used for weed control by 50 percent of the survey respondents (Table 12). Respondants who used cultivation averaged 1.4 cultivations per acre. Sonalan was used on 47 percent of the dry bean acreage, more than any other herbicide. Treflan, fall or spring applied, was used on 41 percent and Basagran was used on 32 percent of the acreage. All other herbicides were used on less than 10 percent of the dry bean acreage. Hand weeding was utilized for weed control by 16 percent of the survey respondents on 6 percent of the acreage. Amiben and Lasso were used on more acreage in Minnesota than in North Dakota. Eastern black nightshade was reported as the "worst weed" more frequently in Minnesota than in North Dakota (Table 11). The greater usage of Lasso and Amiben in Minnesota than North Dakota may have been for control of eastern black nightshade.

Hand weeding was evaluated as giving excellent or good weed control by 67 percent of respondents who used handweeding (Table 13). All herbicide treatments except Basagran and Lasso had a greater percentage of excellent and good evaluations than hand weeding. Basagran and Lasso had the greatest percentage of fair or poor weed control responses. Lasso generally provides poor weed control when rainfall after application is insufficient for herbicide activation. Basagran provides poor control on weeds that are too large.

Dry bean injury from weed control treatments generally was minor (Table 14). Only Basagran, Amiben, fall Treflan, and handweeding had more than 1 percent of the respondents indicate moderate or severe injury. Basagran had the greatest percentage of evaluations in the moderate and severe injury categories but the total was only 5 percent. Weed control treatments caused little serious dry bean injury in 1988.

Table 11. Worst weed problem in 1988 in dry beans in North Dakota and Minnesota as ranked by survey respondents.

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
	----- % of A -----					
Wild mustard	24	51	11	35	22	49
Kochia	22	50	3	14	19	44
Redroot pigweed	12	37	27	57	14	40
Foxtail spp. (pigeongrass)	11	33	11	31	11	32
Wild oats	3	23	3	18	3	22
Common lambsquarters	2	11	11	49	3	17
Common cocklebur	5	17	4	16	5	16
Eastern black nightshade	3	9	13	37	4	13
Canada thistle	3	5	1	1	2	4
Russian thistle	2	3	0	0	2	3
Sunflower	2	2	<1	1	2	2
(volunteer and wild)						
Common milkweed	<1	1	<1	<1	<1	1

Table 12. Weed control practices used in 1988 on dry beans in North Dakota and Minnesota.

Treatment	North Dakota		Minnesota		Total			
	Acres Treated (No.)	(%)	Acres Treated (No.)	(%)	Acres Treated (No.)	(%)	Growers Reporting (No.)	(%)
Post-plant cultivation*	109,253	75	15,096	55	124,349	72	408	50
Sonalan	72,108	49	9,770	36	81,878	47	403	50
Treflan (spring)	49,597	34	7,186	26	56,863	33	367	45
Basagran	49,138	34	7,071	26	52,289	32	364	45
Treflan (fall)	12,941	9	370	1	13,311	8	51	6
Hand weeding	6,248	4	4,163	15	10,491	6	133	16
Amiben	651	<1	7,706	28	8,357	5	37	5
Lasso	471	<1	7,077	26	7,548	4	29	4
Treflan + Eptam	5,471	4	1,535	6	7,006	4	36	4
Eptam	4,049	3	280	1	4,329	2	30	4
Sodium chlorate	3,050	2	820	3	3,870	2	24	3
Prowl	805	1	2,137	8	2,942	2	9	1

* Acres include multiple cultivations per acre. Growers who cultivated averaged 1.4 cultivations.

Table 13. Evaluation of weed control in 1988.

Treatment	No. of Respondants	Evaluation of Weed Control				
		No Answer	Excel.	Good	Fair	Poor
		----- (% of respondents) -----				
Post-plant cultivation	408	18	24	46	10	1
Sonalan	403	2	39	42	15	2
Treflan (spring)	367	4	32	46	16	3
Basagran	364	4	20	43	26	7
Treflan (fall)	51	4	39	45	6	6
Hand weeding	133	20	44	23	7	4
Amiben	37	5	30	43	19	3
Lasso	29	0	34	21	38	7
Treflan + Eptam	36	0	33	53	14	0
Eptam	30	3	23	47	20	7
Prowl	9	0	22	56	22	0

Table 14. Evaluation of dry bean injury caused by weed control practices in 1988.

Weed Control Treatment	No. of Respondants	Evaluation of Injury				
		No Answer	None	Slight	Moderate	Severe
		----- (% of respondents) -----				
Post-plant cultivation	408	29	46	23	1	<1
Sonalan	403	13	74	12	1	<1
Treflan (spring)	367	18	72	10	1	0
Basagran	364	16	49	30	5	<1
Treflan (fall)	51	22	75	2	0	2
Hand weeding	133	32	54	11	1	1
Amiben	37	11	84	3	0	3
Lasso	29	24	69	7	0	0
Treflan + Eptam	36	17	72	11	0	0
Eptam	30	10	83	7	0	0
Prowl	9	0	78	22	0	0

Sodium chlorate was used on 2 percent of the dry bean acres (Table 12). However, 41 percent of the respondents indicated that a desiccant is needed for dry beans (Table 15). The reason for the large difference between expressed need for a desiccant and the actual use of the only registered desiccant is not known. Perhaps dry bean growers are not satisfied with sodium chlorate as a desiccant or perhaps the drought of 1988 reduced the need for a desiccant.

Insect Problems and Insecticide Use. Grasshoppers were reported as the most significant insect problem on 30,314 acres (17.5 percent) impacting dry bean production in 1988 throughout the Northharvest area (Table 16). Spider mites ranked a distant second on 1,933 acres (1.1 percent). The other two pest problems ranking third and fourth, respectively, were aphids on 1,630 acres (0.9 percent) and cutworms on 100 acres (0.1 percent).

Respondants used 10 insecticides on 4,275 acres (2.5 percent) of dry beans in North Dakota and Minnesota (Table 17) and non designated insecticides on 2,480 acres (1.4 percent). Presumably the non designated insecticides were custom applied by commercial aerial and/or ground sprayers. The growers may have asked for an insecticide to control an insect problem without specifying the insecticide.

It is interesting to compare the acres of "worst insect problem" (33,977 acres) reported in Table 16 to the "insecticide use" reported in Table 17 (6,755 acres treated). The total acres reported to have been sprayed with various insecticides is much lower than the acreage reported with the four worst insect problems. Apparently much of the acreage reported to have insect problems in Table 16 did not have infestation levels high enough to warrant an insecticide treatment.

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Table 15. Survey respondent's indication of the need for a desiccant for dry beans.

Need	North Dakota (% of Respondants)	Minnesota (% of Respondants)	Total	
			(% of Respondants)	(No. of Respondants)
No	57	46	55	447
Sometimes	5	0	4	33
Yes	38	54	41	332

Table 16. Worst insect problem in 1988 reported by survey respondents in Minnesota and North Dakota.

District	Grasshoppers		Spider Mites		Aphids		Cutworms	
	# A	% A	# A	% A	# A	% A	# A	% A
MN 1	2,958	23.7	0	0	0	0	0	0
MN 2	0	0	115	2.2	0	0	0	0
MN 3	296	5.1	30	0.5	1,200	20.8	0	0
MN 4	0	0	481	13.6	430	12.2	0	0
Mn 5	0	0	102	42.3	0	0	0	0
MN State	3,254	11.9	728	2.7	1,630	6.0	0	0
ND 1	2,953	8.7	0	0	0	0	100	0.3
ND 2	7,598	27.3	500	1.8	0	0	0	0
ND 3	1,116	4.3	0	0	0	0	0	0
ND 4	10,026	34.7	170	0.6	0	0	0	0
ND 5	5,367	18.2	535	1.8	0	0	0	0
ND State	27,060	18.5	1,205	0.8	0	0	100	0.1
Northharvest	30,314	17.5	1,933	1.1	1,630	0.9	100	0.1

Problem	Northharvest Totals			
	# A	% A	#	%
Grasshoppers	30,314	17.5	130	16.0
Spider mites	1,933	1.1	18	2.2
Aphids	1,630	0.9	2	0.2
Cutworms	100	0.1	1	0.1